SWE 207
Database Management Systems

~ Database System~

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SAKARYA
ÜNİVERSİTESİ

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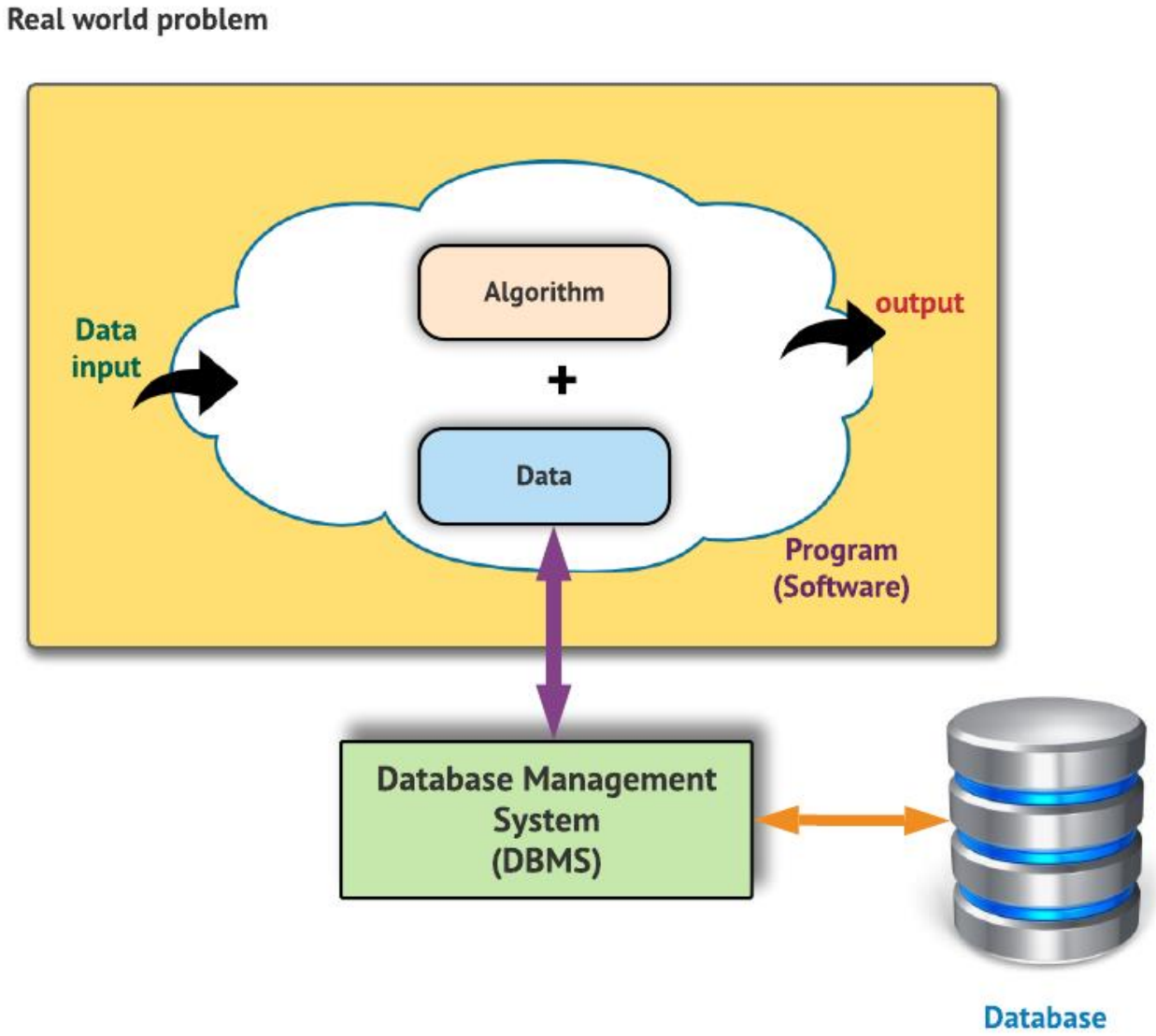
The big picture



Database Management Systems Tasks

- Store
- Manage
  üstesinden gelmek
- Retrieve
  geri almak/kurtarmak

Why is the database important?

database management obligatary

- The group of interrelated data stored in files is called databases.

birbiri ile ilişkili

- Data sizes today: gigabytes, terabytes (1024 gigabytes), petabytes, exabytes, zettabytes, yottabytes
- 38 gigabytes of data is collected per second with China's giant telescope the size of thirty football fields. (2020)
- Google processes an average of 40.000 searches per second (3.5 billion on average per day. Search results can be brought to the user quickly.) (2018)
- The number of Facebook users is 2 billion. An average of 1.5 billion users are active daily. (2018)

Why is the database important?

