

**Comprehensive Database Management and Security Strategies for an IT Company**

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## **1. Introduction**

An Auckland based IT company owned by an entrepreneur who resides on residence visa provides occupational offerings of IT innovation. The company is led by a CEO with two other managers; a Marketing Manager overseeing the customer service, promotion, and sales departments, and a Technical Manager in charge of development and all things technical-overseeing the production of the IT services and software that is state of the art. Coordinated management of the databases is an important aspect in the efficient performance of the company because all the interactions take place with customers, materials suppliers and internal systems (Rawat et al., 2021). It also establishes the ground work for standard, reliable security protocols that protect business critical data and customer data from intrusion and possible vulnerability. Introduction of wide ranging security measures is obligatory to protect the data and ensure ethical business processes. Daily backup and maintenance of the databases are becoming the standard since it help upgrade the integrity and efficiency of the system by analyzing, optimating and checking the integrity of the tables. In overall, database configuration, security and maintenance are the key founding areas that are significantly obligatory for the company's functionality and to fulfil the ethical obligations (Smirnova & Tezuysal, 2022).

## **2. Database Configuration**

The steps for installing MySQL Workbench and MySQL Server are described as follows:

### **Step 1: Download MySQL Installer**

Visit the official MySQL website and navigate to the Downloads section.

Select "MySQL Community (GPL) Downloads."

Choose "MySQL Installer for Windows" and download the installer file.

### **Step 2: Run MySQL Installer**

Open the downloaded MySQL Installer.

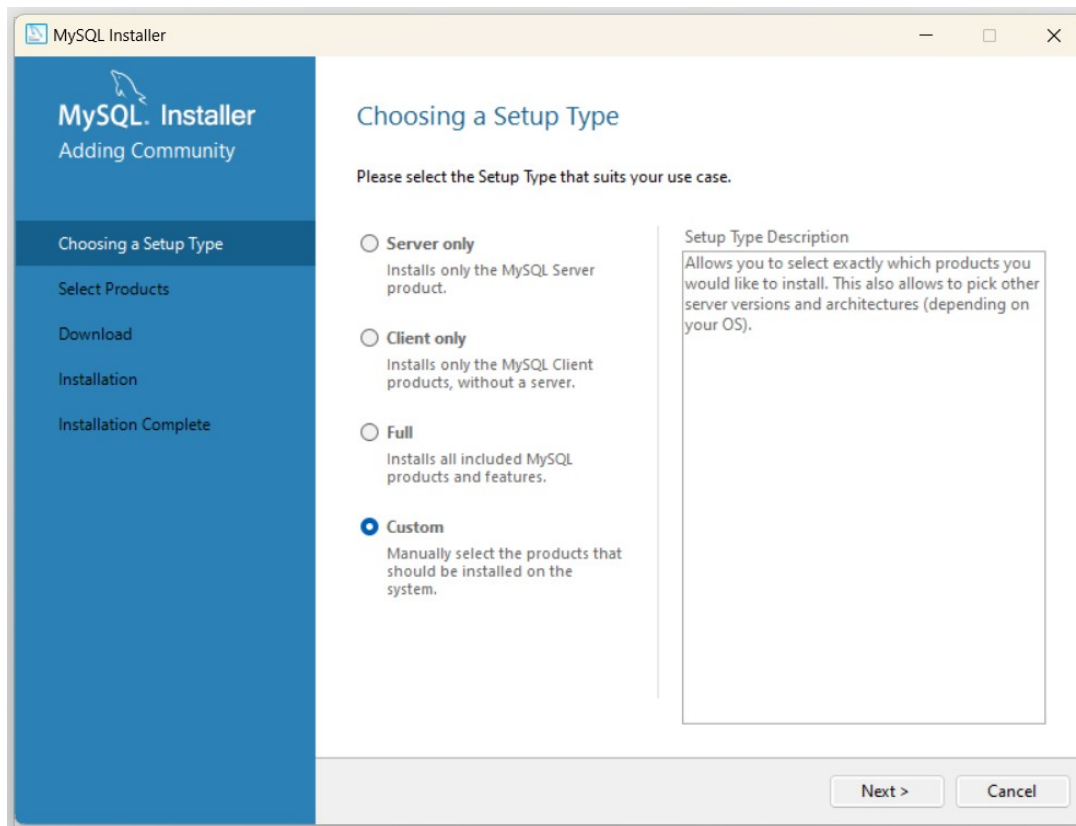


Figure 1: Custom setup type

Select "Custom" setup type for a complete installation of all MySQL products.

Click "Next" to proceed.

### Step 3: Install MySQL Server

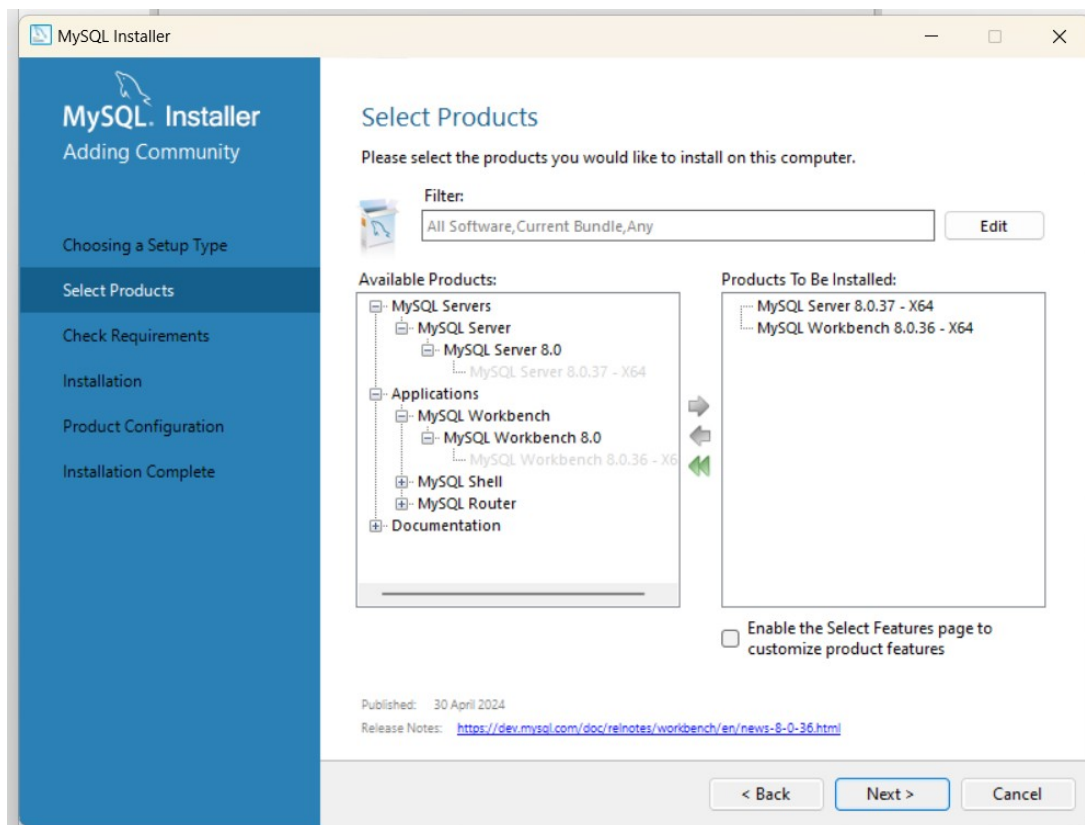


Figure 2: Products Selection

In the "Select Products and Features" window, ensure that "MySQL Server" and "MySQL Workbench" are selected (Bush, 2020).

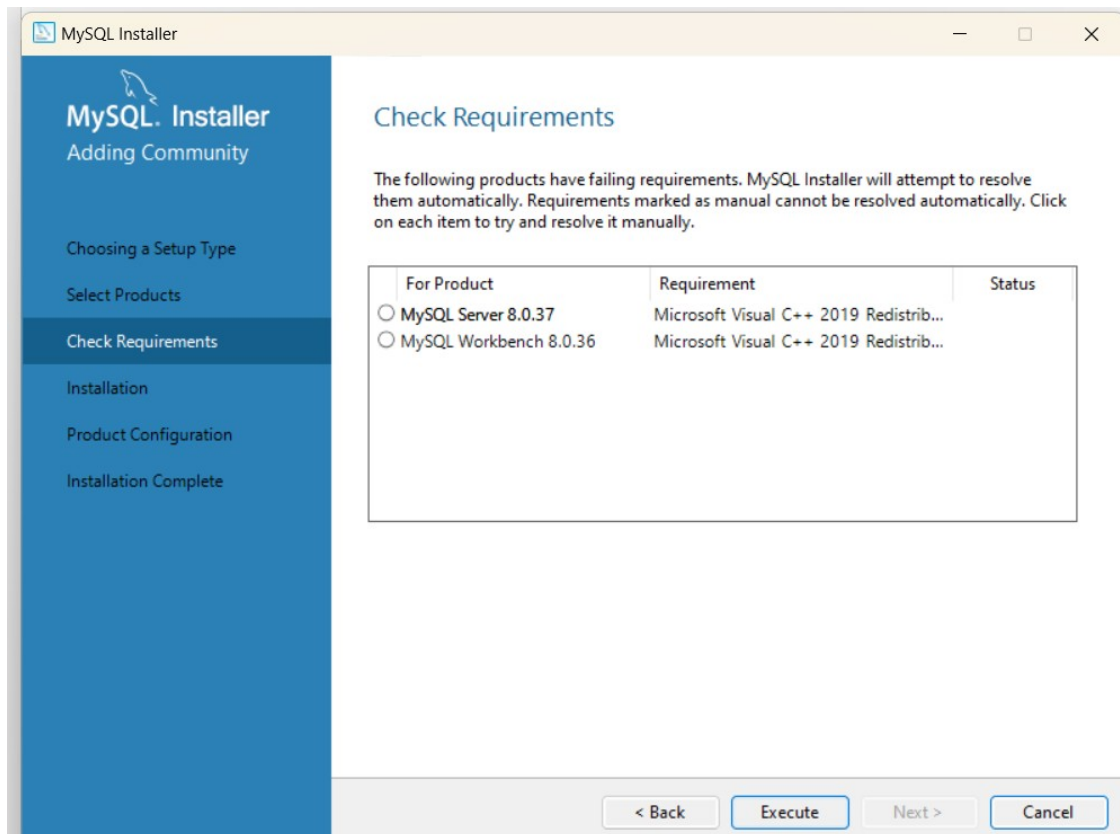


Figure 3: Check requirements

Check requirements for products chosen previously.

Click "Next" and then "Execute" to download and install the selected products.

#### Step 4: Configure MySQL Server

After installation, the configuration process begins.

