

Business Intelligence

IT 4153 Advanced Database

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Introduction

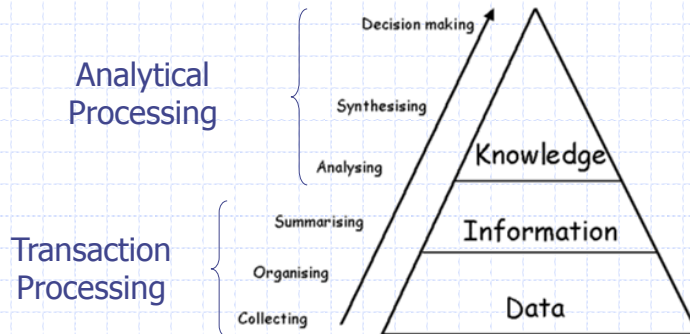
◆ Types of Information Processing

- Transactional Processing
 - ◆ Focus on data insertion, modification, deletion, and transmission
- Analytical Processing
 - ◆ Focus on reporting, analysis, transformation, and decision support

Data Information and Knowledge

◆ DIKW

- <http://en.wikipedia.org/wiki/DIKW>



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What is Business Intelligence?

- ◆ Business Intelligence is a set of methods, processes, architectures, applications, and technologies that transform raw **data** into meaningful and useful information used to enable more effective strategic, tactical, and operational insights and **decision-making**.

- Forrester

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Business Intelligence (BI)

- ◆ BI is the an umbrella term for concepts, methods, and technologies used to support decision making.
 - Traditionally it has been also understood as Decision Support System (DSS).
 - A brief history of DSS:
<http://dssresources.com/history/dsshistory.html>
- ◆ Narrowly speaking, intelligence comes from data (facts).
 - In this sense, BI focuses on analytical processing.
- ◆ Broadly speaking, intelligence, or knowledge, also comes from human experience and tacit knowledge.
 - In this sense, BI is also related to knowledge management.

