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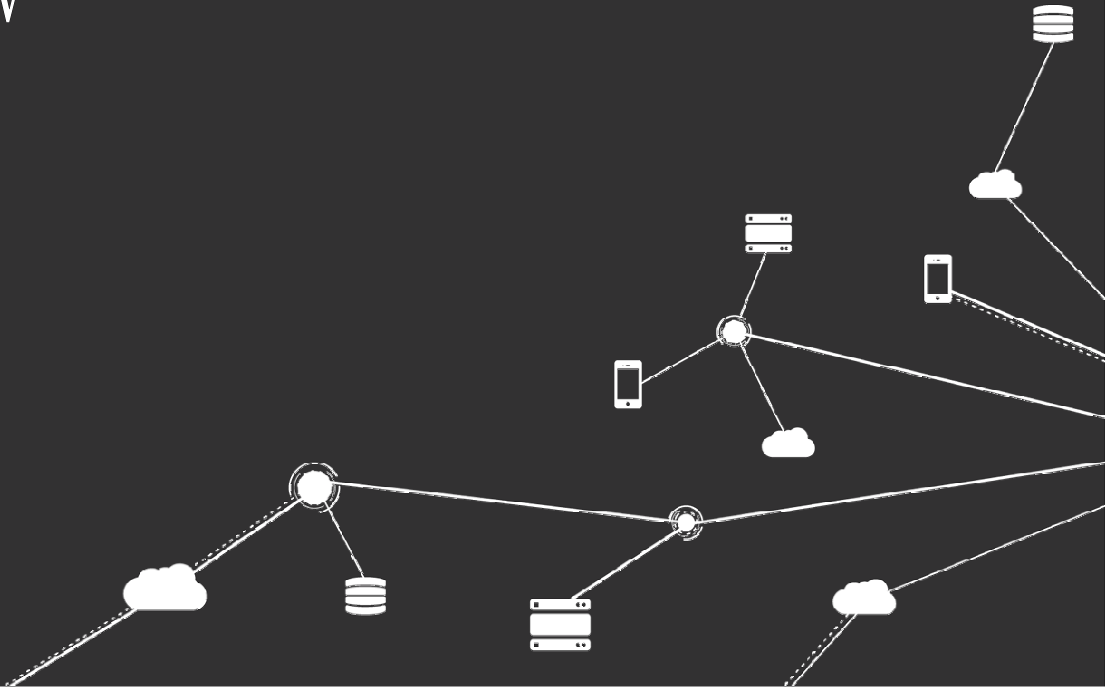
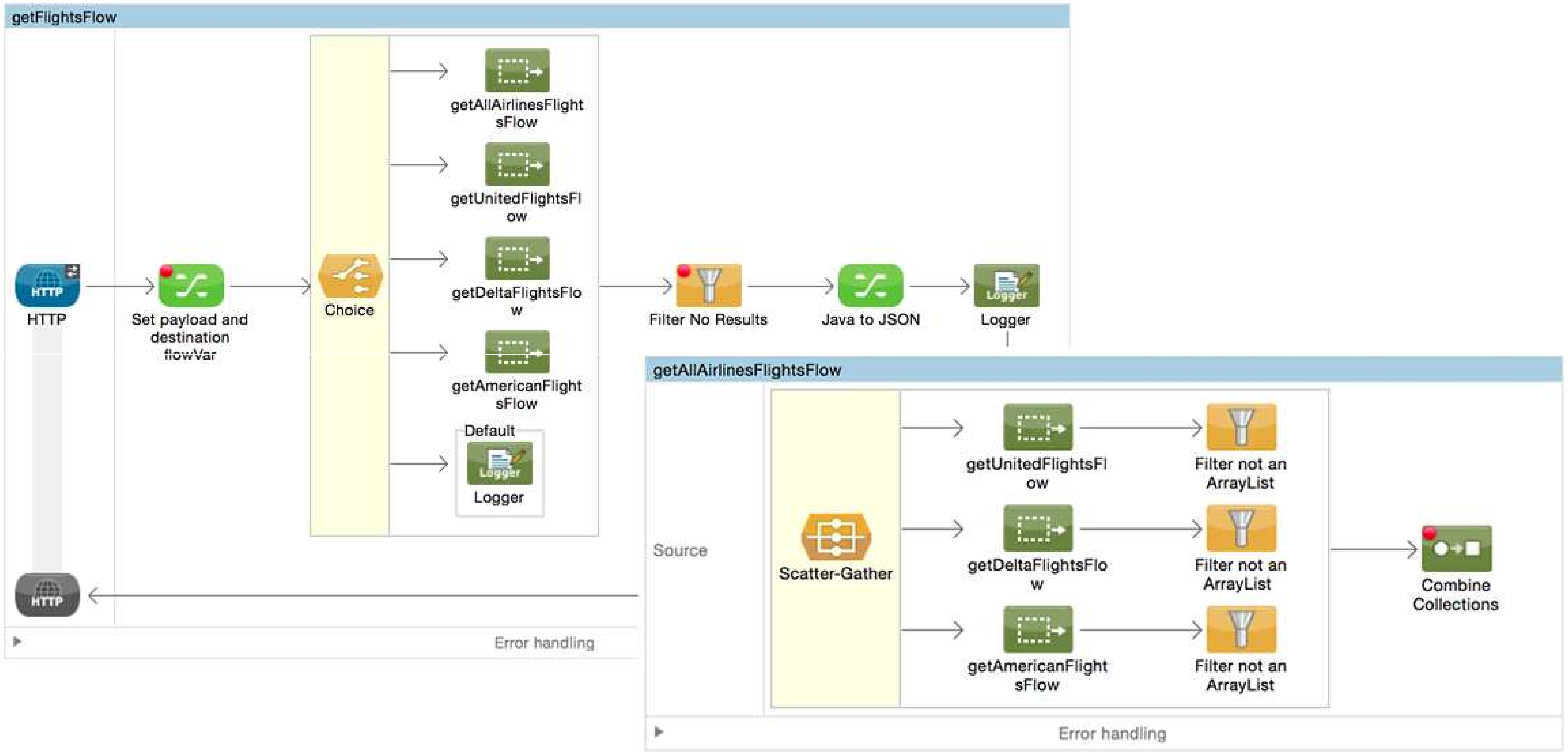
Module 8: Controlling Message Flow



