

Ingesting Data into Amazon S3

Date published: 2020-05-01

Date modified: 2020-06-16

The Cloudera logo is displayed in a bold, orange, sans-serif font. The word "CLOUDERA" is written in all caps, with a stylized 'E' that has a horizontal bar extending to the right.

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Ingesting data into Amazon S3

You can use an Apache NiFi data flow to ingest data into Amazon S3 object stores in CDP Public Cloud by following these steps.

Understand the use case

Learn how you can use a Flow Management cluster connected to a Streams Messaging cluster to build an end-to-end flow that ingests data to Amazon S3 storage. This example use case shows you how to use Apache NiFi to move data from Kafka to S3 buckets.

Why move data to object stores?

Cloud environments offer numerous deployment options and services. There are many ways to store data in the cloud, but the easiest option is to use object stores. Object stores are extremely robust and cost-effective storage solutions with multiple levels of durability and availability. You can include them in your data pipeline, both as an intermediate step and as an end state. Object stores are accessible to many tools and connecting systems, and you have a variety of options to control access.

Apache NiFi for cloud ingestion

As a part of Cloudera Data Flow in CDP Public Cloud, Flow Management clusters run Apache NiFi. You can use NiFi to move data from a range of locations into object stores. NiFi supports data transfer from nearly any type of data source to cloud storage solutions in a secure and governed manner. It also offers a scalable solution for managing data flows with guaranteed delivery, data buffering / pressure release, and prioritized queuing.

NiFi helps you to build a cloud ingestion data flow in a quick and user-friendly way, by simply dragging and dropping a series of processors on the NiFi user interface. When the data flow is ready, you can visually monitor and control the pipeline you have built.

This use case walks you through the steps associated with creating an ingest-focused data flow from Apache Kafka into Amazon S3 object stores. If you are moving data from a location other than Kafka, see the *Getting Started with Apache NiFi* for information about how to build a data flow, and about other data get and consume processor options.

Related Information

[Getting Started with Apache NiFi](#)

[Ingesting Data into Apache Kafka](#)

[Ingesting Data into Apache HBase in CDP Public Cloud](#)

[Ingesting data into Apache Hive in CDP Public Cloud](#)

[Ingesting Data into Apache Kudu in CDP Public Cloud](#)

[Ingesting Data into Azure Data Lake Storage](#)

Meet the prerequisites

Use this checklist to make sure that you meet all the requirements before you start building your data flow.

- You have a CDP Public Cloud environment.
- You have a CDP username and password set to access Data Hub clusters. The predefined resource role of this user is at least EnvironmentUser. This resource role provides the ability to view Data Hub clusters and set the FreeIPA password for the environment.
- Your user is synchronized to the CDP Public Cloud environment.
- You have a Flow Management Data Hub cluster running in your CDP Public Cloud environment.
- You have a Streams Messaging Data Hub cluster in the same CDP environment as the Flow Management cluster.

- Your CDP user has been added to the appropriate pre-defined Ranger access policies to allow access to the NiFi UI.
- You have set up a consumer group in Ranger, and you have a Ranger policy for Kafka allowing your CDP user to access this consumer group.
- You have a Ranger policy on your Kafka topic you will use as a data source allowing the CDP user to consume from the topic.
- You have created a target folder on your AWS Management Console for the data to be moved to the cloud.
- You have created an AWS role with policies attached allowing write access to the S3 bucket you want to use in your data flow.

Related Information

[Understanding roles and resource roles](#)

[Creating your first Flow Management cluster](#)

[Configuring Ranger policies for Apache NiFi](#)

[IDBroker](#)

[Amazon S3 Console User Guide](#)

Build the data flow

Learn how you can create an ingest data flow to move data from Kafka to S3 buckets. This involves opening Apache NiFi in your Flow Management cluster, adding processors and other data flow objects to your canvas, and connecting your data flow elements.

About this task

You can use the `PutHDFS` or `PutS3Object` processors to build your AWS ingest data flows. Regardless of the type of flow you are building, the first steps in building your data flow are generally the same. Open NiFi, add your processors to the canvas, and connect the processors to create the flow.

