01- Database Introduction & Architectures

School of Computer Science
University of Windsor

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Agenda

- Course Introduction
- Team Introduction
- Lecture
- Project hand-out

Deadline

Forming Groups: **20th May 2023 [11:59 PM]**

- Section 4 (MO 08:30 am):Section4_Project_Groups.docx
- Section 1 (MO 11:30 am): Section1_Project_Groups.docx
- Section 2 (TU 08:30 am): Section2_Project_Groups.docx
- Section 3 (WE 11:30 am):Section3_Project_Groups.docx

Introductory Questions

What is a database

What is the history of databases?

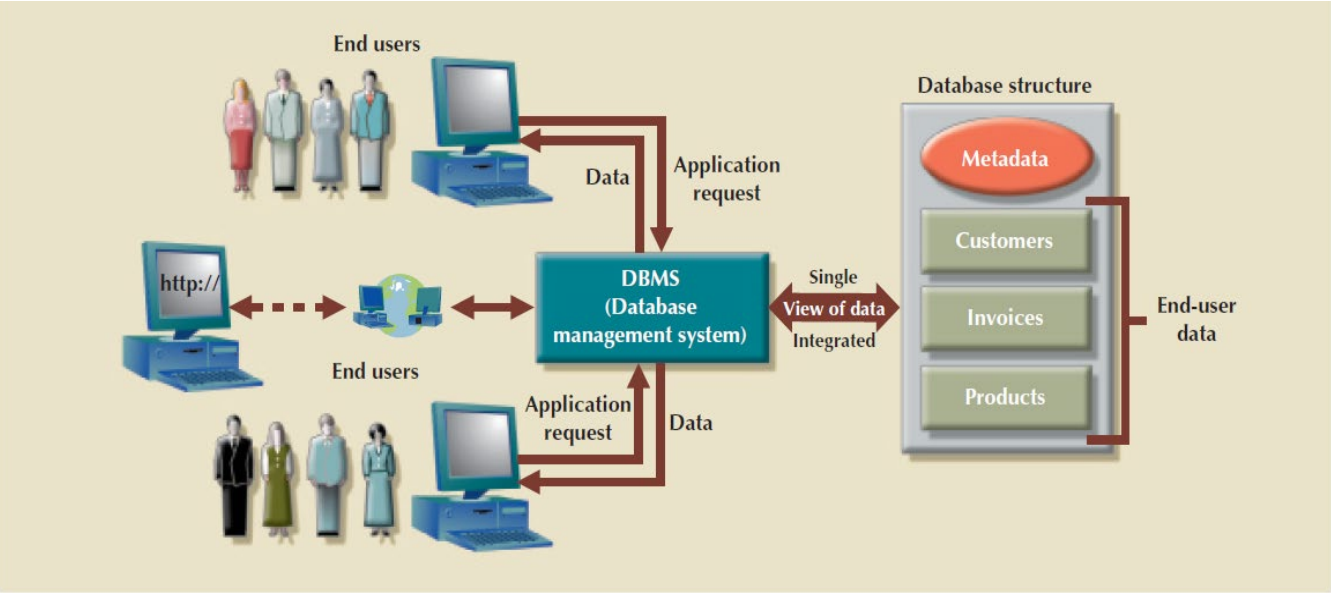
What are the different database system architectures?

What is a data warehouse?

