
🌐 Azure PaaS SQL Database (Azure SQL Database)

🔹 What is it?

Azure SQL Database is a **Platform as a Service (PaaS)** offering from Microsoft Azure. It's a **fully managed relational database service** based on Microsoft SQL Server.

You don't need to install SQL Server, manage hardware, patch the OS, or worry about backups. Microsoft takes care of all the **infrastructure, maintenance, updates, scaling, and high availability**.

🛠️ Key Features of Azure SQL Database

1. **Fully Managed (PaaS)**
    - No need to manage servers, OS, storage, or patches.
    - Microsoft handles upgrades, backups, and HA (high availability).
2. **Built-in High Availability & DR Disaster Recovery**
    - Automatic failover.
    - Geo-replication across regions.
3. **Scalability**
    - Scale **vertically** (increase compute power).
    - Scale **horizontally** (shard databases with Elastic Pool).

4. **Security**
    - Encryption at rest & in transit (TDE & TLS).
    - Advanced Threat Protection.
    - Azure AD authentication.
5. **Performance Optimization**
    - Automatic tuning (indexes, query performance).
    - Intelligent query processing.
6. **Multiple Deployment Options**
    - **Single Database**: Isolated, dedicated database.
    - **Elastic Pool**: Share resources across multiple databases.
    - **Managed Instance**: Almost full SQL Server compatibility, great for lift-and-shift.

⚙️ Deployment Models

Azure SQL Database can be deployed in 3 ways:

1. **Single Database**
    - Best for standalone apps.

    - Dedicated performance (DTU or vCore).

2. **Elastic Pool**
    - Multiple databases share the same compute resources.
    - Cost-effective for many small, variable-usage DBs.
3. **Managed Instance**
    - Provides **near 100% compatibility** with SQL Server on-prem.
    - Supports SQL Agent, cross-database queries, and migration from on-prem.

💰 Pricing Models

1. **DTU-based** (Database Transaction Units – bundled compute + storage).
2. **vCore-based** (Choose cores, memory, and storage separately).
    - Offers more flexibility and cost transparency.

🖼️ Use Cases

- Hosting **web apps or mobile apps** that need a backend SQL DB.
- Migrating on-prem **SQL Server** to the cloud without heavy admin overhead.

- SaaS applications needing **multi-tenant databases**.
- Analytics workloads with **high query performance**.

🔄 Example Lab Flow (Hands-on)

1. Go to **Azure Portal** → Create Resource → Databases → SQL Database.
2. Choose:
    - Subscription & Resource Group.
    - Database Name (e.g., studentdb).
    - Server (create new logical server with username & password).
    - Compute + storage (DTU or vCore).
3. Configure networking:
    - Allow Azure services to connect.
    - Set firewall rules for your client IP.
4. Deploy → Connect using SQL Server Management Studio (SSMS) or Azure Data Studio.

Run queries like:

```
CREATE TABLE Students (
  StudentID INT PRIMARY KEY,
```

```
    Name NVARCHAR(100),
    Course NVARCHAR(50)
);

INSERT INTO Students VALUES (1, 'Asha', 'Azure');
SELECT * FROM Students;
```

5.

🎯 Summary

- **Azure SQL Database = SQL Server in the cloud (fully managed, PaaS).**
- You focus on **data + queries**, Azure manages **infrastructure + availability**.
- Multiple deployment models: Single DB, Elastic Pool, Managed Instance.
- Great for modern apps, migrations, and SaaS workloads.