

Blackbaud CRM™ DEVELOPERS' CONFERENCE

KEEGAN WADE

Solutions Architect,
Blackbaud



Introduction to Data Warehouse Extensions

KEEGAN WADE

Solutions Architect
Blackbaud



Keegan Wade

linkedin.com/in/keeganwade

keegan.wade@blackbaud.com

TITLE

Solutions Architect

AT BLACKBAUD

Since 2006

HOMETOWN

London, Ontario

ABOUT ME

I am a long-time CRM customization developer who has more recently come into the data warehouse customization fold.



Extending the Data Warehouse (DW)

- DW extensions are an important tool in the SDK customization toolbelt
- Goal #1: Experience the DW extension design and dev process
- Goal #2: Demonstrate how to build an archival table in the DW
- Questions and comments – end of presentation

CRM comes with two databases

- Transactional (OLTP) database
- Data warehouse (DW) database

Why create a data warehouse extension?

- When we want to a field in the DW that does not yet exist there

How to create a DW extension

- Always two main steps involved:
 - 1) Create a new table
 - 2) Populate the table


Business requirement!

- Let's say our organization needs to create a report that displays a list of constituents, including the **most recent constituency for each constituent**
- The report will be used heavily during business hours
- To minimize the burden on the system, the report should run against the data warehouse



Constituency

- A constituency is a way in which a constituent relates to your organization

**Robert C. Hernandez**


Notifications: "Prospect research request is open". [Click here for more information.](#)

Individual

Lookup ID: 96

Constituencies: [Alumnus](#) [Board member](#) [Major donor](#) [Event registrant](#) [Student](#) [Volunteer](#)

Personal Information



Dr. Robert Carlos Hernandez
Nickname: Bob
Maiden:

Contact Information

Primary phone

303-997-3301 (Home)

Primary email

rhernandez@net.com (Email)

Addresses

27 Parkview Road
Manchester, CO 03109
Business (Current)

Primary

Spouse
Wend
House
Wend
Primary
Davis

[Show less](#)

Security

Summary

Contact

Personal Info

Relationships

Revenue

Sales Orders

Memberships

Volunteer

Funds Receiv

Personal

Constituencies

Constituencies (7)

[Add](#)

[Filters](#)

[More](#)

Description	Date from	Date to	Active
Alumnus	8/31/1987		
Board member	1/1/2003		
Donor	3/3/2000		
Event registrant	1/28/2000		
Major donor			
Student			
Volunteer			

Blackbaud Community

Guides (SDK/API)

Reference

User Guides

Sections

Other versions

Compare versions

FACT_CONSTITUENCY (4.0)

The Constituency fact associates constituents to constituencies. This includes user defined constituencies as well as system defined ones (Volunteer, Board Member, Fundraiser, Group Member, Staff, and Committee).

Primary Key

Primary Key				Field Type
-------------	--	--	--	------------

Fields

Field	Field Type	Null	Notes	Description
CONSTITUENCYFACTID	int	false		Surrogate key for the Constituency fact.
CONSTITUENCYSYSTEMID	uniqueidentifier	true		dbo.[CONSTITUENCY].[ID]
CONSTITUENTDIMID	int	true		Reference key to the constituent dimension
CONSTITUENTSYSTEMID	uniqueidentifier	true		dbo.[CONSTITUENCY].[CONSTITUENTID]
CONSTITUENCYDIMID	int	true		Reference key to the constituency dimension, derived from dbo.[CONSTITUENCY].[CONSTITUENCYCODEID]
FROMDATEDIMID	int	true		Reference key to the date dimension, derived from dbo.[CONSTITUENCY].[FROMDATE]
FROMDATE	datetime	true		dbo.[CONSTITUENCY].[DATEFROM]
TODATEDIMID	int	true		Reference key to the date dimension, derived from dbo.[CONSTITUENCY].[TODATE]
TODATE	datetime	true		dbo.[CONSTITUENCY].[DATETO]
ISCURRENTCONSTITUENCY	bit	true		Flag indicating if the constituent constituency is currently active.
ISINCLUDED	bit	true		Flag indicating when data should be included in results.
ETLCONTROLID	int	true		ID generated through the ETL process
SOURCEDIMID	int	true		Source system used

DW Constituency Fields

- Double check “most recent constituency” does not already exist
- ([Link to DW tables](#))

Add a new table

- Copy and paste an existing DW table

```
SQLQuery8.sql - R...UD\KeeganWa (80))* X
CREATE TABLE [BBDW].[FACT_CONSTITUENCYMEASURES_EXT](

    [ISINCLUDED] bit NULL,
    [ETLCONTROLID] int NULL,
    [SOURCEDIMID] tinyint NULL,

    CONSTRAINT [PK_FACT_CONSTITUENCYMEASURES_EXT] PRIMARY KEY CLUSTERED (
        [SOURCEDIMID] ASC
    ) WITH (PAD_INDEX = OFF,
        STATISTICS_NORECOMPUTE = OFF,
        IGNORE_DUP_KEY = OFF,
        ALLOW_ROW_LOCKS = ON,
        ALLOW_PAGE_LOCKS = ON,
        FILLFACTOR = 90)
    ON [BBRPT_FACTGROUP]

) ON [BBRPT_FACTGROUP]
```

