Databases Basics

How do RDBMS work?

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Technical Trainers

Software University

http://softuni.bg

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Have a Question?

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Database Management

When Do We Need a Database?

Storage vs. Management

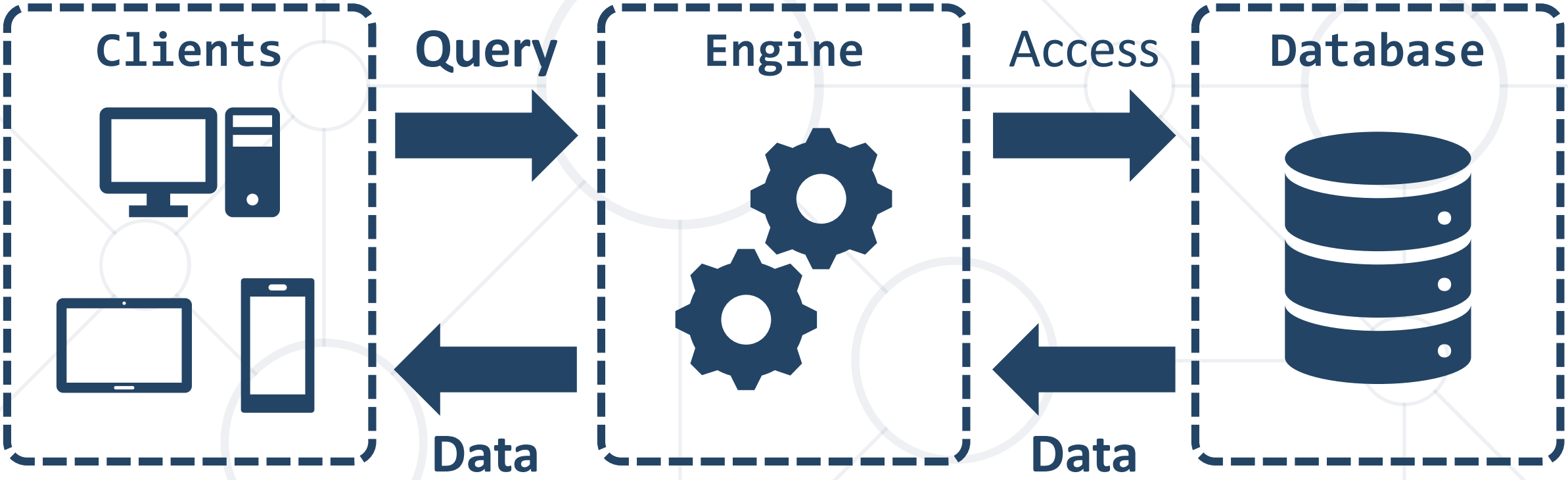
- Storing data is **not** the primary reason to use a Database
- Flat storage **eventually** runs into **issues** with
  - Size
  - Ease of updating
  - Accuracy
  - Security
  - Redundancy
  - Importance