Goal



getFlightsFlow
HTTP
Set payload and destination flowVar
Choice
getAllAirlinesFlightsFlow
getUnitedFlightsFlow
getDeltaFlightsFlow
getAmericanFlightsFlow
Default
Logger
Filter No Results
Java to JSON
Logger
Error handling
getAllAirlinesFlightsFlow
Source
Scatter-Gather
getUnitedFlightsFlow
getDeltaFlightsFlow
getAmericanFlightsFlow
Filter not an ArrayList
Filter not an ArrayList
Filter not an ArrayList
Combine Collections
Error handling

Objectives

- In this module, you will learn:
  - About flow control and filter elements
  - To multicast a message
  - To route message based on conditions
  - To filter messages
  - About synchronous and asynchronous flows
  - To create an asynchronous flow

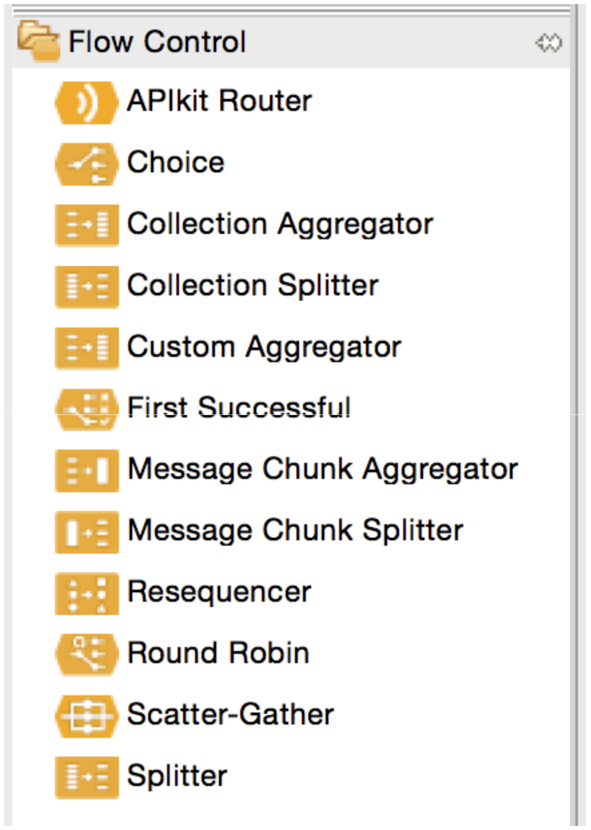
Routing messages

Routers

- Route messages to various destinations in a Mule flow
- Some incorporate logic to analyze and possibly transform messages before routing takes place
- Some change the payload, some don’t

Available flow controls

- Two main types, those that
  - Split and/or aggregate
  - Multicast and aggregate
    - Scatter-Gather
  - Check logic and route
    - Choice


Flow Control
- APIkit Router
- Choice
- Collection Aggregator
- Collection Splitter
- Custom Aggregator
- First Successful
- Message Chunk Aggregator
- Message Chunk Splitter
- Resequencer
- Round Robin
- Scatter-Gather
- Splitter

The Scatter-Gather router

- Scatter-Gather sends the message to each route concurrently and returns a collection of all results
- Is often used with the Combine Collections transformer
  - Flattens a collection of collections into one collection

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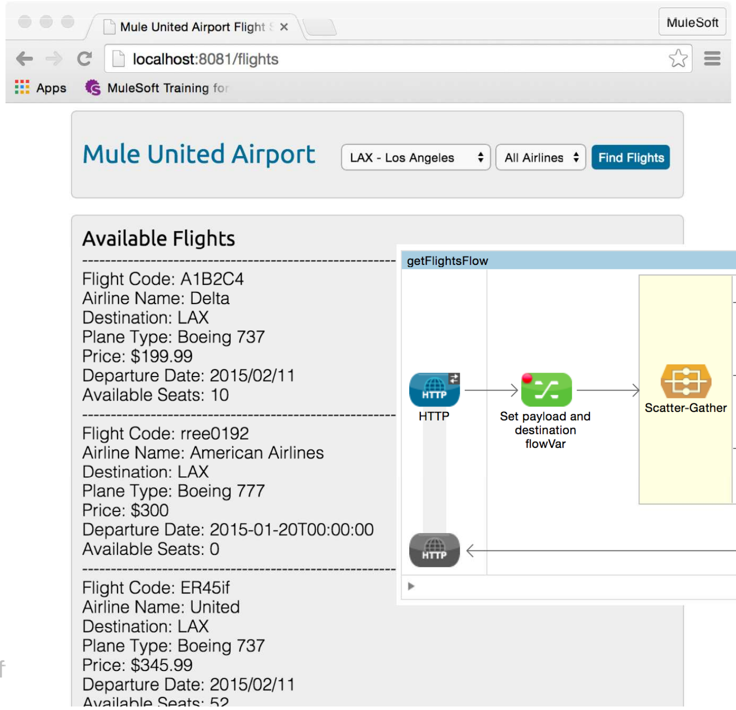
Walkthrough 8-1: Multicast a message