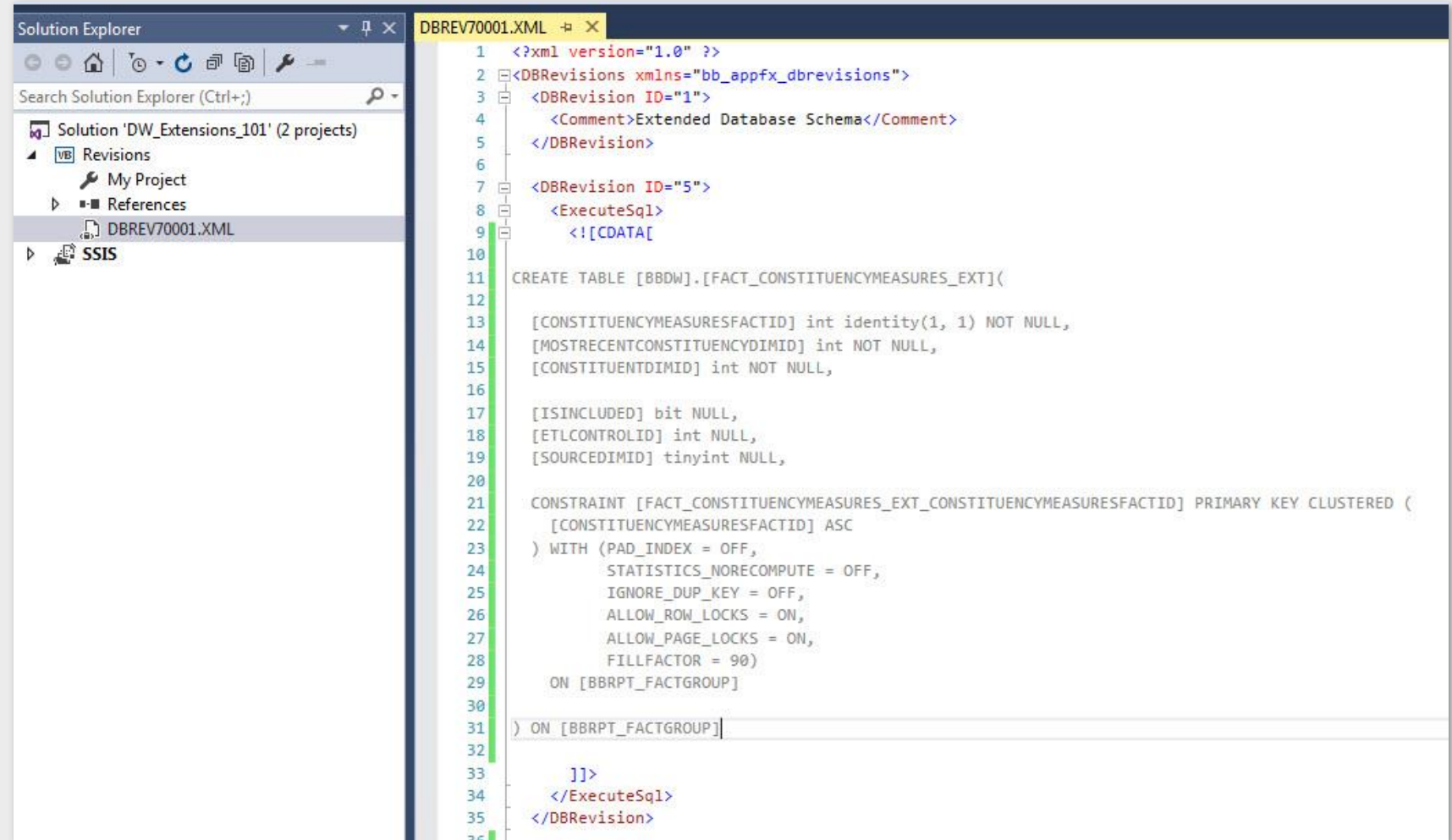
Add a new table

- Three main fields:
 1. Primary key
 2. Most recent constituency link
 3. Constituent link

```
SQLQuery8.sql - R...UD\KeeganWa (80))* X
CREATE TABLE [BBDW].[FACT_CONSTITUENCYMEASURES_EXT](
    [CONSTITUENCYMEASURESFACTID] int identity(1, 1) NOT NULL,
    [MOSTRECENTCONSTITUENCYDIMID] int NOT NULL,
    [CONSTITUENTDIMID] int NOT NULL,
    [ISINCLUDED] bit NULL,
    [ETLCONTROLID] int NULL,
    [SOURCEDIMID] tinyint NULL,
    CONSTRAINT [FACT_CONSTITUENCYMEASURES_EXT_CONSTITUENCYMEASURESFACTID] PRIMARY KEY CLUSTERED (
        [CONSTITUENCYMEASURESFACTID] ASC
    ) WITH (PAD_INDEX = OFF,
        STATISTICS_NORECOMPUTE = OFF,
        IGNORE_DUP_KEY = OFF,
        ALLOW_ROW_LOCKS = ON,
        ALLOW_PAGE_LOCKS = ON,
        FILLFACTOR = 90)
    ON [BBRPT_FACTGROUP]
) ON [BBRPT_FACTGROUP]
```