- Every minute; 4.146.600 YouTube videos are watched, 456.000 tweets are posted, 46.740 photos are uploaded to Instagram, 510.000 comments are added to Facebook. (2018)
- Mobile operators such as Sprint, AT&T have to store/manage trillions of conversations. 70.000 conversations are added per second. (2007)
- In addition to storing/managing the data, it is also necessary to quickly access the desired information.
- A jet plane collects 10 terabytes of sensor data in 30 minutes. (2012)

Why is the database important?

- Internet of Things: Billions of sensors connect to the internet.
- The use of databases is mandatory to store and manage such large data and quickly access the requested information.
- The database is widely used in many different industries and institutions today:
  - Finance, education, transportation, communication, media, health, informatics, production

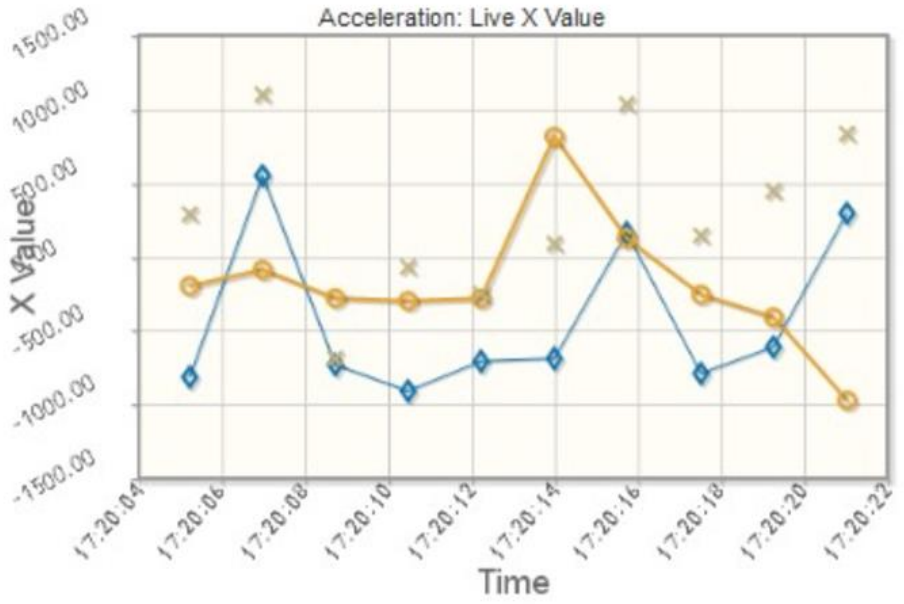
Data and information

- Unprocessed raw truths are called data.
- Information is created by processing the data.
- Information is used to show the meaning of the data.
- Accurate, relevant and timely information is very effective in decision-making processes.
- Making the right decision is extremely important for organizations to survive.
- Data management is one of the most basic activities of organizations.
- Data management is the discipline that interest in the proper production, storage and retrieval of data.

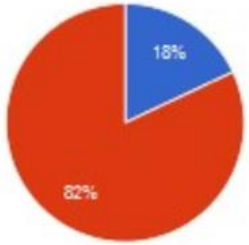
Data and information

Real time sensor data

Location change information



battery level



RTC internal temperature

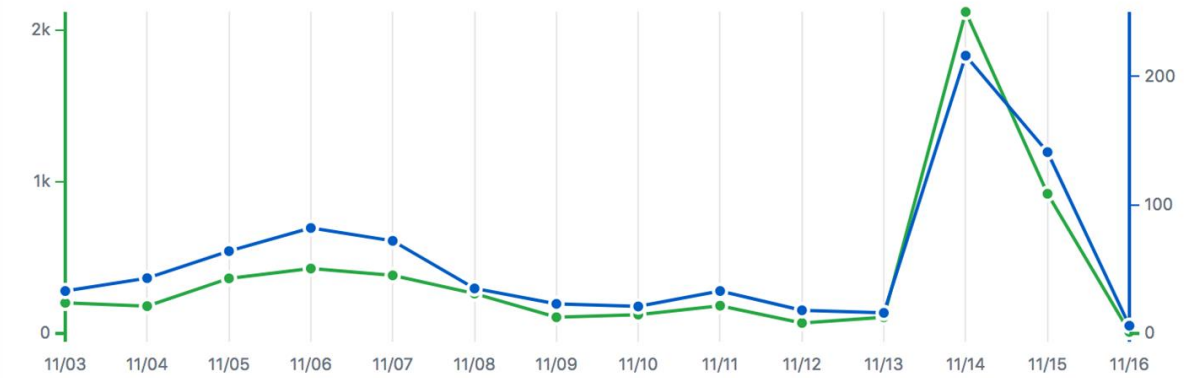
temp. information of the env.

