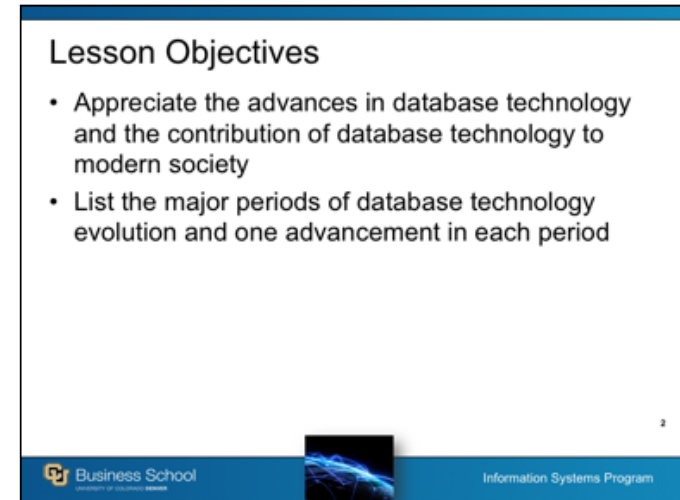


Welcome to Lesson 7 of Module 2 on the Introduction to Databases and DBMSs

- Covers evolution of DBMS technology to provide a context about the contribution of database software to economic development
- Database management systems are vital technology to modern organizations

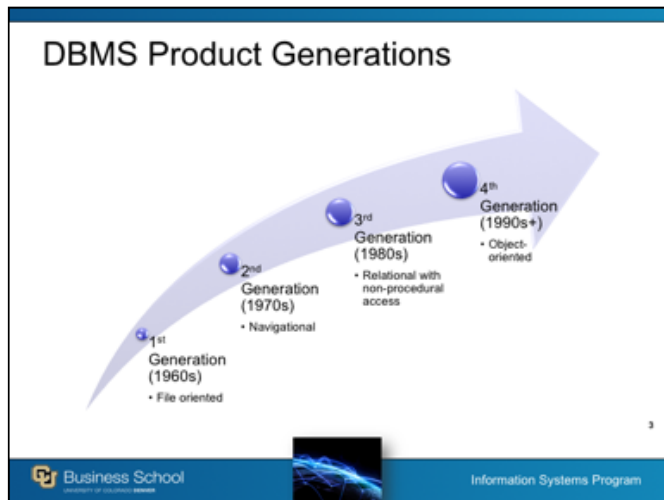
Opening question: What company pioneered early advancements in relational database technology? (trivia question)



Lesson Objectives

- Appreciate the advances in database technology and the contribution of database technology to modern society
- List the major periods of database technology evolution and one advancement in each period

Informational material: background for detailed knowledge presented in other modules



(XML) as a publishing standard. Because these DBMSs view any kind of data as an object to manage, fourth-generation systems are sometimes called “object-relational.” Chapter 19 presents details about object features in DBMSs. In addition to the emphasis on objects, DBMSs have developed new forms of distributed processing. Chapter 18 presents details about parallel and distributed database technology to support increased performance, improved reliability, and local control of data.

The first generation supported sequential and random searching, but the user was required to write a computer program to obtain access.

The second generation products were the first true DBMSs as they could manage multiple entity types and relationships. However, to obtain access to data, a computer program still had to be written. Second generation systems are referred to as “navigational” because the programmer had to write code to navigate among a network of linked records.

Third generation systems are known as relational DBMSs because of the foundation based on mathematical relations and associated operators. Optimization technology was developed so that access using non-procedural languages would be efficient.

Fourth-generation DBMSs are extending the boundaries of database technology to unconventional data, new kinds of distributed processing, and data warehouse processing. Fourth-generation systems can store and manipulate unconventional data types such as images, videos, maps, sounds, animations, and Web data. Most DBMSs now feature convenient ways to publish static and dynamic Web data using the eXtensible Markup Language

Recent Database Technology Developments

- Business intelligence processing
 - Data integration
 - Storage/retrieval of summary data
- Cloud computing
 - No fixed costs of ownership
 - Data and software
- Optimization for big data demands
 - Demands from smart phones, automotive technology, RFID tags, digitized media
 - NoSQL: simplified models for high performance

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entertainment, and security. Big data exceeds the limits of commercial database software to capture, store, process, and analyze.