- In this walkthrough, you will:
  - Use a Scatter-Gather router to concurrently call all flight services
  - Use a Combine Collections transformer to combine a collection of three ArrayLists of objects into one collection
  - Use DataWeave to sort the flights and return them as JSON to the form

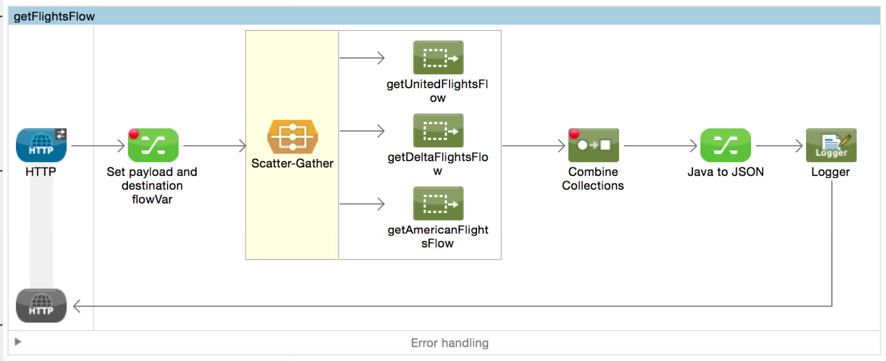


Available Flights

Flight Code: A1B2C4
Airline Name: Delta
Destination: LAX
Plane Type: Boeing 737
Price: $199.99
Departure Date: 2015/02/11
Available Seats: 10

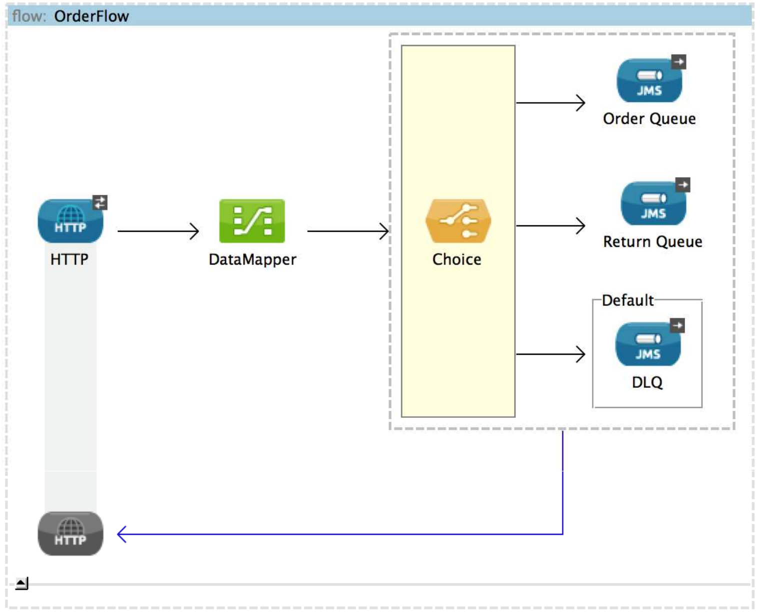
Flight Code: rree0192
Airline Name: American Airlines
Destination: LAX
Plane Type: Boeing 777
Price: $300
Departure Date: 2015-01-20T00:00:00
Available Seats: 0

Flight Code: ER45if
Airline Name: United
Destination: LAX
Plane Type: Boeing 737
Price: $345.99
Departure Date: 2015/02/11
Available Seats: 52

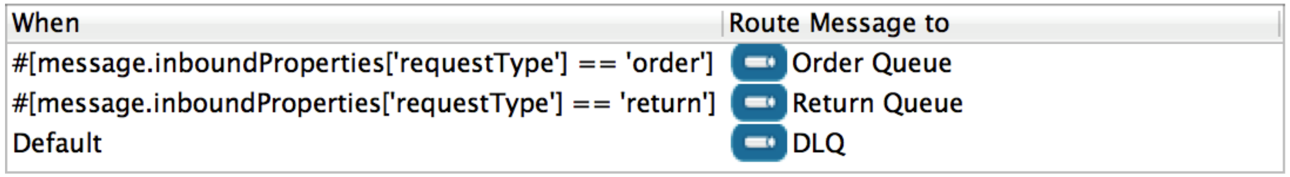


The Choice router

- Sends the message to one route based on conditions
  - Each path can include multiple message processors



