Confluent KAFKA Administration

Rajesh Pasham

What is Confluent Platform?

- Confluent Platform is a full-scale data streaming platform that enables you to easily access, store, and manage data as continuous, real-time streams.
- Built by the original creators of Apache Kafka®, Confluent expands the benefits of Kafka with enterprise-grade features while removing the burden of Kafka management or monitoring.
- Today, over 80% of the Fortune 100 are powered by data streaming technology – and the majority of those leverage Confluent.

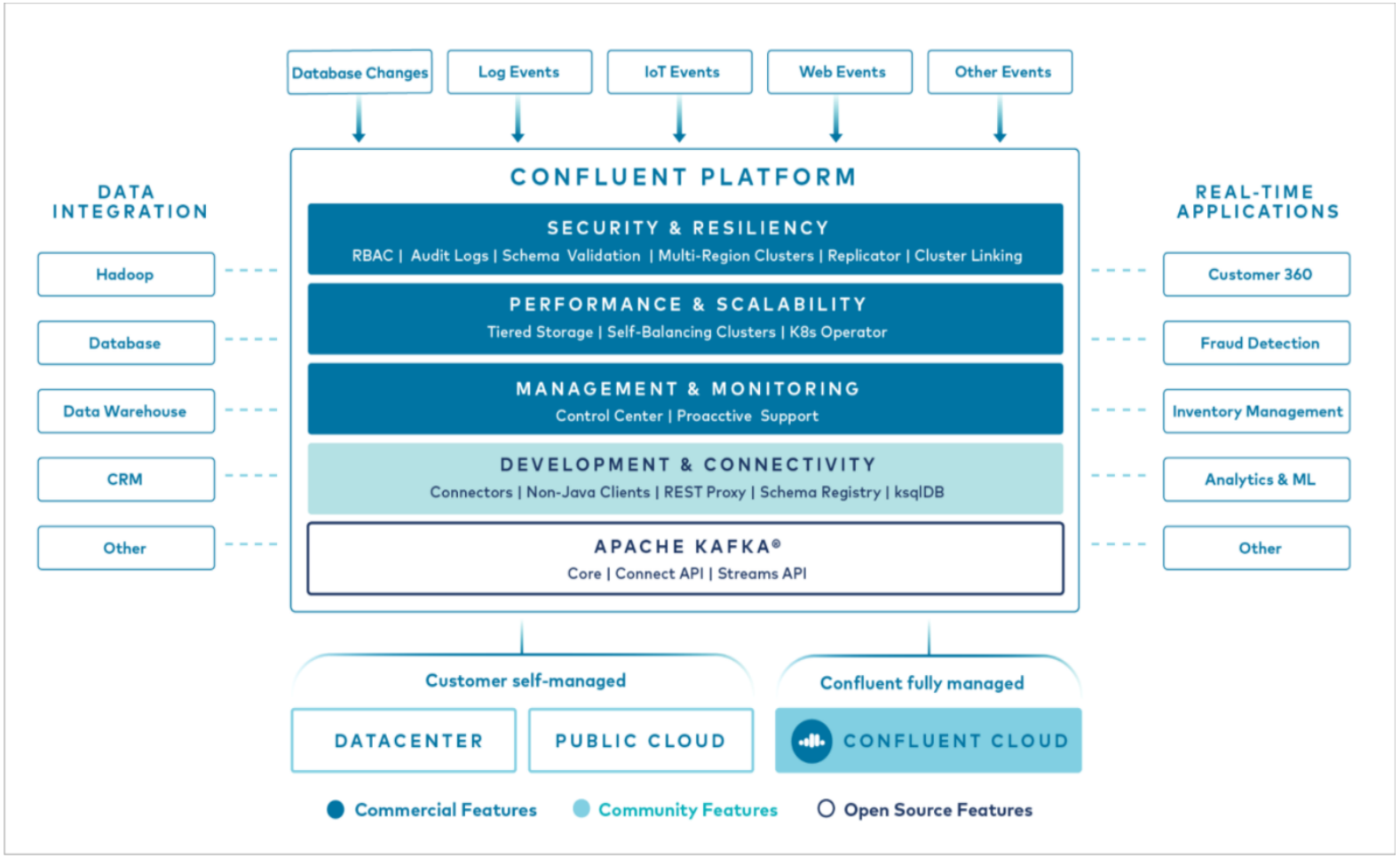
Why Confluent?

- By integrating historical and real-time data into a single, central source of truth, Confluent makes it easy to build an entirely new category of modern, event-driven applications, gain a universal data pipeline, and unlock powerful new use cases with full scalability, performance, and reliability.

What is Confluent Used For?

- Confluent Platform lets you focus on how to derive business value from your data rather than worrying about the underlying mechanics, such as how data is being transported or integrated between disparate systems.
- Specifically, Confluent Platform simplifies connecting data sources to Kafka, building streaming applications, as well as securing, monitoring, and managing your Kafka infrastructure.
- Today, Confluent Platform is used for a wide array of use cases across numerous industries, from financial services, omnichannel retail, and autonomous cars, to fraud detection, microservices, and IoT.

What is Confluent Used For?



Confluent Platform Components

Overview of Confluent's Event Streaming Technology

- At the core of Confluent Platform is Apache Kafka, the most popular open source distributed streaming platform.
- The key capabilities of Kafka are:
  - Publish and subscribe to streams of records
  - Store streams of records in a fault tolerant way
  - Process streams of records
- Out of the box, Confluent Platform also includes Schema Registry, REST Proxy, a total of 100+ pre-built Kafka connectors, and ksqlDB.

- Apache Kafka was originated at LinkedIn and later became an open sourced Apache project in 2011, then First-class Apache project in 2012.

- Kafka is written in Scala and Java.

- Apache Kafka is publish-subscribe based fault tolerant messaging system.

- It is fast, scalable and distributed by design.

- In comparison to other messaging systems, Kafka has better throughput, built-in partitioning, replication and inherent fault-tolerance, which makes it a good fit for large-scale message processing applications.

Why Kafka?

- Kafka is used by 60% of Fortune 500 companies for a variety of use cases, including collecting user activity data, system logs, application metrics, stock ticker data, and device instrumentation signals.

- The key components of the Kafka open source project are Kafka Brokers and Kafka Java Client APIs.

Kafka Brokers

- Kafka brokers that form the messaging, data persistency and storage tier of Kafka.

Why Kafka?

Kafka Java Client APIs

- **Producer API** is a Java Client that allows an application to publish a stream records to one or more Kafka topics.

- **Consumer API** is a Java Client that allows an application to subscribe to one or more topics and process the stream of records produced to them.

- **Streams API** allows applications to act as a stream processor, consuming an input stream from one or more topics and producing an output stream to one or more output topics, effectively transforming the input streams to output streams.

Why Kafka?

