Cool SQL Server Features Everyone Should Know About

David Berry
@DavidCBerry13
https://github.com/DavidCBerry13/CoolSqlServerFeatures/

We all use SQL Server every day...

...we might as well be good at it.

Agenda

Temporal Tables

JSON Support

Window Functions

Temporal Tables

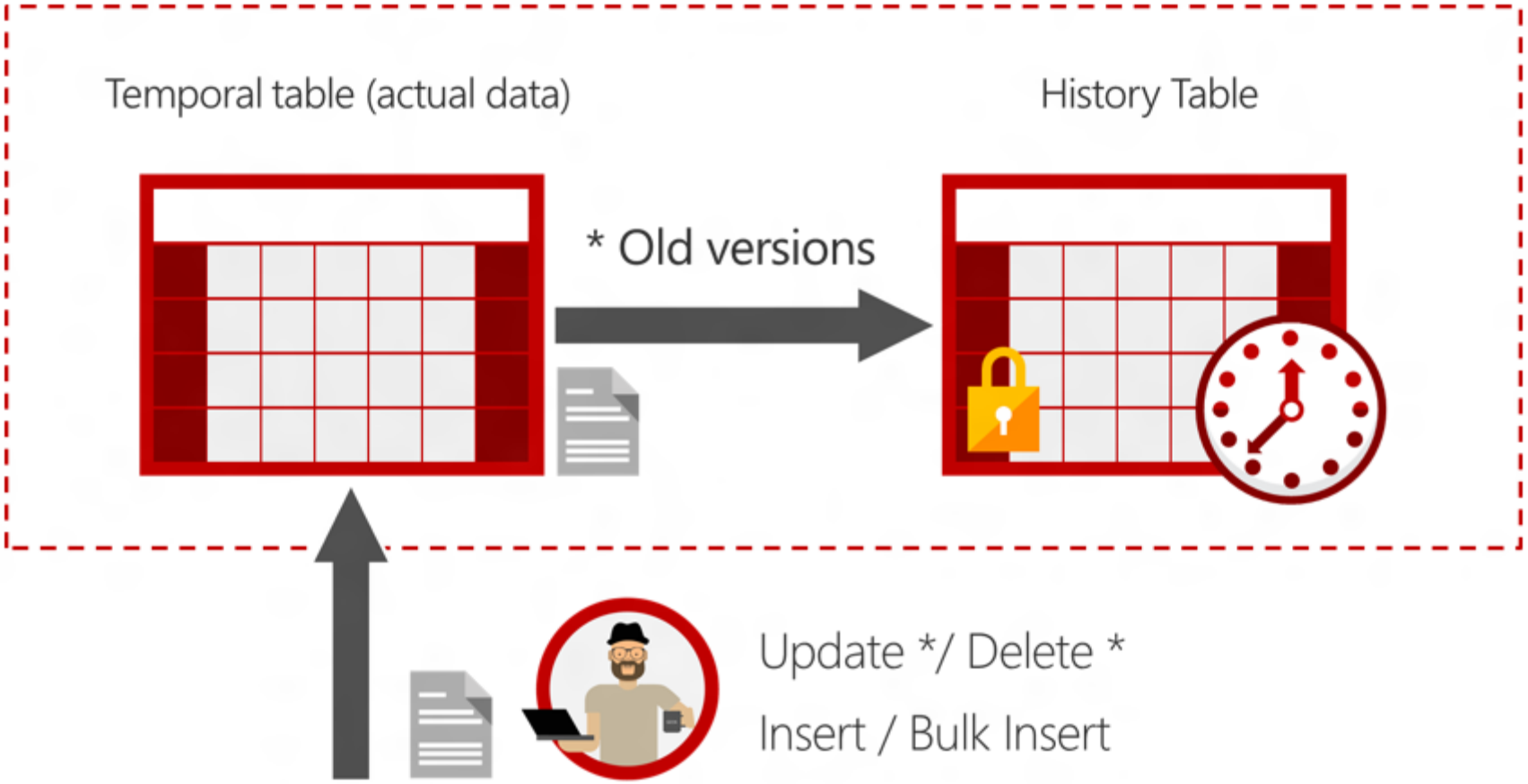
Available in SQL Server 2016, SQL Azure

Every time a row is changed, SQL Server keeps a snapshot of the old row values

SQL constructs allow us to see what the value was at any given date/time

No need to implement your own triggers, history tables and views

Temporal Table Concept



https://docs.microsoft.com/en-us/sql/relational-databases/tables/temporal-tables

CREATE TABLE Syntax

```
CREATE TABLE Contacts
(
    ContactID        INT IDENTITY(1,1)      NOT NULL,
    FirstName        VARCHAR(30)            NOT NULL,
    LastName         VARCHAR(30)            NOT NULL,
    CompanyName      VARCHAR(30)            NULL,
    PhoneNumber      VARCHAR(20)            NULL,
    Email            VARCHAR(50)            NULL,
    ValidFrom        DATETIME2(3) GENERATED ALWAYS AS ROW START,
    ValidTo          DATETIME2(3) GENERATED ALWAYS AS ROW END,
    PERIOD FOR SYSTEM_TIME (ValidFrom, ValidTo),
    CONSTRAINT PK_Contacts PRIMARY KEY (ContactId)
)
WITH (SYSTEM_VERSIONING = ON
    (HISTORY_TABLE = dbo.ContactsHistory));
```

Hiding ValidFrom and ValidTo Columns

```
-- Hide the ValidFrom and ValidTo columns
ALTER TABLE Contacts
   ALTER COLUMN ValidFrom ADD HIDDEN;

ALTER TABLE Contacts
   ALTER COLUMN ValidTo ADD HIDDEN;


-- Show the ValidFrom and ValidTo Columns
ALTER TABLE Contacts
   ALTER COLUMN ValidFrom DROP HIDDEN;

ALTER TABLE Contacts
   ALTER COLUMN ValidTo DROP HIDDEN;
```

Querying Temporal Tables

```
-- Get all currently valid rows (query just like a normal table)
SELECT *
    FROM Contacts;

-- Get the rows that were valid at a certain date/time
SELECT *
    FROM Contacts
        FOR SYSTEM_TIME AS OF AS OF '2017-04-12 14:00:00.000';

-- Get all versions of all rows that have ever existed in the table