Procedure

1. Open NiFi in Data Hub.
 - a) To access the NiFi service in your Flow Management Data Hub cluster, navigate to Management Console serviceData Hub Clusters.
 - b) Click the tile representing the Flow Management Data Hub cluster you want to work with.

c) Click Nifi in the Services section of the cluster overview page to access the NiFi UI.

The screenshot shows the Cloudera Management Console interface for a cluster named 'docs-flowm'. The left sidebar contains navigation options like Dashboard, Environments, Data Lakes, User Management, Data Hub Clusters, Data Warehouses, ML Workspaces, and Classic Clusters. The main content area displays cluster details: STATUS (Running), NODES (5), CREATED AT (03/23/20, 05:16 AM GMT+1), and CLUSTER TEMPLATE (flow-management). Under 'Environment Details', it shows NAME (cdf-docs), DATA LAKE (cdf-docs), CREDENTIAL (mkohs-pm-credential), REGION (us-west-2), and AVAILABILITY ZONE (us-west-2a). The 'Services' section lists CM-UI, NiFi (highlighted with a red box), and NiFi Registry. Below this is 'Cloudera Manager Info' with CM URL, CM VERSION (7.1.0), and PLATFORM VERSION (7.1.0-1.cdh7.1.0.p0.1922354). At the bottom, the 'Nifimaster' table lists three instances:

ID	STATUS	FQDN	STATUS	Private IP	Public IP
+0a98a61b114c3727f	Running	docs-flowm-nifimaster2.cdf-docs.a465-9q4k.cloudera.site	SERVICES_HEALTHY	10.10.164.195	34.220.0.138
+06101d12863ac7c5d	Running	docs-flowm-nifimaster1.cdf-docs.a465-9q4k.cloudera.site	SERVICES_HEALTHY	10.10.189.116	54.212.234.210
+0562d1b4d39df6704	Running	docs-flowm-nifimaster3.cdf-docs.a465-9q4k.cloudera.site	SERVICES_HEALTHY	10.10.160.192	54.186.70.139

You will be logged into NiFi automatically with your CDP credentials.

2. Add the `ConsumeKafkaRecord_2_0` processor for data input in your data flow.

a) Drag and drop the processor icon into the canvas.

This displays a dialog that allows you to choose the processor you want to add.

b) Select the `ConsumeKafkaRecord_2_0` processor from the list.

c) Click Add or double-click the required processor type to add it to the canvas.



Note: This processor consumes messages from Kafka specifically built against the Kafka 2.0 Consumer API.

3. Add the `MergeRecord` processor.



Note: This processor merges together multiple record-oriented flowfiles into a single flowfile that contains all of the records of the input flowfiles. It works by creating bins and then adding flowfiles to these bins until they are full. Once a bin is full, all of the flowfiles are combined into a single output flowfile, and that flowfile is routed to the merged relationship.

When using the `ConsumeKafkaRecord_2_0` processor, you are pulling small-sized records, so it is practical to merge them into larger files before writing them to S3.

4. Add a processor for writing data to S3.

You have two options:

- `PutHDFS` processor: The HDFS client writes to S3 through the S3A API. This solution leverages centralized CDP security. You can use the usernames and passwords you set up in CDP for central authentication, and all requests go through IDBroker.
- `PutS3Object` processor: This is an S3-specific processor that directly interacts with the Amazon S3 API. It is not integrated into CDP's authentication and authorization frameworks. If you use it for data ingestion, the authorization process is handled in AWS, and you need to provide the AWS access credentials file / information when configuring the processor. You can do this by:
 - Providing your access key / secret key pair
 - Using a Credentials File where you give the path to a file that contains your AWS access key and secret key

- Using the AWSCredentialsProvider Controller Service in your data flow.
- Drag and drop the processor icon into the canvas.
In the dialog box you can choose which processor you want to add.
 - Select the processor of your choice from the list.
 - Click Add or double-click the required processor type to add it to the canvas.
5. Connect the processors to create the data flow by clicking the connection icon in the first processor, and dragging and dropping it on the second processor.