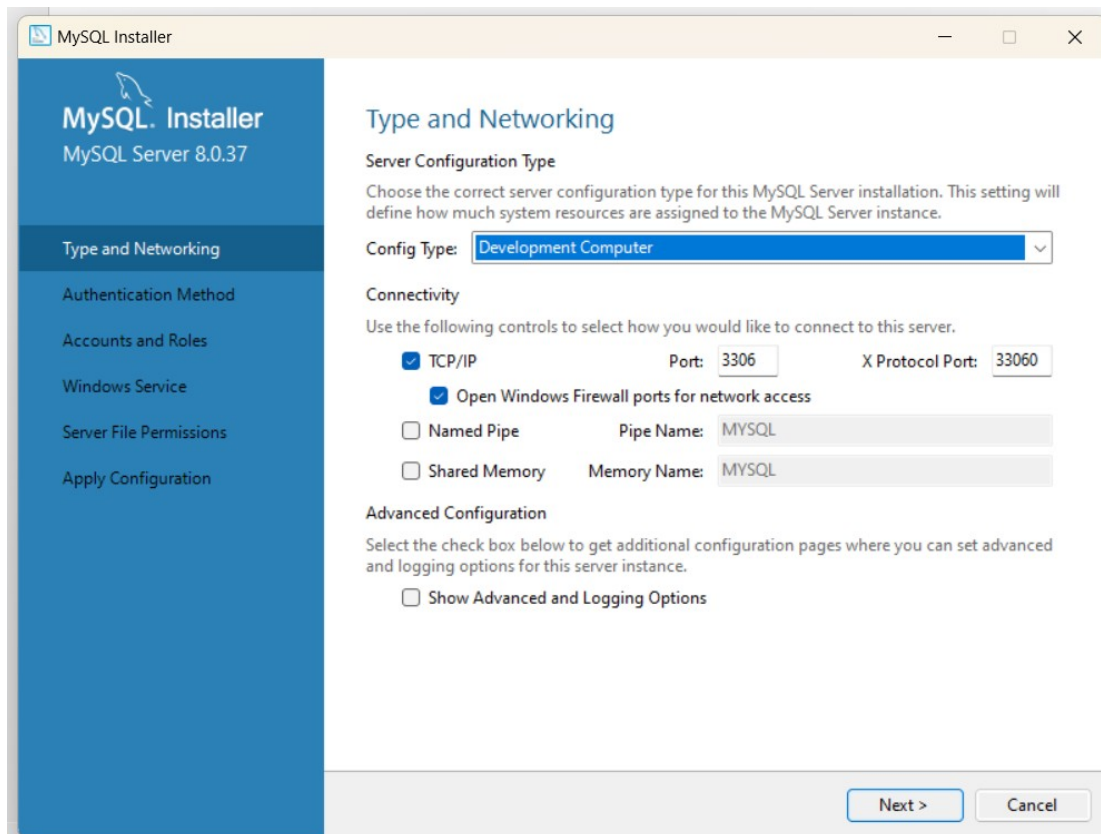


Figure 4: Config Type

Configure the server by setting the following:

Configuration Type: Development Machine.

Connectivity: Ensure TCP/IP is selected with the default port 3306.

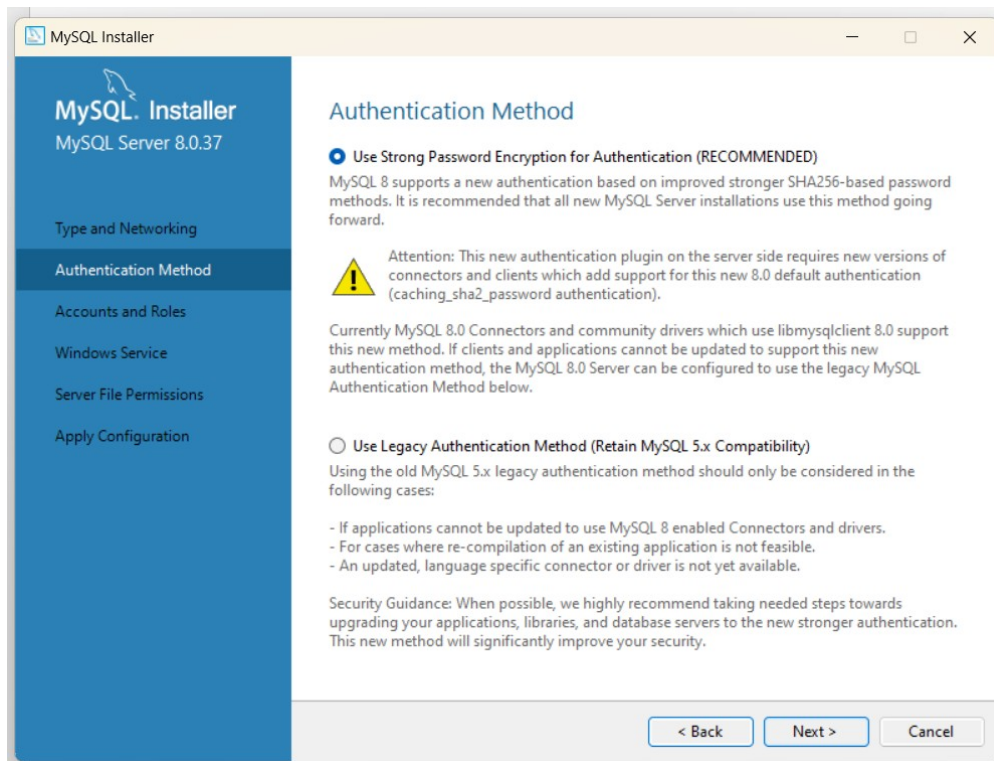


Figure 5: Use Strong Password Encryption.

Authentication Method: Use Strong Password Encryption.

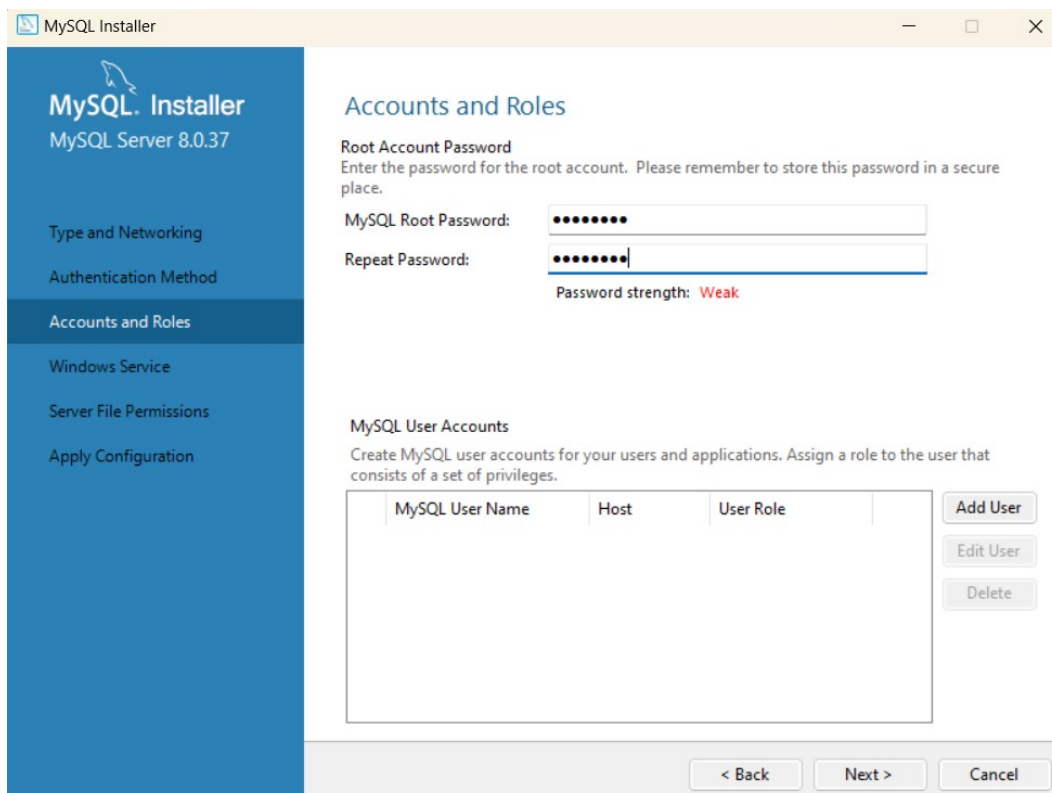


Figure 6: Set root password



Set a root password and create a user account for additional database access.

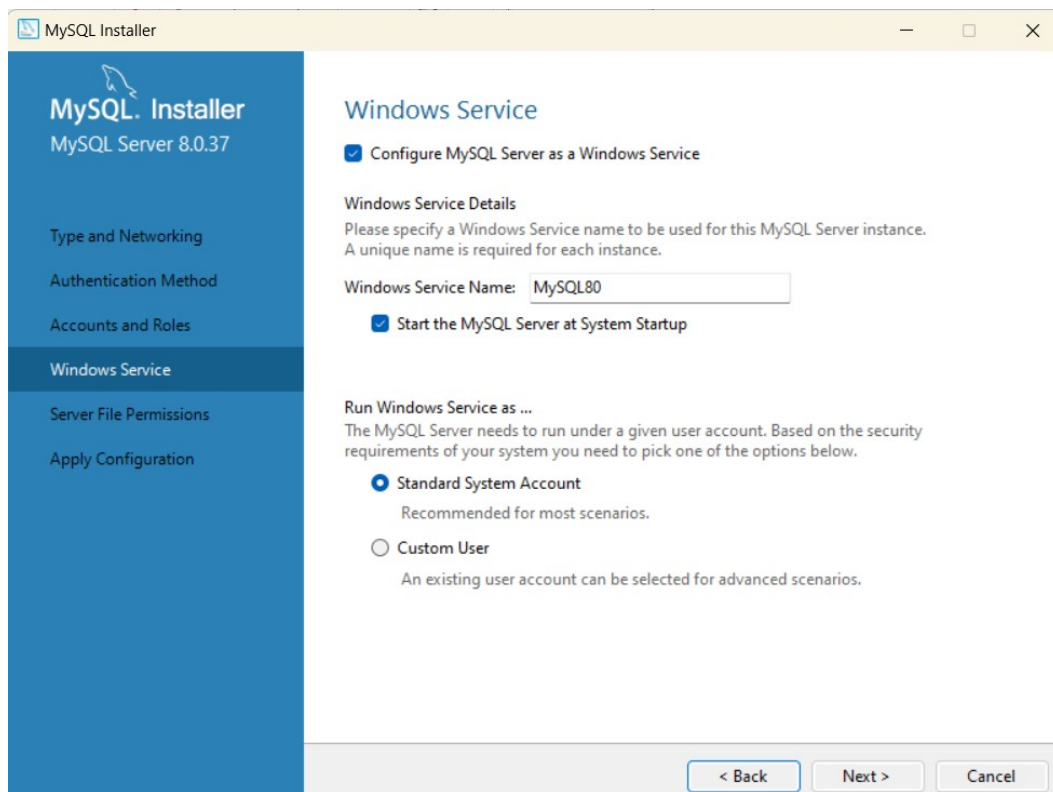


Figure 7: Default settings for windows service

Continue through the configuration steps, leaving default settings for Windows Service configuration.

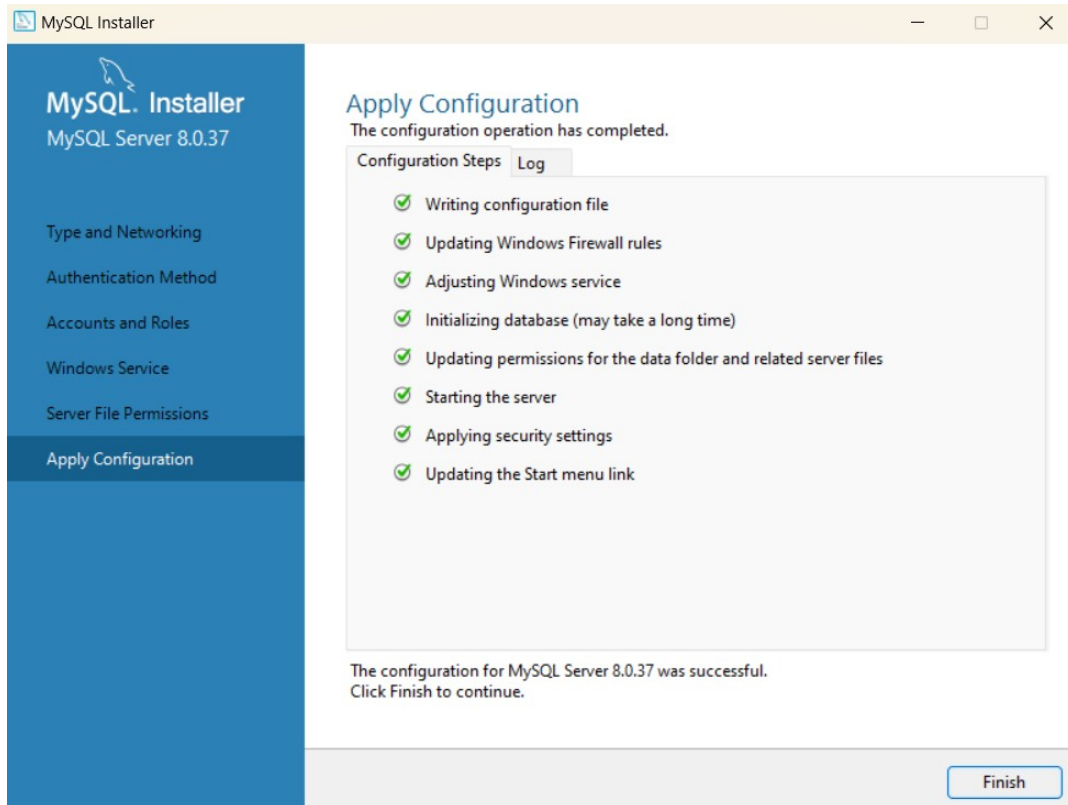


Figure 8: Configuration executed

Click "Execute" to apply the configuration.