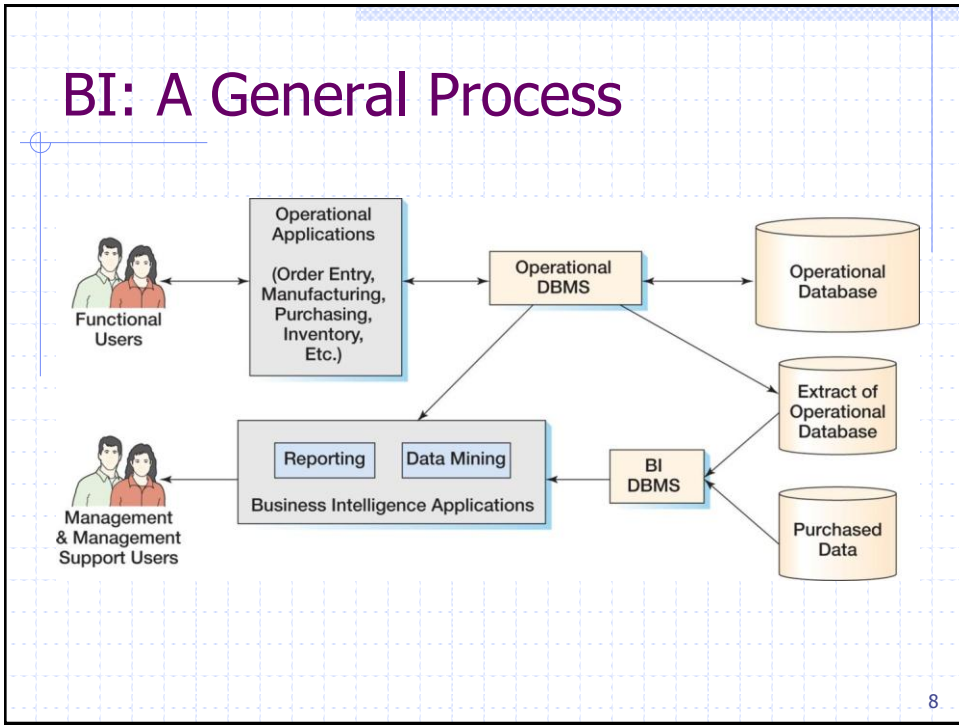
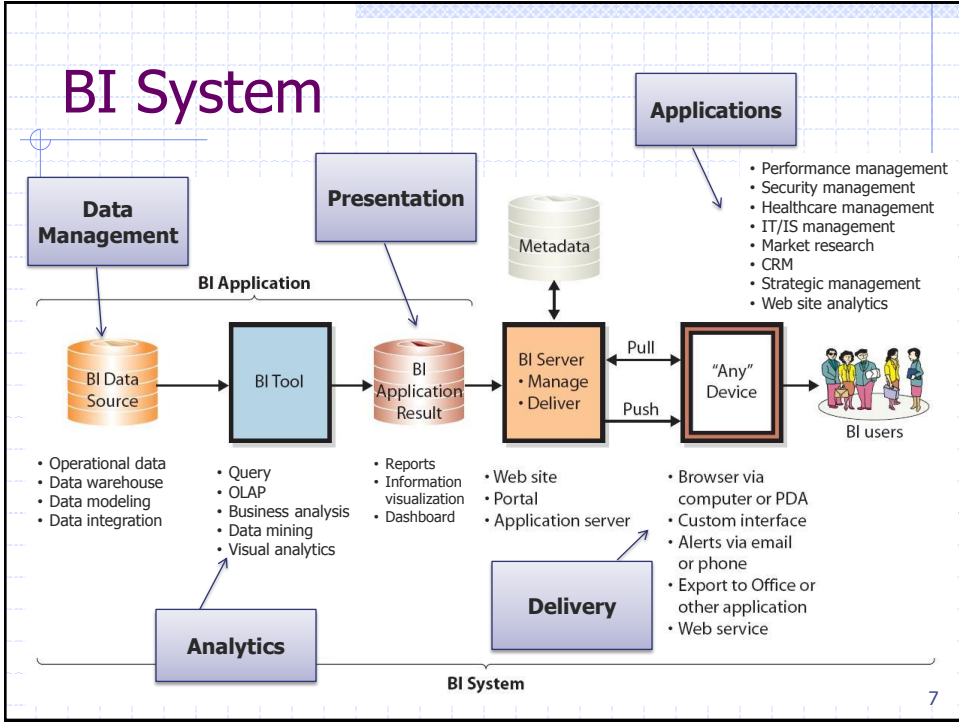
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Why BI is Needed

- ◆ Information overloading
 - There are too much data and information that we cannot find useful information (knowledge) from them.
- ◆ A gap between data and knowledge (useful information leading to a decision).



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Data Warehouse

- ◆ Data warehouse is a special kind of database that support data analysis and decision making
 - The purpose of a data warehouse is to organize lots of stable data for ease of analysis and retrieval.
- ◆ Traditional (operational) databases facilitate data management and transaction processing. They have two limitations for data analysis and decision support
 - Performance
 - ◆ They are transaction oriented (data insert, update, move, etc.)
 - ◆ Not optimized for complex data analysis
 - ◆ Usually do not hold historical data
 - Heterogeneity
 - ◆ Individual databases usually manage data in very different ways, even in the same organization (not to mention external data sources which may be dramatically different).

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Analysis Tools

- ◆ Query
 - Based on simple and direct queries
 - Usually involves simple analysis and transformation of data, such as calculating, sorting, filtering, grouping, and formatting
- ◆ OLAP (Online Analytical Processing)
 - A multi-dimensional analysis and reporting application
 - Great for discovering details from large quantities of data
- ◆ Data mining
 - Data mining techniques are a blend of statistics and mathematics, and artificial intelligence and machine-learning.

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OLAP

◆ Multi-dimensional queries

- A dimension is a particular way (or an attribute) of describing and categorizing data
- Such queries are usually arithmetic aggregation operations (sum, average, etc.) on records grouped by multiple dimensions (attributes).

◆ Examples

- "What is the total sales amount grouped by product line (dimension 1), states (dimension 2), years (dimension 3) and ... (other dimensions)?"
- "What is the total revenue for each store in the last 24 months?"

