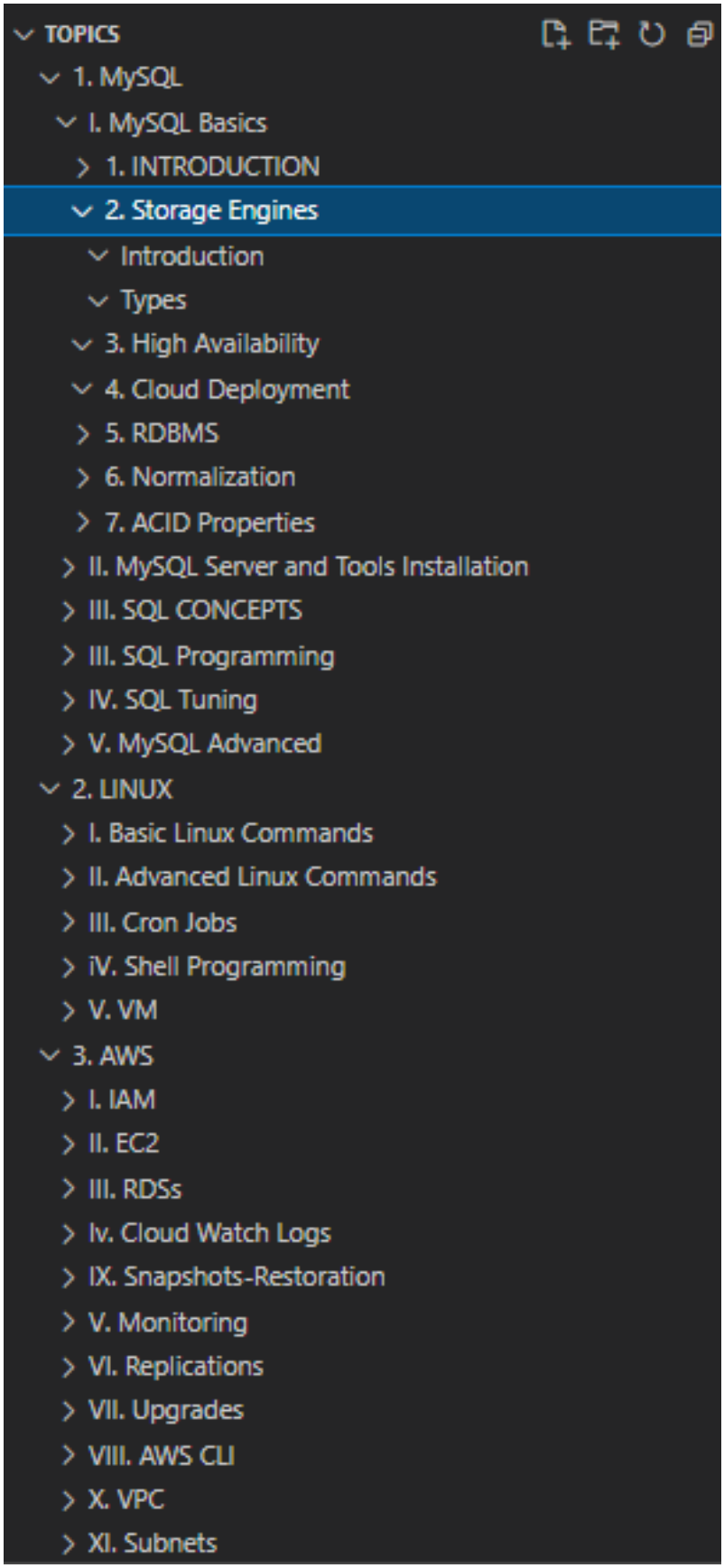
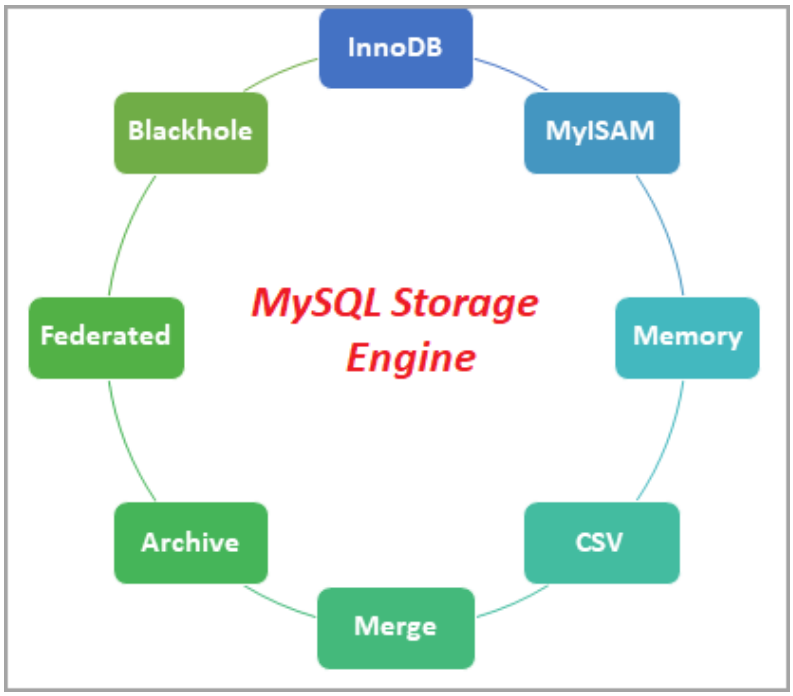
Topics:


TOPICS
1. MySQL
I. MySQL Basics
1. INTRODUCTION
2. Storage Engines
Introduction
Types
3. High Availability
4. Cloud Deployment
5. RDBMS
6. Normalization
7. ACID Properties
II. MySQL Server and Tools Installation
III. SQL CONCEPTS
III. SQL Programming
IV. SQL Tuning
V. MySQL Advanced
2. LINUX
I. Basic Linux Commands
II. Advanced Linux Commands
III. Cron Jobs
iV. Shell Programming
V. VM
3. AWS
I. IAM
II. EC2
III. RDSs
Iv. Cloud Watch Logs
IX. Snapshots-Restoration
V. Monitoring
VI. Replications
VII. Upgrades
VIII. AWS CLI
X. VPC
XI. Subnets

→ Storage Engine

A storage engine is a component within a database that is used to perform different SQL operations related to data creation, data manipulation, and data management. They are designed for different purposes and hence, perform the best when used accordingly.



Different storage engines supported by MySQL are mentioned below:

 # InnoDB

It is the default storage engine for MySQL 5.5 and higher versions.

Various features supported by InnoDB are as follows:

- It offers ACID Compliant transactional support along with transactional features to protect data like commit, roll-back, and crash recovery. **ACID** means **Atomicity, Consistency, Isolation** & **Durability**, which are the properties of transactions within the database, ensuring data validity.
- It supports row-level locking which allows hassle-free multi-user access without affecting database performance.
- Allows usage of the clustered index to organize data for quicker access.
- Supports FOREIGN KEY referential integrity constraint to maintain data integrity across DB tables.

 # MyISAM

Prior to MySQL version 5.5, **MyISAM** used to be the default storage engine for MySQL. This engine is suitable for non-transactional environments like Data Warehouses, where huge tables are there with minimal write operations.

To perform any operation, MyISAM will lock the entire table (table-level locking), that has non-transactional data rather than filtering out the rows within a transactional table (row-level locking) as in InnoDB. This filtering process consumes time and hence, MyISAM performs better than InnoDB in this situation.

 # Memory

Memory storage engine is considered to be the fastest one as it doesn't store data on the physical disk. Rather, it creates data tables in memory itself which can be accessed quickly. It allows table-level locking and loses data once the database gets restarted.

 # CSV

This storage engine allows data to be saved in **CSV** files. It offers flexibility as CSV files can be easily integrated with most of the applications.

 # MergeMerge organizes the MyISAM tables by grouping similar tables together and referring them as a single object. It helps in managing data when in volume, and is more suitable for data warehousing environments.

 # Archive

As the name suggests, the **Archive** engine is used for storing and retrieving historical data. It does not support transactional data and compresses data quickly upon insertion.

 # Federated

Federated engine is recommended for a distributed data environment and it allows the creation of one logical MySQL database by linking the number of physical MySQL servers. Hence, no data gets saved on a local server, and queries will get executed on remote servers automatically.

 # Blackhole

Storage engine **Blackhole** can take the data as an input but doesn't have the ability to store the same. It always returns empty set whenever queried. This type of storage engine is generally used while conducting performance tests, as data storage is not required for the same.

→ High Availability

Data is the heart of any application whether it is on the web or a mobile, be it a social, enterprise, or cloud application. Hence, data availability is the foremost priority for all these applications and they cannot afford any downtime, even for a few minutes.

