Database Management Systems
Introduction

Course Logistics:

- ISA 1 –
- ISA 2 –
- Class Assignments –
- Sem End Quiz -

Why study databases?

- Data (information) is a key resource.
- Databases help us
  - Store it (file structures, disk management)
  - Understand it (data models)
  - Keep it secure (security, recovery)
  - Find it and use it (query languages, concurrency control and data analysis tools)

Why study databases?

- Information is growing
- DBMSs are a key part of most systems
  - banking, making reservations, purchasing, borrowing, marks, schedules, browsing online catalogues, video on demand, interactive maps and images, employee information, web servers

Definitions

- **Data:** known facts that can be recorded
- **Database**: a collection of data
  - represents some aspect of the real world
  - logically coherent collection (not a random collection)
  - designed, built & populated for a specific purpose
- **Database Management System**: the software that manages the data
- **Types:** Multimedia Databases, Geographic Information Systems (GIS), Biological and Genome Databases, Data Warehouses, Mobile databases, Real-time and Active Databases

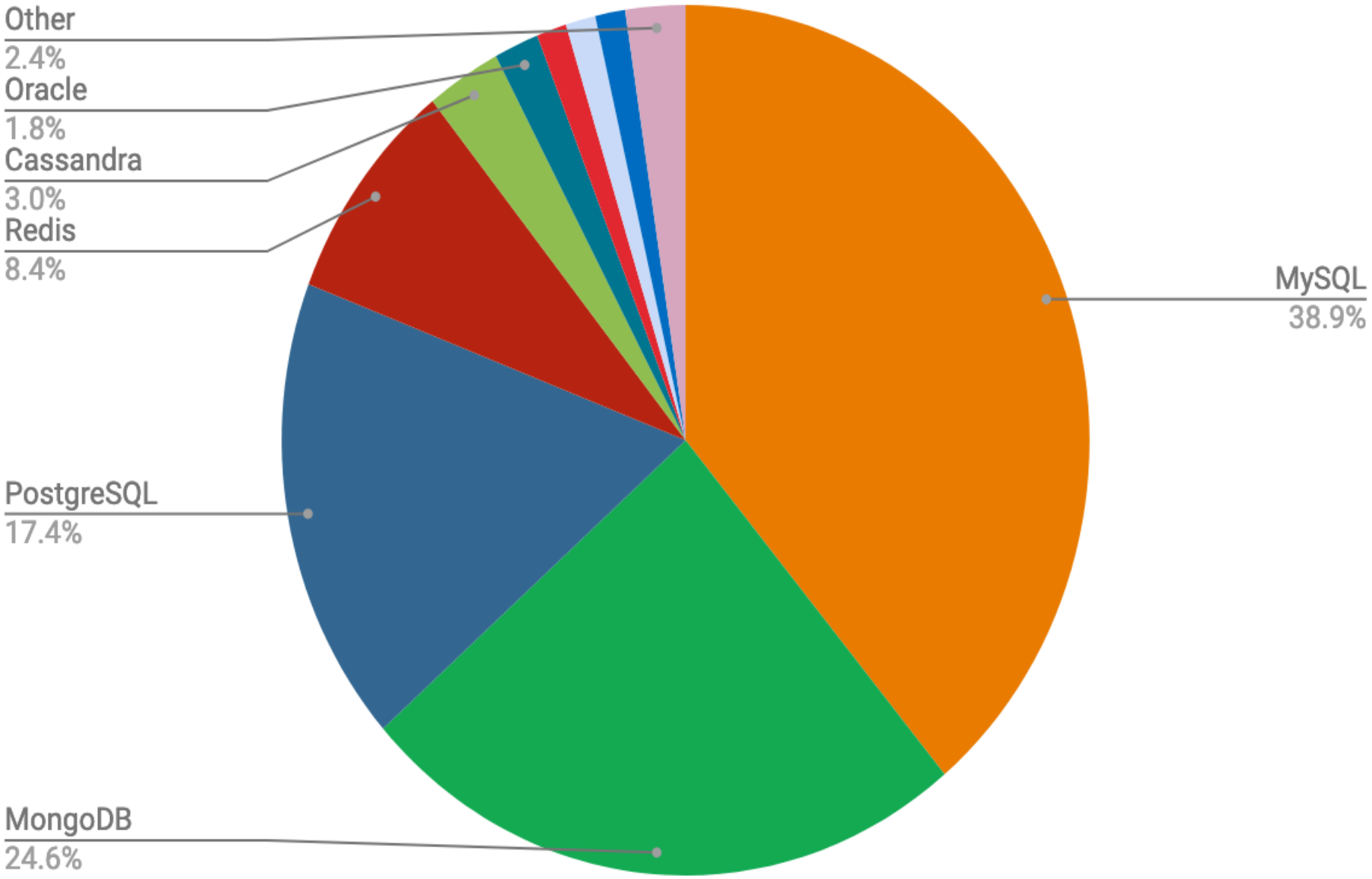
DBMSs provide...

