Hot Issues of Information Management

Foundations of Business Intelligence: IBM and Big Data (Chap. 6)

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TLMXB4B (M0842)
Wed 8,9 (15:10-17:00) B702

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http://mail.tku.edu.tw/myday/
2017-11-29, 2017-12-06
<table>
<thead>
<tr>
<th>週次 (Week)</th>
<th>日期 (Date)</th>
<th>內容 (Subject/Topics)</th>
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<tr>
<td>1</td>
<td>2017/09/20</td>
<td>Introduction to Case Study for Hot Issues of Information Management</td>
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<td>2</td>
<td>2017/09/27</td>
<td>Information Systems in Global Business: UPS (Chap. 1) (pp.53-54)</td>
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<td>Global E-Business and Collaboration: P&amp;G (Chap. 2) (pp.84-85)</td>
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<td>Information Systems, Organization, and Strategy: Starbucks (Chap. 3) (pp.129-130)</td>
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<td>2017/11/01</td>
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<td>Midterm Exam Week (期中考試週)</td>
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<td>Foundations of Business Intelligence: IBM and Big Data (Chap. 6) (pp.261-262)</td>
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<td>Enterprise Applications: Summit and SAP (Chap. 9) (pp.396-398)</td>
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<td>2017/12/27</td>
<td>E-commerce: Zagat (Chap. 10) (pp.443-445)</td>
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Management Information Systems: Managing the Digital Firm

1. Organization, Management, and the Networked Enterprise
2. Information Technology Infrastructure
3. Key System Applications for the Digital Age
4. Building and Managing Systems

Chap. 6
Foundations of Business Intelligence: IBM and Big Data
Case Study:
IBM and Big Data (Chap. 6) (pp. 261-262)
Interactive Session: Technology: Big Data, Big Rewards

1. Describe the kinds of “big data” collected by the organizations described in this case.

2. List and describe the business intelligence technologies described in this case.

3. Why did the companies described in this case need to maintain and analyze big data? What business benefits did they obtain?

4. Identify three decisions that were improved by using “big data.”

5. What kinds of organizations are most likely to need “big data” management and analytical tools? Why?

Overview of Fundamental MIS Concepts

Management

Organization

Technology

Business Challenges

Information System

Business Solutions

Key Partners

Key Activities

Key Resources

Value Proposition

Customer Relationships

Channels

Customer Segments

Cost Structure

Revenue Streams

THE DATA HIERARCHY

Student Database

Database

File

COURSE

File

FINANCIAL

File

PERSONAL

File

COURSE

Student_ID | Course | Date | Grade
---|---|---|---
39044 | IS 101 | F06 | B+
59432 | IS 101 | F06 | A
64029 | IS 101 | F06 | C

Record

Field

0100 1001 (Letter I in ASCII)

Byte

Bit

The Database Approach to Data Management

• Database
  – Serves many applications by centralizing data and controlling redundant data
The Database Approach to Data Management

• Database management system (DBMS)
  – Interfaces between applications and physical data files
  – Separates logical and physical views of data
  – Solves problems of traditional file environment
    • Controls redundancy
    • Eliminates inconsistency
    • Uncouples programs and data
    • Enables organization to central manage data and data security

HUMAN RESOURCES DATABASE WITH MULTIPLE VIEWS

Database Management System

Benefits View
Name
SSN
Health_Care

Payroll View
Name
SSN
Gross_Pay
Net_Pay

Human Resources Database
Employee_ID
Name
SSN
Position
Date_Hired
Gross_Pay
Net_Pay
Life_Insurance
Pension_Benefit
Health_Care

Relational DBMS

• Represent data as two-dimensional tables
• Each table contains data on entity and attributes

Table: grid of columns and rows

- **Rows (tuples):** Records for different entities
- **Fields (columns):** Represents attribute for entity
- **Key field:** Field used to uniquely identify each record
- **Primary key:** Field in table used for key fields
- **Foreign key:** Primary key used in second table as look-up field to identify records from original table