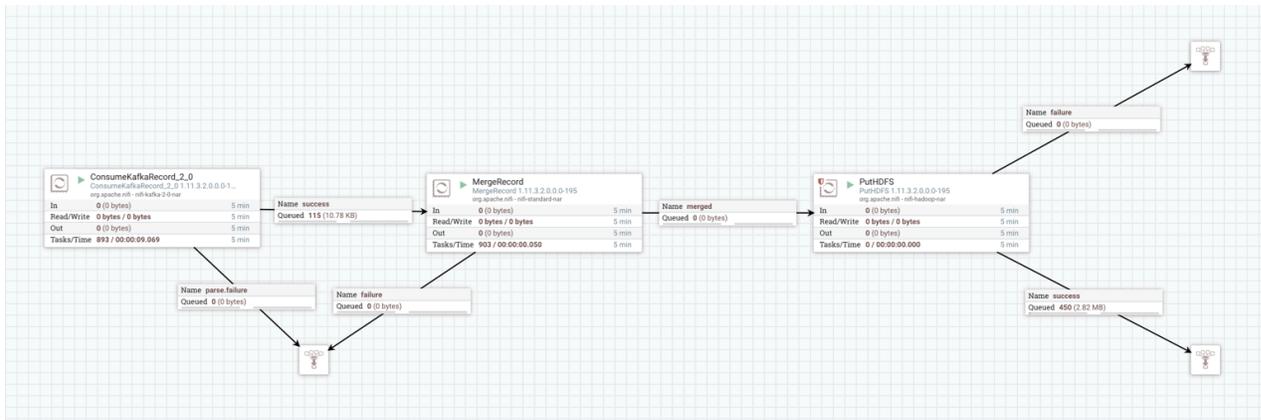
A Create Connection dialog appears with two tabs: Details and Settings. You can configure the connection's name, flowfile expiration time period, thresholds for back pressure, load balance strategy and prioritization.

- Connect ConsumeKafkaRecord_2_0 with MergeRecord.
 - Add the success flow of the ConsumeKafkaRecord_2_0 processor to the MergeRecord processor.
 - Click Add to close the dialog box and add the connection to your data flow.
 - Connect MergeRecord with your target data processor (PutHDFS / PutS3Object).
 - Add the merged flow of the MergeRecord processor to the target data processor.
 - Click Add to close the dialog box and add the connection to your data flow.
6. Optionally, you can add funnels to your flow.
- ConsumeKafkaRecord_2_0: If any of the Kafka messages are pulled but cannot be parsed, the contents of the message will be written to a separate flowfile and that flowfile will be transferred to the parse.failure relationship. You can connect the failure queue coming from the processor to a failure funnel for parse failures.
 - MergeRecord: For merge failures, you can connect the failure queue coming from the processor to the failure funnel you used for ConsumeKafkaRecord_2_0.
 - PutHDFS / PutS3Object: You can add success and failure funnels at the end of the data flow and connect them with your target data processor. These funnels help you see where flow files are being routed when your flow is running.

If you want to know more about working with funnels, see the *Apache NiFi User Guide*.

Results

This example data flow has been created using the PutHDFS processor.



What to do next

If you are using the PutHDFS processor, configure IDBroker mapping authorization.

If you are using the PutS3Object processor, you do not need IDBroker mapping, so proceed to configuring controller services for the processors in your data flow.

Related Information

[Apache NiFi Documentation](#)

Create IDBroker mapping

Learn how you can create the IDBroker mapping for the PutHDFS processor for your data flow. To enable your CDP user to utilize the central authentication features CDP provides and to exchange credentials for AWS access tokens, you have to map your CDP user to the correct IAM role.

About this task

The option to add / modify the mappings is available from the Management Console in your CDP environment.



Note:

This task is only needed if you use the PutHDFS processor for accessing your S3 bucket.

Procedure

1. Access IDBroker mappings.

- a) To access IDBroker mappings in your environment, click ActionsManage Access.

