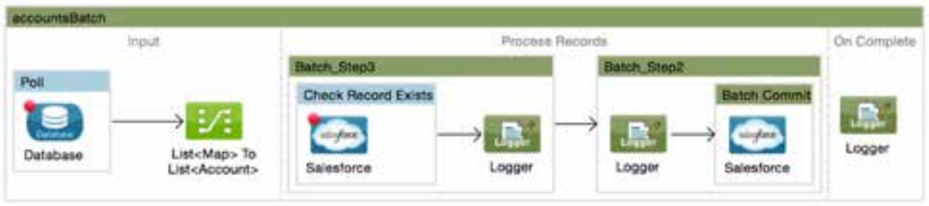
Module 9: Processing Records

Goal



Objectives

- In this module, you will learn:
  - To process items in a collection individually
  - Process items in a collection individually
  - Use DataWeave with CSV files
  - Use the Batch Job element (EE) to process individual records
  - Synchronize data from a CSV file to a SaaS application
  - Synchronize data from a legacy database to a SaaS application

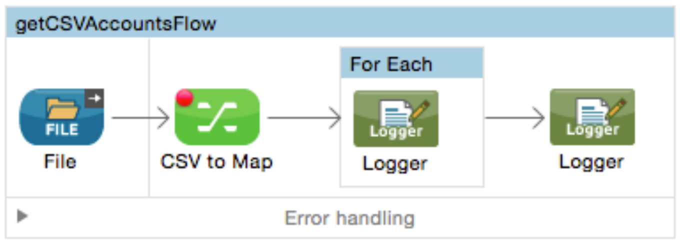
Processing items in a collection

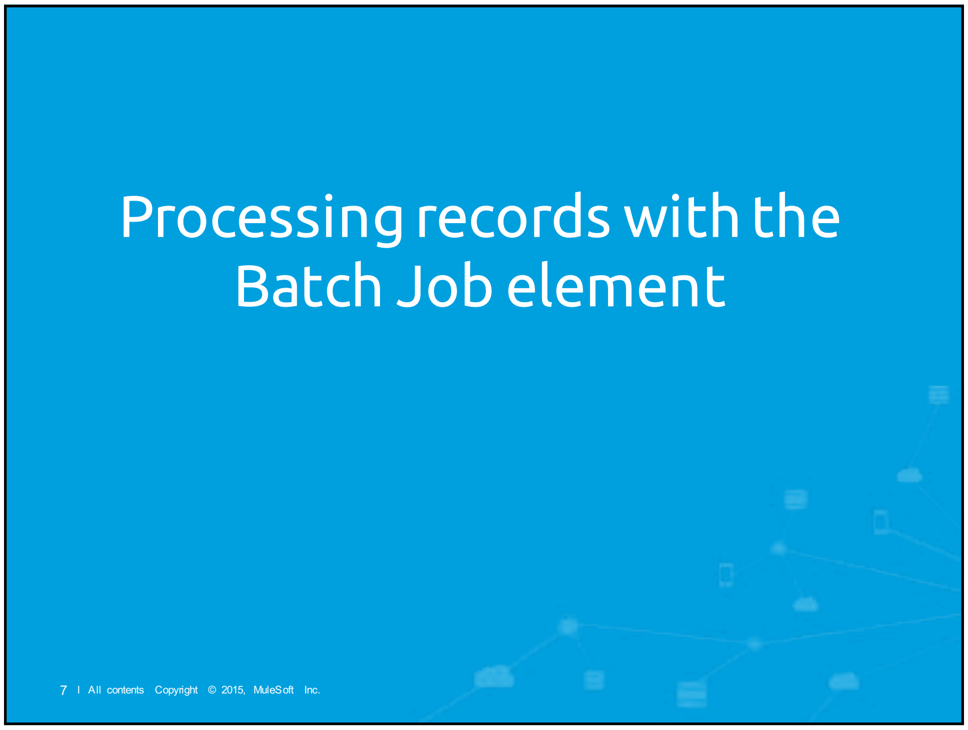
Processing items in a collection

- Create a flow that uses
  - A splitter-aggregator pairs
    - One flow control splits the collection into individual elements, which the flow processes iteratively, then another flow control is used to re-aggregate the elements into a new collection so they can be passed out of the flow
  - A For Each scope
    - Splits a message collection and processes the individual elements and then returns the original message
    - More versatile and convenient that splitter/aggregator pairs
- Use a batch job (EE)
  - Created especially for processing data sets
  - Not a flow, but another top level element