Kafka Java Client APIs

- It has a very low barrier to entry, easy operationalization, and a high-level DSL for writing stream processing applications.
- As such it is the most convenient yet scalable option to process and analyze data that is backed by Kafka.

- **Admin API** provides the capability to create, inspect, delete, and manage topics, brokers, ACLs, and other Kafka objects.

Why Kafka?

Kafka Connect API

- Connect API is a component that you can use to stream data between Kafka and other data systems in a scalable and reliable way.
- It makes it simple to configure connectors to move data into and out of Kafka.
- Kafka Connect can ingest entire databases or collect metrics from all your application servers into Kafka topics, making the data available for stream processing.
- Connectors can also deliver data from Kafka topics into secondary indexes like Elasticsearch or into batch systems such as Hadoop for offline analysis.

What is a Messaging System?

- A Messaging System is responsible for transferring data from one application to another, so the applications can focus on data, but not worry about how to share it.
- Distributed messaging is based on the concept of reliable message queuing.
- Messages are queued asynchronously between client applications and messaging system.
- Two types of messaging patterns are available − one is point to point and the other is publish-subscribe (pub-sub) messaging system.

Point to Point Messaging System

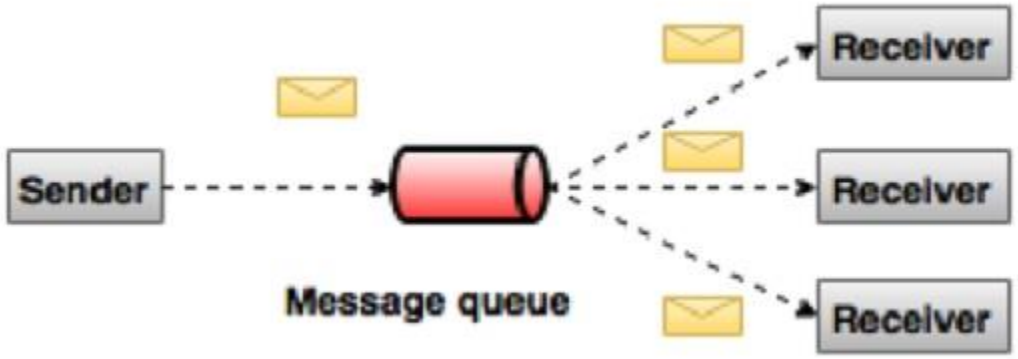
- In a point-to-point system, messages are persisted in a queue.
- One or more consumers can consume the messages in the queue, but a particular message can be consumed by a maximum of one consumer only.
- Once a consumer reads a message in the queue, it disappears from that queue.
- The typical example of this system is an Order Processing System, where each order will be processed by one Order Processor, but Multiple Order Processors can work as well at the same time

Point to Point Messaging System

Publish-Subscribe Messaging System

- In the publish-subscribe system, messages are persisted in a topic.
- Unlike point-to-point system, consumers can subscribe to one or more topic and consume all the messages in that topic.
- In the Publish-Subscribe system, message producers are called publishers and message consumers are called subscribers.
- A real-life example is Dish TV, which publishes different channels like sports, movies, music, etc.

Publish-Subscribe Messaging System



What is Kafka?

- Apache Kafka is a distributed publish-subscribe messaging system and a robust queue that can handle a high volume of data and enables you to pass messages from one end-point to another.

- Kafka is suitable for both offline and online message consumption.

- Kafka messages are persisted on the disk and replicated within the cluster to prevent data loss.

What is Kafka?

- Kafka is built on top of the ZooKeeper synchronization service.

- It integrates very well with Apache Storm and Spark for real-time streaming data analysis.

Benefits

- **Reliability** − Kafka is distributed, partitioned, replicated and fault tolerance.
- **Scalability** − Kafka messaging system scales easily without down time.
- **Durability** − Kafka uses Distributed commit log which means messages persists on disk as fast as possible, hence it is durable.
- **Performance** − Kafka has high throughput for both publishing and subscribing messages. It maintains stable performance even many TB of messages are stored.

Use Cases

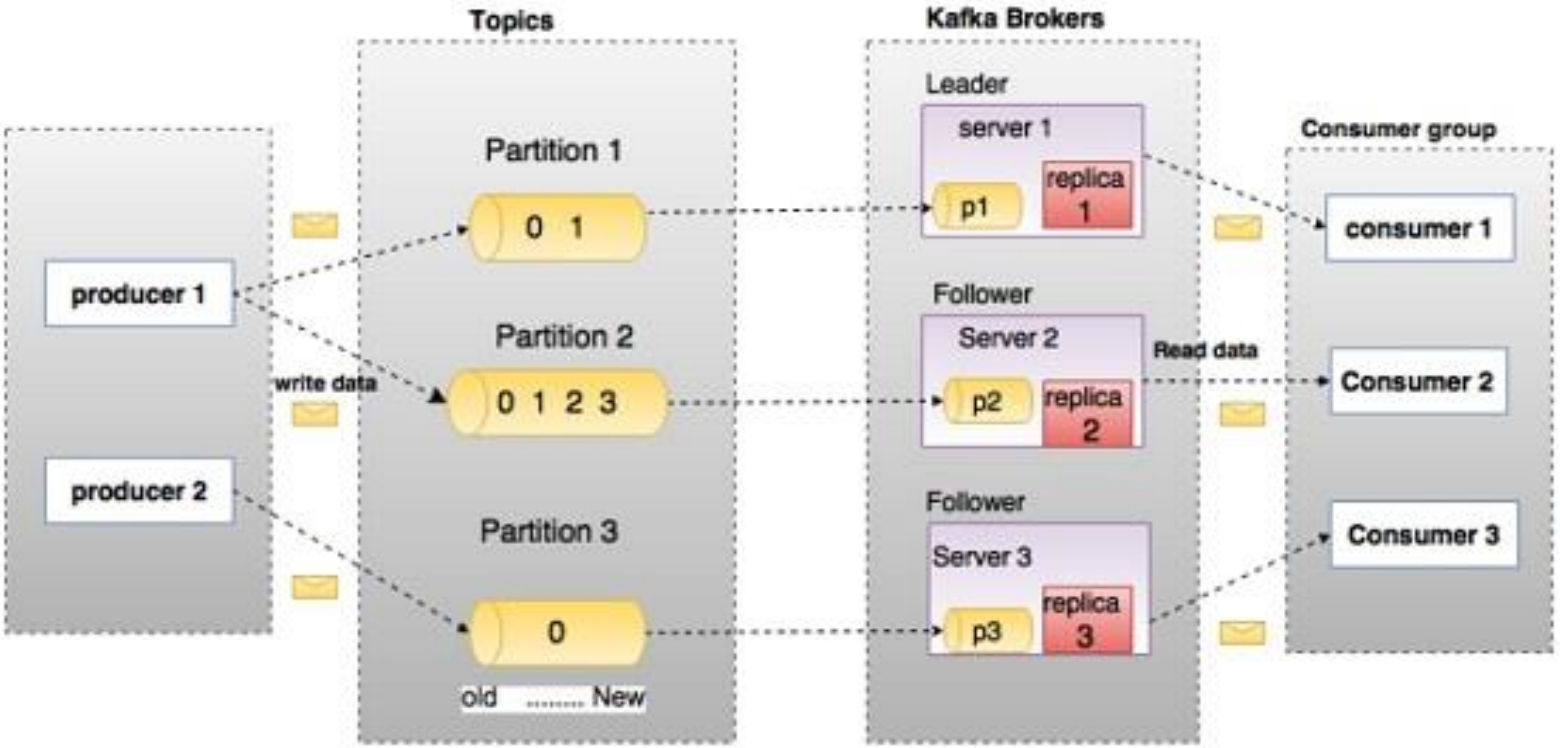
- **Metrics** − Kafka is often used for operational monitoring data.
- **Log Aggregation Solution** − Kafka can be used across an organization to collect logs from multiple services and make them available in a standard format to multiple consumers.
- **Stream Processing** − Popular frameworks such as Storm and Spark Streaming read data from a topic, processes it, and write processed data to a new topic where it becomes available for users and applications.