### Step 5: Install MySQL Workbench

MySQL Workbench installation will proceed automatically.

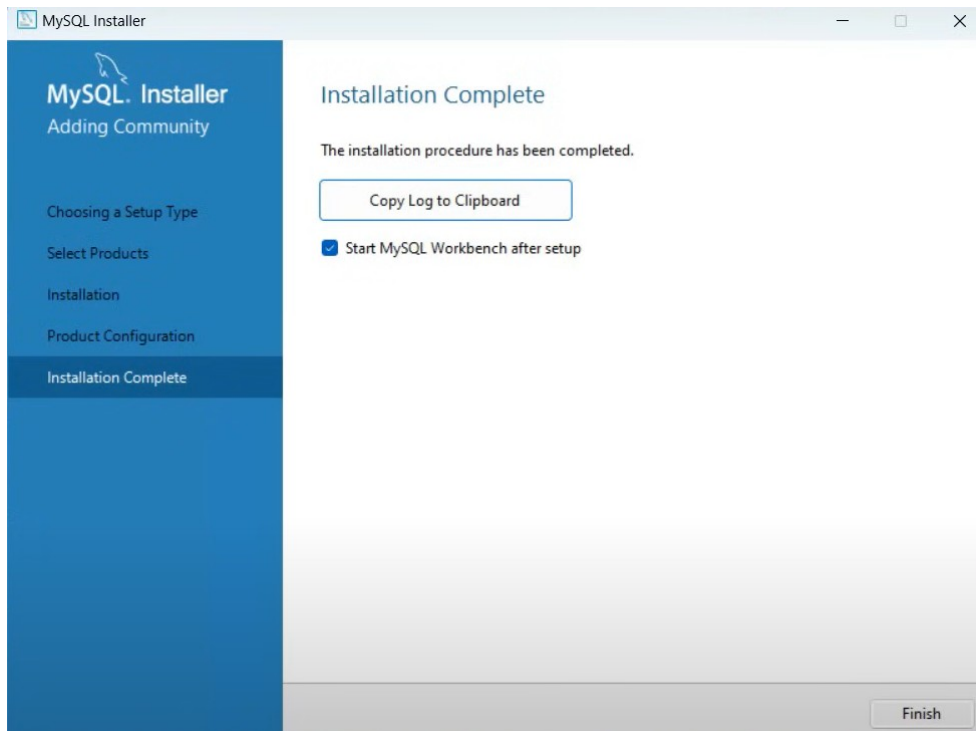


Figure 9: Installation completed

Once installation is complete, launch MySQL Workbench from the Start Men or click the checkbox for starting MySQL workbench automatically after the setup.

### **Step 6: Configure MySQL Workbench**

Open MySQL Workbench.

Create a new connection by clicking the "plus" icon next to "MySQL Connections."

Enter the connection name, hostname (localhost), port (3306), and the username (root).

Test the connection to ensure it's working correctly.

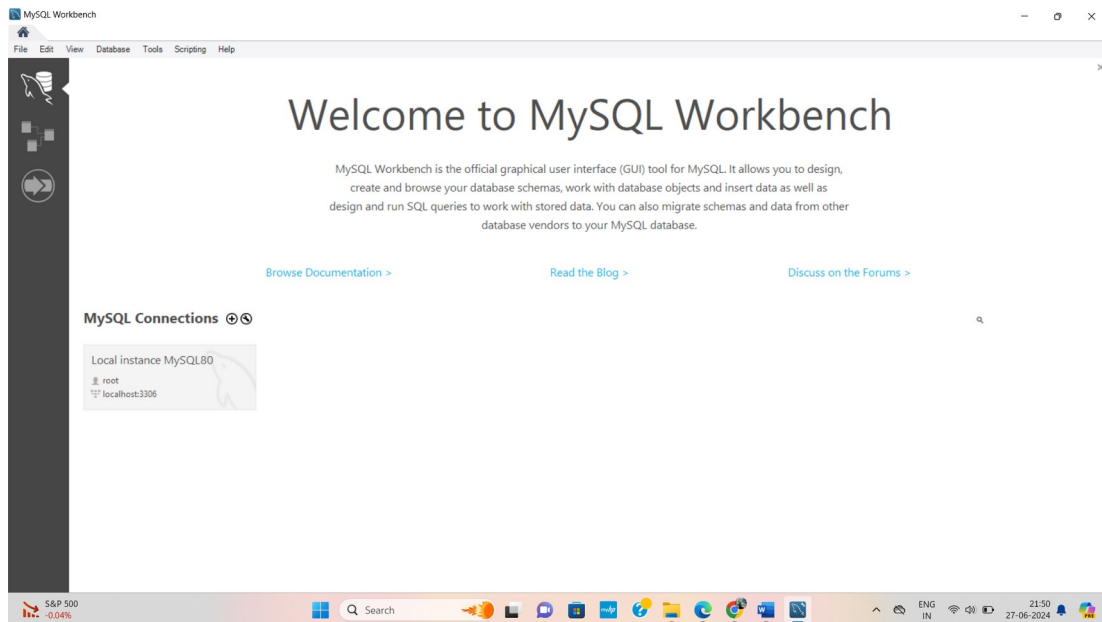


Figure 10: Connection created

Save the connection configuration.

### 3. Security and Ethical requirements

The database used by our IT company located in Auckland is the central point in managing of different aspects of the company's work. It comprises tables for the products, customers, and user management. The primary user roles established are:

**CEO:** In charge of all the business organizational management functions and decision management of the enterprise.

**Marketing Manager:** Responsible for customer relations, advertisement of service(s)/product(s) and other strategies of selling (Bush, 2020).

**Technical Manager:** Is also responsible for directing the product development, solving technical problems, and maintaining the system.

These roles are critical for operations management and for guaranteeing that every function or process of the business is well managed in the database environment.

```

1  -- Create database
2  • CREATE DATABASE it_company;
3
4  -- Use the database
5  • USE it_company;
6
7  -- Create tables
8  • CREATE TABLE products (
9      product_id INT AUTO_INCREMENT PRIMARY KEY,
10     product_name VARCHAR(255) NOT NULL,
11     product_description TEXT,
12     price DECIMAL(10, 2)
13 );
14
15 • CREATE TABLE customers (
16     customer_id INT AUTO_INCREMENT PRIMARY KEY,
17     customer_name VARCHAR(255) NOT NULL,
18     contact_info VARCHAR(255)

```

Output

Action Output

#	Time	Action	Message
✓ 1	22:42:00	DROP DATABASE 'restored_db'	2 row(s) affected
✓ 2	22:42:06	DROP DATABASE 'itcompanydb'	2 row(s) affected
✓ 3	22:42:29	CREATE DATABASE it_company	1 row(s) affected
✓ 4	22:42:29	USE it_company	0 row(s) affected
✓ 5	22:42:29	CREATE TABLE products ( product_id INT AUTO_INCREMENT PRIMARY KEY, product_name VARCHAR(25...	0 row(s) affected
✓ 6	22:42:29	CREATE TABLE customers ( customer_id INT AUTO_INCREMENT PRIMARY KEY, customer_name VARCHA...	0 row(s) affected

Figure 11: Database and Table creation

This query leads to the creation of an `it_company` database in which all tables and other data relating to the firm will be stored. This command performs the task of setting the active database in which other operations will be carried out and in this case the active database is `it_company`. A table with the name `products` and the fields of `product_id`, `product_name`, `product_description`, and `price` is created. The `product_id` is also used as the Primary key of the table with auto incremented values. A table with the name `customers` is created and includes `customer_id`, `customer_name`, `contact_info` as its fields (Christudas, 2019).

```

20
21 -- Create users
22 • CREATE USER 'ceo'@'localhost' IDENTIFIED BY 'ceo__123';
23 • CREATE USER 'marketing_manager'@'localhost' IDENTIFIED BY 'marketing123';
24 • CREATE USER 'technical_manager'@'localhost' IDENTIFIED BY 'technical123';
25 • CREATE USER 'ceoIT'@'localhost' identified by 'ceo123';
26
27 -- Assign privileges

```

Output

Action Output

#	Time	Action	Message
✓ 10	22:45:24	CREATE USER 'marketing_manager'@'localhost' IDENTIFIED BY 'marketing123'	0 row(s) affected
✓ 11	22:45:31	CREATE USER 'technical_manager'@'localhost' IDENTIFIED BY 'technical123'	0 row(s) affected
✗ 12	22:46:23	CREATE USER 'ceo'@'localhost' identified by 'ceo123'	Error Code: 1396. O
✓ 13	22:46:39	CREATE USER 'ceoIT'@'localhost' identified by 'ceo123'	0 row(s) affected

Figure 12: User Creation

The above figure is showing the SQL commands required to create the users for the CEO of the company, Marketing Manager of the company and the Technical Manager of the company with their relative privileges (Isiaka, 2020).

```

27 -- Assign privileges
28 • GRANT ALL PRIVILEGES ON it_company.* TO 'ceoIT'@'localhost';
29 • GRANT SELECT, INSERT, UPDATE ON it_company.customers TO 'marketing_manager'@'localhost';
30 • GRANT SELECT, INSERT, UPDATE, DELETE ON it_company.products TO 'technical_manager'@'localhost';
31
32 -- Display privileges
33 • SHOW GRANTS FOR 'ceoIT'@'localhost';
34 • SHOW GRANTS FOR 'marketing_manager'@'localhost';
35 • SHOW GRANTS FOR 'technical_manager'@'localhost';
36

```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

#	Time	Action	Message
✓ 14	22:47:50	GRANT ALL PRIVILEGES ON it_company.* TO 'ceoIT'@'localhost'	0 row(s) affected
✓ 15	22:47:50	GRANT SELECT, INSERT, UPDATE ON it_company.customers TO 'marketing_manager'@'localhost'	0 row(s) affected
✓ 16	22:47:50	GRANT SELECT, INSERT, UPDATE, DELETE ON it_company.products TO 'technical_manager'@'localhost'	0 row(s) affected
✓ 17	22:48:02	SHOW GRANTS FOR 'ceoIT'@'localhost'	2 row(s) returned

Screenshot 13: Privilege Assignment and verification

This query illustrates the GRANT statements that can be used to grant specific privileges to each role depending on the tasks they are expected to handle. The reason why Full access privileges are assigned to CEO is to provide him/her with full control over the account. Marketing Manager permission is set to Limited to SELECT, INSERT, and UPDATE on the customers' data to address interacting and sales whereby crucial details would not be divulged. selective rights where Technical Manager has been allowed SELECT, INSERT, UPDATE, DELETE rights on products regarding product life-cycle, and for attending to technical problems (Lauscher & Bork, 2023).

