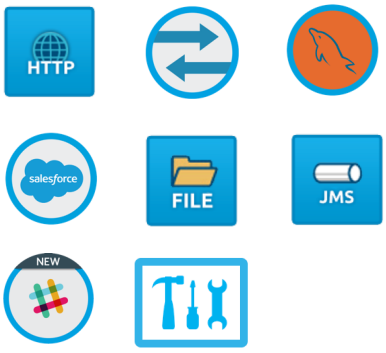
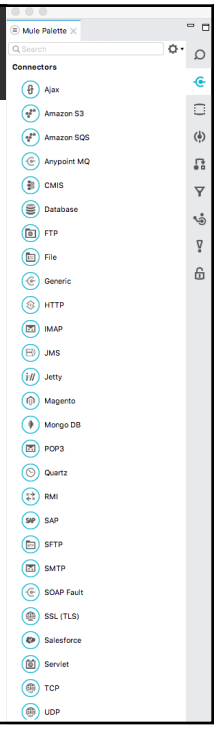
Module 12: Connecting to Additional Resources

Goal





At the end of this module, you should be able to

MuleSoft

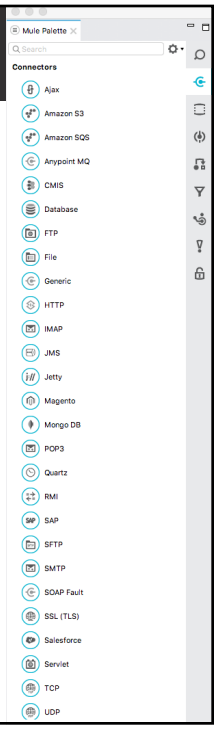
- Connect to SaaS applications
- Connect to files
- Poll resources
- Connect to JMS queues
- Discover and install connectors not bundled with Anypoint Studio

Connecting to SaaS applications

Out-of-the-box SaaS connectors

- SaaS connectors are operation-based endpoints for connecting to third-party APIs
- Many bundled with Anypoint Studio

- Additional SaaS connectors can be found on Anypoint Exchange



The Salesforce connector

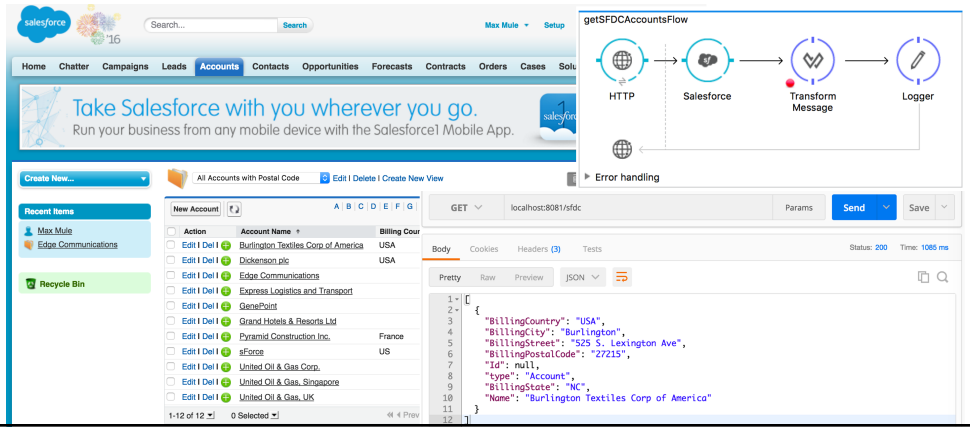
MuleSoft

- Is as a secure way to access and act upon Salesforce.com (SFDC) data from a Mule application
  - Eliminates need to custom-code and secure a connection
- Handles all of five of the integration patterns for connecting with Salesforce
  - As identified by Salesforce
- Can perform operations that Salesforce exposes via four of their APIs
  - It does not expose all possible operations

Walkthrough 12-1: Connect to a SaaS application (Salesforce)