Add a new table

- Copy our sql to a “revision file” in Visual Studio



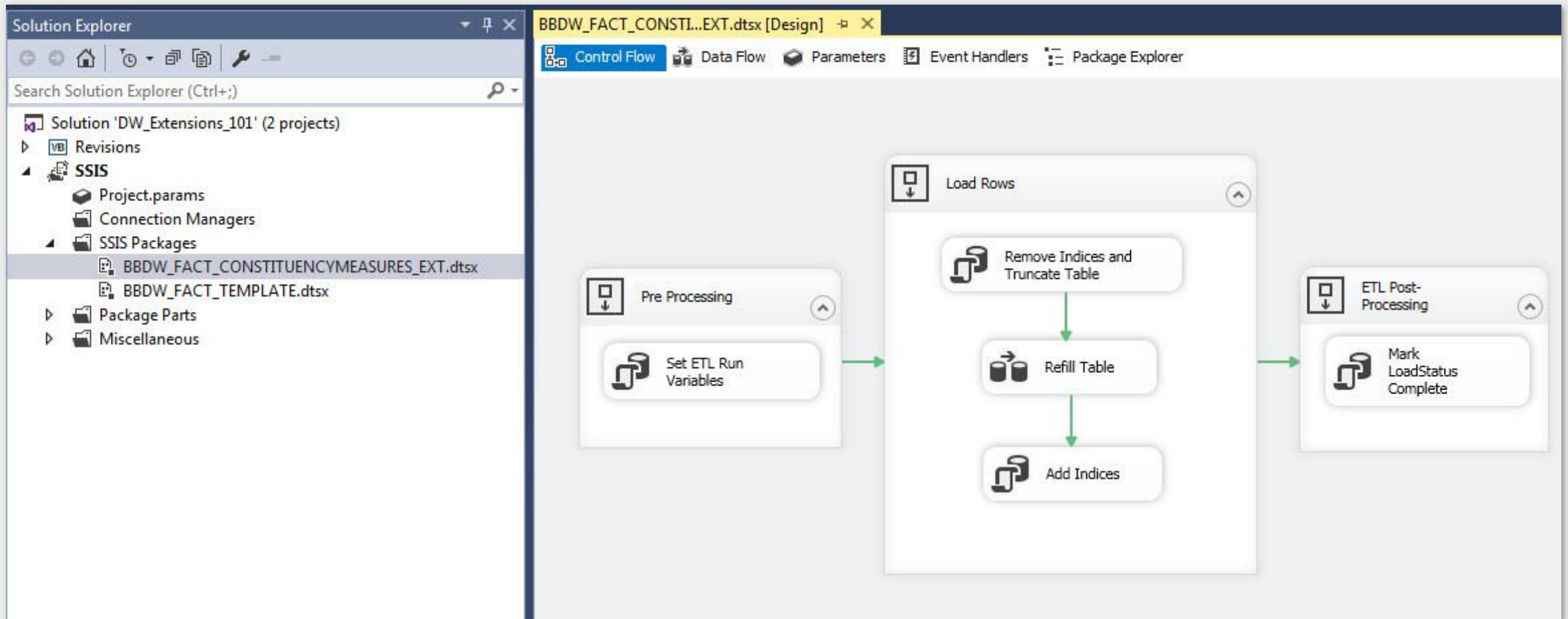
The screenshot shows the Visual Studio interface. On the left, the Solution Explorer displays a project named 'DW_Extensions_101' with two sub-projects: 'Revisions' and 'My Project'. Under 'Revisions', there is a file named 'DBREV70001.XML'. The main editor window shows the content of this XML file, which is an XML document with a root element 'DBRevisions' and two 'DBRevision' elements. The first 'DBRevision' has an ID of '1' and contains a comment. The second 'DBRevision' has an ID of '5' and contains an 'ExecuteSql' element with a CDATA section containing SQL code to create a table.

```
<?xml version="1.0" ?>
<DBRevisions xmlns="bb_appfx_dbrevisions">
  <DBRevision ID="1">
    <Comment>Extended Database Schema</Comment>
  </DBRevision>
  <DBRevision ID="5">
    <ExecuteSql>
      <![CDATA[
CREATE TABLE [BBDW].[FACT_CONSTITUENCYMEASURES_EXT](
  [CONSTITUENCYMEASURESFACTID] int identity(1, 1) NOT NULL,
  [MOSTRECENTCONSTITUENCYDIMID] int NOT NULL,
  [CONSTITUENTDIMID] int NOT NULL,
  [ISINCLUDED] bit NULL,
  [ETLCONTROLID] int NULL,
  [SOURCEDIMID] tinyint NULL,
  CONSTRAINT [FACT_CONSTITUENCYMEASURES_EXT_CONSTITUENCYMEASURESFACTID] PRIMARY KEY CLUSTERED (
    [CONSTITUENCYMEASURESFACTID] ASC
  ) WITH (PAD_INDEX = OFF,
    STATISTICS_NORECOMPUTE = OFF,
    IGNORE_DUP_KEY = OFF,
    ALLOW_ROW_LOCKS = ON,
    ALLOW_PAGE_LOCKS = ON,
    FILLFACTOR = 90)
  ON [BBRPT_FACTGROUP]
) ON [BBRPT_FACTGROUP]

]]>
    </ExecuteSql>
  </DBRevision>
```

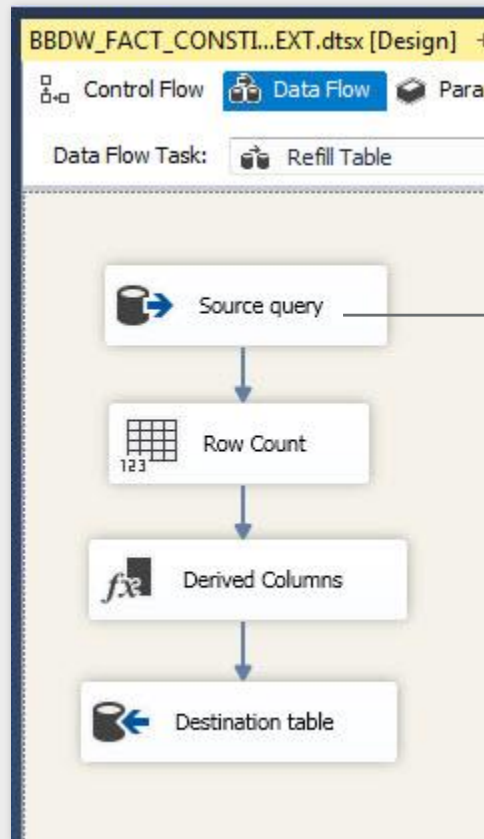

Populate the table i.e. ETL

- Copy and paste a template SSIS package
- Let's use a simple “truncate and refill” strategy



Populate the table i.e. ETL

- In the “Refill Table” dataflow component, query the most recent constituency for each constituent