#### **4. Maintain database system**

Most database systems require constant updates and checks to keep them running efficiently, and remain free from deterioration. The general types of operations performed in tables maintenance comprises of

**Table Analysis:** It involves analyzing structure, metadata of tables in search of some problem, possibly fragmentation or erroneous/stale statistics. It aids in the achievement of optimal performance queries and granting a proper search for data (Murazzo et al., 2019).

**Table Optimization:** Tuning procedures refer to the methods of fine-tuning the database by restructuring, reallocating the blocks, rebuilding indexes or reconstructing tables so as to fit usage pattern. This step makes query execution faster and makes the system more efficient to use.

**Check Operations:** Tables checking is the process of verifying the consistency and integrity of the database by identifying and fixing problems such as corruption and inconsistency. It entails checking of integrity to see if relationships between attributes and constraints have been implemented correctly (Penberthy & Roberts, 2022).

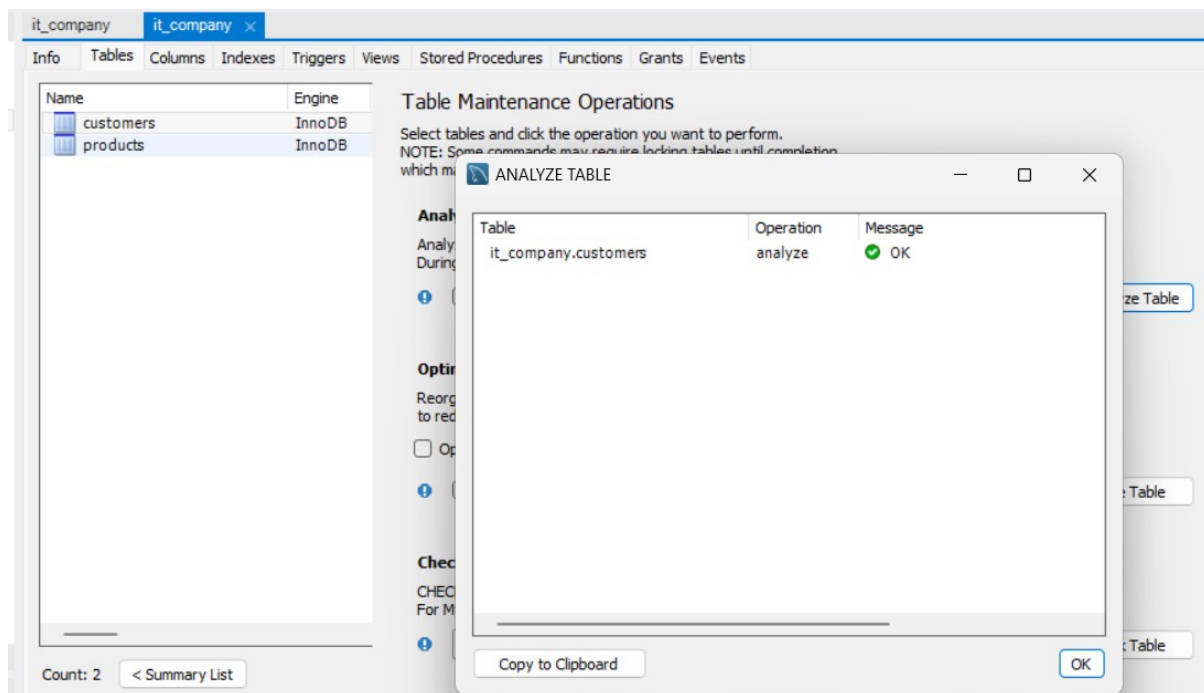


Figure 14: Table Analysis

The table analysis shows MySQL Workbench environment with Schema Inspector tool connected; the analysis report section focuses on statistics of table, usage of indices, and storage details. The conclusion of this analysis would be used to identify tables that can have high fragmentation or have statistics that are not up to date and hence, where the optimization should be done (Rawat et al., 2021).

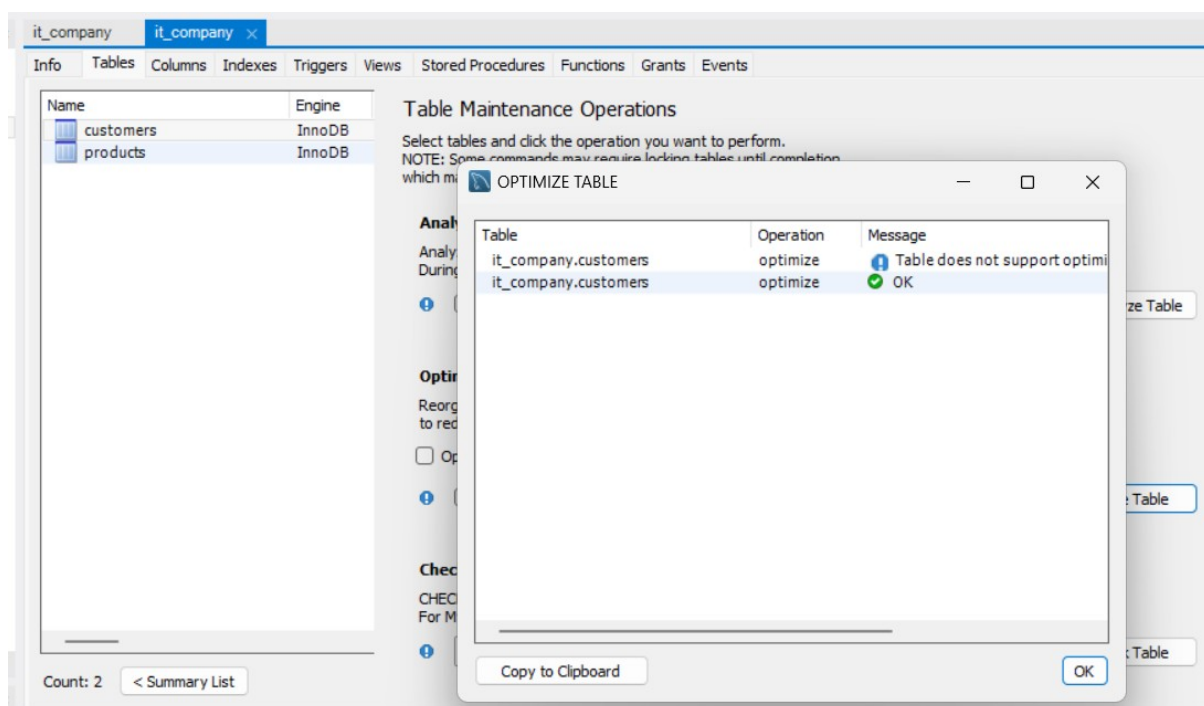




Figure 15: Table Optimization

The table optimization is going to explain the optimization process in the MySQL Workbench, and indicates the command themselves to rebuild indexes or even switch the data in tables. Optimisation narrows down the key meaning of queries thereby decreasing disk I/O and optimising physical space hence increasing overall database efficiency.

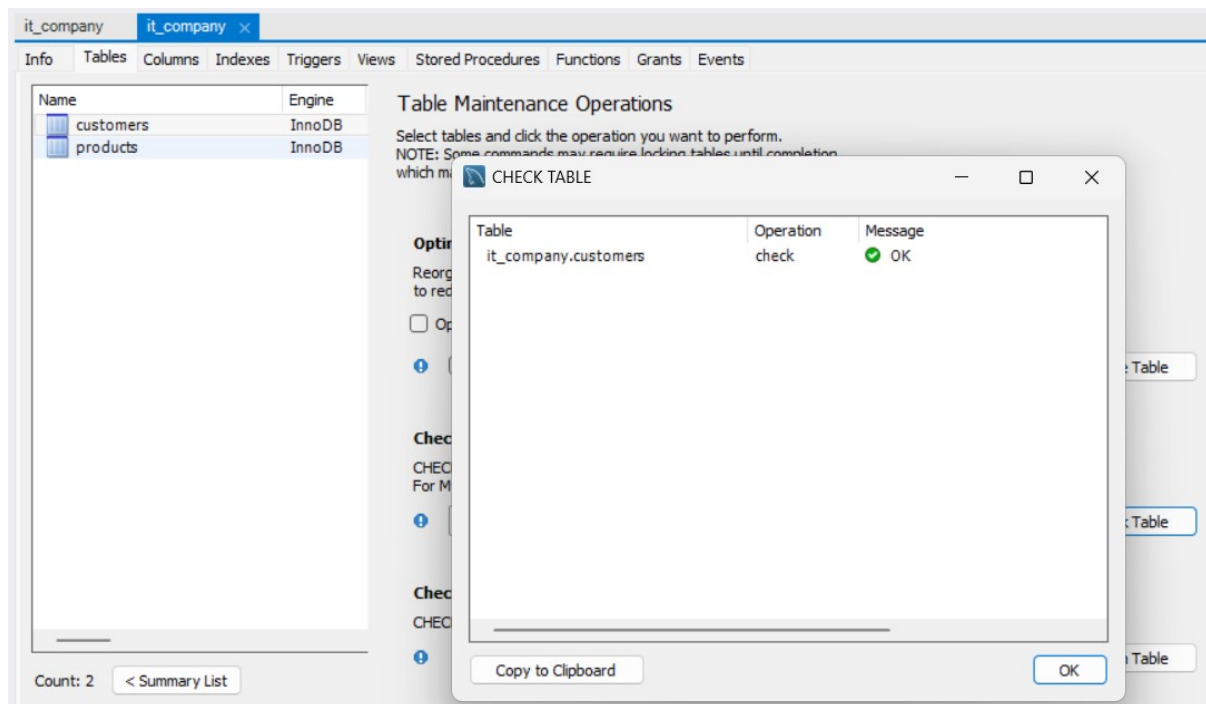


Figure 16: Check Operations

The check operation presents the use of SQL commands for the validation of integrity by displaying check results that proves the data relations and constraints are valid. Doing that on a regular basis allows for constant verification of integrity in the data, allowing the possibility of error detection and correction, ensuring consistency in the presented data (Silva, 2023).

## 5. Maintenance routines for data integrity and performance optimization

In sequential scanning, query processing requires that each row of the table in question be scanned and acted on – this may be to gather data from the table or perform queries on the table, and much more. It is important for query performance analysis and making a preferable query performance optimization. MySQL offers the EXPLAIN statement that gives detailed information on how the queries are going to be addressed in the backend (Smirnova & Tezuysal, 2022).

When using the EXPLAIN statement, several parameters are crucial for optimizing query performance:

Select Type: MESSAGE: Specifies the kind of SELECT query using a keyword on queries such as a SIMPLE, PRIMARY, or SUBQUERY.

Table: Precise identification of the table in use as well as any aliases assigned.

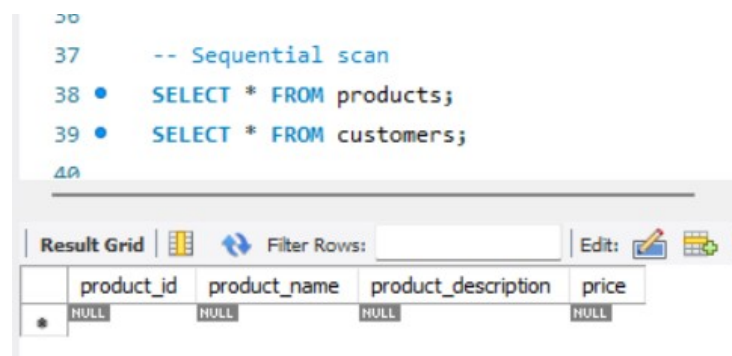
Type: Defines a join type or access code (e. g. , ALL, index, range).

