Data Definition and Data Types

Managing DBs using IDEs

SoftUni Foundation

SoftUni Team

Technical Trainers

Software University

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Data Types in MySQL Server

Numeric, String and Data Types

Numeric Data Types

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- Numeric data types have certain range
- Their range can be changed if they are:
  - Signed - represent numbers both in the positive and negative ranges
  - Unsigned - represent numbers only in the positive range
- E.g. signed and unsigned INT:

Signed Range		Unsigned Range	
Min Value	Max Value	Min Value	Max Value
-2147483648	2147483648	0	4294967295

Numeric Data Types

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- **INT** [(*M*)] [UNSIGNED]
  - TINYINT, SMALLINT, MEDIUMINT, BIGINT
- **DOUBLE** [(*M, D*)] [UNSIGNED]

Digits stored for value

Decimals after floating point

  - E.g. DOUBLE[5, 2] – 999.99
- **DECIMAL** [(*M, D*)] [UNSIGNED] [ZEROFILL]

String Types

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- String column definitions include attributes that specify the character set or collation
  - CHARACTER SET (Encoding)
    - E.g. utf8, ucs2
  - CHARACTER COLLATION – rules for encoding comparison
    - E.g. latin1_general_cs, Traditional_Spanish_ci_ai etc.
- Set and collation can be defined at the database, table or column level

Determines the storage of each character (single or multiple bytes)

Determines the sorting order and case-sensitivity

CHARACTER COLLATION - Example

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- ORDER BY with different collations

latin1_swedish_ci	latin1_german1_ci	latin1_german2_ci
Muffler	Muffler	Müller
MX Systems	Müller	Muffler
Müller	MX Systems	MX Systems
MySQL	MySQL	MySQL

String Types (2)

- **CHAR** [(M)] - up to 30 characters
- **VARCHAR(M) –** up to 255 characters
- **TEXT** [(M)] – up to 65 535 characters
  - TINYTEXT, MEDIUMTEXT, LONGTEXT
- **BLOB -** Binary Large OBject [(M)] - 65 535 ($2^{16} - 1$) characters
  - TINYBLOB, MEDIUMBLOB, LONGBLOB

Column name	Column Type
title	VARCHAR(CHAR)
content	TEXT(LONGTEXT)
picture	BLOB(LONGBLOB)

Date Types

- **DATE** - for values with a date part but no time part
- **TIME** - for values with time but no date part
- **DATETIME** - values that contain both date and time parts
- **TIMESTAMP** - both date and time parts

Column name	Column Type
birthdate	DATE
last_time_online	TIMESTAMP
start_at	TIME
deleted_on	DATETIME

DATETIME and TIMESTAMP have different time ranges

Date Types (2)

- MySQL retrieves values for a given date type in a standard output format
  - E.g. as a string in either 'YYYY-MM-DD' or 'YY-MM-DD'

Data Type	Column Type
DATE	'0000-00-00'
TIME	'00:00:00'
DATETIME	'0000-00-00 00:00:00'
TIMESTAMP	'0000-00-00 00:00:00'
YEAR	0000

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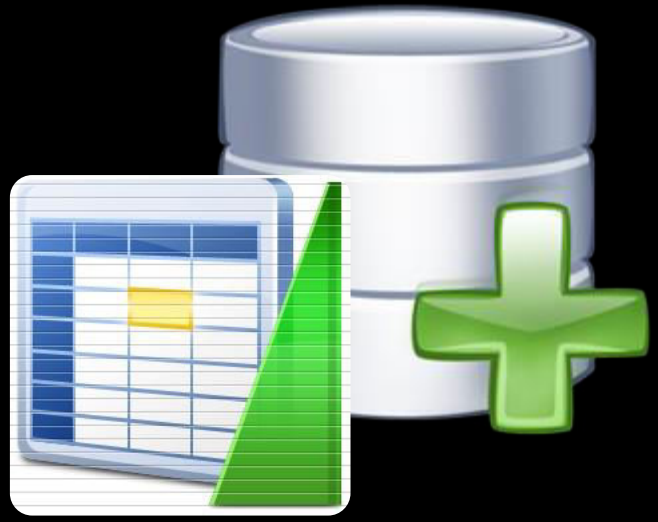

