Understanding SQL Security Levels and Real-World Risks

1. What are SQL Security Levels?

SQL Server provides layered security controls:

- **Server-Level Login**: Authenticates users at the SQL Server instance level. (e.g., CREATE LOGIN hr_login ...)
- **Database-Level User**: Maps a server login to a specific database. (e.g., CREATE USER hr_user FOR LOGIN hr_login;)
- **Schema-Level Permissions**: Grants access to entire logical sections (schemas) like HR or Sales.
- **Object-Level Permissions**: Grants access to specific tables, views, or stored procedures.

2. Benefits of Applying Security Levels

- Restrict sensitive data like salaries from non-HR staff.
- Prevent unauthorized changes to customer data.
- Reduce human errors by limiting access.
- Satisfy compliance and audit requirements.

3. Real-World Risks Without Security

- If everyone has full access:
    - Sensitive HR data could be leaked.
    - Accidental or malicious data modifications.
- Developers might unknowingly damage production data.
- Interns or junior developers might access restricted data.

4. Task Summary: What We Did

- Created database CompanyDB with two schemas: HR and Sales.
- Created login and users: hr_login/hr_user, sales_login/sales_user, and User1Login/User1.
- Assigned schema-level permissions:
    - hr_user can only access HR schema.
    - sales_user can only access Sales schema.
    - User1 has read-only access to Sales.
- Inserted sample data and verified access using EXECUTE AS USER.
- Sales user could not read HR data, and vice versa.

5. Security Scenario: "The Overpowered Developer"

What Went Wrong:

1. Adil accidentally deleted all employee records.
2. Salary report was shared externally.
3. A junior developer gained full access.
4. Tables were created in the wrong schema.

Root Causes:

- No separation between development and production environments.
- Developers had full access without restriction.
- No schema-level or role-based control.
- No auditing or approval for login creation.

Suggested Solutions:

- Use schema-level permissions (as done in this task).
- Assign minimum roles (e.g., ReadOnly, DataEntry).
- Use views to hide sensitive columns.
- Implement audit logs.
- Separate dev and prod environments.

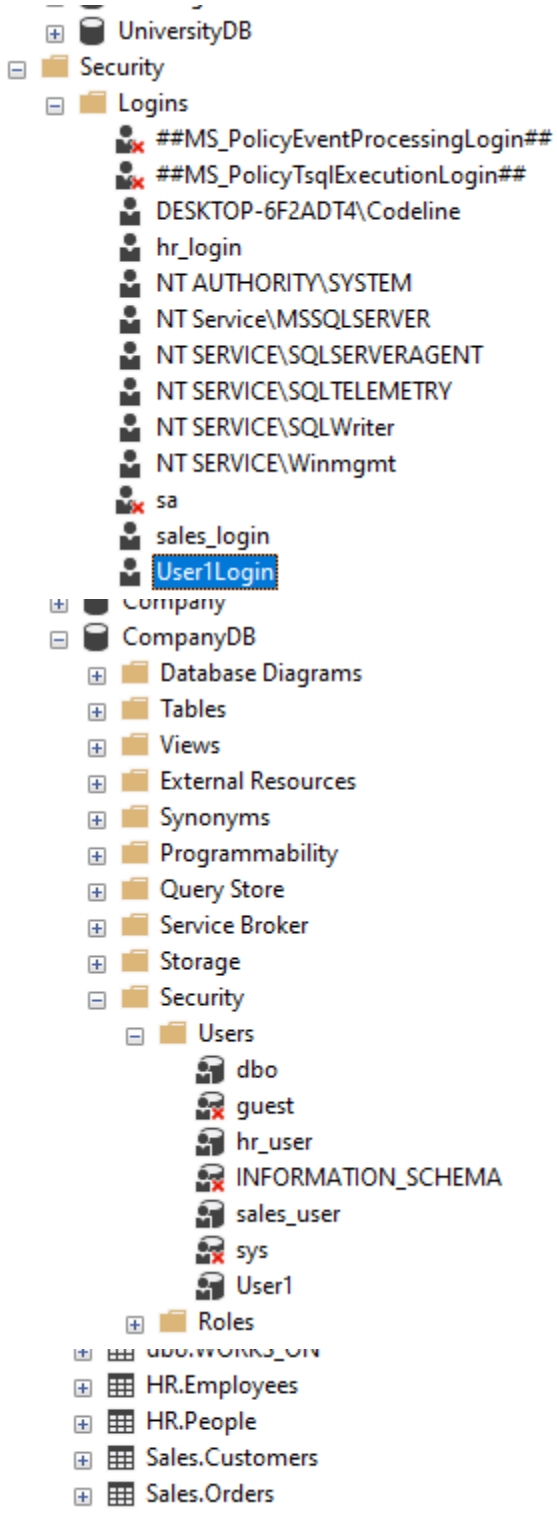
Lessons Learned:

- Developers should access only non-sensitive schemas/tables.
- Only DBAs/admins should manage logins and schemas.
- Always apply "least privilege" principle to reduce risk.

Bonus: Role-Based Security Test

- Created ReadOnly_Dev role and granted SELECT only on HR schema.
- Added hr_user to this role.
- Verified that INSERT/DELETE commands failed.

Screen shots



Codes:

```
-- SQL SECURITY TASK: Schema-Level Access Control



-- Step 1: Create Database
CREATE DATABASE CompanyDB;
GO

USE CompanyDB;
GO

-- Step 2: Create Schemas
CREATE SCHEMA HR;
GO

CREATE SCHEMA Sales;
GO

-- Step 3: Create Tables in Schemas
CREATE TABLE HR.Employees (
  EmployeeID INT PRIMARY KEY,
  Name NVARCHAR(100),
  Position NVARCHAR(100),
  Salary DECIMAL(10, 2)
);
```

```
GO

CREATE TABLE Sales.Customers (
   CustomerID INT PRIMARY KEY,
   Name NVARCHAR(100),
   PurchaseAmount DECIMAL(10, 2)
);
GO

CREATE TABLE Sales.Orders (
   OrderID INT PRIMARY KEY,
   CustomerName NVARCHAR(100)
);
GO

CREATE TABLE HR.People (
   EmpID INT PRIMARY KEY,
   FullName NVARCHAR(100)
);
GO

-- Insert sample data
INSERT INTO Sales.Orders VALUES (1, 'Ali'), (2, 'Fatma');
INSERT INTO HR.People VALUES (101, 'Ahmed'), (102, 'Huda');
GO
```

```
-- Step 4: Create Logins and Users
CREATE LOGIN hr_login WITH PASSWORD = 'Hr@12345';
GO
CREATE USER hr_user FOR LOGIN hr_login;
GO

CREATE LOGIN sales_login WITH PASSWORD = 'Sales@12345';
GO
CREATE USER sales_user FOR LOGIN sales_login;
GO

CREATE LOGIN User1Login WITH PASSWORD = 'StrongPass123';
GO
CREATE USER User1 FOR LOGIN User1Login;
GO

-- Step 5: Grant Schema-Level Permissions
-- HR user access only HR schema
GRANT SELECT, INSERT, UPDATE, DELETE ON SCHEMA::HR TO hr_user;
DENY SELECT ON SCHEMA::Sales TO hr_user;
GO

-- Sales user access only Sales schema
GRANT SELECT, INSERT, UPDATE, DELETE ON SCHEMA::Sales TO sales_user;
DENY SELECT ON SCHEMA::HR TO sales_user;
GO
```

```
-- User1 gets read access only on Sales
GRANT SELECT ON SCHEMA::Sales TO User1;
GO

-- Step 6: Optional - Read-Only Role for HR
CREATE ROLE ReadOnly_Dev;
GO
GRANT SELECT ON SCHEMA::HR TO ReadOnly_Dev;
EXEC sp_addrolemember 'ReadOnly_Dev', 'hr_user';
GO

-- Step 7: Impersonation Test (User1)
EXECUTE AS USER = 'User1';
GO

-- Should succeed
SELECT * FROM Sales.Orders;
GO

-- Should fail
SELECT * FROM HR.People;
GO

-- Revert session
REVERT;
```

GO