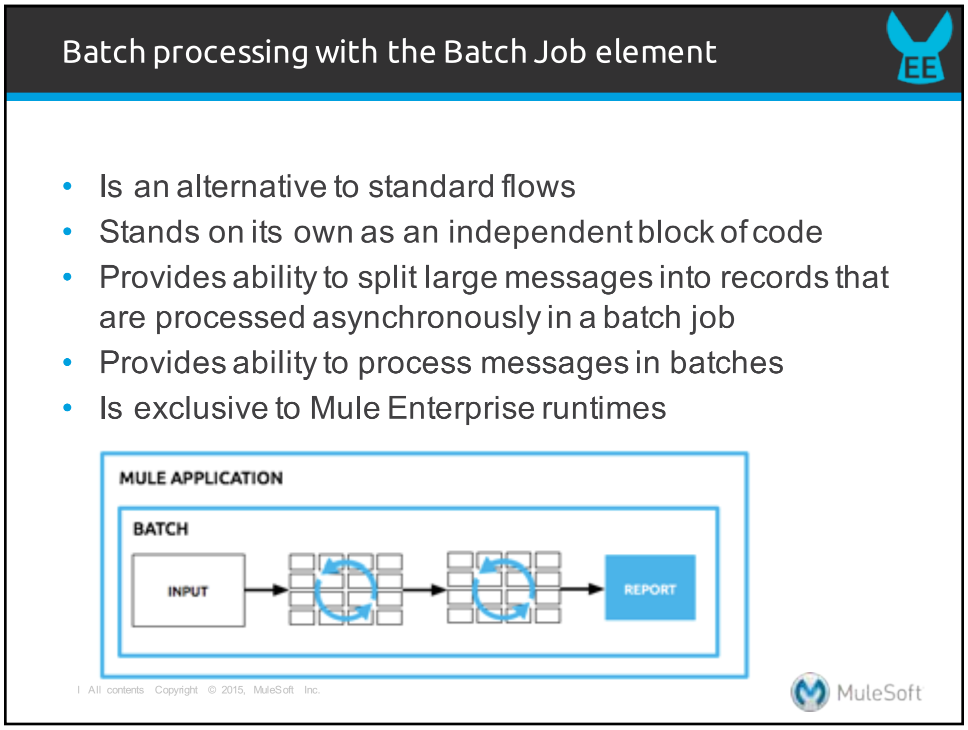
Walkthrough 9-1: Process items in a collection individually

- In this walkthrough, you will:
  - Add metatdata to a File endpoint
  - Read a CSV file and use DataWeave to convert it to a collection of objects
  - Use the For Each scope element to process each item in a collection individually



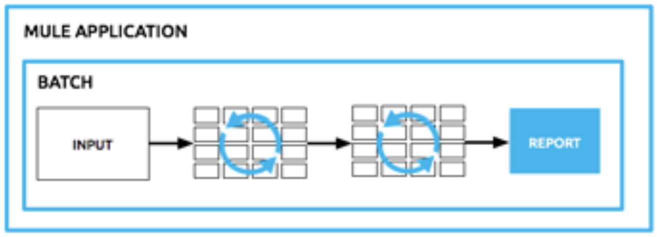


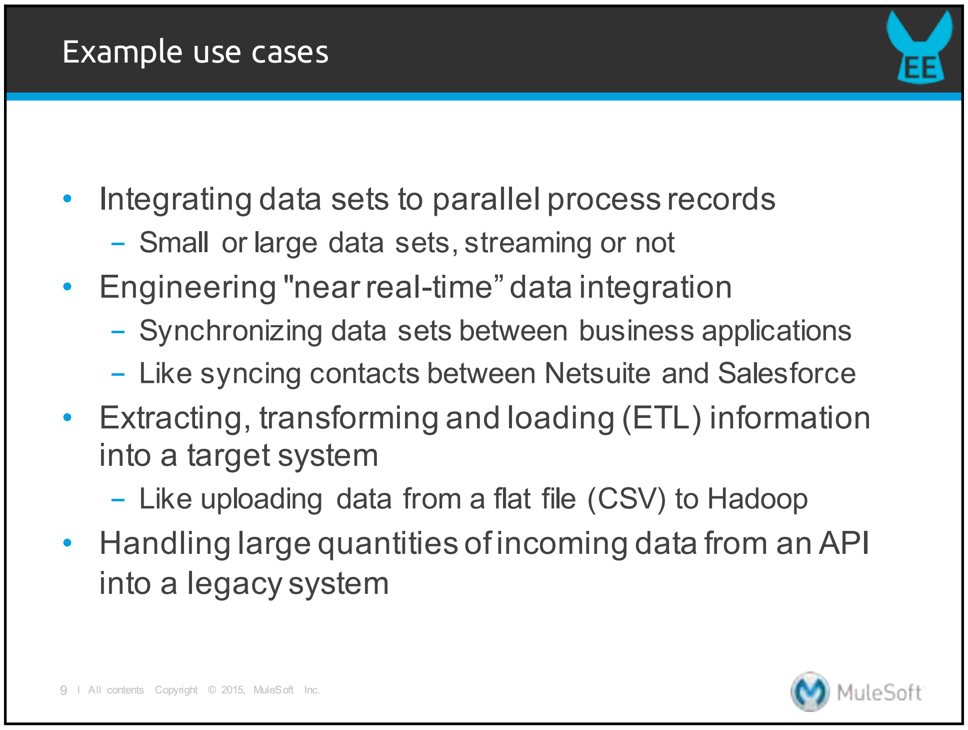
Processing records with the Batch Job element