Database Modeling

Data Definition using GUI Clients

Working with IDEs

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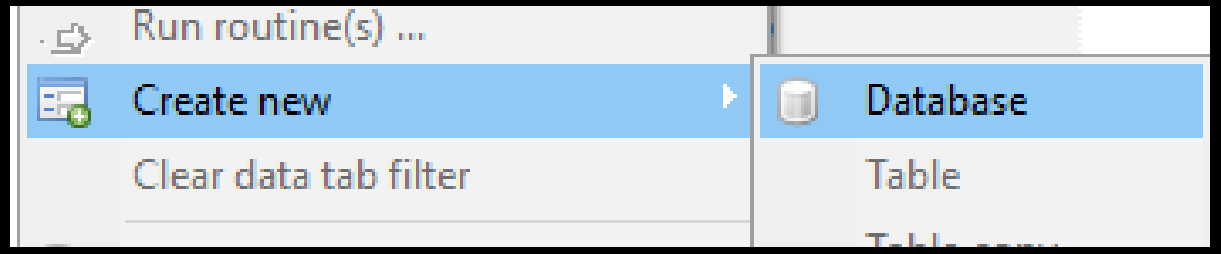
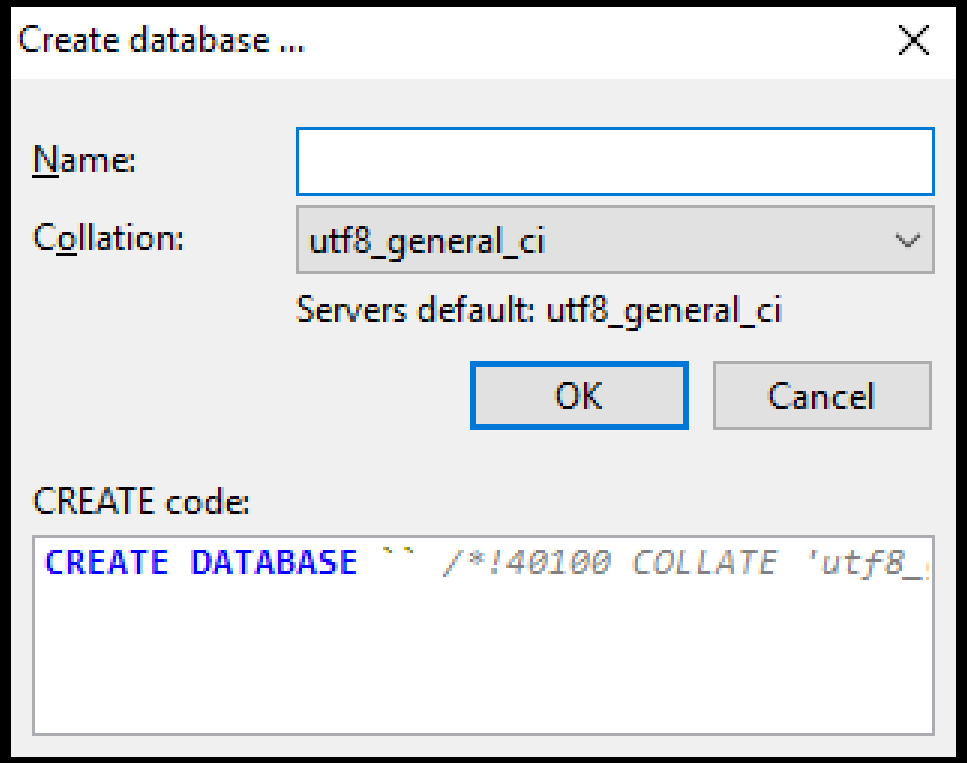
- We will manage databases with HeidiSQL