# RELATIONAL DATABASE TABLES

## SUPPLIER

<table>
<thead>
<tr>
<th>Supplier_Number</th>
<th>Supplier_Name</th>
<th>Supplier_Street</th>
<th>Supplier_City</th>
<th>Supplier_State</th>
<th>Supplier_Zip</th>
</tr>
</thead>
<tbody>
<tr>
<td>8259</td>
<td>CBM Inc.</td>
<td>74 5th Avenue</td>
<td>Dayton</td>
<td>OH</td>
<td>45220</td>
</tr>
<tr>
<td>8261</td>
<td>B. R. Molds</td>
<td>1277 Gandolly Street</td>
<td>Cleveland</td>
<td>OH</td>
<td>49345</td>
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<tr>
<td>8283</td>
<td>Jackson Composites</td>
<td>8233 Micklin Street</td>
<td>Lexington</td>
<td>KY</td>
<td>56723</td>
</tr>
<tr>
<td>8444</td>
<td>Bryant Corporation</td>
<td>4315 Mill Drive</td>
<td>Rochester</td>
<td>NY</td>
<td>11344</td>
</tr>
</tbody>
</table>

Key Field (Primary Key)

## PART

<table>
<thead>
<tr>
<th>Part_Number</th>
<th>Part_Name</th>
<th>Unit_Price</th>
<th>Supplier_Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>137</td>
<td>Door latch</td>
<td>22.00</td>
<td>8259</td>
</tr>
<tr>
<td>145</td>
<td>Side mirror</td>
<td>12.00</td>
<td>8444</td>
</tr>
<tr>
<td>150</td>
<td>Door molding</td>
<td>6.00</td>
<td>8263</td>
</tr>
<tr>
<td>152</td>
<td>Door lock</td>
<td>31.00</td>
<td>8259</td>
</tr>
<tr>
<td>155</td>
<td>Compressor</td>
<td>54.00</td>
<td>8261</td>
</tr>
<tr>
<td>178</td>
<td>Door handle</td>
<td>10.00</td>
<td>8259</td>
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</table>

Primary Key

Foreign Key

Rows (Records, Tuples)

Operations of a Relational DBMS

• Three basic operations used to develop useful sets of data
  – **SELECT**: Creates subset of data of all records that meet stated criteria
  – **JOIN**: Combines relational tables to provide user with more information than available in individual tables
  – **PROJECT**: Creates subset of columns in table, creating tables with only the information specified

The select, join, and project operations enable data from two different tables to be combined and only selected attributes to be displayed.

Non-relational databases: “NoSQL”

• More flexible data model
• Data sets stored across distributed machines
• Easier to scale
• Handle large volumes of unstructured and structured data (Web, social media, graphics)

Databases in the cloud

• Typically, less functionality than on-premises DBs
• Amazon Relational Database Service, Microsoft SQL Azure
• Private clouds

Designing Databases

• Conceptual (logical) design:
  – abstract model from business perspective

• Physical design:
  – How database is arranged on direct-access storage devices

Design process identifies and Normalization

• Design process identifies:
  – Relationships among data elements, redundant database elements
  – Most efficient way to group data elements to meet business requirements, needs of application programs

• Normalization
  – Streamlining complex groupings of data to minimize redundant data elements and awkward many-to-many relationships
# AN UNNORMALIZED RELATION FOR ORDER

### ORDER (Before Normalization)

<table>
<thead>
<tr>
<th>Order Number</th>
<th>Order Date</th>
<th>Part Number</th>
<th>Part Name</th>
<th>Unit Price</th>
<th>Part Quantity</th>
<th>Supplier Number</th>
<th>Supplier Name</th>
<th>Supplier Street</th>
<th>Supplier City</th>
<th>Supplier State</th>
<th>Supplier Zip</th>
</tr>
</thead>
</table>

NORMALIZED TABLES CREATED FROM ORDER

AN ENTITY-RELATIONSHIP DIAGRAM

SUPPLIER provides is supplied by PART is ordered contains LINE_ITEM belongs to ORDER includes

Using Databases to Improve Business Performance and Decision Making

• **Big data**
  – Massive sets of unstructured/semi-structured data from Web traffic, social media, sensors, and so on
  – Petabytes, exabytes of data

• Volumes too great for typical DBMS
  – Can reveal more patterns and anomalies

Using Databases to Improve Business Performance and Decision Making

- **Business intelligence infrastructure**
  - Today includes an array of tools for separate systems, and big data

- **Contemporary tools**:  
  - Data warehouses  
  - Data marts  
  - Hadoop  
  - In-memory computing  
  - Analytical platforms

Business Intelligence Infrastructure

- Operational Data
- Historical Data
- Machine Data
- Web Data
- Audio/Video Data
- External Data