Environments / cdf-docs / Clusters

aws cdf-docs
cnrjg:environments-us-west-1-558bc1d2-8867-4357-8524-311d51259233:environment-e66ea9b7-c25d-431a-8a76-39ce6816d050
US West (Oregon) - us-west-2

DATA LAKE NAME: cdf-docs-dl | DATA LAKE STATUS: Stopped | NODES: 2 | Atlas

Data Hubs

Status	Name	Data Hub Type	Version	Node Count
Stopped	docs-opdb	7.1.0 - Operational Database: Apache HBase, Phoenix	CDH 7.1.0	7
Running	docs-messaging	7.1.0 - Streams Messaging Light Duty: Apache Kafka, Schema Registry, Streams Messaging Manager	CDH 7.1.0	4
Running	docs-flowm	flow-management	CDH 7.1.0	5
Stopped	docs-dataeng	7.1.0 - Data Engineering: Apache Spark, Apache Hive, Apache Oozie	CDH 7.1.0	4

- b) Choose the IDBroker Mappings tab where you can provide mappings for users or groups and click Edit.

Environments / cdf-docs / IDBroker Mappings

Access | IDBroker Mappings | Workload Password

Last Sync Status

Status: Completed | Sync Needed: No | Sync Mappings

Current Mappings

Data Access Role: arn:aws:iam::381358652250:role/mkohs-dladmin-role

Ranger Audit Role: arn:aws:iam::381358652250:role/mkohs-ranger-audit-role

User or Group	Role
nifi-hive-ingest	arn:aws:iam::381358652250:role/mkohs-dladmin-role
nifi-s3-ingest	arn:aws:iam::381358652250:role/mkohs-customer-ingest-role

2. Add your CDP user or group and the corresponding AWS role that provides write access to your folder in your S3 bucket to the Current Mappings section by clicking the blue + sign.



Note: You can get the AWS IAM role ARN from the Roles Summary page in AWS and can copy it into the IDBroker role field. The selected AWS IAM role must have a trust policy allowing IDBroker to assume this role.

3. Click Save and Sync.

What to do next

Configure controller services for your data flow.

Related Information

[IDBroker](#)

[Onboarding CDP users and groups for cloud storage](#)

[Create a provisioning credential for AWS](#)

Create controller services for your data flow

Learn how you can create and configure controller services for an S3 ingest data flow in CDP Public Cloud.

Controller services provide shared services that can be used by the processors in your data flow. You will use these Controller Services later when you configure your processors.

