

Web Data Integration

Introduction to

MapForce



Agenda

1. Project Phase Overview
2. Altova MapForce
 - i. Altova MapForce Introduction
 - ii. Creating an Integrated Target Schema
 - iii. Loading your data into MapForce
 - CSV
 - Excel
 - JSON
 - iv. Creating Correspondences
 - v. Get the Translated Data Out
3. Hands-on: Schema Mapping with Altova MapForce

1. Project Phase Overview

- Phase I: Data Collection and Data Translation

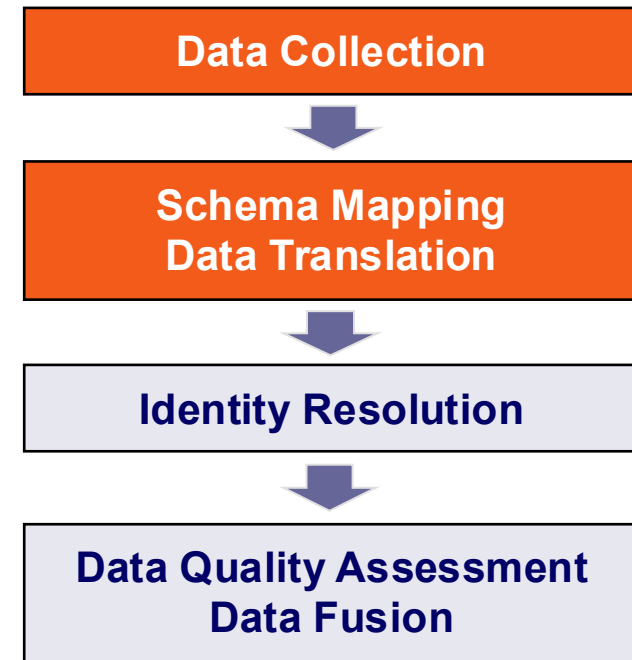
Duration: now till October 29th

Tasks:

1. Decide on a use case
2. Collect data from the Web
3. Profile your data and write outline about profile
4. Generate integrated schema (target schema)
5. Convert all your data into the integrated schema using MapForce

Result: All data is represented using a single unified schema

- one XML file per data source



Project Phase Overview: Requirements

You should integrate:

1. **3 different data sets**
2. at least **2,500 entities** described in total (in joint dataset)
 - but more are better, good: >10,000 but <100,000
3. at least **1,000 entities** should be contained in at least **two datasets**
 - please estimate based on small sample
4. at least **8 attributes** in joint dataset
 - entities should be identifiable by attribute combinations of at **least two attributes**, e.g. name+birthdate
5. at least **5 attributes** should be contained in at least **two datasets**
 - some attributes (other than name) should be contained in three datasets (for fusion by voting)
6. ideally, at least one of your attributes is a **list attribute**
 - actors of a movie, directors of a company, songs on a CD

2. Altova MapForce

- Visual Schema Mapping Tool
 - Supports many data formats such as CSV, XML, JSON, EXCEL, ...
 - Build-in mapping functions which can be used by *drag & drop*
 - Requires windows operating system ☐
 - ... but I will provide Mac Users with a VM
- How to get and run *MapForce*
 - Download & Install: <https://www.altova.com/mapforce/download>
 - Version: **Altova MapForce 2026 Enterprise Edition**
 - Run MapForce for the first time and use the free 30-day version for now
 - Documentation: <http://manual.altova.com/Mapforce/mapforceenterprise/>
- Most tools of Altova can be tested for 30-days for free
 - We also have a license server running
 - If the 30 days are not enough, contact us and we will give you access

Altova MapForce Interface

Insert

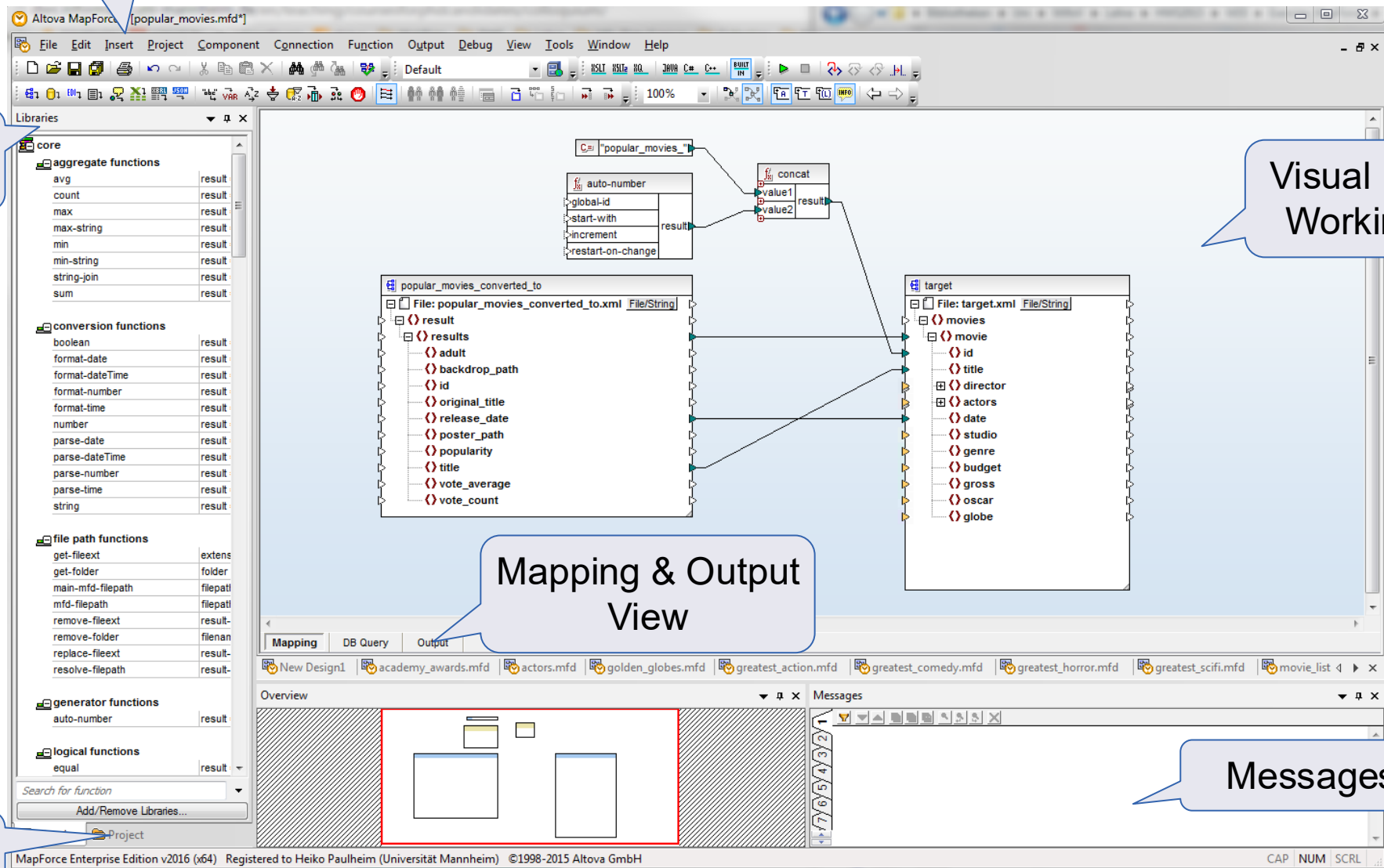
Built-In Functions

Visual Mapping Working Area

Mapping & Output View

Messages/Log

Project Overview



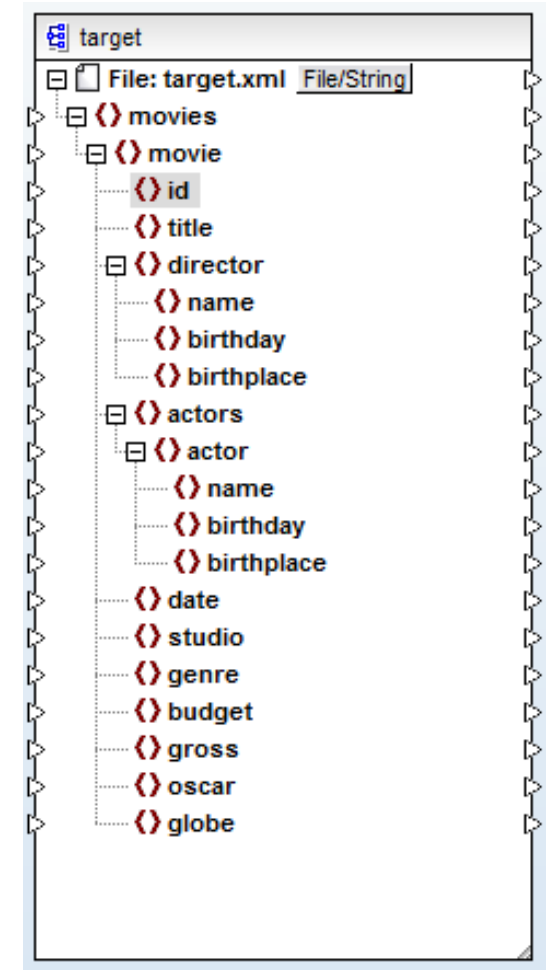
Creating an Integrated Target Schema

- Options:
 - Create XML schema by hand
 - Retrieve the XML schema from a XML file (example)
- The latter is encouraged...
- Example file:

```
<movies>
  <movie id="m1">
    <title>The Shining</title>
    <director>Stanley Kubrick</director>
  </movie>
  <movie id="m2">
    <title>Pi</title>
    <director>Darren Aronofsky</director>
  </movie>
</movies>
```