Need for Kafka

- Kafka is a unified platform for handling all the real-time data feeds.
- Kafka supports low latency message delivery and gives guarantee for fault tolerance in the presence of machine failures.
- It has the ability to handle a large number of diverse consumers.
- Kafka is very fast, performs 2 million writes/sec.

Apache Kafka - Fundamentals

- The following diagram illustrates the main terminologies



Apache Kafka - Fundamentals

- In the above diagram, a topic is configured into three partitions.
- Partition 1 has two offset factors 0 and 1.
- Partition 2 has four offset factors 0, 1, 2, and 3.
- Partition 3 has one offset factor 0.
- The id of the replica is same as the id of the server that hosts it.

Apache Kafka - Fundamentals

- Assume, if the replication factor of the topic is set to 3, then Kafka will create 3 identical replicas of each partition and place them in the cluster to make available for all its operations.

- To balance a load in cluster, each broker stores one or more of those partitions.

- Multiple producers and consumers can publish and retrieve messages at the same time.

Apache Kafka - Fundamentals

Topics

- A stream of messages belonging to a particular category is called a topic. Data is stored in topics. Topics are split into partitions.
- For each topic, Kafka keeps a minimum of one partition. Each such partition contains messages in an immutable ordered sequence.
- A partition is implemented as a set of segment files of equal sizes.

Apache Kafka - Fundamentals

Partition

- Topics may have many partitions, so it can handle an arbitrary amount of data.

Partition offset

- Each partitioned message has a unique sequence id called as offset.

Apache Kafka - Fundamentals

Replicas of partition

- Replicas are nothing but backups of a partition.
- Replicas are never read or write data.
- They are used to prevent data loss.

Apache Kafka - Fundamentals

Brokers

- Brokers are simple system responsible for maintaining the published data.
- Each broker may have zero or more partitions per topic.
- If there are N partitions in a topic and N number of brokers, each broker will have one partition.

Apache Kafka - Fundamentals

Brokers

- If there are N partitions in a topic and more than N brokers (n + m), the first N broker will have one partition and the next M broker will not have any partition for that particular topic.
- If there are N partitions in a topic and less than N brokers (n-m), each broker will have one or more partition sharing among them.
- This scenario is not recommended due to unequal load distribution among the broker.

Apache Kafka - Fundamentals

Kafka Cluster

- Kafka's having more than one broker are called as Kafka cluster.
- A Kafka cluster can be expanded without downtime.
- These clusters are used to manage the persistence and replication of message data.

Apache Kafka - Fundamentals

Producers

- Producers are the publisher of messages to one or more Kafka topics.
- Producers send data to Kafka brokers. Every time a producer publishes a message to a broker, the broker simply appends the message to the last segment file. Actually, the message will be appended to a partition.
- Producer can also send messages to a partition of their choice.

Apache Kafka - Fundamentals

Consumers

- Consumers read data from brokers.
- Consumers subscribes to one or more topics and consume published messages by pulling data from the brokers.

Leader

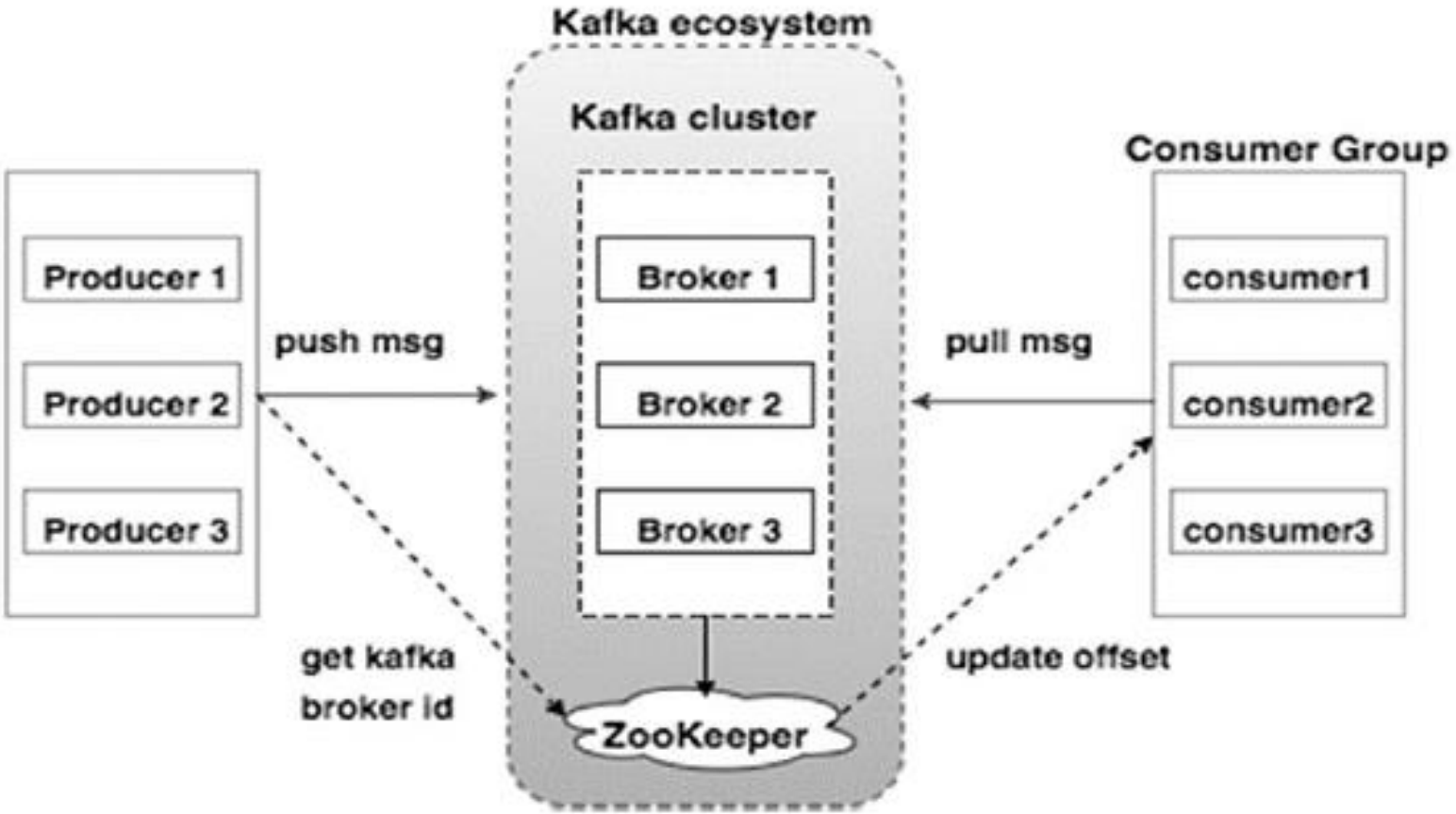
- Leader is the node responsible for all reads and writes for the given partition. Every partition has one server acting as a leader.