Possible Keys: Enumerates the indexes that are available for inclusion in query optimality.

Key: Is used to identify which index should be used for optimizing the query.

Rows: Displays a number of rows evaluated or used as a result of an operation.

Extra: Gives more details about query executing (for example, if temporary tables are used, or filesort is needed).

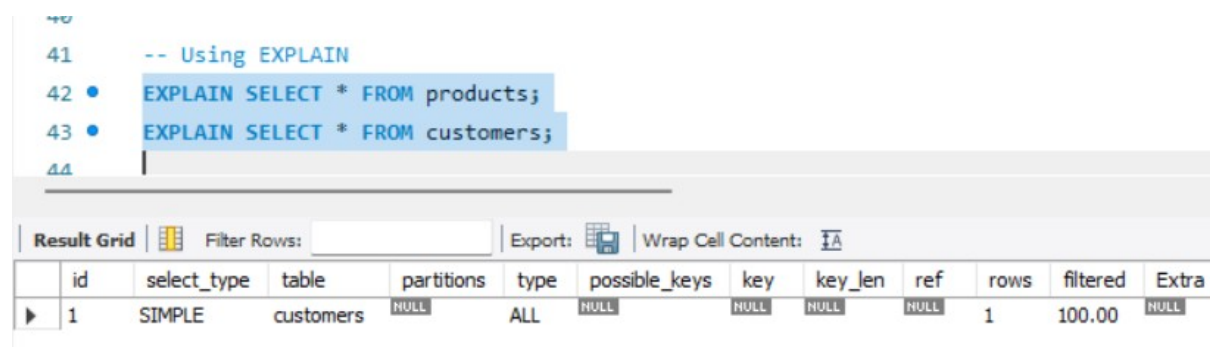


```
37 -- Sequential scan
38 • SELECT * FROM products;
39 • SELECT * FROM customers;
```

	product_id	product_name	product_description	price
*	NULL	NULL	NULL	NULL

Figure 17: Sequential Scan

This shows a query doing a table scan in this instance, commonly associated with poor database optimization. It is costly but often required for the system to conduct full table scan for operations that need data from every row in the table (Šušter & Ranisavljević, 2023).

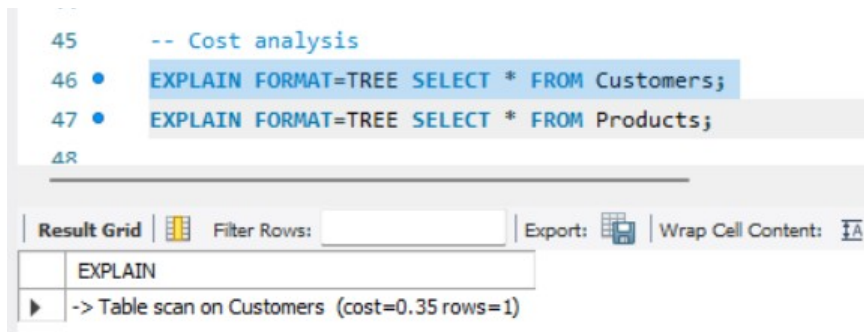


```
41 -- Using EXPLAIN
42 • EXPLAIN SELECT * FROM products;
43 • EXPLAIN SELECT * FROM customers;
```

	id	select_type	table	partitions	type	possible_keys	key	key_len	ref	rows	filtered	Extra
►	1	SIMPLE	customers	NULL	ALL	NULL	NULL	NULL	NULL	1	100.00	NULL

Figure 18: EXPLAIN Statement

This figure shows the result that an EXPLAIN statement returns for a SELECT query. EXPLAIN makes database design tuning possible by enabling people to know which queries are fast and which ones are slow.



```

45  -- Cost analysis
46  • EXPLAIN FORMAT=TREE SELECT * FROM Customers;
47  • EXPLAIN FORMAT=TREE SELECT * FROM Products;
48

```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: |

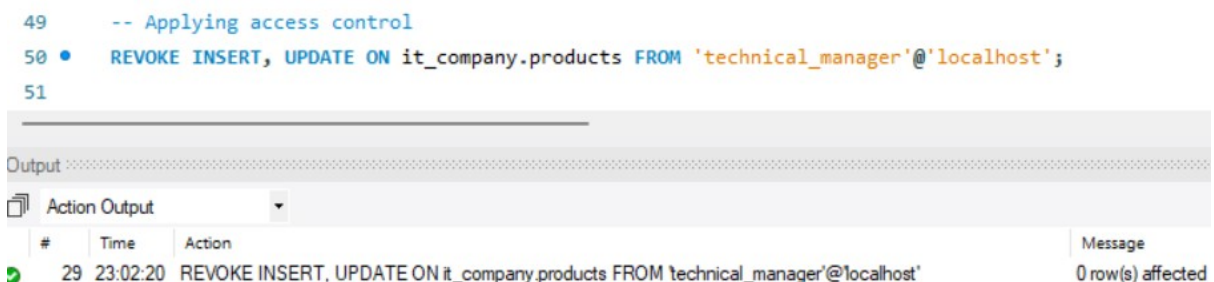
EXPLAIN
-> Table scan on Customers (cost=0.35 rows=1)

Figure 19: Cost Analysis

This includes factors such as the time taken to execute certain queries, CPU consumption and I/O operations among others. Cost analysis assists in determining the effects of the optimization of queries in the system's performance and resource utilization.

## 6. Security strategy

Enforcement of proper controlling of access is important in the protection of data and adherence to security standards and policies. Thus, for our IT company database, access control measures entail instructions concerning user roles according to their functions and the principle of least privilege.



```

49  -- Applying access control
50  • REVOKE INSERT, UPDATE ON it_company.products FROM 'technical_manager'@'localhost';
51

```

Output

Action Output

#	Time	Action	Message
29	23:02:20	REVOKE INSERT, UPDATE ON it_company.products FROM 'technical_manager'@'localhost'	0 row(s) affected

Figure 20: Privilege Adjustments

This illustrates the change in privileges of the Technical Manager on product tables of a firm. The query represents the statement that revokes delete privilege accompanied by changes in permission. This wraps the privileges with the modern responsibilities in an organization to minimize cases of abuse or unauthorized manipulation or loss of crucial data (Silva, 2023).

## 7. Recovery process

Database backups are critical for data security to prevent data loss due to system crashes or data corruption and for the organization's business continuity.

### Creating Database Backups:

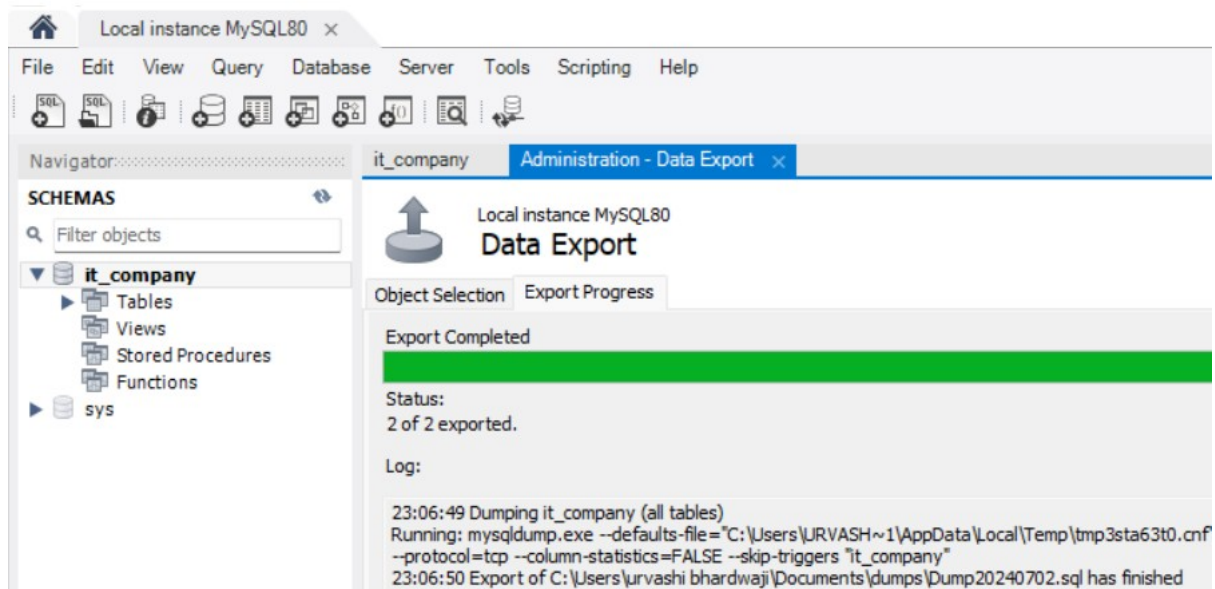


Figure 21: Data exported

Perform a backup of the MySQL database by using `mysqldump` command or by clicking on Data export in the Server tab. Do not copy the backup file alongside the actual data because this would expose the data to risks of loss due to faults in the storage equipment or catastrophes (Silva, 2023).

### Restoring Database Backups:

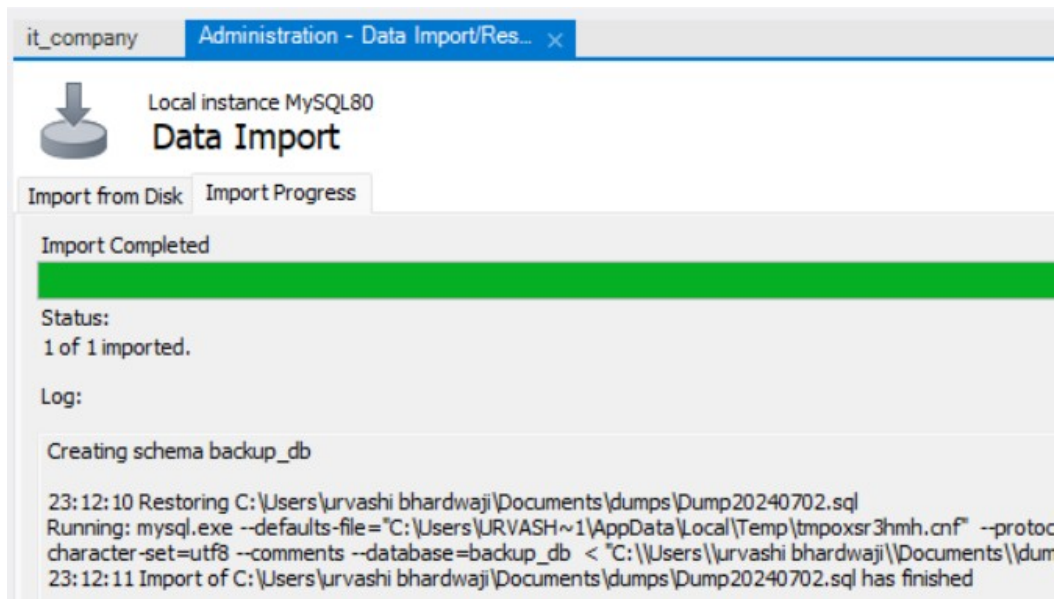


Figure 22: Data imported successfully

To recover a backup open the mysql command with the source option to backup the database or by clicking on the Data import in the Server tab. Before leaving the site or initiating subsequent sessions, it is essential to check the database for any errors or inconsistencies (Isiaka, 2020).

## 8. Conclusion

In the course of this assignment, numbers of critical activities were performed efficiently to control and protect the developed database system. Downloading, installation and configuration of MySQL Workbench and MYSQL Server set the coherent working environment for handling the data by achieving better efficiency in managing and retrieving the data. Security means such as user roles, and access rights were put in place to prevent misuse of the data and meet the needed ethical standards on use of information. Every action performed – configuration of the database, the daily/weekly/monthly processes to ensure data quality and improved efficiency, and the methods of protection – were critical in preserving the database integrity and security. Work like table analysis and query optimization that are run as routine are critical for maintaining optimum performance and integrity of the system. Each of them in their way contributes to database system reliability and security to guard organizational data assets and gain stakeholders' confidence in the operation of the IT company.