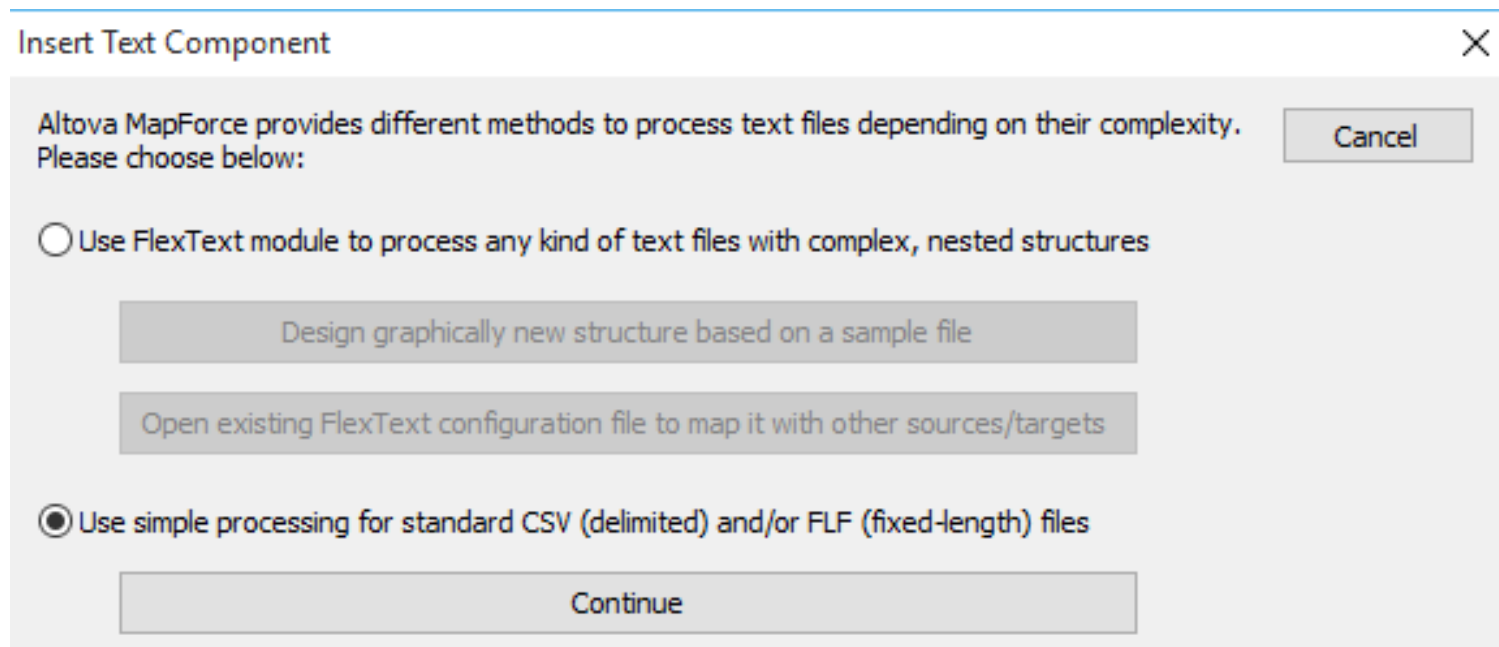
Creating an Integrated Target Schema

1. Open MapForce
2. Choose `Insert` → XML Schema/File...
3. Let MapForce create a schema for you
4. Edit the schema, if necessary, e.g.
 1. Adjust cardinalities
 2. Change component name
 3. ...



Loading Your Data into MapForce: CSV

1. To import your csv, choose `Insert → Text File...`,
2. **Select** `use simple processing for standard csv`
3. Continue to configure the file importer



Loading Your Data into MapForce: CSV

Component Settings

Component name: **Name**

Input / Output File

select file

☒ Save all file paths relative to MFD file

Input / Output Encoding

Encoding name: **select encoding**

Byte order: ☐ Include byte order mark

CSV Settings

Field delimiter: ☐ Tab ☐ Semicolon ☒ Comma ☐ Space ☐ Custom: **select CSV layout**

Quote character: ☐ None ☐ ' ☒ " **are there headlines?**

☒ First row contains field names ☒ Treat empty fields as absent

☒ Add when needed ☐ Add always

☒ CSV ☐ Fixed

Year	Category	Nominee	Additional Info	Won?	F
2010 (83rd)	Actor -- Leading Role	Javier Bardem	Biutiful {"Uxbal"}	NO	
2010 (83rd)	Actor -- Leading Role	Jeff Bridges	True Grit {"Rooster Cogburn"}	NO	
2010 (83rd)	Actor -- Leading Role	Jesse Eisenberg	The Social Network {"Mark Zuckerberg"}	NO	

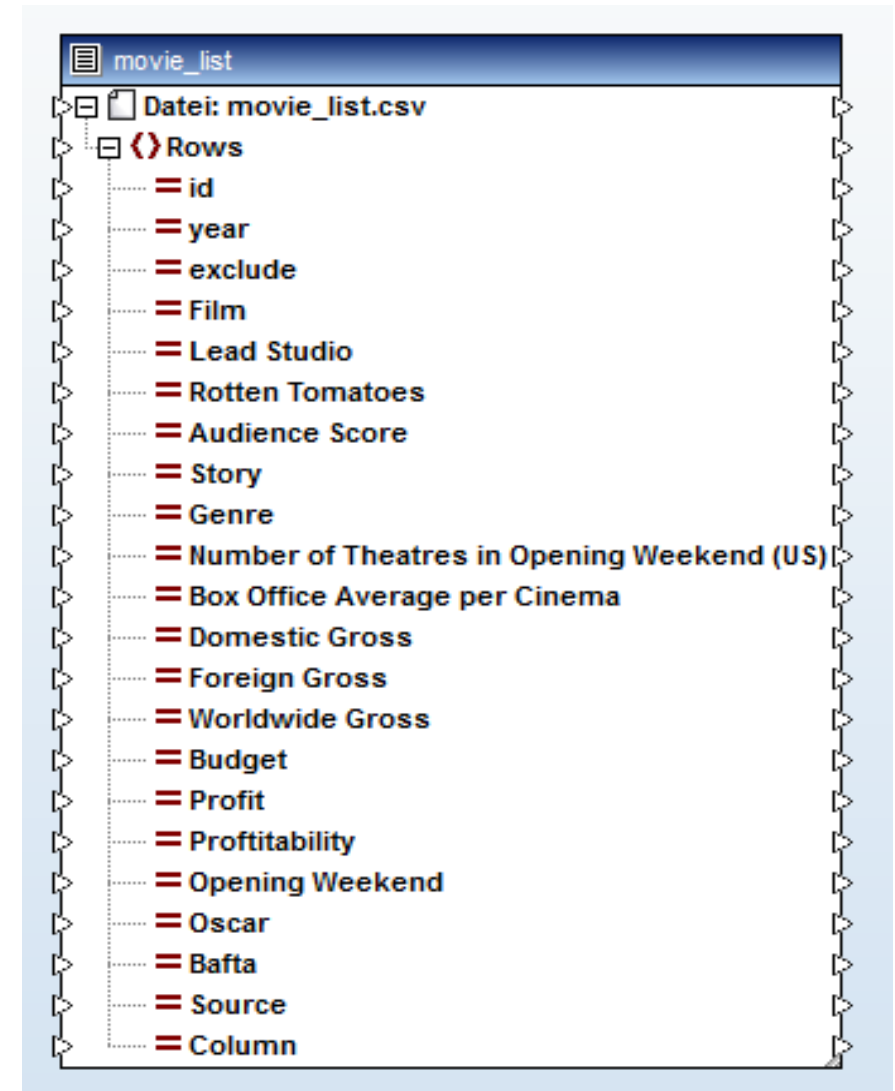
adjust datatypes

<< >>

control output

Loading Your Data into MapForce: CSV

1. Review the final output
2. Check for missing attributes or not correctly imported fields



Loading Your Data into MapForce: Excel

1. To import Excel files, choose `Insert` → `Excel 2007+ File...`

MapForce



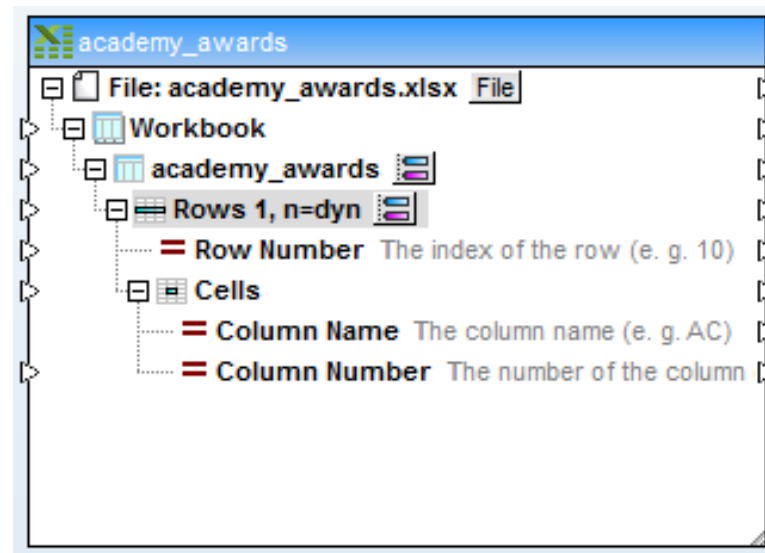
MapForce allows you to define Excel workbooks as source and target. For a source workbook, you might want to provide a sample XLSX file or global resource to preview your transformation.

Do you want to supply a sample XLSX file, a global resource, or not supply any at all?

Browse...