◆ OLAP is a function/operation that is optimized to answer queries that are multi-dimensional in nature

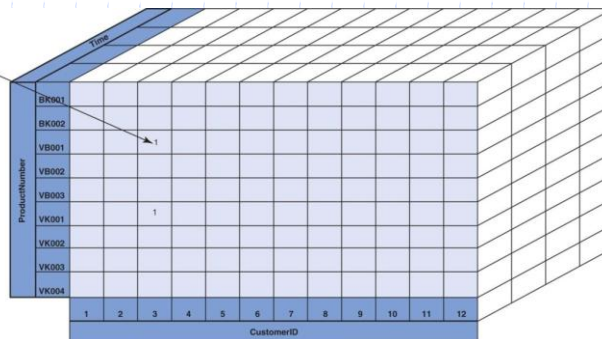
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OLAP Report View

A pivot table

3 Store Sales Net	Store Type					
4 Product Family	Deluxe Supermarket	Gourmet Supermarket	Mid-Size Grocery	Small Grocery	Supermarket	Grand Total
5 Drink	\$8,119.05	\$2,392.83	\$1,409.50	\$685.89	\$16,751.71	\$29,358.98
6 Food	\$70,276.11	\$20,026.18	\$10,392.19	\$6,109.72	\$138,960.67	\$245,764.87
7 Non-Consumable	\$18,884.24	\$5,064.79	\$2,813.73	\$1,534.90	\$36,189.40	\$64,487.05
8 Grand Total	\$97,279.40	\$27,483.80	\$14,615.42	\$8,330.51	\$191,901.77	\$339,610.90

Each cell will show the total quantity of each product that has been purchased by each customer on a specific date



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Data Mining

- ◆ Data mining (or, knowledge discovery in database, KDD)
 - Processes and techniques for seeking knowledge (relationship, trends, patterns, etc.) from a large amount of data
 - Non-trivial, non-obvious, and implicit knowledge
 - Extremely large datasets

- ◆ Data mining applications use sophisticated statistical and mathematical techniques to find patterns and relationships among data
 - Classification, clustering, association, estimation, prediction, trending, pattern, etc.

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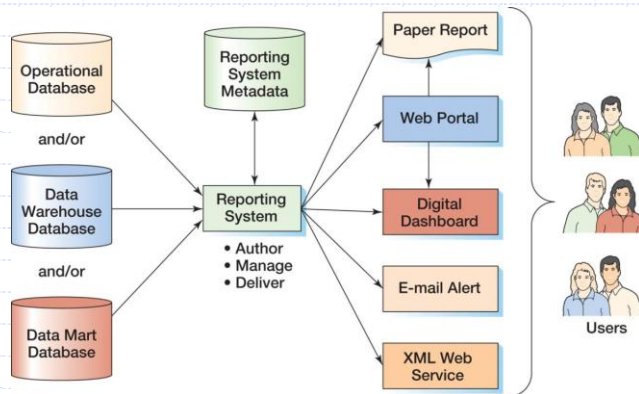
Common Data Mining Techniques

- ◆ K-means: a clustering technique used to identify groups of entities with similar characteristics
- ◆ Regression analysis: produces equations that offer probabilities that certain events will occur
- ◆ Decision tree analysis: classifies entities into groups based on past history
- ◆ Artificial Neural Network (ANN): non-linear prediction techniques
- ◆ Market Basket Analysis: determines patterns of associated buying behavior
- ◆ Genetic Algorithm (GA): searching optimum solutions in a relative large solution space.

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BI Reporting and Delivery

- ◆ BI reporting is about delivering to users and managing analysis results



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BI Reporting and Data Visualization

- ◆ Visualization is an essential way for human understanding and sense making
 - Table, charts, diagrams
 - Visualization can also be part of the analysis process (visual analytics)
- ◆ Dashboard
 - Digital dashboard is a visual and interactive presentation of data to make it easy to read and understand in a short time
 - Why
 - ◆ Quickly understand data and respond quickly
 - ◆ Ability to identify trends
 - ◆ Save time over running multiple reports
 - ◆ Gain total visibility of all systems instantly at one place
 - Example
 - ◆ <http://www.itdashboard.gov/>

