Caltech | **Center for Technology & Management Education**

Full Stack Java Developer

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MySQL

Understanding MySQL

Learning Objectives

By the end of this lesson, you will be able to:

◉ Learn the importance of data

◉ Define databases and list the types of databases

◉ Discover the significance and operation of a database

◉ Differentiate between databases and spreadsheets

◉ Learn what MySQL is

Learning Objectives

By the end of this lesson, you will be able to:

⊙ List the features of MySQL in storing and managing data

⊙ Learn to install MySQL

⊙ Understand how to connect and disconnect from the server

⊙ Learn how to create a database, table, and a new user

⊙ Explain database and table-specific privileges

A Day in the Life of a Full Stack Developer

You are hired as a full-stack developer in an organization and have been assigned to an application development project. The application is a job description portal that collects data from the candidate along with their resumes and suggests an appropriate job opening for them.

You, being a developer of the application, need to store all the incoming data in the database and whenever the user searches for the details of the applied jobs, fetch the data from the database and display it to the user.

To do so, you would need to connect your application to the database. Moreover, it is important for you to understand which database can be used here and how can you connect and fetch data from it. For this, explore more about how data is stored, the need for DBMS, and its working.

The Importance of Data

The Importance of Data

Data dictates the ways to return on investment (ROI).

It provides insights that lead to effective business strategies and decisions.

Organizations need data and predictive analytics to develop better products.

The Importance of Data

Imagine that a digital marketer is hired and the organization does not have a database.

The organization has its previous customer's information and a few prospective buyers' information, stored in a Microsoft spreadsheet.

Microsoft spreadsheet

The Importance of Data

A strong database is needed to analyze prospects and digital touchpoints.
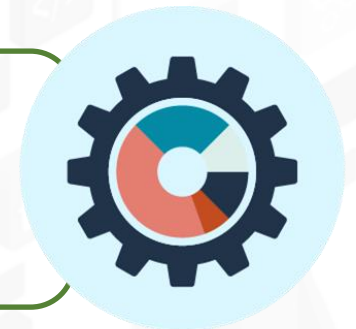
Data should be leveraged for audience analysis.
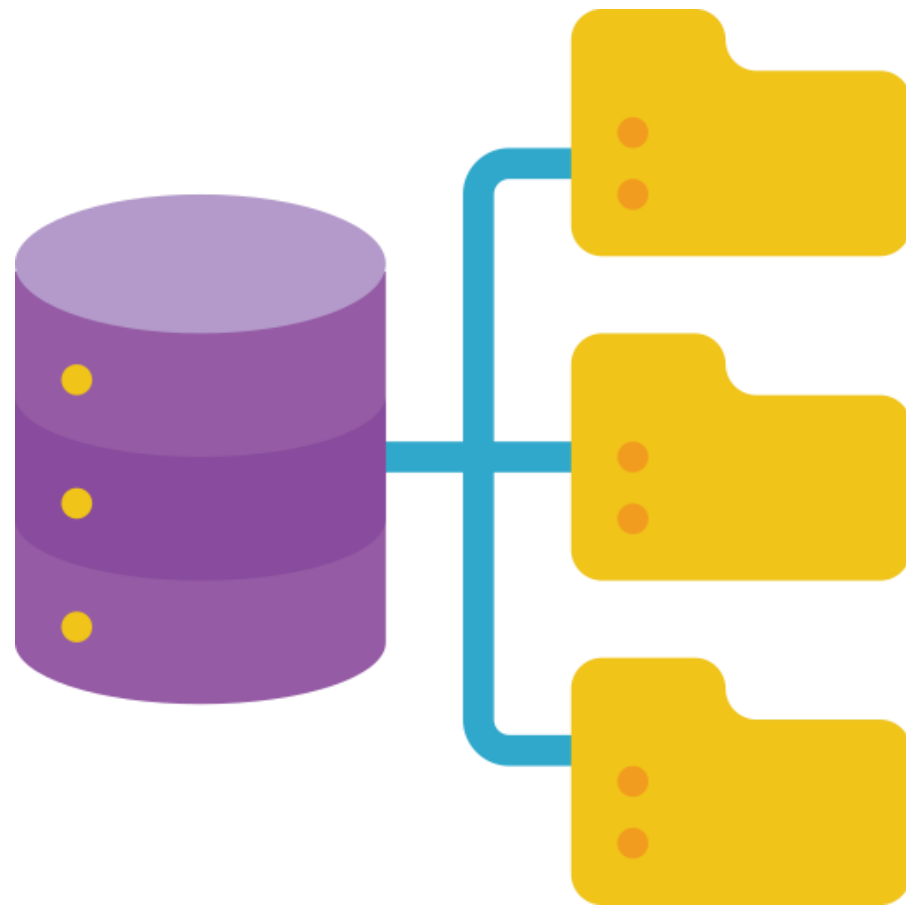
Data helps to create a personalized experience for every customer.

Database systems help in collecting huge data and storing it in the right format.
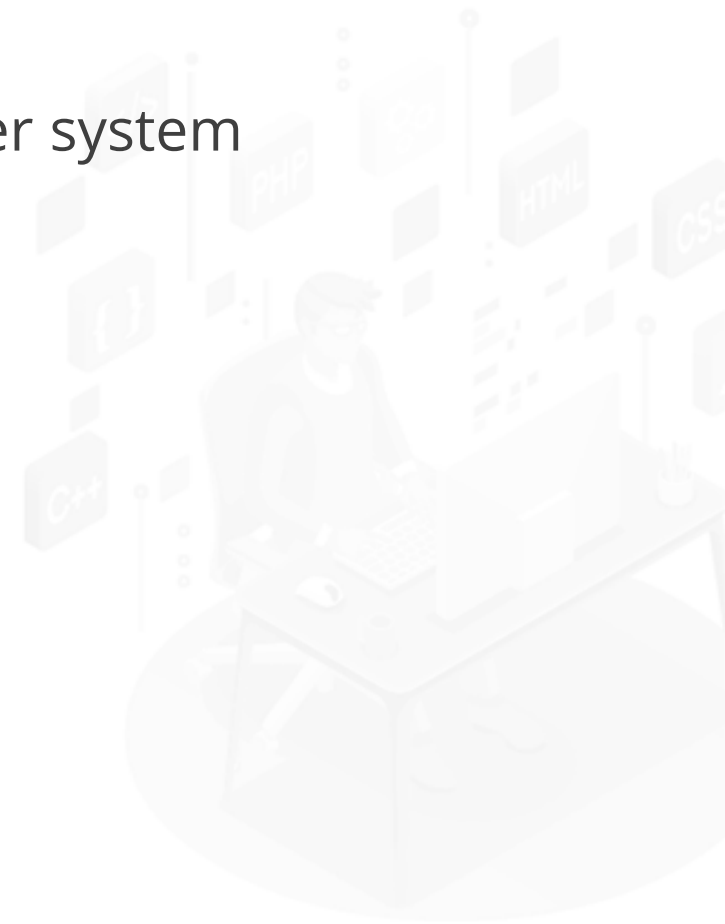
What Is Database?

What Is Database?

A database system is a computer-based record-keeping system.

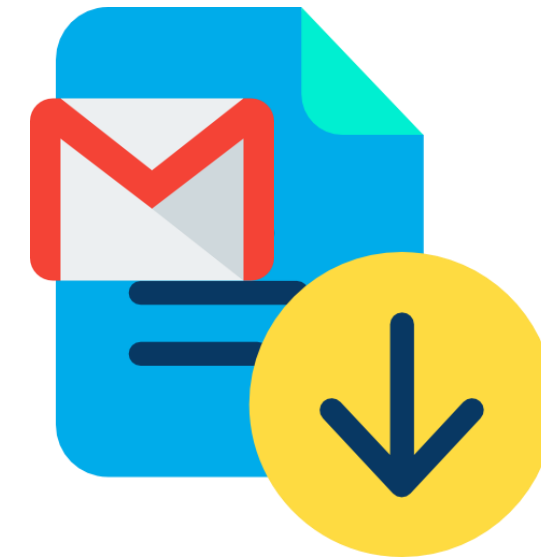Collection of structured data stored on a computer system

Allows to pull the data, edit the data

Stores data from any application

Record-Keeping

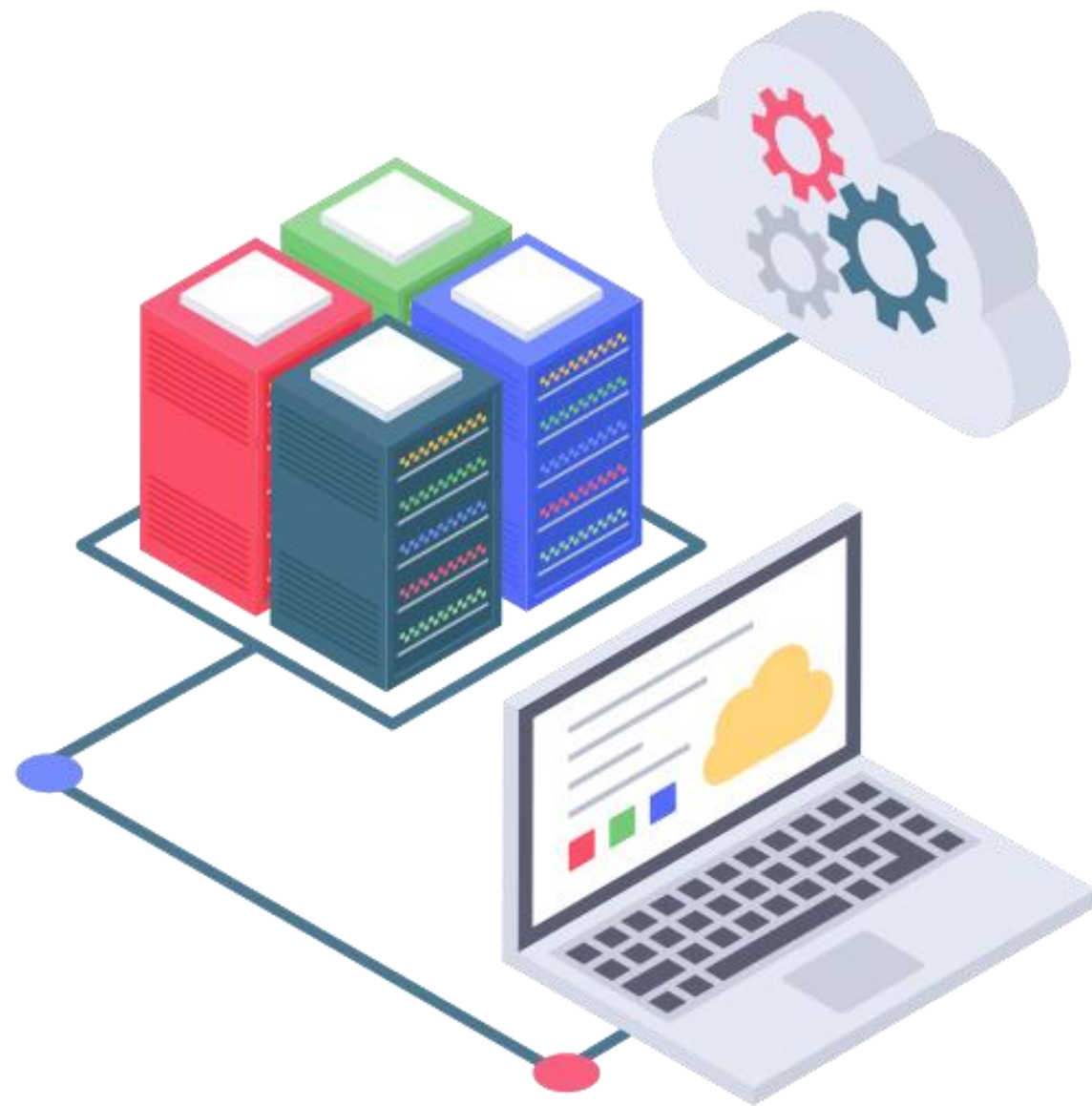Record-keeping is a terminology used in banking, accounting, and finance.

It helps to retrieve records (e-mails, agreements).

Database

A database is an organized collection of data stored in a structured format on a computer system that can easily be accessed.

Create   Edit   **maintain**

This software (DBMS) also allows users or programs to create and store, retrieve, update, and manage data with strong database security.

Database Management System (DBMS)

Connect with DBMS to provide instructions for querying or modifying data.

The DBMS executes instructions and sends the results back.

Data + DBMS + Applications = Database system

Digital Marketing: Example

Suppose one wants to know which sector of cars has made a good sale during the last quarter.
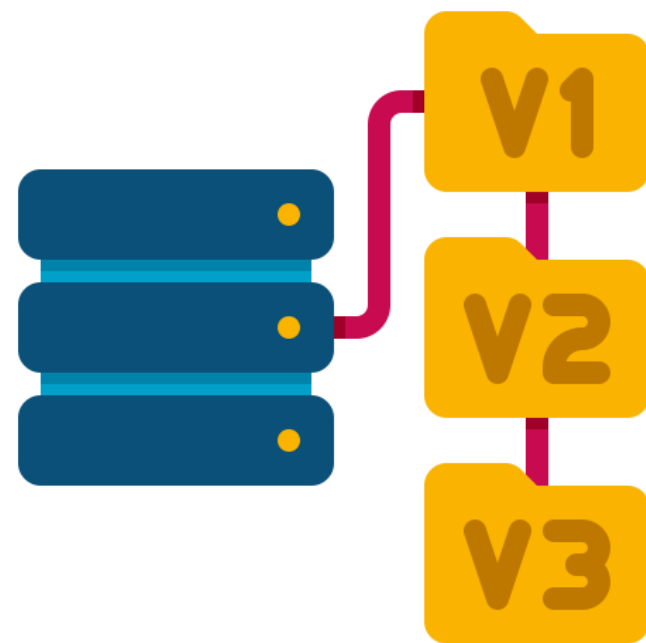
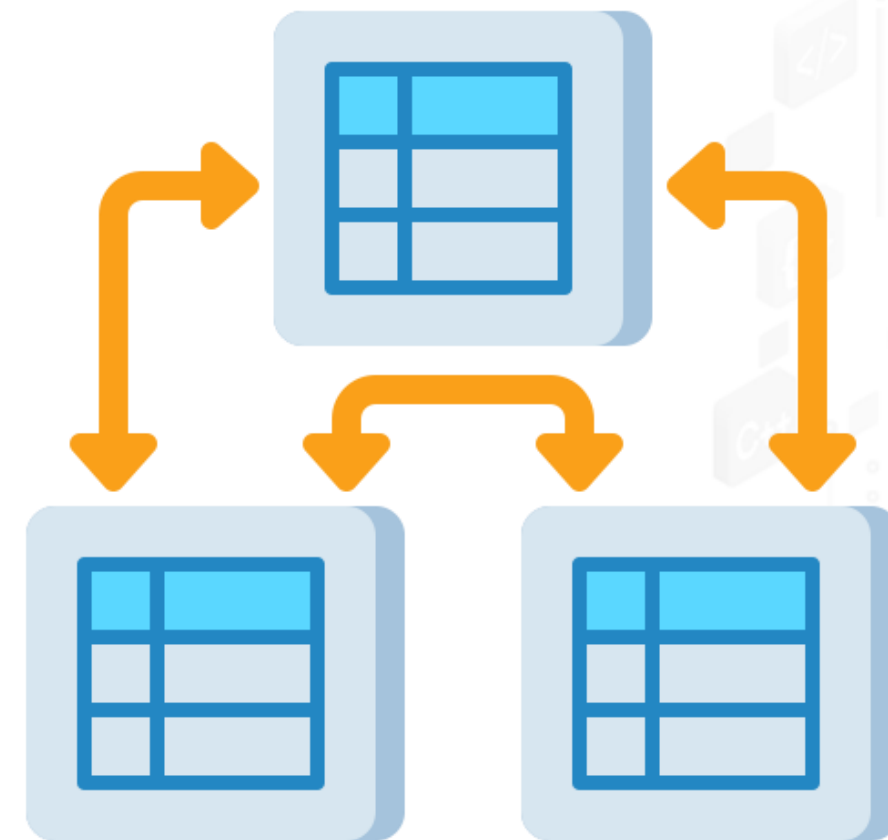One will access the database application and key in the information (query).

A report with numbers and a sales graph

Database

A database is also described as a set of interrelated data held together to serve various applications.

It may serve as a basis for future application development.

A database is frequently defined as the repository of information required to carry out specific duties in a firm or organization.

Database

The database enables the recovery of information and the change of data required for operation control.

A database can be searched for queries.