Batch processing with the Batch Job element

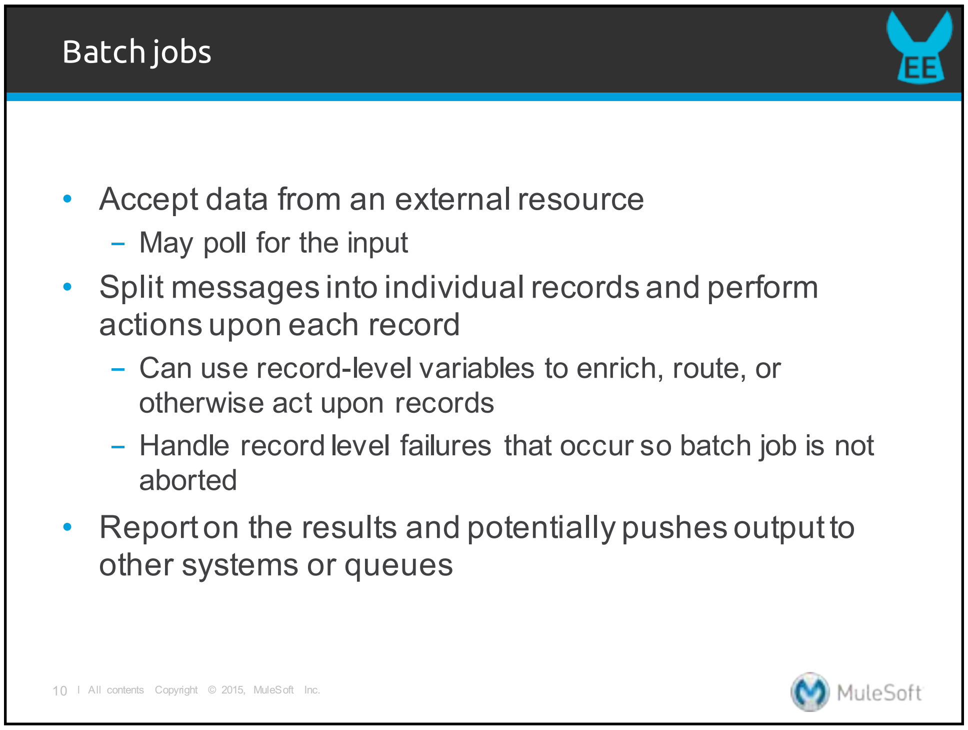
- Is an alternative to standard flows
- Stands on its own as an independent block of code
- Provides ability to split large messages into records that are processed asynchronously in a batch job
- Provides ability to process messages in batches
- Is exclusive to Mule Enterprise runtimes





Example use cases

- Integrating data sets to parallel process records
  - Small or large data sets, streaming or not
- Engineering "near real-time" data integration
  - Synchronizing data sets between business applications
  - Like syncing contacts between Netsuite and Salesforce
- Extracting, transforming and loading (ETL) information into a target system
  - Like uploading data from a flat file (CSV) to Hadoop
- Handling large quantities of incoming data from an API into a legacy system

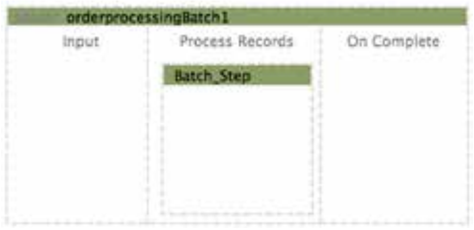


Batch jobs

- Accept data from an external resource
  - May poll for the input
- Split messages into individual records and perform actions upon each record
  - Can use record-level variables to enrich, route, or otherwise act upon records
  - Handle record level failures that occur so batch job is not aborted
- Report on the results and potentially pushes output to other systems or queues