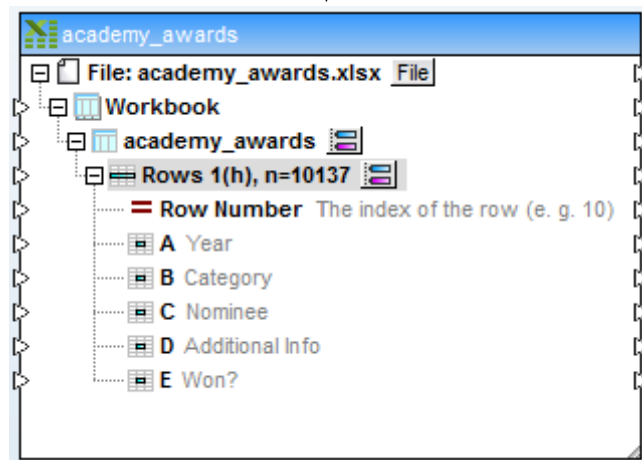
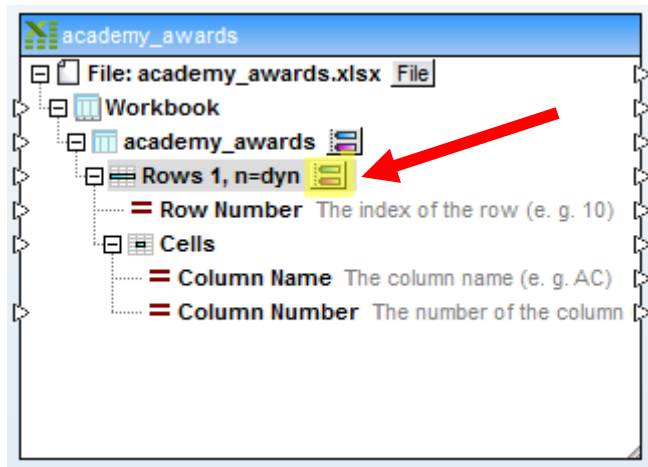
Skip

2. Select `Skip` (if you want an Excel file as output)
3. Select `Browse` (if you want to specify an Excel file as input)



Loading Your Data into MapForce: Excel

– Configure the Import



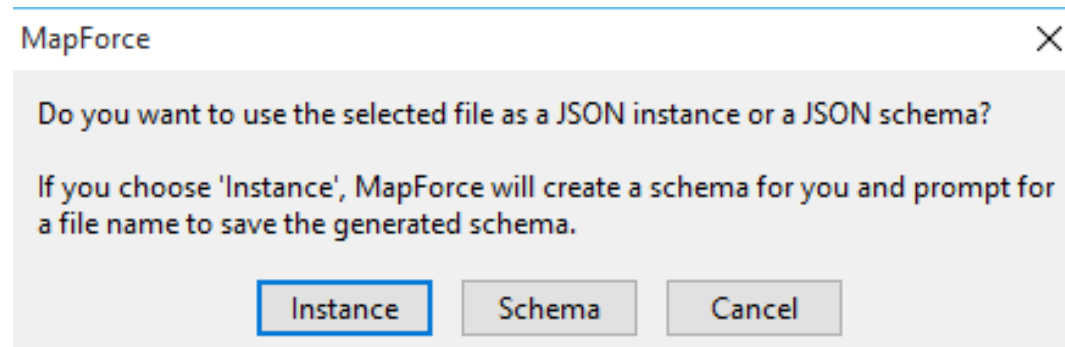
The screenshot shows the 'Select Range of Cells' dialog box. The 'Load Range from Excel Input File' section has a 'Select Cell Range to Load...' dropdown and a 'Refresh' button. The 'Starting Row' section has radio buttons for 'Row' (selected), 'Previous range with offset', and 'Row Count' (set to 10137). The 'Columns' section has radio buttons for 'Show a single Cells item for all columns' and 'Show separate items for columns' (selected). The 'Data type' is set to 'string'. The 'Column range' is set from 'A' to 'E'. The 'First row is header with column names' checkbox is checked. The 'Reload' button is visible. The 'Select types for the cells and enter column names:' section contains a table with the following data:

	Type	Column Name
A	string	Year
B	string	Category
C	string	Nominee
D	string	Additional Info
E	string	Won?

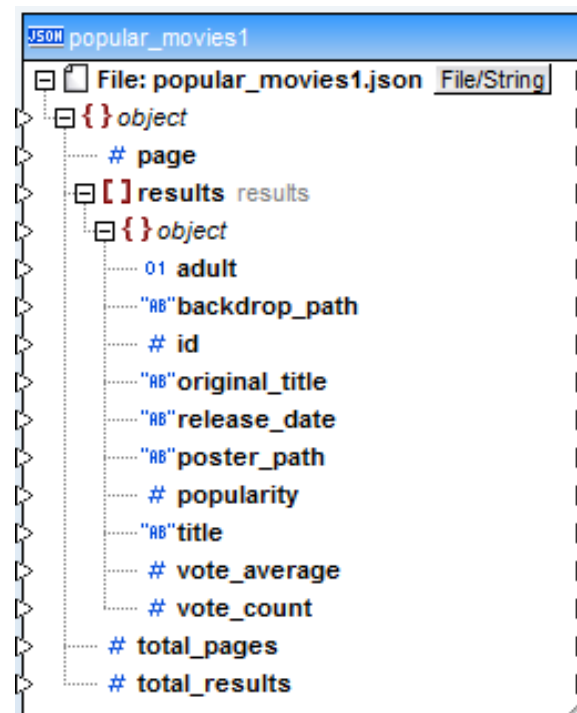
The 'OK' and 'Cancel' buttons are at the bottom right.

Loading Your Data into MapForce: JSON

- To import a JSON file, choose `Insert → JSON Schema/File...`

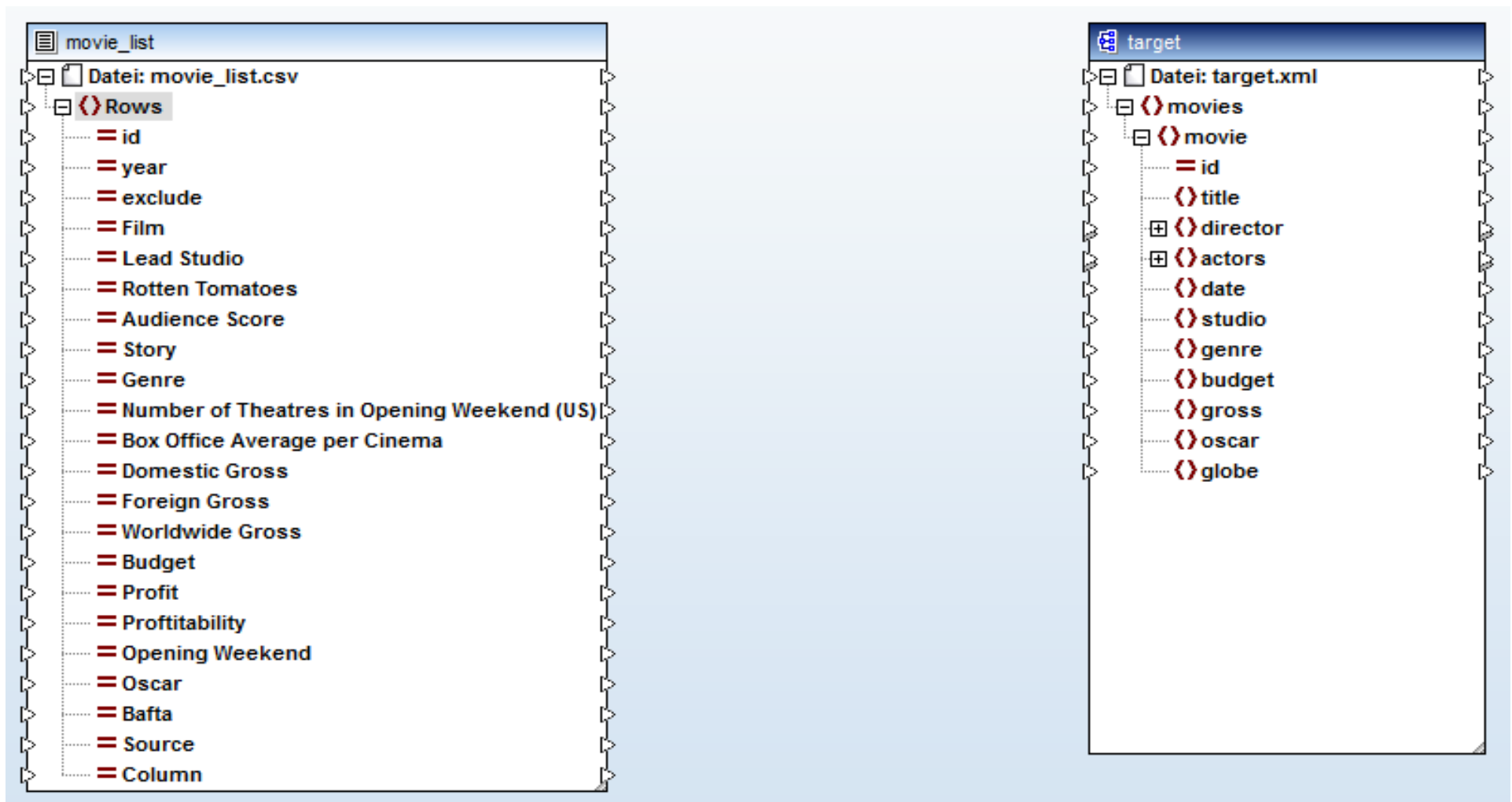


- Choose Instance



Creating Correspondences

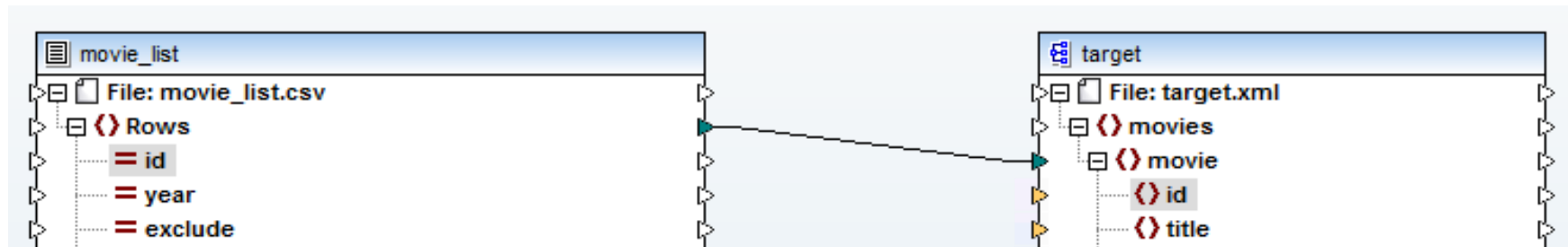
- Now, you have two schemata (source: left, target: right) in your MapForce view