Database

A database is a reservoir for the data required for an organization's information processing.
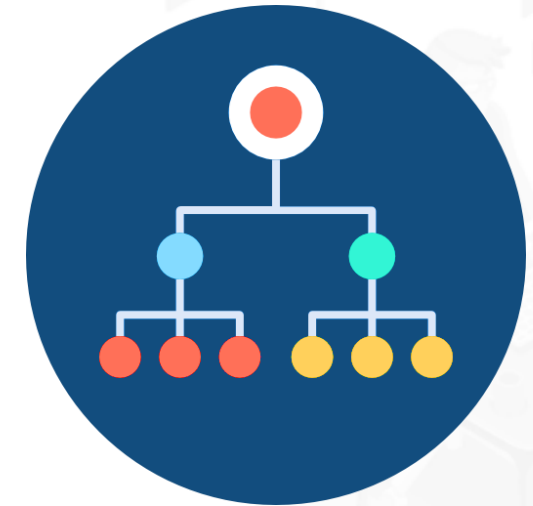
The information needs to be:

Accurate   Confidential   Secure   Structured

Database

The database holds all the pertinent information about the company.
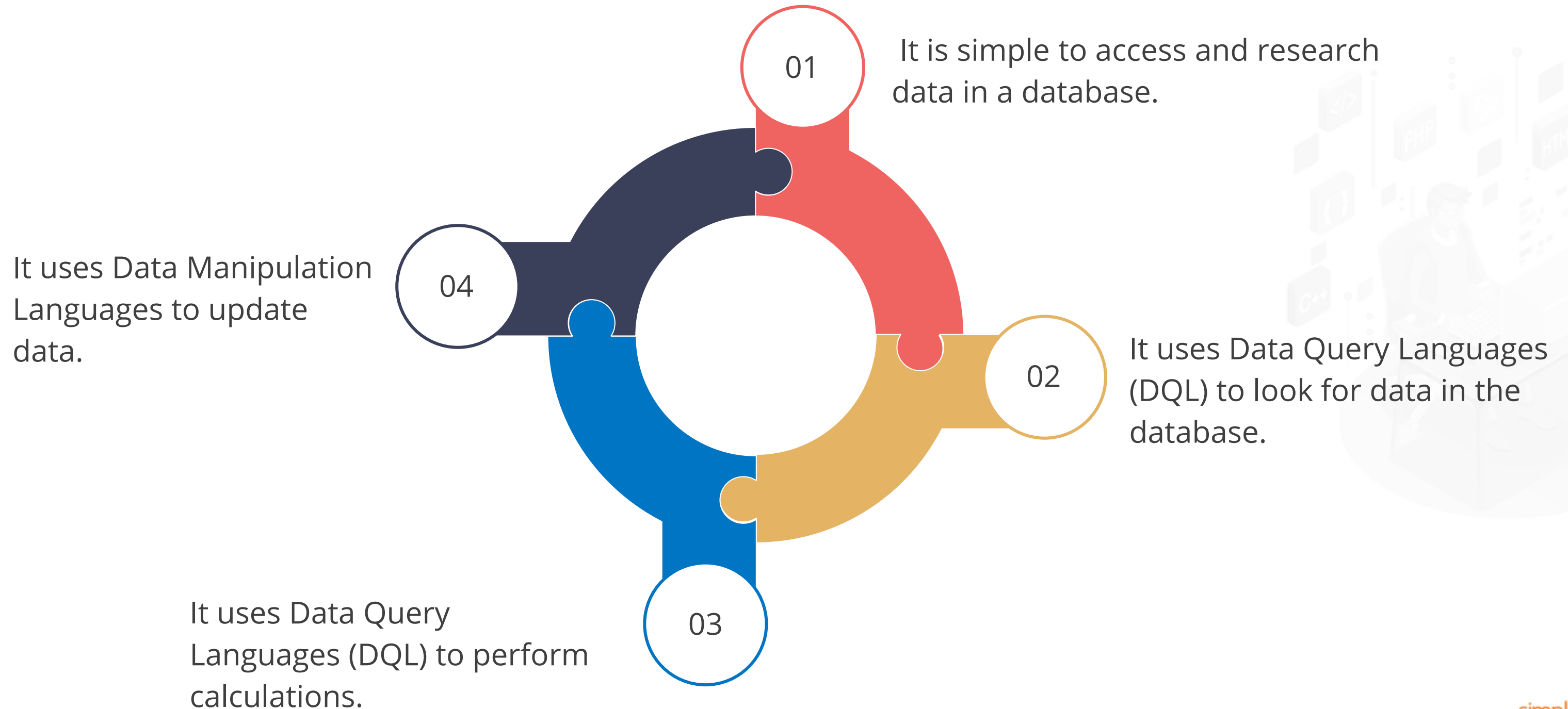
Worker records

Value-based records

Remuneration subtleties

Database

MySQL is one of the most popular databases.

It is simple to access and research data in a database.

It uses Data Query Languages (DQL) to look for data in the database.

It uses Data Query Languages (DQL) to perform calculations.

It uses Data Manipulation Languages to update data.

01

02

03

04

Database Vs. Spreadsheets

Database vs. Spreadsheets

The difference between Databases and Spreadsheets are as follows.

Spreadsheets	Vs.	Databases
• Allows individual user		• Allows multiple users on various devices
• Stores limited data storage		• Stores massive amount of data
• Offers less chance for manipulation		• Allows multiple users access at once
• Is unscalable for big data		• Handles large amount of data with ease

Types of Databases

Types of Databases

Types of databases are as follows:
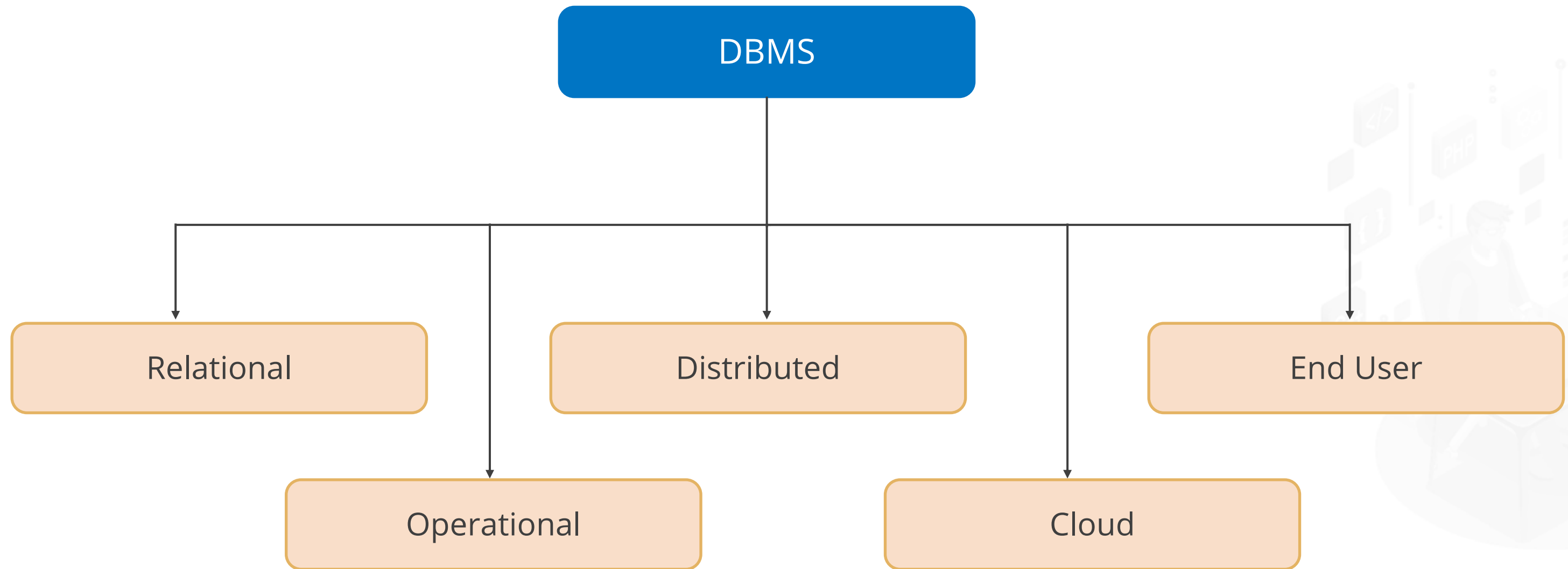
Relational Database

A relational database stores data in rows and columns that form a table. It uses SQL for:

Storing data

Changing data

Maintaining data

Every table in the database contains a key that differentiates data from other sources.

Relational Database: Properties

There are four properties of relational databases known as ACID properties.

A stands for Atomicity

A data operation will complete either with success or with failure.

D stands for Durability

Ensures that once the operation is finished and data finalized, data changes must be permanent.

C stands for Consistency

When the data is modified, its value before and after the modification must be preserved.

I stands for Isolation

Ensures that more than one transaction can occur concurrently without impacting consistency.

01
02
03
04

Operational Database

Operational databases help to create and edit the database in real time.

Companies use operational databases for handling daily transactions.

Distributed Database

A distributed database is spread over different sites, computers, or networks of computers.

Delivers files quickly and easily

Allows to upsize the database system
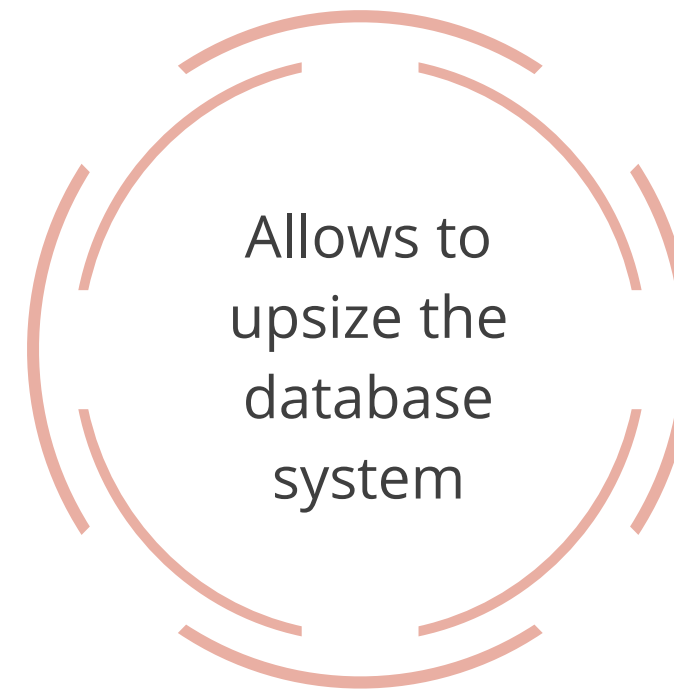
Note

Failure of one server does not impact the overall database.

Distributed Database: Types

A distributed database is divided into two types.

Distributed

Homogeneous

Heterogeneous

- Runs on the same operating system
- Uses the same process and hardware
- Is quite easy to manage

- Runs on different operating systems with different processes
- Leads to problems and failures as all sites are unaware of others
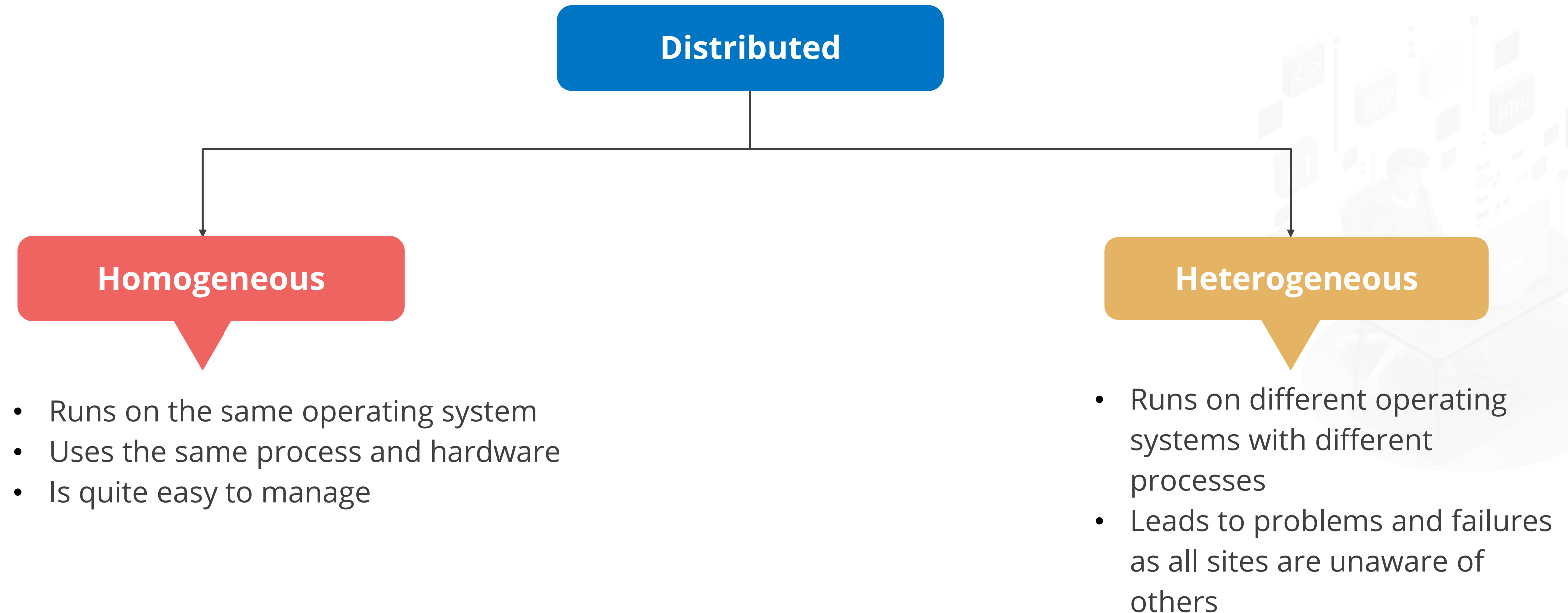
Cloud Database

In a cloud database, the data is stored in a virtual environment and runs on the cloud computing area.

It offers various computing services like:

PaaS

HaaS

SaaS
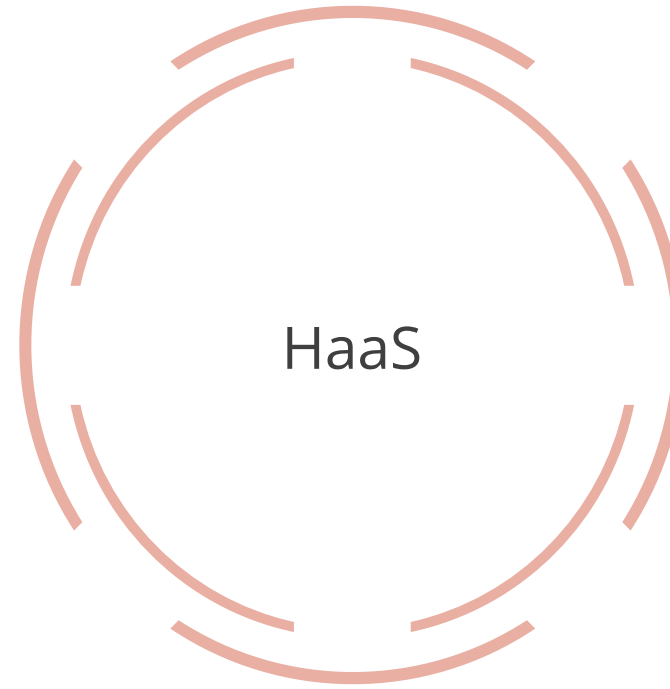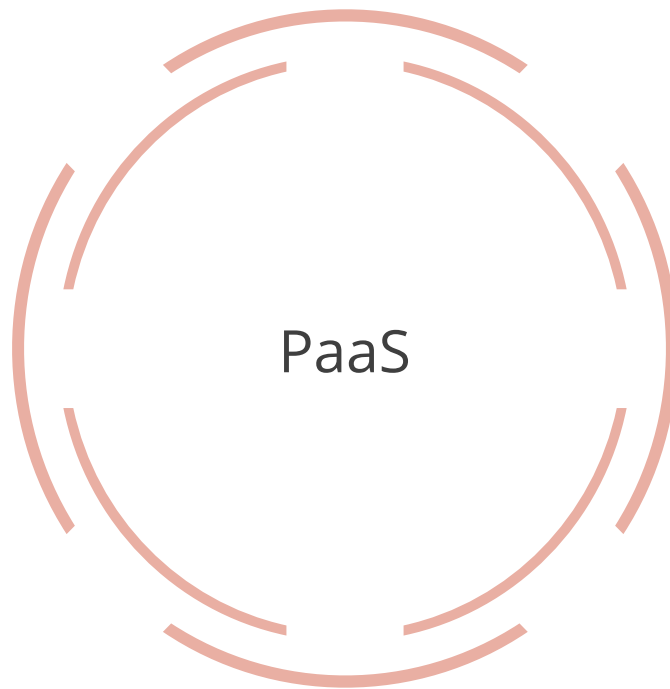
Cloud Database

There are many cloud platforms, but the most popular ones are:

Microsoft Azure

KAMATERA
PERFORMANCE CLOUD

Google Cloud

aws

ScienceSoft

End-User Database

The end-user is mindful of the product.

It is a common database that is intended for the end-user.

The end-user database is known as a "Shared database".

What Is MySQL?

DBMS

Any enterprise depends a lot on its proper functioning.

The data and information about different aspects of an enterprise are very crucial.

A DBMS provides enterprises with centralized control of their operational data, especially sensitive and crucial data.

MySQL

MySQL is a Relational Database Management System (RDBMS) that uses SQL to query from databases.

It is a widely used database as it is free, fast, reliable, and scalable.

It is written in C++ and c programming language.

It allows for keeping records of an important database.

It contains many tables and stores thousands of individual records.

MySQL

MySQL is a Relational Database Management System (RDBMS) that uses SQL to query from databases.

It provides in-built features that support a secure environment.

It manages information.

It operates using client/server architecture.

It is a multi-user database system.

MySQL= MySQL server instance + MySQL database

How Does MySQL Function?

The server takes the client requests that are received on the network through GUI (Graphic user interface) and accesses database contents according to those requests.

Sends request →

Sends response ←

Client/ Program
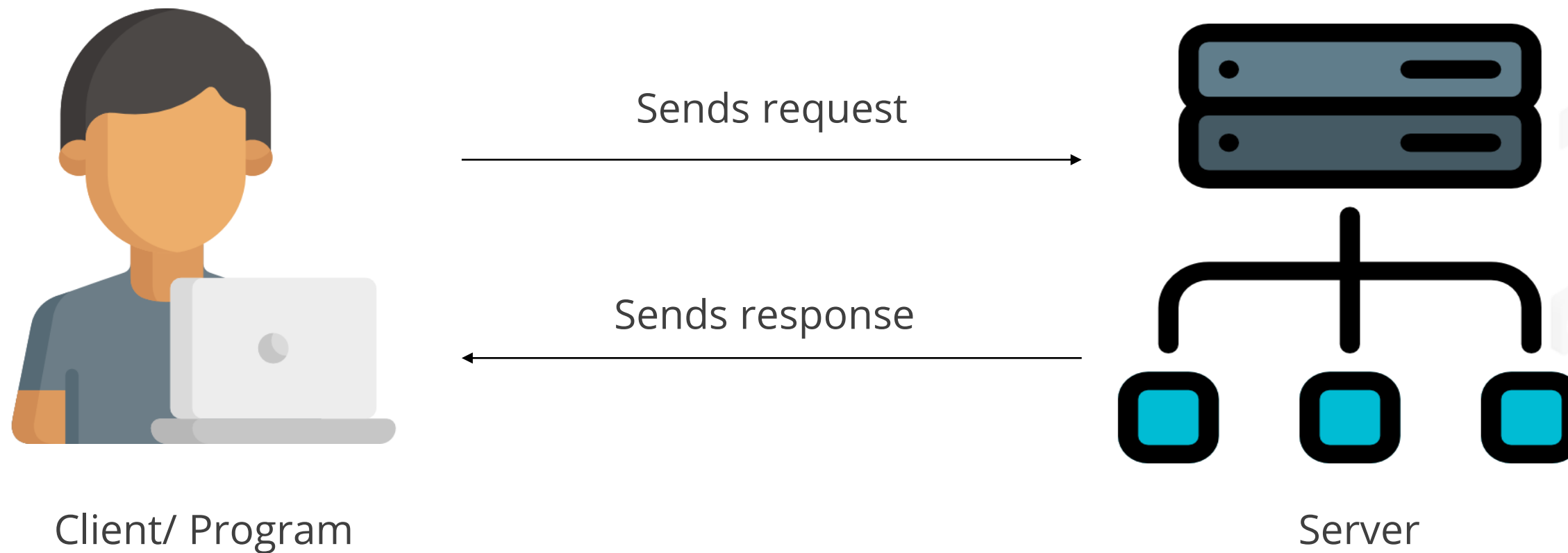
Server

Clients refer to the programs that connect to the database server and issue queries in a pre-specified format.