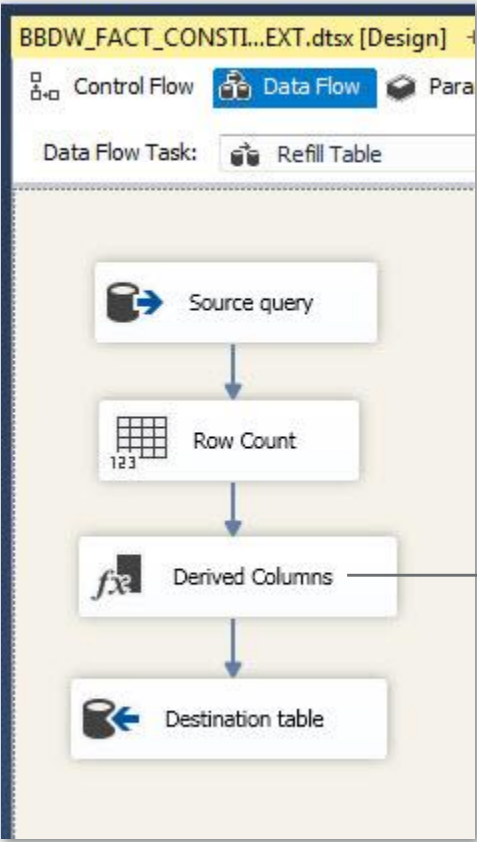
```
with CONSTITUENCYRANKINGS(MOSTRECENTDATERANK, CONSTITUENTDIMID, CONSTITUENCYDIMID) as
(
    select
        -- rank the most recent constituency "FROMDATE" value for each constituent
        row_number() over (partition by fc.CONSTITUENTDIMID order by fc.FROMDATE desc) as MOSTRECENTFROMDATE,

        fc.CONSTITUENTDIMID,
        fc.CONSTITUENCYDIMID
    from bbdw.FACT_CONSTITUENCY fc
    join bbdw.DIM_CONSTITUENCY dc on dc.CONSTITUENCYDIMID = FC.CONSTITUENCYDIMID
)

select
    CONSTITUENTDIMID,
    CONSTITUENCYDIMID as MOSTRECENTCONSTITUENCYDIMID
from CONSTITUENCYRANKINGS
where MOSTRECENTDATERANK = 1 -- we want the most recent one for each constituent
```

Populate the table i.e. ETL

- (Get values for the necessary administrative fields)



Derived Column Transformation Editor

Specify the expressions used to create new column values, and indicate whether the values update existing columns or populate new columns.

+

 Variables and Parameters

+

 Columns

+

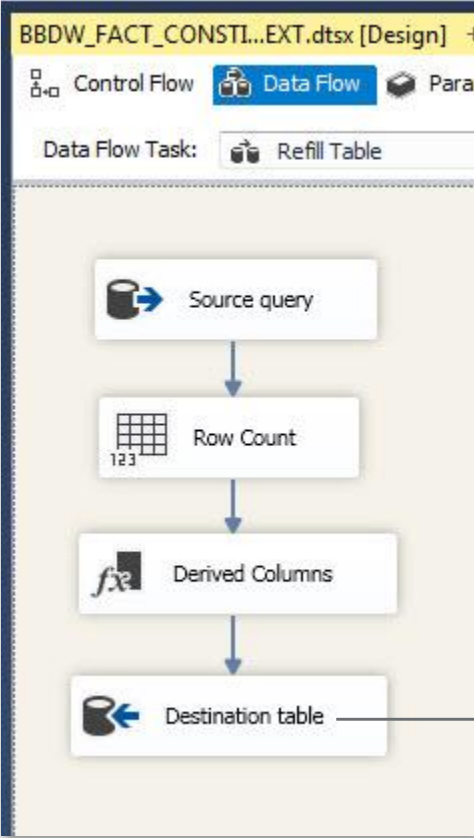
 Mathematical Functions

+

 String Functions

+

Populate the table i.e. ETL



Data access mode:

Table or view - fast load

Name of the table or the view:

[BBDW].[FACT_CONSTITUENCYMEASURES_EXT]

Connection Manager

Mappings

Error Output

Available Input Columns

Name

CONSTITUENTDIMID
MOSTRECENTCONSTITUENCYDIMID
ISINCLUDED
SOURCEDIMID
ETLCONTROLID

Available Destination Columns

Name

ISINCLUDED
ETLCONTROLID
SOURCEDIMID
CONSTITUENCYMEASURESFACTID
MOSTRECENTCONSTITUENCYDIMID
CONSTITUENTDIMID

Input Column	Destination Column
ISINCLUDED	ISINCLUDED
ETLCONTROLID	ETLCONTROLID
SOURCEDIMID	SOURCEDIMID
<ignore>	CONSTITUENCYMEASURESFACTID
MOSTRECENTCONSTITUENCYDIMID	MOSTRECENTCONSTITUENCYDIMID
CONSTITUENTDIMID	CONSTITUENTDIMID

Results

- After running the ETL:

```
select d.CONSTITUENCY, m.*
from bbdw.FACT_CONSTITUENCYMEASURES_EXT m
join bbdw.DIM_CONSTITUENCY d on d.CONSTITUENCYDIMID = m.MOSTRECENTCONSTITUENCYDIMID
join bbdw.DIM_CONSTITUENT c on c.CONSTITUENTDIMID = m.CONSTITUENTDIMID
where c.FULLNAME = 'Robert C. Hernandez'
```

100 %

Results

Messages

	CONSTITUENCY	CONSTITUENCYMEASURESFACTID	MOSTRECENTCONSTITUENCYDIMID	CONSTITUENTDIMID	ISINCLUDED	ETLCONTROLID	SOURCEDIMID
1	Board member	501	13	716	1	0	1

- This reflects what we saw in the frontend

Security	Summary	Contact	Personal Info	Relationships	Revenue	Sales Orders	Memberships	Volunteer	Funds Recei
Personal		Constituencies							
Constituencies (7) + Add Y Filters 2 More									
	Description	Date from	Date to	Active					
<input checked="" type="checkbox"/>	Alumnus	8/31/1987		<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Board member	1/1/2003		<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Donor	3/3/2000		<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Event registrant	1/28/2000		<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Major donor			<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Student			<input checked="" type="checkbox"/>					
<input checked="" type="checkbox"/>	Volunteer			<input checked="" type="checkbox"/>					

Business requirement!