real-time sensor data

- {"sensor":[{"sensorName":"tanımlanamadı","data":"<=>\u0004"},{"sensorName":"tanımlanamadı","data":"366405224"},{"sensorName":"tanımlanamadı","data":"node_01"},{"sensorName":"tanımlanamadı","data":"142"},{"sensorName":"BAT","data":"18"},{"sensorName":"ACC","data":"295;-970;834"},{"sensorName":"IN_TEMP","data":"27.25"},{"sensorName":"TCA","data":"25.81"},{"sensorName":"tanımlanamadı","data":""}],"time":"2016-03-23 17:20:21"}

Data and information

Visitors



5,460	602
Views	Unique visitors

Referring sites

Site	Views	Unique visitors
ogr.sakarya.edu.tr	1,271	294
github.com	508	102
bulentaltinbas.com.tr	90	42
iotlab.sakarya.edu.tr	79	14
l.facebook.com	41	21
facebook.com	23	5
web.whatsapp.com	9	1
celalceken.sakarya.edu.tr	8	5
Google	7	4

Popular content

Content	Views	Unique visitors
GitHub - celalceken/Datab...	1,374	492
DatabaseManagementSyst...	288	154
DatabaseManagementSyst...	269	152
DatabaseManagementSyst...	259	162
DatabaseManagementSyst...	251	141
DatabaseManagementSyst...	244	144
DatabaseManagementSyst...	195	110
DatabaseManagementSyst...	188	110
DatabaseManagementSyst...	179	112

Classic file structure

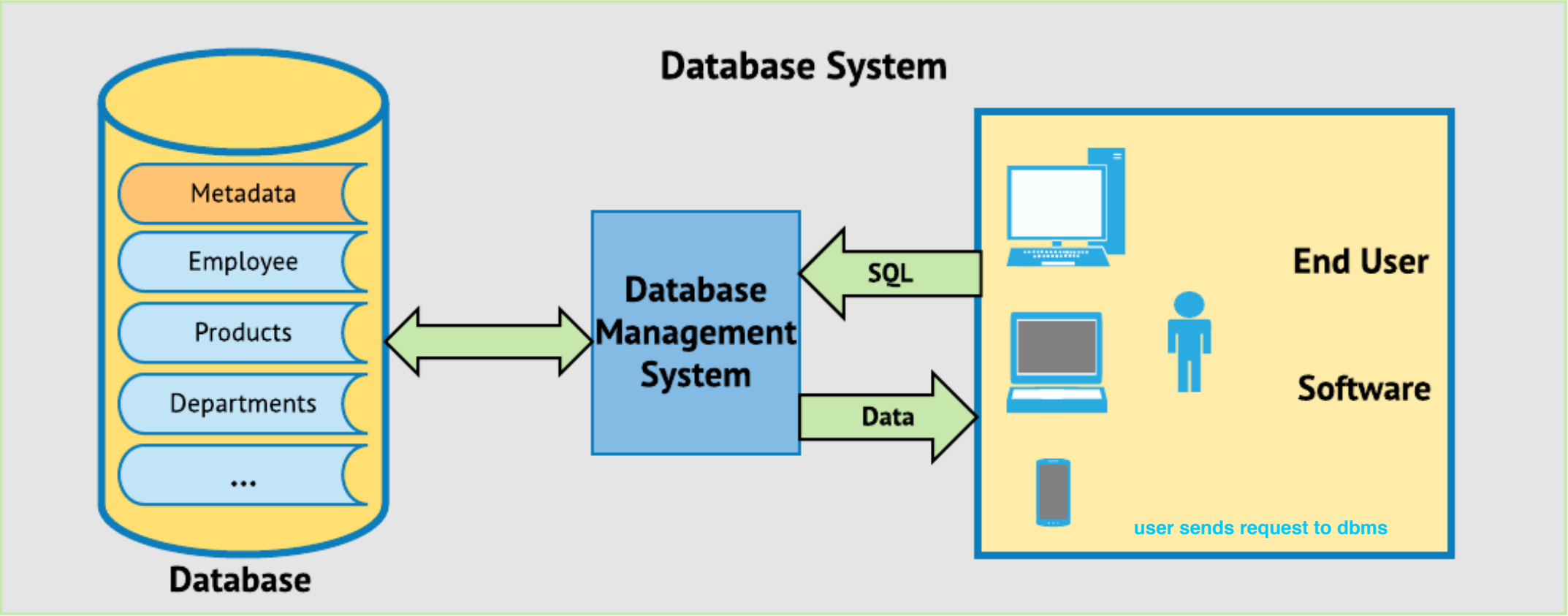
- The data are stored as records using the classical file structure.
- A sample file structure is given below:

Ders Kodu	Ders Adı	Öğr.Türü	Dönem	Bölüm Adı
BSM207	VERİ YAPILARI (B)	1. Öğretim	1	BİLGİSAYAR MÜHENDİSLİĞİ PR.
BSM303	VERİTABANI YÖNETİM SİSTEMLERİ (A)	1. Öğretim	1	BİLGİSAYAR MÜHENDİSLİĞİ PR.
BSM207	VERİ YAPILARI (B)	2. Öğretim	1	BİLGİSAYAR MÜHENDİSLİĞİ PR. (İÖ)
BSM303	VERİTABANI YÖNETİM SİSTEMLERİ (A)	2. Öğretim	1	BİLGİSAYAR MÜHENDİSLİĞİ PR. (İÖ)
BSM303	VERİTABANI YÖNETİM SİSTEMLERİ (?)	Uzaktan Eğitim	1	BİLGİSAYAR MÜHENDİSLİĞİ PR. (UZAKTAN EĞİTİM)
EBT514	VERİTABANI TASARIM VE YÖNETİMİ (?)	Uzaktan Eğitim	1	BİLİŞİM TEKNOLOJİLERİ PR. (YL) (UZAKTAN EĞİTİM)
BSM829	UZMANLIK ALANI (?)	1. Öğretim	1	BİLGİSAYAR VE BİLİŞİM MÜHENDİSLİĞİ PR. (YL)
BSM929	UZMANLIK ALANI (?)	1. Öğretim	1	BİLGİSAYAR VE BİLİŞİM MÜHENDİSLİĞİ PR. (DR)
BSM401	BİLGİSAYAR MÜHENDİSLİĞİ TASARIMI (F)	1. Öğretim	1	BİLGİSAYAR MÜHENDİSLİĞİ PR.
BSM401	BİLGİSAYAR MÜHENDİSLİĞİ TASARIMI (F)	2. Öğretim	1	BİLGİSAYAR MÜHENDİSLİĞİ PR. (İÖ)

Database system

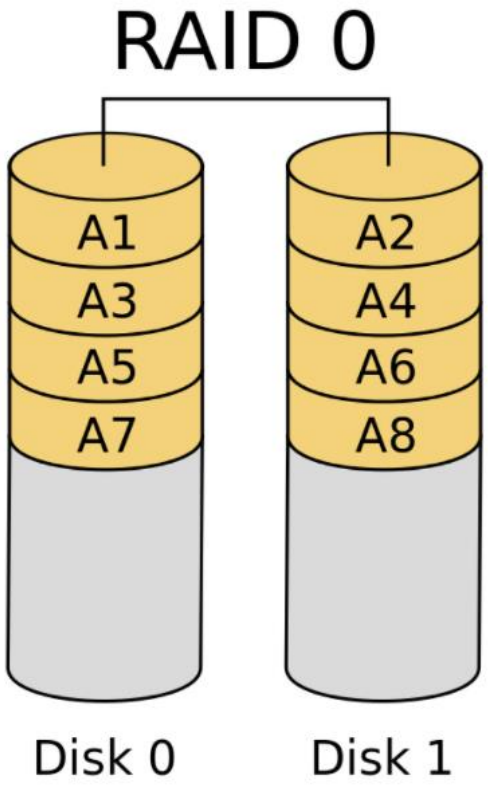
- Database System = Database + DBMS + Users
- The group of interrelated data stored in files is called database.
  - Database = RawData + Metadata (Relations + Data Characteristics)
- The software that manages the database structure and provides access to data is called Database Management System.
- Users: end users using the database, software developer, application software, client software

