



# EPL342 –Databases

## Lab 2

### Introduction to SQL Server 2017



# Before We Begin

- Start the SQL Server Management Studio
  - **Server: mssql.cs.ucy.ac.cy**
  - **Authentication: SQL Server Authentication**
  - **Username: <check your email>**
  - **Password: <check your email>**



# What is SQL Server?

- **Relational Model Database Server**
- Manages two types of databases
  - **Online Transaction Processing (OLTP)** databases
  - **Online Analytical Processing (OLAP)**
- Primary Languages: T-SQL, ANSI-SQL

# A brief history of SQL Server



Year	Version	Name
1989	1	SQL Server 1.0
1993	4.21	SQL Server 4.21
1995	6	SQL Server 6
1996	6.5	SQL Server 6.5 (Hydra)
1998	7	SQL Server 7 (Sphinx)
1999	7	SQL Server 7 OLAP (Plato)
2000	8	SQL Server 2000 (Shiloh)
2003	8	SQL Server 2000 64-bit (Liberty)
2005	9	SQL Server 2005 (Yukon)
2008	10	SQL Server 2008 (Katmai)
2010	10.25 & 10.50	Azure SQL database (initial release - Cloud database) & SQL Server 2008 R2 (Kilimanjaro)
2012	11	SQL Server 2012
2014	12	SQL Server 2014 & Azure SQL database
2016	2016	SQL Server 2016
2017	2017	SQL Server 2017



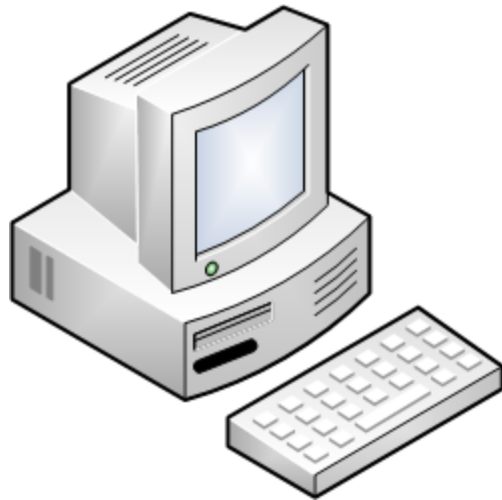
# Useful Links

- **SQL Server 2017 Home**  
<https://www.microsoft.com/en-us/sql-server/sql-server-2017>
- **SQL Server 2017 Documentation**  
<https://docs.microsoft.com/en-us/sql/sql-server/sql-server-technical-documentation?view=sql-server-2017>
- **Download SQL Server 2017 Express Edition (free)**  
<https://www.microsoft.com/en-us/download/details.aspx?id=55994>
  - You can also download other editions from your Azure account (provided by the CS department)
- **Download SQL Server Management Studio (free)**  
<https://docs.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms?view=sql-server-2017>