Data Warehouse

Extract, transform, load

Hadoop Cluster

Data Mart

Casual users
- Queries
- Reports
- Dashboards

Power users
- Queries
- Reports
- OLAP
- Data mining

Data Warehouse vs. Data Marts

• **Data warehouse:**
  – Stores current and historical data from many core operational transaction systems
  – Consolidates and standardizes information for use across enterprise, but data cannot be altered
  – Provides analysis and reporting tools

• **Data marts:**
  – Subset of data warehouse
  – Summarized or focused portion of data for use by specific population of users
  – Typically focuses on single subject or line of business

Hadoop

• Enables distributed parallel processing of big data across inexpensive computers

• Key services
  – Hadoop Distributed File System (HDFS): data storage
  – MapReduce: breaks data into clusters for work
  – Hbase: NoSQL database

• Used by Facebook, Yahoo, NextBio

In-memory computing

- Used in big data analysis
- Use computers main memory (RAM) for data storage to avoid delays in retrieving data from disk storage
- Can reduce hours/days of processing to seconds
- Requires optimized hardware

Analytic platforms

• High-speed platforms using both relational and non-relational tools optimized for large datasets

• Examples:
  – IBM Netezza
  – Oracle Exadata

Analytical tools: Relationships, patterns, trends

• Business Intelligence Analytics and Applications
• Tools for consolidating, analyzing, and providing access to vast amounts of data to help users make better business decisions
  – Multidimensional data analysis (OLAP)
  – Data mining
  – Text mining
  – Web mining

Online analytical processing (OLAP)

• Supports multidimensional data analysis
  – Viewing data using multiple dimensions
  – Each aspect of information (product, pricing, cost, region, time period) is different dimension
  – Example: How many washers sold in East in June compared with other regions?

• OLAP enables rapid, online answers to ad hoc queries

MULTIDIMENSIONAL DATA MODEL

Data mining

• Finds hidden patterns, relationships in datasets
  – Example: customer buying patterns
• Infers rules to predict future behavior
  – Data mining provides insights into data that cannot be discovered through OLAP, by inferring rules from patterns in data.

Types of Information Obtained from Data Mining

- **Associations**: Occurrences linked to single event
- **Sequences**: Events linked over time
- **Classification**: Recognizes patterns that describe group to which item belongs
- **Clustering**: Similar to classification when no groups have been defined; finds groupings within data
- **Forecasting**: Uses series of existing values to forecast what other values will be

Text mining

• Extracts key elements from large unstructured data sets
  – Stored e-mails
  – Call center transcripts
  – Legal cases
  – Patent descriptions
  – Service reports, and so on

• Sentiment analysis software
  – Mines e-mails, blogs, social media to detect opinions

Web mining

• Discovery and analysis of useful patterns and information from Web
  – Understand customer behavior
  – Evaluate effectiveness of Web site, and so on

• 3 Tasks of Web Mining
  – Web content mining
    • Mines content of Web pages
  – Web structure mining
    • Analyzes links to and from Web page
  – Web usage mining
    • Mines user interaction data recorded by Web server

Databases and the Web

• Many companies use Web to make some internal databases available to customers or partners

• Typical configuration includes:
  – Web server
  – Application server/middleware/CGI scripts
  – Database server (hosting DBMS)

• Advantages of using Web for database access:
  – Ease of use of browser software
  – Web interface requires few or no changes to database
  – Inexpensive to add Web interface to system

LINKING INTERNAL DATABASES TO THE WEB

Managing Data Resources

• Establishing an information policy
  – Firm’s rules, procedures, roles for sharing, managing, standardizing data
  – Data administration
    • Establishes policies and procedures to manage data
  – Data governance
    • Deals with policies and processes for managing availability, usability, integrity, and security of data, especially regarding government regulations
  – Database administration
    • Creating and maintaining database
Managing Data Resources

• Ensuring data quality
  – More than 25% of critical data in Fortune 1000 company databases are inaccurate or incomplete
    • Redundant data
    • Inconsistent data
    • Faulty input
  – Before new database in place, need to:
    • Identify and correct faulty data
    • Establish better routines for editing data once database in operation

Managing Data Resources

• **Data quality audit**
  – Structured survey of the accuracy and level of completeness of the data in an information system
    • Survey samples from data files, or
    • Survey end users for perceptions of quality

• **Data cleansing**
  – Software to detect and correct data that are incorrect, incomplete, improperly formatted, or redundant
  – Enforces consistency among different sets of data from separate information systems

Data Scientist

What makes a data scientist?