Apache Kafka - Fundamentals

Follower

- Node which follows leader instructions are called as follower.
- If the leader fails, one of the follower will automatically become the new leader.
- A follower acts as normal consumer, pulls messages and updates its own data store.

Apache Kafka - Cluster Architecture



Apache Kafka - Cluster Architecture

Broker

- Kafka cluster typically consists of multiple brokers to maintain load balance.
- Kafka brokers are stateless, so they use ZooKeeper for maintaining their cluster state.
- One Kafka broker instance can handle hundreds of thousands of reads and writes per second and each broker can handle TB of messages without performance impact.
- Kafka broker leader election can be done by ZooKeeper.

Apache Kafka - Cluster Architecture

ZooKeeper

- ZooKeeper is used for managing and coordinating Kafka broker.
- ZooKeeper service is mainly used to notify producer and consumer about the presence of any new broker in the Kafka system or failure of the broker in the Kafka system.
- As per the notification received by the Zookeeper regarding presence or failure of the broker then producer and consumer takes decision and starts coordinating their task with some other broker.

Apache Kafka - Cluster Architecture

Producers

- Producers push data to brokers.
- When the new broker is started, all the producers search it and automatically sends a message to that new broker.
- Kafka producer doesn’t wait for acknowledgements from the broker and sends messages as fast as the broker can handle.

Apache Kafka - Cluster Architecture

Consumers

- Since Kafka brokers are stateless, which means that the consumer has to maintain how many messages have been consumed by using partition offset.
- If the consumer acknowledges a particular message offset, it implies that the consumer has consumed all prior messages.
- The consumer issues an asynchronous pull request to the broker to have a buffer of bytes ready to consume.

Apache Kafka - Cluster Architecture

Consumers

- The consumers can rewind or skip to any point in a partition simply by supplying an offset value.
- Consumer offset value is notified by ZooKeeper.

Apache Kafka - Workflow

- Kafka is simply a collection of topics split into one or more partitions.
- A Kafka partition is a linearly ordered sequence of messages, where each message is identified by their index (called as offset).
- All the data in a Kafka cluster is the disjointed union of partitions.

Apache Kafka - Workflow

- Incoming messages are written at the end of a partition and messages are sequentially read by consumers.
- Durability is provided by replicating messages to different brokers.
- Kafka provides both pub-sub and queue based messaging system in a fast, reliable, persisted, fault-tolerance and zero downtime manner.

Apache Kafka - Workflow

- producers simply send the message to a topic and consumer can choose any one type of messaging system depending on their need.

Workflow of Pub-Sub Messaging

- Producers send message to a topic at regular intervals.
- Kafka broker stores all messages in the partitions configured for that particular topic.
- It ensures the messages are equally shared between partitions.
- If the producer sends two messages and there are two partitions, Kafka will store one message in the first partition and the second message in the second partition.

Workflow of Pub-Sub Messaging

- Consumer subscribes to a specific topic.
- Once the consumer subscribes to a topic, Kafka will provide the current offset of the topic to the consumer and also saves the offset in the Zookeeper ensemble.
- Consumer will request the Kafka in a regular interval (like 100 Ms) for new messages.
- Once Kafka receives the messages from producers, it forwards these messages to the consumers.

Workflow of Pub-Sub Messaging

- Consumer will receive the message and process it.
- Once the messages are processed, consumer will send an acknowledgement to the Kafka broker.
- Once Kafka receives an acknowledgement, it changes the offset to the new value and updates it in the Zookeeper.
- Since offsets are maintained in the Zookeeper, the consumer can read next message correctly even during server outages.

Workflow of Pub-Sub Messaging

- This above flow will repeat until the consumer stops the request.

- Consumer has the option to rewind/skip to the desired offset of a topic at any time and read all the subsequent messages.

Workflow of Queue Messaging / Consumer Group

- In a queue messaging system instead of a single consumer, a group of consumers having the same Group ID will subscribe to a topic.
- In simple terms, consumers subscribing to a topic with same Group ID are considered as a single group and the messages are shared among them.
- Producers send message to a topic in a regular interval.
- Kafka stores all messages in the partitions configured for that particular topic similar to the earlier scenario.

Workflow of Queue Messaging / Consumer Group

- A single consumer subscribes to a specific topic, assume Topic-01with Group ID as Group-1.
- Kafka interacts with the consumer in the same way as Pub-Sub Messaging until new consumer subscribes the same topic, Topic-01with the same Group ID as Group-1.
- Once the new consumer arrives, Kafka switches its operation to share mode and shares the data between the two consumers.

Workflow of Queue Messaging / Consumer Group

- This sharing will go on until the number of consumers reach the number of partition configured for that particular topic.
- Once the number of consumer exceeds the number of partitions, the new consumer will not receive any further message until any one of the existing consumer unsubscribes.
- This scenario arises because each consumer in Kafka will be assigned a minimum of one partition and once all the partitions are assigned to the existing consumers, the new consumers will have to wait.

Role of ZooKeeper

- A critical dependency of Apache Kafka is Apache Zookeeper, which is a distributed configuration and synchronization service.
- Zookeeper serves as the coordination interface between the Kafka brokers and consumers.
- The Kafka servers share information via a Zookeeper cluster.
- Kafka stores basic metadata in Zookeeper such as information about topics, brokers, consumer offsets (queue readers) and so on.