Database system

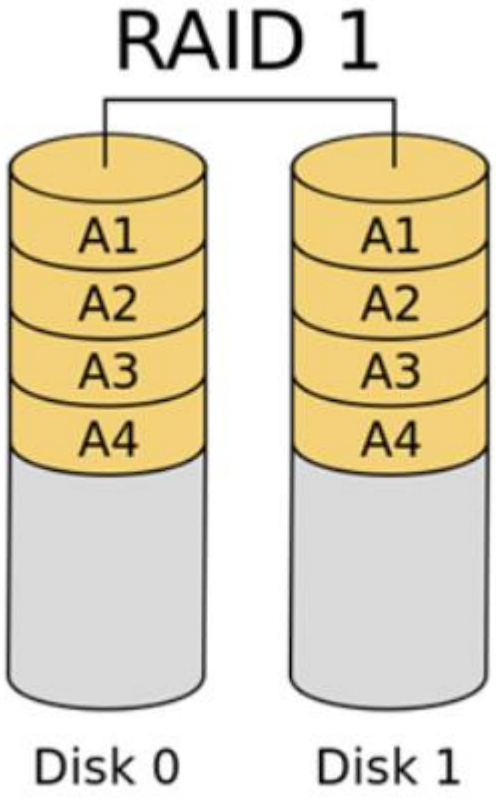


Database system environment

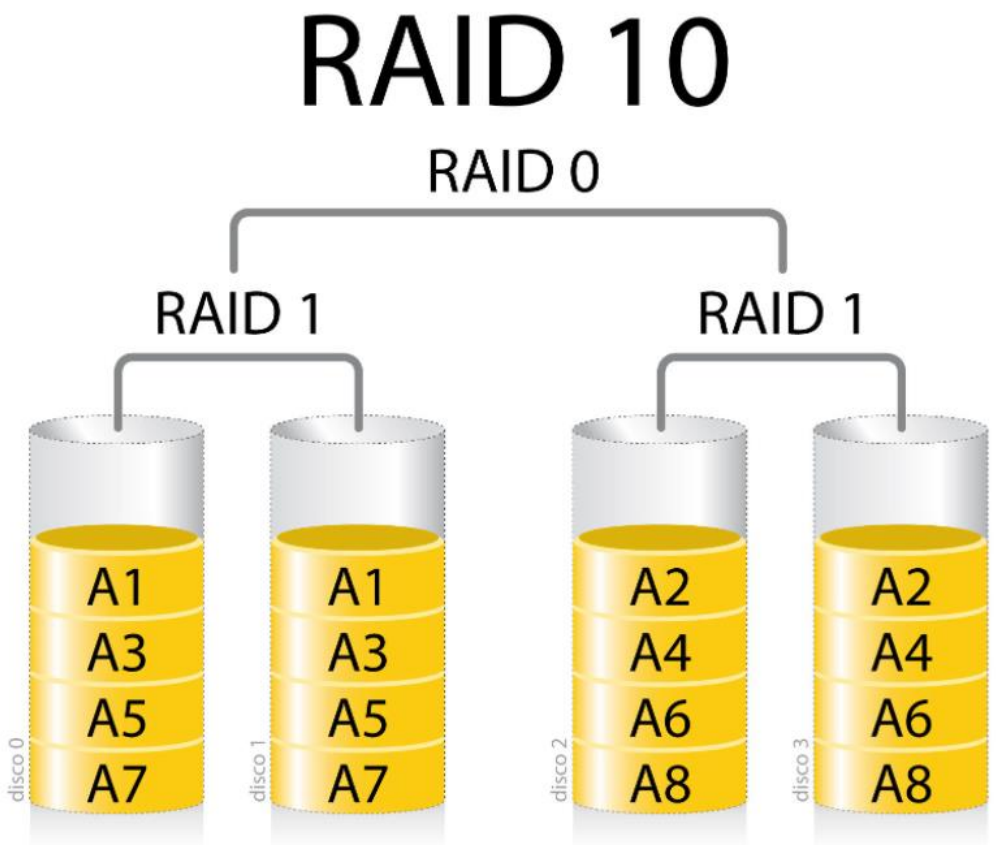
- Hardware
  - Servers, workstations, network, storage devices, raid, etc.
- Software
  - Operating systems
  - DBMS (Oracle, PostgreSQL, DB2, MSSQL, MySQL, etc.)
  - Application and utility programs
- Person
  - System administrator (maintanance and bakup of the syst), database administrator (management, backup, role management), database designer, application programmer, user
- Data



