**What is index and why index:**

Think index as the way that SQL organizes data so that it can find data quickly. An analogy will be the contact list in your phone. Your contacts are organized most likely alphabetically based on their last names and then their first names. So if you need to call “Jane Smith”, you’ll first jump to S, to get to Smith, and then find Jane. That organization system is a type of index. Instead, if all of your contacts are just stored in a “Note” without a particular order, it’ll be difficult to find a person.

**Types of index**

Clustered index

It dictates how the data is physically stored in the database. It’s organized in a tree-like structure to help SQL find specific data fast.

* When SQL searches data that is clustered index, instead of scan the entire table, it’s able to follow the index and make quick decisions on where the data is stored and fetch it. Similar to how you would search your contact list.
* You can only have 1 clustered index per table, because data can only be physical stored in one way or another.
* By default, the PK will be the way that the table is clustered indexed, unless you instruct SQL to do otherwise.

Good candidate for clustered index:

1. Unique
2. Accessed using =, <, > (eg, date)
3. Identity column
4. Used frequently to sort data

Bad candidate:

1. Columns that change a lot
2. Too wide (combination of too many columns)

Non-clustered index:

In addition to a single clustered index, a table can have multiple non-clustered index. Non-clustered index is built upon clustered index if it exists, meaning that it utilizes the infrastructure of clustered index to help find random data fast. Rule of thumb is that:

* Put non-clustered index on all columns that are part of frequent table joins, if the joins are not already covered by the PK.
* Put non-clustered index on any column used in a filter on dashboard.

**Formats of index**

Index can be place on a single column or a combination of columns.

Note: you can choose to name your index, and the name for the index needs to be unique for each table. Or, you can let the system automatically generate a name for you.

**Limitation of index**

Size:

Same as keys, don’t exceed 900byte (~900 English characters). So you can’t put a regular index on varchar(max) column.

Trade-offs:

Due to the way SQL implements index, the more indexes you have in a table, generally the SLOWER your INSERT/UPDATE/DELETE query will run. You are trading this off for a better performance for SELECT/GROUP BY/WHERE type of query.

**Additional reading:**

Basic index: <https://www.simple-talk.com/sql/learn-sql-server/sql-server-index-basics/>

Create index: <https://msdn.microsoft.com/en-us/library/ms188783.aspx>