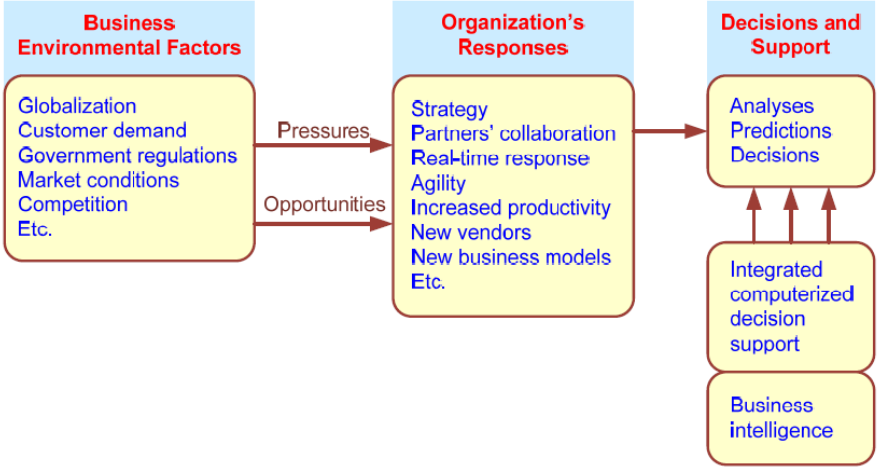
Changing Business Environment

- Companies are moving aggressively to computerized support of their operations ⇨ Business Intelligence
- Business Pressures–Responses–Support Model
  - Business pressures result of today's competitive business climate
  - Responses to counter the pressures
  - Support to better facilitate the process

Business Pressures–Responses–Support Model



Business Environment Factors

- The environment in which organizations operate today is becoming more and more complex, creating
  - opportunities, and
  - problems.
  - Example: globalization.
- Business environment factors:
  - markets, consumer demands, technology, and societal…

Business Environment Factors

FACTOR	DESCRIPTION
Markets	Strong competition
	Expanding global markets
	Blooming electronic markets on the Internet
	Innovative marketing methods
	Opportunities for outsourcing with IT support
	Need for real-time, on-demand transactions
Consumer demand	Desire for customization
	Desire for quality, diversity of products, and speed of delivery
	Customers getting powerful and less loyal
Technology	More innovations, new products, and new services
	Increasing obsolescence rate
	Increasing information overload
	Social networking, Web 2.0 and beyond
Societal	Growing government regulations and deregulation
	Workforce more diversified, older, and composed of more women
	Prime concerns of homeland security and terrorist attacks
	Necessity of Sarbanes-Oxley Act and other reporting-related legislation
	Increasing social responsibility of companies
	Greater emphasis on sustainability

Organizational Responses

- Be reactive, anticipative, adaptive, and proactive
- Managers may take actions, such as
  - Employ strategic planning
  - Use new and innovative business models
  - Restructure business processes
  - Participate in business alliances
  - Improve corporate information systems
  - **Take business intelligence initiatives**

A Framework for Business Intelligence (BI)

- BI is an evolution of decision support concepts over time
  - Then: Executive Information System
  - Now: Everybody's Information System (BI)
- BI systems are enhanced with additional visualizations, alerts, and performance measurement capabilities
- The term BI emerged from industry

Definition of BI

- BI is an umbrella term that combines architectures, tools, databases, analytical tools, applications, and methodologies
- BI is a content-free expression, so it means different things to different people
- BI's major objective is to enable easy access to data (and models) to provide business managers with the ability to conduct analysis
- BI helps *transform* data, to information (and knowledge), to decisions, and finally to action