- Enables us:
  - To create a new database
  - To create objects in the database (tables, stored procedures, relationships and others)
  - To change the properties of objects
  - To enter records into the tables

Creating a New Database

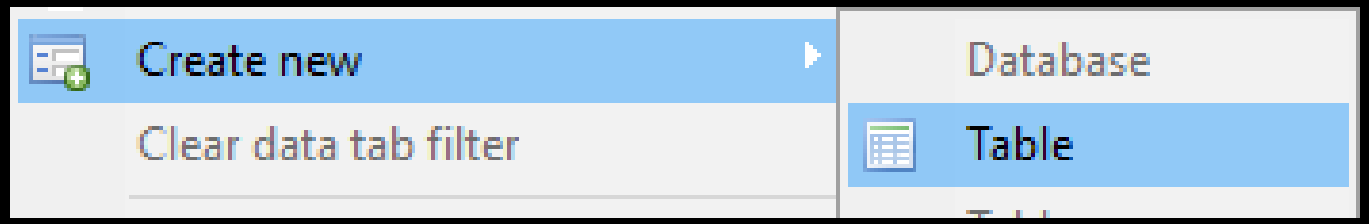
- Select the instance Create new -> Database from the context menu





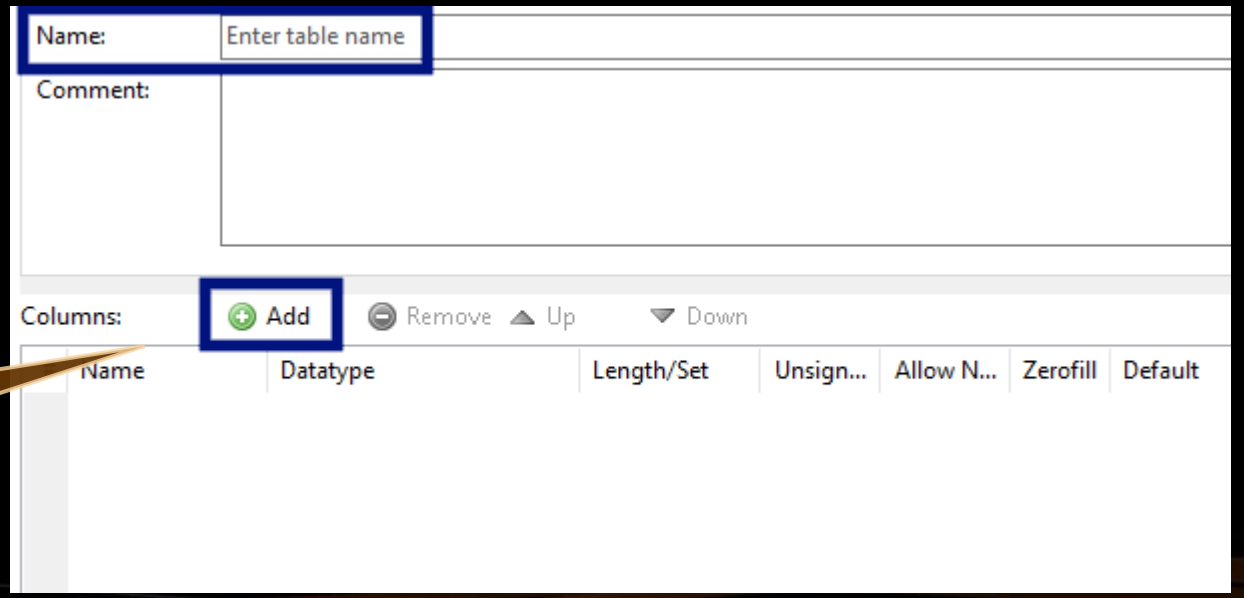