MySQL: Features

Features of MySQL are as follows:

Speed

MySQL:

- Runs very fast
- Supports clustered servers demanding applications
- Provides multiple functionalities

MySQL: Features

Features of MySQL are as follows:

Ease of use

MySQL is a high-performance simple database system

Supports multiple OS with different programming languages like:

- PHP
- PERL
- C, C++
- JAVA

MySQL: Features

Features of MySQL are as follows:

Data Types

MySQL is equipped with data types to support data. It:

- Supports fixed-length and variable-length records

- Offers a standard limit of 4 GB per table

MySQL: Features

Features of MySQL are as follows:

Connectivity	Localization	Cost
Clients connect to MySQL Server using various protocols.	The server provides error messages in many languages.	MySQL is free.

MySQL Installation

Installing MySQL

Open the MSI installer .exe file
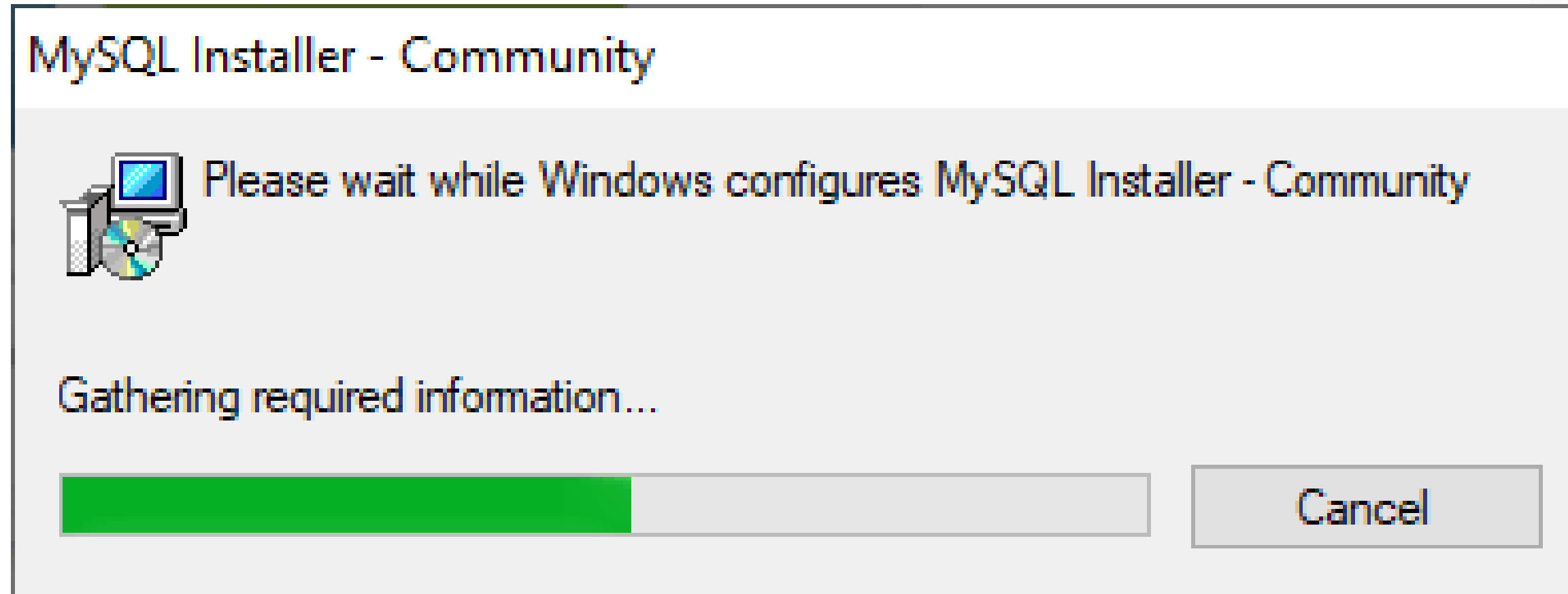
Installing MySQL

Select the suitable setup type from the Choosing a Setup Type page and click Next
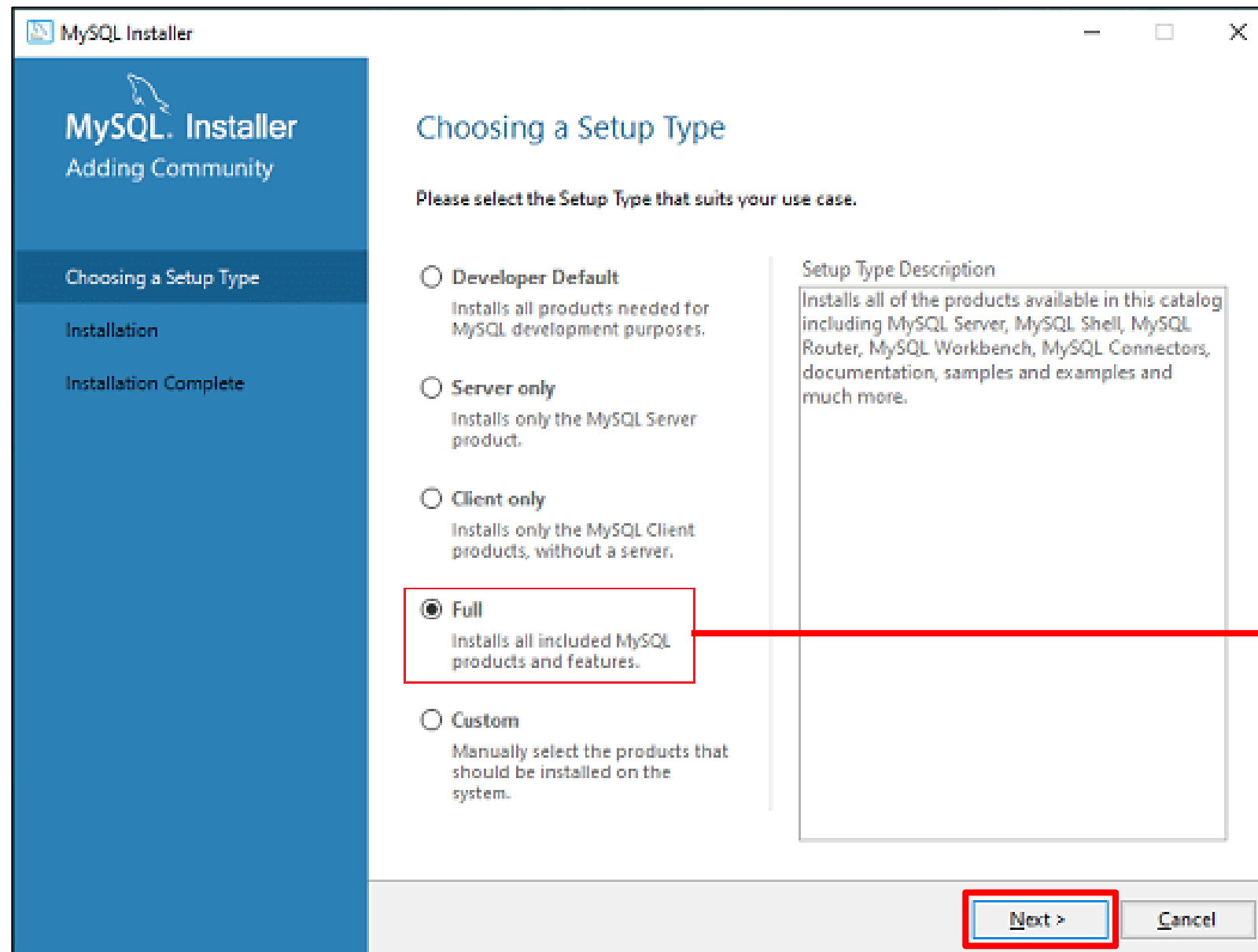
MySQL server, MySQL Shell, MySQL Workbench, MySQL Router, MySQL connector

Installing MySQL

Click Execute to download and install all the required information on the system. Then, click Next
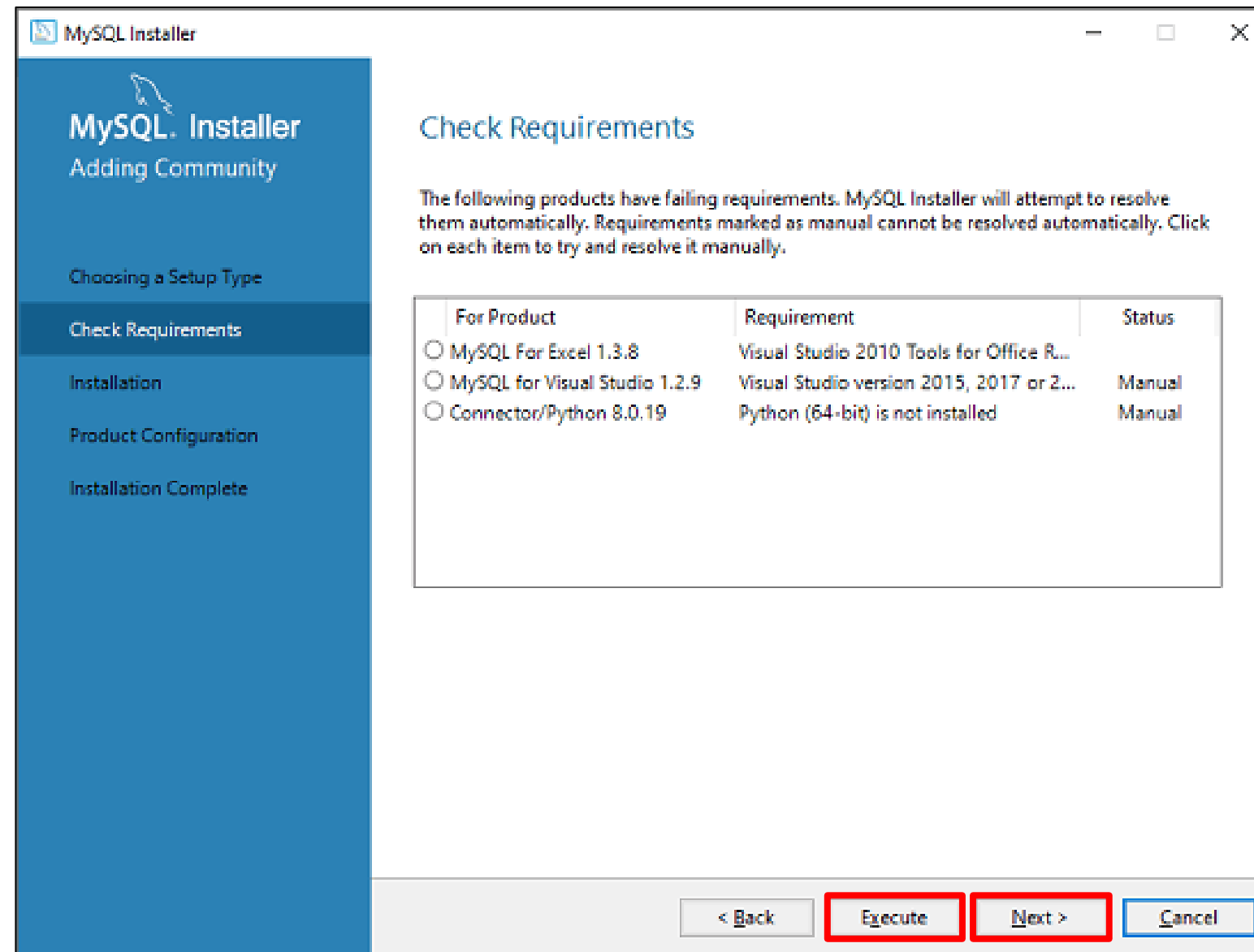
Installing MySQL

The dialog box will appear. Click Yes

MySQL Installer

One or more product requirements have not been satisified

Those products with missing requirements will not be installed or upgraded.
Do you want to continue?

Yes   No
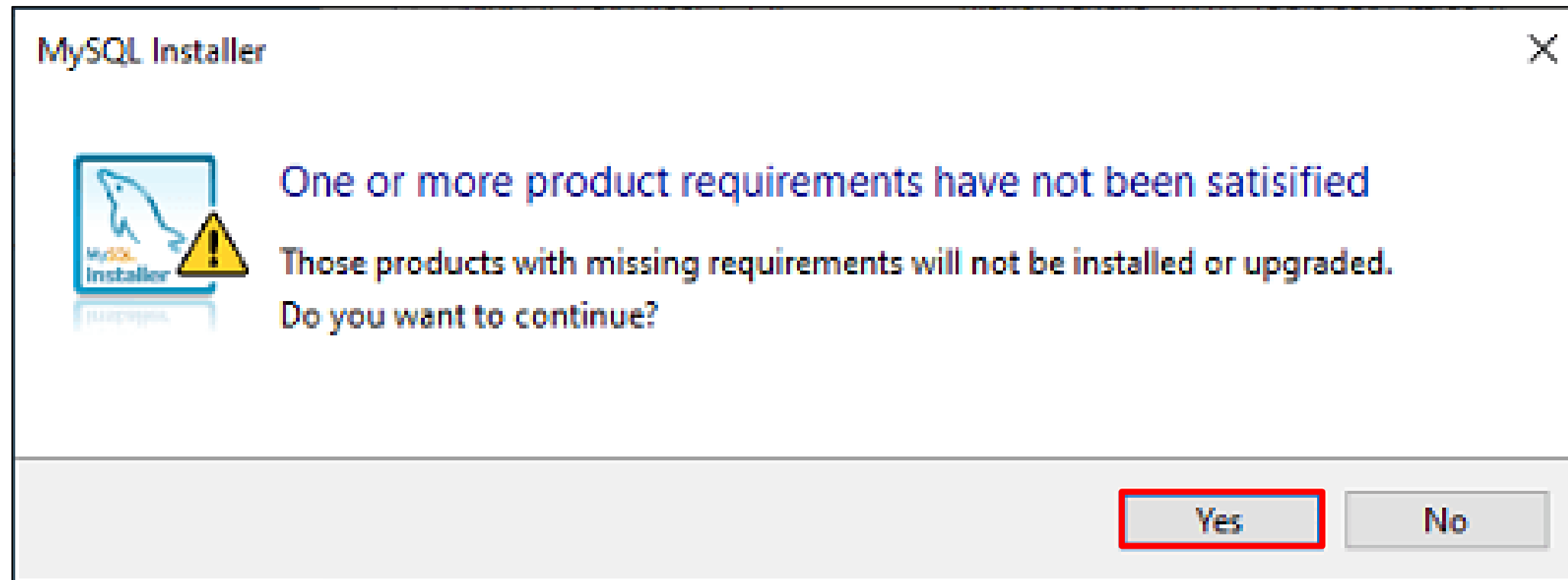
Installing MySQL

The products installed will be displayed. Click Execute
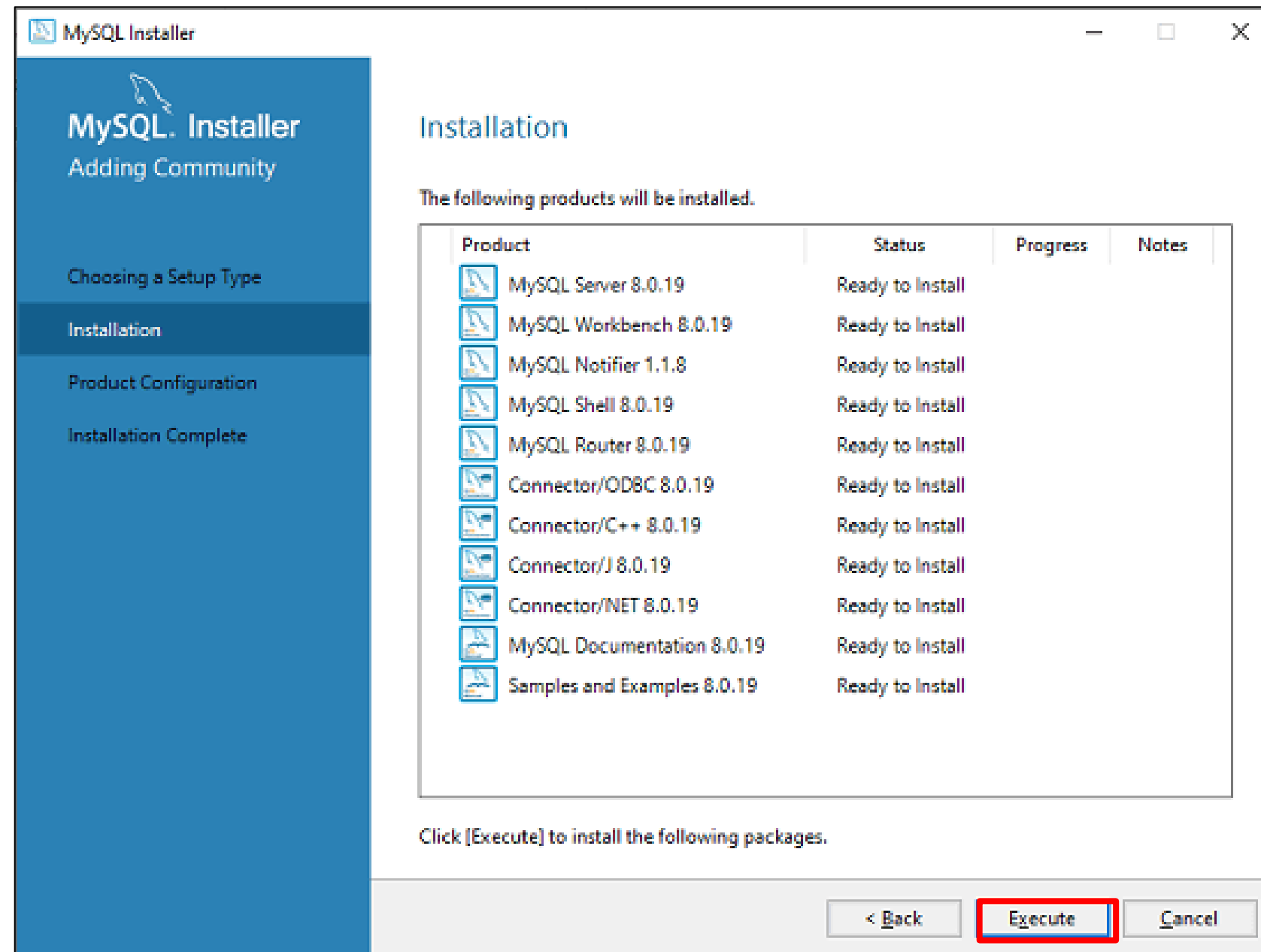
Installing MySQL