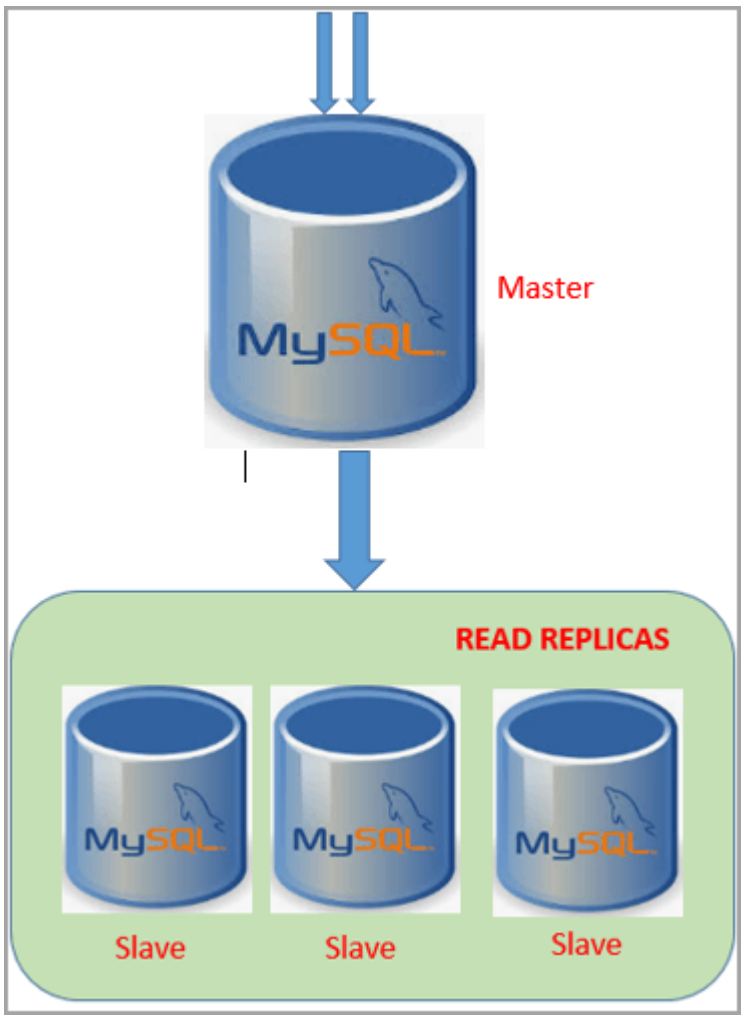
Term **High Availability** refers to the ability of an application to cope up in case of failure. Failure could be due to technical faults at the host, database, or at the OS level or it could be a hardware issue.

It offers 24*7 hours availability and offers a number of solutions for the same as mentioned below:

1) Replication

Replication allows data to be copied from one MySQL server (called as Master) to one or more servers (called as Slaves) so as to keep a backup in case failover

happens with source server and also to divide workloads. So, this process is also known as the **Master/Slave Replication** process which ensures the high availability of database servers.



2) Fail-Over Management with Replication GTIDs

GTIDs stands for "**Global Transaction Identifiers**" which are the transaction ids for each committed transaction on master servers. In case a failover happens before sync completes for the slave, pending transactions can be identified by comparing the replicated data on slave servers using GTIDs. Hence, better **Fail-Over Management** can be done using Replication GTIDs.

3) Group Replication

During **Group Replication**, a group of servers coordinate with each other and form a group. A powerful communication system is used by members of this group to coordinate on tasks like failover handling, maintaining data consistency, server replication, etc.

Hence, using group replication is more efficient as no manual intervention is required and auto-configuration will happen for the group, in case a new member adds or leaves the group.

4) MySQL Cluster CGE (Carrier Grade Edition)

MySQL Cluster is a transactional database that offers high availability up to 5 Nines (99.999%) which means downtime will be less than 5.26 minutes per year. MySQL achieved this by possessing "share-nothing" architecture with no point of failure. MySQL Cluster can replicate in-memory or disk-based data to all nodes within a cluster in no time and hence supports high availability.

→ Cloud Deployment

This database can also be installed on cloud platforms like Oracle Cloud, Amazon EC2, and Microsoft Azure. Cloud platform like Oracle Cloud has offered MySQL "**as a Service"** which gives the user the ability to deploy MySQL Server in the cloud**.** Hence, users don't need to install the database on their local servers, and instead, databases are maintained over the cloud platform. Cloud service owners will take care of database installation, administration, and maintenance tasks.

In order to create a MySQL Service instance over the cloud, users need to complete the below pre-requisites.

- Procure subscription for MySQL Cloud service.
- Create an SSH key pair that will provide secure access to the nodes on which deployment is supposed to be done. Application owners can use MySQL as a service for building their applications in a secure and cost-effective way. As Oracle MySQL is built over MySQL Enterprise Edition, it supports all advanced features of this edition over clouds such as **MySQL Data Encryption, MySQL Enterprise Authentication** and**Encryption, MySQL Firewall** and **Network Access Control**.

1. What is RDBMS?

RDBMS stands for Relational Database Management System. RDBMS is the basis for SQL, and for all modern database systems like MS SQL Server, IBM DB2, Oracle, MySQL, and Microsoft Access.

A Relational database management system (RDBMS) is a database management system (DBMS) that is based on the relational model as introduced by E. F. Codd.

→ What is a table?

The data in an RDBMS is stored in database objects which are called as tables. This table is basically a collection of related data entries and it consists of numerous columns and rows.

Remember, a table is the most common and simplest form of data storage in a relational database. The following program is an example of a CUSTOMERS table –

| ID | NAME | AGE | ADDRESS | SALARY |

| 1 | Ramesh | 32 | Ahmedabad | 2000.00 |

| 2 | Khilan | 25 | Delhi | 1500.00 |

| 3 | kaushik | 23 | Kota | 2000.00 |

| 4 | Chaitali | 25 | Mumbai | 6500.00 |

| 5 | Hardik | 27 | Bhopal | 8500.00 |

| 6 | Komal | 22 | MP | 4500.00 |

| 7 | Muffy | 24 | Indore | 10000.00 |

+----+----------+-----+-----------+----------+

→ What is a field?

Every table is broken up into smaller entities called fields. The fields in the CUSTOMERS table consist of ID, NAME, AGE, ADDRESS and SALARY.

A field is a column in a table that is designed to maintain specific information about every record in the table.

→ What is a Record or a Row?

A record is also called as a row of data is each individual entry that exists in a table. For example, there are 7 records in the above CUSTOMERS table. Following is a single row of data or record in the CUSTOMERS table –

| 1 | Ramesh | 32 | Ahmedabad | 2000.00 |

A record is a horizontal entity in a table.

→ What is a column?

A column is a vertical entity in a table that contains all information associated with a specific field in a table.

For example, a column in the CUSTOMERS table is ADDRESS, which represents location description and would be as shown below –

| ADDRESS |

| Ahmedabad |

| Delhi |

| Kota |

| Mumbai |

| Bhopal |

| MP |

| Indore |

+----+------+

→ **What is a NULL value?**

A NULL value in a table is a value in a field that appears to be blank, which means a field with a NULL value is a field with no value.

It is very important to understand that a NULL value is different than a zero value or a field that contains spaces. A field with a NULL value is the one that has been left blank during a record creation.

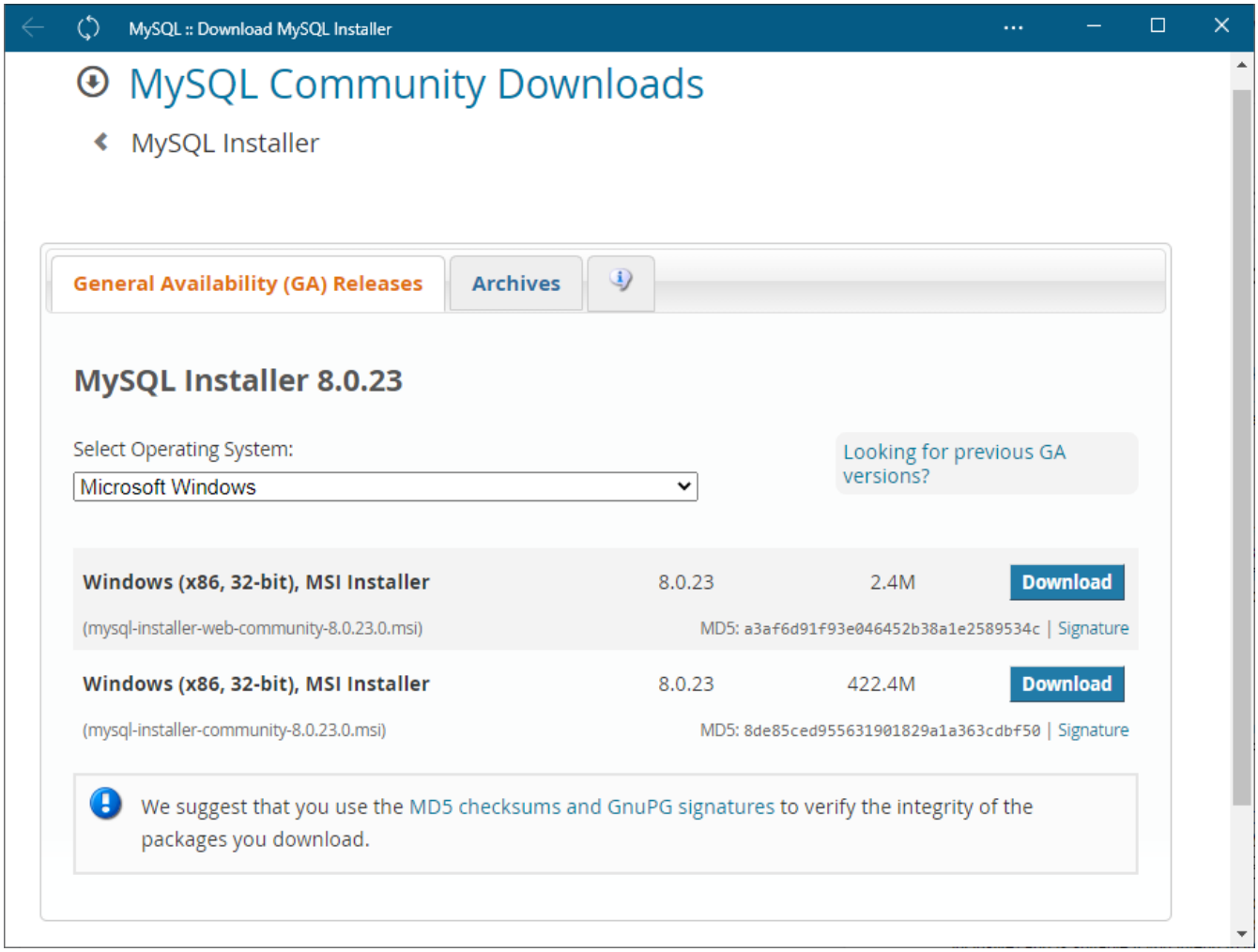
2. How to Install MySQL on Windows Using MySQL Installer