Role of ZooKeeper

- Since all the critical information is stored in the Zookeeper and it normally replicates this data across its ensemble, failure of Kafka broker / Zookeeper does not affect the state of the Kafka cluster.
- Kafka will restore the state, once the Zookeeper restarts.
- This gives zero downtime for Kafka.
- The leader election between the Kafka broker is also done by using Zookeeper in the event of leader failure.

Confluent Platform vs Kafka – Key Differences

- Each release of Confluent Platform includes the latest release of Kafka and additional tools and services that make it easier to build and manage an Event Streaming Platform.

- Confluent Platform delivers both community and commercially licensed features that complement and enhance your Kafka deployment.

Overview of Confluent Platform's Enterprise Features

Confluent Control Center

- Confluent Control Center is a GUI-based system for managing and monitoring Kafka.

- It allows you to easily manage Kafka Connect, to create, edit, and manage connections to other systems.

- It also allows you to monitor data streams from producer to consumer, assuring that every message is delivered, and measuring how long it takes to deliver messages.

Overview of Confluent Platform's Enterprise Features

Confluent Control Center

- Using Control Center, you can build a production data pipeline based on Kafka without writing a line of code.

- Control Center also has the capability to define alerts on the latency and completeness statistics of data streams, which can be delivered by email or queried from a centralized alerting system.

Overview of Confluent Platform's Enterprise Features

Confluent for Kubernetes

- Confluent for Kubernetes is a *Kubernetes operator*.
- Kubernetes operators extend the orchestration capabilities of Kubernetes by providing the unique features and requirements for a specific platform application.
- For Confluent Platform, this includes greatly simplifying the deployment process of Kafka on Kubernetes and automating typical infrastructure lifecycle tasks.

Overview of Confluent Platform's Enterprise Features

Confluent Connectors to Kafka

- Connectors leverage the Kafka Connect API to connect Kafka to other systems such as databases, key-value stores, search indexes, and file systems.
- Confluent Hub has downloadable connectors for the most popular data sources and sinks.
- These include fully tested and supported versions of these connectors with Confluent Platform.
- Confluent provides both commercial and Community licensed connectors.

Overview of Confluent Platform's Enterprise Features

Self-Balancing Clusters

- Self-Balancing Clusters provides automated load balancing, failure detection and self-healing.

- It provides support for adding or decommissioning brokers as needed, with no manual tuning.

- Self-Balancing is the next iteration of Auto Data Balancer in that Self-Balancing auto-monitors clusters for imbalances, and automatically triggers rebalances based on your configurations.

Overview of Confluent Platform's Enterprise Features

Self-Balancing Clusters

- You can choose to auto-balance *Only when brokers are added* or *Anytime*.

- Partition reassignment plans and execution are taken care of for you.

Overview of Confluent Platform's Enterprise Features

Confluent Cluster Linking

- Cluster Linking directly connects clusters together and mirrors topics from one cluster to another over a link bridge.

- Cluster Linking simplifies setup of multi-datacenter, multi-cluster, and hybrid cloud deployments.

Overview of Confluent Platform's Enterprise Features

Confluent Auto Data Balancer

- As clusters grow, topics and partitions grow at different rates, brokers are added and removed and over time this leads to unbalanced workload across datacenter resources.

- Some brokers are not doing much at all, while others are heavily taxed with large or many partitions, slowing down message delivery.

- When executed, Confluent Auto Data Balancer monitors your cluster for number of brokers, size of partitions, number of partitions and number of leaders within the cluster.

Overview of Confluent Platform's Enterprise Features

Confluent Auto Data Balancer

- It allows you to shift data to create an even workload across your cluster, while throttling rebalance traffic to minimize impact on production workloads while rebalancing.

Overview of Confluent Platform's Enterprise Features

Confluent Replicator

- Replicator makes it easier than ever to maintain multiple Kafka clusters in multiple data centers.

- Managing replication of data and topic configuration between data centers enables use-cases such as:
  - Active-active geo-localized deployments: allows users to access a near-by data center to optimize their architecture for low latency and high performance
  - Centralized analytics: Aggregate data from multiple Kafka clusters into one location for organization-wide analytics

Overview of Confluent Platform's Enterprise Features

Confluent Replicator

- Managing replication of data and topic configuration between data centers enables use-cases such as:
  - Cloud migration: Use Kafka to synchronize data between on-prem applications and cloud deployments

- You can use Replicator to configure and manage replication for all these scenarios from either Confluent Control Center or command-line tools.

Overview of Confluent Platform's Enterprise Features

Tiered Storage

- Tiered Storage provides options for storing large volumes of Kafka data using your favorite cloud provider, thereby reducing operational burden and cost.

- With Tiered Storage, you can keep data on cost-effective object storage, and scale brokers only when you need more compute resources.

Overview of Confluent Platform's Enterprise Features

Confluent JMS Client

- Confluent Platform includes a JMS-compatible client for Kafka.
- This Kafka client implements the JMS 1.1 standard API, using Kafka brokers as the backend.
- This is useful if you have legacy applications using JMS, and you would like to replace the existing JMS message broker with Kafka.
- By replacing the legacy JMS message broker with Kafka, existing applications can integrate with your modern streaming platform without a major rewrite of the application.

Overview of Confluent Platform's Enterprise Features

Confluent MQTT Proxy

- Provides a way to publish data directly Kafka from MQTT devices and gateways without the need for a MQTT Broker in the middle.

Overview of Confluent Platform's Enterprise Features

Confluent Security Plugins

- Confluent Security Plugins are used to add security capabilities to various Confluent Platform tools and products.

- Currently, there is a plugin available for Confluent REST Proxy which helps in authenticating the incoming requests and propagating the authenticated principal to requests to Kafka.

- This enables Confluent REST Proxy clients to utilize the multi-tenant security features of the Kafka broker.

Community Features

ksqlDB

- ksqlDB is the streaming SQL engine for Kafka.

- It provides an easy-to-use yet powerful interactive SQL interface for stream processing on Kafka, without the need to write code in a programming language such as Java or Python.

- ksqlDB is scalable, elastic, fault-tolerant, and real-time.
- It supports a wide range of streaming operations, including data filtering, transformations, aggregations, joins, windowing, and sessionization.

Community Features

ksqlDB

- ksqlDB supports these use cases:

  Streaming ETL

  - Kafka is a popular choice for powering data pipelines.
  - ksqlDB makes it simple to transform data within the pipeline, readying messages to cleanly land in another system.

  Materialized cache / views

  - A materialized view is a query result that is precomputed (before a user or app actually runs the query) and stored for faster read access.
  - ksqlDB supports the building of materialized views in Kafka as event streams for distributed materializations.
  - Complexity is reduced by using Kafka for storage and ksqlDB for computation.