Creating batch jobs

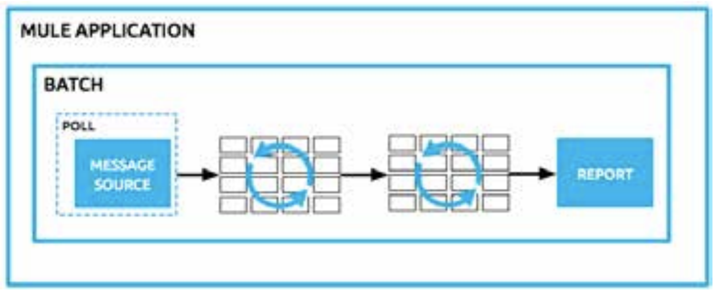
- Batch jobs are top-level elements that exists outside the context of any regular Mule flow
- To create
  - Drag a Batch scope element to the canvas or
  - Add a <batch:job> in XML



```
<batch:job
name="orderprocessingBatch1">
  <batch:process-records>
    <batch:step  name="Step1"/>
  </batch:process-records>
</batch:job>
```

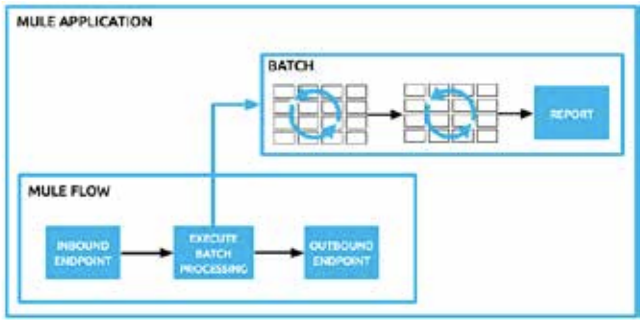
Triggering batch jobs: Option 1

- Place an inbound, one-way message source at the beginning of the batch job
  - It cannot be a request-response inbound message source



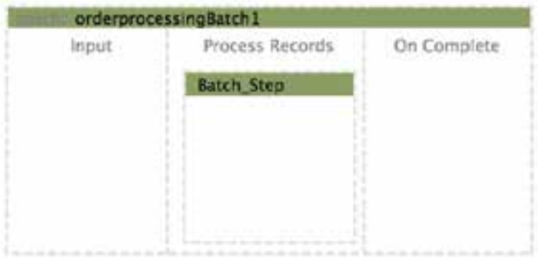
Triggering batch jobs: Option 2

- Use a Batch Execute message processor to reference the batch job from within a Mule flow in the same application

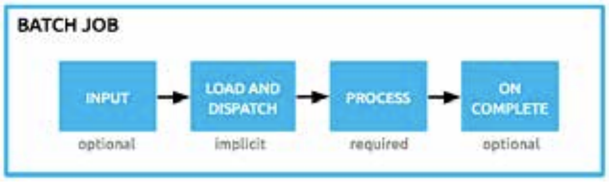


Batch phases in the canvas

- When you add a Batch scope element to the canvas, multiple phases are shown
  - Input, Process Records, and On Complete

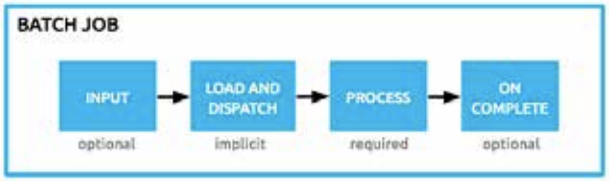


Phases of a batch job



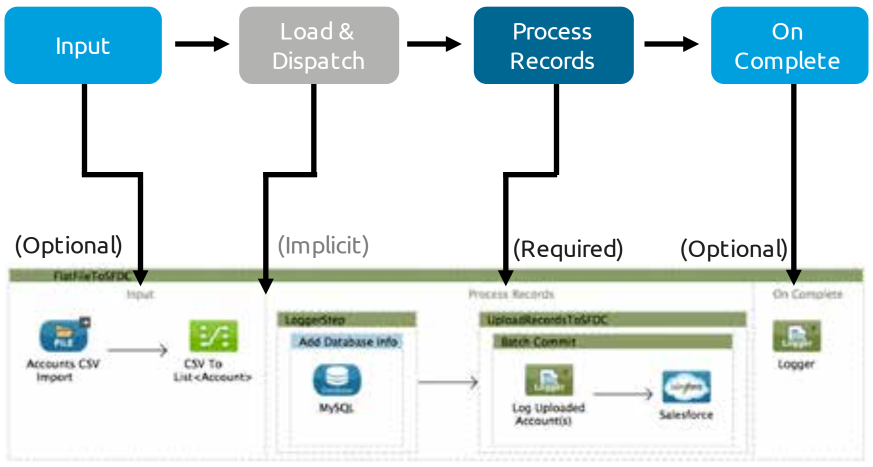
- Input (optional)
  - Triggers the processing via an inbound endpoint
  - Modifies the payload as needed before batch processing
- Load and dispatch (implicit)
  - Performs "behind-the-scene" work
  - Splits payload into a collection of records and creates a queue

Phases of a batch job



- Process (required)
  - Asynchronously processes the records
  - Contains one or more batch steps
- On Complete (optional)
  - Report summary of records processed
  - Get insight into which records failed so can address issues