The big data phenomenon trained a bright spotlight on those who perform deep information analysis and can combine quantitative and statistical modeling expertise with business acumen and a talent for finding hidden patterns. Here’s a closer look.

Data scientists rely on analytics, predictive models, statistical analysis and modeling, data mining, sentiment and what-if analysis, and more to do their jobs. Cleansing raw data and building models is detailed work, and the right tools make the process much more efficient.

The IBM® BigInsights™ Data Scientist module accelerates data science with advanced analytics to extract valuable insights from Hadoop. Stable machine learning algorithms are optimized for Hadoop. Text analytics extract insight from unstructured data with existing tools so analytic applications don’t have to be developed from scratch. Big R statistical analysis and distributed frames allow data scientists to use the entire Hadoop cluster, not just a limited sample.

Good data scientists select and address the business problems that have the most value to the organization. Armed with data and analytical results, they must present their informed conclusions and recommendations to technical and nontechnical stakeholders.

The BigInsights Analyst module lets data scientists use their existing skills to find data across the organization and visualize it without extra coding. IBM BigSheets is a spreadsheet-style data manipulation and visualization tool that gives business users direct access to data through a recognizable interface. IBM-designed Big SQL offers HDFS caching and high availability benefits as well as query optimization—without forcing data scientists to learn a new skill set.

Architecture of Big Data Analytics

Big Data Sources
- * Internal
- * External
- * Multiple formats
- * Multiple locations
- * Multiple applications

Big Data Transformation
- Middleware
- Extract Transform Load
- Data Warehouse
- Traditional Format CSV, Tables
- Raw Data
- Transformed Data

Big Data Platforms & Tools
- Hadoop
- MapReduce
- Pig
- Hive
- Jaql
- Zookeeper
- Hbase
- Cassandra
- Oozie
- Avro
- Mahout
- Others

Big Data Analytics Applications
- Queries
- Reports
- OLAP
- Data Mining

Source: Stephan Kudyba (2014), Big Data, Mining, and Analytics: Components of Strategic Decision Making, Auerbach Publications
Architecture of Big Data Analytics

Big Data Sources
- Internal
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Big Data Transformation

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- Hadoop
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- Mahout
- Others

Big Data Analytics Applications
- Queries
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Data Mining

Big Data Analytics Applications

Source: Stephan Kudyba (2014), Big Data, Mining, and Analytics: Components of Strategic Decision Making, Auerbach Publications
Social Big Data Mining
(Hiroshi Ishikawa, 2015)

Architecture for Social Big Data Mining
(Hiroshi Ishikawa, 2015)

Enabling Technologies
- Integrated analysis model
- Natural Language Processing
- Information Extraction
- Anomaly Detection
- Discovery of relationships among heterogeneous data
- Large-scale visualization
- Parallel distrusted processing

Analysts
- Model Construction
- Explanation by Model
- Construction and confirmation of individual hypothesis
- Description and execution of application-specific task

Source: Hiroshi Ishikawa (2015), Social Big Data Mining, CRC Press
Case Study:
Google, Apple, and Microsoft (Chap. 7) (pp. 318-320)

Apple, Google, and Microsoft Battle for Your Internet Experience

1. Define and compare the business models and areas of strength of Apple, Google, and Microsoft.

2. Why is mobile computing so important to these three firms? Evaluate the mobile platform offerings of each firm.

3. What is the significance of applications and app stores, and closed vs. open app standards to the success or failure of mobile computing?

4. Which company and business model do you believe will prevail in this epic struggle? Explain your answer.

5. What difference would it make to a business or to an individual consumer if Apple, Google, or Microsoft dominated the Internet experience? Explain your answer.

資訊管理專題
(Hot Issues of Information Management)

1. 請同學於資訊管理專題個案討論前
   應詳細研讀個案，並思考個案研究問題。

2. 請同學於上課前複習相關資訊管理相關理論，
   以作為個案分析及擬定管理對策的依據。

3. 請同學於上課前
   先繳交資訊管理專題個案研究問題書面報告。

4. 上課時間地點：
   週三 8,9 (15:10-17:00) B702
References


– Kenneth C. Laudon & Jane P. Laudon 原著，游張松 主編，陳文生 翻譯 (2014)，資訊管理系統，第13版，滄海