→ Download MySQL Installer

The most convenient way to install and set up MySQL Server on the Windows Operating System is to apply MySQL Installer. This setup wizard provides the means to simplify the installation and configuration processes of MySQL products that run on Microsoft Windows. The list of MySQL products includes the following items:

- MySQL Server
- MySQL Workbench
- MySQL Shell
- MySQL Router
- MySQL for Visual Studio
- MySQL Connectors (MySQL Connector/NET, MySQL Connector/Python, etc.)
- MySQL Reference Manuals in PDF
- MySQL database samples.

For starters, go to the download MySQL Installer page. As you see, there are two options suggested for download: a web community version and a full version. The main difference between these two is that the web package only includes MySQL Installer and configuration files, and it requires an Internet connection to proceed with the installation. Within the web version, you can select the applications you want to download apart from MySQL Server. As for the full package, it includes all MySQL products for Windows (MySQL Server inclusive) and is suitable if you intend to install MySQL offline.



→ Set Up MySQL Installer for Windows

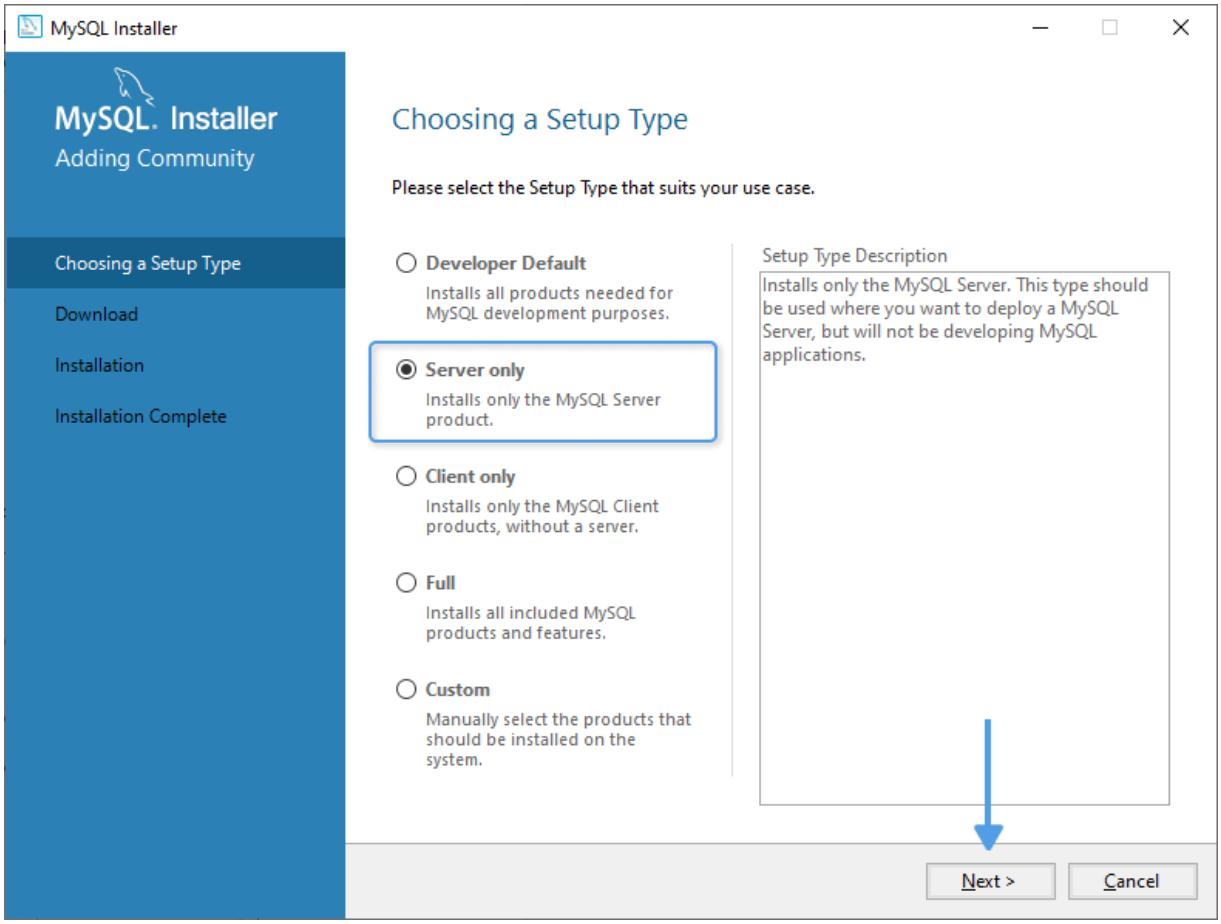
After you have selected the Installer version that suits your needs, download and run it.

Note that you can use MSI Installer to not only perform the initial setup but also to upgrade the current version of MySQL. The software identifies existing MySQL products installed on the host and lets you decide on your further actions with the products.First, you will need to accept the license terms. The next step is to select a setup type. Note that despite selecting a certain installation type, you still have an opportunity to install or update any of the MySQL applications later.

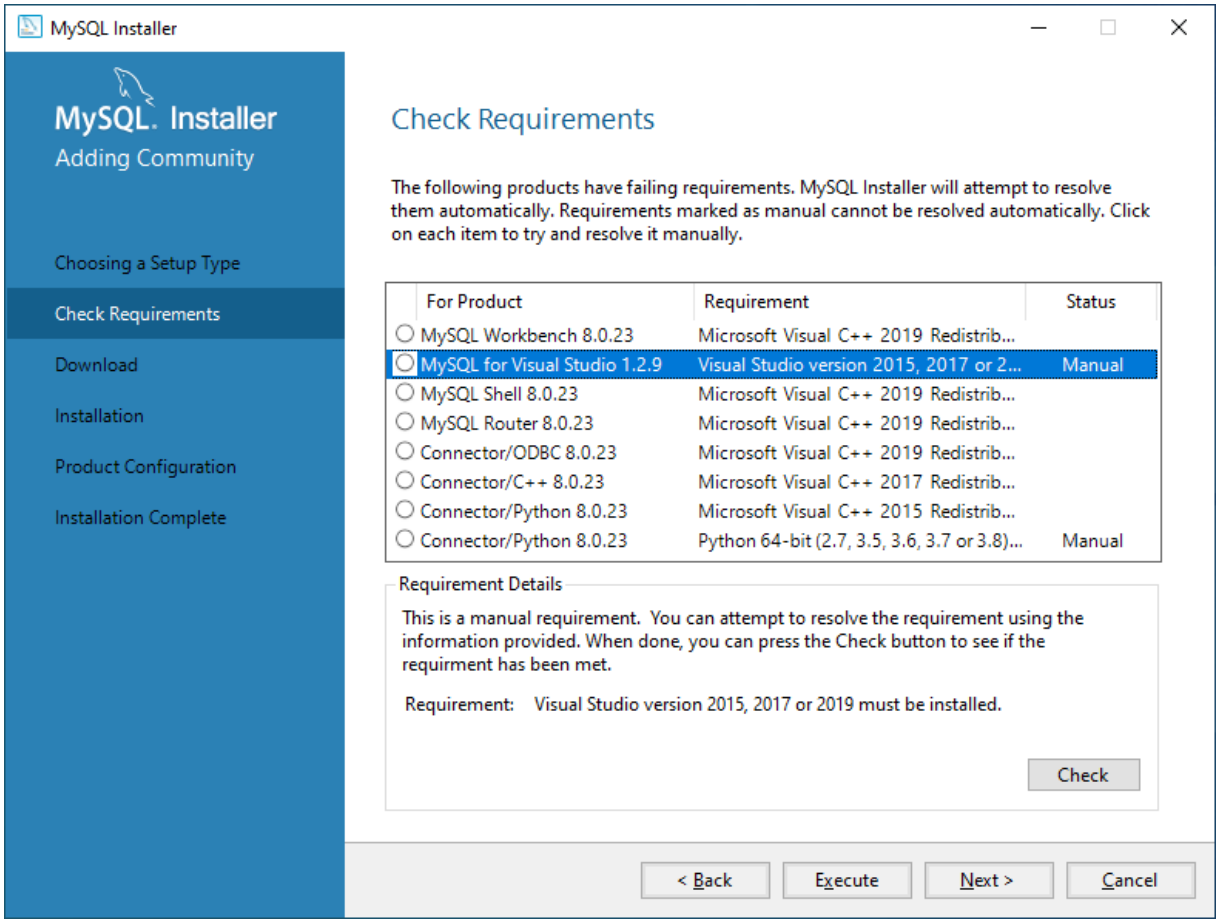
Now, choose from the setup types the one that corresponds to your use case best:

- Developer Default involves the installation of MySQL Server and all other tools that can be used for development. If you plan to build a MySQL database from scratch, this type will be most appropriate.
- Server only suggests installing only an instance of MySQL Server. This type is suitable if you are not going to manage the database directly.
- Client only installs all MySQL applications and connectors, excluding the MySQL Server product.
- A full setup will install all available MySQL products.
- The Custom type provides broad options that allow customizing the installation and selecting the tools from the MySQL catalog.