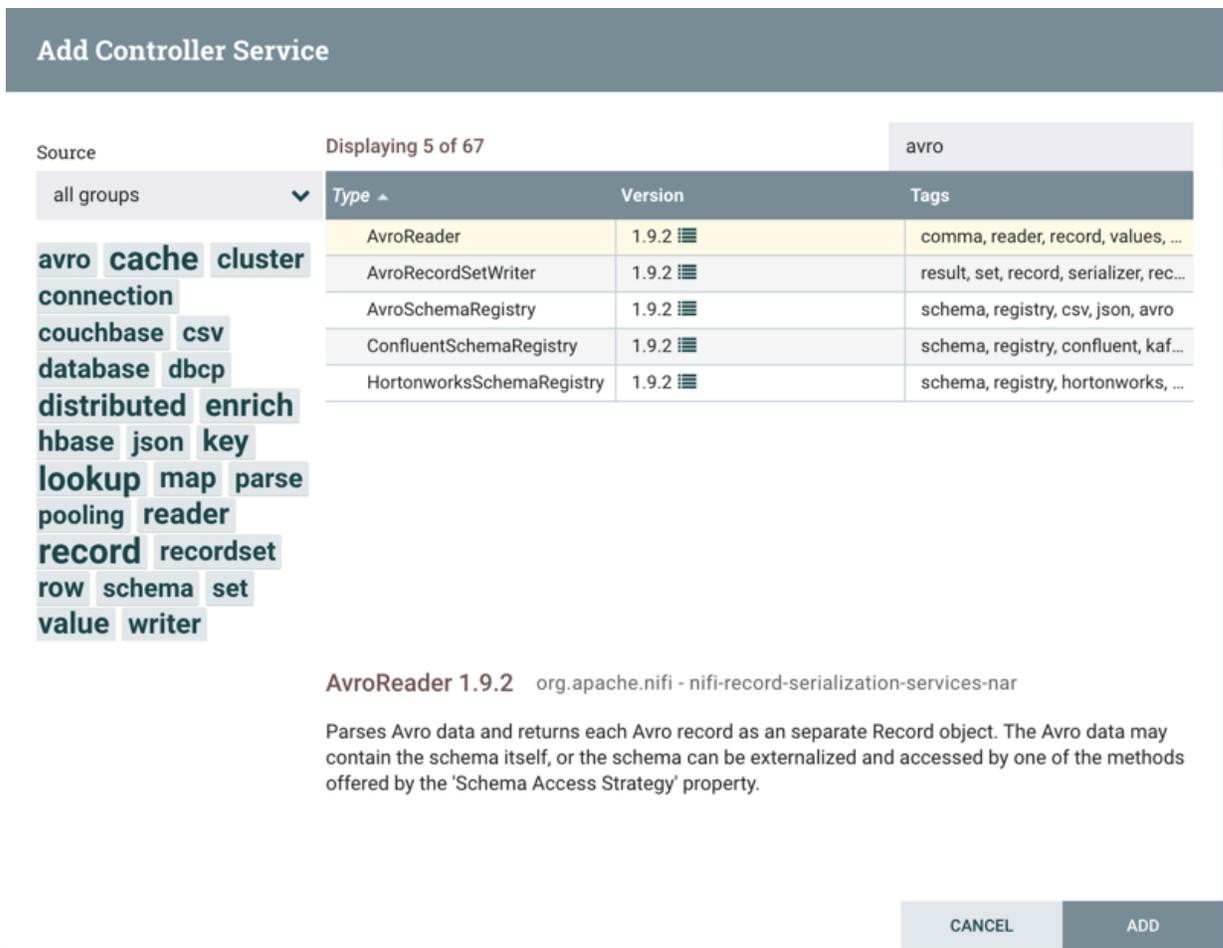
Procedure

1. To add a Controller Service to your flow, right-click on the canvas and select Configure from the pop-up menu. This displays the Controller Services Configuration window.
2. Select the Controller Services tab.

- Click the + button to display the Add Controller Service dialog.



- Select the required Controller Service and click Add.



- Perform any necessary Controller Service configuration tasks by clicking the Configure icon in the right-hand column.



- When you have finished configuring the options you need, save the changes by clicking the Apply button.

7. Enable the Controller Service by clicking the Enable button (flash) in the far-right column of the Controller Services tab.

Example

In this example the following controller services are used:

AvroReader Controller Service

Table 1: AvroReader Controller Service properties

Property	Description	Example value for ingest data flow
Schema Access Strategy	Specify how to obtain the schema to be used for interpreting the data.	HWX Content-Encoded Schema Reference
Schema Registry	Specify the Controller Service to use for the Schema Registry.	CDPSchemaRegistry
Schema Name	Specify the name of the schema to look up in the Schema Registry property.	customer

CSVReader Controller Service

Table 2: CSVReader Controller Service Properties

Property	Description	Example value for ingest data flow
Schema Access Strategy	Specify how to obtain the schema to be used for interpreting the data.	Use String Fields From Header
Treat First Line as Header	Specify whether the first line of CSV should be considered a header or a record.	true

CSVRecordSetWriter Controller Service

Table 3: CSVRecordSetWriter Controller Service Properties

Property	Description	Example value for ingest data flow
Schema Write Strategy	Specify how the schema for a record should be added to the data.	Do Not Write Schema
Schema Access Strategy	Specify how to obtain the schema to be used for interpreting the data.	Use 'Schema Name' Property
Schema Name	Specify the name of the schema to look up in the Schema Registry property. See the Appendix for an example schema.	customer

What to do next

Configure the processors in your data flow.

Related Information

[Adding Controller Services for data flows](#)

[Apache NiFi Documentation](#)

Configure the processor for your data source

Learn how you can configure the `ConsumeKafkaRecord_2_0` data source processor for your S3 ingest data flow. You can set up a data flow to move data to Amazon S3 from many different locations. This example assumes that you are streaming data from Kafka and shows you the configuration for the relevant data source processor.

Procedure

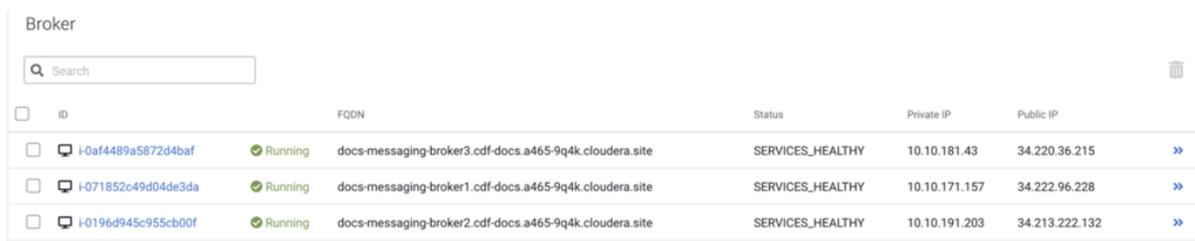
1. Launch the Configure Processor window, by right clicking the `ConsumeKafkaRecord_2_0` processor and selecting Configure.

This gives you a configuration dialog with the following tabs: Settings, Scheduling, Properties, Comments.

2. Configure the processor according to the behavior you expect in your data flow.
3. When you have finished configuring the options you need, save the changes by clicking the Apply button.

Make sure that you set all required properties, as you cannot start the processor until all mandatory properties have been configured.

In this example data flow, the data source is Kafka. You can create the modified Kafka broker URLs using the broker hostnames and adding port `:9093` to the end of each FQDN. You can find the hostnames on the Streams Messaging cluster overview page when selecting the Hardware tab.



ID	FQDN	Status	Private IP	Public IP
I-0af4489a5872d4baf	docs-messaging-broker3.cdf-docs.a465-9q4k.cloudera.site	SERVICES_HEALTHY	10.10.181.43	34.220.36.215
I-071852c49d04de3da	docs-messaging-broker1.cdf-docs.a465-9q4k.cloudera.site	SERVICES_HEALTHY	10.10.171.157	34.222.96.228
I-0196d945c955cb00f	docs-messaging-broker2.cdf-docs.a465-9q4k.cloudera.site	SERVICES_HEALTHY	10.10.191.203	34.213.222.132



Note: Property values can be parameterized. For example, you can create a parameter context to hold Kafka connection information and apply it to the Kafka Brokers property instead of adding the broker URLs individually.

The following table includes a description and example values for the properties required to configure the example ingest data flow. For a complete list of `ConsumeKafkaRecord_2_0` properties, see the *Apache Nifi Documentation*.

Table 4: ConsumeKafkaRecord_2_0 processor properties

Property	Description	Example value for ingest data flow
Kafka Brokers	Provide a comma-separated list of known Kafka Brokers. In the format: <host>:<port>	Docs-messaging-broker1.cdf-docs.a465-9q4k.cloudera.site:9093,docs-messaging-broker2.cdf-docs.a465-9q4k.cloudera.site:9093,docs-messaging-broker3.cdf-docs.a465-9q4k.cloudera.site:9093
Topic Name(s)	Provide the name of the Kafka Topic(s) to pull from.	Customer
Record Reader	Specify the Record Reader to use for incoming FlowFiles.	ReadCustomerAvroRoot
Record Writer	Specify the Record Writer to use in order to serialize the data before sending to Kafka.	CSVRecordSetWriter
Security Protocol	Specify the protocol used to communicate with Kafka brokers.	SASL_SSL
SASL Mechanism	Specify the SASL mechanism to use for authentication.	PLAIN
Username	Use your CDP workload username to set this Authentication property.	srv_nifi-kafka-ingest
Password	Use your CDP workload password to set this Authentication property.	password

Property	Description	Example value for ingest data flow
SSL Context Service	Specify the SSL Context Service to use for communicating with Kafka. Use the pre-configured SSLContextProvider.	Default NiFi SSL Context Service
Group ID	Provide the consumer group ID to identify consumers that are within the same consumer group.	nifi-s3-ingest



Note: If you want to move data to Amazon S3 from a location other than Kafka, see the *Apache NiFi Getting Started* for information about other data ingest processor options.

What to do next

Configure the processor for merging your records.

Related Information

[Configuring a processor](#)

[Apache NiFi Documentation](#)

[Getting Started with Apache NiFi](#)

Configure the processor for merging records

Learn how you can configure the MergeRecord processor for your S3 ingest data flow. You can use it to merge together multiple record-oriented flow files into a large flow file that contains all records of your Kafka data input.

Procedure

1. Launch the Configure Processor window, by right clicking the MergeRecord processor and selecting Configure.

This gives you a configuration dialog with the following tabs: Settings, Scheduling, Properties, Comments.

2. Configure the processor according to the behavior you expect in your data flow.
3. When you have finished configuring the options you need, save the changes by clicking the Apply button.

Make sure that you set all required properties, as you cannot start the processor until all mandatory properties have been configured.

In this example the following settings and properties are used:

Table 5: MergeRecord processor scheduling

Scheduling	Description	Example value for ingest data flow
Automatically Terminate Relationships		original

Table 6: MergeRecord processor properties

Property	Description	Example value for ingest data flow
RecordReader	Specify the Controller Service to use for reading incoming data.	ReadCustomerCSVRoot
RecordWriter	Specify the Controller Service to use for writing out the records.	CSVRecordSetWriter

Property	Description	Example value for ingest data flow
Merge Strategy	Specify the algorithm used to merge records. The Bin-Packing Algorithm generates a FlowFile populated by arbitrarily chosen FlowFiles.	Bin-Packing Algorithm
Minimum Number of Records	Specify the minimum number of records to include in a bin.	900
Maximum Number of Records	Specify the maximum number of Records to include in a bin.	1000

For a complete list of MergeRecord properties, see the *processor documentation*.

What to do next

Configure the processor for your data target.

Related Information

[Configuring a processor](#)

[Apache NiFi Documentation](#)

[Getting Started with Apache NiFi](#)

Configure the processor for your data target

Learn how you can configure the data target processor for your S3 ingest data flow. This example assumes that you are moving data to AWS S3 and shows you how to configure the corresponding processors.

Procedure

1. Launch the Configure Processor window by right clicking the processor you added for writing data to S3 (PutHDFS or PutS3Object) and selecting Configure.

This gives you a configuration dialog with the following tabs: Settings, Scheduling, Properties, Comments.

2. Configure the processor according to the behavior you expect in your data flow.

Make sure that you set all required properties, as you cannot start the processor until all mandatory properties have been configured.

3. When you have finished configuring the options you need, save the changes by clicking the Apply button.

In this example, the following properties are used for PutHDFS:

Table 7: PutHDFS processor properties

Property	Description	Example value for ingest data flow
Hadoop Configuration Resources	Specify the path to the core-site.xml configuration file. Make sure that the default file system (fs, default.FS) points to the S3 bucket you are writing to.  Note: The core-site.xml file used for the Hadoop Configuration Resources property is present on every Flow Management cluster. Cloudera Manager stores the right core-site.xml file in the same /etc directory for every cluster.	/etc/hadoop/conf.cloudera.core_settings/core-site.xml
Kerberos Principal	Specify the Kerberos principal (your username) to authenticate against CDP.	srv_nifi-s3-ingest

Property	Description	Example value for ingest data flow
Kerberos Password	Provide the password that should be used for authenticating with Kerberos.	password
Directory	Provide the path to your target directory in AWS expressed in an S3A compatible path.	s3a://your path/customer

You can leave all other properties as default configurations.

For a complete list of PutHDFS properties, see the *processor documentation*.

If you want to use the PutS3Object processor to store the data in S3, you have to configure your S3 connection in a secure way:

- You add the AWS access key or secret access key as properties of the processor
- You configure these access keys in a credentials file and add that as a property of the processor
- You use a AWS Credentials provider service and configure it with the required information for authenticating against AWS.

If you want to move data to a different location, review the other use cases in the *Cloudera Data Flow for Data Hub library*.

What to do next

Your data flow is ready to ingest data into AWS S3. Start the flow.