İncrease the speed



Reduce the risk of data loss



İncrease the speed

Reduce the risk of data loss

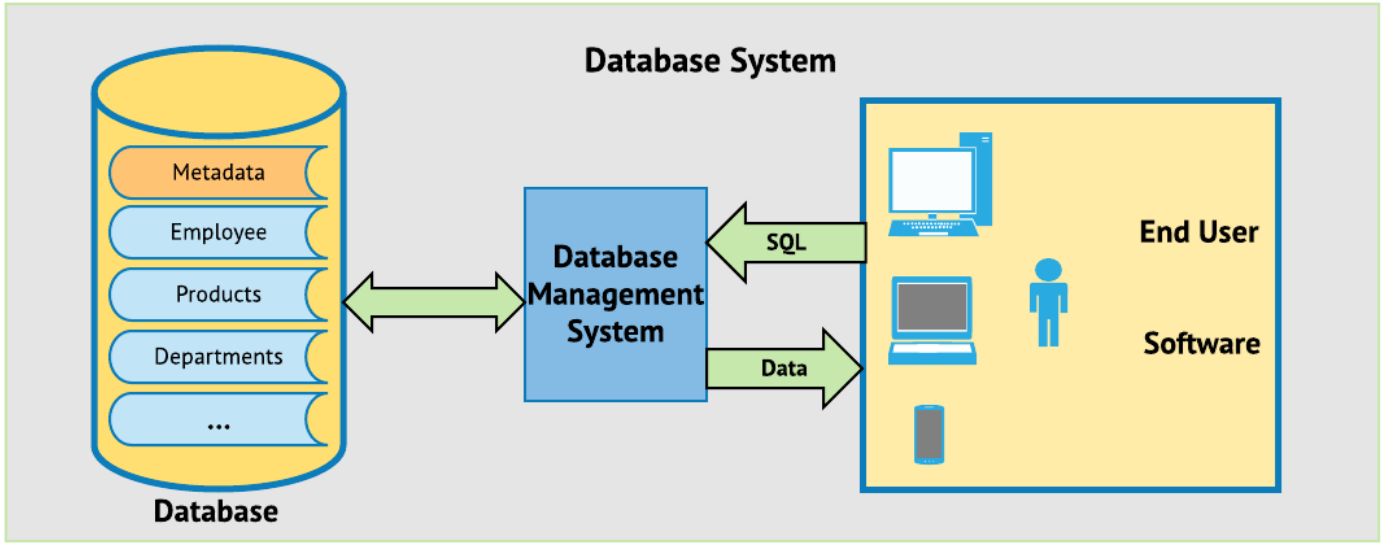
Benefits of using a DBMS

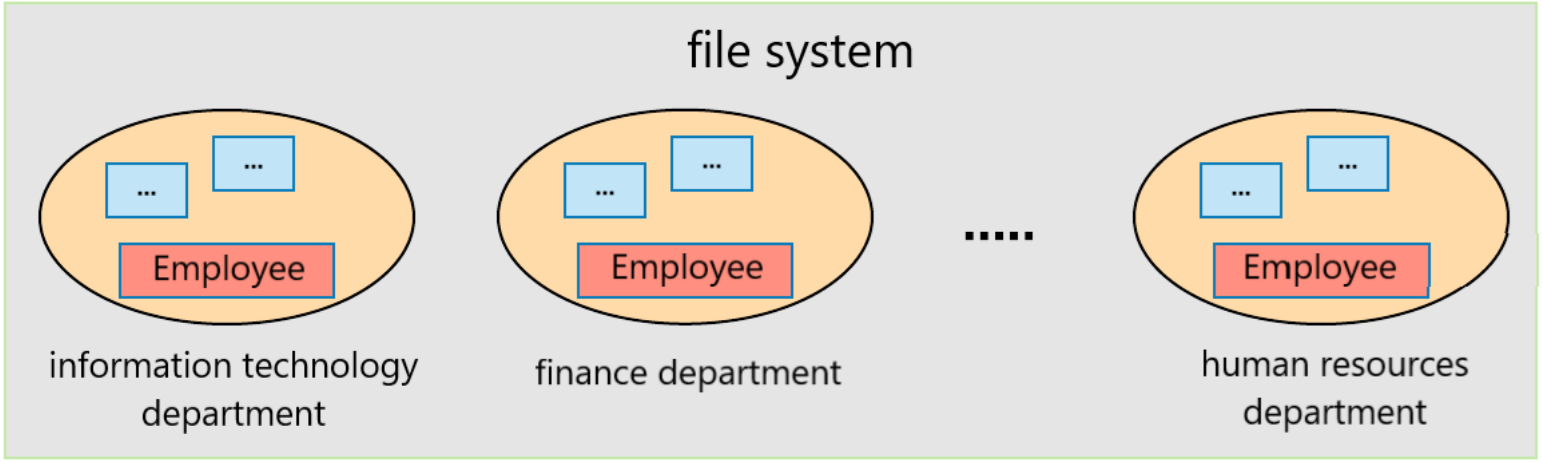
- Comparison of DBMS and file system
  - Data Integration: Data integration is the process of **combining data** from different sources into **a single, unified view logically and physically.**
  - Efficient storage of data without repetition can be guaranteed.

    The disadvantages of data repitition

    1. Unnecesary resource usage
    2. Anomalies can occur in insert, update and delete of data
  - Data Integrity: It can be ensured that the data are stored without damage and consistently. By **using constraints, data consistency can be ensured** (key constraints, integrity rules).
  - Data Security: It can be ensured that data is not lost and its consistency is protected in the face of system errors or despite the attack (transaction, raid systems, recovery mechanisms, advanced authorization structure, etc.).
  - Data Abstraction: Instead of a complex physical data structure, the user meets with a logical model that is easier to understand and manage.