SELECT *
    FROM Contacts
        FOR SYSTEM_TIME ALL;

-- Get all versions of a row for a given key in a table (basically a history of this row)
SELECT *
    FROM Contacts
        FOR SYSTEM_TIME ALL
    WHERE ContactId = 1;
```

Temporal Table Query Qualifiers

Expression	Description
AS OF <date time>	Gets all of the rows that were active at the specified date and time
FROM <start time> TO <end time>	Gets all of the rows that were active at any point during the specified time period, excluding rows that were only active at the start time or end time
BETWEEN <start time> AND <end time>	Gets all rows active in the time period including rows that became active at the ending time of the period
CONTAINED IN (<start time>, <end time>)	Gets all rows that were opened and closed in the period specified
ALL	Get all rows in the table and the history table

Converting an Existing Table to a Temporal Table

```sql
-- Step 1 – Add the columns and period
ALTER TABLE Contacts ADD
    ValidFrom DATETIME2(3) GENERATED ALWAYS AS ROW START
        NOT NULL DEFAULT '1900-01-01 00:00:00.000',
    ValidTo   DATETIME2(3)  GENERATED ALWAYS AS ROW END
        NOT NULL DEFAULT '9999-12-31 23:59:59.999’,
    PERIOD FOR SYSTEM_TIME (ValidFrom, ValidTo);

-- Step 2 – Turn on System Versioning and define the history table
ALTER TABLE Employees
    SET (SYSTEM_VERSIONING = ON (HISTORY_TABLE = dbo.ContactsHistory));
```

JSON Support

Available in SQL Server 2016, SQL Azure

JSON data stored in a VARCHAR data type

Functions available to interact with JSON data

Allows us to mix relational and NoSQL data models in the same database

Storing JSON in Tables

```
CREATE TABLE WeatherDataJson
(
    ObservationId     INT IDENTITY(1,1)  NOT NULL,
    StationCode       VARCHAR(10)        NOT NULL,
    City              VARCHAR(30)        NOT NULL,
    State             VARCHAR(2)         NOT NULL,
    ObservationDate   DATETIME           NOT NULL,
    ObservationData   VARCHAR(4000)      NOT NULL,
    CONSTRAINT PK_WeatherDataJson
        PRIMARY KEY (ObservationId)
);
```