NoSQL (Not only SQL) database technology has been developed to deal with some of the challenges of big data. As the name implies, NoSQL database technology does not use the traditional relational database model and SQL standard. Instead NoSQL database products use simplified database models, less stringent transaction processing models, and distributed processing to reduce bottlenecks for dealing with big data. NoSQL products cover a wide range of data models to support management of key-record pairs, documents, XML, graphs, and objects.



A data warehouse is a database that supports mid-range and long-range decision making in organizations. The retrieval of summarized data dominate data warehouse processing, whereas a mixture of updating and retrieving data occur for databases that support the daily operations of an organization. Chapter 17 presents details about DBMS features to support data warehouse processing.

Cloud computing is a recent area of product development for both established DBMS vendors and new vendors. Cloud computing supports on-demand and pay-per-use access for both data and software. Cloud computing usage is web-based without fixed costs of software ownership. Major DBMS vendors have developed cloud computing models as an alternative to their traditional approach of product licensing and ownership. In addition, a number of new vendors have created DBMS products tailored to the cloud computing model.

Part of the promise of cloud computing is support for applications with exploding data growth known as big data. The growth in data comes from a variety of sources such as sensors in smart phones, energy meters, and automobiles, interaction of individuals in social media websites, radio frequency identification tags in retail, and digitized media content in medicine,

DBMS Marketplace

- **Enterprise DBMS**
 - Oracle: dominates in Unix; strong in Windows
 - SQL Server: strong in Windows
 - DB2: strong in MVS and VM environments
 - Teradata: usage as a data warehouse platform
 - SAP Sybase: possible challenge to Oracle
 - Significant open source DBMSs: MySQL, PostgreSQL, MongoDB, MariaDB
 - Cloud-based and NoSQL: rapidly evolving
- **Desktop DBMS**
 - Access: dominates
 - LibreOffice Base, Corel Paradox, FileMaker Pro


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products at the low end of the enterprise DBMS market. Although source code for open source DBMS products is available without charge, most organizations purchase support contracts so the open source products are not free. Still, many organizations have reported lower cost of ownership using open source DBMS products. MySQL, first introduced in 1995, is the leader in the open source DBMS market. According to hosting statistics by Jelastix.com in 2011, MySQL has 46% market share of open source DBMSs. MongoDB (21%), PostgreSQL (19%), and MariaDB (14%) follow MySQL in open source market shares.

The market positions for the top five firms have changed little in the last decade although Oracle has gained some market share, now approaching 50%. The SAP acquisition of Sybase may change the market as SAP has large financial resources and lots of opportunity to market Sybase with its other enterprise products. Enterprise DBMSs use mainframe servers running IBM's MVS operating system and mid-range servers running Unix (Linux, Solaris, AIX, and other variations) and Microsoft Windows Server operating systems. The Unix/Linux and Windows Server environments dominate enterprise DBMS sales with IBM mainframe environments with a much smaller market share.

DB-Engines.com ranks relational DBMS products by popularity using the number of mentions on websites, frequency of search in Google Trends, job offers in leading job websites, and profiles in professional websites. The DB-Engines ranking (top 10) in September 2013 was Oracle, Microsoft SQL Server, MySQL, PostgreSQL, DB2, Microsoft Access, SQLite, Sybase, Teradata, and FileMaker. For enterprise products, the ranking is similar to the revenue ranking by the Gartner Group.

Open source DBMS products have begun to challenge the commercial DBMS

Summary

- Databases and database technology vital to modern organizations
- Remarkable product evolution
- Competitive industry with lots of continuing innovation

IBM dominated early development of relational database technology