Creating Correspondences

- Map the top level elements
 - each movie instance (row in CSV file) in the input becomes a movie instance in the output

Mapping DB Query Output



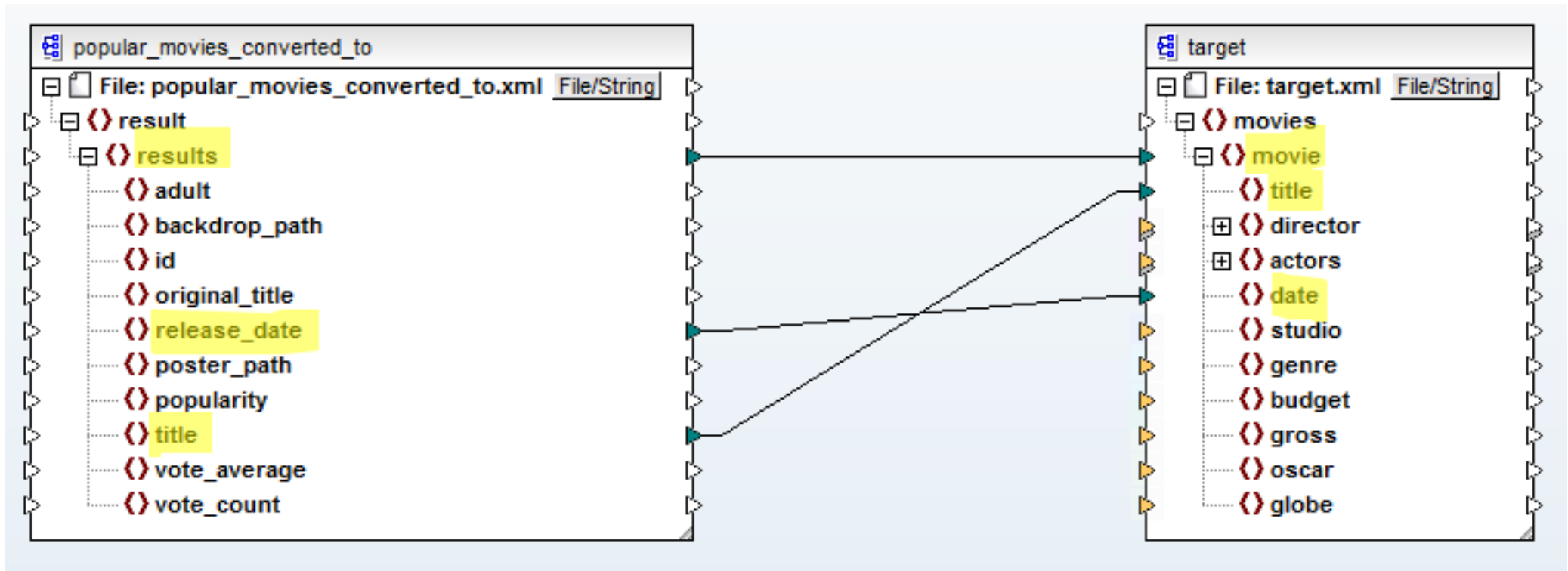
- Output View
 - a list of (still empty) movie elements

Mapping DB Query Output

```
1 <?xml version="1.0" encoding="UTF-8"?>
2 <movies xsi:noNamespaceSchemaLocation="C:/Work_Volha/Teaching/HWS201~3/04_EXE~1/examples/movies/input/target.xsd" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
3   <movie/>
4   <movie/>
5   <movie/>
6   <movie/>
7   <movie/>
```

Creating Correspondences

- Simple 1:1 correspondences are created by drawing arrows from left to right

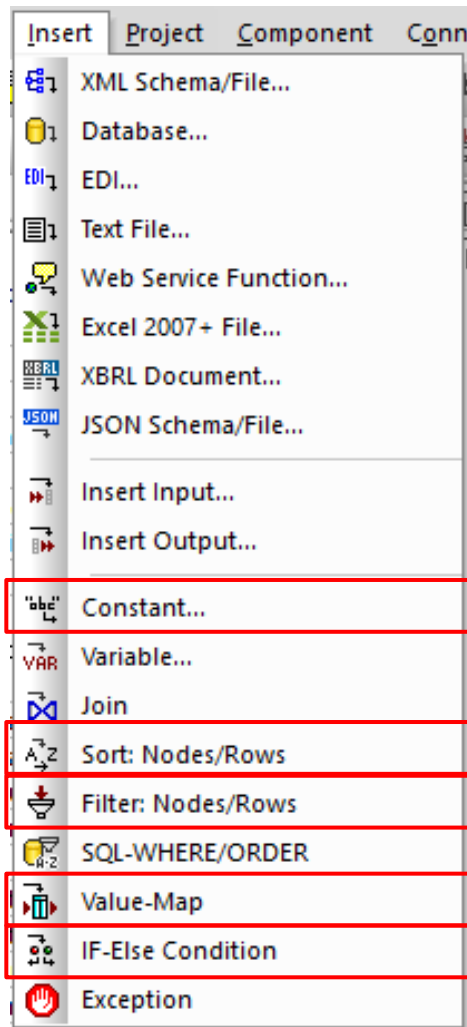


Creating Correspondences

- Simple 1:1 correspondences are created by drawing arrows from left to right

```
1  <?xml version="1.0" encoding="UTF-8"?>
2  <movies xsi:noNamespaceSchemaLocation="C:/Users/Oliver/Documents/Lehre/WEBDAT~1
3  <movie>
4  <title>Rififi</title>
5  <date>1955-04-13</date>
6  </movie>
7  <movie>
8  <title>Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb</title>
9  <date>1964-01-29</date>
10 </movie>
11 <movie>
12 <title>The Pink Panther</title>
13 <date>1963-12-19</date>
14 </movie>
15 <movie>
16 <title>For a Few Dollars More</title>
17 <date>1965-12-18</date>
18 </movie>
19 <movie>
20 <title>The Jazz Singer</title>
21 <date>1927-10-06</date>
22 </movie>
23 <movie>
24 <title>The Lady Vanishes</title>
25 <date>1938-11-01</date>
26 </movie>
27 <movie>
28 <title>Lethal Weapon</title>
29 <date>1987-03-05</date>
30 </movie>
31 </movie>
```

Built-in Functions



Built-in functions allow for the creation of more complex mappings:

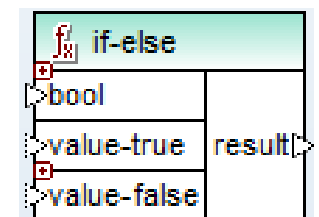
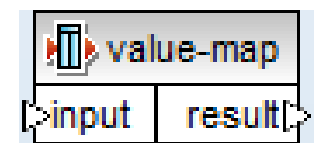
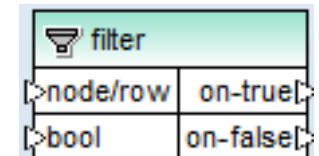
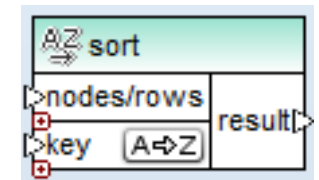
Sort: Sort a set of records by the specified key

Filter: Filter a set of records by the Boolean input for each record

Constant: A constant value of type “String”, “Number” or “All other”