Database Engines

Client-Server Model

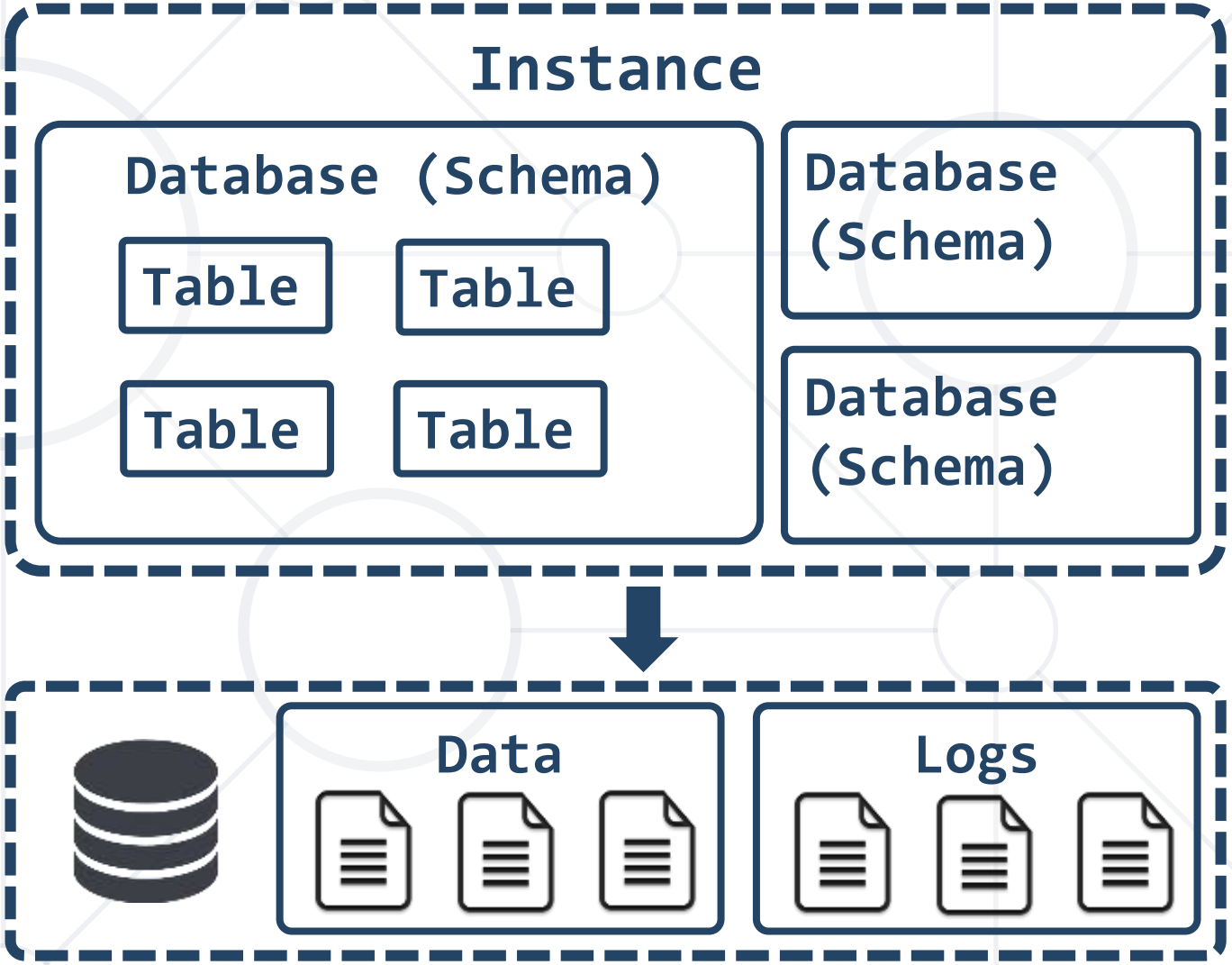
Database Engine Flow

- SQL Server uses the Client-Server Model



Server Architecture

- Logical Storage
  - Instance
  - Database / Schema
  - Table
- Physical Storage
  - Data Files and Log Files
  - Data Pages



Database Table Elements

- The table is the main **building block** of any database

Column

Row

CustomerId	FirstName	Birthdate	CityId
1	August	03/12/1975	101
2	Bejnamin	04/04/1984	102
3	Denis	15/10/1988	103
4	Linda	07/01/1984	104

Cell

- Each **row** is called a **record** or **entity**
- Columns (**fields**) define the **type** of data they contain

Structured Query Language

Query Components

Structured Query Language

- Programming language designed for managing data in a relational database
- To communicate with the Engine we use SQL
- Logically divided in four sections
  - Data Definition – describe the **structure** of our data
  - Data Manipulation – **store** and **retrieve data**
  - Data Control – define who can **access the data**
  - Transaction Control – bundle **operations** and allow **rollback**

MySQL

Working with Relational Databases

MySQL

- **Open-source** relational database management system
- Used in many **large-scale** websites
  - Amazon
  - Apple
  - Facebook
- Works on **many** system platforms – MAC OS, Windows, Linux

Developer Tools

- **XAMPP**
  - Web server stack
    - Apache + MariaDB + PHP + Perl
  - Cross-platform
- **HeidiSQL**
  - Tool using the popular MySQL, MSSQL and PostgreSQL
  - Can modify database
  - Easy to track database saves

Queries

- We can **communicate** with the database engine
- Queries provide greater **control** and **flexibility**
- To create a database using MySQL

```
CREATE DATABASE employees;
```

Database name

Creating Table and Inserting Values

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- Table creation

Table name

```
CREATE TABLE people (
    id INT NOT NULL PRIMARY KEY AUTO_INCREMENT,
    email VARCHAR(40) NOT NULL,
    first_name VARCHAR(40) NOT NULL,
    last_name VARCHAR(40) NOT NULL
)
```

Custom attributes

Column name

Data type

- Inserting values

```
INSERT INTO `people` (`email`, `first_name`, `last_name`)
VALUES ('b@b.bg', 'John', 'Smith');
```

Retrieve Records

- Get all records from a table

```
SELECT * FROM people;
```

*** retrieves all columns**

- You can limit the number of columns

```
SELECT first_name, last_name FROM people;
```

List of columns

- You can limit the number of rows

```
SELECT TOP (5) fisrt_name, last_name FROM people;
```