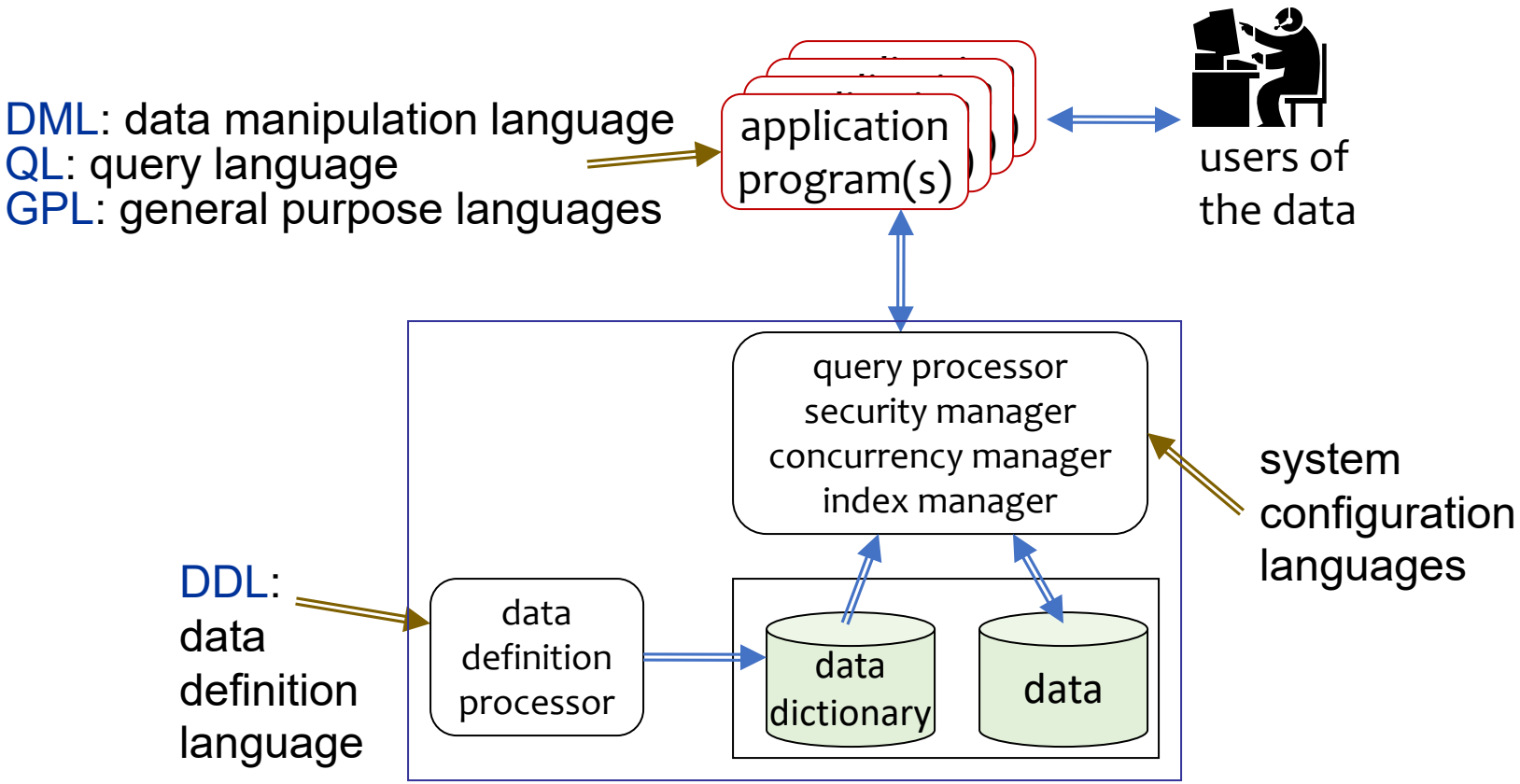
What is a Database?

- A database is any collection of data.

- A DBMS is a software that manages and controls access to the database.



DBMS Languages



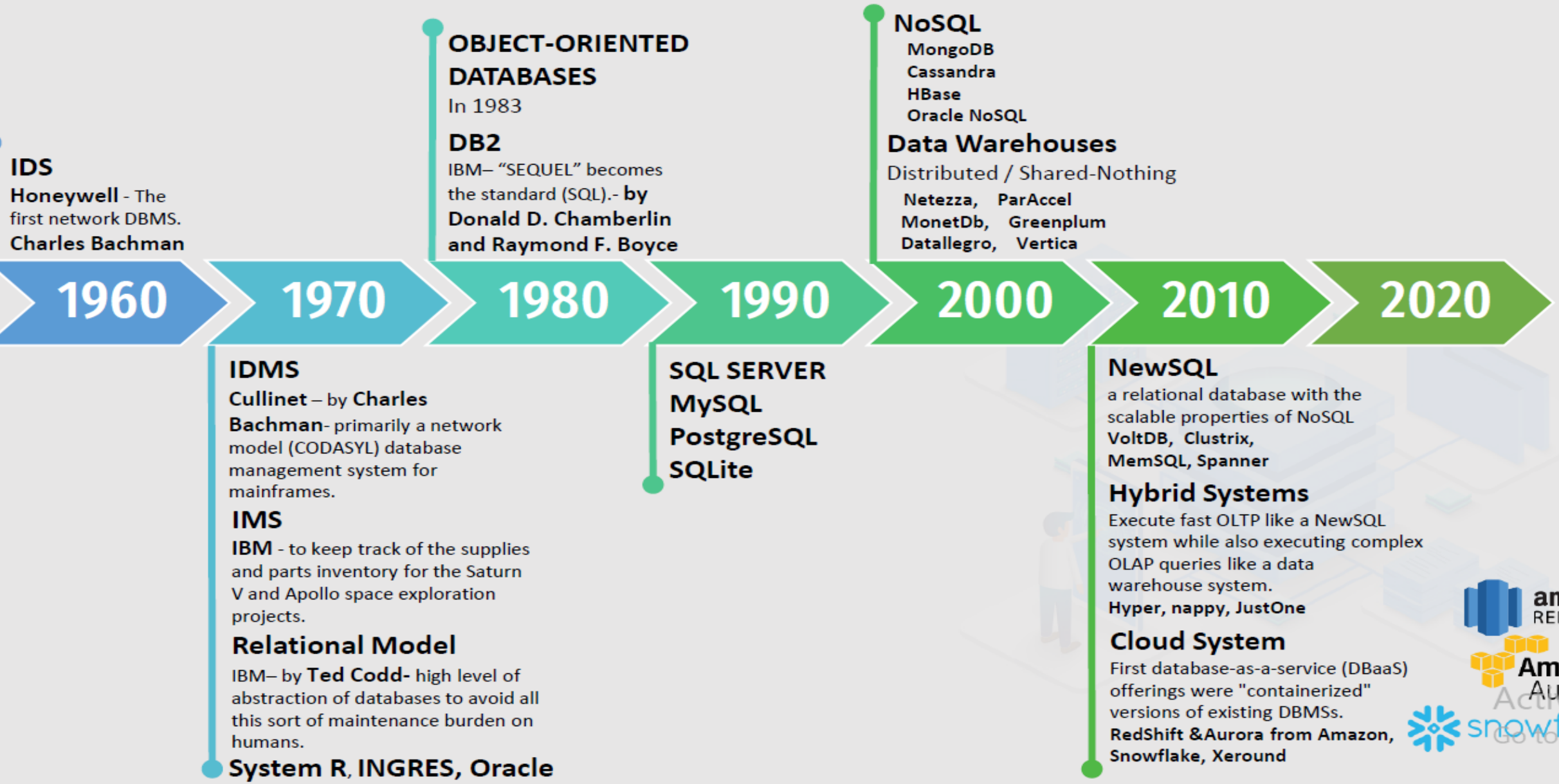
Advantages of Using a DBMS

Anything you can do with a DBMS, you can do with a file system, a network and a heap of C code. So why spend the money to buy a DBMS?

- **Integrity**: A DBMS maintains the consistency of stored data
- **Concurrency**: A DBMS supports access by concurrent users
- **Access Control**: A DBMS can restrict access to authorized users
- **Redundancy Control**: A DBMS can assist in controlling redundancy
- **Backup and Recovery**: A DBMS can provide backup and recovery.
  - *backup* = snapshots of the data particular times
  - *recovery* = restoring the data to a consistent state after a system crash