Value-Map: Specify values to be replaced by other values

If-Else: Output values is conditional on Boolean input



Built-In Functions Example: Filter

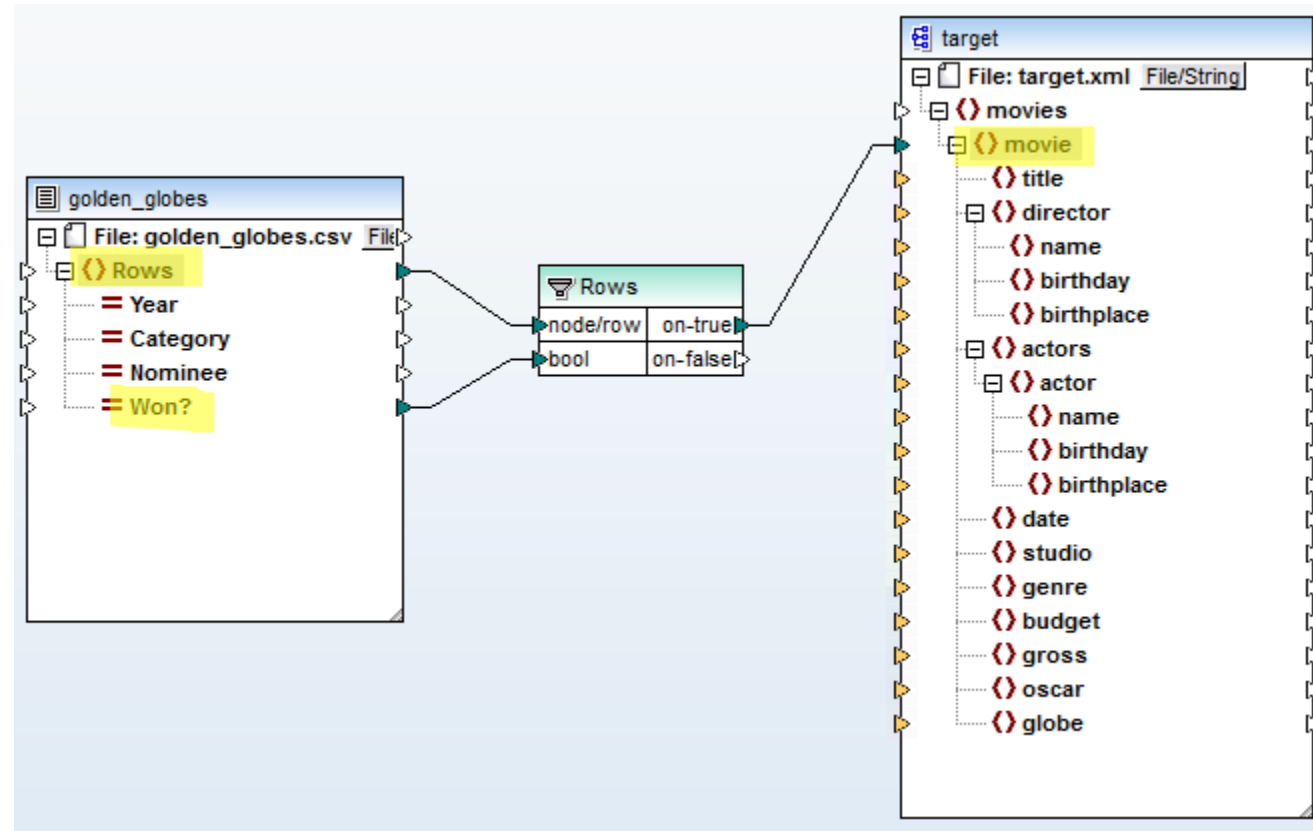
- Goal: Only use data rows that won a Golden Globe

- Insert Filter

- Specify which rows to filter as first input
- Condition as second input

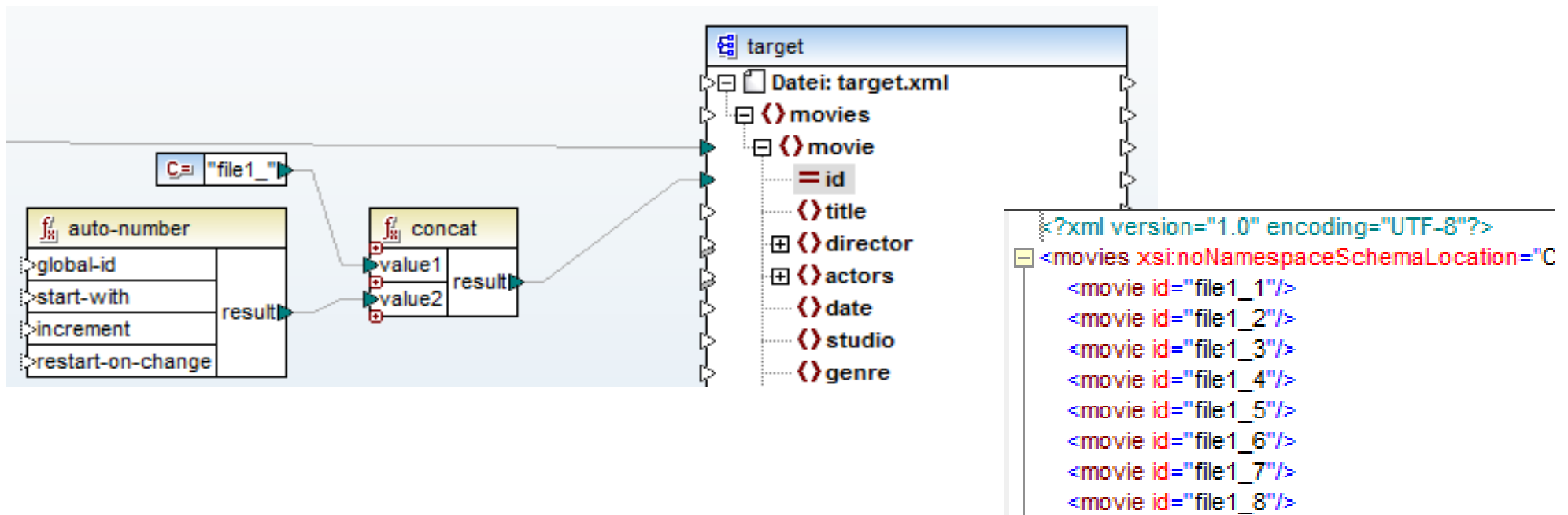
- Output

- on-true: All records for which the condition is true
- on-false: All records for which the condition is false



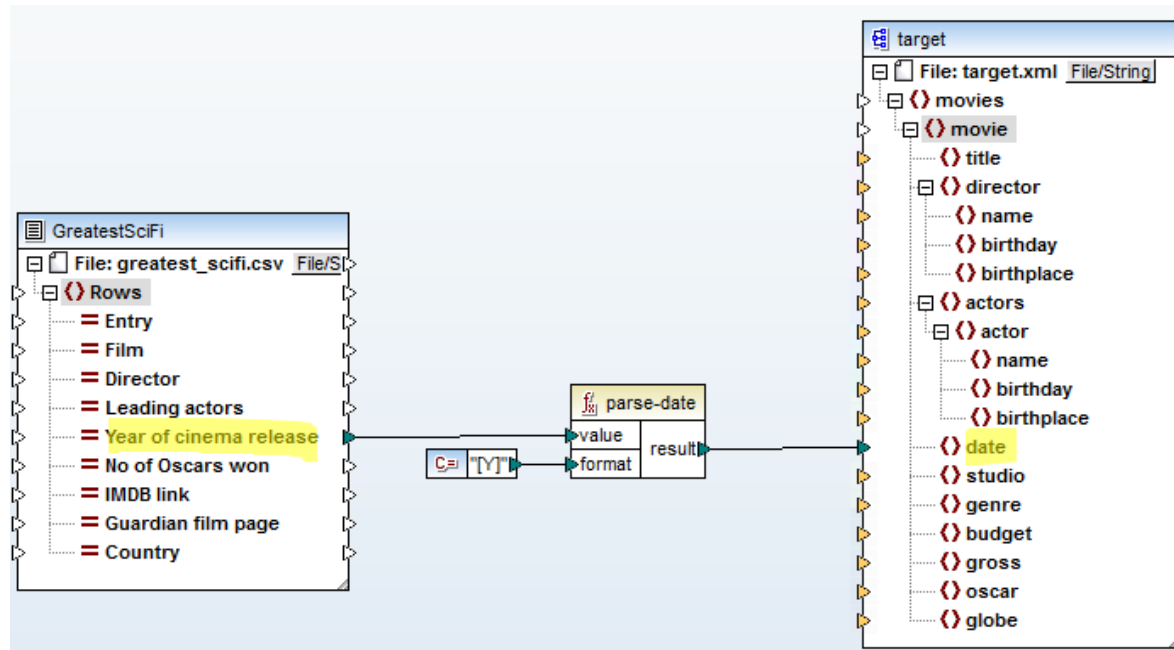
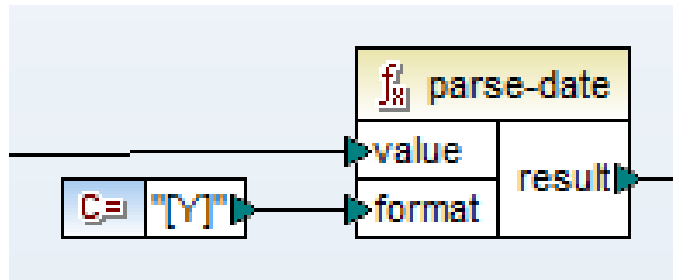
Creating Correspondences

- Generating identifiers (ids) (*optional step*)
 - Using the `auto-number` function
 - Caution: your ids should be unique across all generated files
 - Thus: rather use prefix (e.g. file name) + auto-number
 - Using the `concat` function
 - Insert constant with right click → insert constant



Conversions: parse-date / parse-dateTime

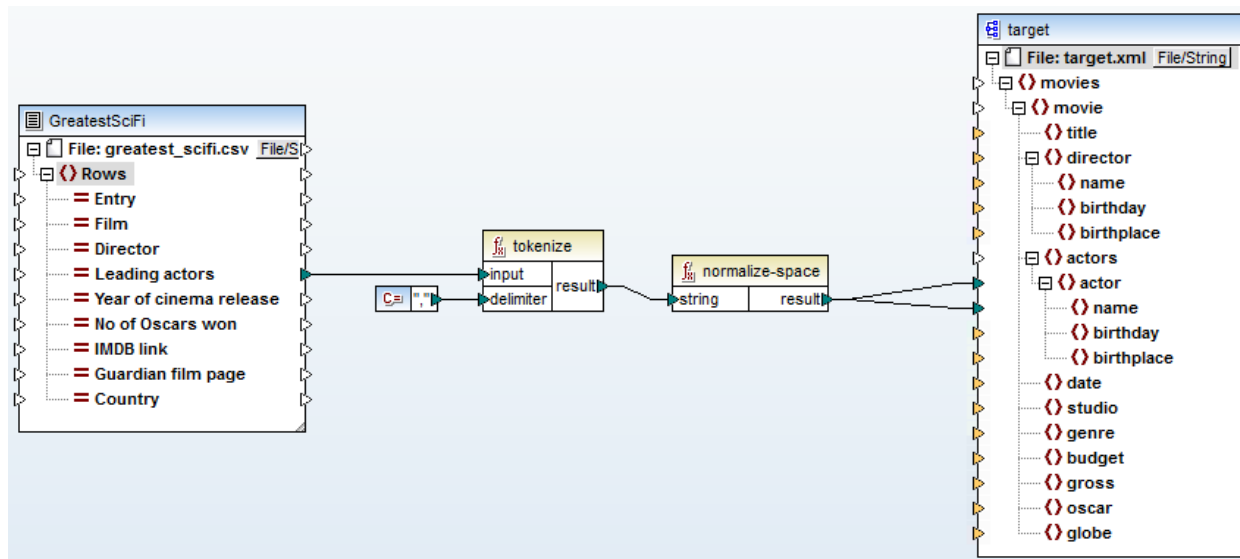
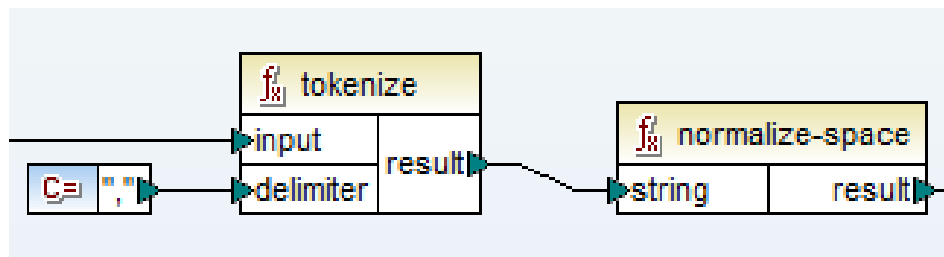
- Converts a string into a date / dateTime
- See also: format-date / format-dateTime