In the Product Configuration page, click Next to configure the MySQL server and router
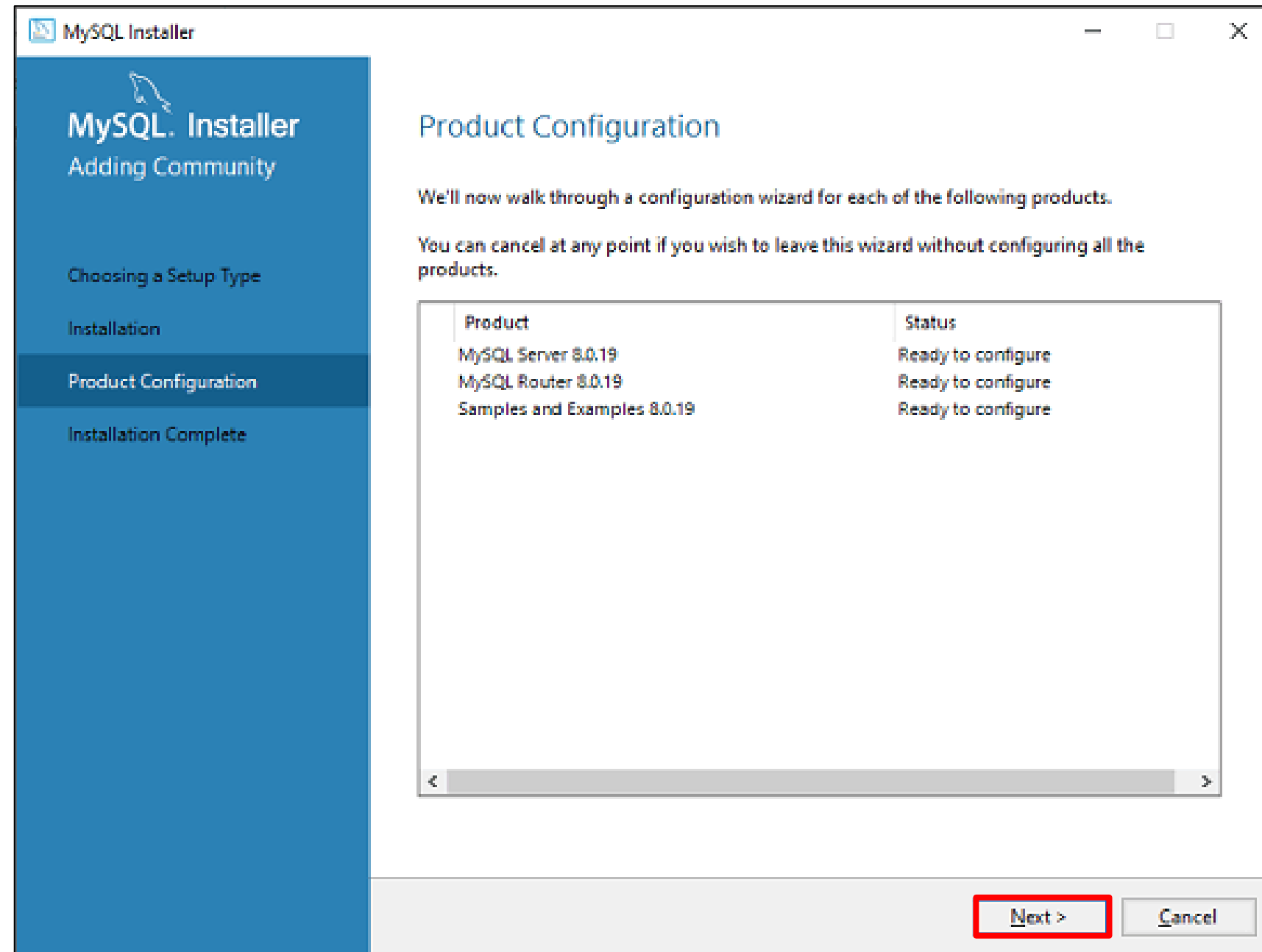
Installing MySQL

Select the Standalone MySQL Server or the Classic MySQL Replication option to configure the MySQL server
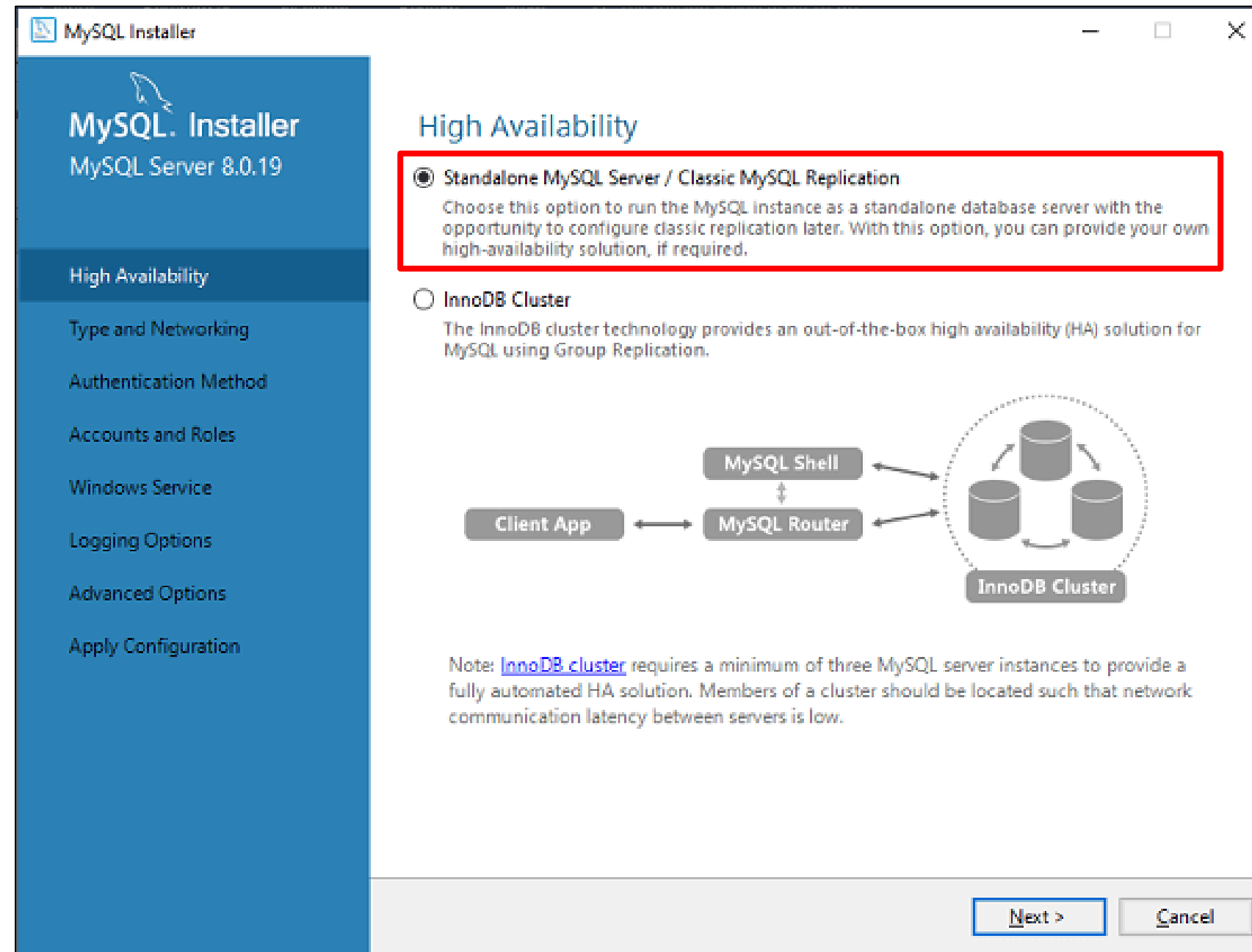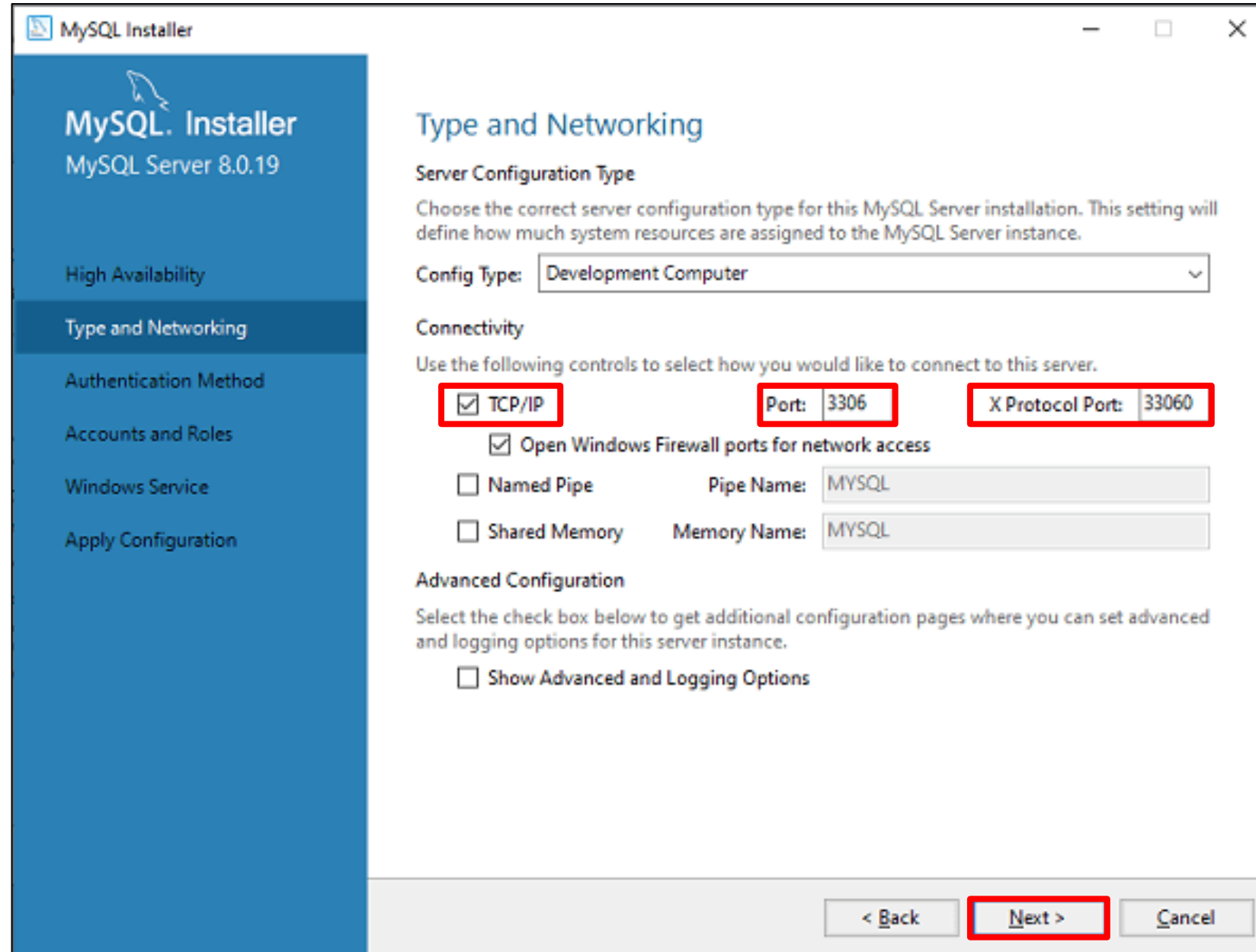
Installing MySQL

Select the Development Computer list option from the Config Type drop-down list
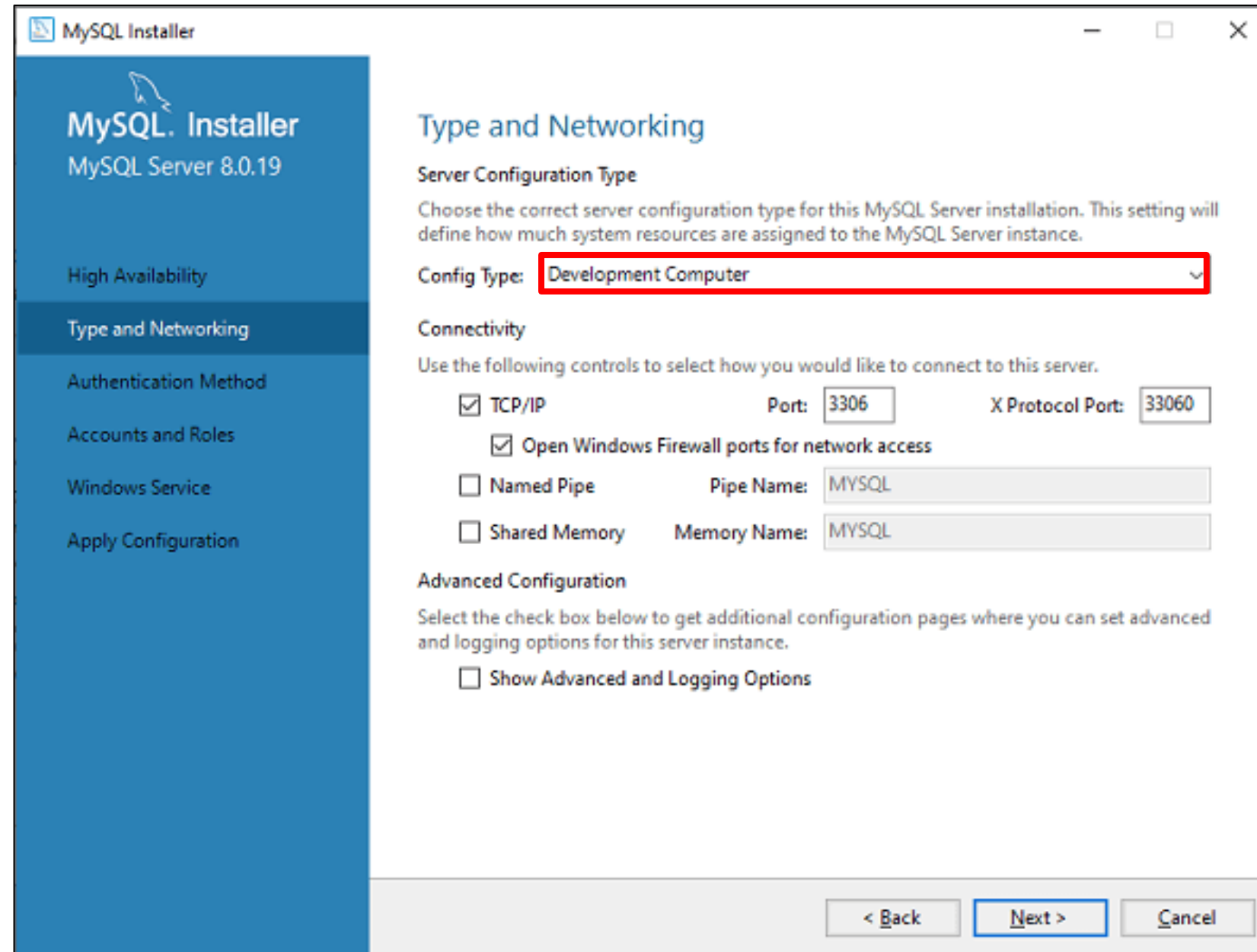
Installing MySQL