1. Having selected the suitable Setup Type, click Next:

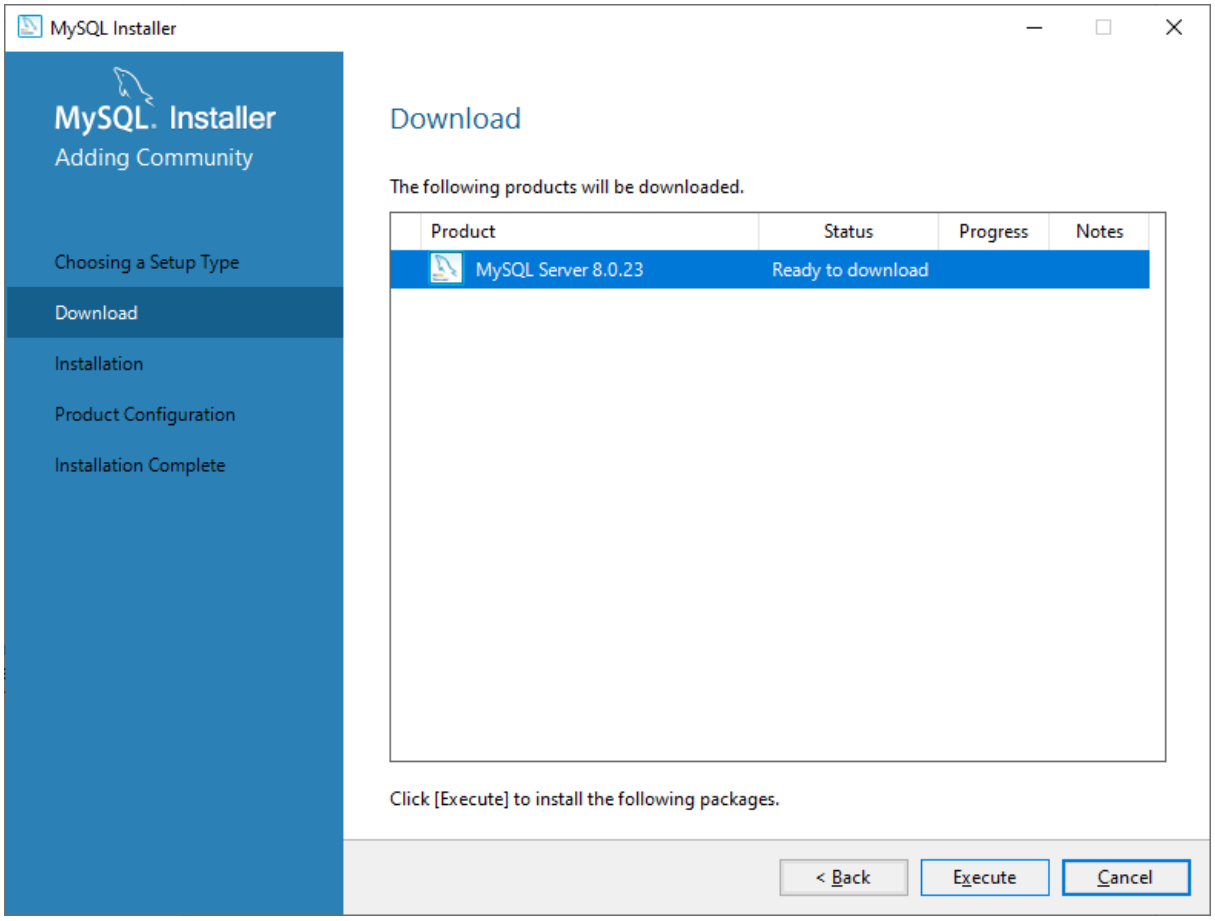


2. Following that, MySQL Installer ensures that you meet the requirements necessary for the installation. If there are any failing requirements, the installer will try to resolve the inconsistencies automatically. If it fails to do so, you will be asked to manually settle the issues. For instance, you may need to install some additional applications or packages (e.g., Microsoft Visual C++ 2019 Redistributable Package). Besides, you may encounter the problem of Path installation inconsistencies in case you have previously installed MySQL on your Windows Server.



3. Check the status of the product requirements (if you have any). If you have no manual requirements, Click Execute, and the Wizard will install the required software. Provided that you have manual requirements, resolve them on your own, click Check to verify, and

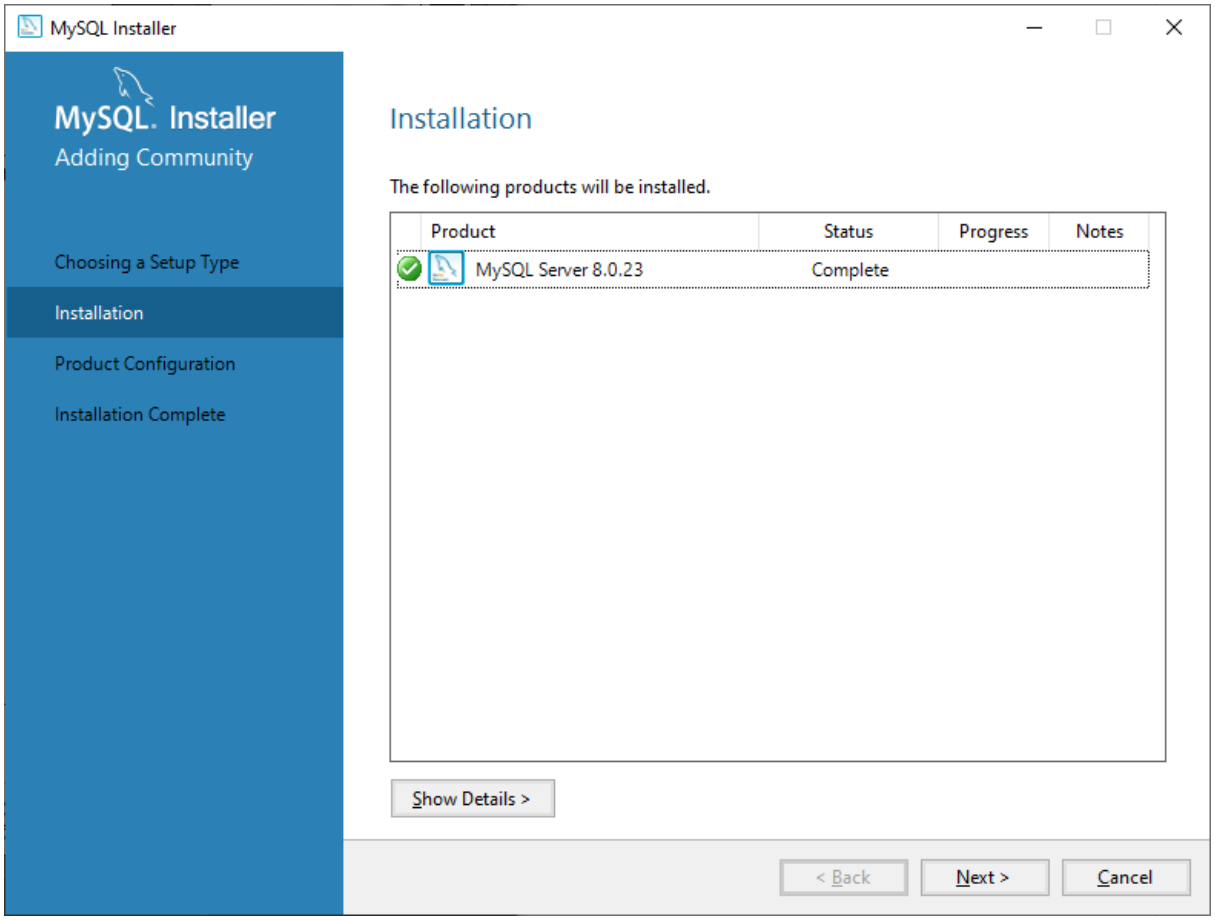
then click Execute to begin the installation process:



4. Install MySQL using the MySQL installer

   In this step, the wizard downloads all of the selected MySQL products. As soon as the installation status is indicated as *Complete,* click Next and proceed to the configuration of the MySQL