Y	year (absolute value)
M	month of the year
D	day of month
d	day of year
F	day of week
W	week of the year
w	week of month
H	hour (24 hours)
h	hour (12 hour)
P	A.M. or P.M.
m	minutes in hour
s	seconds in minute
f	fractional seconds
Z	timezone as a time offset from UTC
z	timezone as a time offset using GMT

String Functions

- Example: list of actors in string with commas
 - `normalize-space` removes leading and trailing space

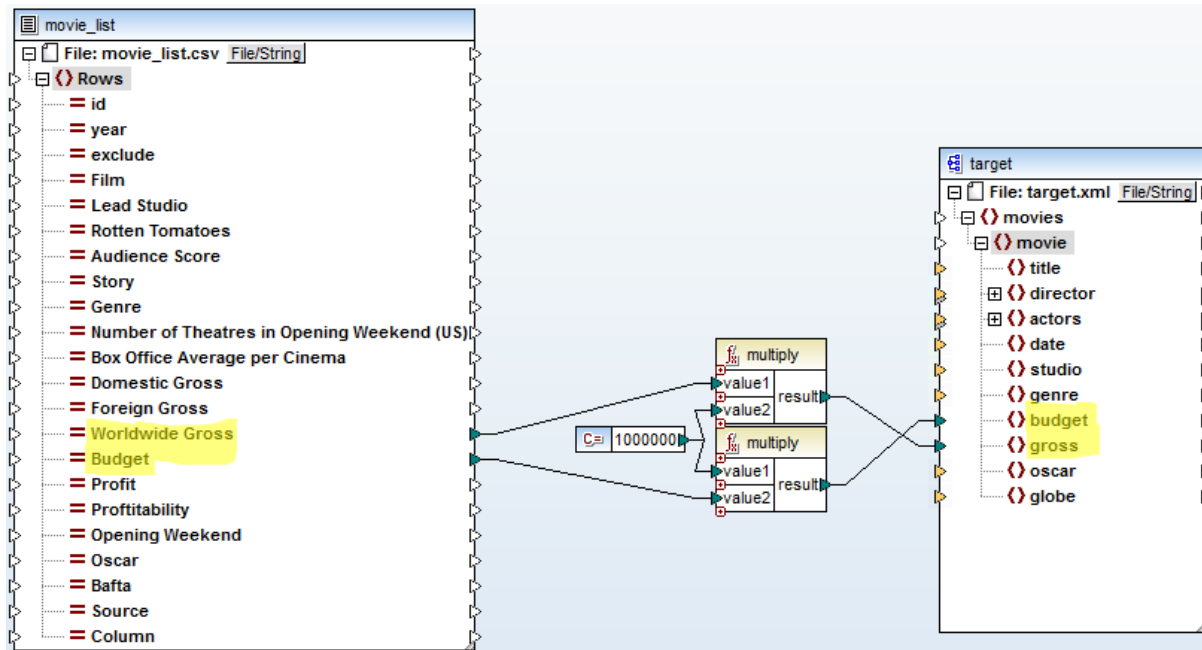
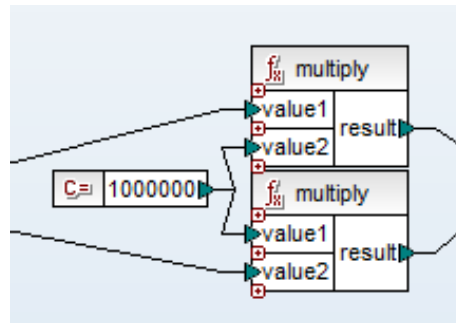


string functions	
<code>char-from-code</code>	<code>result = char-from-code(value)</code>
<code>code-from-char</code>	<code>result = code-from-char(value)</code>
<code>concat</code>	<code>result = concat(string1, string2)</code>
<code>contains</code>	<code>result = contains(value, substring)</code>
<code>normalize-space</code>	<code>result = normalize-space(string)</code>
<code>starts-with</code>	<code>result = starts-with(string, substr)</code>
<code>string-length</code>	<code>result = string-length(string)</code>
<code>substring</code>	<code>result = substring(string, start [,length])</code>
<code>substring-after</code>	<code>result = substring-after(string, substr)</code>
<code>substring-before</code>	<code>result = substring-before(string, substr)</code>
<code>tokenize</code>	<code>result = tokenize(input, pattern)</code>
<code>tokenize-by-length</code>	<code>result = tokenize-by-length(input, length)</code>
<code>tokenize-regexp</code>	<code>result = tokenize-regexp(input, pattern, flags)</code>
<code>translate</code>	<code>result = translate(value, string1, string2)</code>

string functions	
<code>capitalize</code>	<code>result = capitalize(value)</code>
<code>count-substring</code>	<code>result = count-substring(string, substr)</code>
<code>empty</code>	<code>result = empty(value)</code>
<code>find-substring</code>	<code>result = find-substring(string, substr [,startindex])</code>
<code>format-guid-string</code>	<code>formatted_guid = format-guid-string(unformatted_guid)</code>
<code>left</code>	<code>result = left(string, number)</code>
<code>left-trim</code>	<code>result = left-trim(string)</code>
<code>lowercase</code>	<code>result = lowercase(string)</code>
<code>match-pattern</code>	<code>result = match-pattern(string, substr)</code>
<code>pad-string-left</code>	<code>result = pad-string-left(string, final-length, pad-string)</code>
<code>pad-string-right</code>	<code>result = pad-string-right(string, final-length, pad-string)</code>
<code>repeat-string</code>	<code>result = repeat-string(string, count)</code>
<code>replace</code>	<code>result = replace(value, oldstring, newstring)</code>
<code>reversefind-substring</code>	<code>result = reversefind-substring(string, substr [,startindex])</code>
<code>right</code>	<code>result = right(string, number)</code>
<code>right-trim</code>	<code>result = right-trim(string)</code>
<code>string-compare</code>	<code>result = string-compare(string1, string2)</code>
<code>string-compare-ignore-case</code>	<code>result = string-compare-ignore-case(string1, string2)</code>
<code>uppercase</code>	<code>result = uppercase(string)</code>

Mathematical Functions

- Example: Multiply original values with a constant-value

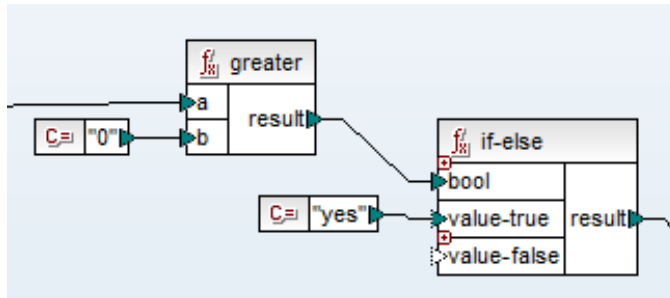


math functions	
add	result = value1 + value2
ceiling	result = ceiling(value)
divide	result = value1 / value2
floor	result = floor(value)
modulus	result = value1 mod value2
multiply	result = value1 * value2
round	result = round(value)
round-precision	result = round-precision(value, decimals)
subtract	result = value1 - value2

math functions	
abs	result = abs(value)
acos	result = acos(value)
asin	result = asin(value)
atan	result = atan(value)
cos	result = cos(value)
degrees	result = degrees(value)
divide-integer	result = value1 div value2
exp	result = exp(value)
log	result = log(value)
log10	result = log10(value)
max	result = max(value1, value2)
min	result = min(value1, value2)
pi	result = pi()
pow	result = a ^ b
radians	result = radians(value)
random	result = random()
sin	result = sin(value)
sqrt	result = sqrt(value)
tan	result = tan(value)
unary-minus	result = -value