Benefits of using a DBMS - Comparison of DBMS and file system





Benefits of using a DBMS

- Comparison of DBMS and file system
- Data Abstraction

Reading from a classic file

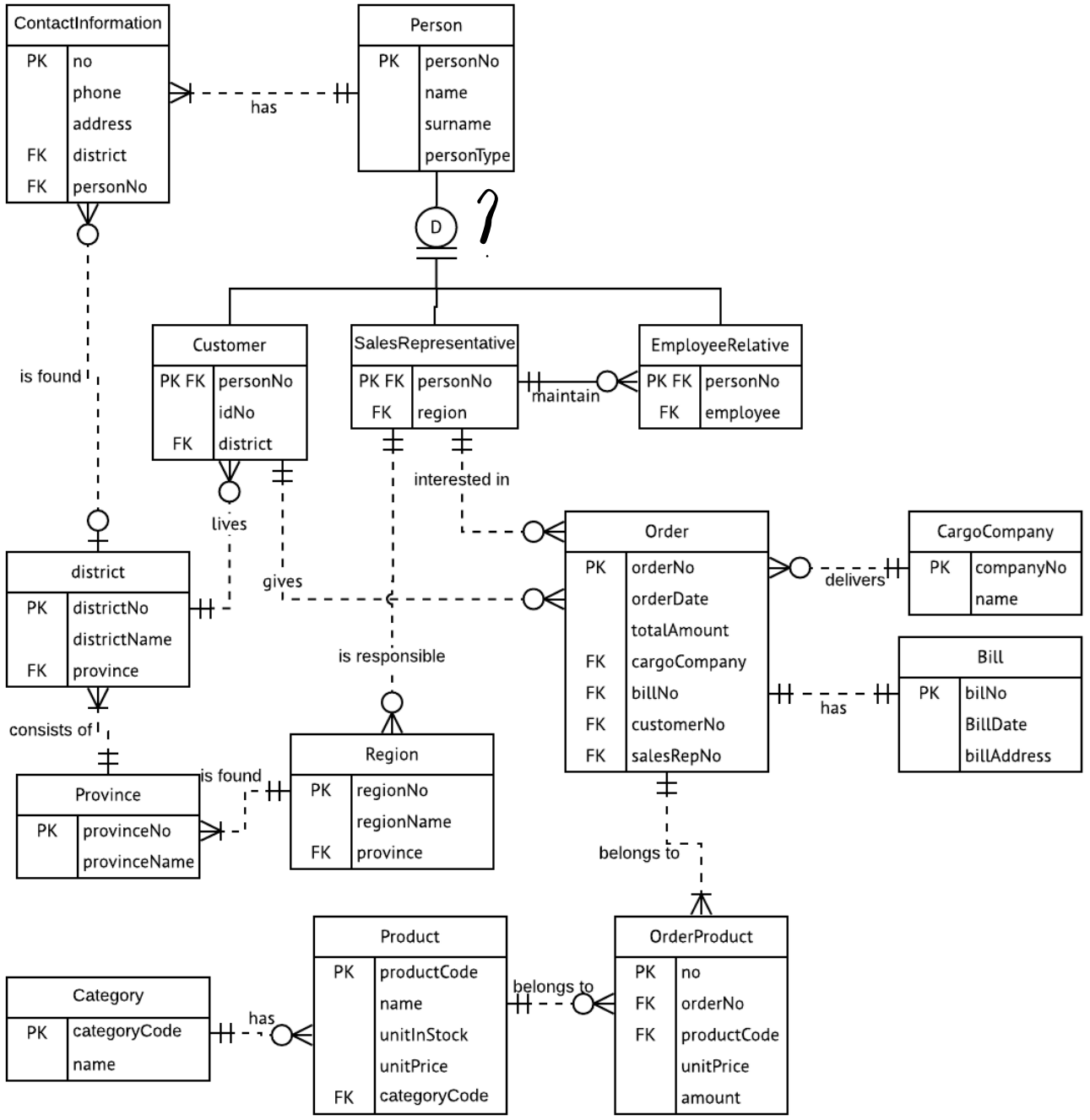
```
String file = "Students.dat";
try {
    FileReader fileReader = new FileReader(file);
    BufferedReader bufferedReader = new BufferedReader(fileReader);

    String line = null;
    while ((line = bufferedReader.readLine()) != null) {
        System.out.println(line);
    }
    bufferedReader.close();
} catch (IOException e) {
    e.printStackTrace();
}
```