Getting Data From a JSON Column

JSON_VALUE	Extract a scalar value from a JSON String
JSON_QUERY	Extract an object or an array from a JSON String
OPENJSON	Table value function used for parsing JSON and returning a rowset view of the data

Querying Scalar Values

```
SELECT
        ObservationId,
        StationCode,
        City,
        State,
        ObservationDate,
        JSON_VALUE(ObservationData, '$.dryBulbFarenheit') As Temperature,
        JSON_VALUE(ObservationData, '$.relativeHumidity') As Humidity,
        ObservationData
    FROM WeatherDataJson
    WHERE State = 'WI’
        AND City = 'Milwaukee’
        AND ObservationDate > '2016-08-15’
        AND ObservationDate < '2016-08-16';
```

Exposing JSON Values With Computed Columns

```
-- Create a computed column on the table
ALTER TABLE WeatherDataJson
  ADD Temperature AS
    (JSON_VALUE(ObservationData,'$.dryBulbFarenheit’));


--This column can now be queried like any other column
```

Querying Values in JSON Arrays

```
SELECT
        ObservationId,
        StationCode,
        City,
        State,
        ObservationDate,
        CONVERT(datetime, JSON_VALUE(Observations.[Value], '$.observationDateTime'), 126)
As ObservationTime,
        JSON_VALUE(Observations.[Value], '$.dryBulbFarenheit') As Temperature,
        JSON_VALUE(Observations.[Value], '$.relativeHumidity') As Humidity,
        JSON_VALUE(Observations.[Value], '$.windDirection') As WindDirection,
        JSON_VALUE(Observations.[Value], '$.windSpeed') As WindSpeed
    FROM DailyWeatherDataJson d
    CROSS APPLY OPENJSON(JSON_QUERY(ObservationData, '$.weatherObservations'))
Observations
    WHERE City = 'Milwaukee'
    AND State = 'WI'
    AND ObservationDate = ('2016-08-15');
```

Return Results As JSON

```
SELECT
        s.StationCode,
        s.City,
        s.State,
        observations.ObservationDate,
        observations.DryBulbFarenheit As Temperature,
        observations.RelativeHumidity,
        observations.WindDirection,
        observations.WindSpeed
    FROM WeatherStations s
    INNER JOIN WeatherObservations observations
        ON s.StationCode = observations.StationCode
    WHERE
        observations.ObservationDate > '2016-06-01'
        AND observations.ObservationDate < '2016-06-07'
    FOR JSON AUTO;
```

Column or alias names used for property names

Alias used as name of child object

Window Functions

Available in SQL Server 2008 and later, SQL Azure

Extended functionality over traditional GROUP BY queries

Can partition and aggregate data by different criteria in the same statement

Greatly enhances reporting capabilities in SQL Server

Window Functions

Ranking Functions

ROW_NUMBER
RANK
DENSE_RANK
NTILE

Aggregate Functions

AVG
COUNT
SUM
MIN
MAX
STDEV
STDEVP
VAR
VARP
CHECKSUM_AGG

Analytic Functions

LAG
LEAD
FIRST_VALUE
LAST_VALUE
CUME_DIST
PERCENTILE_CONT
PERCENTILE_DISC
PERCENTILE_RANK

Window Function Syntax

```
SELECT DISTINCT
    City,
    State
    CONVERT(DATE, ObservationDate) AS SummaryDate,
    RANK()
        OVER (PARTITION BY City, State, CONVERT(DATE, ObservationDate)
        ORDER BY DailyHighTemp DESC) As HighTemp
FROM DailyWeatherSummaries o
WHERE
    State = 'WI'
      AND ObservationDate BETWEEN '2016-05-01' AND '2016-06-01';
```

PARTITION BY	Splits the result set into different partitions or groups using these columns
ORDER BY	Orders the rows within each partition for functions where order is important (not used in for some functions)