Number of records

Update Records

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- You can filter rows by specific conditions using the WHERE clause

```
SELECT last_name, age
FROM people
WHERE last_name = 'Pesho'
```

- Updating information

```
UPDATE people
SET last_name = 'Petrov'
WHERE first_name = 'Pesho'
```

Updates the last name of person

Comparing with NULL

- NULL is a special value that means missing value
  - Not the same as 0 or a blank space
- Checking for NULL values

This is always false!

```
SELECT last_name FROM Employees
WHERE email = NULL
```

```
SELECT last_name FROM Employees
WHERE email IS NULL
```

```
SELECT last_name FROM Employees
WHERE email IS NOT NULL
```

Deleting

- Deleting structures is called dropping
  - Table

```
TRUNCATE TABLE people;
```

Delete all records in a table

```
DROP TABLE people;
```

Delete the data and the structure

  - Entire Database

```
DROP DATABASE employees;
```

Delete entire database

- Both of these actions **cannot be undone**

NoSQL

Using MongoDB

NoSQL Database

- SQL query is **not used** in NoSQL systems
- More **scalable** and provide **superior performance**
- Such databases are **MongoDB**, **Cassandra**, **Redis**, etc
- Key-value **stores**

```
{
    ObjectId("59d3fe7ed81452db0933a871"),
    "email": peter@gmail.com,
    "age": 22
}
```

MongoDB

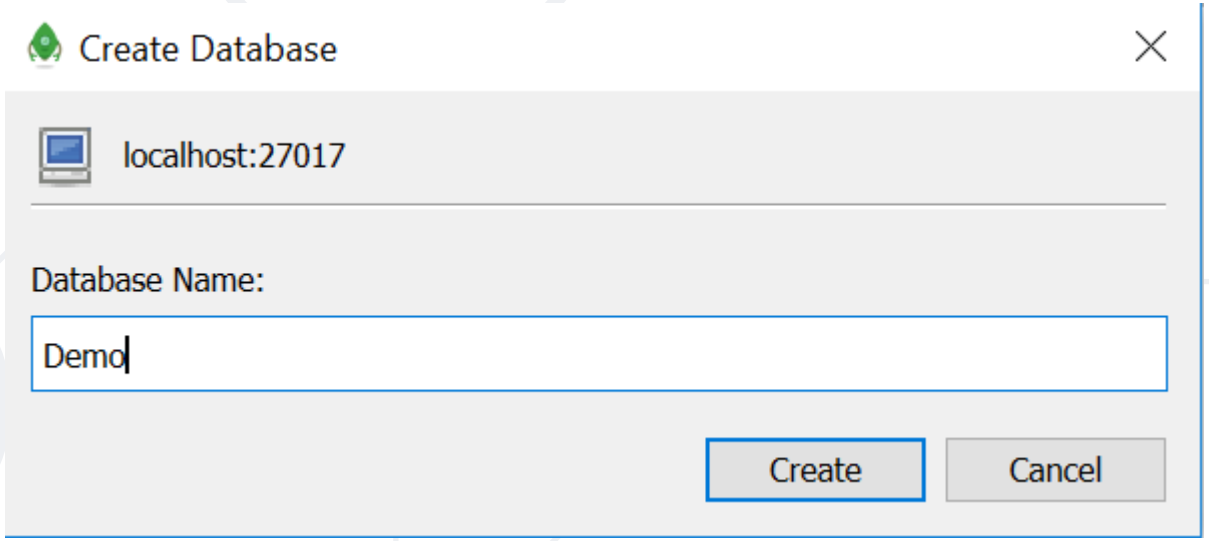
- Free **open-source** cross-platform document-oriented program
- Uses **JSON**-like documents with schemata.
- Good for **e-commerce** product catalog, blogs, evolving data requirements
- **Loosely coupled** objectives – the design **may change** by over time.

Developer Tools

- **Robo 3T**
  - Fully featured IDE with embedded shell
  - Visual Query Builder
  - IntelliShell with Auto-Completion
- Alternatives (**NoSQLBooster**)
  - Shell-centric cross platform GUI
  - Fluent Query Builder

Creating a Database

- Creating a database is done using the GUI
- Right click on **New Connection** and select **Create Database**



Creating Collection and Inserting Values

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- Create collection

Collection name

```
db.createCollection('people')
```

- Inserting values

```
db.getCollection('people')
.insert({
    firstName: 'Michael',
    lastName: 'Smith',
    email: 'michael@gmail.com',
})
```

Data is inserted as **an object**

Retrieve Entries

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- Get **all entries** from a collection

```
db.getCollection('people').find({})
```