Creating Tables

- Right click on database Select Create new -> Table



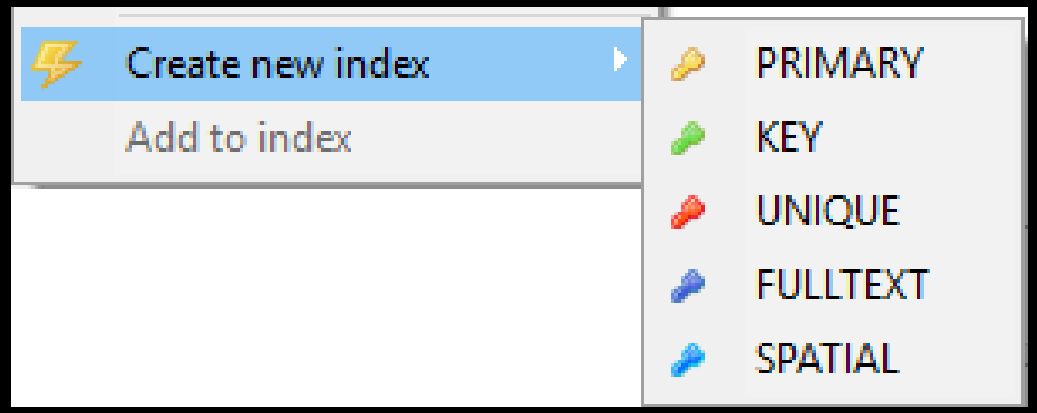
Set up table name

Add new record



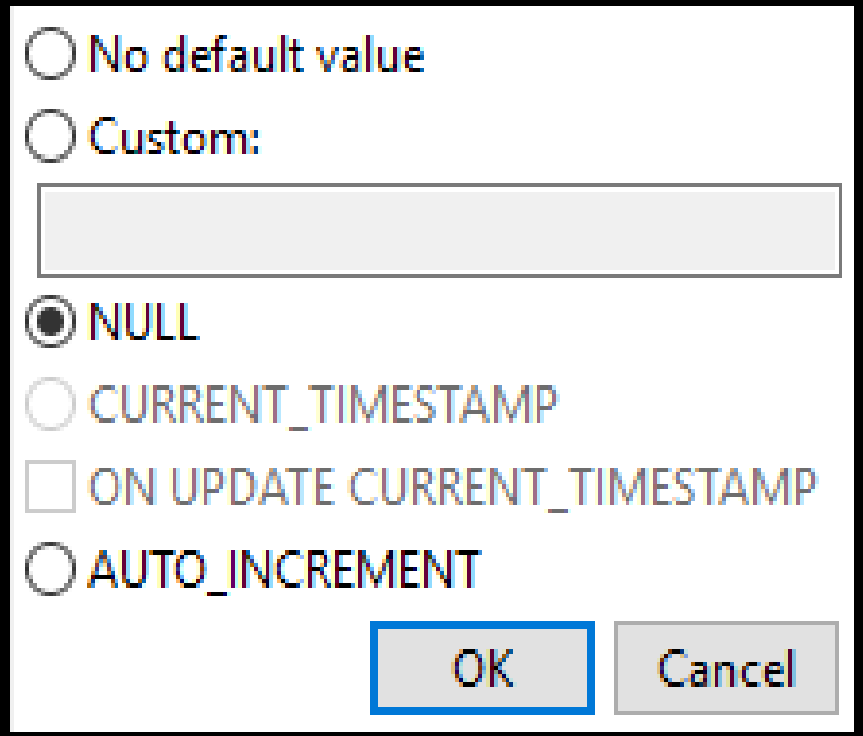
Creating Tables (2)

- A Primary Key is used to uniquely identify and index records
- Click on row Create new index -> Primary from the context menu of the desired row



Creating Tables (3)