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BI Delivery

◆ Web portal

- A web portal is a central place for managing and retrieving data and reports
- Example: <https://discoverer.gsu.edu>

◆ Web services

- Offered capabilities for data mashup

◆ EAI

- Integrating results with office applications

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BI Applications

◆ Business management

- Performance management
- Business service management
- Business planning and operation optimization
- Business scenarios and forecasting

◆ Marketing and sales

- CRM
- Competitive and location analysis
- Customer behavior analysis
- Targeted marketing and sales strategies

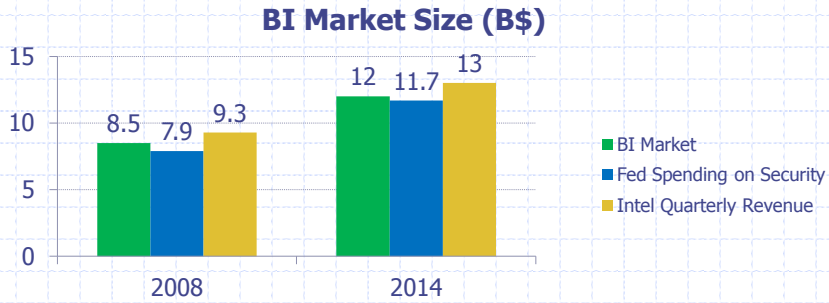
◆ Financial management and compliance

◆ Domains

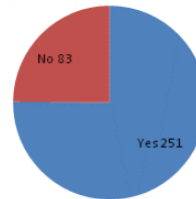
- Strategy management
- Security management
- Healthcare management

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BI is Growing Fast

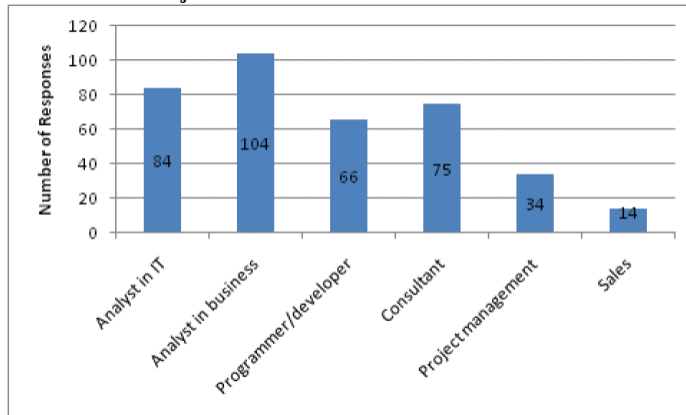


- ◆ Growing student interests
 - BI Congress survey 2010



BI Career Perspectives

What kinds of jobs are available for students out of universities?

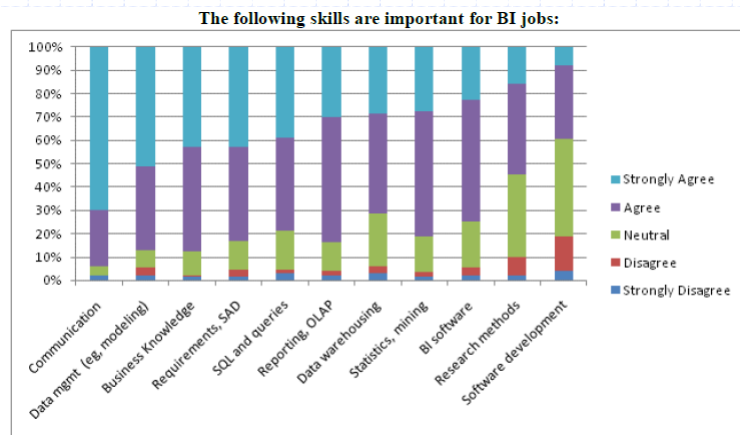


Data from BI Congress Survey 2010

Examples of BI Careers

- ◆ BI solution architects and integration specialists
- ◆ Business and BI analysts
- ◆ BI application developers and testers
- ◆ Data warehouse specialists
- ◆ Database analysts, developers and testers
- ◆ Database support specialists

What are employers looking for?