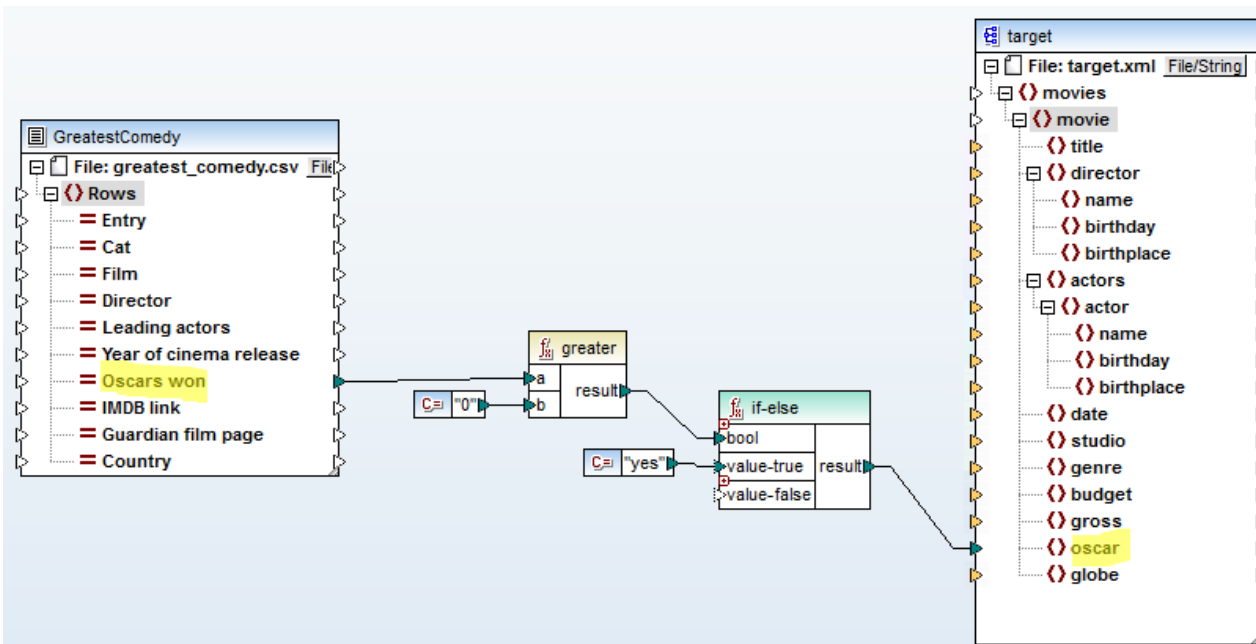
Logical Functions

- Example: Transform integer to Boolean value



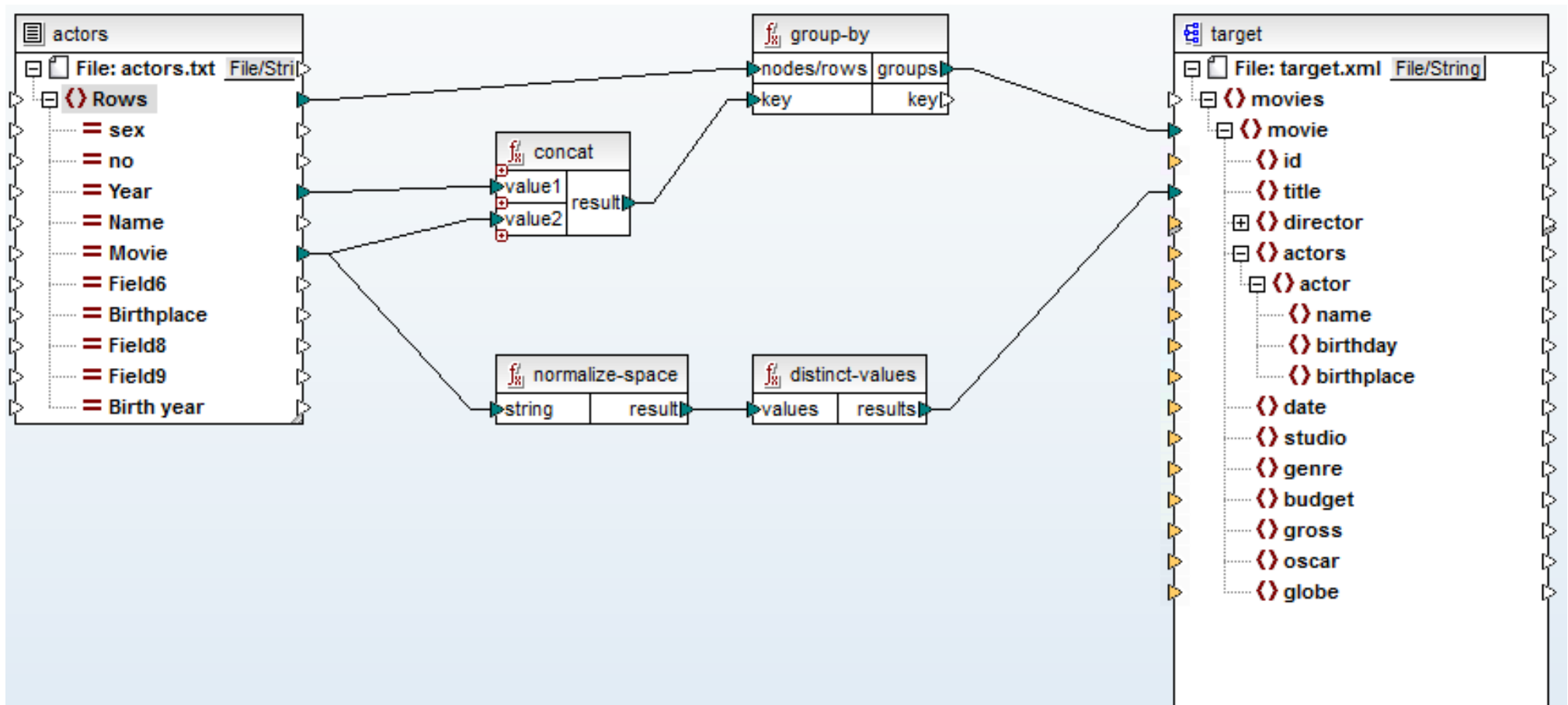
logical functions	
equal	result = a equal b
equal-or-greater	result = a >= b
equal-or-less	result = a <= b
greater	result = a > b
less	result = a < b
logical-and	result = logical-and(value1, value2)
logical-not	result = logical-not(value)
logical-or	result = logical-or(value1, value2)
not-equal	result = logical-not(a equal b)

logical functions	
logical-xor	result = logical-xor(value1, value2)
negative	result = value < 0
numeric	result = numeric(value)
positive	result = value >= 0



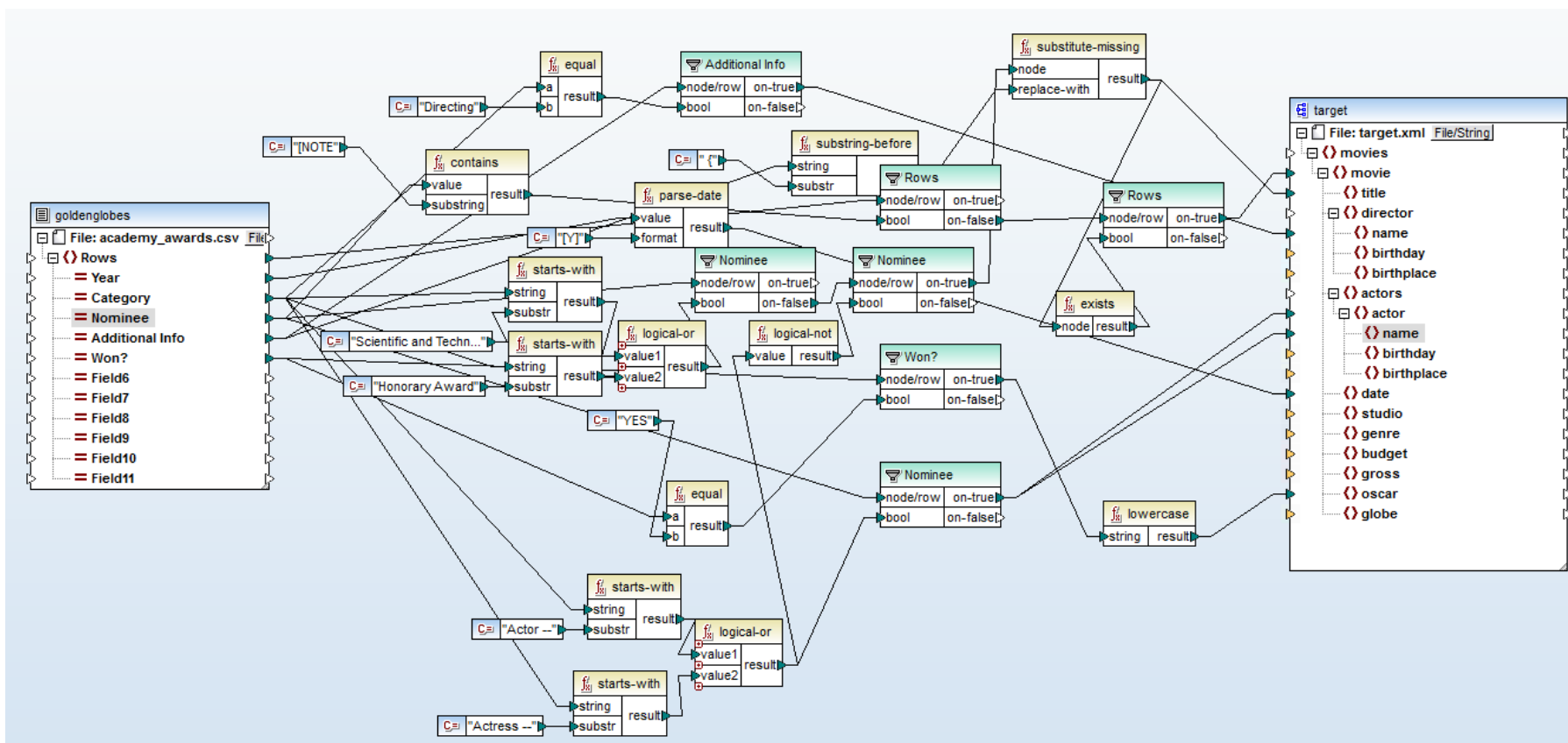
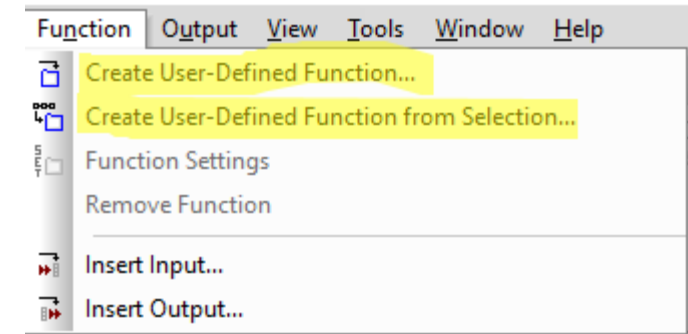
Sequence Functions