A Brief History of BI

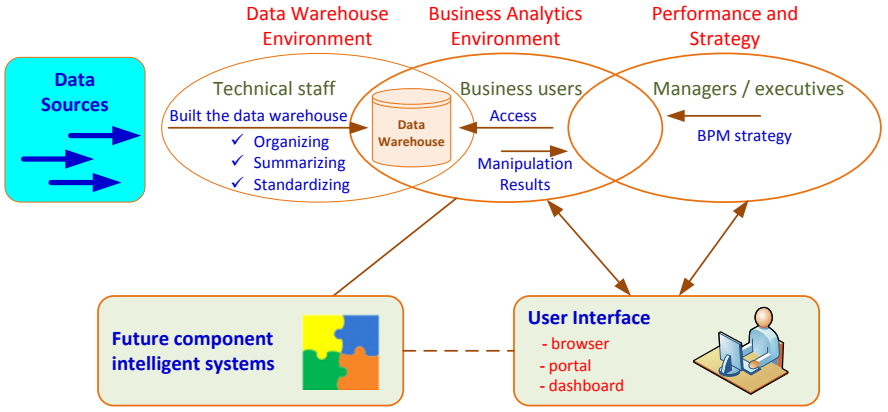
- The term BI was coined by the Gartner Group in the mid-1990s
- However, the concept is much older
  - 1970s - MIS reporting - static/periodic reports
  - 1980s - Executive Information Systems (EIS)
  - 1990s - OLAP, dynamic, multidimensional, ad-hoc reporting -> coining of the term “BI”
  - 2010s - Data/Text/Web Mining; Web-based Portals, Dashboards, Big Data, Social Media, and Visual Analytics
  - 2020s - yet to be seen

The Evolution of BI Capabilities

The Architecture of BI

- A BI system has four major components
  - a data warehouse, with its source data
  - business analytics, a collection of tools for manipulating, mining, and analyzing the data in the data warehouse
  - business performance management (BPM) for monitoring and analyzing performance
  - a user interface (e.g., dashboard)

A High-Level Architecture of BI



Components in a BI Architecture

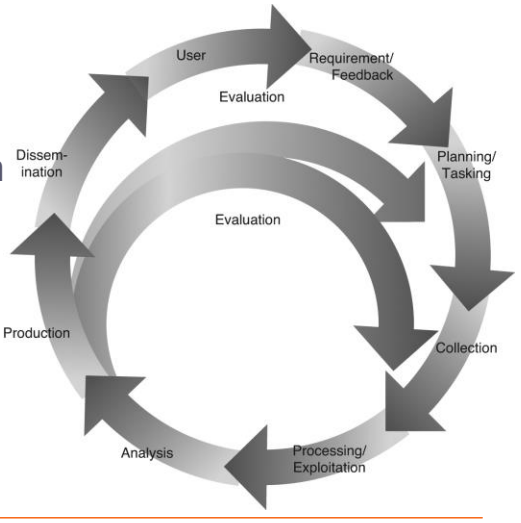
- The data warehouse is the cornerstone of any medium-to-large BI system.
  - Originally, the data warehouse included only historical data that was organized and summarized, so end users could easily view or manipulate it.
  - Today, some data warehouses include access to current data as well, so they can provide real-time decision support
- Business analytics are the tools that help the user transform data into knowledge (e.g., queries, data/text mining tools, etc.)

Components in a BI Architecture

- Business Performance Management (BPM), which is also referred to as corporate performance management (CPM), is an emerging portfolio of applications within the BI framework that provides enterprises tools they need to better manage their operations
- User Interface (i.e., dashboards) provide a comprehensive graphical/pictorial view of corporate performance measures, trends, and exceptions

Intelligence Creation, Use, and BI Governance

- Data warehouse and BI initiatives typically follow a process similar to that used in military intelligence initiatives.
- Intelligence and Espionage



Intelligence and Espionage

- Stealing corporate secrets, CIA, …
  - Intelligence vs. Espionage
- Intelligence

  The way that the modern companies ethically and legally organize themselves to glean as much as they can from their customers, their business environment, their stakeholders, their business processes, their competitors, and other such sources of potentially valuable information
- Problem – too much data, very little value
  - Use of data/text/Web mining

Transaction Processing Versus Analytic Processing

- Transaction processing systems (OLTP) are constantly involved in handling updates (add/edit/delete) to what we might call operational databases
  - ATM withdrawal transaction, sales order entry via an ecommerce site – updates DBs
  - OLTP – handles routine on-going business
  - ERP, SCM, CRM systems generate and store data in OLTP systems
  - The main goal is to have high efficiency

Transaction Processing Versus Analytic Processing

- Online analytic processing (OLAP) systems are involved in extracting information from data stored by OLTP systems
  - Routine sales reports by product, by region, by sales person, by …
  - Often built on top of a data warehouse where the data is not transactional
  - Main goal is the effectiveness (and then, efficiency) – provide correct information in a timely manner

