



Module 11: Connecting to Additional Resources

Goal

The screenshot displays the MuleSoft interface. On the left, under the 'Goal' header, there is a grid of icons representing different connectors: HTTP (globe), a bidirectional arrow, an orange circle with a white arrow, Salesforce (cloud with 'salesforce' text), FILE (folder), JMS (cylinder), a 'NEW' tag with a plus sign, and a tools icon (wrench and screwdriver). On the right, the 'Mule Palette' sidebar is visible, listing various connectors: Ajax, Amazon S3, Amazon SQS, Anypoint MQ, CMIS, Database, FTP, File, Generic, HTTP, IMAP, JMS, Jetty, Magento, MongoDB, POP3, Quartz, RMI, SAP, SFTP, SMTP, SOAP Fault, SSL (TLS), Salesforce, Servlet, TCP, and UDP.

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Objectives



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

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Connecting to SaaS applications



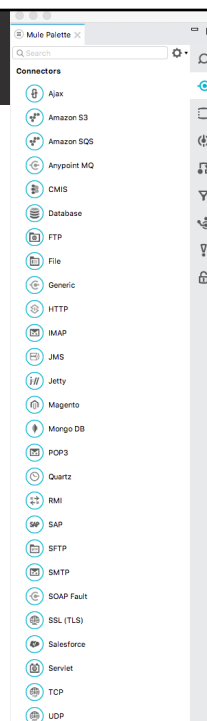
Out-of-the-box SaaS connectors

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



- Additional SaaS connectors can be found on the Anypoint Exchange

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The Salesforce connector



- 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

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Walkthrough 11-1: Connect to a SaaS application (Salesforce)



- 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

The screenshot shows the Salesforce 'Accounts' page with a list of accounts. Overlaid on this is an Anypoint Studio flow diagram titled 'getSFDCAccountsFlow'. The flow consists of four steps: HTTP (GET), Salesforce (retrieve), Transform Message, and Logger. The HTTP step is configured with 'localhost:8081/sfdc' as the endpoint. The Salesforce step is configured with 'retrieve' as the operation. The Transform Message step is configured with a JSON transformation. The Logger step is configured with a message.

The Salesforce interface shows a list of accounts with columns for Action, Account Name, and Billing Country. The 'Accounts' tab is selected, and the 'All Accounts with Postal Code' view is active. The list includes accounts like 'Burlington Textiles Corp of America', 'Dickenson plc', 'Edge Communications', 'Express Logistics and Transport', 'GenePoint', 'Grand Hotels & Resorts Ltd', 'Paternal Construction Inc.', 'sEcon', 'United Oil & Gas Corp.', and 'United Oil & Gas, Singapore'.

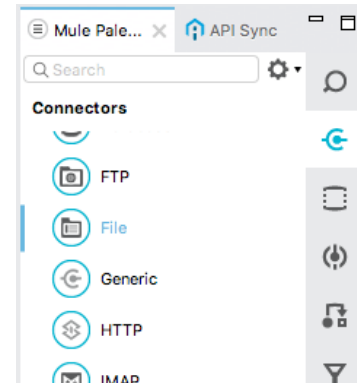
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Connecting to files

The File connector



- 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



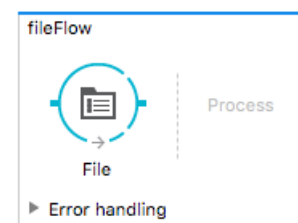
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Using the File connector as an inbound endpoint



- 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



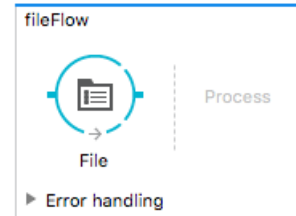
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Using the File connector as an inbound endpoint



- 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`



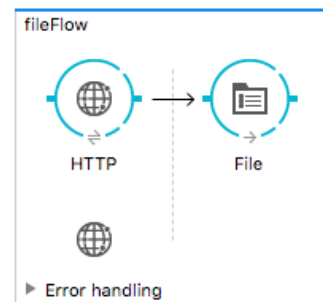
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Using the File connector as an outbound endpoint



- 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



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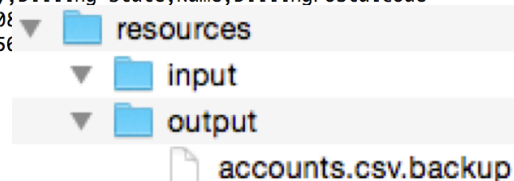
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Walkthrough 11-2: Connect to a file (CSV)



- 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



- 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



- 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

☐ Fixed frequency scheduler
 Frequency: 1000
 Start delay: 0
 Time unit: MILLISECONDS (Default)

☒ Cron scheduler
 Expression: 1 1 1 1,6 *

- Cron scheduler

- 0 15 10 ? * *
- 0 15 10 * * ? 2015
- 1 1 1 1,6 *

Poll at 10:15am every day

Poll at 10:15pm every day in 2015

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



- 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

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Walkthrough 11-3: 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

The screenshot shows a web browser window displaying a table of accounts. Below the table, a flow diagram is visible, showing a 'Poll' scope connected to a 'Database' connector, which then connects to a 'Logger' component. The flow is named 'pollDatabaseFlow'.

MUA Accounts

accountID	name	street	city	state	postal	country
4	Beverly Hills	12312 Blue Rd	Cleveland	Ohio	44147	United States
3	Mark's Markers	39203 red st	San Francisco	California	94116	United States
		Blue St	San Francisco	California	94116	United States
		Blue Rd	Avon	Ohio	44011	United States

Parameterized query:

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

Error handling

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Connecting to JMS queues



Java Messaging Service (JMS)



- 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



- 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

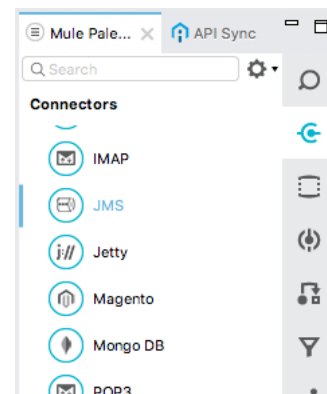


- Topics: Pub-Sub (publish / subscribe)
 - One-to-many
 - A publisher sends a message to a topic and all active subscribers of the topic receive the message
 - Subscribers that are not actively listening to the topic will miss the published message
 - Unless messages are made durable

Connecting to JMS queues



- 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



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Supported JMS providers



- 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



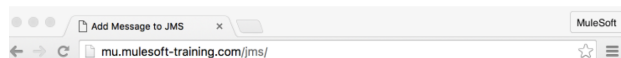
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Walkthrough 11-4: Connect to a JMS queue (ActiveMQ)



- 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



Send a Message to a JMS Topic

Name

Max

INFO 2016-06-05 14:46:36,845 [[apdev-examples].getTopicMessagesFlow.st
LoggerMessageProcessor: Hello

Message

Hello

INFO 2016-06-05 14:47:11,557 [[apdev-examples].getTopicMessagesFlow.st
LoggerMessageProcessor: Is it break time yet?

Send

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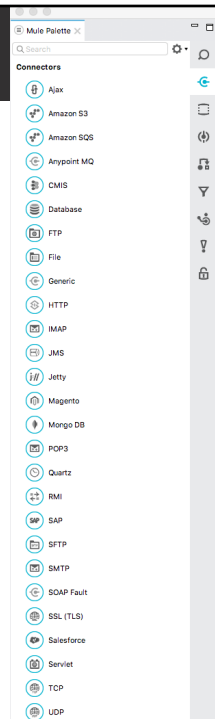
Discovering and using additional connectors



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
 - Operation-based endpoints for connecting to third-party APIs
 - Find them on the Anypoint Exchange
 - Install them from the Anypoint Exchange
 - Or as new software to Anypoint Studio from the Anypoint Connectors Update Site

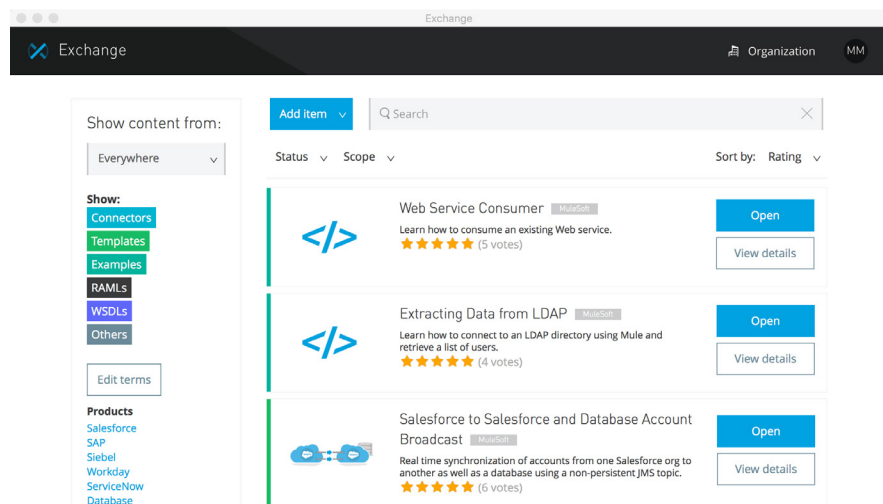
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The Anypoint Exchange



- A library of assets for both public and private assets including
 - Connectors
 - Templates
 - Examples
 - RAMLs
 - WSDLs
 - Others



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Connector levels



	Premium	Select	Standard	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	Zendesk Auora	LinkedIn Slack

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

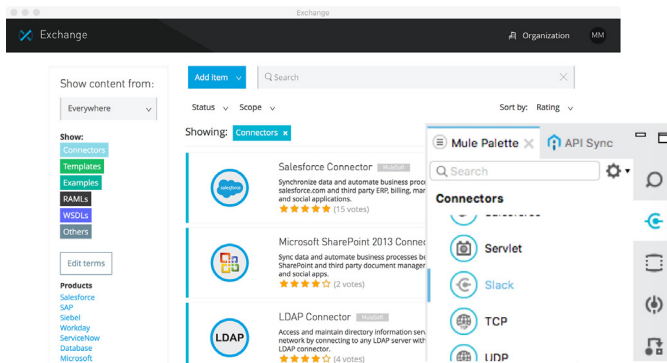
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Walkthrough 11-5: Find and install not-in-the-box connectors



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



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Introducing Anypoint Connector DevKit for creating custom connectors

Custom connectors



- 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

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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



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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>



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Summary



Summary



- There are 120+ connectors created by MuleSoft and the community
 - Anypoint Studio comes with 30 out-of-the-box connectors
 - Find additional connectors on the Anypoint Exchange
 - Connector levels include premium, select, standard, 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

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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 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

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