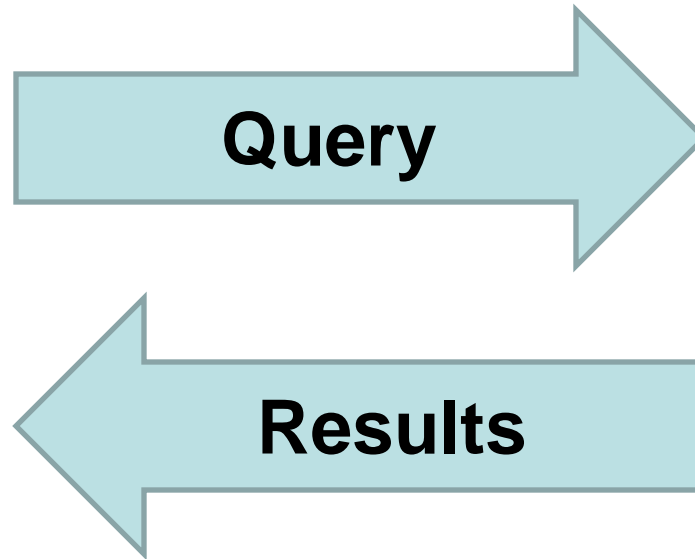


# Communicating with SQL Server

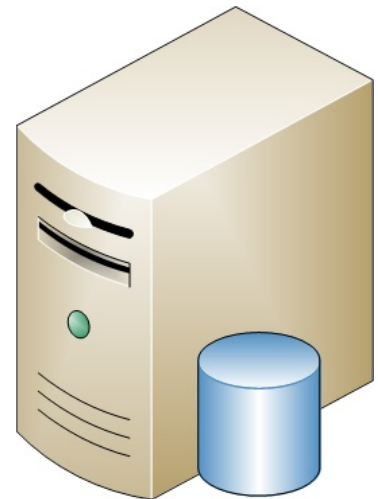
## Client



Client application



## SQL Server

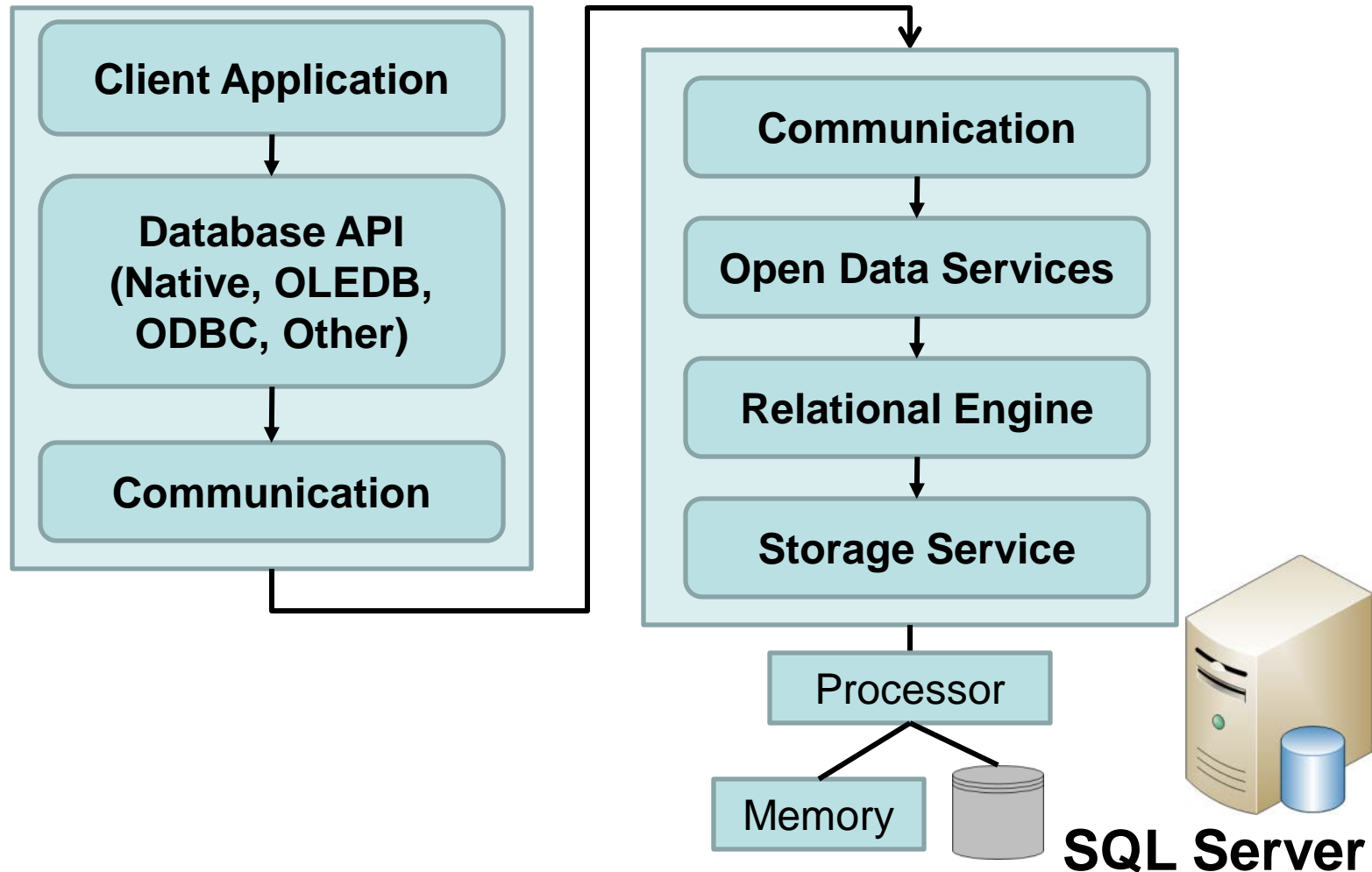


Relational Database Management System



# Communicating with SQL Server

## Client





# Authentication

- SQL Server 2017 supports two types of authentication:
  - Windows Authentication
  - SQL Server Authentication