A batch job example



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How record processing works

- Only one queue exists and records are picked out of it for each batch step, processed, and then sent back to it
- Each record keeps track of what stages it has been processed through while it sits on this queue
- A batch job instance does not wait for all its queued records to finish processing in one batch step before pushing any of them to the next batch step

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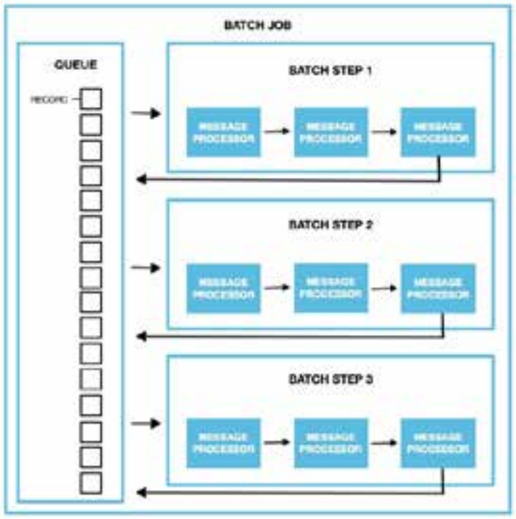
How record processing works

- Each record
  - Moves through the processors in the first batch step
  - Is sent back to the queue
  - Waits to be processed by the second batch step
- This repeats until each record has passed through every batch step



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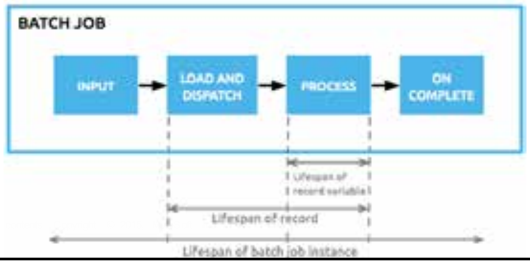
Batch record variables

Variable

Record Variable

- Store information at the record level, rather than the flow or session level
- Persist across all batch steps in the processing phase
  - A flow variable only persists in a single batch stop
- Commonly used to capture whether or not a record already exists in a database
- Is stored in the recordVars scope



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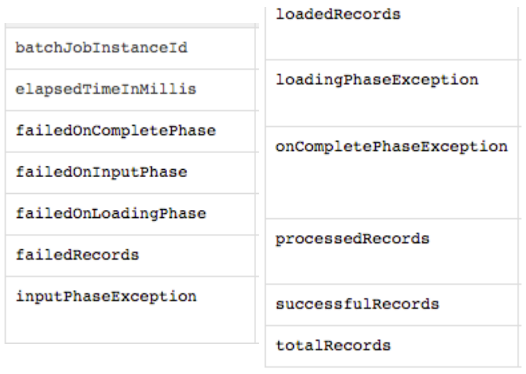
Reporting in the on complete phase

- Payload is a BatchJobResult
  - Has properties for processing statistics



batchJobInstanceId	loadedRecords
elapsedTimeInMillis	loadingPhaseException
failedOnCompletePhase	onCompletePhaseException
failedOnInputPhase	processedRecords
failedOnLoadingPhase	successfulRecords
failedRecords	totalRecords
inputPhaseException	

Handling record-level errors during processing

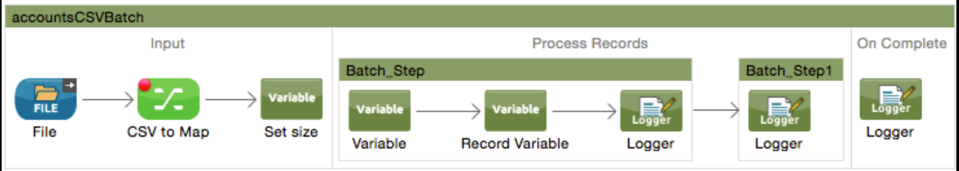
- If a message processor in a batch step cannot process a record (corrupt or incomplete data) there are 3 options

```
<batch:job name="Batch1" max-failed-records="0”>
```

  - 0: Stop processing the entire batch (default)
    - Any remaining batch steps are skipped and all records are passed to the on complete phase
  - -1: Continue processing the batch
    - You need to use filters to instruct subsequent batch steps how to handle failed records
  - {integer}: Continue processing the batch until a max number of failed records is reached
    - All records are then passed to the on complete phase

Walkthrough 9-2: Create a batch job for records in a file

- In this walkthrough, you will:
  - Create a new flow containing a batch job
  - Explore flow and record variable persistence across batch steps and phases
  - In the input phase, check for CSV files every second and convert them to a collection of objects
  - In the process records phase, create two batch steps for setting and tracking variables
  - In the on complete phase, display the number of records processed and failed