Click TCP/IP to mark it selected and fill in the input field
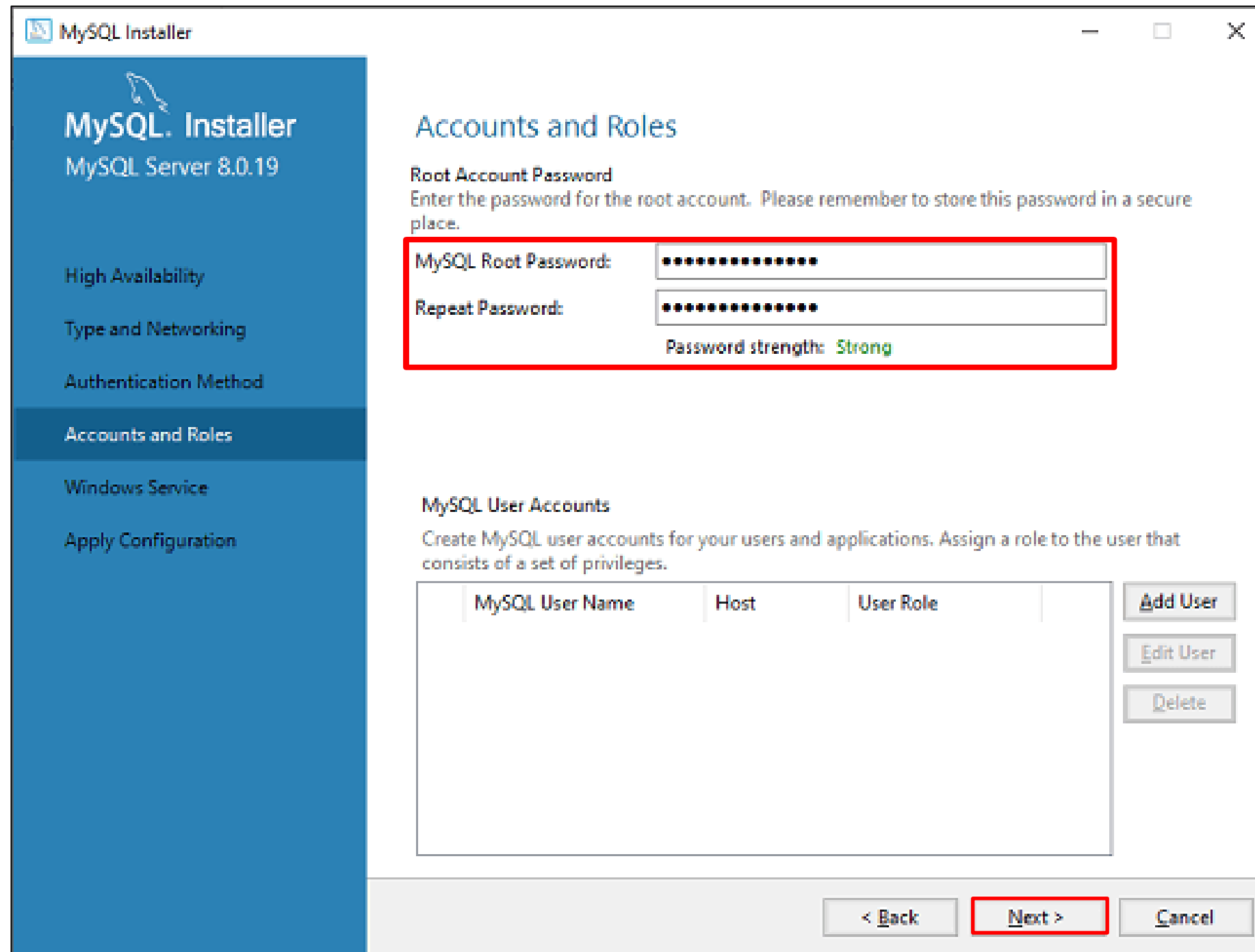
Installing MySQL

Select the Use Strong Password Encryption for Authentication
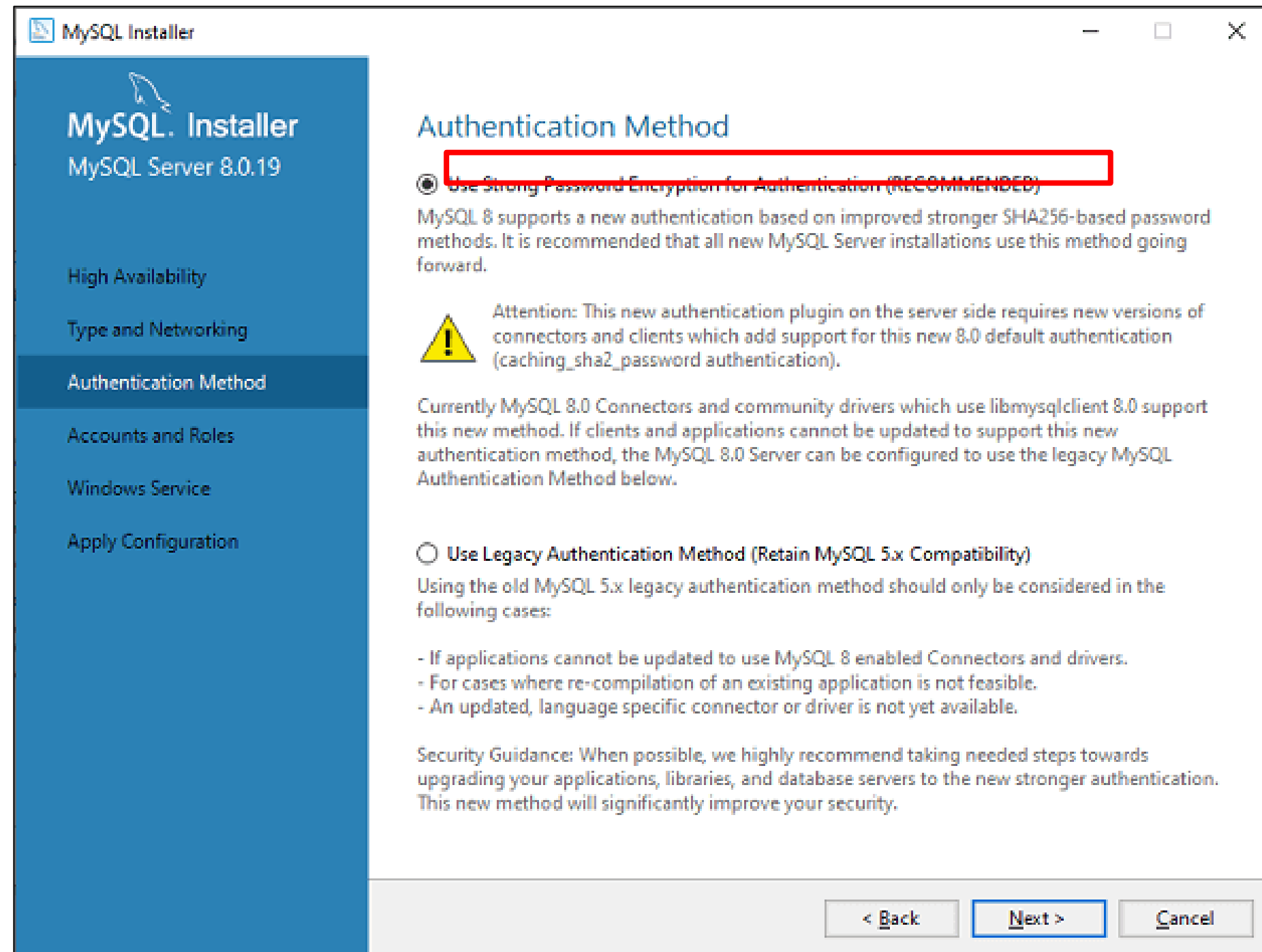
Installing MySQL

Enter the desired password and click Next

Installing MySQL

Keep all the default settings as is and click Next

Installing MySQL

Click Execute to apply the changes
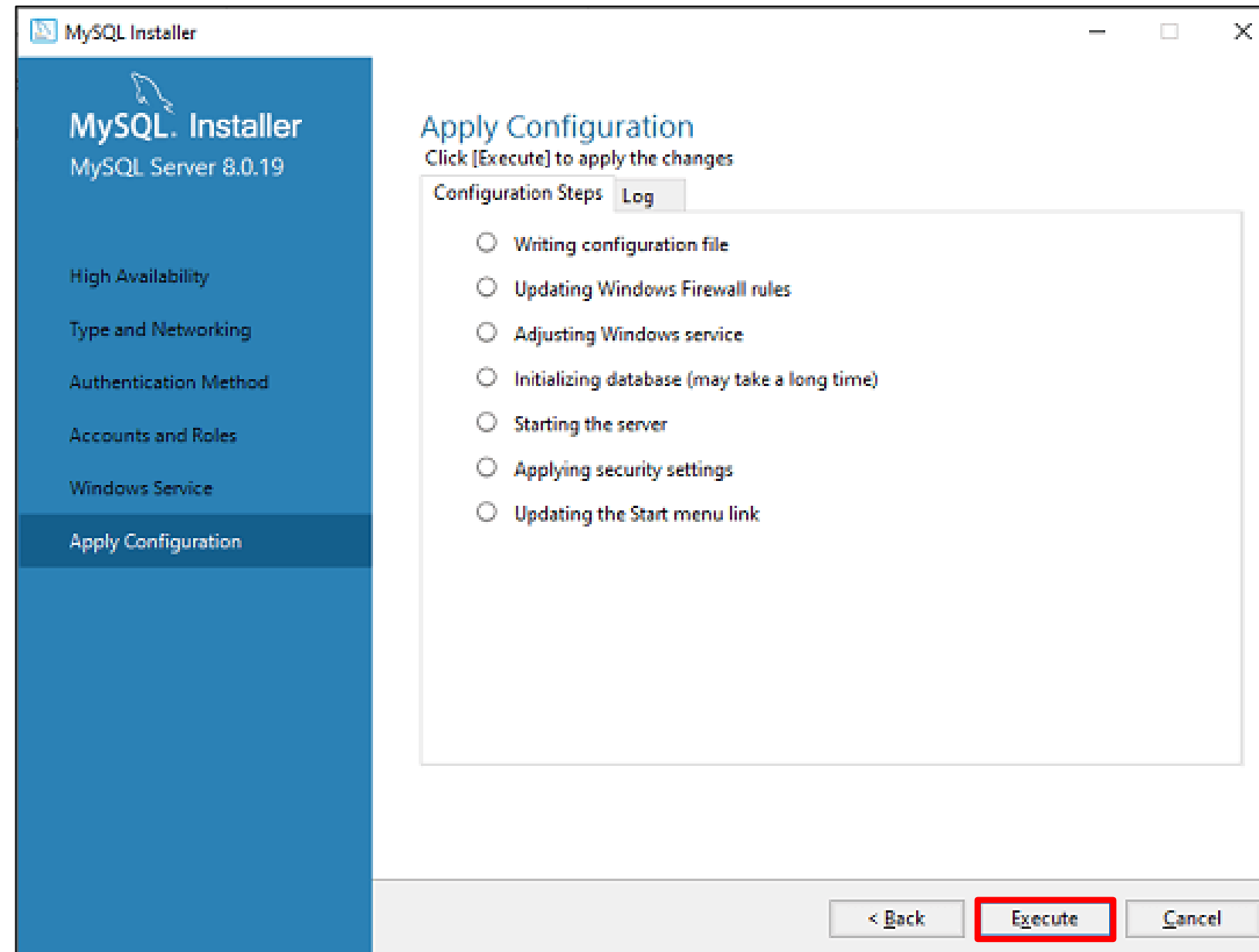
Installing MySQL

The options will be checked with a green checkmark
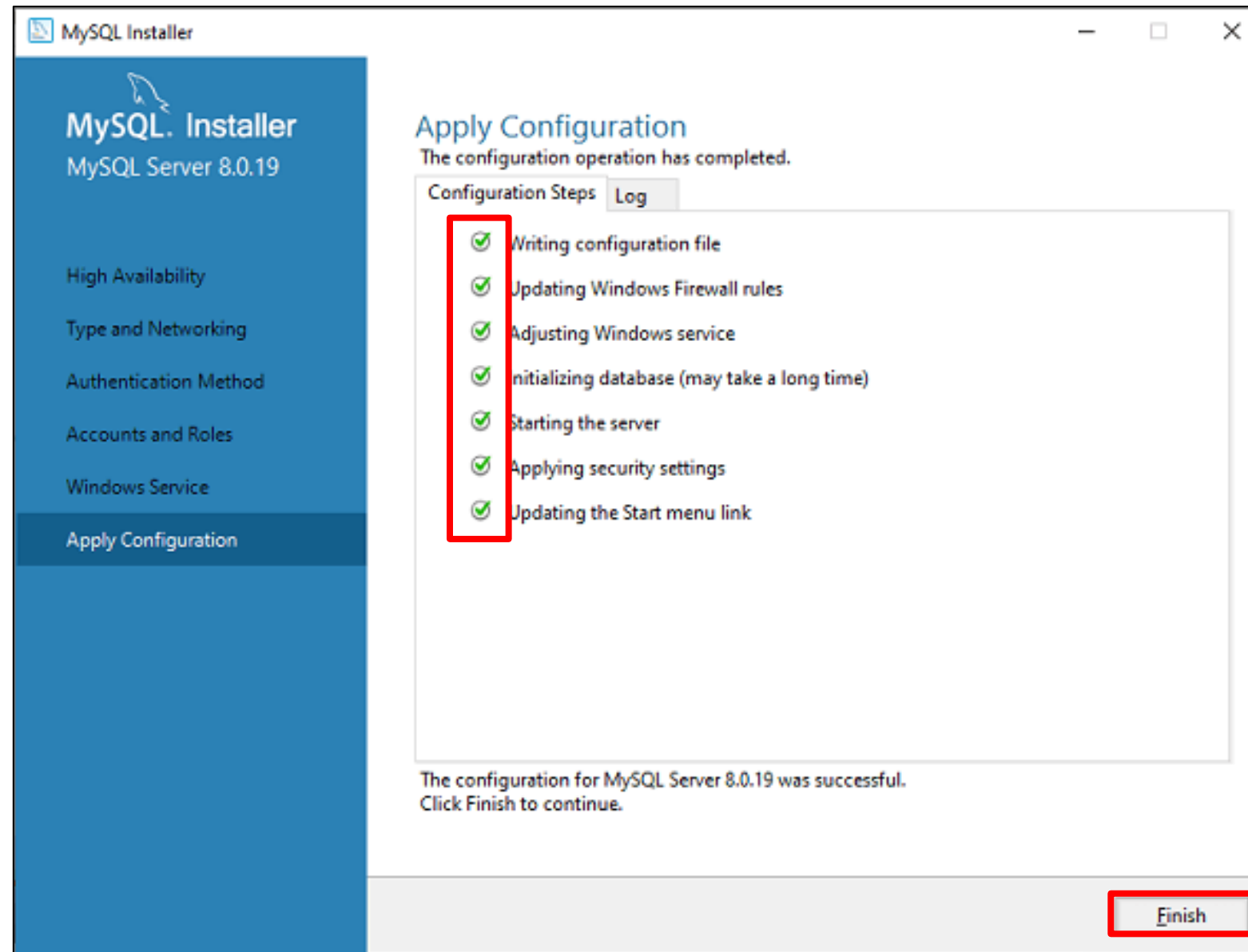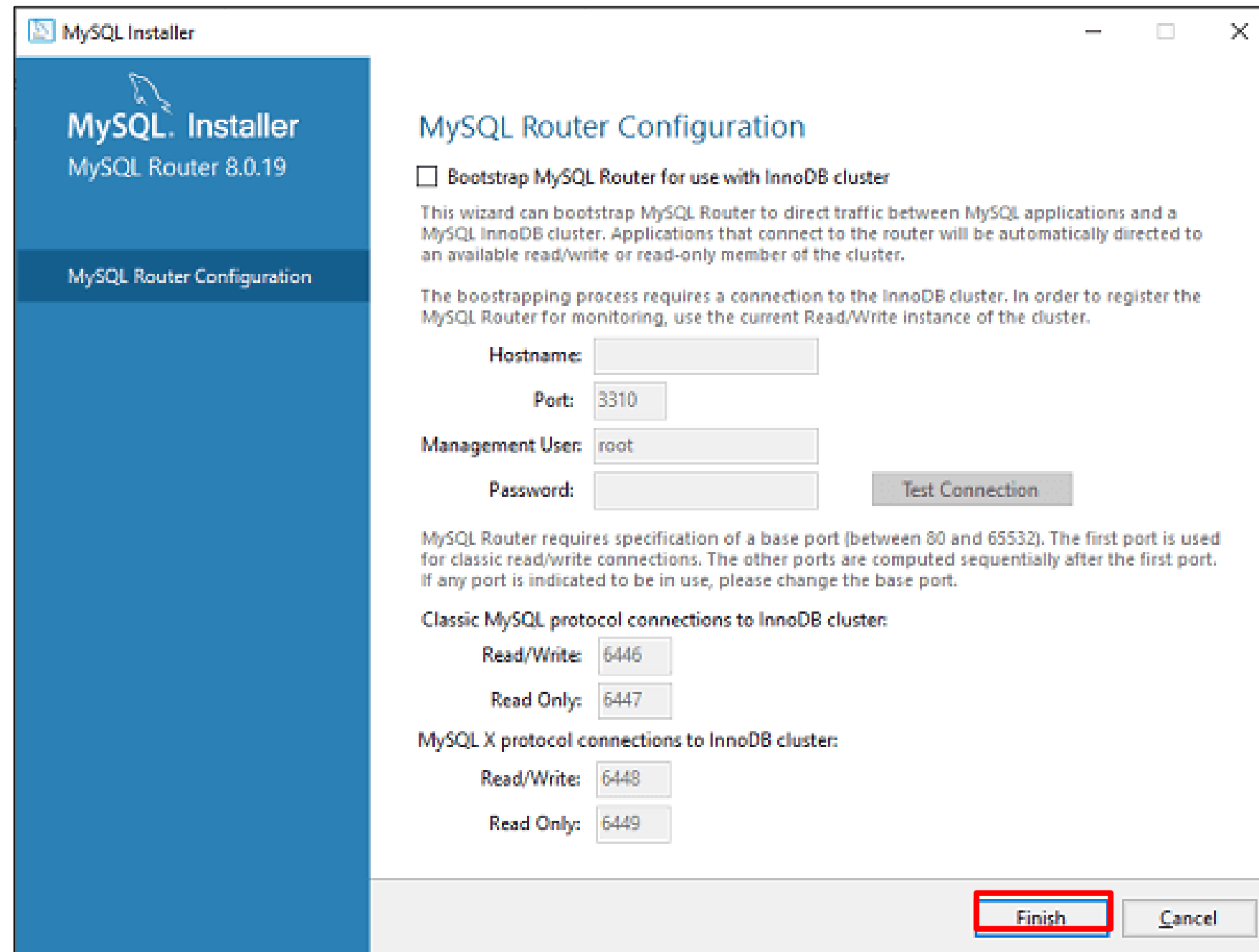
Installing MySQL