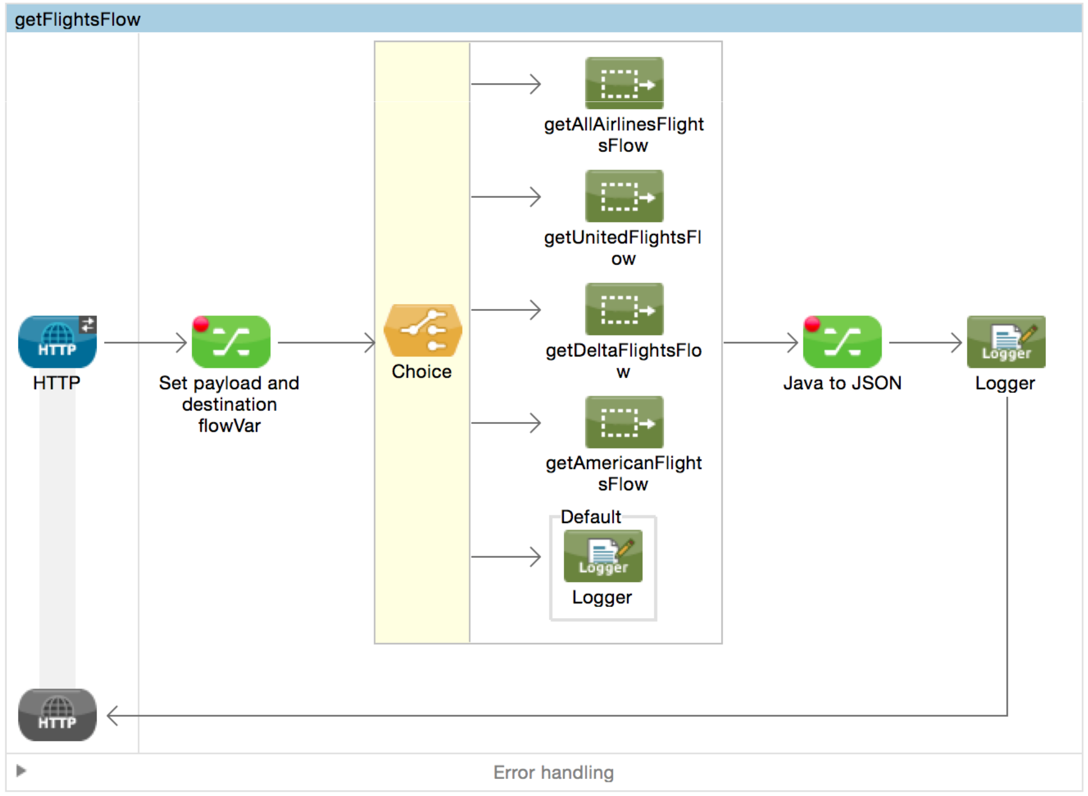
- The conditions are written with MEL



When	Route Message to
#[message.inboundProperties['requestType'] == 'order']	Order Queue
#[message.inboundProperties['requestType'] == 'return']	Return Queue
Default	DLQ

Walkthrough 8-2: Route messages based on conditions

- In this walkthrough, you will:
  - Use a Choice router to get flight results for all three airlines or only a specific airline
  - Set the router paths based on the airline value sent from the flight form



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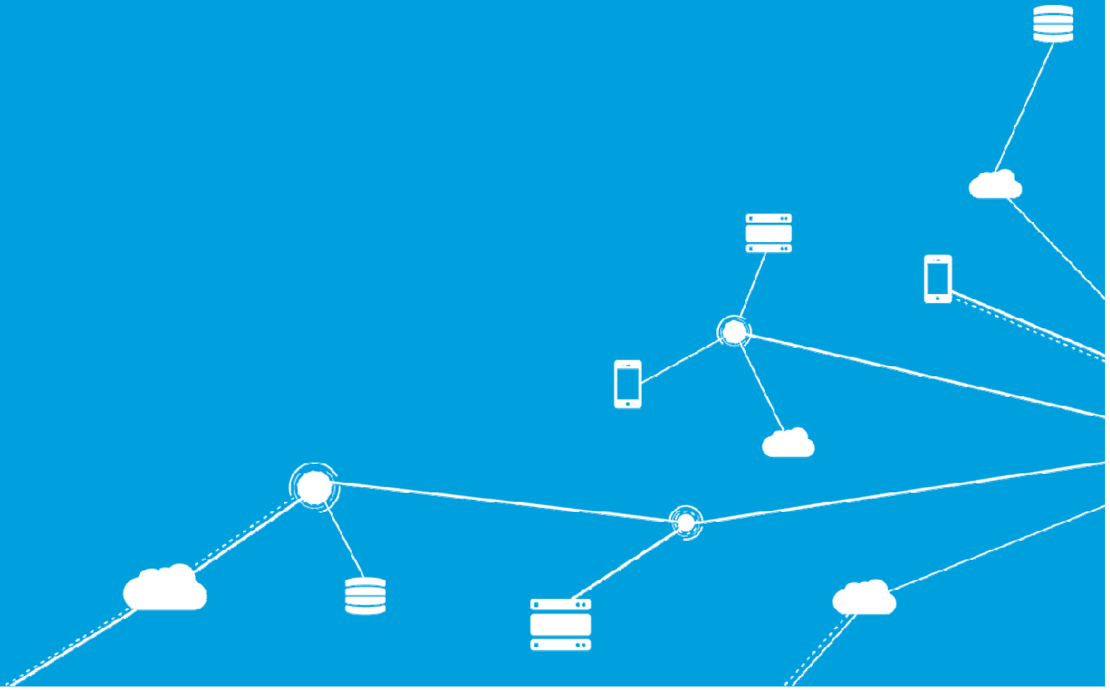
Filtering messages