Data from BI Congress Survey 2010

Critical Knowledge and Skills

- ◆ Technical knowledge
 - Knowledge of database systems and data warehousing technologies
 - Ability to manage database system integration, implementation and testing
 - Ability to manage relational databases and create complex reports
 - Knowledge and ability to implement data and information policies, security requirements, and state and federal regulations
- ◆ Solution development and management
 - Working with business and user Requirements
 - Capturing and documenting the business requirements for BI solution
 - Translating business requirements into technical requirements
 - BI project lifecycle and management
- ◆ Business and Customer Skills and Knowledge
 - Effective communication and consultation with business users
 - Understanding of the flow of information throughout the organization
 - Ability to effectively communicate with and get support from technology and business specialists
 - Ability to understand the use of data and information in each organizational units
 - Ability to train business users in information management and interpretation

Sample Role: Business Intelligence Analysts

- ◆ Business skills requirements
 - Generate standard or custom reports summarizing business, financial, or economic data for review by executives, managers, clients, and other stakeholders.
 - Analyze competitive market strategies through analysis of related product, market, or share trends.
 - Collect business intelligence data from available industry reports, public information, field reports, or purchased sources.
 - Maintain library of model documents, templates, or other reusable knowledge assets.
- ◆ Technical skill requirements
 - Create business intelligence tools or systems, including design of related databases, spreadsheets, or outputs.
 - Maintain or update business intelligence tools, databases, dashboards, systems, or methods.
 - Provide technical support for existing reports, dashboards, or other tools.

Sample Role: Business Intelligence (BI) Specialist

- ◆ Business Intelligence (BI) Specialist works with business users to obtain data requirements for new analytic applications, design conceptual and logical models for the data warehouse and/or data mart and communicate physical designs to the database group.

- ◆ The BI specialist also develops processes for capturing and maintaining metadata from all data warehousing components.

Sample Role: Business Intelligence Developer

- ◆ Business Intelligence Developer is responsible for designing and developing Business Intelligence solutions for the enterprise.

- ◆ Key functions include designing, developing, testing, debugging, and documenting extract, transform, load (ETL) data processes and data analysis reporting for enterprise-wide data warehouse implementations.

- ◆ Responsibilities include:
 - working closely with business and technical teams to understand, document, design and code ETL processes;
 - working closely with business teams to understand, document and design and code data analysis and reporting needs;
 - translating source mapping documents and reporting requirements into dimensional data models;
 - designing, developing, testing, optimizing and deploying server integration packages and stored procedures to perform all ETL related functions;
 - develop data cubes, reports, data extracts, dashboards or scorecards based on business requirements.

Sample Role: Business Intelligence Report Developer

- ◆ The Business Intelligence Report Developer is responsible for developing, deploying and supporting reports, report applications, data warehouses and business intelligence systems.
- ◆ Primary responsibilities include creating and automating quality control processes and methods, providing maintenance and enhancement of data warehouse reports, creating ad hoc data warehouse queries, solving data related reporting issues and documenting all reports created.
- ◆ The report developer must have experience in user facing roles (e.g. gathering requirements, establishing project objectives, leading meetings) and in developing, selecting and conducting user training as needed.
- ◆ The Developer also participates in all aspects of data warehouse projects including conceptualization, design, construction, testing, selection, deployment and post-support implementation.

Where Can You Learn BI in Atlanta?

- ◆ GATech: no major courses known
- ◆ Emory
 - Business: 2-3 courses focused on analytics (using spreadsheets)
 - CS: courses focused on database and data mining
- ◆ GSU
 - Management science: elective general BI and data mining courses
 - CS: focused on data mining and artificial intelligence
- ◆ SPSU: focused on data warehouse - two more courses are going to be offered
 - CS: data mining
 - IT: business intelligence systems and technologies
- ◆ Mercer: none
- ◆ KSU: 2 electives on data warehouse and data mining

Summary

- ◆ Key concepts
 - Business intelligence
 - BI system components
 - Data warehouse
 - OLAP
 - Multidimensional analysis
 - Data mining
 - BI reporting

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Good Resources

- ◆ DSS Resources
 - <http://dssresources.com/>
- ◆ Business intelligence resources
 - <http://www.businessintelligence.com/>

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