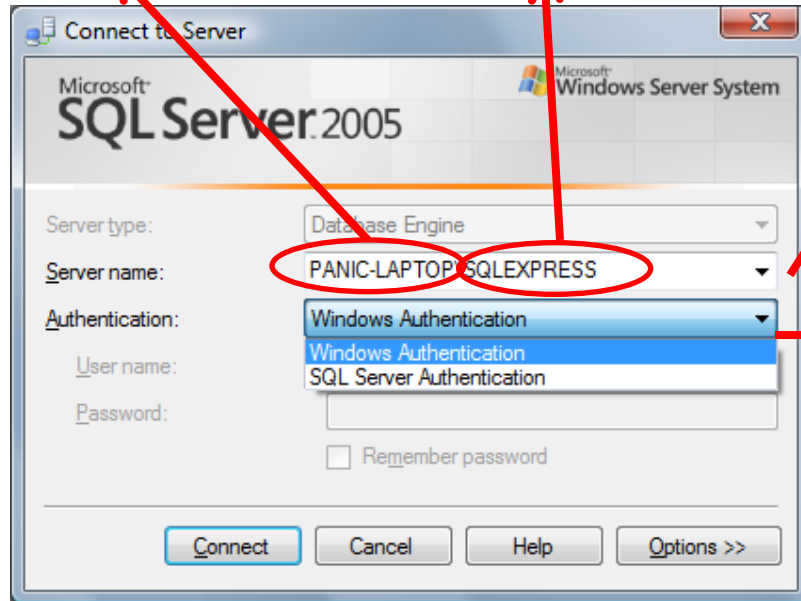
# Logging-in to SQL Server

Server Address

Instance Name

## Server Name

You can have multiple server instances installed on the same PC



## Authentication Type

Two authentication types:

- Windows authentication
  - Logs in with the Windows credentials
- SQL Server authentication
  - Requires SQL Server user/pass

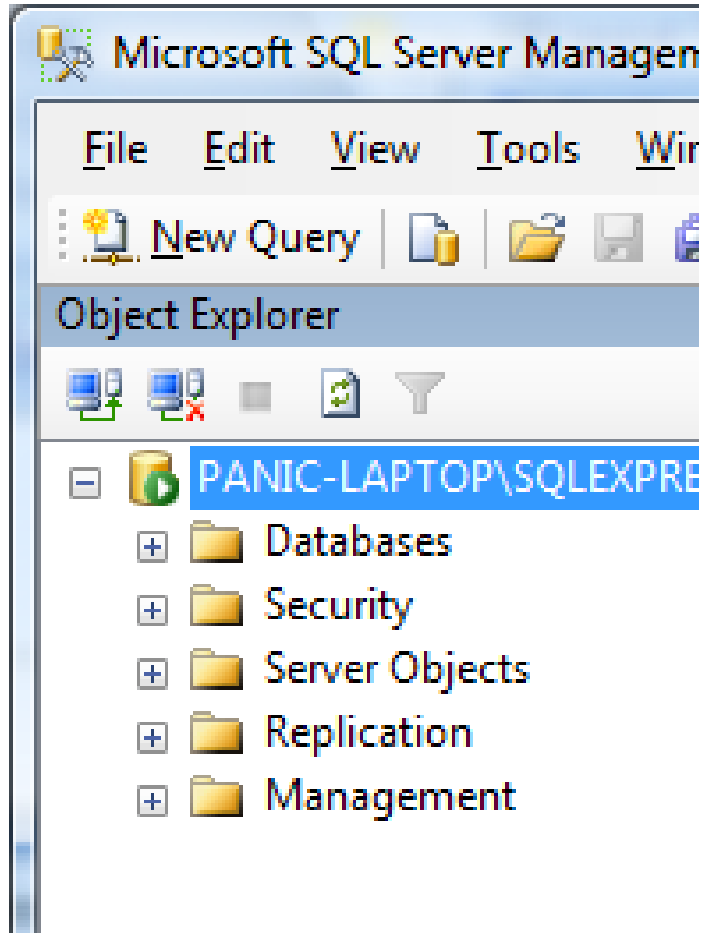
## Connecting to UCY

SQL Server is installed on **mssql**  
Username and password was sent to your email