- The CRM developers and users at our organization really like this new “most recent constituency” field, but sometimes they want to see a history of how it has changed over time for constituents
- **Solution:** Store “versions” of our field as it changes for constituents in an archival or “slowly changing” table.
- Make the table contents permanent, even if users choose to “reset the ETL”.



Revise our table (or create a new one)

Old table

```
CREATE TABLE [BBDW].[FACT_CONSTITUENCYMEASURES_EXT](  
  
    [CONSTITUENCYMEASURESFACTID] int identity(1, 1) NOT NULL,  
    [MOSTRECENTCONSTITUENCYDIMID] int NOT NULL,  
    [CONSTITUENTDIMID] int NOT NULL,
```

New table

```
CREATE TABLE [BBDW].[FACT_MOSTRECENTCONSTITUENCY_EXT](  
  
    [MOSTRECENTCONSTITUENCYFACTID] int identity(1, 1) NOT NULL,  
    [MOSTRECENTCONSTITUENCY] nvarchar(100) NOT NULL,  
    [CONSTITUENTSYSTEMID] uniqueidentifier NOT NULL,  
  
    [STARTDATEDIMID] int NOT NULL,  
    [ENDDATEDIMID] int NULL,
```

- Most recent constituency: Want a snapshot of the value at the time the ETL runs
- Constituent ID: Dim IDs not static, System IDs are
- “Start date” and “End date” fields - all about ETL, NOT constituency from/to dates

Revise our ETL

- How to accomplish this in SSIS?

Revise our ETL

- Start with the same query as before:

```
-- find the most recent constituency for each constituent
;with CONSTITUENCYRANKINGS as
(
  select
    -- rank the most recent constituency "FROMDATE" value for each constituent
    row_number() over (partition by fc.CONSTITUENTSYSTEMID order by fc.FROMDATEDIMID desc) as MOSTRECENTDATERANK,
    fc.CONSTITUENTSYSTEMID,
    dc.CONSTITUENCY

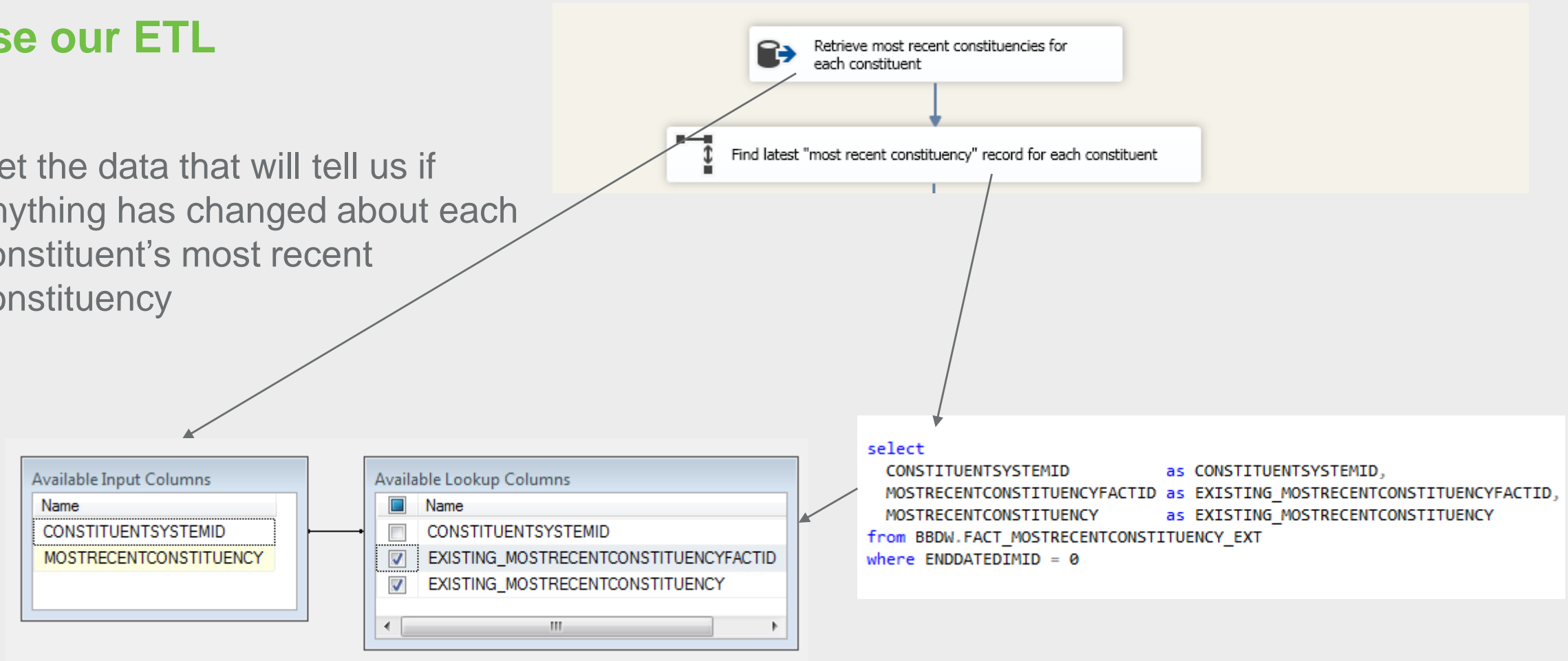
  from bbdw.FACT_CONSTITUENCY fc
  join bbdw.DIM_CONSTITUENCY dc on dc.CONSTITUENCYDIMID = FC.CONSTITUENCYDIMID
)
select
  CONSTITUENTSYSTEMID,
  CONSTITUENCY as MOSTRECENTCONSTITUENCY
from CONSTITUENCYRANKINGS
where MOSTRECENTDATERANK = 1 -- retrieve the most recent constituency for each constituent
```