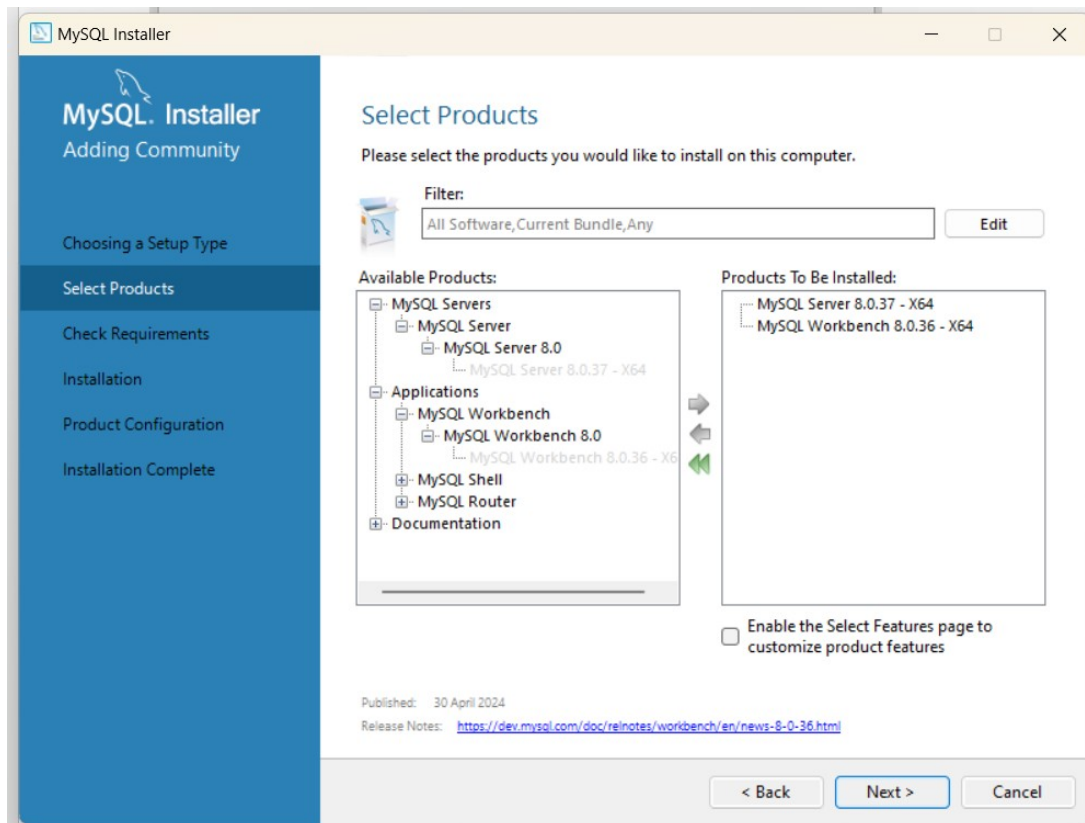
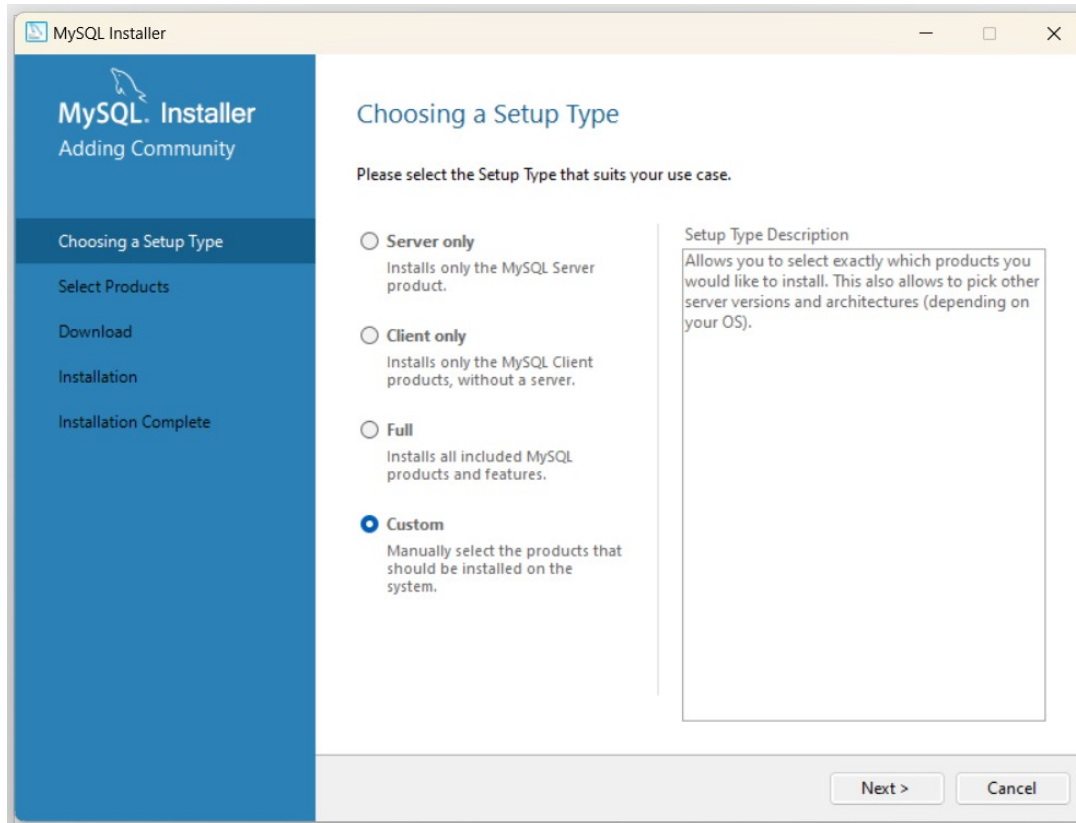
## References

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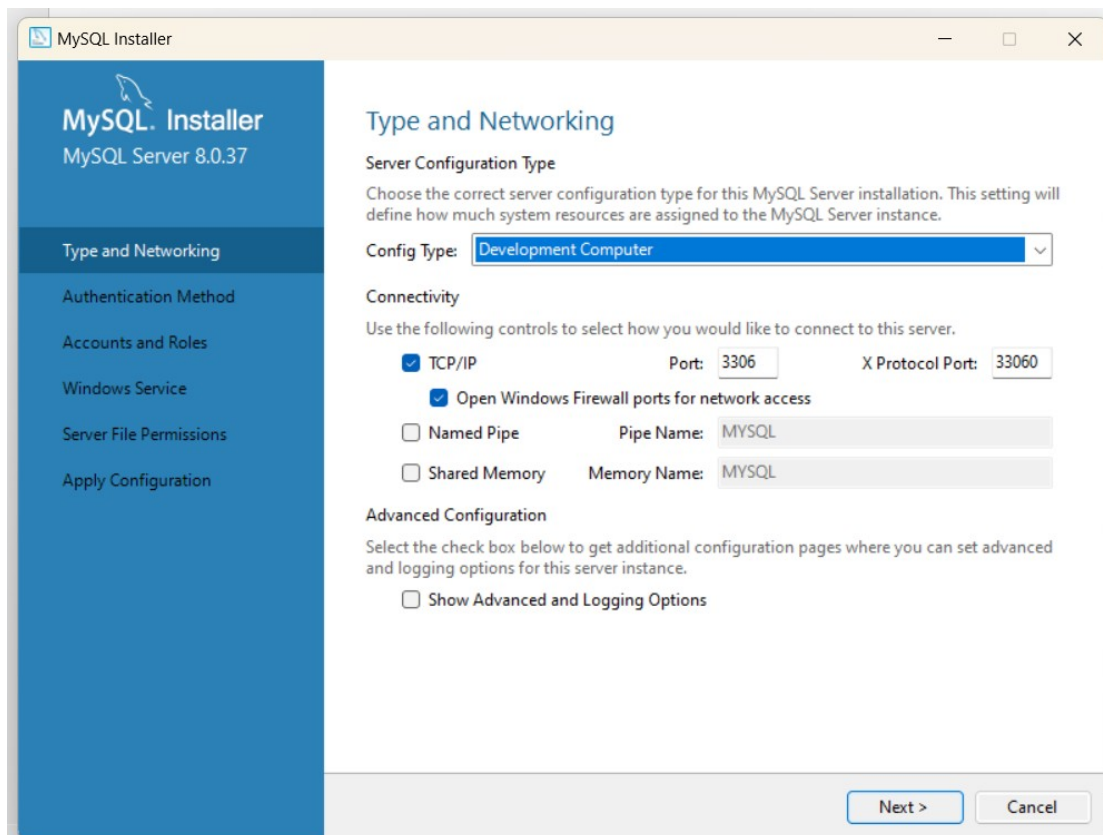
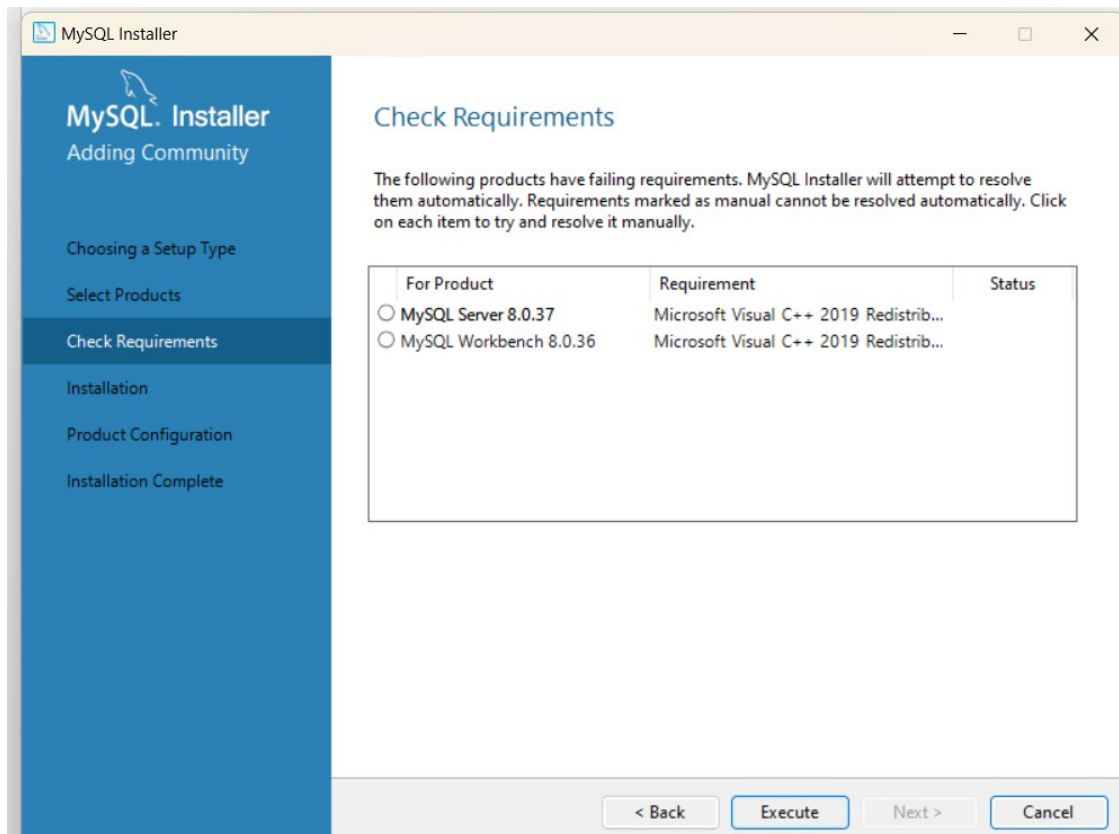
Šušter, I., & Ranisavljević, T. (2023). OPTIMIZATION OF MYSQL DATABASE. *Journal of Process Management. New Technologies*, 11(1-2), 141–151.  
<https://doi.org/10.5937/jpmnt11-44471>