History of Database Systems

History of Database –Video



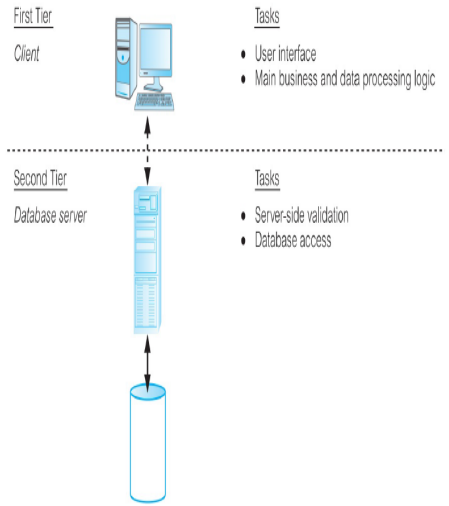
415 systems in ranking, May 2023

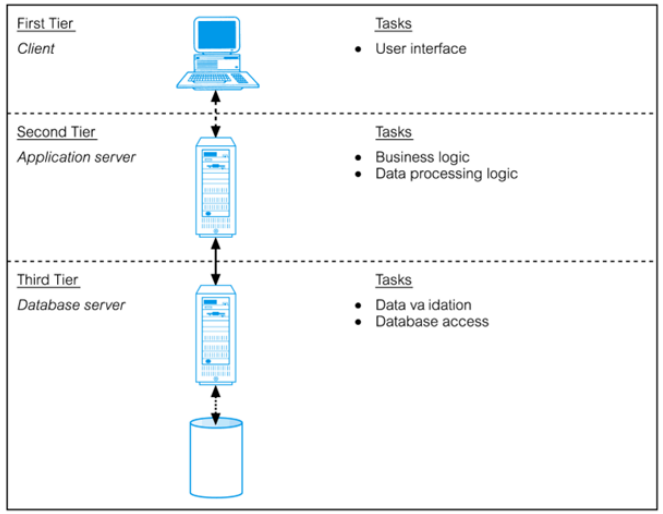
Rank			DBMS	Database Model	Score		
May 2023	Apr 2023	May 2022			May 2023	Apr 2023	May 2022
1.	1.	1.	Oracle	Relational, Multi-model	1232.64	+4.36	-30.18
2.	2.	2.	MySQL	Relational, Multi-model	1172.46	+14.68	-29.64
3.	3.	3.	Microsoft SQL Server	Relational, Multi-model	920.09	+1.57	-21.11
4.	4.	4.	PostgreSQL	Relational, Multi-model	617.90	+9.49	+2.61
5.	5.	5.	MongoDB	Document, Multi-model	436.61	-5.29	-41.63
6.	6.	6.	Redis	Key-value, Multi-model	168.13	-5.42	-10.89
7.	7.	7.	IBM Db2	Relational, Multi-model	143.02	-2.48	-17.31
8.	8.	8.	Elasticsearch	Search engine, Multi-model	141.63	+0.56	-16.06
9.	9.	↑ 10.	SQLite	Relational	133.86	-0.68	-0.87
10.	10.	↓ 9.	Microsoft Access	Relational	131.17	-0.20	-12.27
11.	↑ 12.	↑ 14.	Snowflake	Relational	111.73	+0.60	+18.22
12.	↓ 11.	↓ 11.	Cassandra	Wide column	111.14	-0.67	-6.88
13.	13.	↓ 12.	MariaDB	Relational, Multi-model	96.87	+0.93	-14.26
14.	14.	↓ 13.	Splunk	Search engine	86.64	+1.20	-9.71
15.	↑ 16.	↑ 16.	Amazon DynamoDB	Multi-model	81.11	+3.66	-3.35
16.	↓ 15.	↓ 15.	Microsoft Azure SQL Database	Relational, Multi-model	79.19	+0.13	-6.14
17.	17.	17.	Hive	Relational	73.61	+1.96	-8.00
18.	↑ 19.	↑ 24.	Databricks	Multi-model	63.94	+2.98	+16.09
19.	↓ 18.	↓ 18.	Teradata	Relational, Multi-model	62.71	+1.12	-5.67
20.	20.	↑ 23.	Google BigQuery	Relational	54.87	+1.55	+6.26

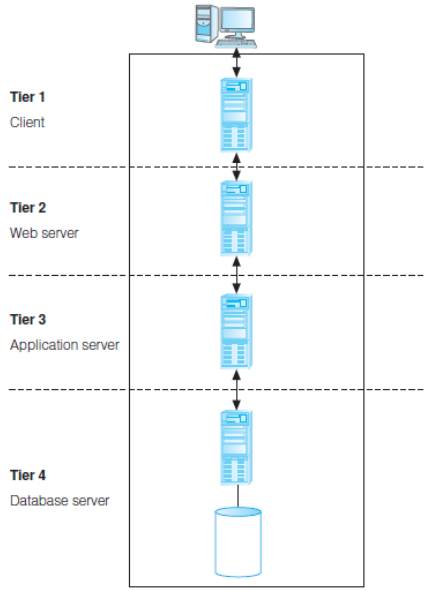
Source: https://db-engines.com/en/ranking

Multi-user DBMS Architectures

Two-Tier Client-Server	Three-Tier Client-Server	n-Tier Client-Server (e.g. 4-Tier)
Client (tier 1) manages user interface and runs applications. Server (tier 2) holds database and DBMS.	The need for enterprise scalability challenged the traditional two-tier client–server model	The three-tier architecture can be expanded to n tiers, with additional tiers providing more flexibility and scalability.