- Auto increment – on the "Default" field



Storing and Retrieving Data

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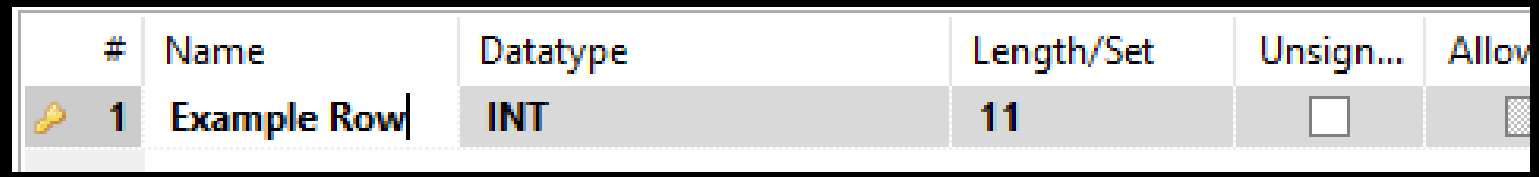
- We can add, modify and read records with GUI Clients
- To insert or edit a record, click inside the cell



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```
CREATE TABLE people
(
  id INT NOT NULL,
  email VARCHAR(50) NOT NULL,
  first_name VARCHAR(50),
  last_name VARCHAR(50)
);
```

Basic SQL Queries

Data Definition using SQL

SQL Queries

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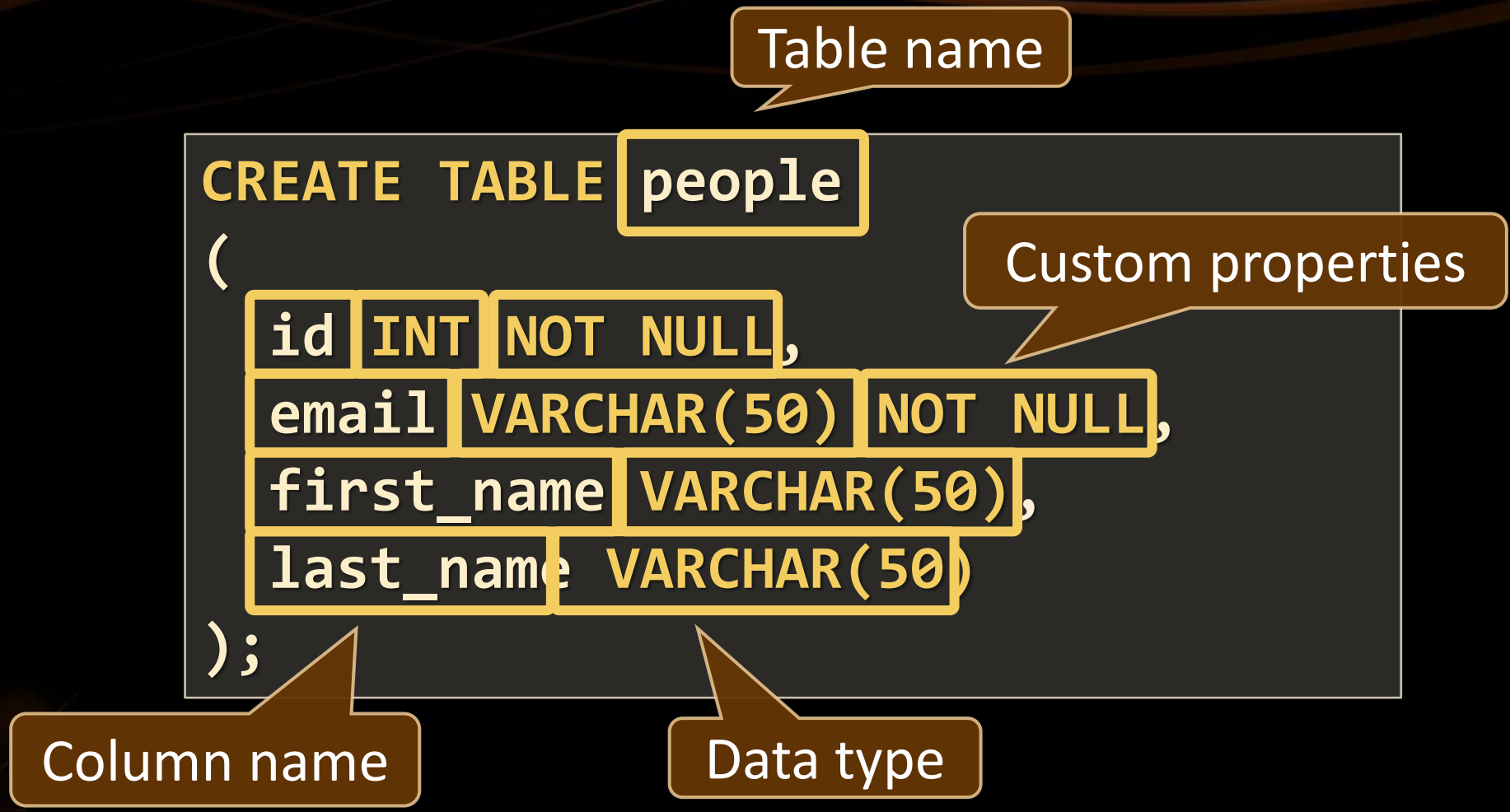
- We communicate with the database engine using SQL
- Queries provide greater control and flexibility
- To create a database using SQL:

Database name