Successful BI Implementation

- Implementing and deploying a BI initiative is a lengthy, expensive, and risky endeavor!
- Success of a BI system is measured by its widespread usage for better decision making
- The typical BI user community includes
  - Not just the top executives (as was for EIS)
  - All levels of the management hierarchy
    - Provide what is needed to whom he/she needs it
- A successful BI system must be of benefit to the enterprise as a whole…

BI - Alignment with Business Strategy

- To be successful, BI must be aligned with the company's business strategy
  - BI cannot/should not be a technical exercise for the information systems department
- BI changes the way a company conducts business by
  - improving business processes, and
  - transforming decision making to a more data/fact/information driven activity
- BI should help execute the business strategy and not be an impediment for it!

Issues for Successful BI

- Developing vs. Acquiring BI systems
- Justifying via cost-benefit analysis
  - It is easier to quantify costs
  - Harder to quantify benefits
- Security and Protection of Privacy
- Integration of Systems and Applications

Real-Time, On-Demand BI Is Attainable

- The demand for “real-time” BI is growing!
- Is “real-time” BI attainable?
- Technology is getting there…
  - Automated, faster data collection (RFID, sensors,…)
  - Database and other software technologies (agent, SOA, …) technology is advancing
  - Telecommunication infrastructure is improving
  - Computational power is increasing while the cost for these technologies is decreasing
- Trent -> Business Activity Management

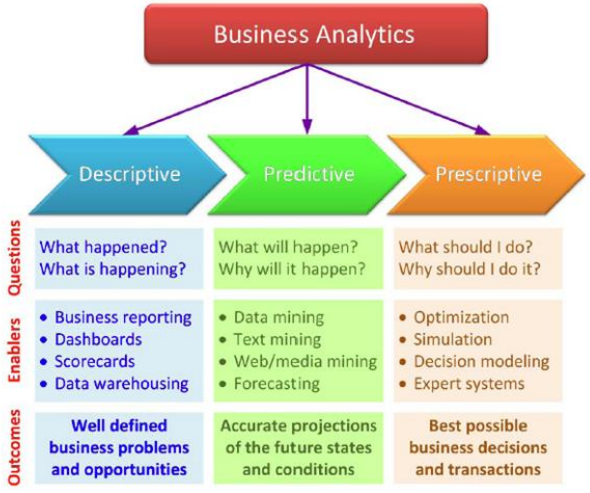
BI Implementation Considerations

- Developing or acquiring BI systems
  - BI shell?
  - In-house versus outside consultants
- Justification and cost-benefit analysis
- Security and protection of privacy
- Integration of systems and applications

Business Value of BI Applications

- Customer segmentation
- Propensity to buy
- Customer profitability
- Fraud detection
- Customer attrition
- Channel optimization

Business Analytics



Business Analytics

- Descriptive analytics
  - The use of data to understand past and current business performance and make informed decisions
- Predictive analytics
  - Predict the future by examining historical data, detecting patterns or relationships in these data, and then extrapolating these relationships forward in time.
- Prescriptive analytics
  - Identify the best alternatives to minimize or maximize some objective

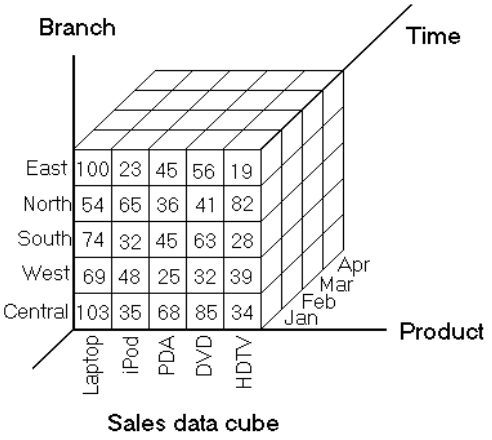
Business Analytics Applications

- Pricing
  - Setting prices for consumer and industrial goods, government contracts, and maintenance contracts
- Customer segmentation
  - Identifying and targeting key customer groups in retail, insurance, and credit card industries
- Merchandising
  - Determining brands to buy, quantities, and allocations
- Location
  - Finding the best location for bank branches and ATMs, or where to service industrial equipment
- Social Media
  - Understand trends and customer perceptions
  - Assist marketing managers and product designers