MuleSoft

- Browse Salesforce data on http://salesforce.com
- Use the Salesforce connector to retrieve accounts for a postal code
- Use the Query Builder to write a query



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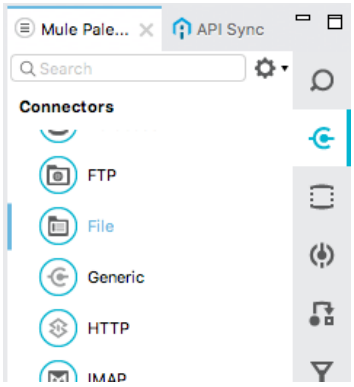
Connecting to files

The File connector

MuleSoft

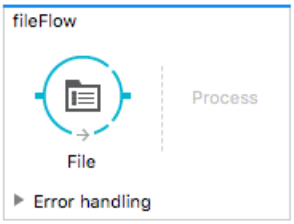
- Gives Mule applications the ability to both read and write files in the local file system
  - Read files every certain period of time and delete, move, or leave the file as it is once processed
  - Copy files from one directory to another
  - Read input files while saving a backup of the input file
  - Create new files with a specific names
  - Append output to existing files



Using the File connector as an inbound endpoint

MuleSoft

- Add the File endpoint to the source section of a flow
- It checks for files in a location at some set frequency
- It triggers the flow whenever it receives an incoming file

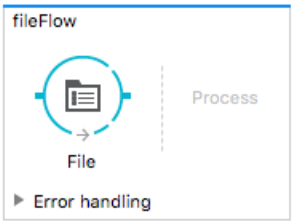


- It reads the file into the payload and dispatches the message to the next processor
- By default, it consumes the file, but it can also move and/or rename the file
- It can filter the files it reads by different name patterns

Using the File connector as an inbound endpoint

MuleSoft

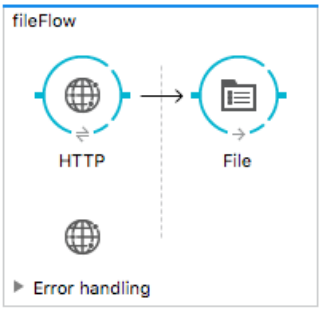
- By default, it uses streaming
  - Payload is a FileInputStream
  - Streams are closed by transformers reading the input stream
  - Can turn off streaming if you want a byte array instead
- Does not require a connector configuration
- Create and use a connector configuration for
  - Reusability
  - Setting properties, like autoDelete=false or streaming=false



Using the File connector as an outbound endpoint

MuleSoft

- Add the File endpoint to the process section of a flow
- It will serve as an outbound endpoint, passing files to the connected file system
- It can generate new files or append content to an existing file
- The file name can be set at runtime

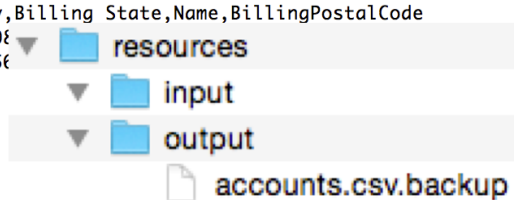


Walkthrough 12-2: Connect to a file (CSV)

MuleSoft

- Add and configure a File endpoint to watch an input directory, read the contents of any added files, and then rename and move the files
- Use DataWeave to convert a CSV file to a string
- Add a CSV file to the input directory and watch it renamed and moved
- Restrict the type of file read
- Add payload metadata to a file endpoint

```
INFO  2015-08-19 13:44:16,688 [[apessentials].getCSVAccountsFlow.stage1.02] org.mule.api.processor.Logger
MessageProcessor: Billing Street,Billing City,Billing Country,Billing State,Name,BillingPostalCode
111 Boulevard Hausmann,Paris,France,,Dog Park Industries,75008
400 South St,San Francisco,USA,CA,Iguana Park Industries,91156
777 North St,San Francisco,USA,CA,Cat Park Industries,91156
```