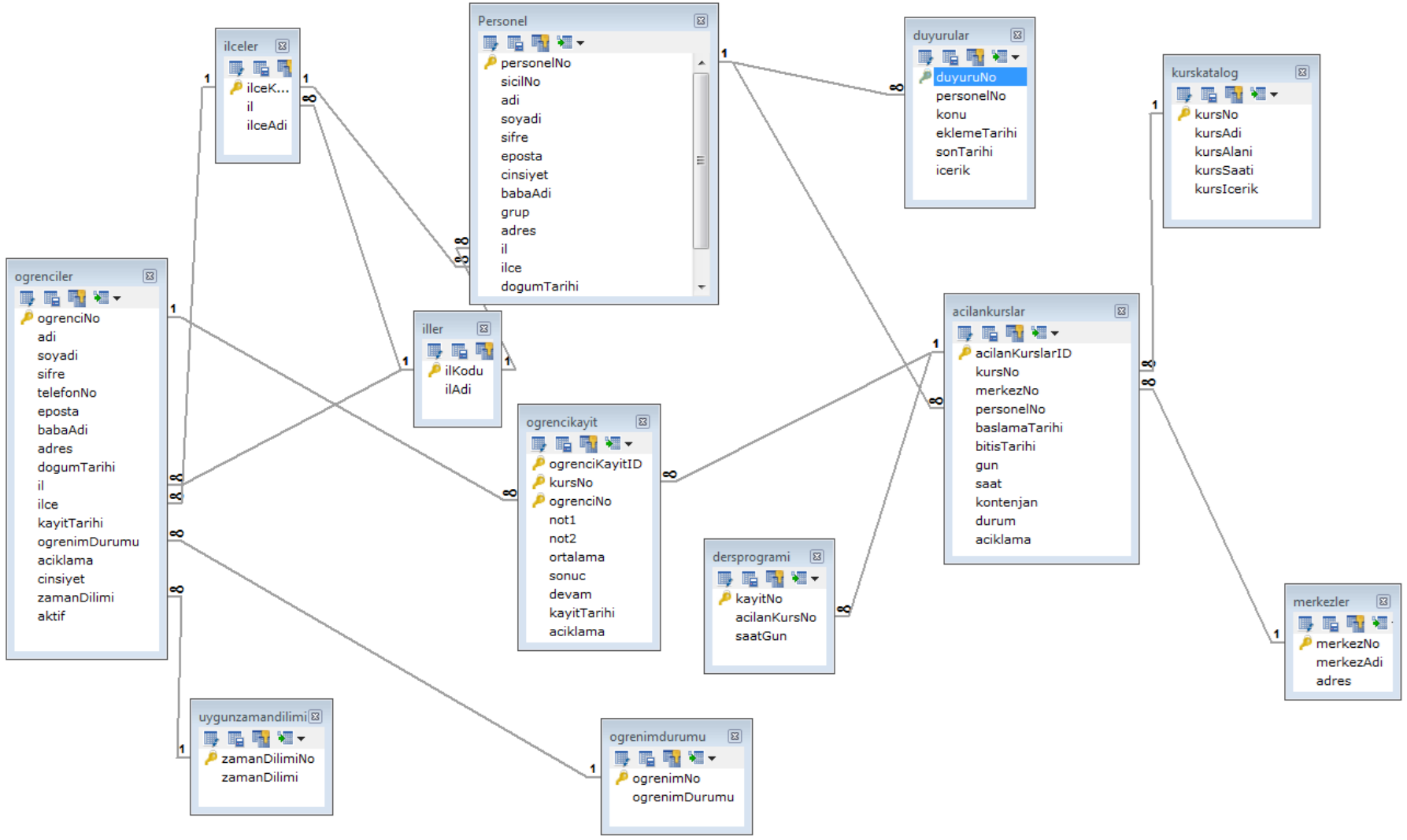
Reading with DBMS (SQL)

```
SELECT * FROM Students;
```

A sample database
(Entity Relationship Model)



A Sample Database (Relational Model)



Database classes

- Purpose of usage
  - Operational: Continuous changes are made to the data. (OLTP: Online Transaction Processing) **This mode is more effective if the insert update delete processes are done frequently.**
  - Data warehouse: Data are used for reporting and decision support purposes. (OLAP: Online Analytical Processing) **This mode is more effective if just select processes are done frequently.**

veri deposu

Database classes

DBMS	Number of users			purpose of usage		data storage form	
	Single user	Multiuser (workstation)	Multiuser (institutional)	data warehouse	Operational	Central	distri-buted
MS Access	+	+			+	+	
SQLite	+	+			+	+	
PostgreSQL	+	+	+	+	+	+	+
MySQL	+	+	+	+	+	+	+
MS SQL Server	+	+	+	+	+	+	+
Oracle Database	+	+	+	+	+	+	+
IBM DB2	+	+	+	+	+	+	+
SAP Sybase RAP	+	+	+	+	+	+	+
Maria DB	+	+	+	+	+	+	+
FireBird	+	+	+	+	+	+	+

References

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- Apache Spark Tutorial | Spark Tutorial for Beginners | Apache Spark Training | Edureka
  - https://www.youtube.com/watch?v=9mELEARcxJo