Filters

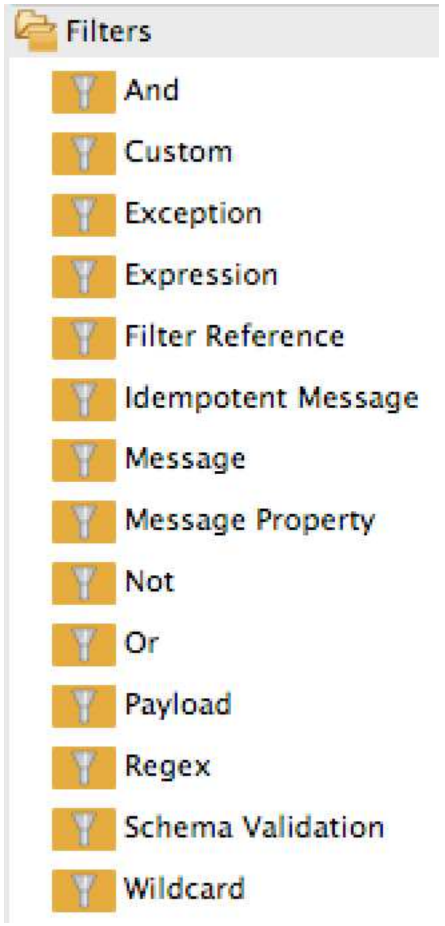
- Determine whether a message can proceed in a Mule flow

- By default, filtered messages are dropped and processing of the message ends
  - Keeps subsequent processors from receiving irrelevant or incomprehensible messages
  - Filters can be configured to throw an exception

Available filters

- There are 12 bundled filters
  - Expression and Payload are often used
  - And, Or, Not apply Boolean logic
  - Message filter nests other filters for more complex logical conditions
  - Idempotent ensures a message is not delivered more than once

- You can create custom filters
- You can define global filters and reference them for reuse



Filters
- And
- Custom
- Exception
- Expression
- Filter Reference
- Idempotent Message
- Message
- Message Property
- Not
- Or
- Payload
- Regex
- Schema Validation
- Wildcard

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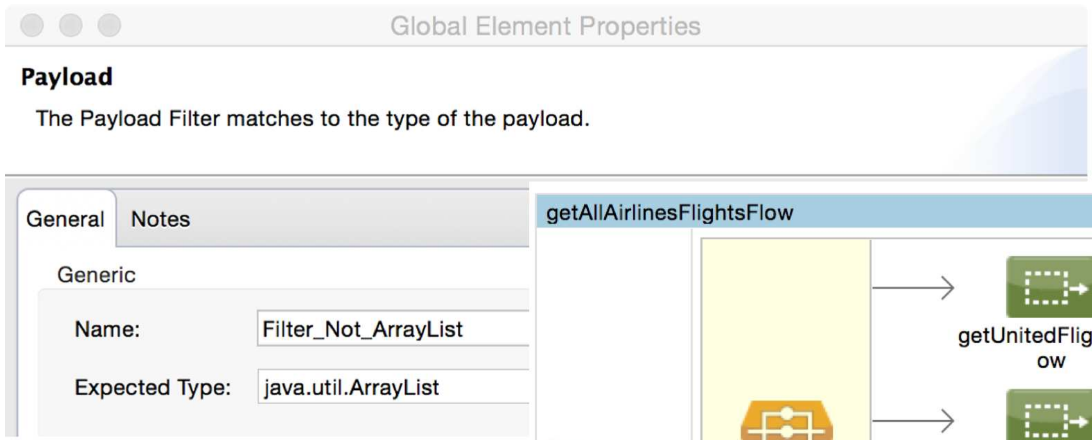
Walkthrough 8-3: Filter messages

- In this walkthrough, you will:
  - Filter the results in the multicast to ensure they are ArrayLists and not exception strings
  - Use the Payload and Expression filters
  - Create and use a global filter


Global Element Properties

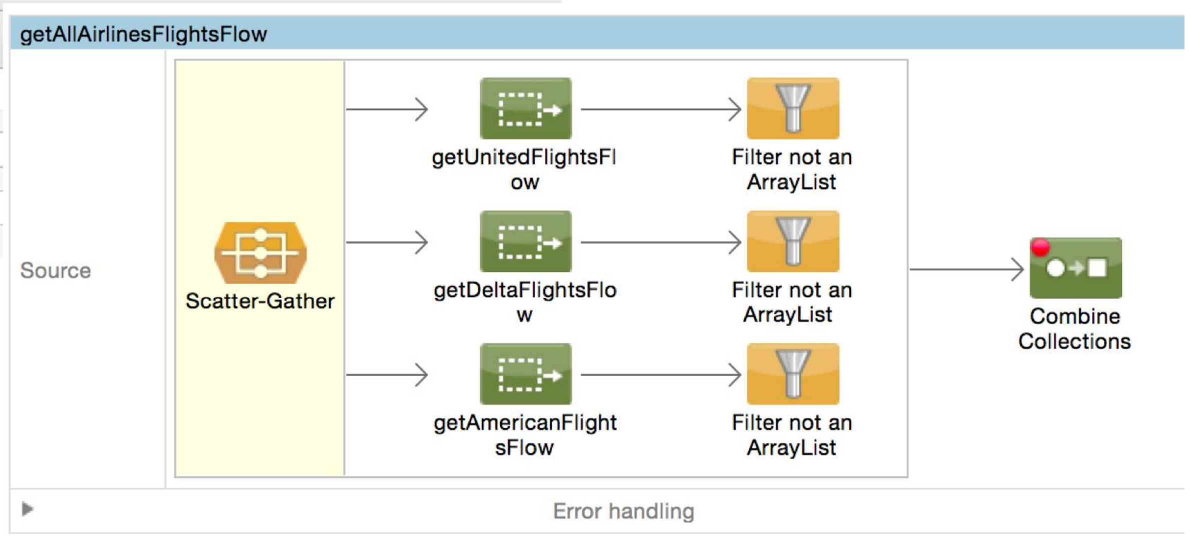
Payload

The Payload Filter matches to the type of the payload.