Once the product configuration is done, click Next
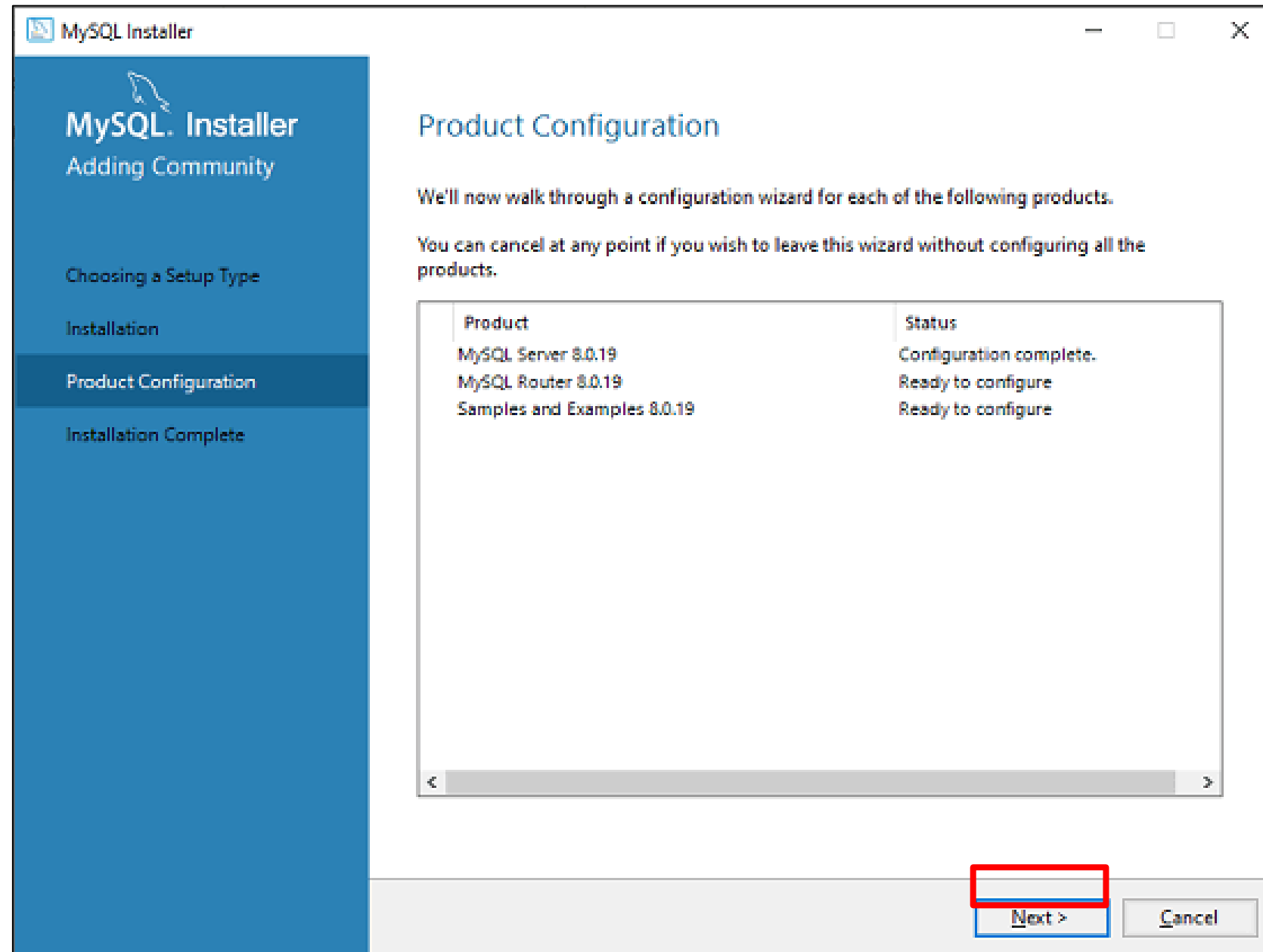
Installing MySQL

Click Finish to set up the router

Installing MySQL

In the Connect to Server page, click Execute. Once the connection is successful, click Next
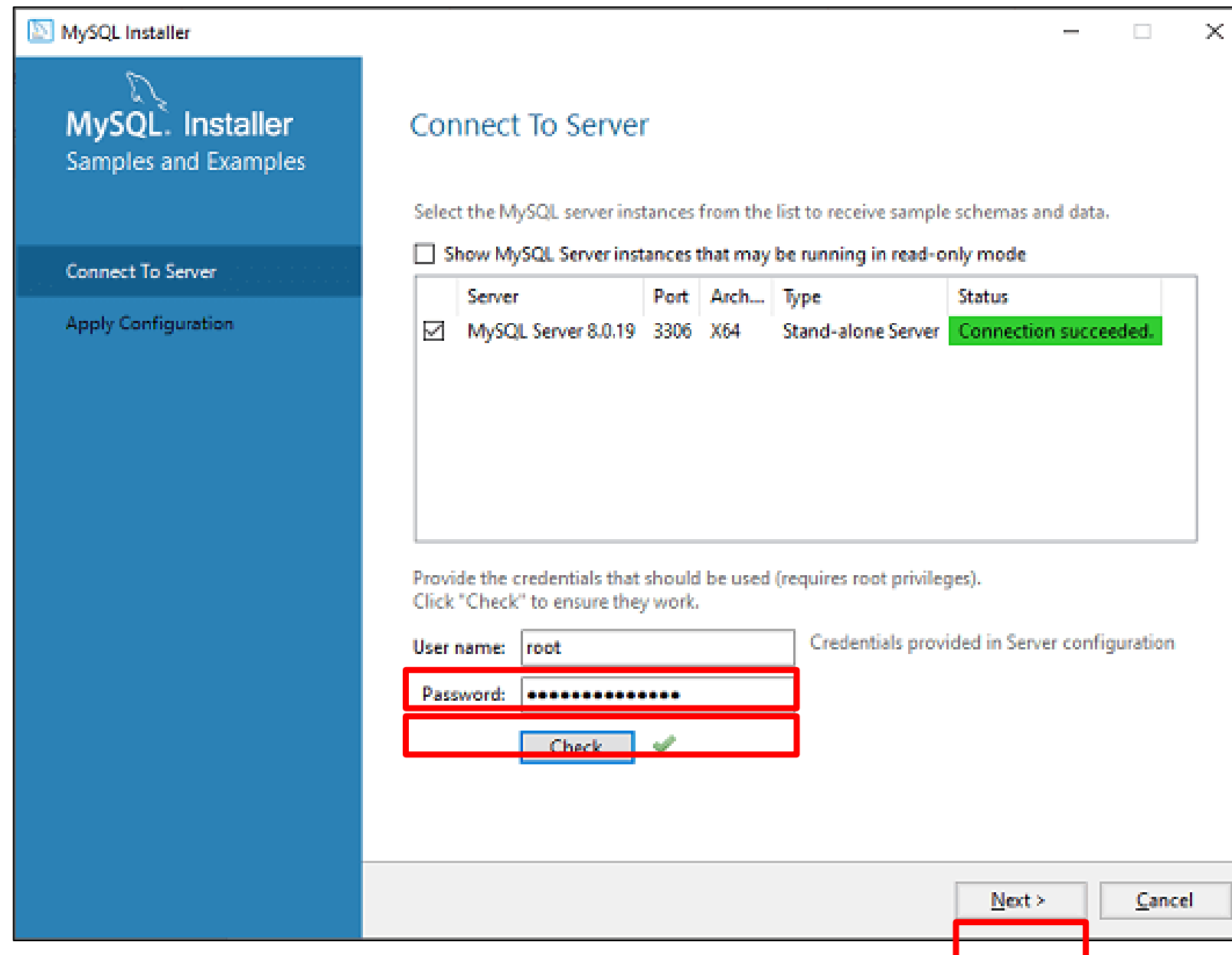
Installing MySQL

Go to the Apply Configuration page and click Execute to set up the Configuration Steps
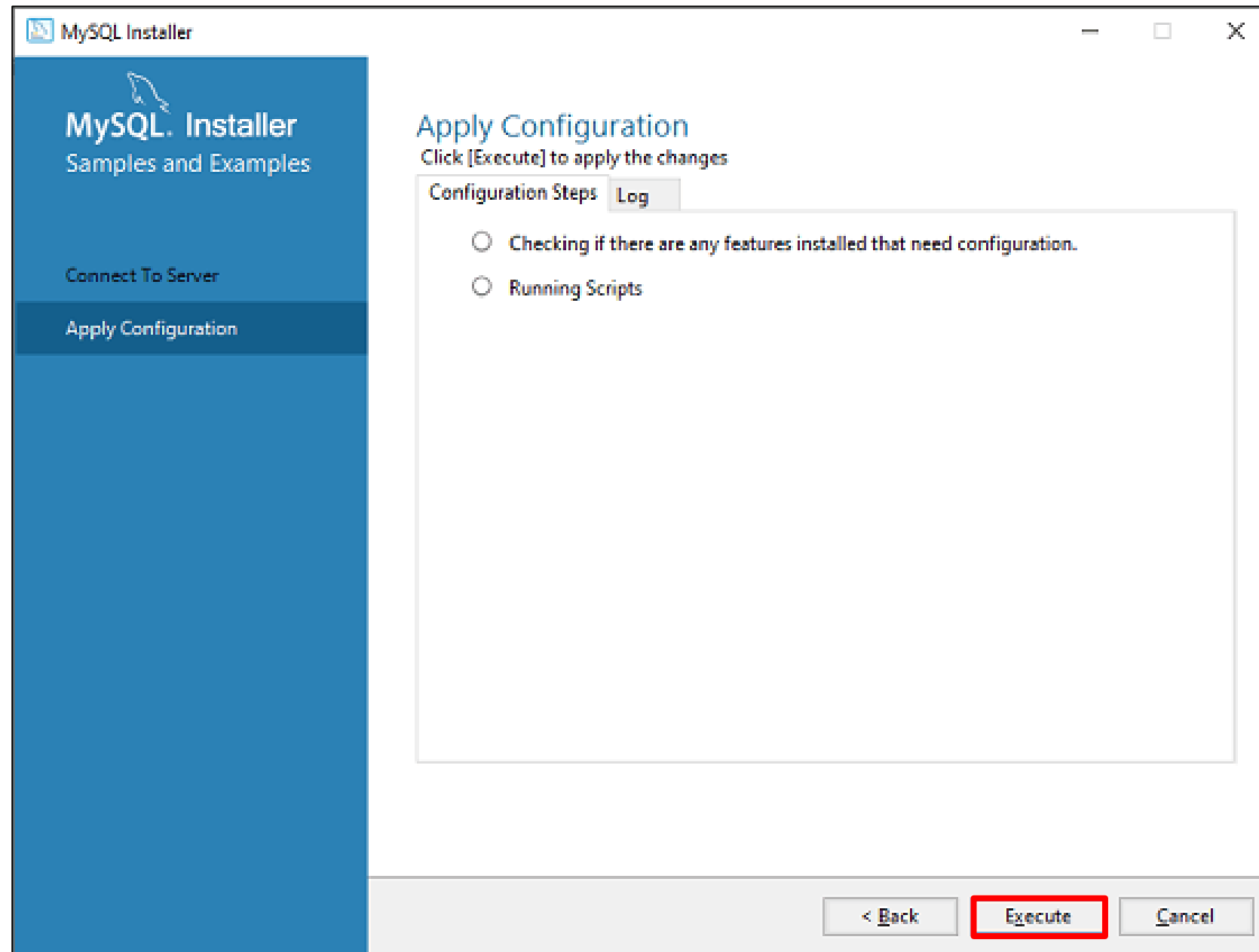
Installing MySQL

When both the configuration steps options are checked with a green checkmark, click Next
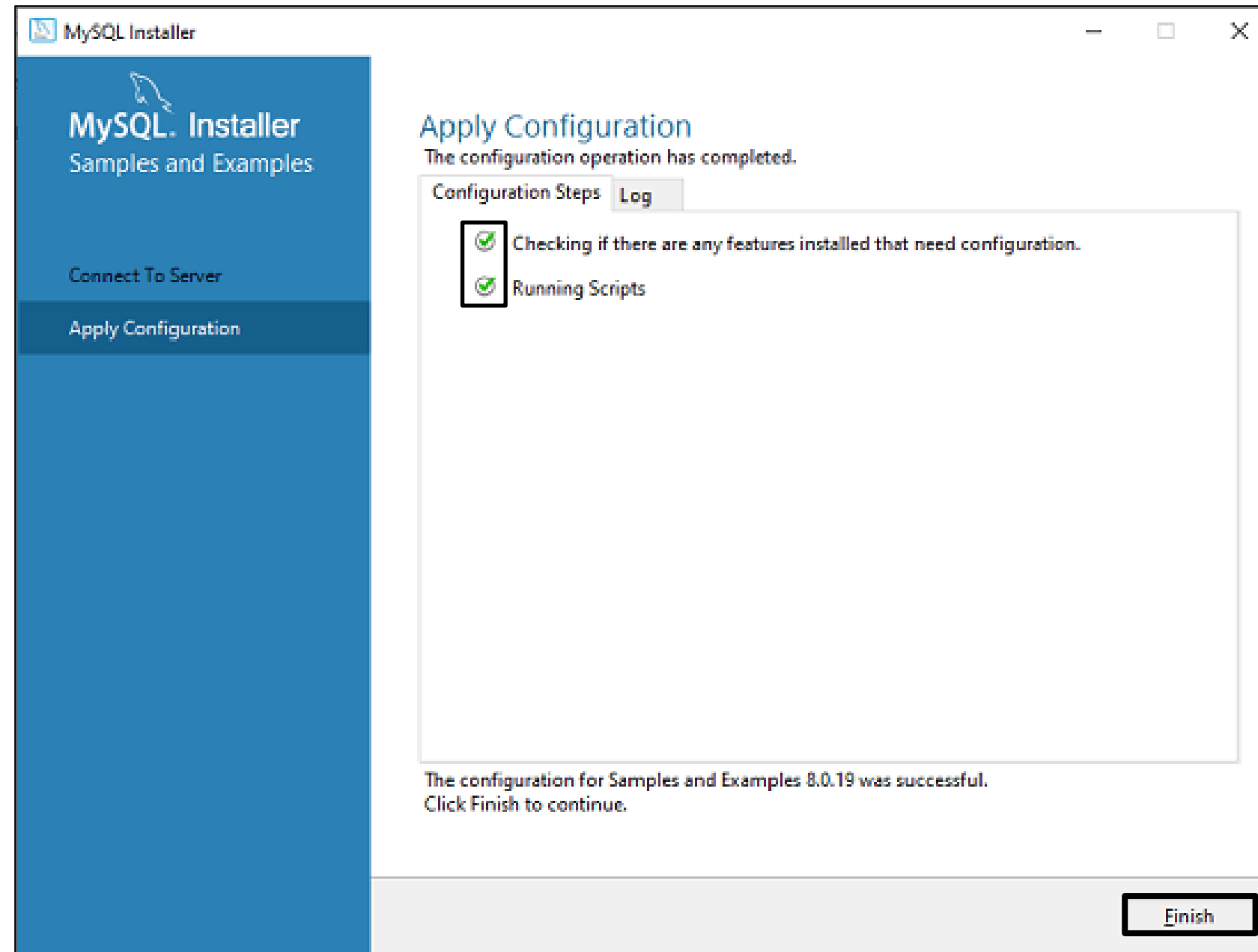
Installing MySQL

MySQL is successfully installed on the machine. Click Finish
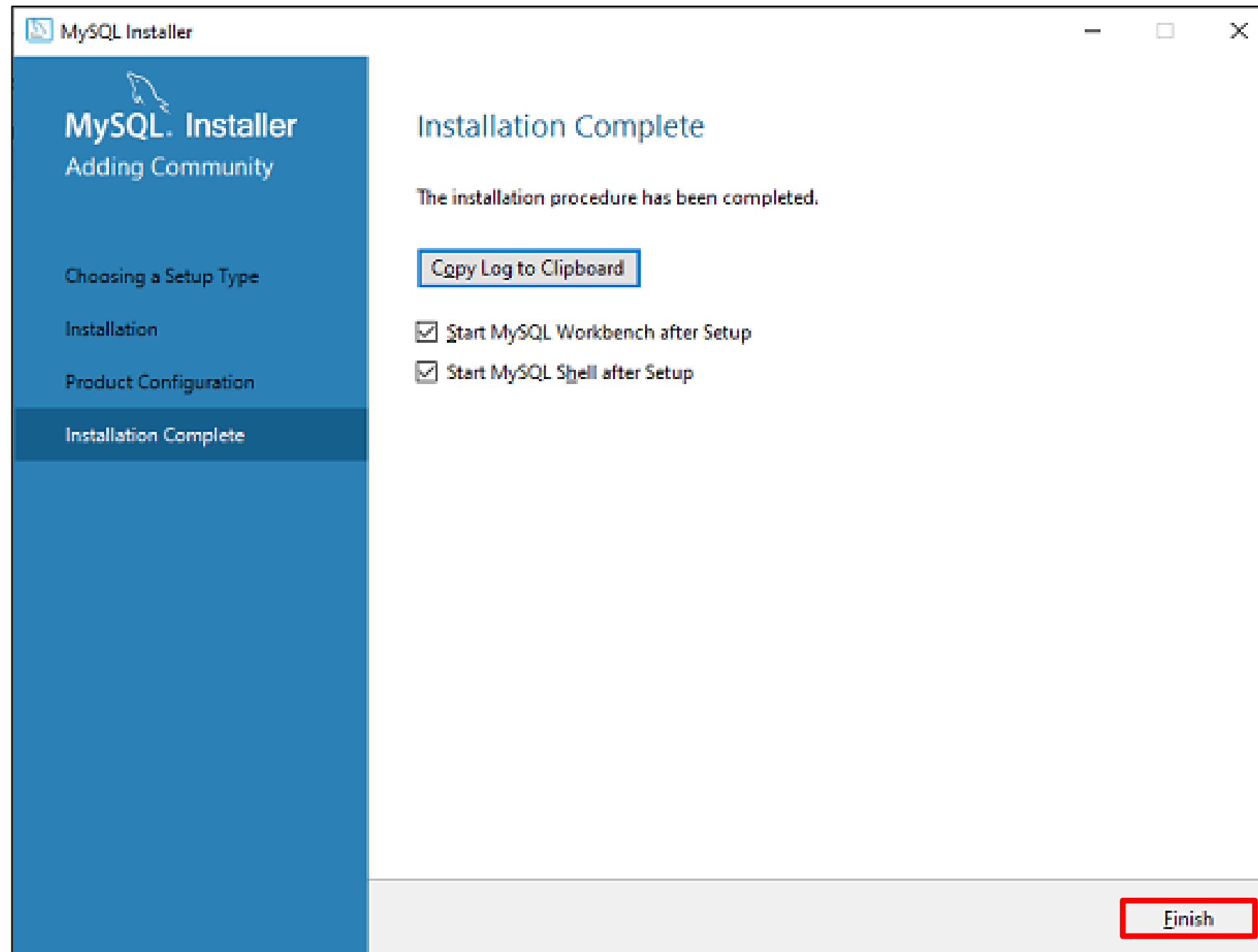
Installing MySQL