Facilities to:

- **Define** – specify data types, structures & constraints for the data to be stored in the database
- **Construct** – store the data
- **Manipulate** – pose queries to retrieve specific data, update data or generate reports based on the data

Popular Examples

- Company Databases
  - employees, departments, projects …
- Airline Reservation Systems
  - flights, fares, customers, reservations ..
- Library Databases
  - authors, titles, publishers, videos …
- Bank Databases
  - accounts, customers ...


Other
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Oracle
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Cassandra
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Redis
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MySQL
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PostgreSQL
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MongoDB
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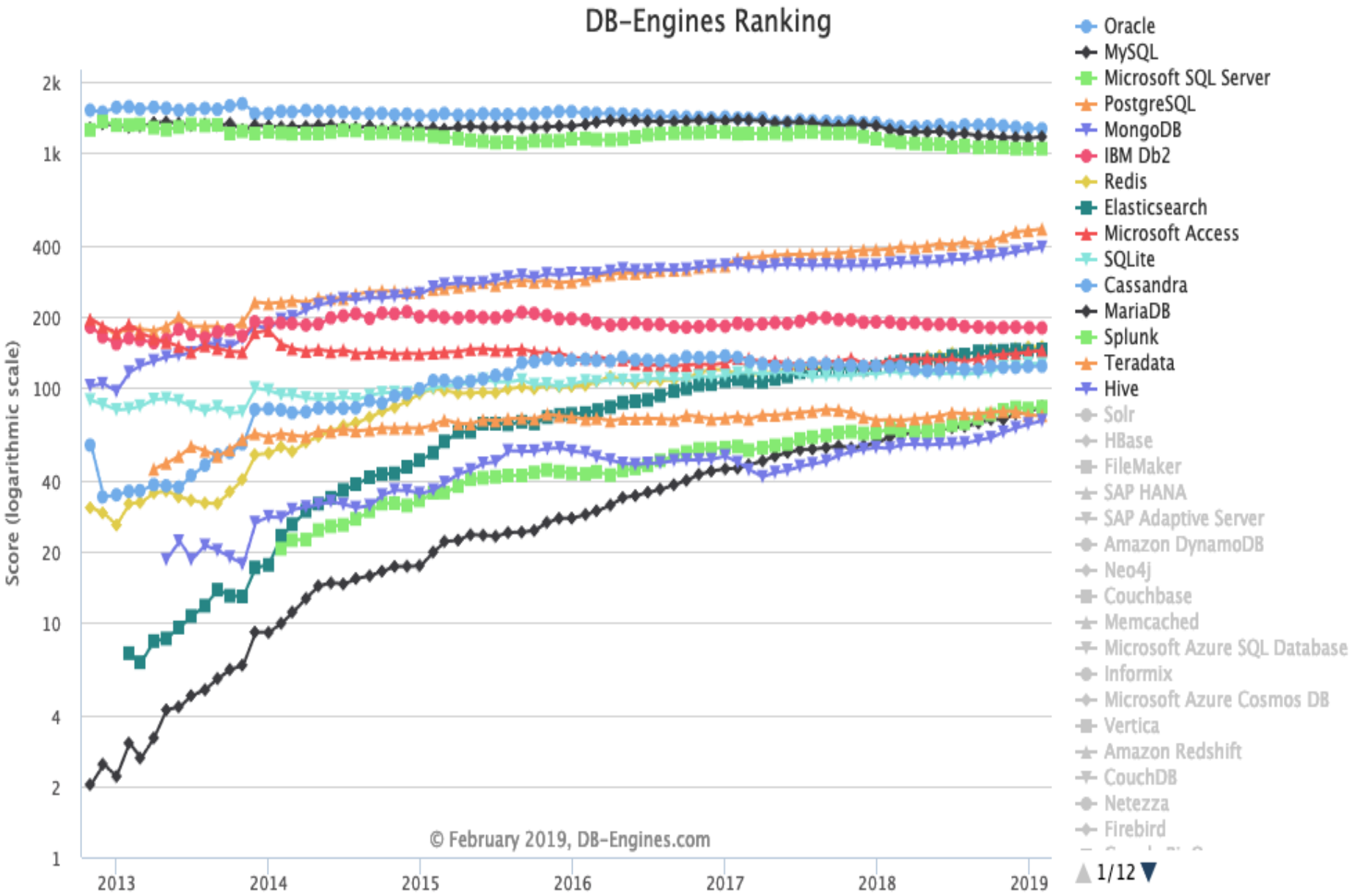
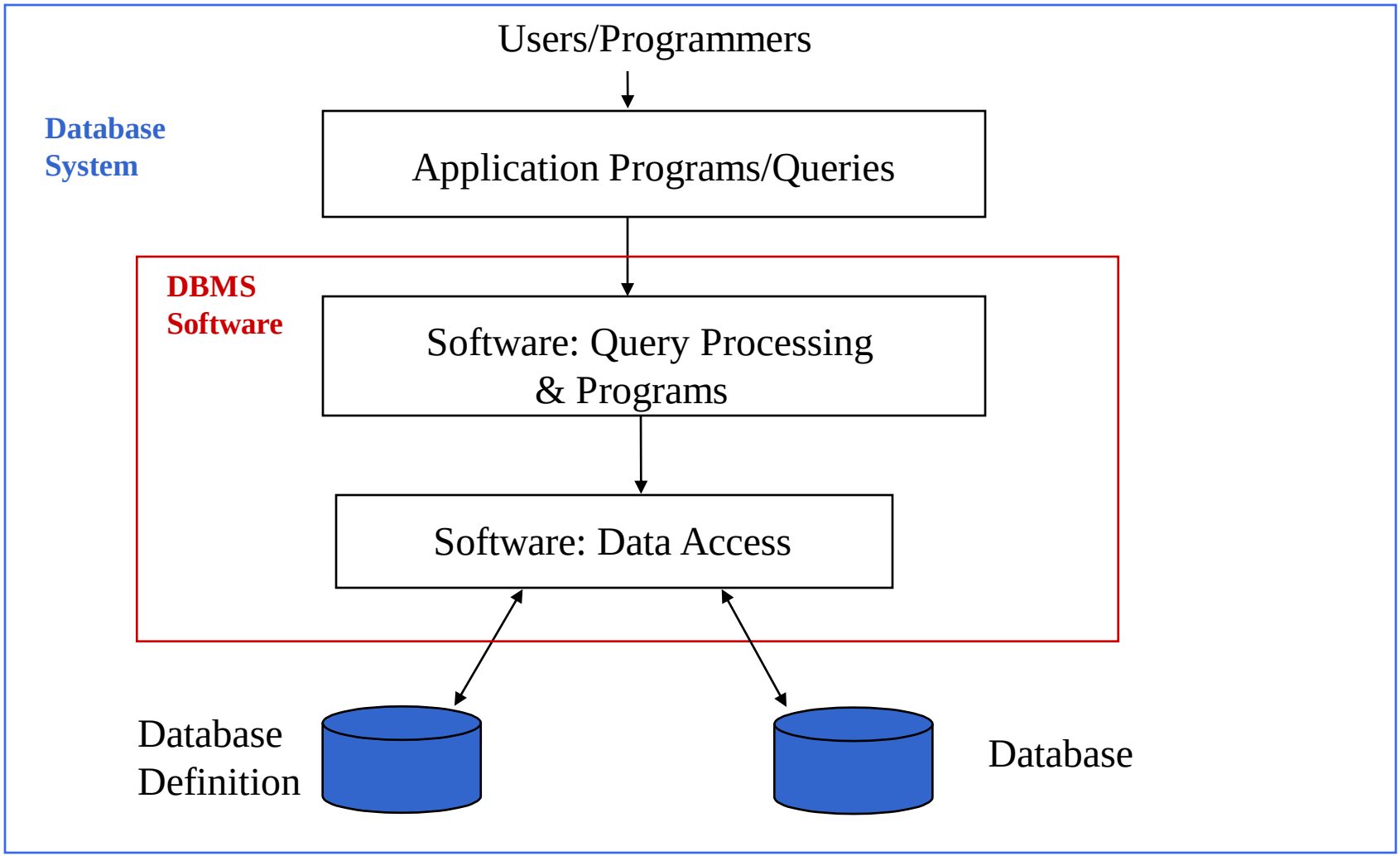