- Filter elements by **given criteria**

```
db.getCollection('people').find({ firstName: 'Michael' })
```

- Return **specified** field

```
db.getCollection('people').find(
  { firstName: 'Michael' },
  { firstName: 1 }
)
```

Will retrieve an **entity** with the desired **field only**

Updating Entries

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- Update **first** entry

```
db.getCollection('people').update(
  { firstName: 'Anne' },
  { firstName: 'George' }
)
```

Old value

New value

```
db.getCollection('people').update(
  { firstName: 'Anne' },
  { firstName: 'George' },
  { $multi: true }
)
```

Updates **all entries** with the given value

Deleting Entries

- Delete the **first entry** that matches given criteria

```
db.getCollection('people').deleteOne(
    { firstName: 'George' }
)
```

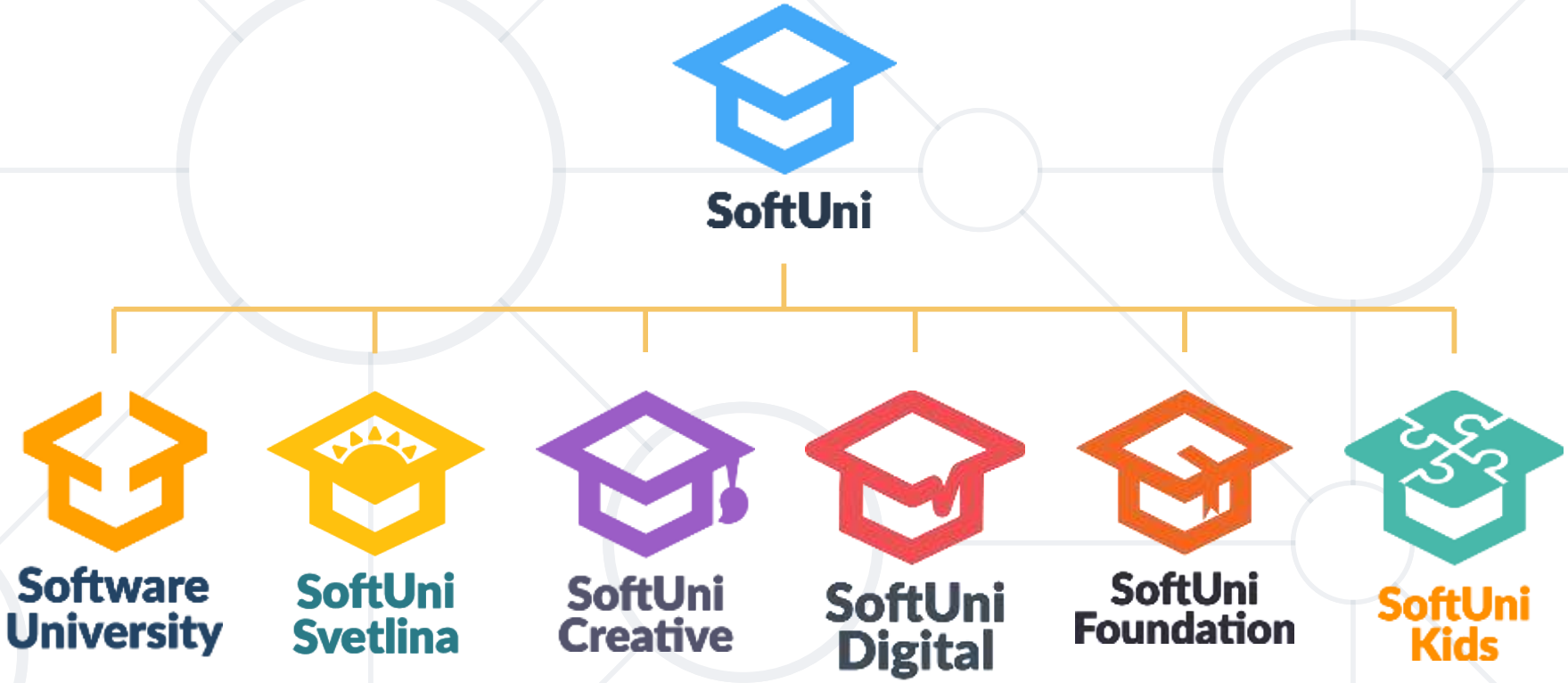
- Delete **all entries** that match given criteria

```
db.getCollection('people').deleteMany(
    { firstName: 'George' }
)
```

Summary

- RDBMS **store** and **manage data**
- We **communicate** with the DB engine via SQL
- **MySQL** is a multiplatform RDBMS **using SQL**
- **NoSQL** Databases are more **scalable**
- **MongoDB** stores entries in **JSON** format

Questions?



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