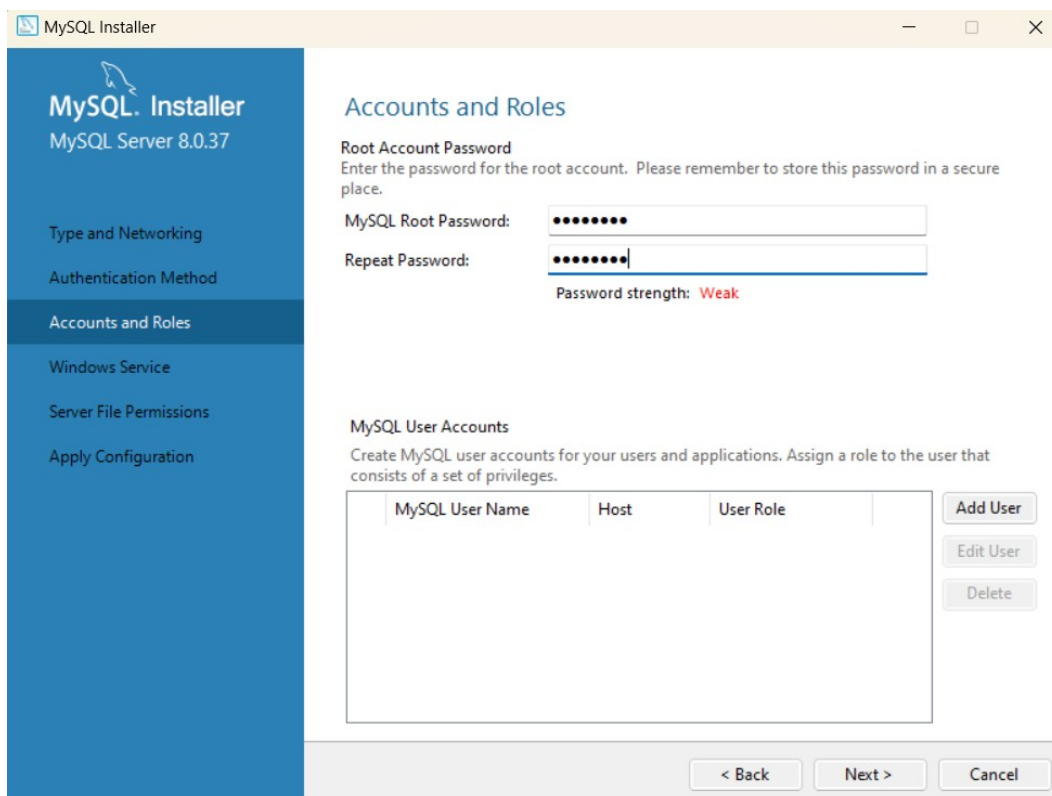
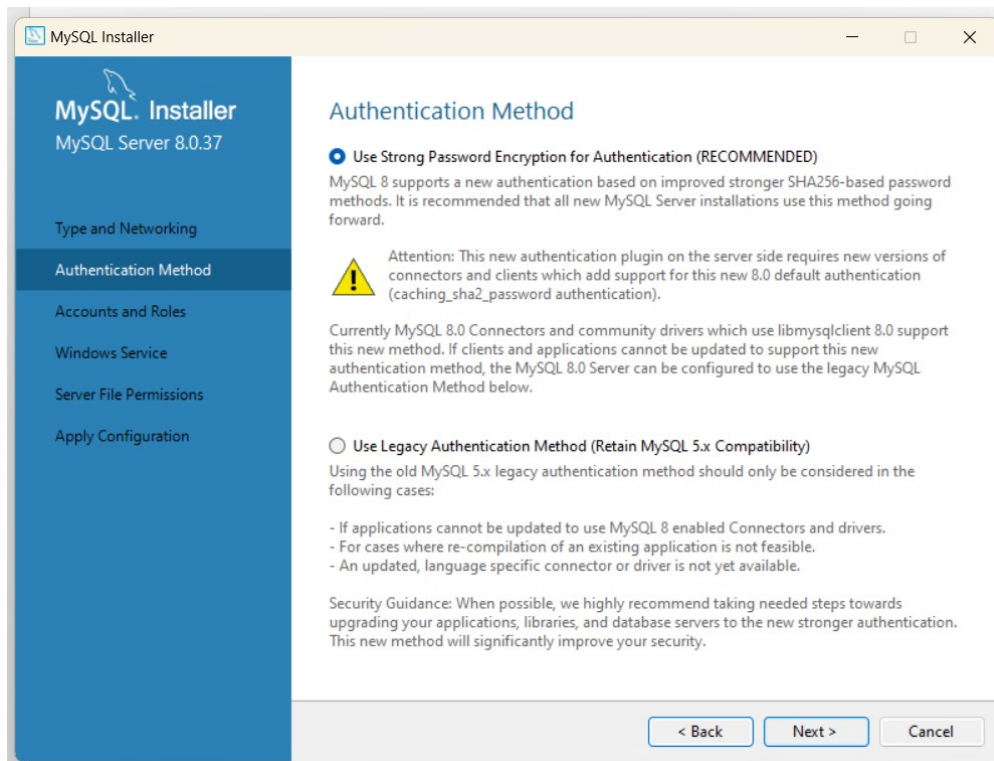


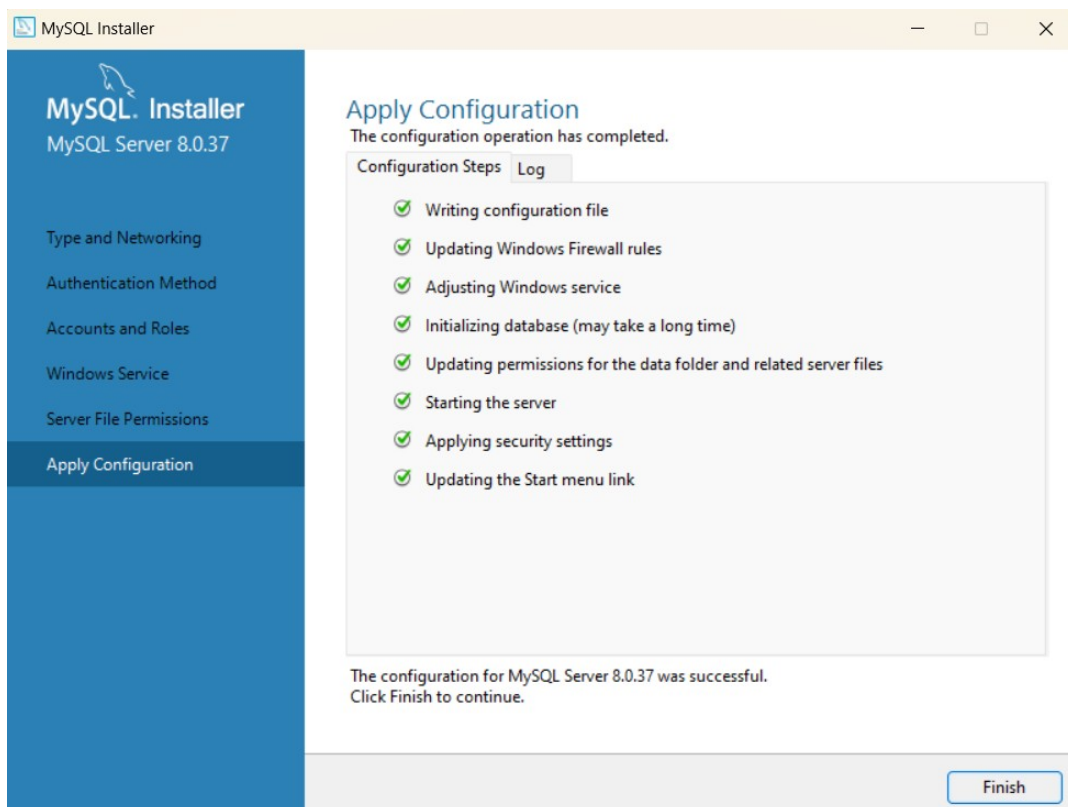
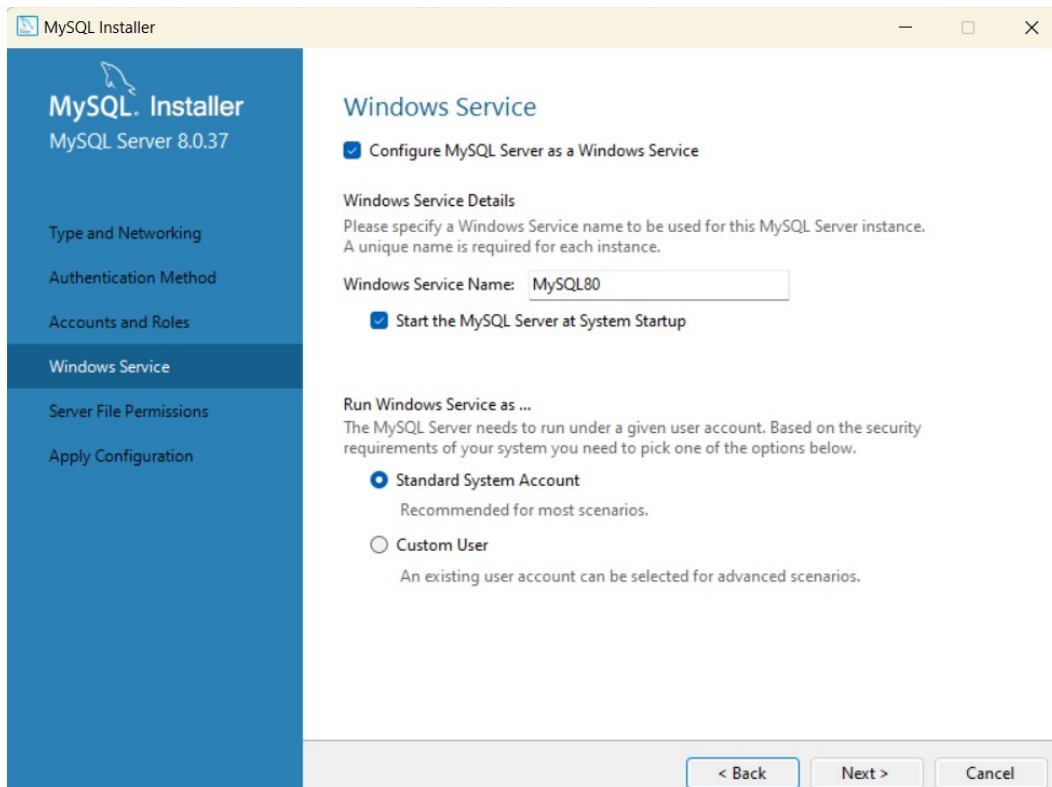
## Appendices