```
CREATE DATABASE employees;
```

- SQL keywords are conventionally capitalized

Table Creation in SQL



Retrieve Records in SQL

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- Get all information from a table

Table name

```
SELECT * FROM employees;
```

- You can limit the columns and number of records

```
SELECT first_name, last_name FROM employees
LIMIT 5;
```

List of columns

Number of records

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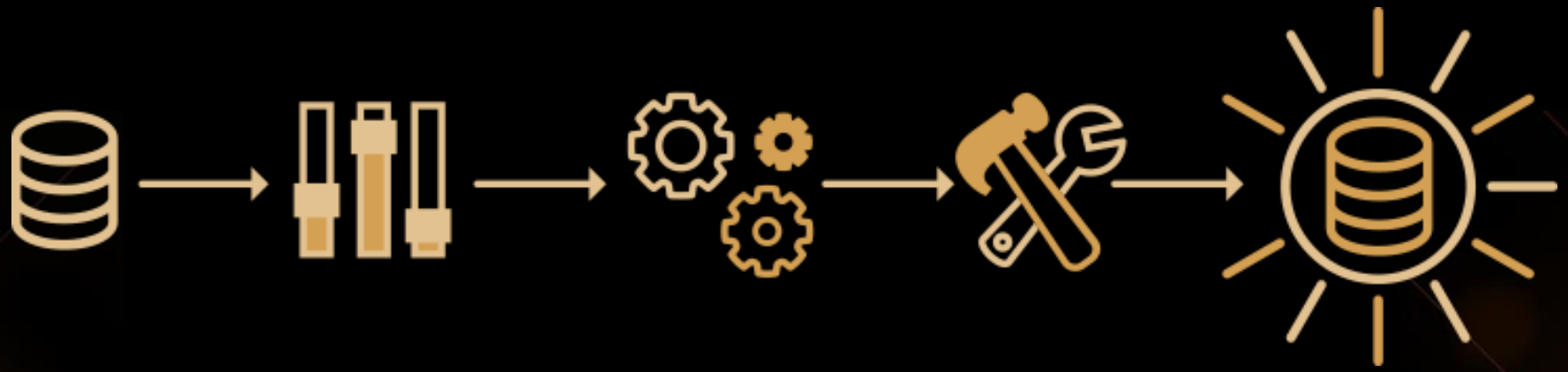

Table Customization

Adding Rules, Constraints and Relationships

Custom Column Properties

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- Primary Key

```
id INT NOT NULL PRIMARY KEY
```

- Auto-Increment (Identity)

```
id INT AUTO_INCREMENT PRIMARY KEY
```

- Unique constraint – no repeating values in entire table

```
email VARCHAR(50) UNIQUE
```

- Default value – if not specified (otherwise set to **NULL**)