Verify the installation using these steps:

Open the MySQL Command Line Client, it should show mysql> brief

Enter the password

Connect to the MySQL server

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Connecting and Disconnecting from the Server

Connecting and Disconnecting from the Server

Connections are crucial in sending commands and receiving results from the other servers.
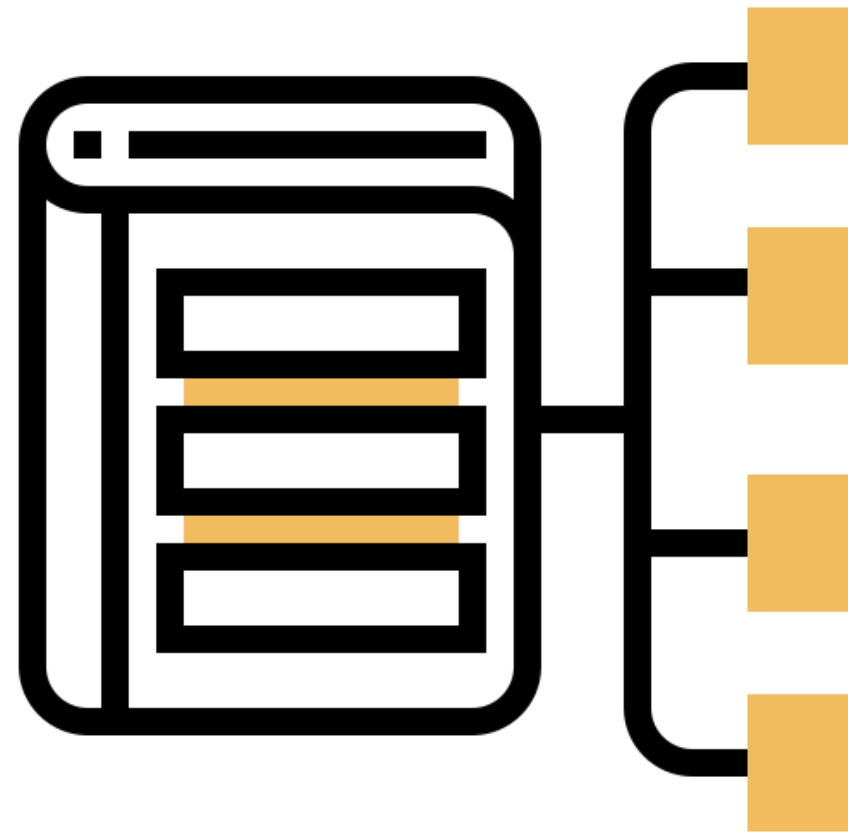
IT facility helps to connect with the same machine servers.

Connecting to the Server

MySQL offers many ways to connect with database servers:

MySQL Username

Command-line Client

PHP Script
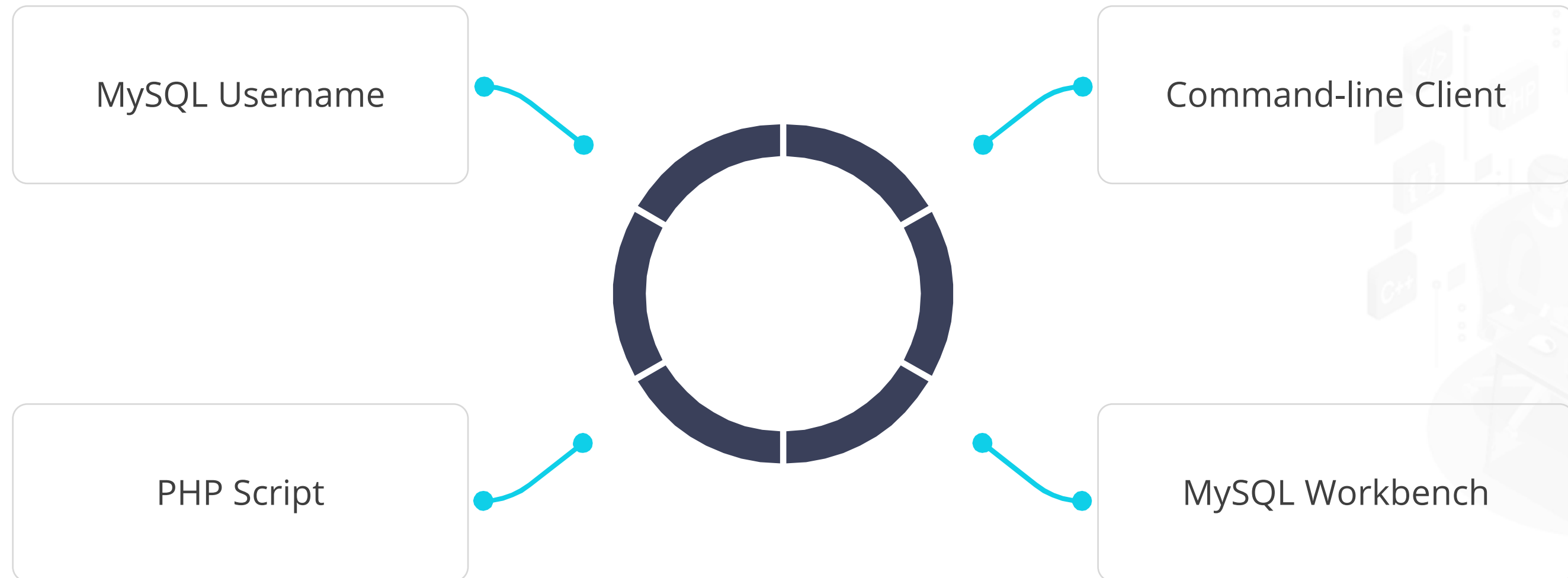
MySQL Workbench

Connecting to the Server

Below are the differences between Command-line Client and MySQL Workbench:

Command-line Client	Vs.	MySQL Workbench
• Helps in making interaction with a database server • Available in the bin directory		Gives the authority to: • Design • Develop • Create the database schemas • Insert queries as well as data to work with stored data

Connecting to the Server

MySQL provides the authority to its users for keeping their database secure by creating a username.

This helps to keep a record of the table that contains:
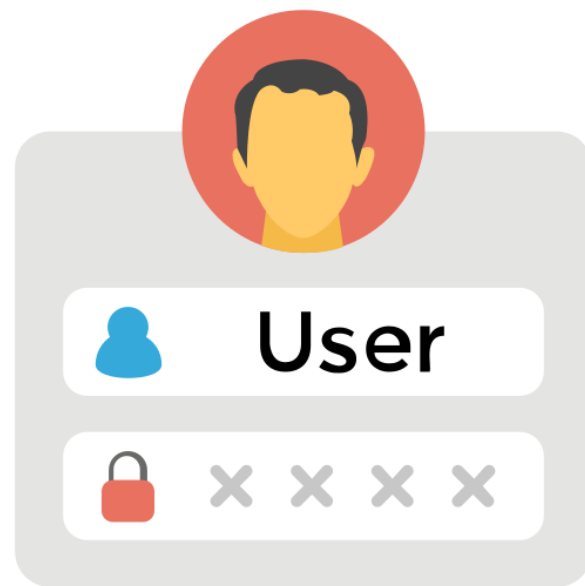
Login Information

Host Information

Account Privileges

Connecting to the Server

To make a connection with the server, enter the username and the password to authenticate the login

If the server runs on a different machine, determine the hostname.

Connecting to the Server

Link to the host using mysql –h host –u user -p

MySQL database system will show the introductory information followed by a mysql> prompt:

```
mysql –h host –u user –p
        Enter password: *****

Welcome to the MySQL monitor. Commands end with: or Vg. Your
MySQL connection id is xxxx to the server version: x.x.x-
standard Type 'help:' or for help.
Type '\c' to clear the buffer.mysql>
```

Connecting to the Server

While login into the system where SQL is running, the host can be omitted and the following code can be used:

```
Mysql –u user –p

Error message 00 Sign into the MySQL server


ERROR 2002 (HYOOO) : can't connect to local MySQL server

through socket '/tmp/mysql.sock' (2) ,
```

Connect with that server by conjuring MySQL >mysql

Disconnecting to the Server

```
Enter QUIT or \q at the cli: mysql> QUIT

Or Press CTRL + D
```

Structured Query Language (SQL)

Structured Query Language (SQL)

SQL is a standard technical language to store, retrieve, and manipulate databases.

Store
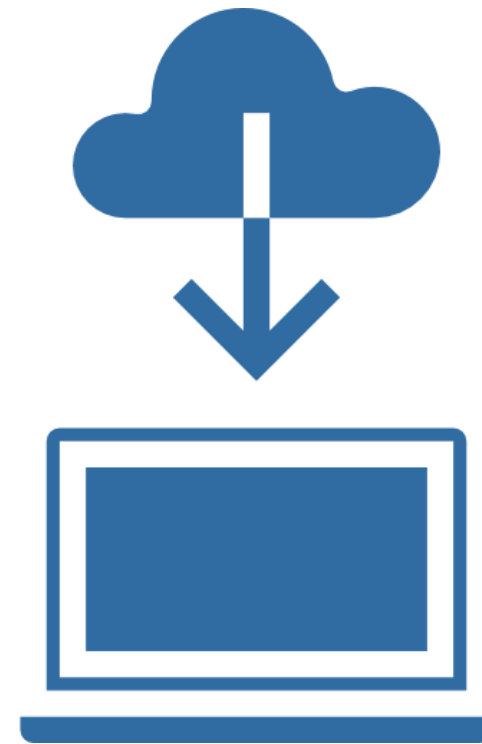
Retrieve

Manipulate

All SQL statements are instructions to the database only.

Structured Query Language (SQL)

SQL functionalities include:

Connecting to a database and updating, retrieving, deleting, and inserting records

Creating new tables, stored procedures, and views in the database

Accessing to set permissions on tables, processes, and views

SQL Command Categories

SQL commands can be divided into five categories:
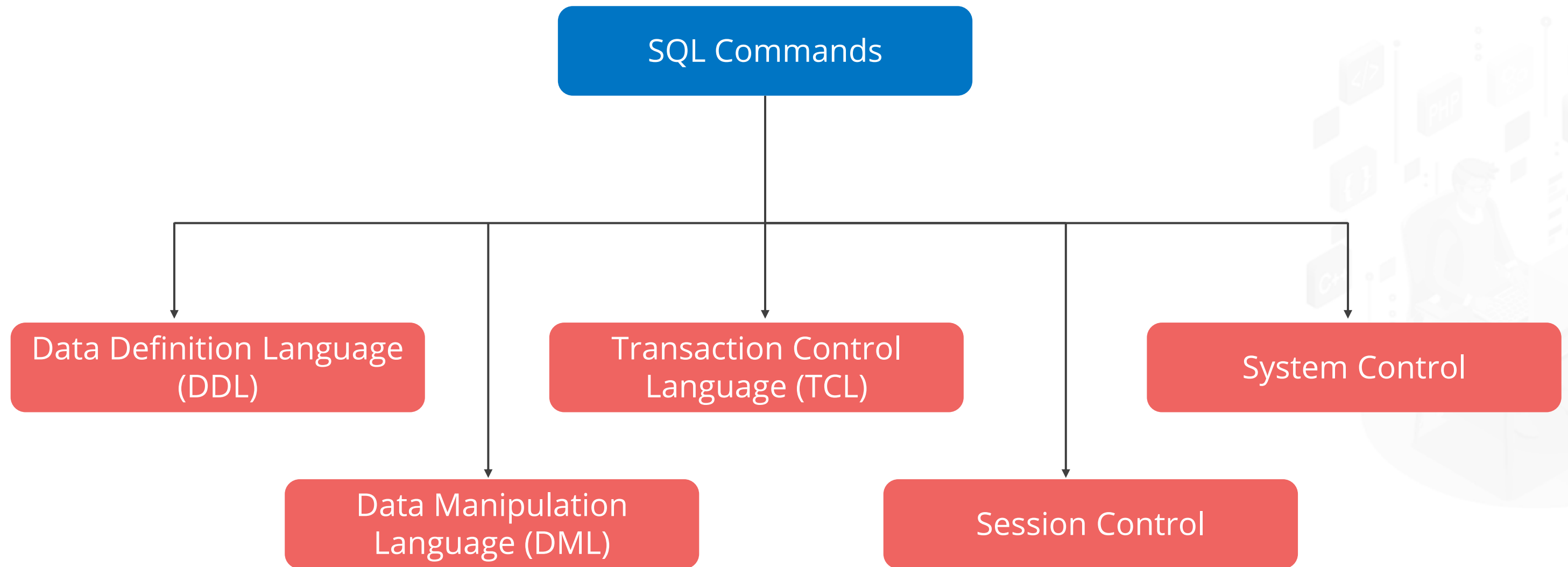
SQL Commands

Data Definition Language (DDL)

Data Manipulation Language (DML)

Transaction Control Language (TCL)

Session Control

System Control

Data Definition Language (DDL) Commands

The DDL commands help the user perform data definitions tasks.

Create schema objects

Delete or remove schema objects

Create

Alter

Drop

Rename

Modify or change the existing schema objects

Change the table name
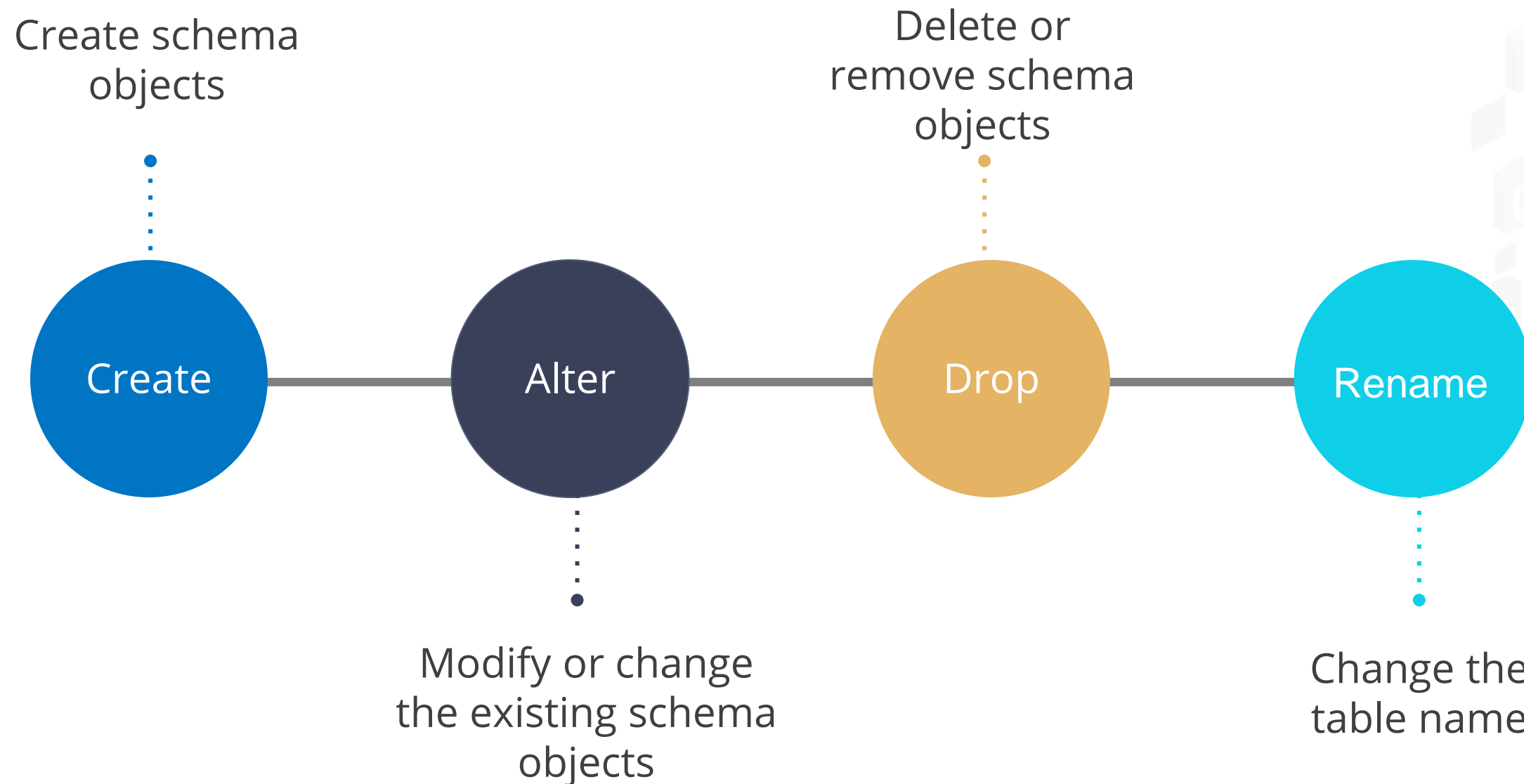
Data Definition Language (DDL) Commands

The DDL commands are also known as Data Control Language (DCL).