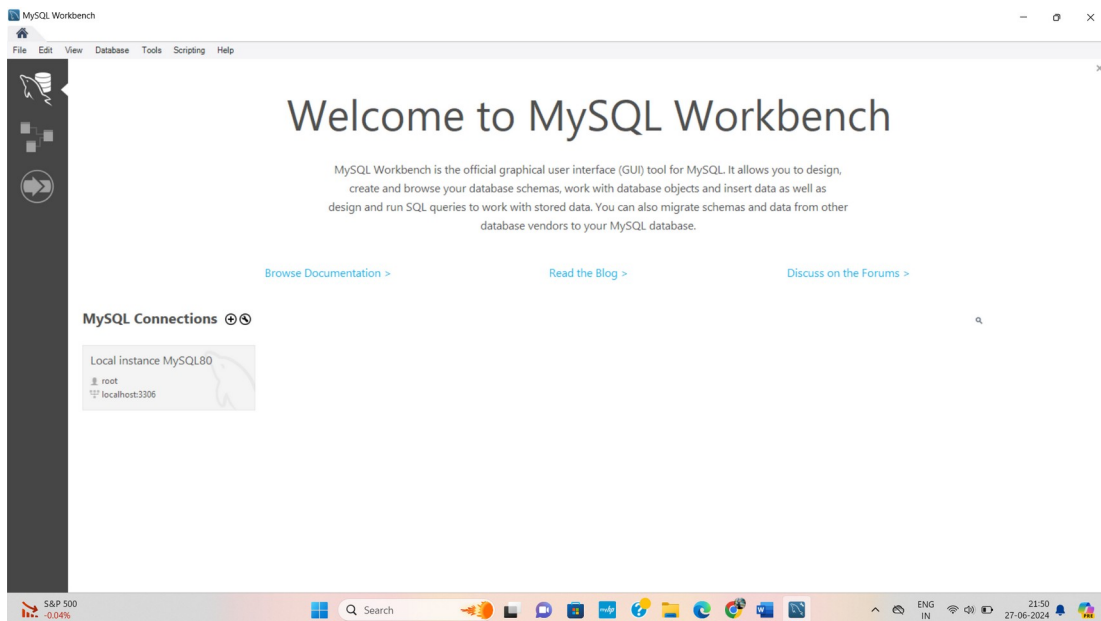
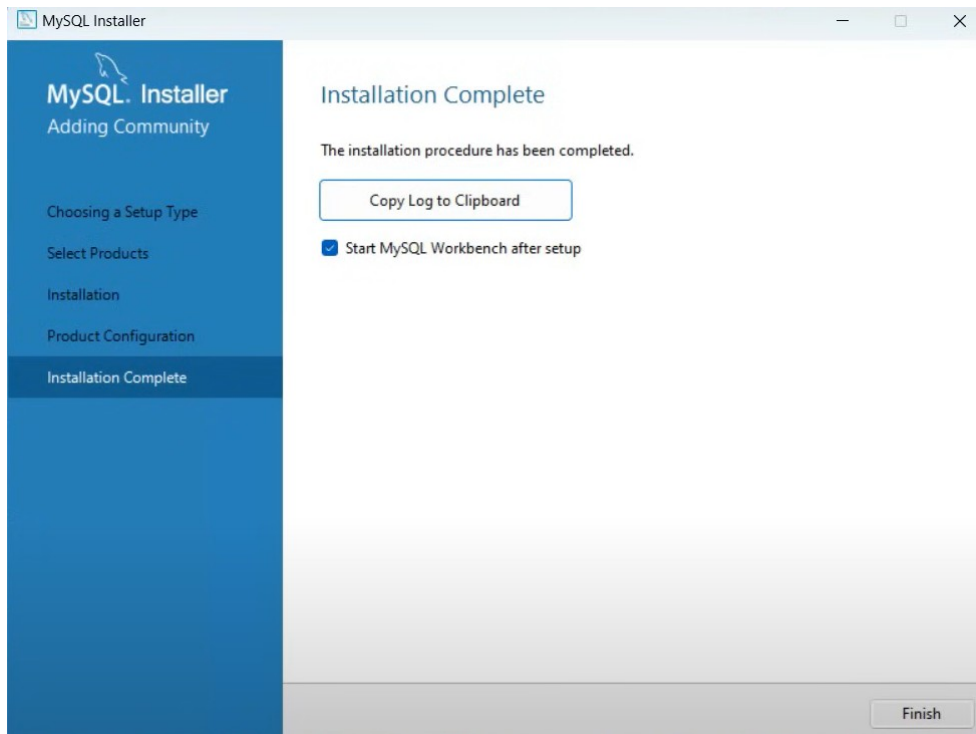












```

it_company x
1  -- Create database
2  • CREATE DATABASE it_company;
3
4  -- Use the database
5  • USE it_company;
6
7  -- Create tables
8  • CREATE TABLE products (
9      product_id INT AUTO_INCREMENT PRIMARY KEY,
10     product_name VARCHAR(255) NOT NULL,
11     product_description TEXT,
12     price DECIMAL(10, 2)
13 );
14
15 • CREATE TABLE customers (
16     customer_id INT AUTO_INCREMENT PRIMARY KEY,
17     customer_name VARCHAR(255) NOT NULL,
18     contact_info VARCHAR(255)

```

Output

Action Output

#	Time	Action	Message
✓ 1	22:42:00	DROP DATABASE 'restored_db'	2 row(s) affected
✓ 2	22:42:06	DROP DATABASE 'itcompanydb'	2 row(s) affected
✓ 3	22:42:29	CREATE DATABASE it_company	1 row(s) affected
✓ 4	22:42:29	USE it_company	0 row(s) affected
✓ 5	22:42:29	CREATE TABLE products ( product_id INT AUTO_INCREMENT PRIMARY KEY, product_name VARCHAR(25...	0 row(s) affected
✓ 6	22:42:29	CREATE TABLE customers ( customer_id INT AUTO_INCREMENT PRIMARY KEY, customer_name VARCHA...	0 row(s) affected

```

20
21  -- Create users
22  • CREATE USER 'ceo'@'localhost' IDENTIFIED BY 'ceo__123';
23  • CREATE USER 'marketing_manager'@'localhost' IDENTIFIED BY 'marketing123';
24  • CREATE USER 'technical_manager'@'localhost' IDENTIFIED BY 'technical123';
25  • CREATE USER 'ceoIT'@'localhost' identified by 'ceo123';
26
27  -- Assign privileges

```

Output

Action Output

#	Time	Action	Message
✓ 10	22:45:24	CREATE USER 'marketing_manager'@'localhost' IDENTIFIED BY 'marketing123'	0 row(s) affected
✓ 11	22:45:31	CREATE USER 'technical_manager'@'localhost' IDENTIFIED BY 'technical123'	0 row(s) affected
✗ 12	22:46:23	CREATE USER 'ceo'@'localhost' identified by 'ceo123'	Error Code: 1396. O
✓ 13	22:46:39	CREATE USER 'ceoIT'@'localhost' identified by 'ceo123'	0 row(s) affected



```

27 -- Assign privileges
28 • GRANT ALL PRIVILEGES ON it_company.* TO 'ceoIT'@'localhost';
29 • GRANT SELECT, INSERT, UPDATE ON it_company.customers TO 'marketing_manager'@'localhost';
30 • GRANT SELECT, INSERT, UPDATE, DELETE ON it_company.products TO 'technical_manager'@'localhost';
31
32 -- Display privileges
33 • SHOW GRANTS FOR 'ceoIT'@'localhost';
34 • SHOW GRANTS FOR 'marketing_manager'@'localhost';
35 • SHOW GRANTS FOR 'technical_manager'@'localhost';
36

```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: IA

Grants for ceoIT@localhost  
 GRANT USAGE ON \*.\* TO 'ceoIT'@'localhost'  
 GRANT ALL PRIVILEGES ON `it\_company`.\* TO...

Result 1 x

Output

Action Output

#	Time	Action	Message
✓ 14	22:47:50	GRANT ALL PRIVILEGES ON it_company.* TO 'ceoIT'@'localhost'	0 row(s) affected
✓ 15	22:47:50	GRANT SELECT, INSERT, UPDATE ON it_company.customers TO 'marketing_manager'@'localhost'	0 row(s) affected
✓ 16	22:47:50	GRANT SELECT, INSERT, UPDATE, DELETE ON it_company.products TO 'technical_manager'@'localhost'	0 row(s) affected
✓ 17	22:48:02	SHOW GRANTS FOR 'ceoIT'@'localhost'	2 row(s) returned

it\_company

it\_company x

Info Tables Columns Indexes Triggers Views Stored Procedures Functions Grants Events

Name	Engine
customers	InnoDB
products	InnoDB

Count: 2 < Summary List

### Table Maintenance Operations

Select tables and click the operation you want to perform.  
 NOTE: Some commands may require locking tables until completion.  
 which may affect other users.

ANALYZE TABLE

Table	Operation	Message
it_company.customers	analyze	✓ OK

Copy to Clipboard

OK

it\_company it\_company x

Info Tables Columns Indexes Triggers Views Stored Procedures Functions Grants Events

Name	Engine
customers	InnoDB
products	InnoDB

Count: 2 < Summary List

### Table Maintenance Operations

Select tables and click the operation you want to perform.  
NOTE: Some commands may require locking tables until completion, which may block other users.

#### OPTIMIZE TABLE

Table	Operation	Message
it_company.customers	optimize	Table does not support optimize
it_company.products	optimize	OK

Copy to Clipboard OK

it\_company it\_company x

Info Tables Columns Indexes Triggers Views Stored Procedures Functions Grants Events

Name	Engine
customers	InnoDB
products	InnoDB

Count: 2 < Summary List

### Table Maintenance Operations

Select tables and click the operation you want to perform.  
NOTE: Some commands may require locking tables until completion, which may block other users.

#### CHECK TABLE

Table	Operation	Message
it_company.products	check	OK

Copy to Clipboard OK

```

37 -- Sequential scan
38 • SELECT * FROM products;
39 • SELECT * FROM customers;

```

Result Grid

	product_id	product_name	product_description	price
*	NULL	NULL	NULL	NULL

```

41 -- Using EXPLAIN
42 • EXPLAIN SELECT * FROM products;
43 • EXPLAIN SELECT * FROM customers;
44

```

	id	select_type	table	partitions	type	possible_keys	key	key_len	ref	rows	filtered	Extra
▶	1	SIMPLE	customers	NULL	ALL	NULL	NULL	NULL	NULL	1	100.00	NULL

```

45 -- Cost analysis
46 • EXPLAIN FORMAT=TREE SELECT * FROM Customers;
47 • EXPLAIN FORMAT=TREE SELECT * FROM Products;
48

```

	EXPLAIN
▶	-> Table scan on Customers (cost=0.35 rows=1)

```

49 -- Applying access control
50 • REVOKE INSERT, UPDATE ON it_company.products FROM 'technical_manager'@'localhost';
51

```

Output

#	Time	Action	Message
29	23:02:20	REVOKE INSERT, UPDATE ON it_company.products FROM 'technical_manager'@'localhost'	0 row(s) affected

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator: it\_company Administration - Data Export x

**SCHEMAS**

Filter objects

- it\_company
  - Tables
  - Views
  - Stored Procedures
  - Functions
- sys

**Data Export**

Object Selection Export Progress

Export Completed

Status:  
2 of 2 exported.

Log:

23:06:49 Dumping it\_company (all tables)  
Running: mysqldump.exe --defaults-file="C:\Users\URVASH~1\AppData\Local\Temp\tmp3sta63t0.cnf" --protocol=tcp --column-statistics=FALSE --skip-triggers "it\_company"  
23:06:50 Export of C:\Users\urvashi bhardwaji\Documents\dumps\Dump20240702.sql has finished





Local instance MySQL80

## Data Import

Import from Disk

Import Progress

Import Completed

Status:

1 of 1 imported.

Log:

Creating schema backup\_db

23:12:10 Restoring C:\Users\urvashi bhardwaji\Documents\dumps\Dump20240702.sql

Running: mysql.exe --defaults-file="C:\Users\URVASH~1\AppData\Local\Temp\tmpoxsr3hnh.cnf" --protocol=socket --character-set=utf8 --comments --database=backup\_db &lt; "C:\Users\urvashi bhardwaji\Documents\dumps\Dump20240702.sql" has finished