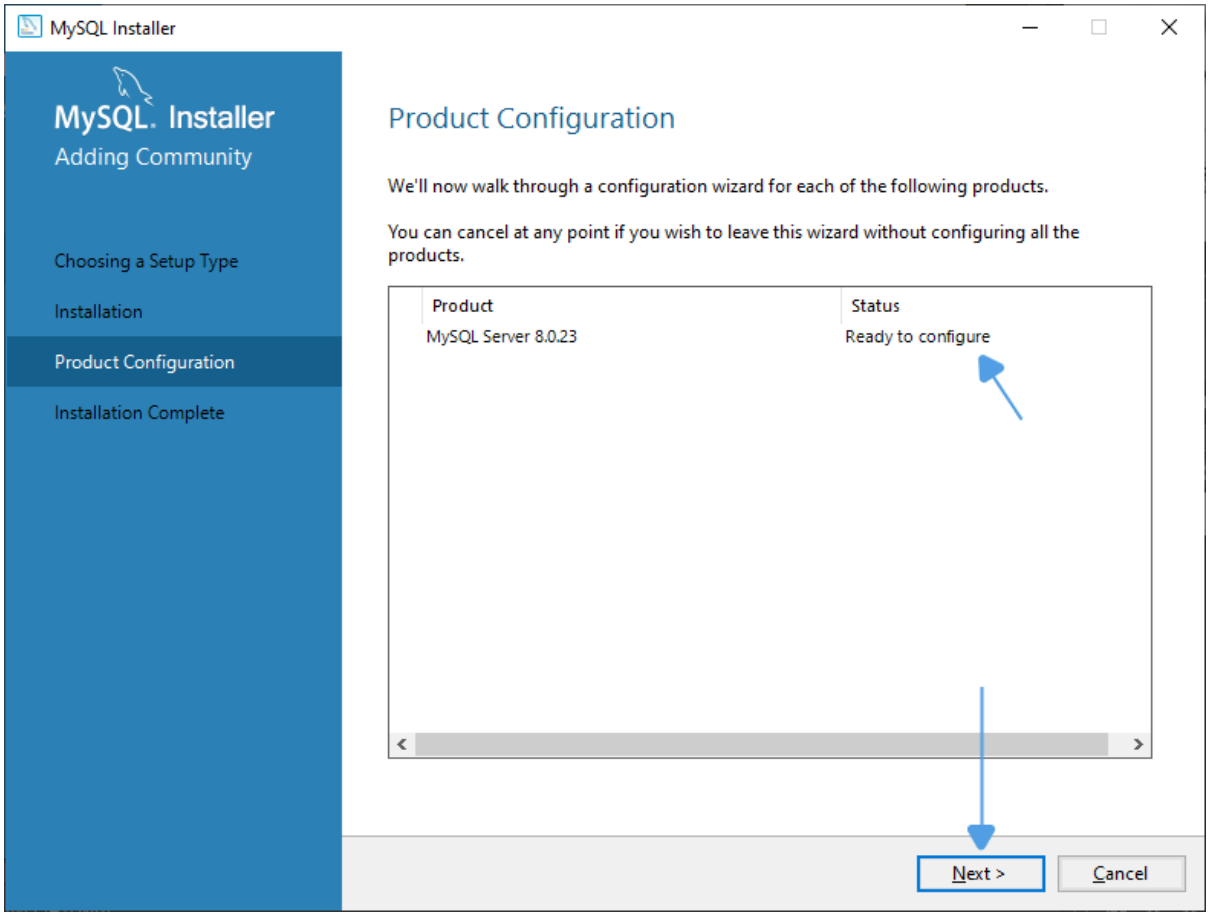
database:



5. Configure MySQL Server on Windows

   We have now reached the part where we are going to configure

MySQL Server. Initiate the process by clicking Next.

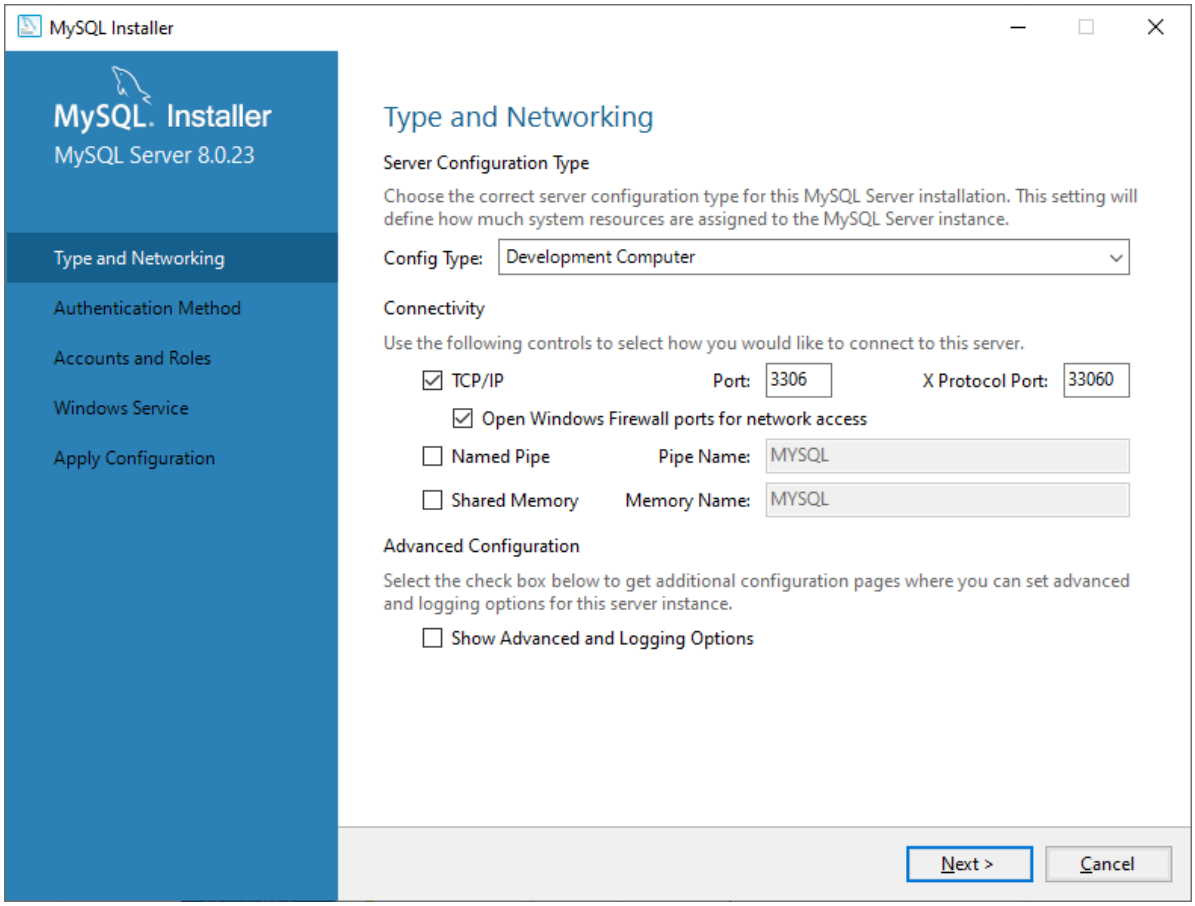


6. Type and Networking

   In the Type and Networking section, you can choose between three server configuration types: Development Computer, Server Computer, and Dedicated Computer to define the part of system memory that will be allocated to your MySQL server instance. If your computer hosts a lot of other applications, select Development Computer, and if there are no other major applications, opt for the Dedicated type.

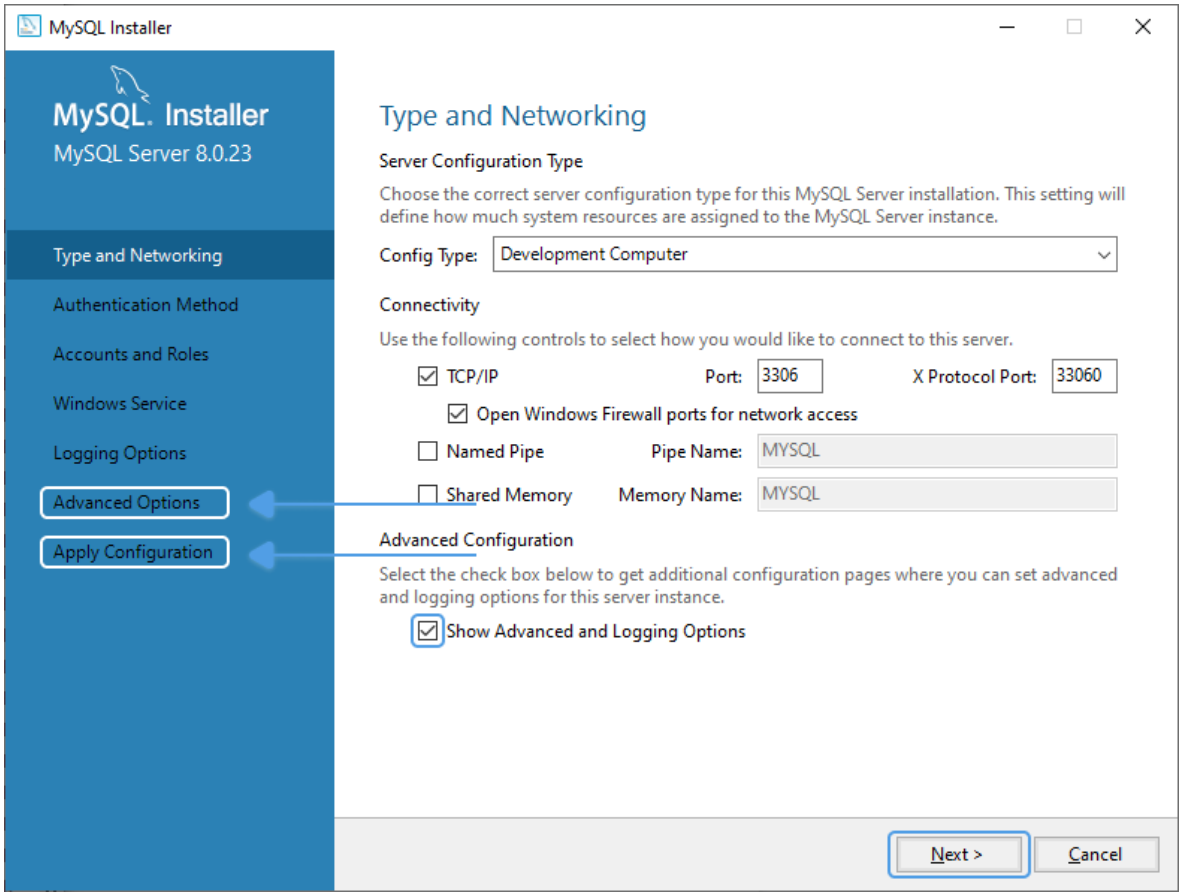
   Select the Connectivity options that meet your needs. You can also configure custom logging and advanced options in the following steps if you check the corresponding box. After you have finished