Tips for using the File connector

MuleSoft

- For on-prem Mule runtimes, the account running Mule must have read and/or write permissions on the specified directories
- In the cloud, the File connector can only be used with /tmp folder
- Be careful not to permanently delete or overwrite files
  - Use autoDelete and moveToDirectory attributes wisely
- See both the File connector documentation and the File Transport documentation
  - https://docs.mulesoft.com/mule-user-guide/v/3.8/file-transport-reference

Polling resources

Polling resources

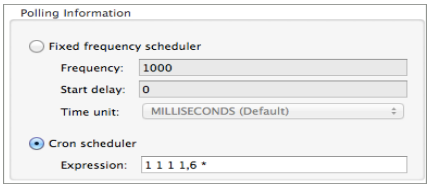
MuleSoft

- 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

MuleSoft

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



  - Cron scheduler
    - 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

Polling for new data using watermarks

MuleSoft

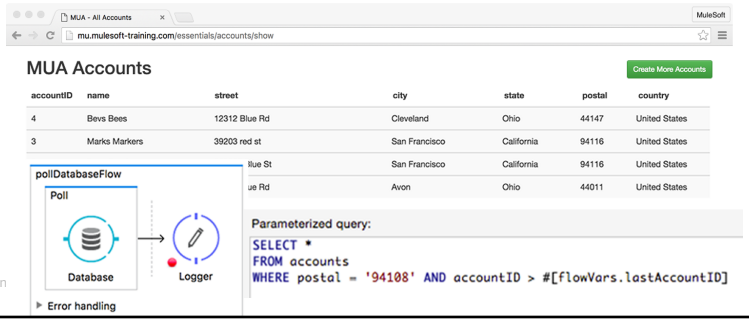
- Instead of polling a resource for all its data every call, you often want to only retrieve the data that has been newly created or updated since the last call
- To do this, you need to keep a persistent record of either
  - The item that was last processed
  - The last time the resource was polled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

How watermarks work

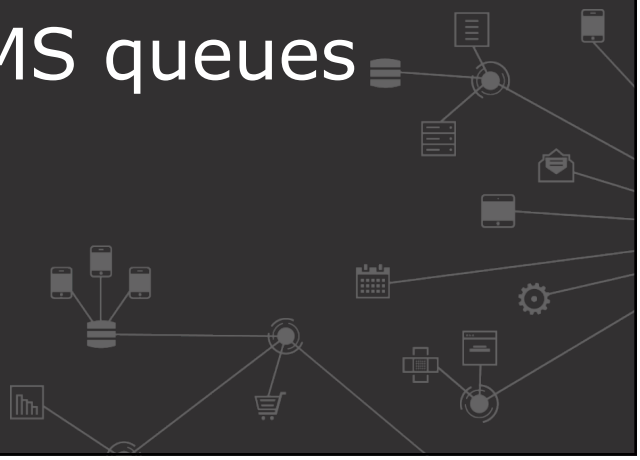
- The first time the poll runs, the watermark is set to a default value
- It is then used as necessary when running a query or calling a resource
- The value of the watermark may be kept or changed depending upon the logic
- The value must persist across flows
  - Mule uses a built-in object store for 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 12-3: Poll a resource

- Use a form to add accounts for a postal code to an accounts table
- Create a flow with a Poll scope as the message source
- Poll a database every 5 seconds for records with a specific postal code
- Use a poll watermark to track the ID of the latest record retrieved
- Use the watermark to only retrieve new records with that postal code



Connecting to JMS queues



Java Messaging Service (JMS)

MuleSoft

- Is a widely-used API for enabling applications to communicate through the exchange of messages
- Simplifies application development by providing a standard interface for creating, sending, and receiving messages
- Supports two messaging models
  - Queues: PTP (point-to-point)
  - Topics: Pub-Sub (publish/subscribe)

JMS messaging models: Point to Point

MuleSoft

- Queues: PTP (point-to-point)
  - One-to-one
  - A sender delivers messages to a queue and a single receiver pulls the message off of the queue
  - The receiver does not need to be listening to the queue at the time the message is sent

JMS messaging models: Pub-Sub

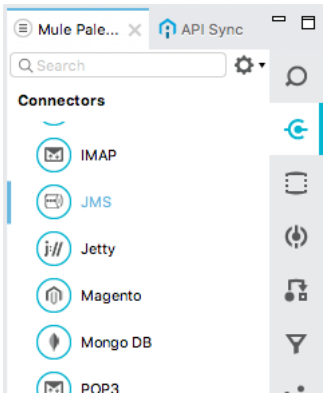
MuleSoft

- Topics: Pub-Sub (publish / subscribe)
  - One-to-many
  - A publisher sends a message to a topic and all active subscribers of the topic receive the message
  - Subscribers that are not actively listening to the topic will miss the published message
    - Unless messages are made durable

Connecting to JMS queues

MuleSoft

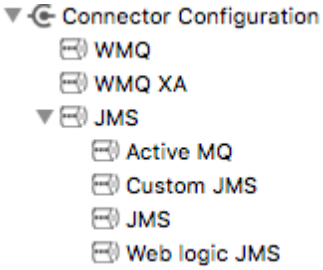
- The Mule JMS transport provides support for sending messages via JMS queues
- The JMS connector is a generic connector for sending and receiving messages over JMS queues
  - Can connect to any JMS messaging service that implements the JMS spec
  - Lets you send and receive messages to queues and topics



Supported JMS providers

MuleSoft

- Out-of-the-box support for
  - ActiveMQ and WebLogic JMS
  - Others are supported by a generic JMS or custom JMS configuration

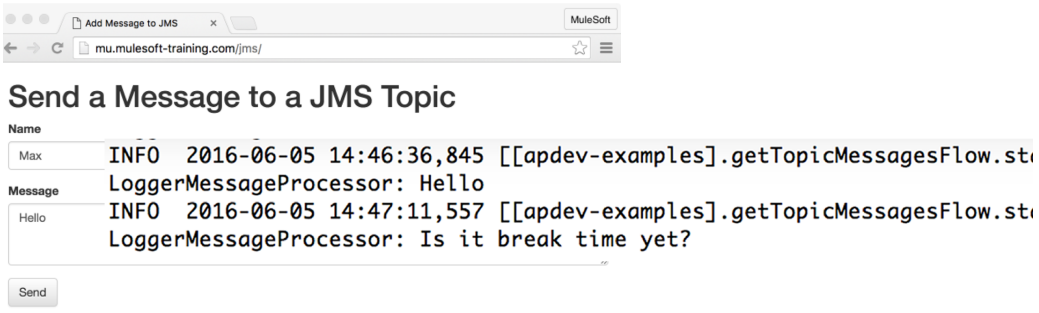


- HornetMQ, Open MQ, Solace JMS, Tibco EMS
  - Examples in the documentation
- WebSphereMQ
  - Mule Enterprise has an enhanced transport to use

Walkthrough 12-4: Connect to a JMS queue (ActiveMQ)

MuleSoft

- Create a flow accessible at http://localhost:8081/jms
- Add and configure an ActiveMQ connector
- Use a JMS endpoint to retrieve messages from a JMS topic
- Add messages to the topic using a web form
- Use a JMS endpoint to send messages to a JMS topic



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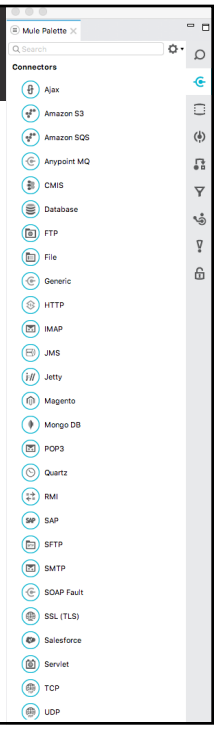
Discovering and using additional connectors

Not-in-the-box connectors

- Anypoint Studio comes with 30 out-of-the-box connectors
  - Endpoint-based connectors
  - Some operation-based connectors
- There are many other connectors you can use to connect to third-party APIs
  - Find them in Anypoint Exchange
  - Install them from Anypoint Exchange
    - Or as new software to Anypoint Studio from the Anypoint Connectors Update Site



Connector levels

MuleSoft

	Premium	Select	MuleSoft Certified	Community
Additional cost	x			
Updated APIs	x	x		
Fully tested	x	x		
MuleSoft Support	Tier 1-3	Tier 1-3	Tier 1 (From developer: T2/T3)	Tier 1
Connector examples	HL7 SAP Siebel	Salesforce Workday	AS/400 Oracle JD Edwards Microsoft Azure Storage	LinkedIn Slack

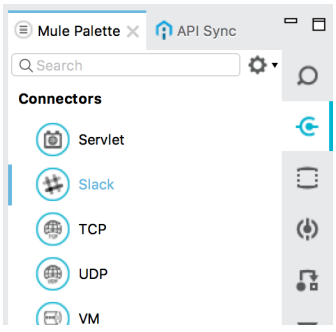
Connector support levels

- Tier 1
  - MuleSoft will isolate the problem and diagnose it
- Tier 2
  - MuleSoft will find a workaround
- Tier 3
  - MuleSoft will fix the code

	Premium	Select	MuleSoft Certified	Community
Not included in Platform license	x			
Tier 2-3 Support	x	x		
Tier 1 Support	x	x	x	x

Walkthrough 12-5: Find and install not-in-the-box connectors

- Browse Anypoint Exchange from Anypoint Studio
- Install a connector from Exchange to Anypoint Studio
- Locate the new connector in Anypoint Studio
- Manage installed software



Introducing Anypoint Connector DevKit for creating custom connectors

Custom connectors

MuleSoft

- A connector is software that provides a connection between a Mule flow and an external resource
  - The resource can be any source of content, such as a database, protocol, or API
- Despite the 120+ connectors created by MuleSoft and the community, you may want a custom connector
  - To facilitate integration with additional SaaS and on-prem web services, applications, or data sources
- You create custom connectors with Anypoint Studio and the Anypoint Connector DevKit

Creating custom connectors with DevKit

- Anypoint Connector DevKit provides the tools and interfaces for building custom connectors
- Custom connectors
  - Facilitate integration with SaaS and on-prem web services, applications, and data sources
  - Function as extensions of the core product
  - Are reusable components that hide API complexity from the integration developer
  - Are written in Java version 8
  - Access web resources using REST, SOAP, or the Java SDK
  - Use Maven for development and building

Training for creating Anypoint Connectors

- *Anypoint Platform Development: Custom Connectors* (1 day)
  - An instructor-led training class
  - Teaches you to build, implement, and install an Anypoint Connector
    - Creating a connector with the DevKit plugin
    - Implementing connection management
    - Implementing connector message processors
    - Invoking web services with REST annotations
    - Testing and documenting connectors
    - Packaging and installing connectors
  - http://training.mulesoft.com

Summary

Summary

MuleSoft

- There are **120+ connectors** created by MuleSoft and the community
  - Anypoint Studio comes with 30 out-of-the-box connectors
  - Find additional connectors in Anypoint Exchange
  - Connector levels include premium, select, MuleSoft Certified, and community and have different levels of support from MuleSoft
  - There are many operation-based SaaS connectors for connecting to third-party APIs
- Use the **File** connector to read or write local files
  - As an inbound endpoint, it checks for files in a location at some set frequency
  - As an outbound endpoint, it creates new files or appends existing files

Summary

MuleSoft

- 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 **JMS** connector to connect to any JMS messaging service that implements the JMS spec
  - Lets you send and receive messages to queues and topics
  - There are specific configs for Active MQ and WebLogic JMS
  - Use the Generic JMS config for all others
- Create **custom connectors** with Anypoint Studio and the Anypoint Connector DevKit
  - Uses Java 8 and Maven