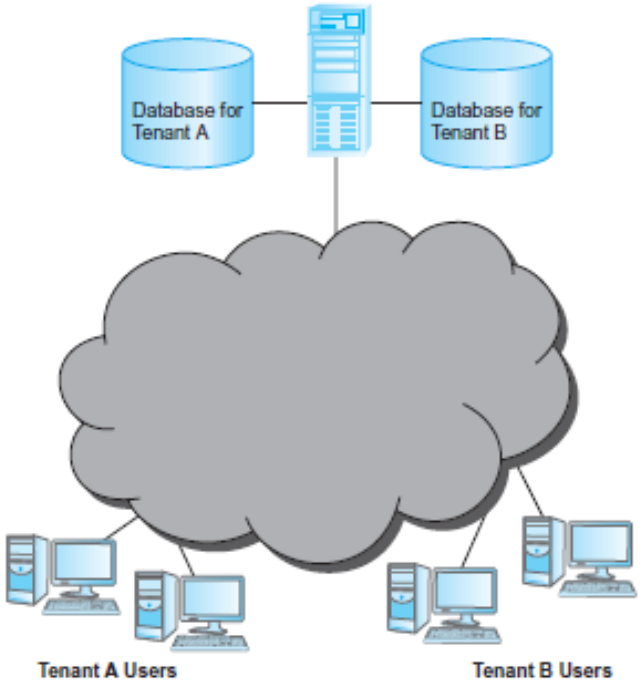


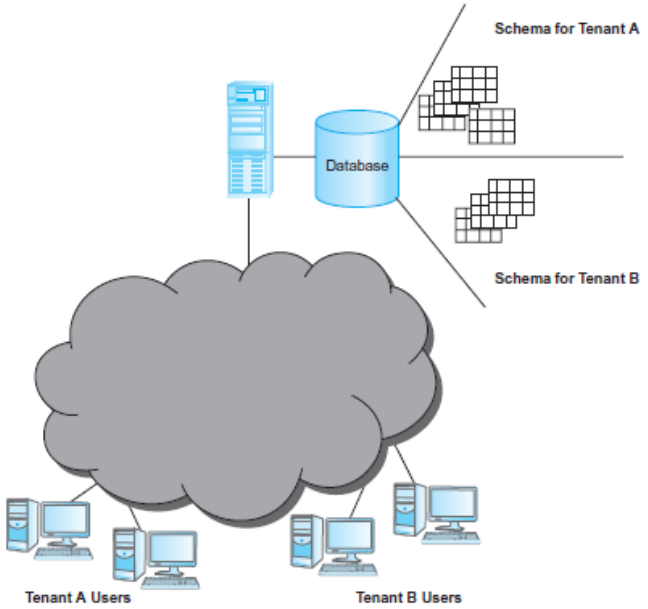




Cloud-based database solutions

- Multi-tenant cloud database
  - shared DBMS server, separate databases.
  - shared database, separate schema architecture



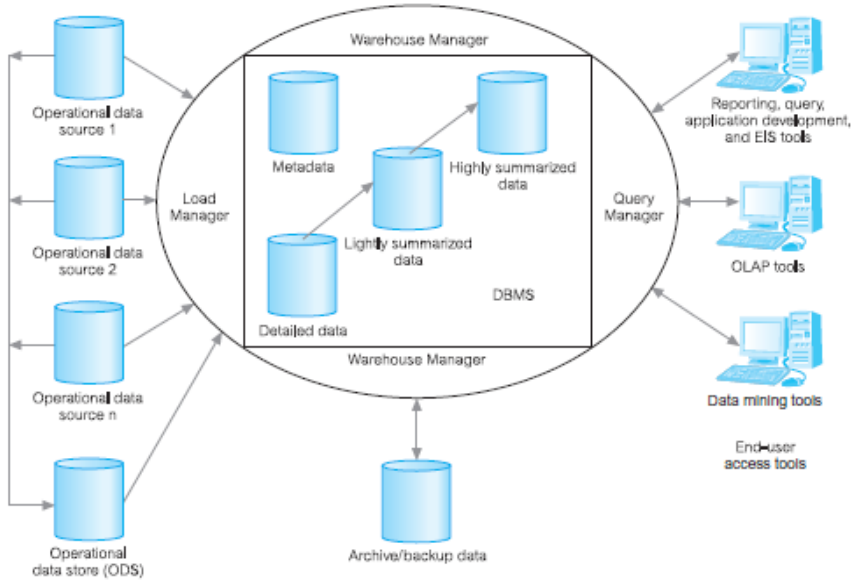


Source: Pearson Education

Data Warehousing

- A consolidated/integrated view of corporate data drawn from disparate operational data sources and a range of end-user access tools capable of supporting simple to highly complex queries to support decision making.

- Data Warehouse Video



Source: Pearson Education

University of Windsor

Data Warehouse Video

Inside The World's Largest Data Center - YouTube

Recap and Conclusion

- Introduction
- Database Structure
- Advantages of the Database Approach
- History of Database Systems
- Multi-User DBMS Architecture
- Cloud-based Database Architecture
- Data Warehousing

Test your understanding

- Which of the following is **not** a valid NoSQL database?
  - A. Cassandra
  - B. HBase
  - C. MongoDB
  - D. PostgreSQL

Project Intro

Any Questions