https://scalegrid.io/blog/2019-database-trends-sql-vs-nosql-top-databases-single-vs-multiple-database-use/

Database System Environment



DBMSs VS File Processing

Why do we need a DBMS?

Why not just use files to store data?

File Processing VS DBMS

File Processing

- data definition is part of application programs
- programs & data are interdependent

DBMS

- **self-describing**
- **program-data independence**
- **support of multiple views of data**
- **provides concurrency control & transaction processing capabilities**
- provides mechanisms for backup & recovery
- support for query languages
- provides access control
- Reduced application development time

Desirable Capabilities

- control redundancy
- restrict access
- provide persistent storage for program objects & data structures
- permit inferencing & actions by using rules
- provide multiple user interfaces
- represent complex relationships among data
- enforce integrity constraints
- provide back-up & recovery

Additional Advantages of using a DBMS

- Potential for enforcing standards
- Reduced application development time
- Flexibility
- Availability of up-to-date info to all users
- Economical
- Multi-user to a high degree

Database Players

- DBA
  - access authorization, coordination & monitoring database usage, problem determination, performance tuning ,
  - identify the requirements & choose the appropriate structures to represent & store the data
- Users – casual, naïve (canned transactions, mobile apps), sophisticated…
- System analysts & application programmers
- DBMS system designers & implementers
- Tool developers
- Operators & maintenance personnel