```
balance DECIMAL(10,2) DEFAULT 0
```

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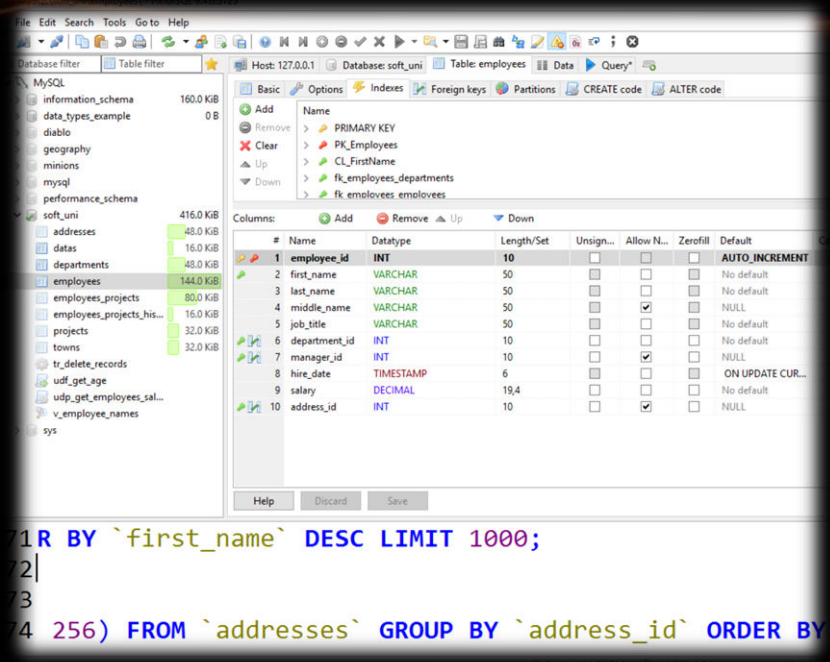

Altering Tables

Changing Table Properties After Creation

Altering Tables Using SQL

- A table can be changed using the keywords **ALTER TABLE**

```
ALTER TABLE employees;
```

Table name

- Add new column

```
ALTER TABLE employees
ADD salary DECIMAL;
```

Column name

Data type

Altering Tables Using SQL (2)

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- Delete existing column

```
ALTER TABLE people
DROP COLUMN full_name;
```

Column name

- Modify data type of existing column

```
ALTER TABLE people
MODIFY COLUMN email VARCHAR(100);
```

Column name

New data type

Altering Tables Using SQL (3)

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- Add primary key to existing column

```
ALTER TABLE people
ADD CONSTRAINT pk_id
PRIMARY KEY (id);
```

Constraint name

Column name
(more than one for composite key)

- Add unique constraint

```
ALTER TABLE people
ADD CONSTRAINT uq_email
UNIQUE (email)
```

Constraint name

Columns name(s)

Altering Tables Using SQL (4)

- Set default value

```
ALTER TABLE people
ALTER COLUMN balance SET DEFAULT 0;
```

Default value

Column name

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Deleting Data and Structures

Dropping and Truncating

Deleting from Database

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- Deleting structures is called dropping
  - You can drop keys, constraints, tables and entire databases
- Deleting all data in a table is called truncating
- Both of these actions cannot be undone – use with caution!

Dropping and Truncating

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- To delete all the entries in a table

```
TRUNCATE TABLE employees;
```

Table name

- To drop a table – delete data and structure

```
DROP TABLE employees;
```

Table name

- To drop entire database

```
DROP DATABASE soft_uni;
```

Database name

Dropping and Truncating (2)

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- To remove a constraining rule from a column
  - Primary keys, value constraints and unique fields

```
ALTER TABLE employess
DROP CONSTRAINT pk_id;
```

Table name

Constraint name

- To remove **DEFAULT** value (if not specified, revert to **NULL**)

```
ALTER TABLE employess
ALTER COLUMN clients
DROP DEFAULT;
```

Table name

Columns name

Summary

- Table columns have a fixed type
- We can use GUI Clients to create and customize tables
- SQL provides greater control

```
CREATE TABLE people
(
  id INT NOT NULL,
  email VARCHAR(50) NOT NULL,
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```

Data Definition and Data Types

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Questions?

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Summary

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CREATE TABLE people
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```

Database Basics MySQL – DDL

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