Retrieve most recent constituencies for each constituent

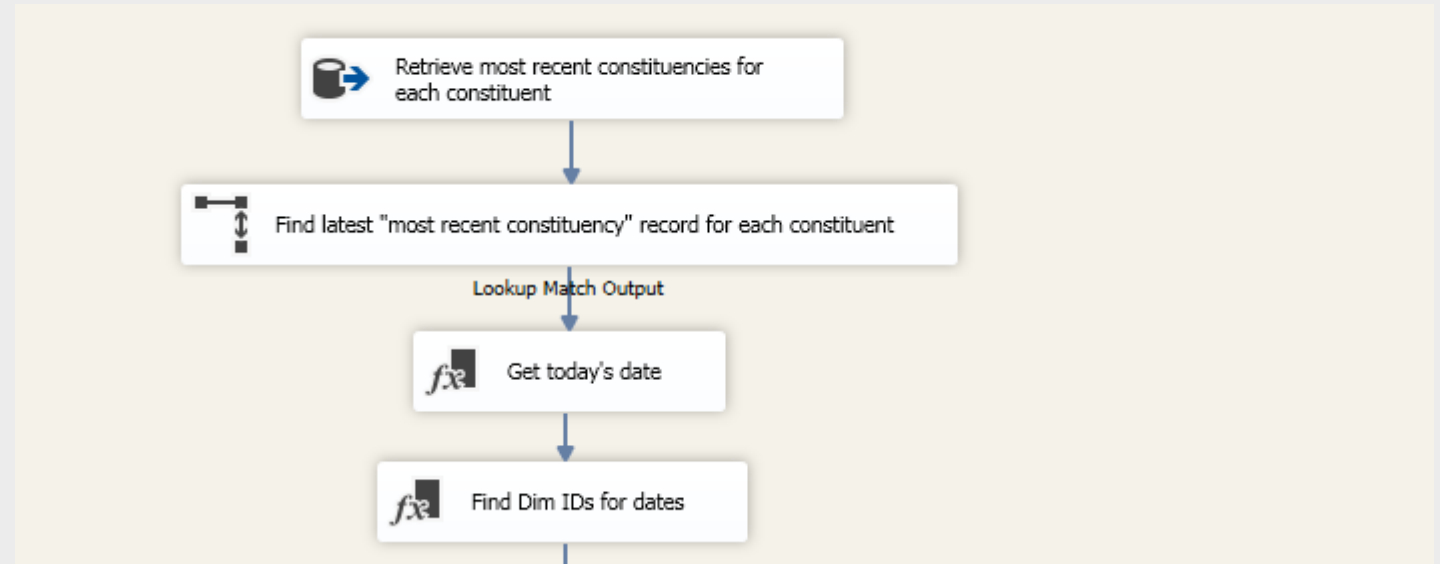
Revise our ETL

- Get the data that will tell us if anything has changed about each constituent's most recent constituency



Revise our ETL

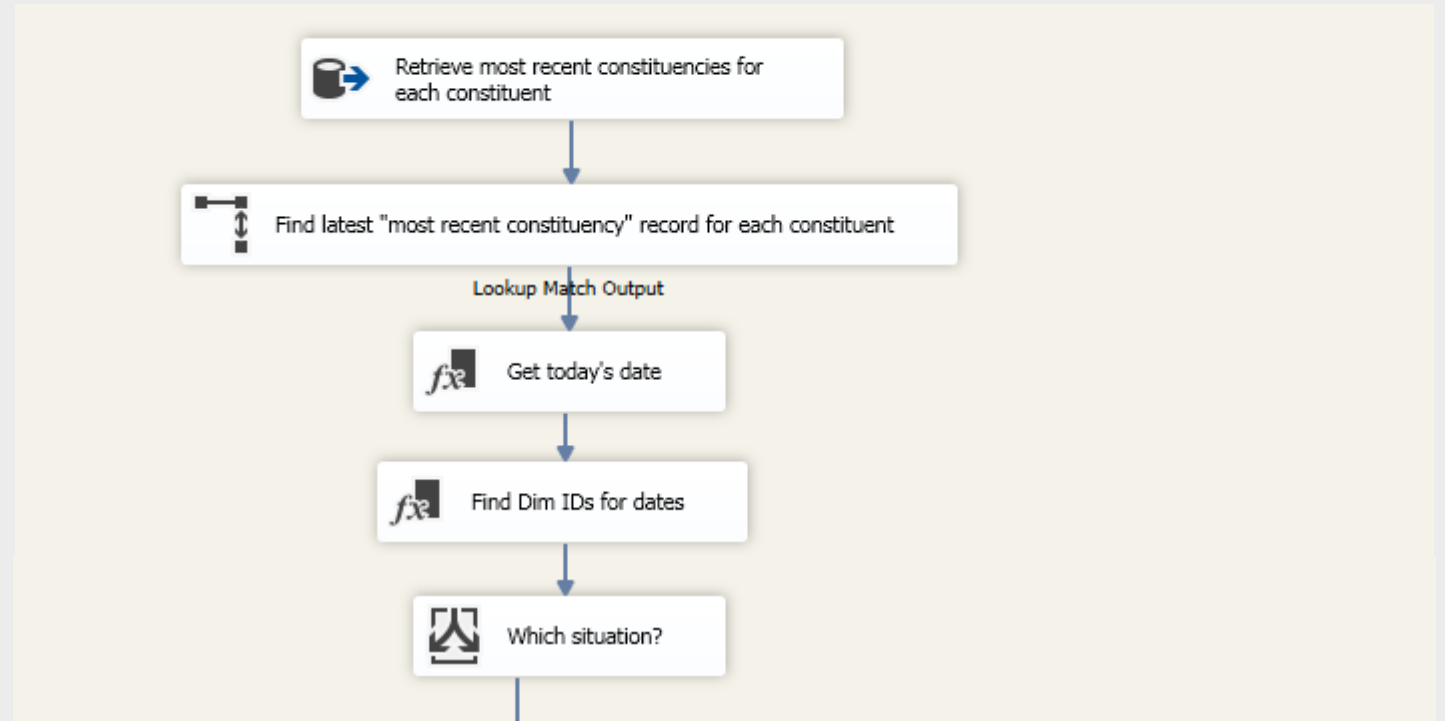
- We need “today’s date”
- Also included ETLCONTROLID, SOURCEDIMID, ISINCLUDED here too



Revise our ETL

- For every constituent in the data flow, determine the situation

Either...