Community Features

ksqlDB

- ksqlDB supports these use cases:

  Event-driven Microservices

  - Provides support for modeling stateless, event-driven microservices in Kafka.
  - Stateful stream processing is managed on a cluster of servers, while side-effects run inside your stateless microservice, which reads events from a Kafka topic and takes action as needed.

Community Features

Confluent Connectors to Kafka

- Connectors leverage the Kafka Connect API to connect Kafka to other systems such as databases, key-value stores, search indexes, and file systems.

- Confluent Hub has downloadable connectors for the most popular data sources and sinks.

- Confluent provides both commercial and Community licensed connectors.

Confluent Clients

C/C++ Client Library

- The library **librdkafka** is the C/C++ implementation of the Kafka protocol, containing both Producer and Consumer support.

- It was designed with message delivery, reliability and high performance in mind.

- Current benchmarking figures exceed 800,000 messages per second for the producer and 3 million messages per second for the consumer.

Confluent Clients

C/C++ Client Library

- This library includes support for many new features of Kafka 0.10, including message security.

- It also integrates easily with libserdes, our C/C++ library for Avro data serialization (supporting Schema Registry).

Confluent Clients

Python Client Library

- A high-performance client for Python.

Go Client Library

- Confluent Platform includes of a full-featured, high-performance client for Go.

.NET Client Library

- Confluent Platform bundles a full featured, high performance client for .NET.

Confluent Schema Registry

- One of the most difficult challenges with loosely coupled systems is ensuring compatibility of data and code as the system grows and evolves.

- With a messaging service like Kafka, services that interact with each other must agree on a common format, called a *schema*, for messages.

- In many systems, these formats are ad hoc, only implicitly defined by the code, and often are duplicated across each system that uses that message type.

Confluent Schema Registry

- As requirements change, it becomes necessary to evolve these formats.
- With only an ad-hoc definition, it is very difficult for developers to determine what the impact of their change might be.
- **Confluent Schema Registry** enables safe, zero downtime evolution of schemas by centralizing the schema management.
- It provides a RESTful interface for storing and retrieving Avro®, JSON Schema, and Protobuf schemas.

Confluent Schema Registry

- Schema Registry tracks all versions of schemas used for every topic in Kafka and only allows evolution of schemas according to user-defined compatibility settings.

- This gives developers confidence that they can safely modify schemas as necessary without worrying that doing so will break a different service they may not even be aware of.

- Support for schemas is a foundational component of a data governance solution.

Confluent Schema Registry

- Schema Registry also includes plugins for Kafka clients that handle schema storage and retrieval for Kafka messages that are sent in the Avro format.

- This integration is seamless – if you are already using Kafka with Avro data, using Schema Registry only requires including the serializers with your application and changing one setting.

Confluent REST Proxy

- The Confluent REST Proxy makes it easy to work with Kafka from any language by providing a RESTful HTTP service for interacting with Kafka clusters.

- The REST Proxy supports all the core functionality: sending messages to Kafka, reading messages, both individually and as part of a consumer group, and inspecting cluster metadata,

- such as the list of topics and their settings. You can get the full benefits of the high quality, officially maintained Java clients from any language.

Confluent REST Proxy

- The REST Proxy also integrates with Schema Registry.
- It can read and write Avro data, registering and looking up schemas in Schema Registry.
- Because it automatically translates JSON data to and from Avro, you can get all the benefits of centralized schema management from any language using only HTTP and JSON.

Docker images of Confluent Platform

- Docker images of Confluent Platform are available on Docker Hub.
- Some of these images contain proprietary components that require a Confluent commercial license.
- These are identified cp-enterprise-${component_name}.

Confluent CLI and other Command Line Tools

- Confluent Platform ships a number of command line interface (CLI) tools, including the Confluent CLI.

Confluent Quick Start

Local install

- **Prerequisites:**
  - Internet connectivity.
  - Operating System currently supported by Confluent Platform.
  - A supported version of Java downloaded and installed.
  - Java 8 and Java 11 are supported in this version of Confluent Platform (Java 9 and 10 are not supported).

Confluent Quick Start

Step 1: Download and Start Confluent Platform

- Go to the downloads page.
- Scroll to the **Download Confluent Platform** section and provide the following:
  - Email: Your email address
  - Format: deb, rpm, tar, or zip
- Click **DOWNLOAD FREE**.
- Decompress the file. You should have the directories, such as bin and etc.
- Set the environment variable for the Confluent Platform directory.

Confluent Quick Start

Step 1: Download and Start Confluent Platform

- Set the environment variable for the Confluent Platform directory.
  - export CONFLUENT_HOME=<path-to-confluent>
- Add the Confluent Platform bin directory to your PATH.
  - export PATH=$PATH:$CONFLUENT_HOME/bin
- Install the Kafka Connect Datagen source connector using the Confluent Hub client.
  - This connector generates mock data for demonstration purposes and is not suitable for production.
  - Confluent Hub is an online library of pre-packaged and ready-to-install extensions or add-ons for Confluent Platform and Kafka.

Confluent Quick Start

Step 1: Download and Start Confluent Platform

- Confluent Hub is an online library of pre-packaged and ready-to-install extensions or add-ons for Confluent Platform and Kafka.

  confluent-hub install --no-prompt confluentinc/kafka-connect-datagen:latest

- Start Confluent Platform using the Confluent CLI

confluent local services start command.

- This command starts all of the Confluent Platform component, including Kafka, ZooKeeper, Schema Registry, HTTP REST Proxy for Kafka, Kafka Connect, ksqlDB, and Control Center.

  confluent local services start

Confluent Quick Start

Step 1: Download and Start Confluent Platform

Your output should resemble:

```
Starting Zookeeper
Zookeeper is [UP]
Starting Kafka
Kafka is [UP]
Starting Schema Registry
Schema Registry is [UP]
Starting Kafka REST
Kafka REST is [UP]
Starting Connect
Connect is [UP]
Starting KSQL Server
KSQL Server is [UP]
Starting Control Center
Control Center is [UP]
```