Window Function Grouping

```
RANK()
    OVER (PARTITION BY City, State, CONVERT(DATE, ObservationDate)
    ORDER BY DailyHighTemp DESC) As HighTemp
```

City	State	SummaryDate	DailyHighTemp	Rank()
Chicago	IL	2017-06-01	65	1
Chicago	IL	2017-06-01	63	2
Chicago	IL	2017-06-01	62	3
Chicago	IL	2017-06-02	67	1
Chicago	IL	2017-06-02	65	2
Chicago	IL	2017-06-02	63	3
Milwaukee	WI	2017-06-01	71	1
Milwaukee	WI	2017-06-01	70	2
Milwaukee	WI	2017-06-01	68	3

Partition Group

Partition Group

Partition Group

Partition Columns

Sort Column

Ranking Window Functions

ROW_NUMBER()	Creates sequential number of a row within a partition of a result set, starting at 1 for the first row in each partition
RANK()	Returns the rank of each row within the partition of a result set. If there two or more values tie for a rank, then there will be a gap to the next ranking
DENSE_RANK()	Returns the rank of each row within the partition of a result set without any gaps between rankings in event of multiple values for the same rank
NTILE(<integer>)	Distributes the rows in the partition into the specified number of buckets (groups) and shows what bucket that row falls in.

Analytic Window Functions

FIRST_VALUE(<column>)	Returns the first value of the partition as sorted by the ORDER BY clause
LAST_VALUE(<column>)	Returns the last value of the partition as sorted by the ORDER BY clause
LAG(<column>, <offset>, <default>)	Returns the preceding value in the partition. Offset (optional) allows you to reach back multiple rows. Default (optional) allows a default value to be specified
LEAD(<column>, <offset>, <default>)	Returns the next value in the partition. Offset (optional) allows you to reach forward multiple rows. Default (optional) allows a default value to be specified

Resources

Temporal Tables

https://docs.microsoft.com/en-us/sql/relational-databases/tables/temporal-tables

JSON Functions

https://docs.microsoft.com/en-us/sql/t-sql/functions/json-functions-transact-sql

https://www.simple-talk.com/sql/learn-sql-server/json-support-in-sql-server-2016/

Window Functions

https://docs.microsoft.com/en-us/sql/t-sql/queries/select-over-clause-transact-sql

https://www.simple-talk.com/sql/learn-sql-server/window-functions-in-sql-server/

MERGE Statement

Available in SQL Server 2008 and later, SQL Azure

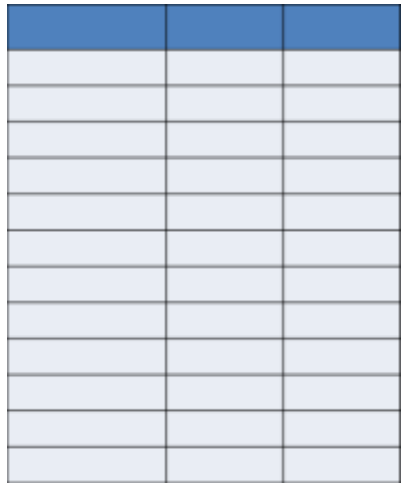
Essentially provides and “UPSERT” capability

Useful when doing bulk updates to tables

Can be useful for setting reference data in DEV databases

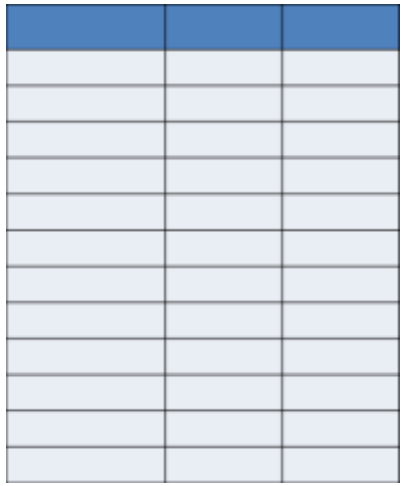
Problem Scenario

Source Table



*May contain records
already in our data table

Target Table



Use a MERGE statement
to perform an UPSERT