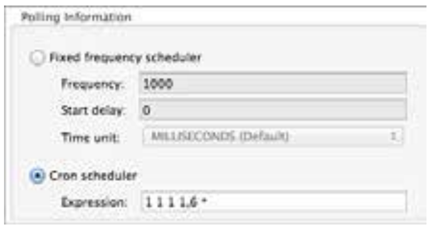
Polling resources

Polling resources

- Most message processors in Mule are triggered when called by a previous element in a flow
- Some connectors use or can use a polling process to actively retrieve messages from an external resource
  - File, FTP, SFTP
- If you want the other message processors to actively call a resource at regular intervals
  - Use a Poll scope element

Scheduling a poll

- By default, a resource is polled every 1000 milliseconds
- There are two methods to change the polling interval
  - Fixed frequency scheduler
  - Cron scheduler



Polling Information

( ) Fixed frequency scheduler

Frequency:	1000
Start delay:	0
Time unit:	MILLISECONDS (Default)

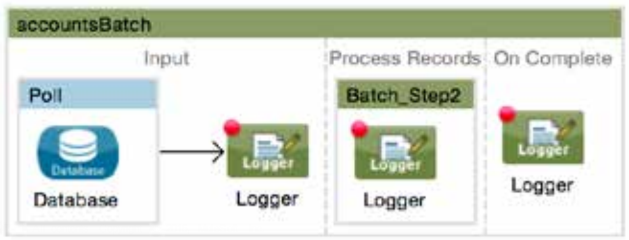
(●) Cron scheduler

Expression:	1 1 1 1,6 *

0 15 10 ? * *	Poll at 10:15am every day
0 15 10 * * ? 2015	Poll at 10:15pm every day in 2015
1 1 1 1,6 *	Poll the first day of January and June every year in the first second of the first minute of the first hour

Walkthrough 9-3: Create a batch job for records in a database

- In this walkthrough, you will:
  - Go a form and add multiple accounts for a specific postal code to the database
  - Create a new flow containing a batch job that polls a MySQL database every 30 seconds for records with a specific postal code
  - Use the Poll scope



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Restricting processing using a poll watermark

Polling for new data using watermarks

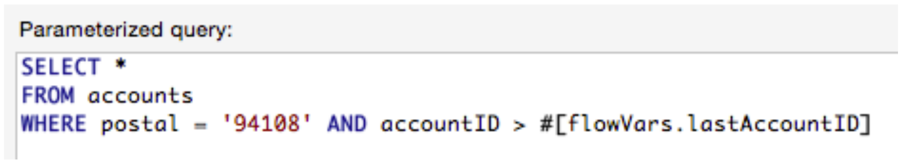
- Instead of polling a resource for all its data every call, you often want to only retrieve the data that has been newly created or updated since the last call
- To do this, you need to keep a persistent record of either
  - The item that was last processed
  - The last time the resource was polled
- In the context of Mule flows, this persistent record is called a watermark

How watermarks work

- The first time the poll runs, the watermark is set to a default value
- It is then used as necessary when running a query or calling a resource
- The value of the watermark may be kept or changed depending upon the logic
- The value must persist across flows
  - Mule uses a built-in object store for persistent storage and exposes the value as a flow variable
    - Saved to file for embedded Mule and standalone Mule runtime
    - Saved to data storage for CloudHub
    - Saved to shared distributed memory for clustered Mule runtimes

Walkthrough 9-4: Restrict processing using a poll watermark

- In this walkthrough, you will:
  - Modify the Poll to use a watermark to keep track of the last record returned from the database
  - Modify the database query to use the watermark
  - Clear application data


Parameterized query:

```
SELECT *
FROM accounts
WHERE postal = '94108' AND accountID > #[flowVars.lastAccountID]
```

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Restricting processing using a message enricher and a batch step accept policy

How to avoid processing existing records

- Check to see if a record already exists in the target resource
  - Use the Message Enricher scope to run “nested” message processors that do not modify the original payload
  - Store this result in a record variable
- To subsequent batch steps, add filters to only process qualified records

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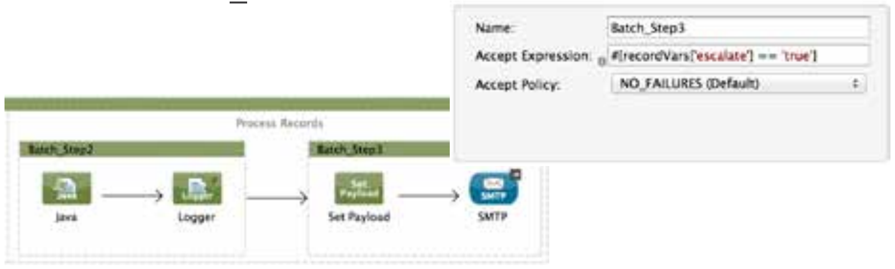
Batch step filters

- Restricts records to be processed
- Accept policies
  - ALL
  - NO_FAILURES
  - FAILURES_ONLY



Name: Batch_Step3
Accept Expression: #[recordVars['escalate'] == 'true']
Accept Policy: NO_FAILURES (Default)

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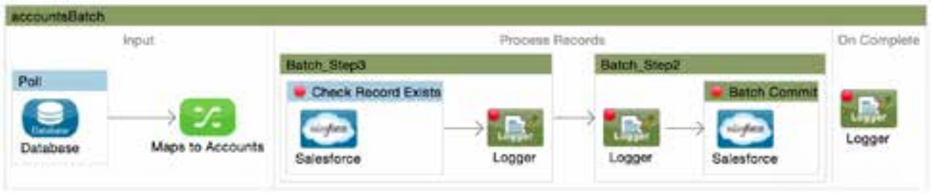
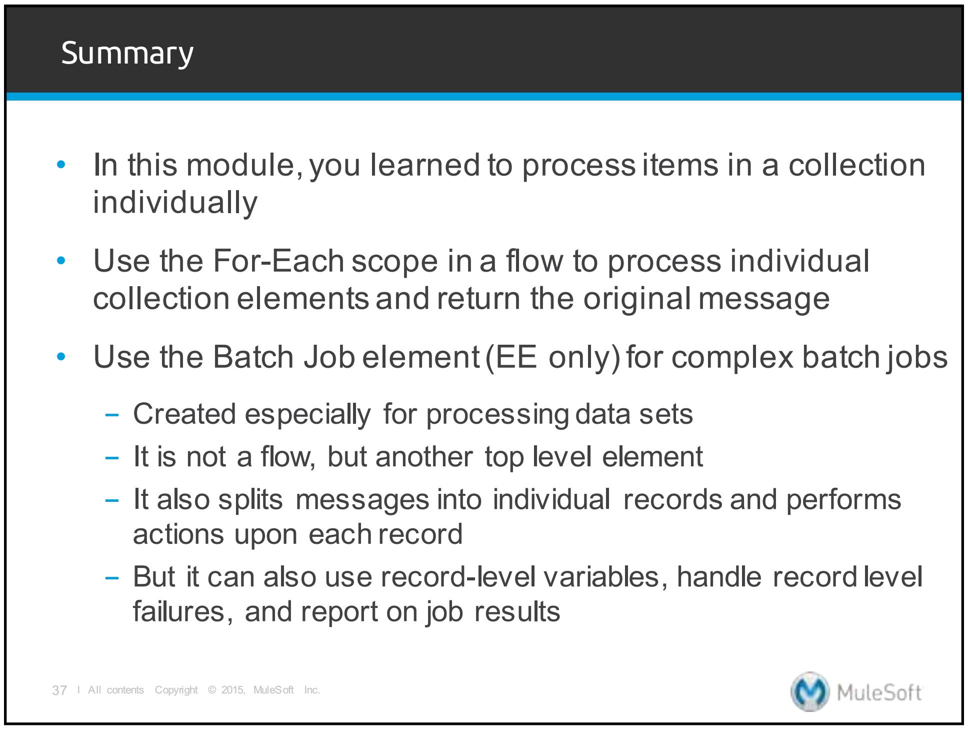
Walkthrough 9-5: Restrict processing using a message enricher and a batch step filter

- In this walkthrough, you will:
  - Add a first batch step with a Message Enricher scope element that checks if a record already exists in Salesforce (an account with the same Name) and stores the result in a record variable and retains the original payload
  - Modify the second batch step to use a filter that only allows new records (records that don't already exist) to be processed
  - (Optional) Add the record(s) to Salesforce