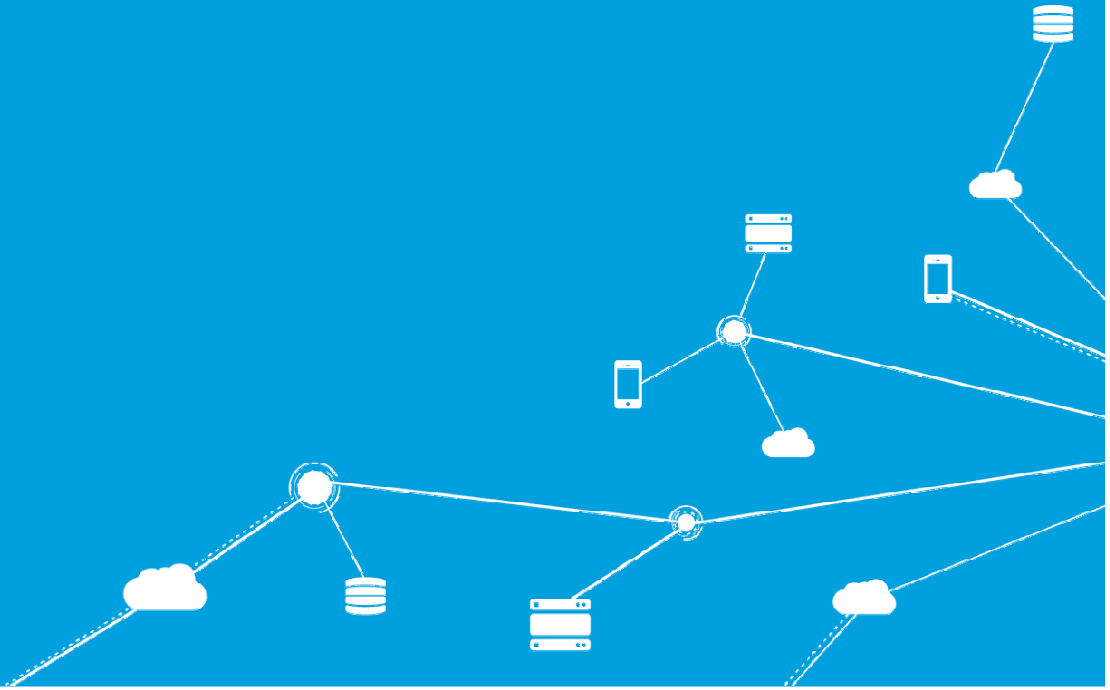
General | Notes

Generic

Name:	Filter_Not_ArrayList
Expected Type:	java.util.ArrayList



Understanding flow processing strategies



What is a flow processing strategy?

- A flow **processing strategy** determines how Mule implements message processing for a given flow
  - Should the message be processed synchronously (on the same thread) or asynchronously (on a different thread)?
  - If asynchronously, what are the properties of the pool of threads used to process the messages?
  - If asynchronously, how will messages wait for their turn to be processed in the second thread?

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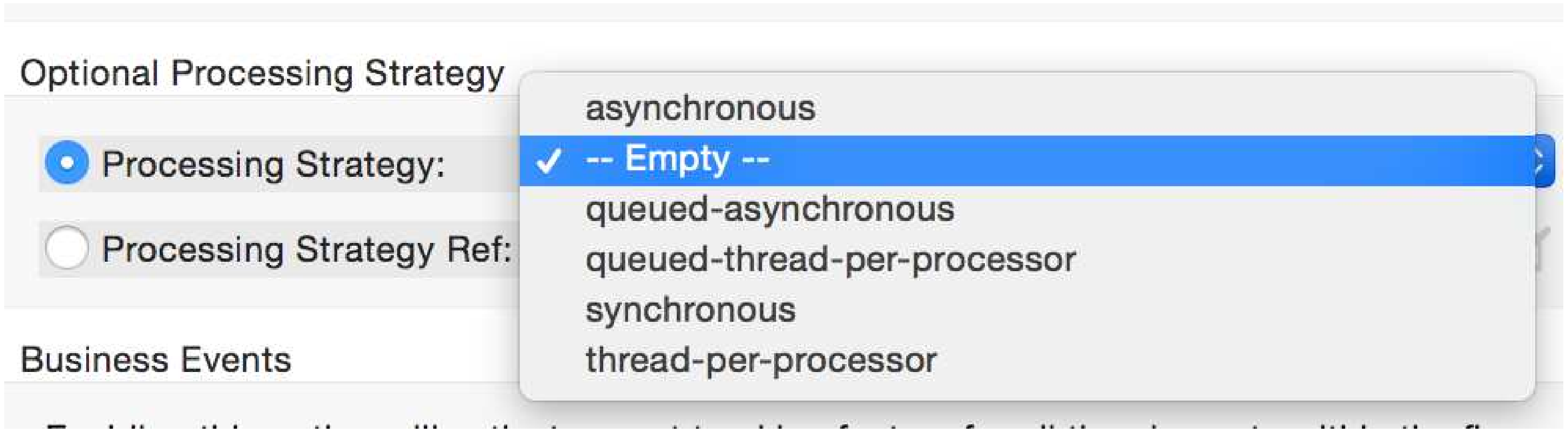
Flow processing strategies