Data Warehouse

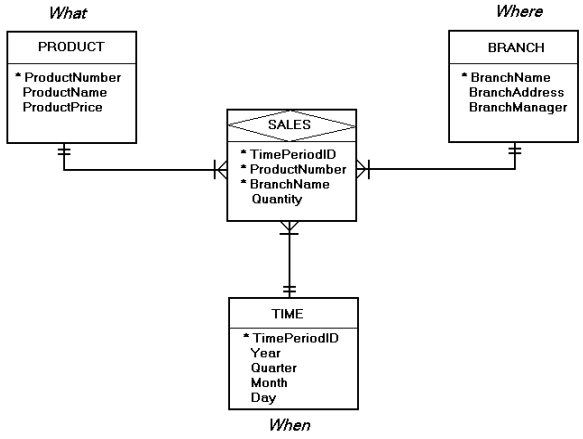
- A data warehouse is a key component of a BI system
  - In a large organization, it is unlikely to have just one database
  - People need a variety of types of data which may not be normalized or may not be current
  - A Data warehouse holds all kinds of data for supporting decision making activities
  - A data warehouse can be divided into **data marts**, and each data mart serves a particular functional division (e.g., finance, accounting, human resource management, etc.)

Multidimensional Data



Sales data cube

Creating Data Cube from Relational Database: Star Schema

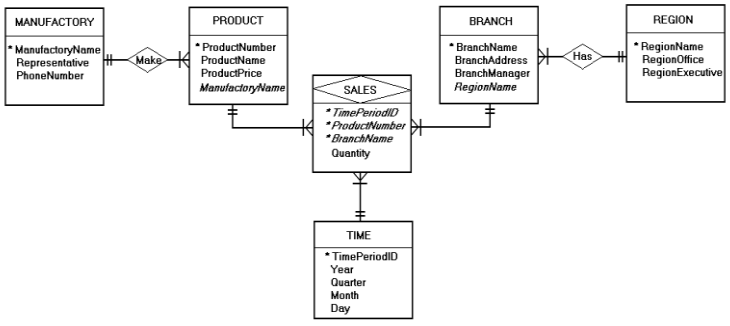


Star Schema

- The **fact table** is the center of the star, and is SALES table in this example that keeps sales data for the data cube
- The query "*Find all monthly sales which are generated by every branch for every existing product within the past four months*" will generate an integrated data cube

Snowflake Design

Snowflake design is 1:M relationship chains towards the center of the star



Snowflake Design

- **Snowflake design** is an extension of star schema design of multidimensional data for data warehousing
- Since the relationships between tables are always 1:M towards the fact table, the snowflake design makes meaningful very high dimensional data cubes possible

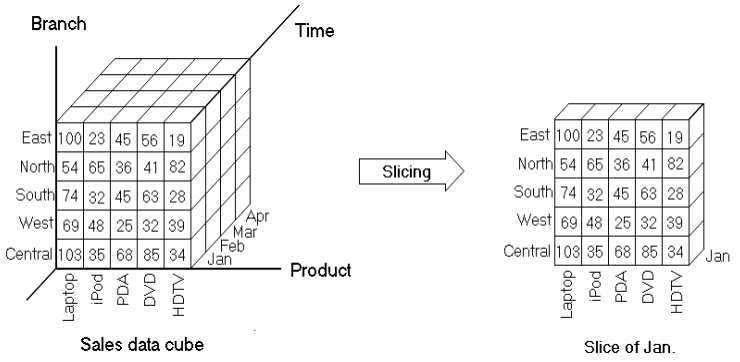
OLAP

- **OLAP** (Online Analytical Processing) is one of the most popular business intelligence techniques in organizations
- The word "**online**" means data availability

Elemental Techniques of OLAP

- SQL queries
- OLAP operations
  - **Slicing** is to reduce the dimensionality of data by fixing the level(s) of one or more dimensions to create slices
  - **Dicing** is to divide the data cube into sub-cubes (so called dice) for comparison, (e.g., actual vs. plan, this year vs. last year).
  - Combinations of slicing and dicing with other methods (such as queries) are also called **drill-down**, which means investigating information in increasing details
- Data visualization

Slicing



Dicing