Confluent Quick Start

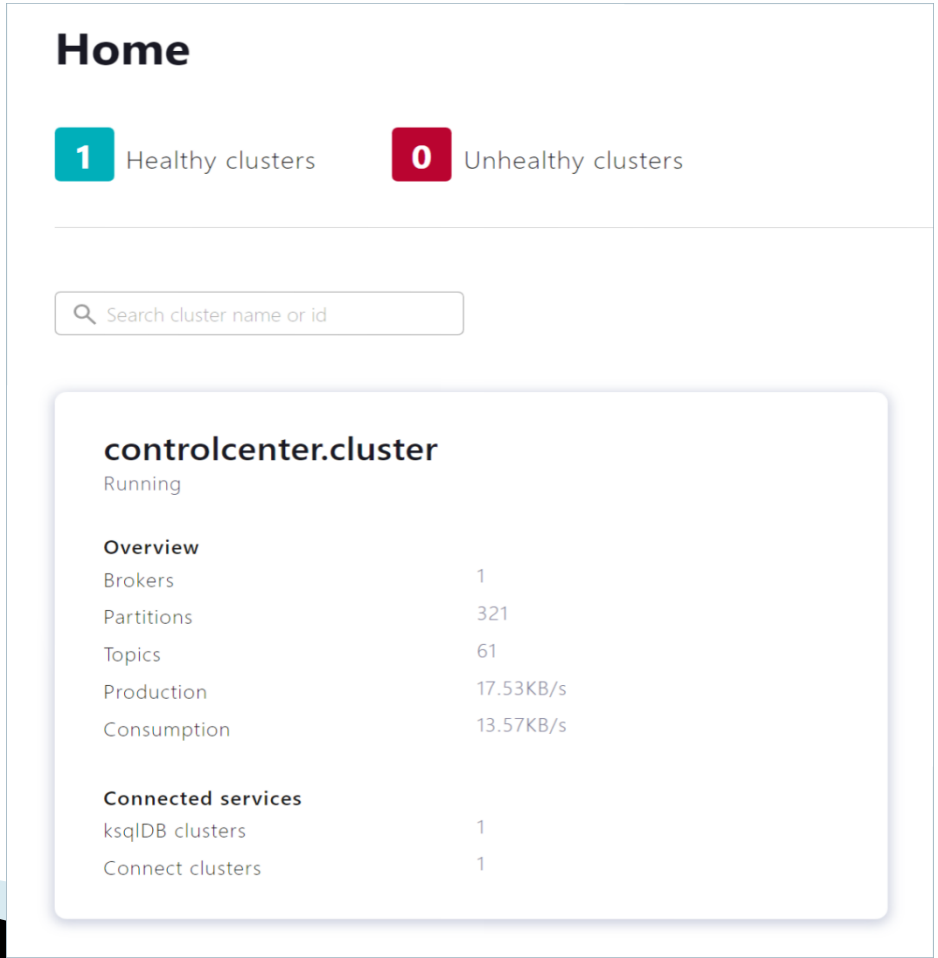
Step 2: Create Kafka Topics

- In this step, you create Kafka topics using Confluent Control Center.
- Confluent Control Center provides the functionality for building and monitoring production data pipelines and event streaming applications.
- Navigate to the Control Center web interface at http://localhost:9021.
- If you installed Confluent Platform on a different host, replace localhost with the host name in the address.
- It may take a minute or two for Control Center to come online.

Confluent Quick Start

Step 2: Create Kafka Topics

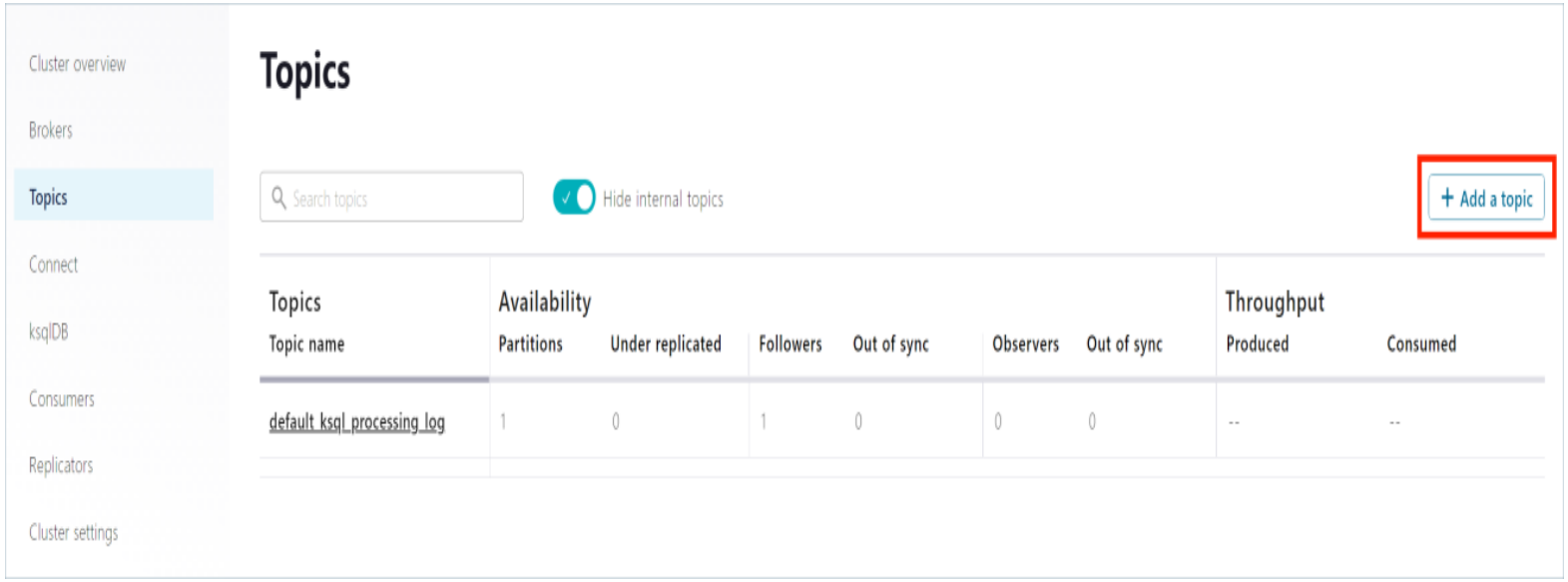
- Click the **controlcenter.cluster** tile.