- All Mule flows have an implicit processing strategy which Mule applies automatically
  - Either synchronous or queued-asynchronous
  - Each of these is optimal for certain flows
- The processing strategy can be changed


Optional Processing Strategy

Processing Strategy: [✓ -- Empty --]

Processing Strategy Ref:

asynchronous
-- Empty --
queued-asynchronous
queued-thread-per-processor
synchronous
thread-per-processor

Business Events

The common flow processing strategies

- Synchronous
  - After the flow receives a message, all processing, including the processing of the response, is done in the same thread
    - With the exception of asynchronous scope Async
- Queued-asynchronous
  - Default if no other processing strategy is configured
  - Higher throughput
  - Uses a queue to decouple the flow's receiver from the rest of the steps in the flow
  - Works the same way in a scope as in a flow
  - Can fine tune number of threads, number queued, object store
  - Asynchronous strategy is same except it doesn't use a queue so cannot be distributed across nodes in a cluster

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What determines a flow's processing strategy?

- Mule selects a processing strategy for a flow based the flow's exchange pattern (and if its transactional)
- The flow exchange pattern is determined by the exchange pattern of the inbound endpoint
  - A **request-response exchange pattern** is used when the sender of the messages expects a response
    - Mule applies a synchronous processing strategy
  - A **one-way exchange pattern** is used when no response is expected
    - Mule applies a queued-asynchronous processing strategy

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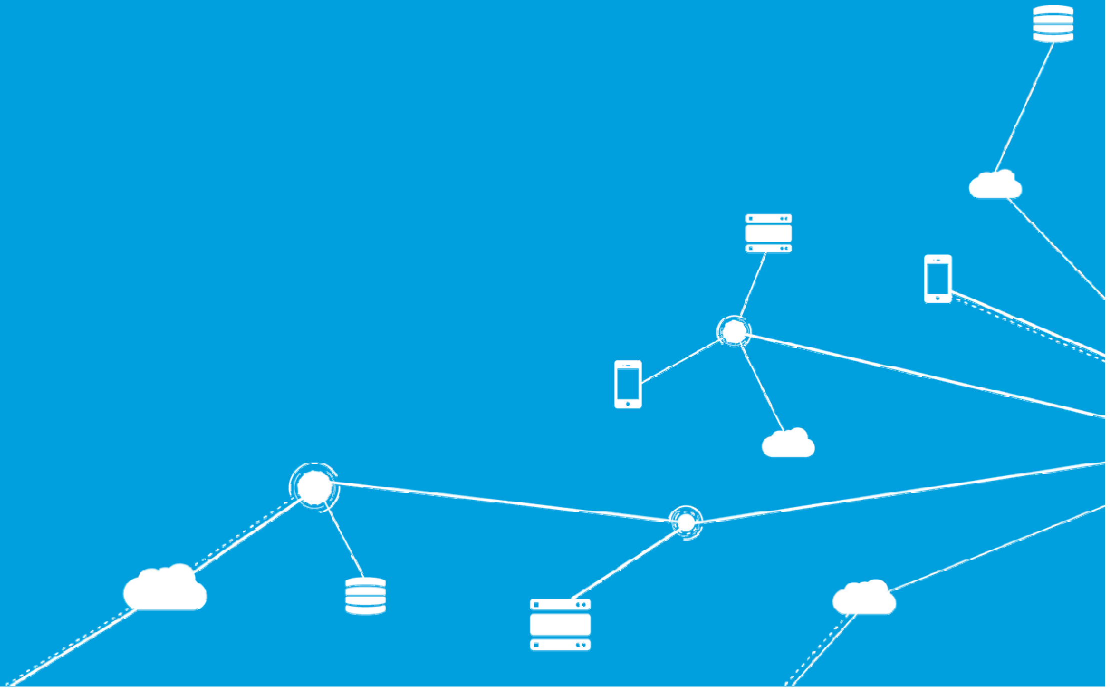
Passing messages to an asynchronous block



Async scope

- A branch processing block that executes simultaneously with the parent message flow
  - Useful for executing time-consuming operations that do not require sending a response back to the initiating flow
    - Printing a file or connecting to a mail server

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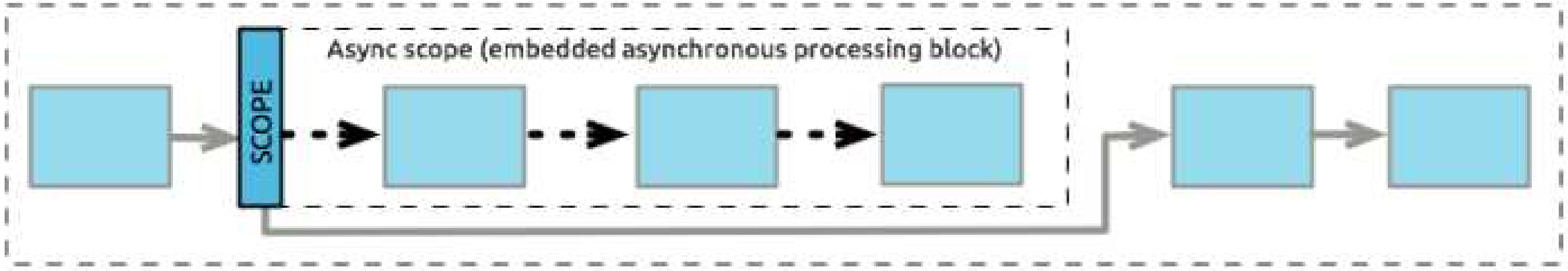
Async scope