configuring, click Next:



7. Select the Connectivity options that meet your needs. You can also configure custom logging and advanced options in the following steps if you select the corresponding box. After you have finished

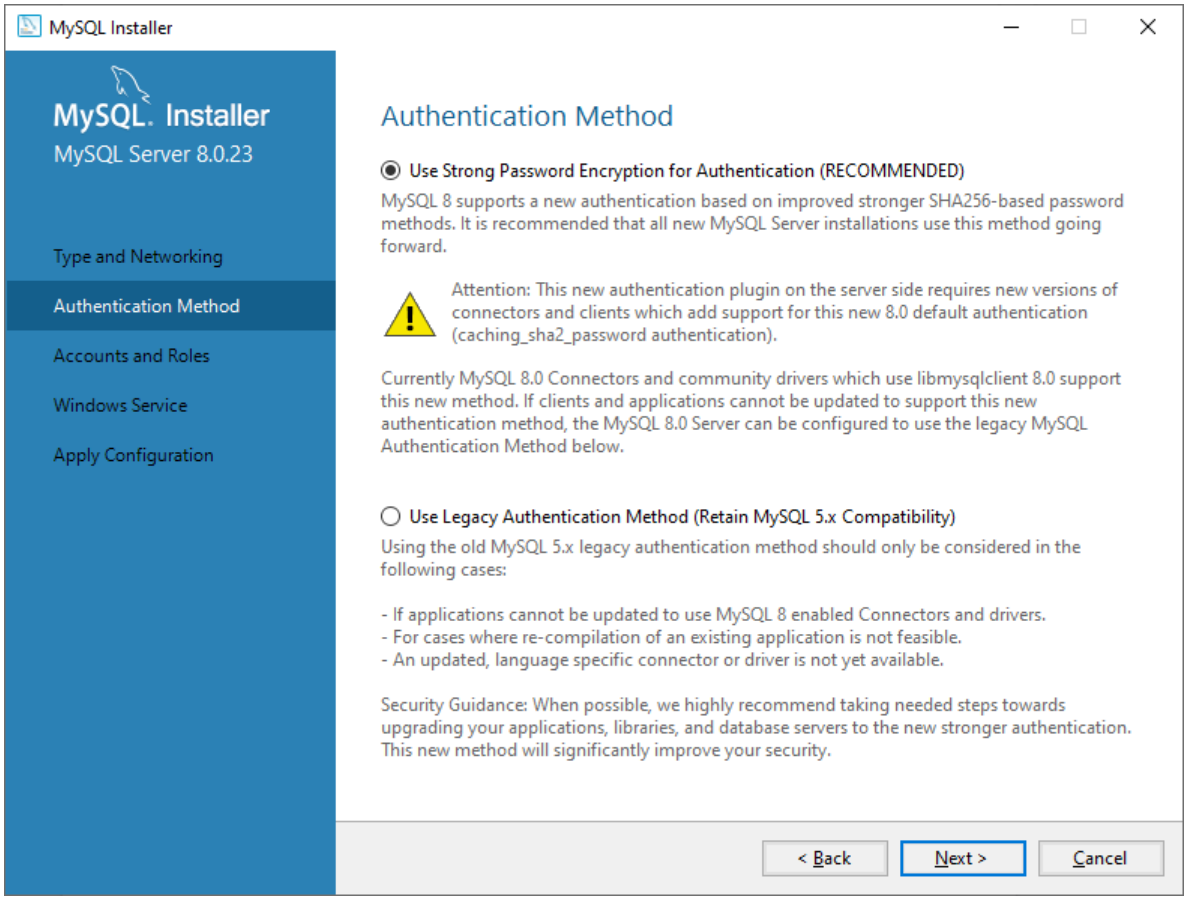
configuring, Click Next:



8. Authentication Method

   In this step, you will be given a choice between the two server-side authentication methods: Strong Password Encryption and Legacy Authentication. Select the recommended Use Strong Password

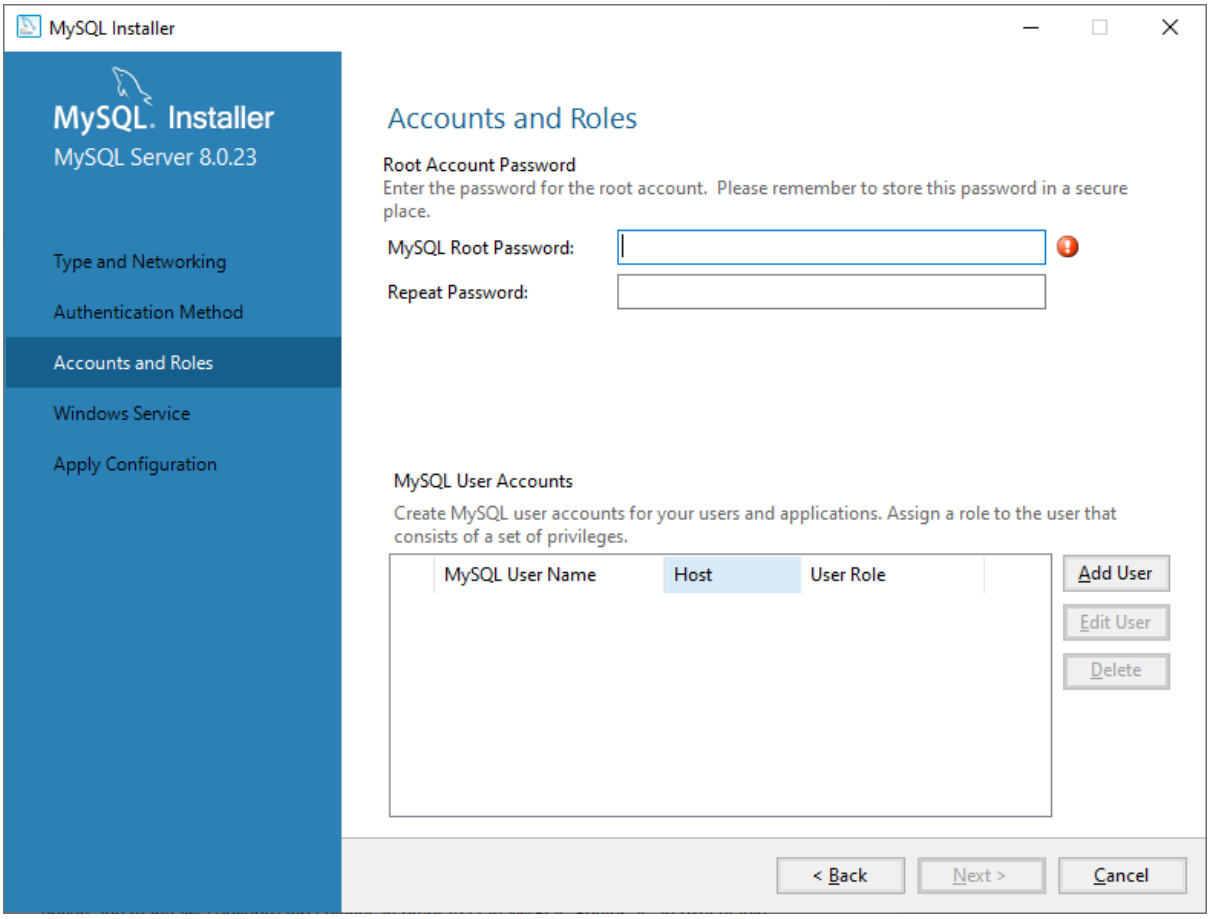
Authentication option and click Next:



9. Accounts and Roles

   Here, you will need to provide a strong password for your MySQL root user. Also, make sure you save the password in a secure place for later use. Optionally, you can create additional MySQL user accounts with predefined roles. Click Next as soon as you are

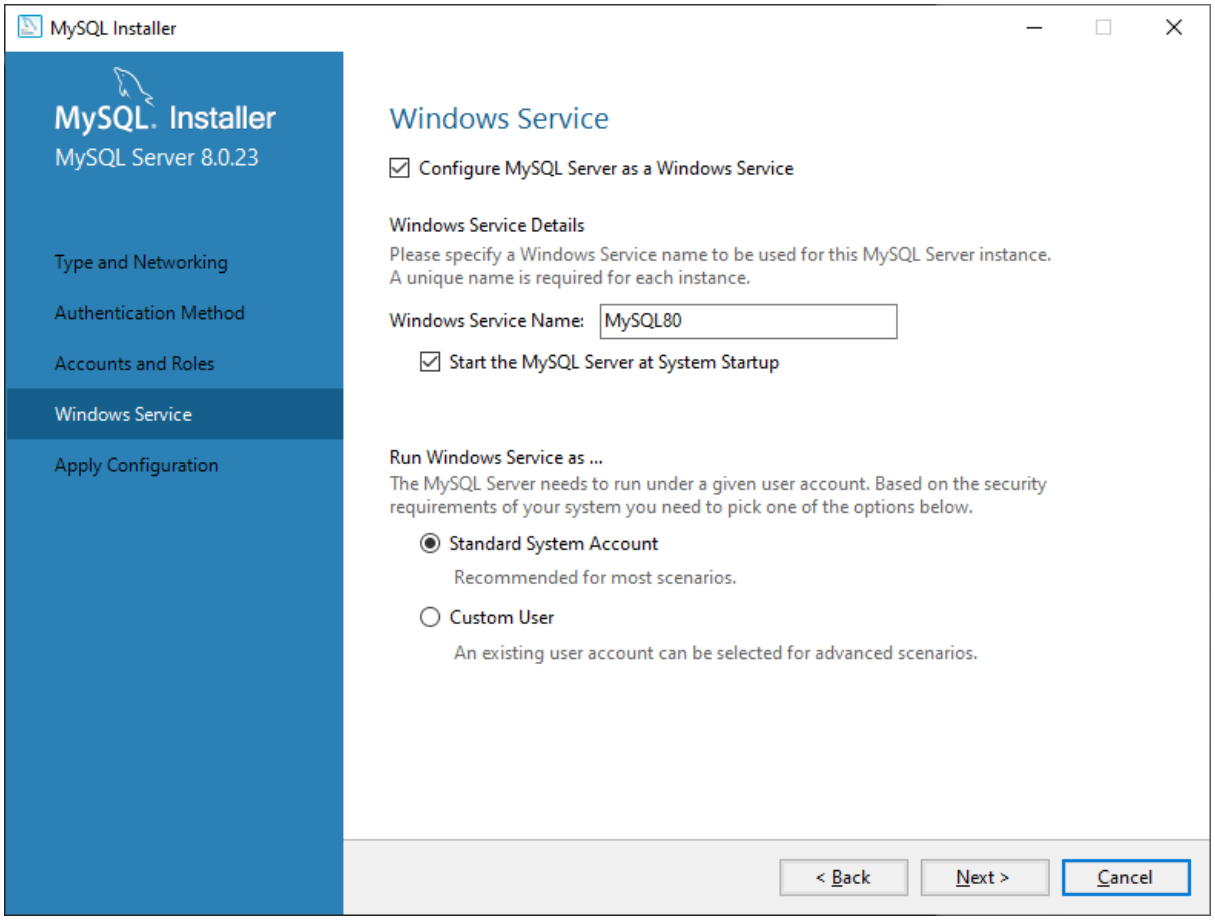
finished:



10. Windows Service

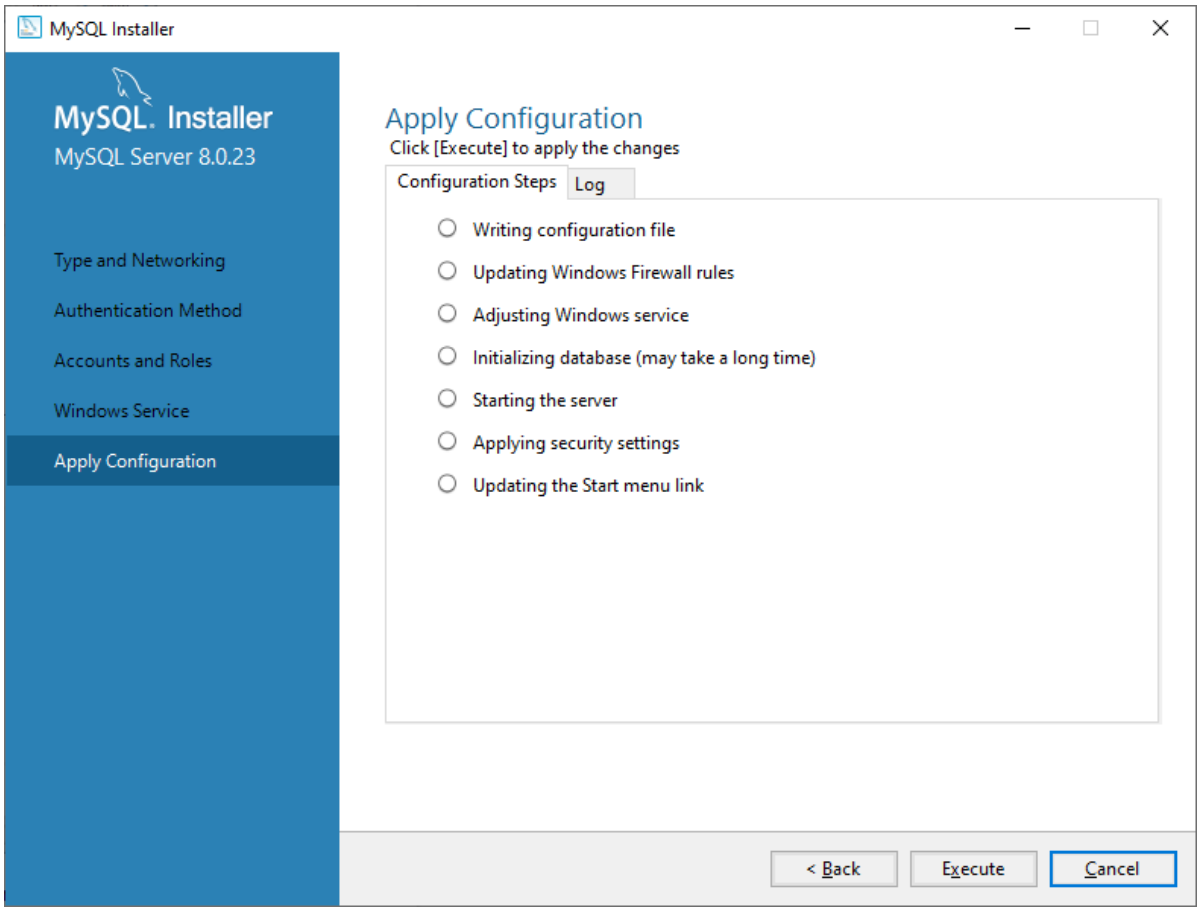
    In this step, you can define MySQL Server as a Windows Service and set it up to start automatically when Windows starts. As an alternative, you can select the Custom User option and manually configure the settings in order to start MySQL Server as an

executable program.