**Connecting from home: only through VPN**



# Object Explorer

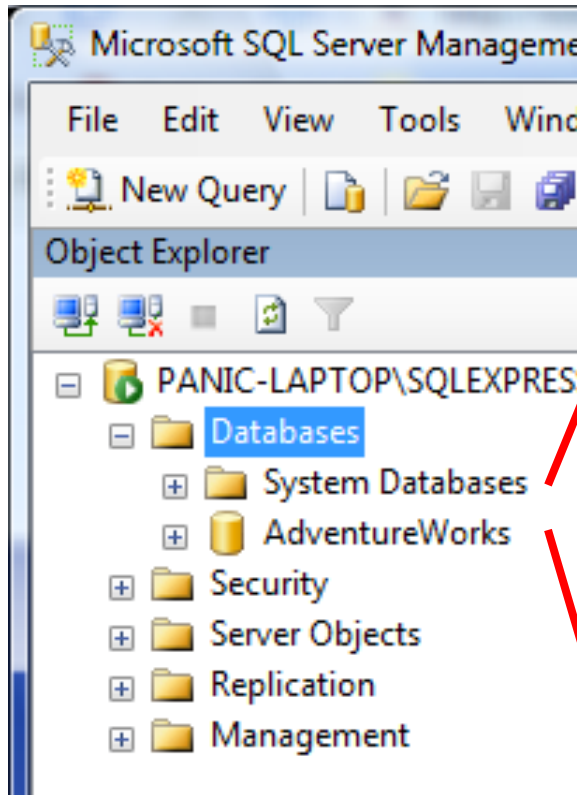


## Object Explorer

A component that provides a view of all objects in the services and presents a user interface to manage them.



# Databases



## Two types of Databases

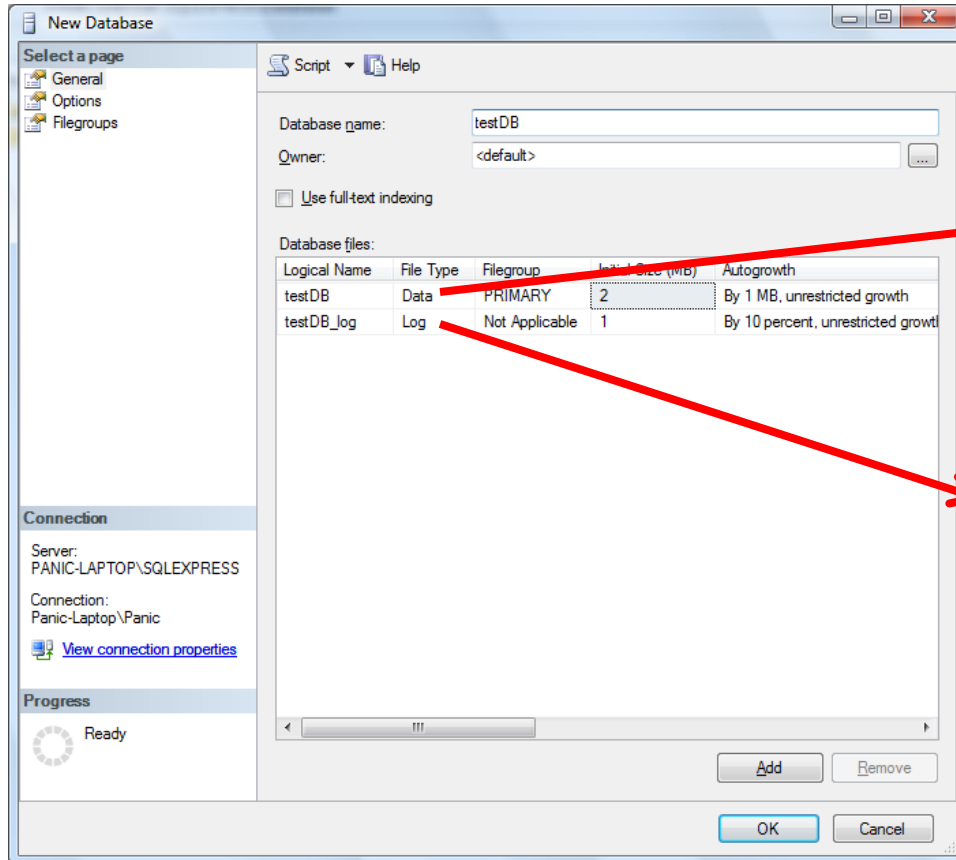
### System Databases:

<b>master</b>	Records all the system-level information for an instance of SQL Server.
<b>msdb</b>	Is used by SQL Server Agent for scheduling alerts and jobs.
<b>model</b>	Is used as the template for all databases created on the instance of SQL Server.
<b>Resource</b>	Is a read-only database that contains system objects that are included with SQL Server.
<b>tempdb</b>	Is a workspace for holding temporary objects or intermediate result sets.

### User Databases



# Creating a database



## Database

Consists of two files:

- <name>.mdf

Data file: stores all data

- <name>\_log.ldf

Log file: stores all actions performed on database



# Inside a database (AdventureWorks)

- AdventureWorks
  - + Database Diagrams
  - + Tables
  - + Views
  - + Synonyms
  - + Programmability
  - + Security

## Database Diagrams

design and visualize a database

## Tables

System table + user tables

## Views, Synonyms,

## Programmability, Security

Will talk about them in upcoming lectures



# Database Diagram

Available here in html and visio formats

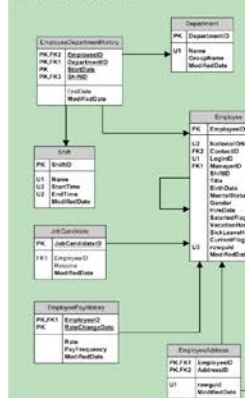
AdventureWorks OLTP Schema  
November 2005

Best Print Results: F  
11x17 paper  
Landscape  
Fit to sheet

dbo



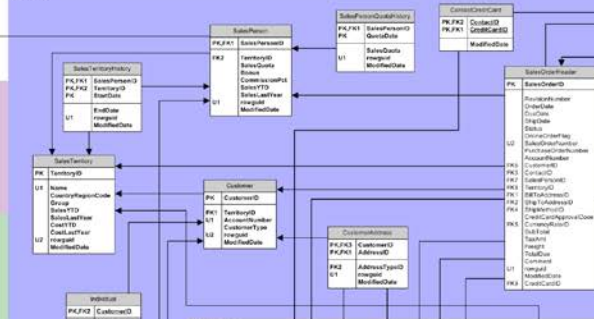
HumanResources



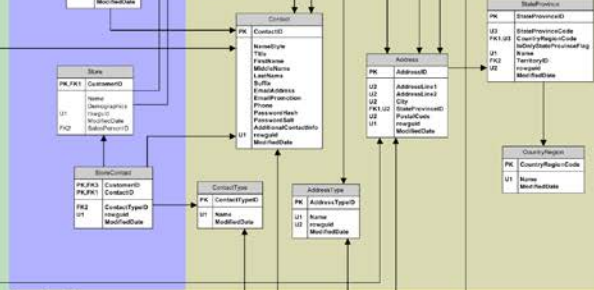
Schemas



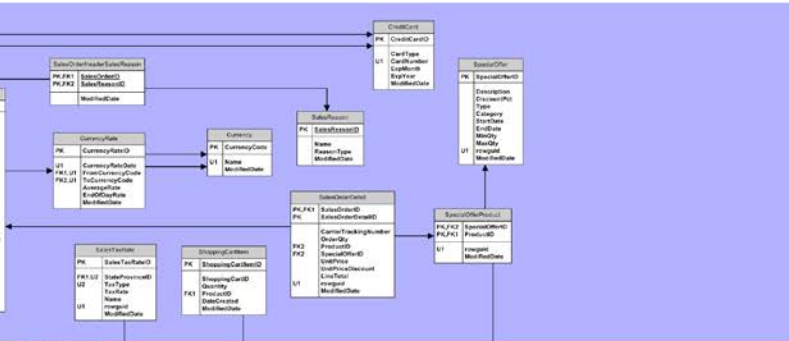
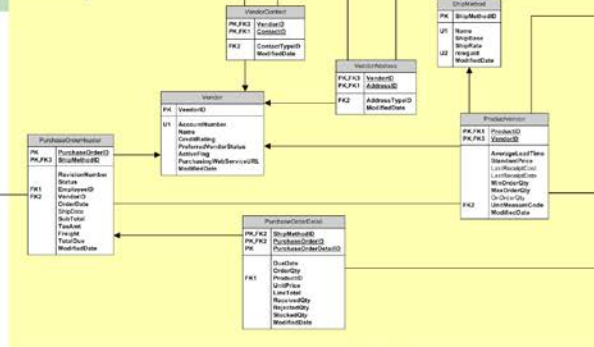
Sales



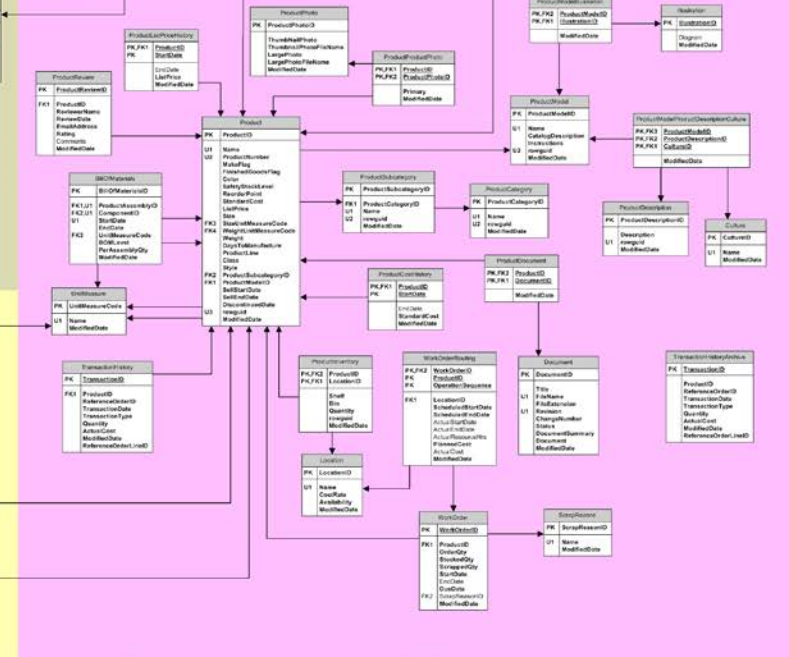
Person



Purchasing

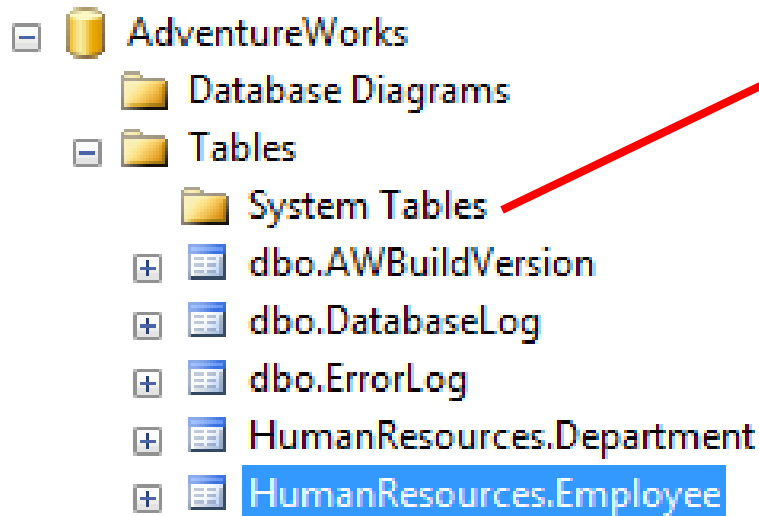


Production





# Tables



## System Tables

The information used by SQL Server and its components is stored in special tables known as system tables.

## User Tables

Tables created by the user



# Table Data

- To view table data right-click on a table and select open table (e.g., Person.Address)

	AddressID	AddressLine1	AddressLine2	City	StateProvinceID	PostalCode	rowguid	ModifiedDa
▶	1	1970 Napa Ct.	<i>NULL</i>	Bothell	79	98011	9aadcb0d-36cf-...	04/01/1998
	2	9833 Mt. Dias Blv.	<i>NULL</i>	Bothell	79	98011	32a54b9e-e034-...	01/01/1999
	3	7484 Roundtree...	<i>NULL</i>	Bothell	79	98011	4c506923-6d1b-...	08/04/2003
	4	9539 Glenside Dr	<i>NULL</i>	Bothell	79	98011	e5946c78-4bcc-...	07/03/1999
	5	1226 Shoe St.	<i>NULL</i>	Bothell	79	98011	fbaff937-4a97-4...	20/01/1999
	6	1399 Firestone ...	<i>NULL</i>	Bothell	79	98011	febfb8191-9804-...	17/03/1999
	7	5672 Hale Dr.	<i>NULL</i>	Bothell	79	98011	0175a174-6c34-...	12/01/2000
	8	6387 Scenic Ave...	<i>NULL</i>	Bothell	79	98011	3715e813-4dca-...	18/01/1999
	9	8713 Yosemite Ct.	<i>NULL</i>	Bothell	79	98011	268af621-76d7-...	01/07/2003
	10	250 Race Court	<i>NULL</i>	Bothell	79	98011	0b6b739d-8eb6-...	03/01/1999
	11	1318 Lasalle Street	<i>NULL</i>	Bothell	79	98011	981b3303-aca2-...	01/04/2003
	12	5415 San Gabrie...	<i>NULL</i>	Bothell	79	98011	1c2c9cfe-ab9f-4...	06/02/2003





# Table Information

[-] [Table Icon] HumanResources.Employee

- [+] [Folder Icon] Columns
- [+] [Folder Icon] Keys
- [+] [Folder Icon] Constraints
- [+] [Folder Icon] Triggers
- [+] [Folder Icon] Indexes
- [+] [Folder Icon] Statistics

## Columns

Data stored on the table, e.g.,  
Firstname, Lastname, Address

## Keys

Special columns e.g., columns  
with unique values (PersonID)

## Constraints

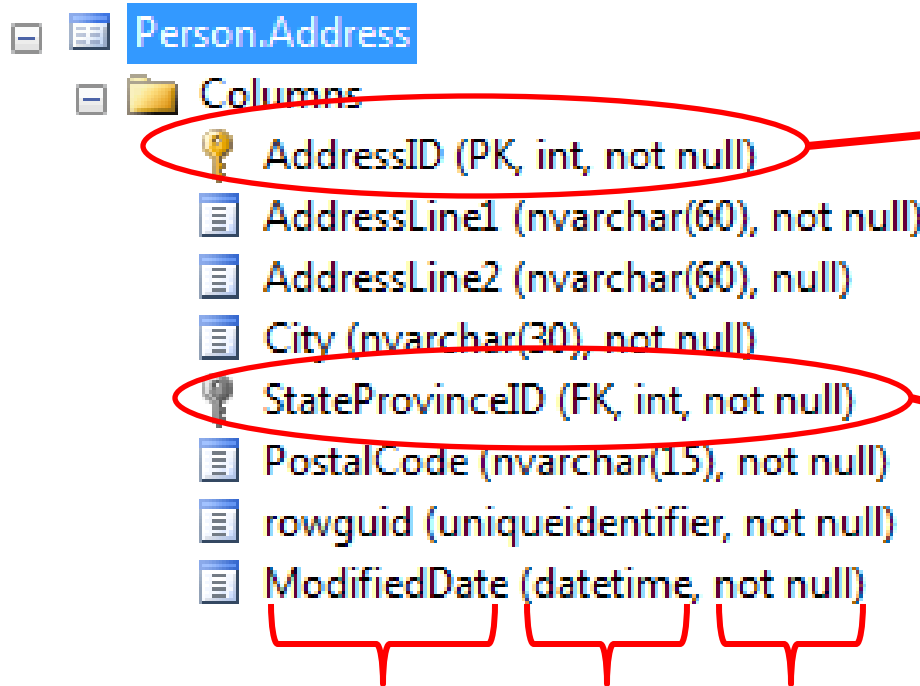
Rules applied to the table, e.g.,  
PersonID must be unique

## Indexes, Statistics

Will talk about them in upcoming  
lectures



# Table - Columns



## Primary Key

Value that uniquely identifies each row of the table

## Foreign Key

The primary key of another table

Column Name	Data Type	Allow Nulls
-------------	-----------	-------------



# SQL Server 2017 Data Types

## Exact Numerics

### Integers

- [bigint](#)  
Integer (whole number) data from  $-2^{63}$  (-9,223,372,036,854,775,808) through  $2^{63}-1$  (9,223,372,036,854,775,807).
- [int](#)  
Integer (whole number) data from  $-2^{31}$  (-2,147,483,648) through  $2^{31} - 1$  (2,147,483,647).
- [smallint](#)  
Integer data from  $-2^{15}$  (-32,768) through  $2^{15} - 1$  (32,767).
- [tinyint](#)  
Integer data from 0 through 255.

### bit

- [bit](#)  
Integer data with either a 1 or 0 value.

## decimal and numeric

- [decimal](#)  
Fixed precision and scale numeric data from  $-10^{38} + 1$  through  $10^{38} - 1$ .
- [numeric](#)  
Functionally equivalent to **decimal**.

## money and smallmoney

- [money](#)  
Monetary data values from  $-2^{63}$  (-922,337,203,685,477.5808) through  $2^{63} - 1$  (+922,337,203,685,477.5807), with accuracy to a ten-thousandth of a monetary unit.
- [smallmoney](#)  
Monetary data values from -214,748.3648 through +214,748.3647, with accuracy to a ten-thousandth of a monetary unit.



# SQL Server 2017 Data Types

## Approximate Numerics

- **float**  
Floating precision number data with the following valid values:  $-1.79E + 308$  through  $-2.23E - 308$ , 0 and  $2.23E + 308$  through  $1.79E + 308$ .
- **real**  
Floating precision number data with the following valid values:  $-3.40E + 38$  through  $-1.18E - 38$ , 0 and  $1.18E - 38$  through  $3.40E + 38$ .

## datetime and smalldatetime

- **datetime**  
Date and time data from January 1, 1753, through December 31, 9999, with an accuracy of three-hundredths of a second, or 3.33 milliseconds.
- **smalldatetime**  
Date and time data from January 1, 1900, through June 6, 2079, with an accuracy of one minute.



# SQL Server 2017 Data Types

## Character Strings

- [char](#)  
Fixed-length non-Unicode character data with a maximum length of 8,000 characters.
- [varchar](#)  
Variable-length non-Unicode data with a maximum of 8,000 characters.
- [text](#)  
Variable-length non-Unicode data with a maximum length of  $2^{31} - 1$  (2,147,483,647) characters.

## Unicode Character Strings

- [nchar](#)  
Fixed-length Unicode data with a maximum length of 4,000 characters.
- [nvarchar](#)  
Variable-length Unicode data with a maximum length of 4,000 characters.  
sysname is a system-supplied user-defined data type that is functionally equivalent to nvarchar(128) and is used to reference database object names.
- [ntext](#)  
Variable-length Unicode data with a maximum length of  $2^{30} - 1$  (1,073,741,823) characters.



# SQL Server 2017 Data Types

## Binary Strings

- [binary](#)  
Fixed-length binary data with a maximum length of 8,000 bytes.
- [varbinary](#)  
Variable-length binary data with a maximum length of 8,000 bytes.
- [image](#)  
Variable-length binary data with a maximum length of  $2^{31} - 1$  (2,147,483,647) bytes.

## Other Data Types

- [cursor](#)  
A reference to a cursor.
- [sql\\_variant](#)  
A data type that stores values of various SQL Server-supported data types, except **text**, **ntext**, **timestamp**, and **sql\_variant**.
- [table](#)  
A special data type used to store a result set for later processing .
- [timestamp](#)  
A database-wide unique number that gets updated every time a row gets updated.
- [uniqueidentifier](#)  
A globally unique identifier (GUID).



# Command prompt access

- SQL Server 2017 support command-line access to databases with `SQLCMD.exe`
- Login with `sqlcmd -U someuser -P somexp@ssword`
- Execute queries:
  - `sqlcmd -d AdventureWorks -q "SELECT FirstName, LastName FROM Person.Contact"`
  - `sqlcmd -d AdventureWorks -q "SELECT TOP 5 FirstName FROM Person.Contact;SELECT TOP 5 LastName FROM Person.Contact;"`
- More info @ <https://docs.microsoft.com/en-us/sql/tools/sqlcmd-utility?view=sql-server-2017>



# Other Information

- Have you send your project group details?