Grant and revoke privileges and roles

Maintenance Commands

Grant or revoke permissions or privileges to work on schema objects
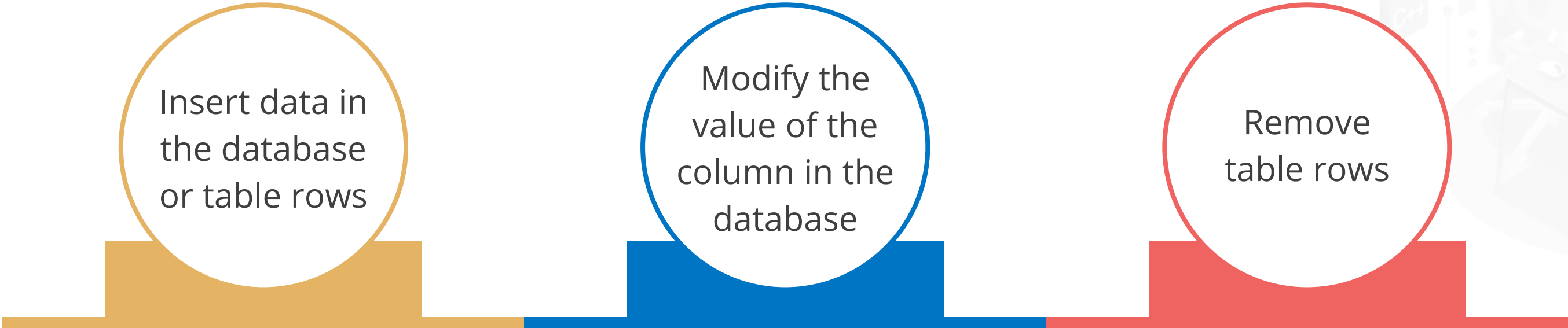
Analyze the table information

Data Manipulation Language (DML) Commands

The DML commands are employed to manipulate and modify data, for example, SELECT, LOCK table, etc.

This command is not permanently saved.

Insert data in the database or table rows

Modify the value of the column in the database

Remove table rows

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Transaction Control Language (TCL) Commands

Transaction control language is used to manage and manipulate the data generated by:

INSERT< UPDATE< DELETE commands

A transaction refers to one complete logical unit of work.

These commands are used to manage changes that are made by DML commands.

Transaction Control Language (TCL) Commands

Commit

Rollback

Savepoint

Set transaction

- Makes all changes made by a statement issued
- Makes the transaction permanent

Undo the changes from the beginning or a save point

Saves the transaction temporarily

Implements properties for the current transaction

MySQL Security and Root Superuser

MySQL Security and Root Superuser

MySQL Security	Root Superuser
Provides strong data security to protect data for: • Secure connections • Authentication services • Authorization and controls • Data encryption and security	An admin who has the super privilege or GRANT statement that allows a user account to make changes and execute various operations in the database table

MySQL Security and Root Superuser

To create a superuser:

```
Login to MySQL server and this command:


mysql -u root -p


mysql -h host_name_ip -u root -p


Create an admin user account

CREATE USER 'admin'@'localhost' IDENTIFIED BY
'the_secure_password';
```

Creating a Database and Table

Creating a Database

The syntax to create a database:

```
CREATE DATABASE databasename;
```

Creating a Table

Creating a table involves understanding data types.

A data type specifies a particular type of data.

```
                         ┌──────────────────┐
                         │    Data type     │
                         └──────────────────┘
                                  │
          ┌───────────────────────┼───────────────────────┐
          │                       │                       │
   ┌─────────────┐        ┌─────────────────┐      ┌─────────────┐
   │  Numeric    │        │  Date and Time  │      │ String Types│
   └─────────────┘        └─────────────────┘      └─────────────┘
```
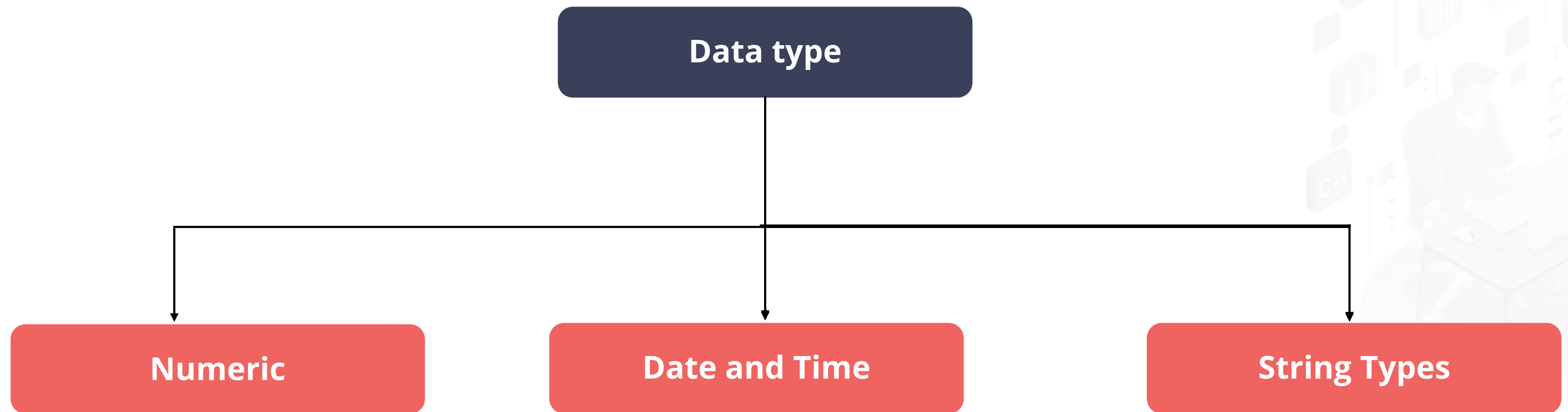
Creating a Database

SQL supports all numeric data types, that include:

Data types	Description	Signed	Unsigned	Width
INT	Integer	Permissible reach: 2147483648 - 2147483647	Permissible reach: 0 - 4294967295	11
TINYINT	Small Integers	Permissible reach: -128 - 127	Permissible reach: 0 - 255	4
SMALLINT	Small Integers	Permissible reach: -32768 - 32767	Permissible reach: 0 – 65535	5
MEDIUMINT	Medium-sized integers	Permissible reach: -8388608 - 8388607	Permissible reach: 0 – 16777215	9
BIGINT	Large integer	Permissible reach: 9223372036854775808 - 9223372036854775807	Permissible reach: 0 - 18446744073709551615	20

Numeric Data Type

SQL supports all numeric data types, that include:

FLOAT(M,D)

- Floating-point numbers (unsigned)
- Define the visual length (M) and the number of decimals (D)
- Decimal accuracy: 24

DOUBLE(M,D)

- Double-precision floating-point numbers (unsigned)
- Visual length (M): 16
- Quantity of decimals (D): 4
- Decimal accuracy: 53

DECIMAL(M,D)

- Unpacked floating-point number (unsigned)
- Every decimal corresponds to 1 byte
- NUMERIC is equivalent to DECIMAL

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Date and Time Data Types

The list of the date and time data types are as follows:

YEAR(M) – Stores in a 2-digit or a 4-digit format

DATE – Written in YYYY-MM-DD format

TIME – Stores in HH:MM:SS format

DATETIME – Written in YYYY-MM-DD HH:MM:SS format

TIMESTAMP – Stored in YYYYMMDDHHMMSS format

simplilearn
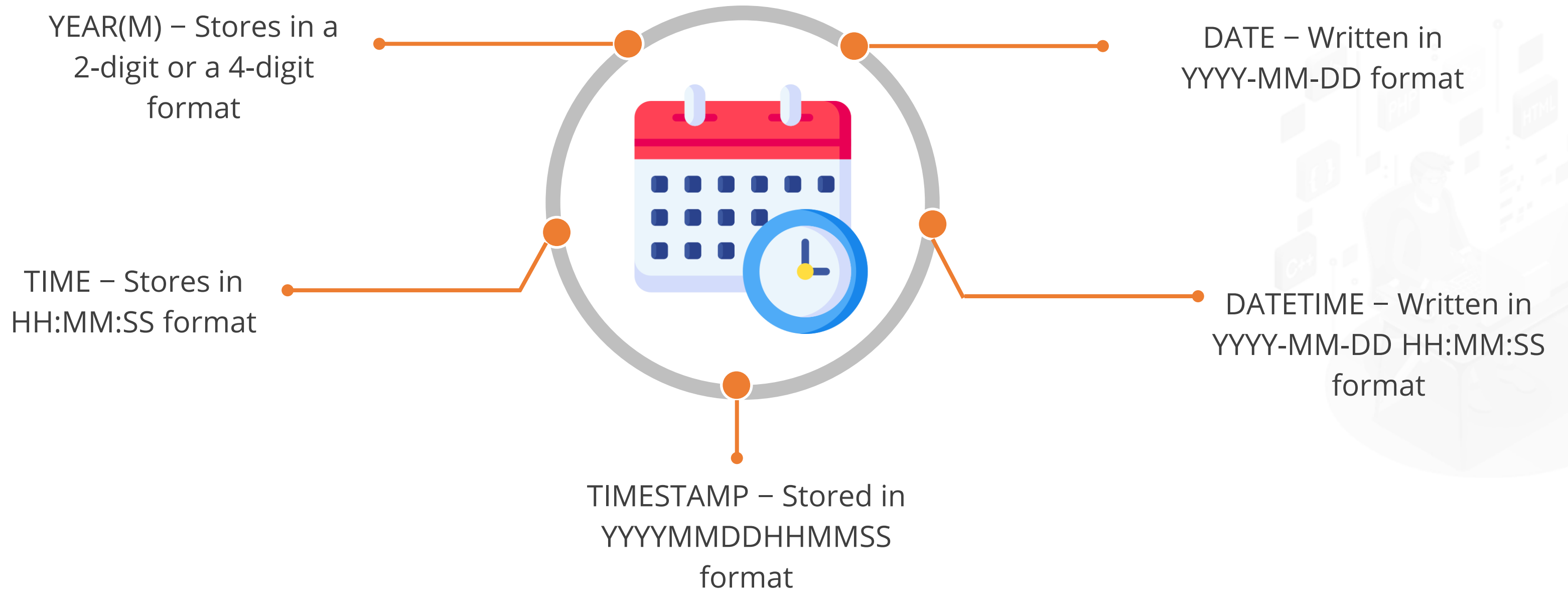
String Data Types

The list of string data types are as follows:

CHAR(M)	VARCHAR(M)	BLOB or TEXT
• Fixed-length string • **Length:** 1 and 255 characters	• Variable-length string • **Length:** 1 and 255 characters	• **Length:** 65535 characters • Stands for "Binary Large Objects" • Helps to store large amounts of binary data

String Data Types

The list of string data types are as follows:

TINYBLOB or TINYTEXT

- BLOB or TEXT column
- **Length:** 255 characters
- Cannot define size

MEDIUMBLOB or MEDIUMTEXT

- BLOB or TEXT column
- **Length:** 16777215 characters
- Cannot define size

LONGBLOB or LONGTEXT

- BLOB or TEXT column
- **Length:** 4294967295 characters
- Cannot define size

ENUM or enumeration refers to an extravagant term for lists.

Creating a Table: Syntax

The syntax for creating a table:

```
CREATE TABLE name_of_table (
column1 datatype,
column2 datatype,
column3 datatype,
   ....
);
```

Creating a Table: Example

Code

```
CREATE TABLE Persons (
PersonID int,
LastName varchar(255),
FirstName varchar(255),
Address varchar(255),
City varchar(255)
)
```

Output
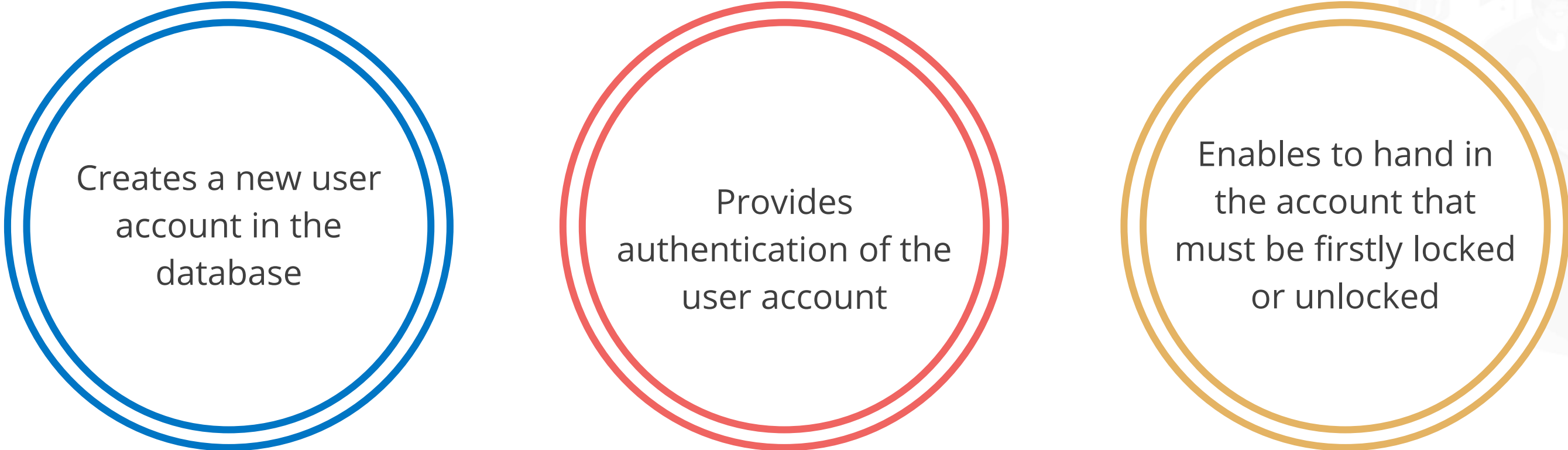
PersonID	LastName	FirstName	Address	City

Creating a New User

Creating a New User

MySQL user record contains login information, account privileges, and host information for SQL accounts.

The Create statement:

Creates a new user account in the database

Provides authentication of the user account

Enables to hand in the account that must be firstly locked or unlocked

Creating a New User

The syntax for creating a new user:

```
CREATE USER 'username' IDENTIFIED BY 'password';
```
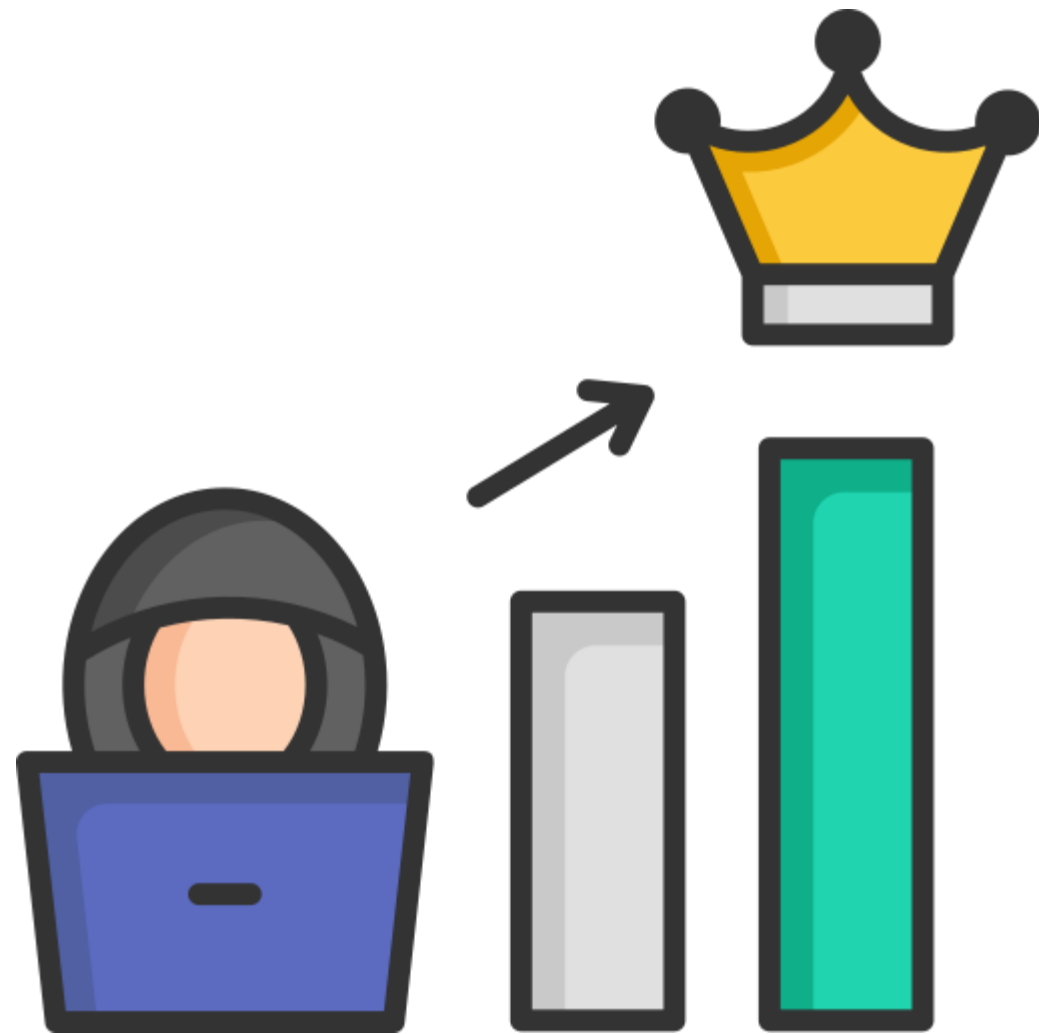
MySQL Database and Table Specific Privileges

MySQL Database and Table Specific Privileges

The privileges granted to a MySQL account help to identify operations a particular account can perform.

These privileges:

Enable users to manage the operation of the MySQL server

Don't just apply to one database as they are global

Apply to a database including the objects within it

Privileges for database objects can be granted for specific objects within a database.

MySQL Database and Table Specific Privileges

A grant statement is used to provide privileges to the users.

```
GRANT            priv_type [(column_list)]
    [, priv_type [(column_list)]] ...
  ON [object_type] priv_level
  TO user_or_role [, user_or_role] ...
  [WITH GRANT OPTION]
  [AS user
      [WITH ROLE
          DEFAULT
        | NONE
        | ALL
        | ALL EXCEPT role [, role ] ...
        | role [, role ] ...
      ]
  ]
```

Key Takeaways

- A database system is a computer-based record-keeping system.

- MySQL is a Relational Database Management System (RDBMS) that uses SQL to query from databases.

- SQL is a standard technical language to store, retrieve, and manipulate databases.

- Transaction control language is used to manage and manipulate the data.

- The DML commands are employed to manipulate and modify data.

- The DDL commands help the user perform data definitions tasks.

Thank You