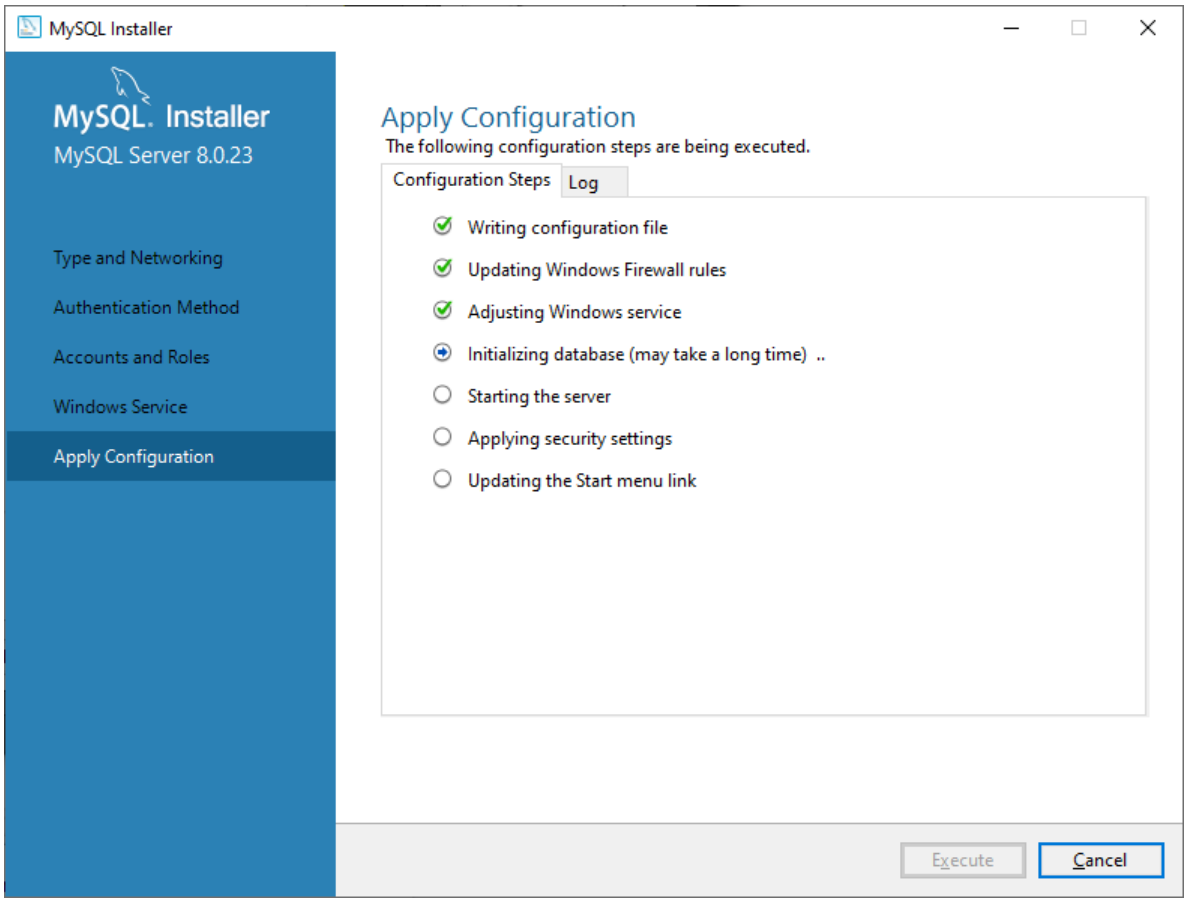


11. Apply Configuration

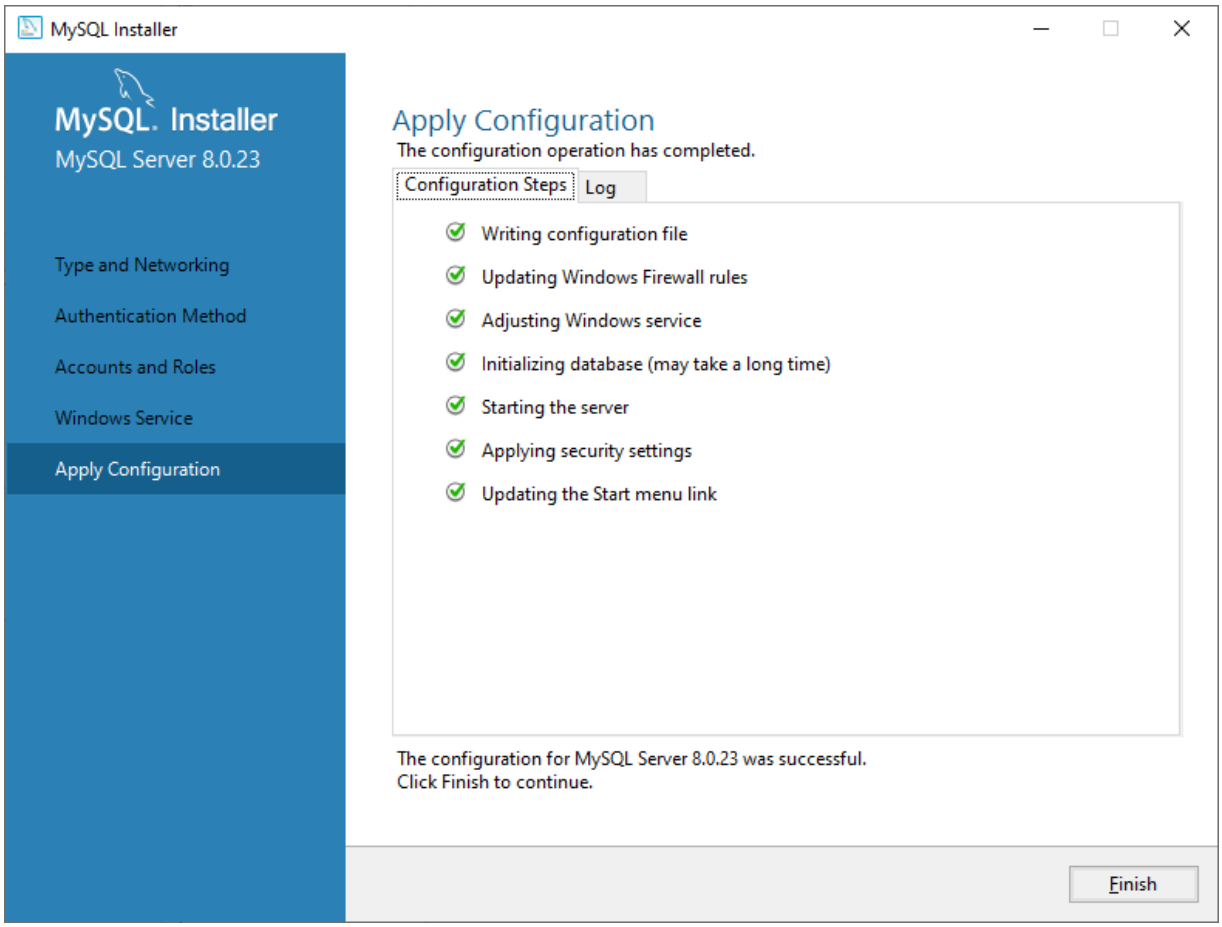
This final step gives an overview of the configuration steps:



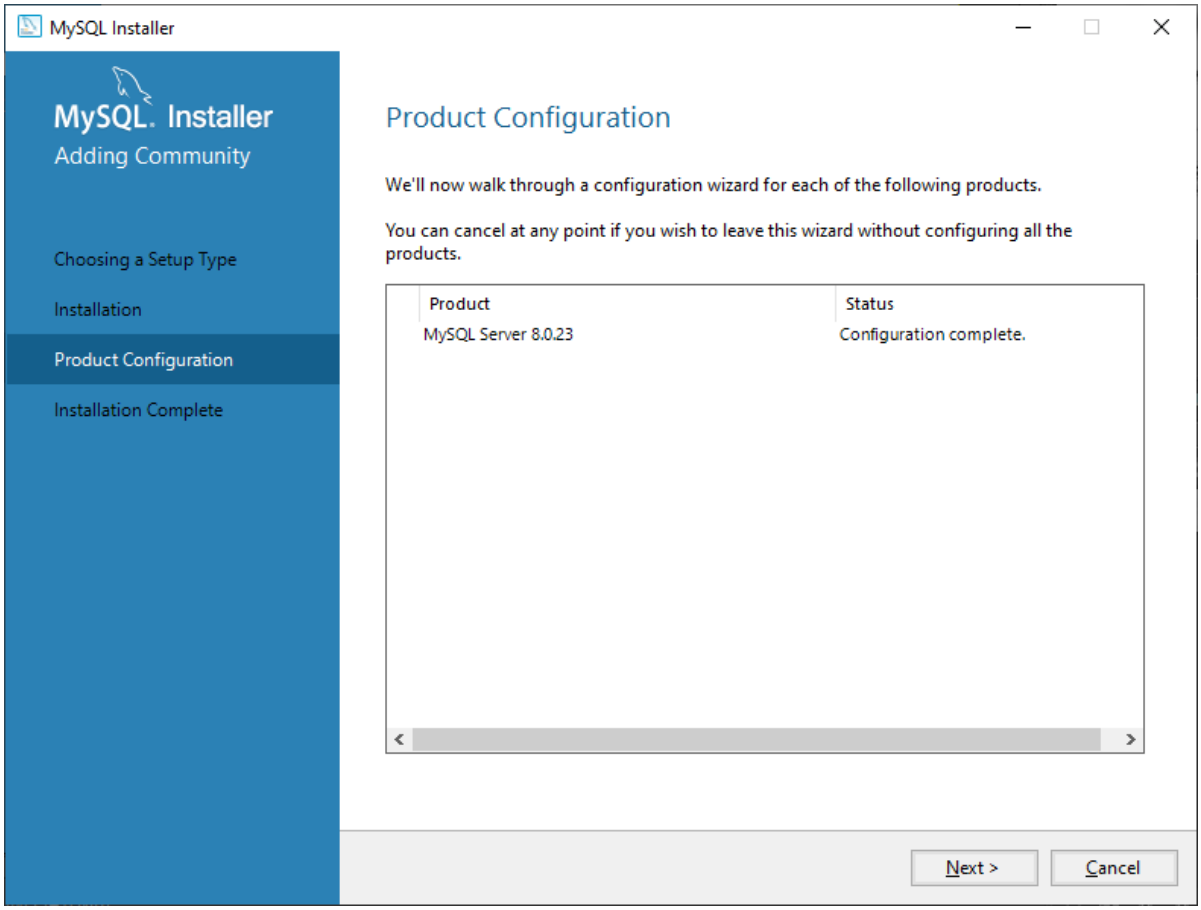
12. By clicking Execute, you will see the configuration settings applied one by one:



13. The green checkmarks inform of the successful completion of the configuration process. Click Finish:



14. The configuration is complete, click Next:



15. Congratulations! You have finished installing MySQL Server. You can now copy the installation process log to the Windows Clipboard and

click Finish: