Overview of SQL

Structured Query Language (SQL)

- Developed to support translation from relational algebra to relational database technology.
- ANSI Standardized grammar introduced in 1986
  - Revised periodically; most recently in 2011
  - Standardization allows us to realize the idea of abstraction of the data from its use and access
- ANSI Standard SQL supported by most major database vendors
  - Though each usually offers its own “flavor” by extending the core SQL
  - Oracle: Procedural Language/SQL (PL/SQL)
  - Microsoft SQL Server: Transact-SQL (t-SQL)

SQL Standards

Year	Name	Highlights
1986	SQL-86	First standard, referred to as SQL-87
1989	SQL-89 (SQL1)	Minor revision, SQL baseline
1992	SQL-92 (SQL2)	JOIN syntax added
1999	SQL-99 (SQL3)	Boolean data types, structured user-defined types, recursive queries
2003	SQL:2003	XML support, Windows functions, cursors, identity columns
2006	SQL:2006	XQuery support
2008	SQL:2008	Partitioned JOINs, TRUNCATE TABLE, other enhancements
2011	SQL:2011	Support for temporal databases

SQL: Language Breakdown

Domain	SQL Commands	Objects
Metadata (DDL)	CREATE ALTER DROP	Tables, functions, views, procedures, etc
DATA (DML)	C - INSERT R - SELECT U - UPDATE D - DELETE	Tables (as a target)
Security (DCL)	GRANT REVOKE	Tables, functions, views, procedures, etc.
Transactions (DTL)	BEGIN TRANS COMMIT ROLLBACK	Controls DML statements

SQL Commands

- Data Definition Language
  - Commands that modify the schema (metadata objects)
  - Create and modify tables, functions, views, etc
  - Commands include:
    - Create
    - Alter
    - Drop

```
create table Member (
    MemberID        int identity    not null
    , FirstName     varchar(30)     not null
    , LastName      varchar(30)     not null
    , EmailAddress  varchar(100)
    , PhoneNumber   varchar(30)
    , constraint MemberPrimaryKey primary key(MemberID)
);

alter table Member
    add MiddleInitial varchar(10);

drop table Member;
```

SQL Commands

- Data Manipulation Language (DML)
  - Commands that modify the data
  - CRUD commands
    - Create
    - Retrieve
    - Update
    - Delete

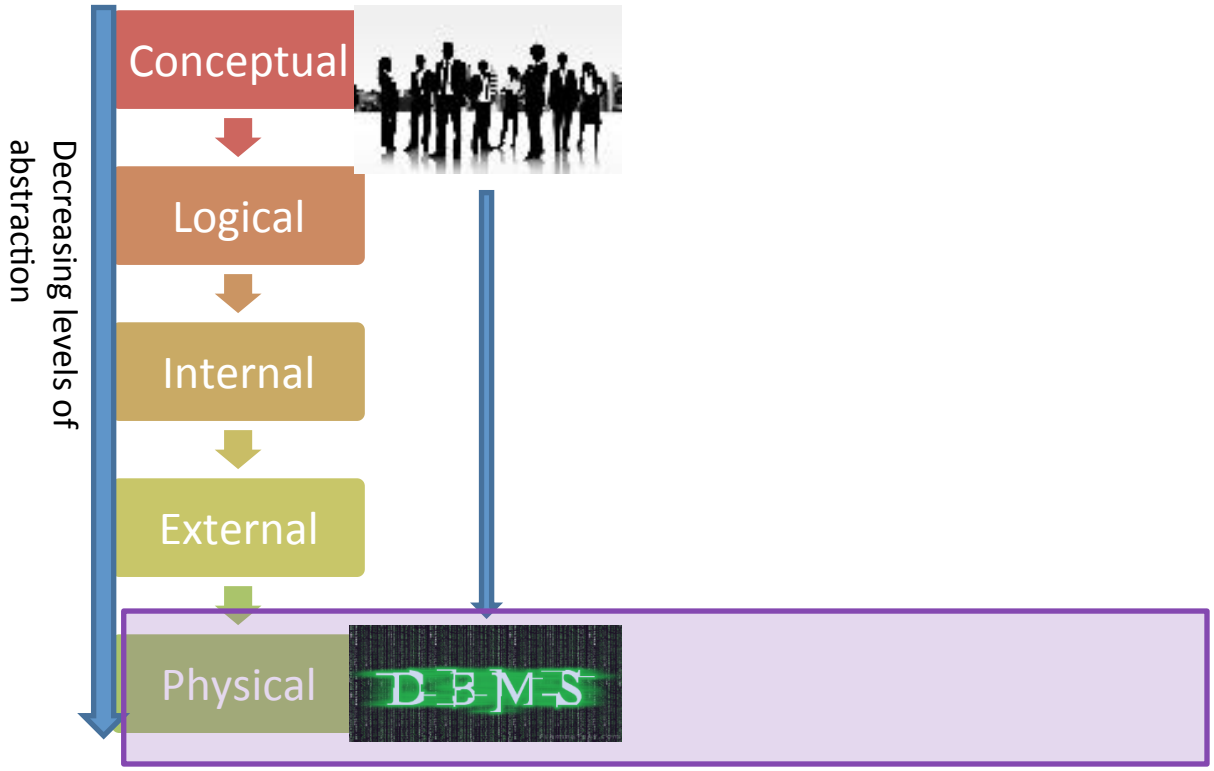
```
insert into Member
    (FirstName, LastName, EmailAddress)
    values
    ('Saul', 'Hudson', 'slash@gnr.com');
insert into Member
    (FirstName, LastName, EmailAddress)
    values
    ('Reginald', 'Dwight', 'ej@rocketman.org');

select * from Member;

update Member set MiddleInitial = 'S' where EmailAddress = 'slash@gnr.com';

delete from Member where EmailAddress = 'ej@rocketman.org';
```

SQL Language Internals

- SQL keywords are case insensitive. “SELECT” and “select” are the same command.
- SQL data comparisons can be case sensitive or case insensitive depending on the DBMS setup.
- SQL isn’t a programming language.

The Physical Domain

Levels of Data Model Abstraction



DBMS : Physical Domain

SQL Server	MySQL	What Is It?
`int`	`int`	Signed Integer values -2G ⇔ +2G
`int identity`	`serial`	Auto-incrementing integer (surrogate keys)
`bit`	`bit`	Used for true/false yes/no values.
`decimal(n,d)`	`decimal(n,d)`	A fixed-point signed decimal of **n** digits with **d** decimal places.
`char(n)`	`char(n)`	Exactly **n** characters, useful for fixed-length data.
`varchar(n)`	`varchar(n)`	Variable length of no more than **n** characters.
`text`	`text`	Variable length of 2G characters; not index able
`datetime`	`datetime`	For storing dates and or times.

Notes:

- Different "flavors" of DBMSs use different data types.
- It's not part of the SQL spec but part of the DBMS implementation.
- There are more types than this. These are the most common.

Numbers and Numeric Data Types

- As a rule, store numeric data as numbers IF AND ONLY IF you're going to do math on the numbers.
- Not good as numeric data types
  - Postal codes
  - Phone numbers
- Avoid `money` as a data type. Use `decimal` instead.
- If you don't need decimal points, always use an integer data type.

Dates and Times

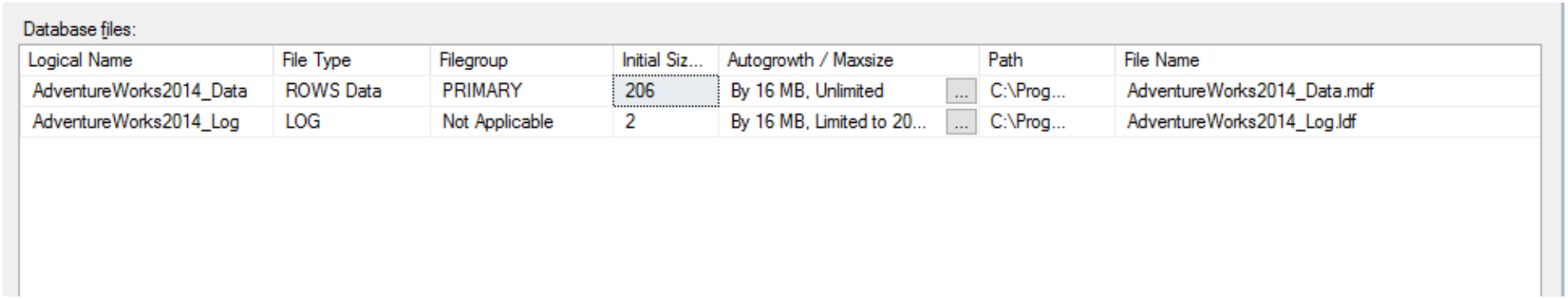
- Use `datetime` for dates and times.
- All computer systems store dates and times as decimal values.
- Everything to the left of the decimal point is the day, month, and year.
- Everything to the right of the decimal is the time in hours, minutes, seconds, and milliseconds.
- For instance, we see: 2016-06-02 23:12:32.783. SQL Server stores it on disk as: 42521.9670461034f

String Data

- `char(n)`, `varchar(n)`, or `text`?
- Avoid `text` as much as possible.
- While `varchar` is nice because it occupies only enough space to accommodate the data, it creates administrative overhead on the retrieval systems
- For the purposes of this class, `varchar` is ok.

Physical Storage

- SQL Server creates two files to store your data:
  - MDF file for the data
  - LDF file for the transaction log


Database files:

Logical Name	File Type	Filegroup	Initial Siz...	Autogrowth / Maxsize		Path	File Name
AdventureWorks2014_Data	ROWS Data	PRIMARY	206	By 16 MB, Unlimited	...	C:\Prog...	AdventureWorks2014_Data.mdf
AdventureWorks2014_Log	LOG	Not Applicable	2	By 16 MB, Limited to 20...	...	C:\Prog...	AdventureWorks2014_Log.ldf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