- Aggregate Actors to Movies
 - Input: one line per actor/movie combination
 - Output: one node per movie



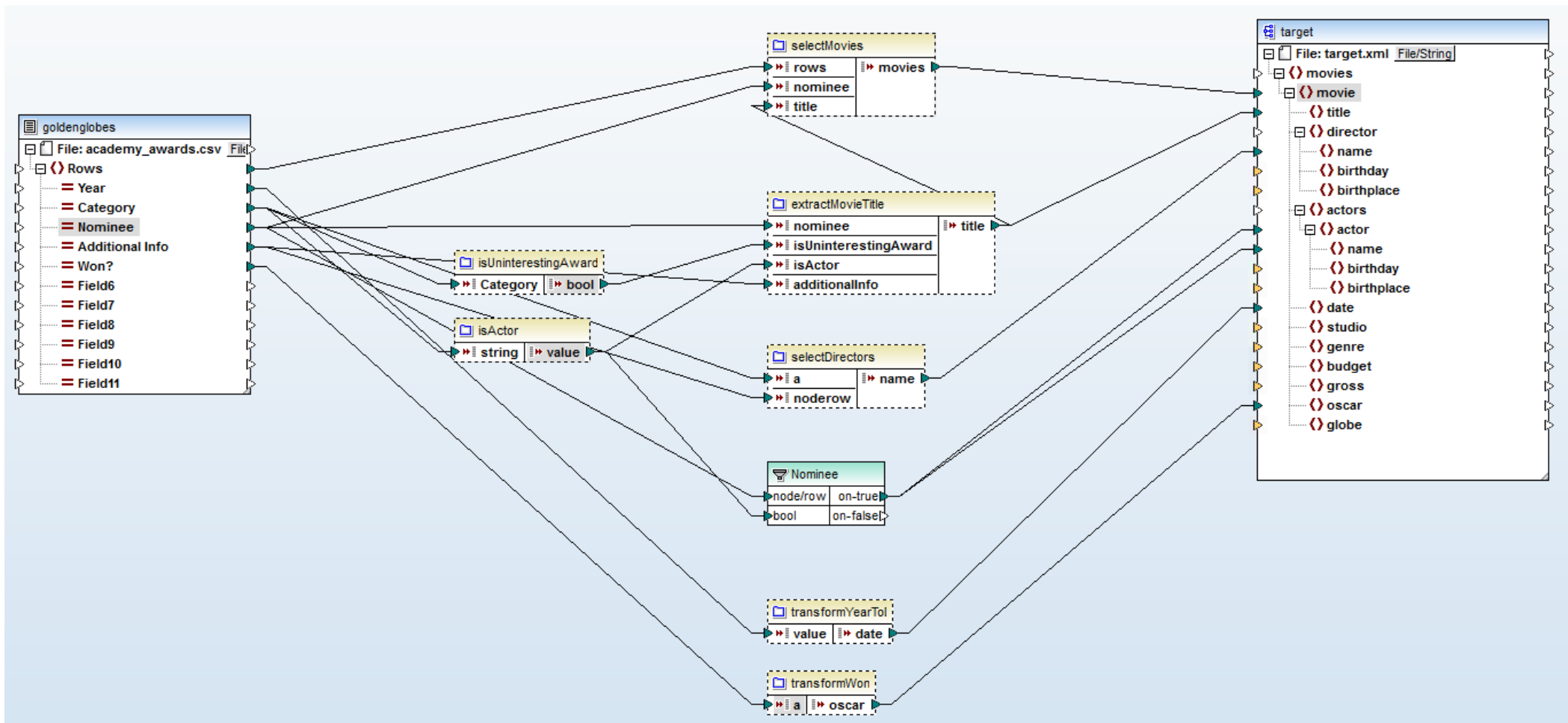
User-Defined Functions

- The mapping view quickly becomes confusing



User-Defined Functions

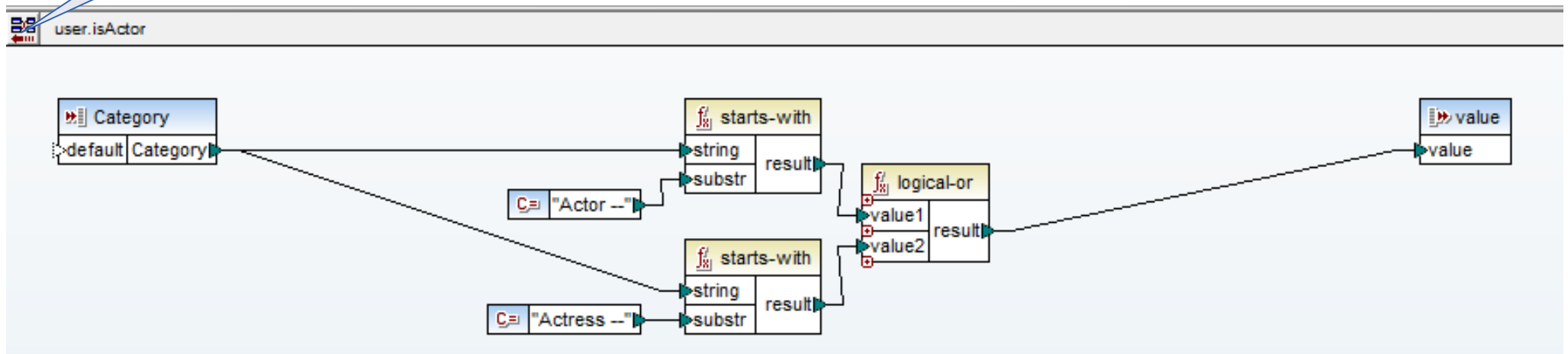
- Make use of User-Defined Functions (UDF) to organize your functions



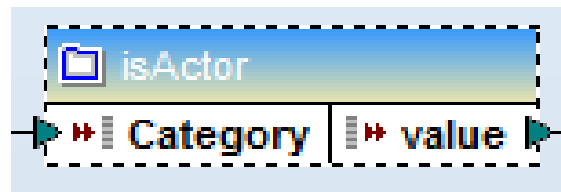
User-Defined Functions

- A UDF maps any number of input parameters to output parameters

Click to return to the overall mapping

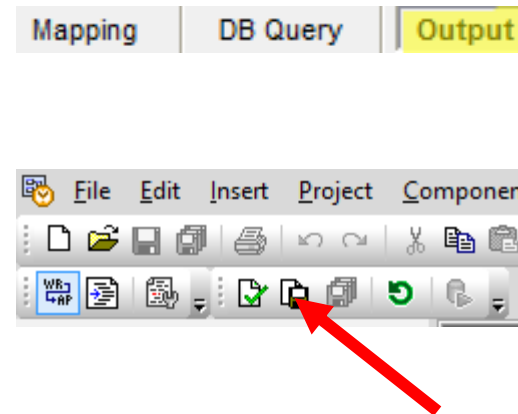


- It is represented by a single function in the mapping view



Get the Translated Data Out

- Go to the Output View
- Select Save generated output



Hands-on: Schema Mapping with MapForce

- Your task: Create mappings between different datasets from the movie domain using MapForce.
- Data
 - target.xsd: An XML schema file providing the target schema
 - movie_list.csv: Dataset describing movies with 22 features such as year, story and genre stored as csv
 - actors.csv: Dataset describing actors with 10 different features such as name, movie in which they acted and birthplace stored as a tab separated file

Hands-on: Schema Mapping with MapForce - Movies

1. Load files

- movie_list.csv as input
- target.xml as target schema

2. Assign IDs

- The id should start with the prefix *movie_list_id* followed by an increasing number which starts at 1000.

Hint : Increment: **auto-number** function
Add prefix to incrementing number: **concat** function

3. Create attribute correspondences from **source** to **target**

- Map **Film** and **Genre** to the corresponding attributes of the target schema
- Set the **gross** attribute value as a summation of the **Domestic** and the **Foreign Gross**. (*hint*: You can only perform summation if all the involved values are numeric)
- Map **year** to **date** and set the day and month to the first of June.

Hint: Foreign Gross: **if** the value is numeric add it **else** add 0
Date: Add prefix, define the **format**, parse the concat values as date

4. Filter

- Exclude the movies where the exclude attribute is set to y

Hint: Check if exclude value **equals** y. On **false** map the source row to the target movie

Hands-on: Schema Mapping with MapForce - Actors

1. Load files

- actors.csv as input
- target.xml as target schema

Hint : The input file is **tab** separated. Define the **datatype** and **names** of the attributes.

2. Aggregate by Movie

- Identify an appropriate mapping key (the name of the movie is not enough as there might be movies with the same title)
- Group by the created key. Use the key as id for the target dataset.
- Map the aggregated rows to the movies in the target schema

Hint: A movie can be uniquely defined by its **name** and its **year**.

3. Create actor correspondences

- Create the missing correspondences for the name, birthplace and the full birthday
- In case the values contain spaces, remove them

Hint: Use **normalize space** function to remove the spaces. **Concatenate** the birthday day, month, year in a parsable **format** like **[D].[M].[Y]**

File Format:

Gender	No	MovieYear	ActorName	Title	Reviews	BirthPlace	BirthMonth	BirthDay	BirthYear
--------	----	-----------	-----------	-------	---------	------------	------------	----------	-----------

...and now

1. Collect your data
2. Profile your data
3. Generate your target schema
4. Convert all your data into the integrated schema using MapForce