- Sends a message copy to
  - The first message processor in its own processing block
  - The next message processor in the main flow
- The payload is not copied
  - The same payload object(s) will be referenced by both messages in the two flows



Async scopes vs asychronous flows

- Similarities
  - Processes the message asynchronously with the main flow without pausing the processing in the main flow thread
  - Does not pass data back into the main flow thread
  - Can have its own processing strategy
- Differences
  - Exists in-line with the main flow thread
  - Is not called by a flow reference component
  - Is not re-usable
  - Cannot have its own exception handling strategy

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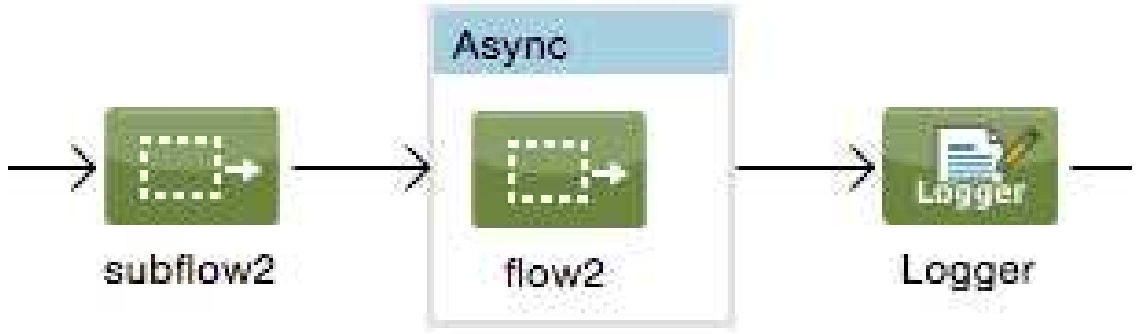
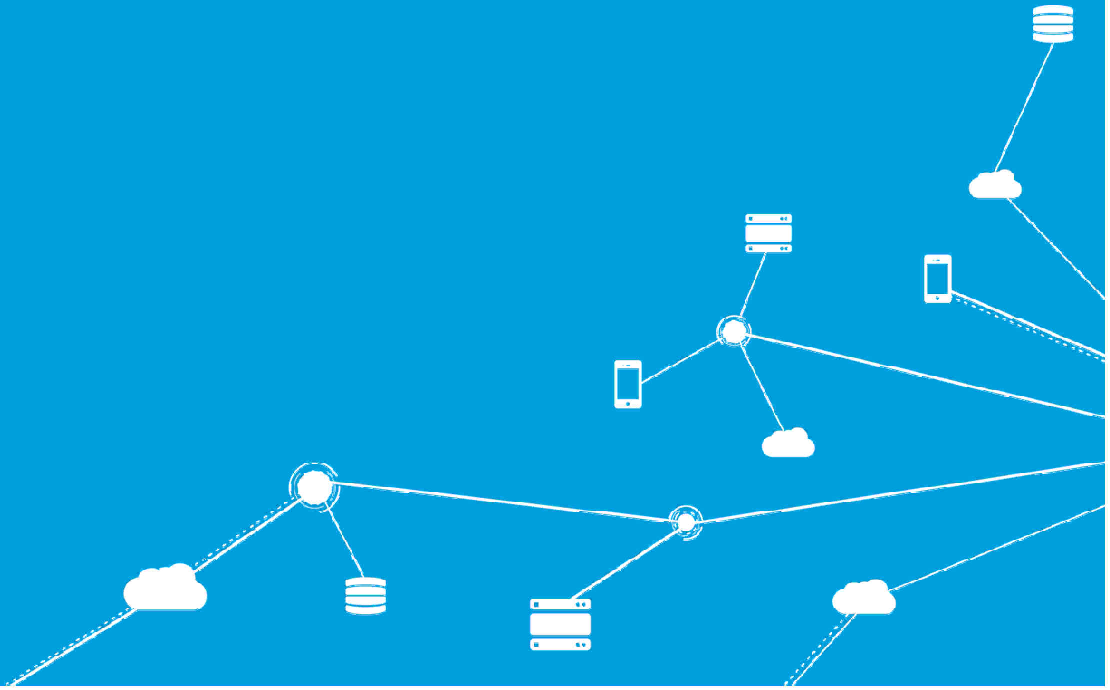
Walkthrough 8-4: Pass messages to an asynchronous flow

- In this walkthrough, you will:
  - Use the Async scope element to create an asynchronous flow
  - Use the Mule Debugger to watch messages flow through both flows



Summary



Summary

- In this module, you learned to use different, routers, filters, and scopes to control message flow
- Use the Scatter-Gather router to send a message concurrently to multiple routes
  - A collection of all results is returned
  - Use Combine Collections to flatten the collection
- Use the Choice router to send a message to one route based on conditions
- Use filters to determine whether a message can proceed in a Mule flow

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Summary

- A flow processing strategy determines how Mule implements message processing for a given flow
- All Mule flows have an implicit processing strategy which Mule applies automatically
  - Endpoints with a request-response exchange pattern are set to synchronous
  - Endpoints with a one-way exchange pattern are set to queued-asynchronous
- Use Async scope to create a branch processing block that executes simultaneously with the parent message flow