Related Information

[Configuring a processor](#)

[Apache NiFi Documentation](#)

[Data ingest use cases in Cloudera Data Flow for Data Hub](#)

Start the data flow

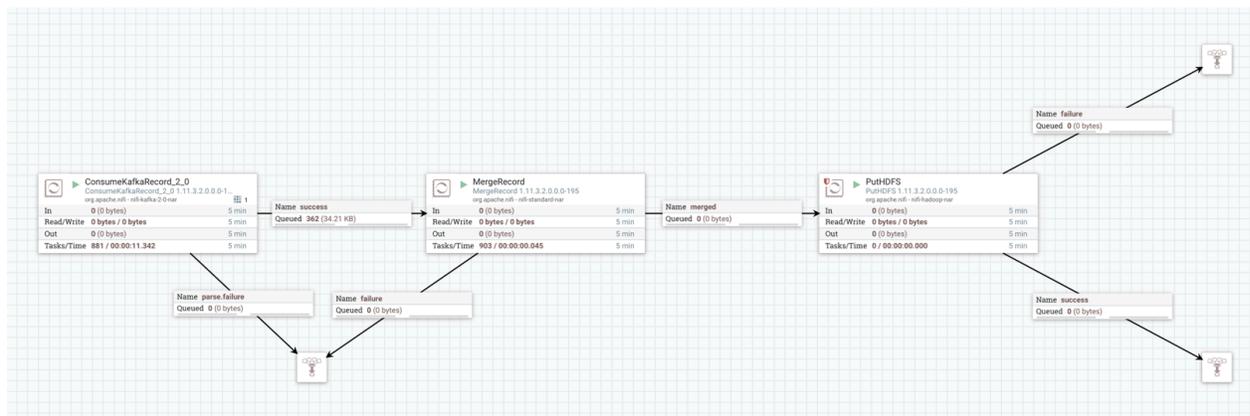
When your flow is ready, you can begin ingesting data into Amazon S3 buckets. Learn how to start your S3 ingest data flow.

Procedure

1. To initiate your data flow, select all the data flow components you want to start.
2. Click the Start icon in the Actions toolbar.

Alternatively, right-click a single component and choose Start from the context menu. Data should be read from Kafka and it should be written to the defined folder of your AWS S3 bucket.

Results



What to do next

It is useful to check that data is running through the flow you have created.

Verify data flow operation

Learn how you can verify the operation of your S3 ingest data flow.

About this task

There are a number of ways you can check that data is running through the flow you have built.

Procedure

1. You can verify that NiFi processors are not producing errors.
2. You can look at the processors in the UI, where you can see the amount of data that has gone through them. You can also right click on the processors, or on connections to view status history.
3. You can check that the data generated appears in your AWS S3 bucket. To do this, return to the dedicated folder of your S3 bucket, where you should see your files listed.

You may have to refresh the page depending on your browser/settings.

Monitoring your data flow

Learn about the different monitoring options for your Amazon S3 ingest data flow in CDP Public Cloud.

You can monitor your data flow for information about health, status, and details about the operation of processors and connections. NiFi records and indexes data provenance information, so you can conduct troubleshooting in real time.

Data statistics are rolled up on a summary screen (the little table icon on the top right toolbar which lists all the processors). You can use the `MonitorActivity` processor to alert you, if for example you have not received any data in your flow for a specified amount of time.

If you are worried about data being queued up, you can check how much data is currently queued. Process groups also conveniently show the totals for any queues within them. This can often indicate if there is a bottleneck in your flow somewhere, and how far the data has got through that pipeline.

Another option to check that data has fully passed through your flow is to check out data provenance to see the full history of your data.

Next steps

Learn about the different options that you have after building a simple Amazon S3 ingest data flow in CDP Public Cloud.

Moving data to the cloud is one of the cornerstones of any cloud migration. Cloud environments offer numerous deployment options and services. This example data flow provides you with a model to design more complex data flows for moving and processing data as part of cloud migration efforts.

You can build a combination of on-premise and public cloud data storage. You can use this solution as a path to migrate your entire data to the cloud over time—eventually transitioning to a fully cloud-native solution or to extend your existing on-premise storage infrastructure, for example for a disaster recovery scenario. Cloud storage can provide secure, durable, and extremely low-cost options for data archiving and long-term backup for on-premise datasets.

You can also use cloud services without storing your data in the cloud. In this case you would continue to use your legacy on-premise data storage infrastructure, and work with on-demand, cloud-based services for data

transformation, processing and analytics with the best performance, reliability and cost efficiency for your needs. This way you can manage demand peaks, provide higher processing power, and sophisticated tools without the need to permanently invest in computer hardware.