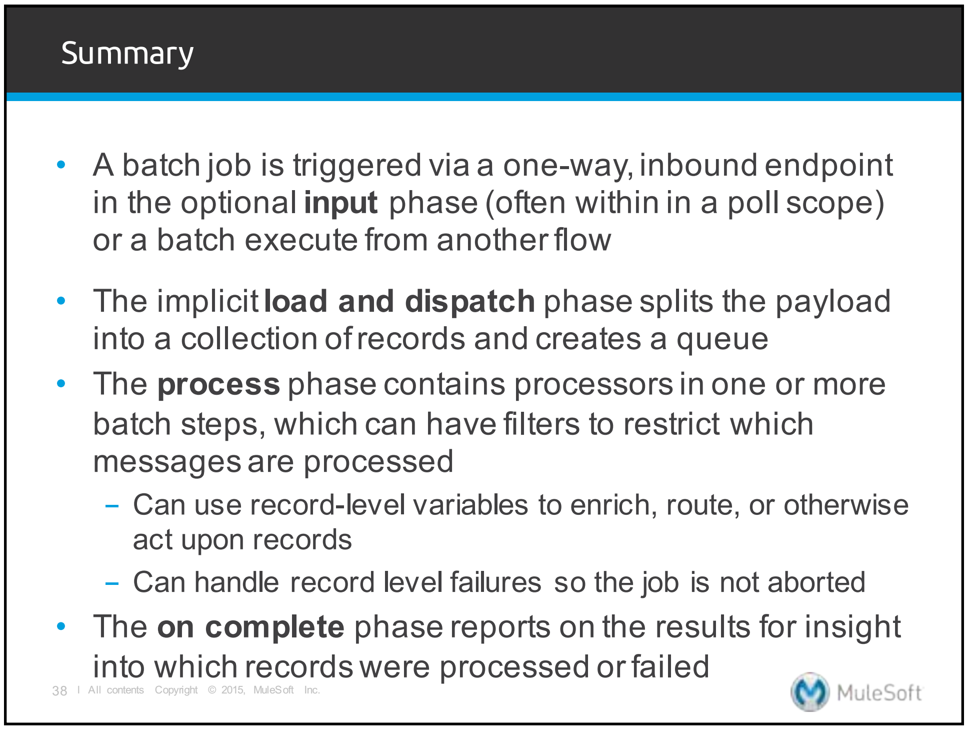


Summary



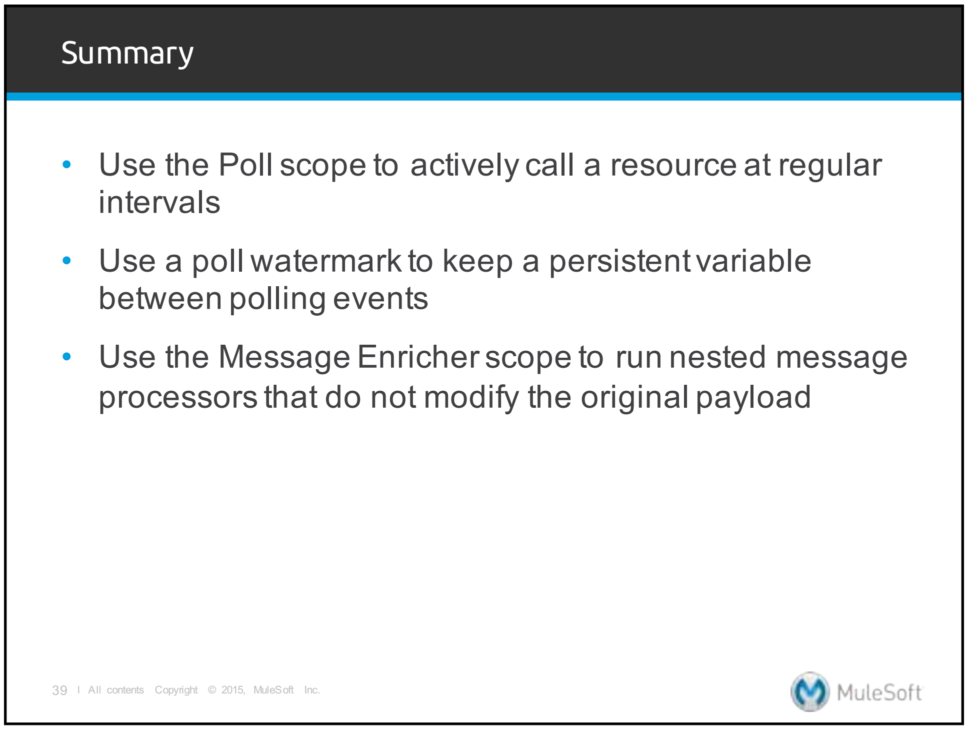
Summary

- In this module, you learned to process items in a collection individually
- Use the For-Each scope in a flow to process individual collection elements and return the original message
- Use the Batch Job element (EE only) for complex batch jobs
  - Created especially for processing data sets
  - It is not a flow, but another top level element
  - It also splits messages into individual records and performs actions upon each record
  - But it can also use record-level variables, handle record level failures, and report on job results



Summary

- A batch job is triggered via a one-way, inbound endpoint in the optional **input** phase (often within in a poll scope) or a batch execute from another flow
- The implicit **load and dispatch** phase splits the payload into a collection of records and creates a queue
- The **process** phase contains processors in one or more batch steps, which can have filters to restrict which messages are processed
  - Can use record-level variables to enrich, route, or otherwise act upon records
  - Can handle record level failures so the job is not aborted
- The **on complete** phase reports on the results for insight into which records were processed or failed



Summary

- Use the Poll scope to actively call a resource at regular intervals
- Use a poll watermark to keep a persistent variable between polling events
- Use the Message Enricher scope to run nested message processors that do not modify the original payload

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