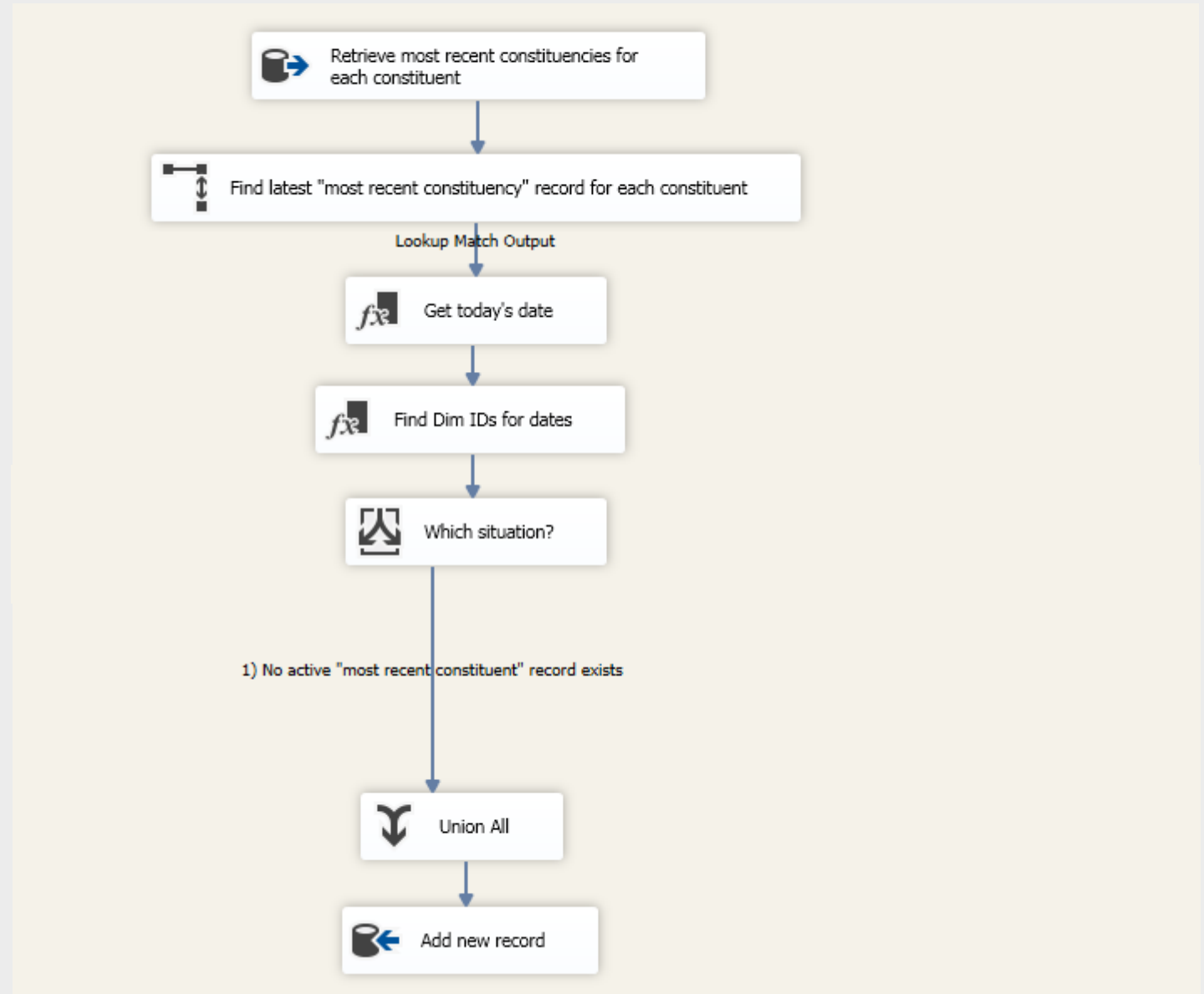


Revise our ETL

- Determine the situation for every constituent in the data flow.

Either...

- 1) It will be their very first “most recent constituency” record. Simply add that record.

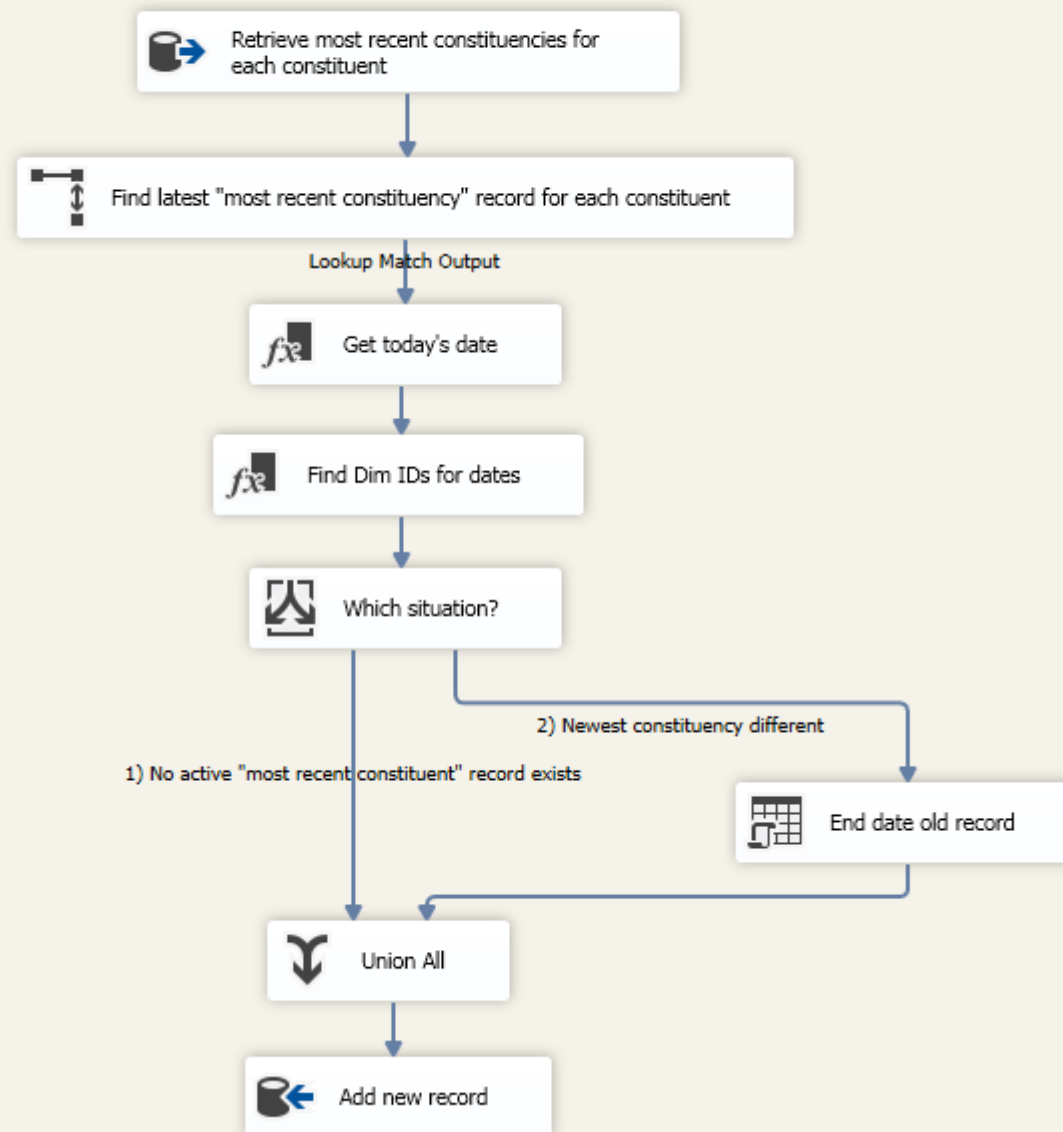


Revise our ETL

- Determine the situation for every constituent in the data flow.

Either...

- 1) It will be their very first “most recent constituency” record. Simply add that record.
- 2) They already have one. End-date the old record with Today’s Date and add a new record.



Results

- First ETL run: similar results to our previous example
- If we ran the ETL on May 15, 2019:

```
select m.*
from bbdw.FACT_MOSTRECENTCONSTITUENCY_EXT m
join bbdw.DIM_CONSTITUENT c on c.CONSTITUENTSYSTEMID = m.CONSTITUENTSYSTEMID
where c.FULLNAME = 'Robert C. Hernandez'
```

Results		Messages						
	MOSTRECENTCONSTITUENCYFACTID	MOSTRECENTCONSTITUENCY	CONSTITUENTSYSTEMID	STARTDATEDIMID	ENDDATEDIMID	ISINCLUDED	ETLCONTROLID	SOURCEDIMID
1	510	Board member	D445A2C7-F7DF-447C-9FB9-C946541CC8B9	20190515	0	1	182	1

Results

- Add a Trustee constituency to Robert's record

Security | Summary | Contact | **Personal Info** | Relationships | Revenue | Sales Orders | Memberships | Volunteer

Personal | **Constituencies**

Constituencies (8) + Add Filter 2 More

	Description	Date from	Date to	Active
	Alumnus	8/31/1987		
	Board member	1/1/2003		
	Donor	3/3/2000		
	Event registrant	1/28/2000		
	Major donor			
	Student			
	Trustee	5/10/2019		
	Volunteer			

- and re-run the ETL...

Results

The second ETL run should produce the following results, if it were run on May 20, 2019

```
select m.*
from bbdw.FACT_MOSTRECENTCONSTITUENCY_EXT m
join bbdw.DIM_CONSTITUENT c on c.CONSTITUENTSYSTEMID = m.CONSTITUENTSYSTEMID
where c.FULLNAME = 'Robert C. Hernandez'
```

	MOSTRECENTCONSTITUENCYFACTID	MOSTRECENTCONSTITUENCY	CONSTITUENTSYSTEMID	STARTDATEDIMID	ENDDATEDIMID	ISINCLUDED	ETLCONTROLID	SOURCEDIMID
1	510	Board member	D445A2C7-F7DF-447C-9FB9-C946541CC8B9	20190515	20190520	1	179	1
2	642	Trustee	D445A2C7-F7DF-447C-9FB9-C946541CC8B9	20190520	0	1	187	1

Make your archival table permanent

- Do not add code to truncate the table in the “reset ETL” procedure (bbdw.RESETETL_EXT)
- Copy the DW when refreshing an environment; do not re-create the DW

Github link to the code from this demo

- <https://github.com/blackbaud-community/Blackbaud-CRM-Intro-To-DW-Extensions>

Useful DW Extension Links

- [Out-of-the-box DW tables](#)
- [DW extension guide](#)
- [DW FAQ](#)
- Helpful DW blog posts:
 - <https://www.bbdevnetwork.com/author/ronfrum/>
 - <https://www.bbdevnetwork.com/author/alaneager/>

Questions or comments?