Confluent Quick Start

Step 2: Create Kafka Topics

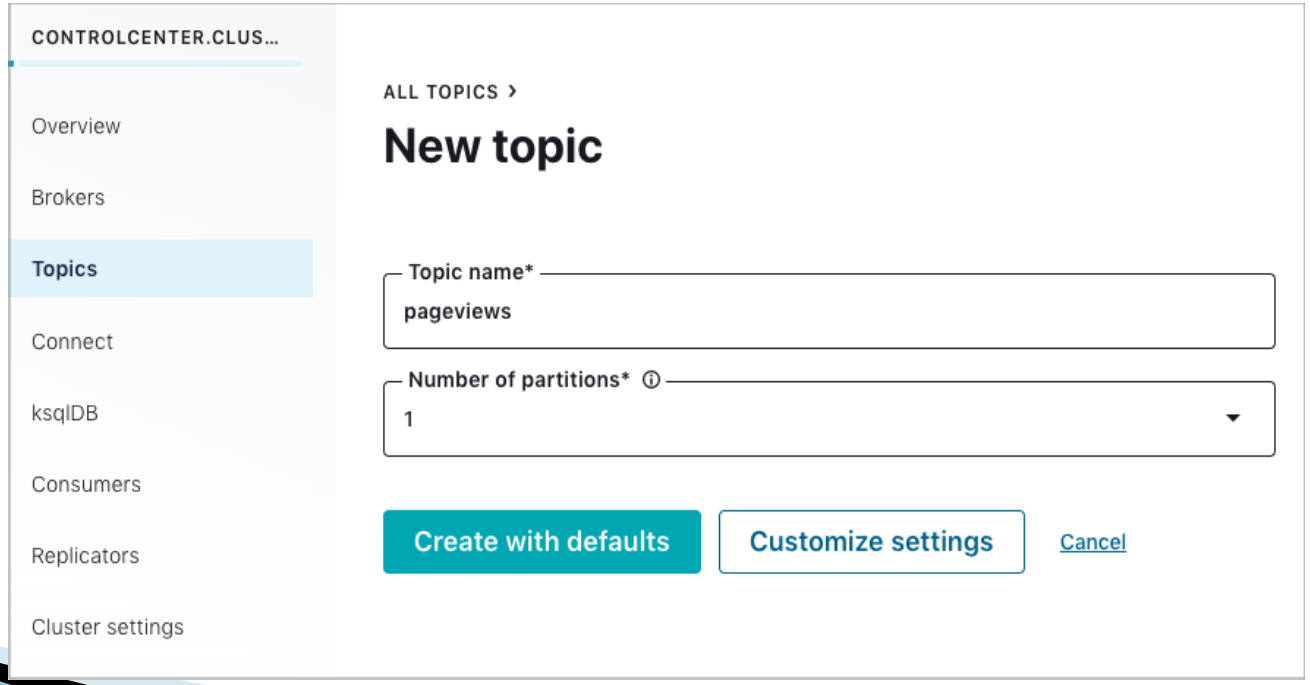
- In the navigation bar, click **Topics** to open the topics list, and then click **Add a topic**.



Confluent Quick Start

Step 2: Create Kafka Topics

- In the Topic name field, specify pageviews and click **Create with defaults**.
- Note that topic names are case-sensitive.



Confluent Quick Start

Step 2: Create Kafka Topics

- In the navigation bar, click **Topics** to open the topics list, and then click **Add a topic**.
- In the Topic name field, specify users and click **Create with defaults**.

Confluent Quick Start

Step 3: Install a Kafka Connector and Generate Sample Data

- In this step, you use Kafka Connect to run a demo source connector called kafka-connect-datagen that creates sample data for the Kafka topics pageviews and users.

- The Kafka Connect Datagen connector was installed manually in Step 1: Download and Start Confluent Platform.

Confluent Quick Start

Step 3: Install a Kafka Connector and Generate Sample Data

- Run the first instance of the Kafka Connect Datagen connector to produce Kafka data to the pageviews topic in AVRO format.
  - In the navigation bar, click **Connect**.
  - Click the connect-default cluster in the **Connect Clusters** list.
  - Click **Add connector**.
  - Select the DatagenConnector tile.
  - In the **Name** field, enter datagen-pageviews as the name of the connector.

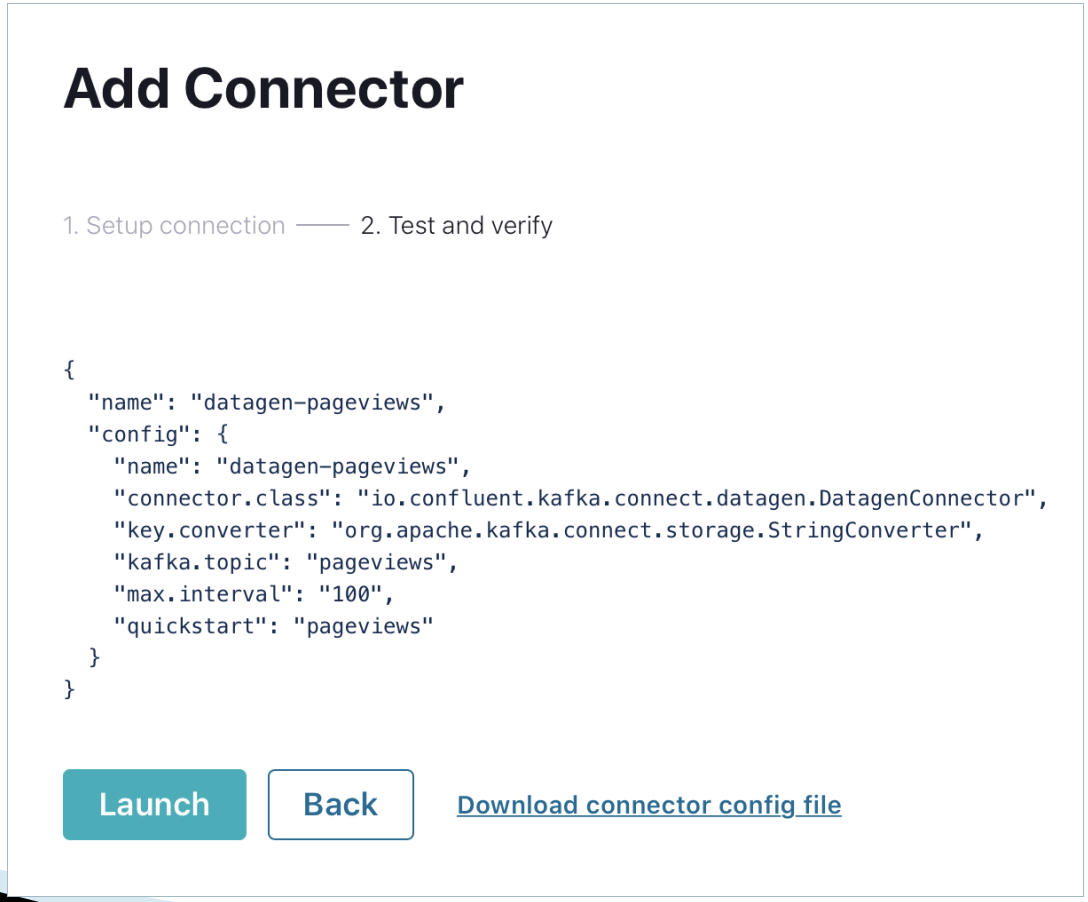
Confluent Quick Start

Step 3: Install a Kafka Connector and Generate Sample Data

- Run the first instance of the Kafka Connect Datagen connector to produce Kafka data to the pageviews topic in AVRO format.
  - Enter the following configuration values:
    - **Key converter class:** org.apache.kafka.connect.storage.StringConverter.
    - **kafka.topic:** pageviews.
    - **max.interval:** 100.
    - **quickstart:** pageviews.
  - Click **Next**.
  - Review the connector configuration and click **Launch**.

Confluent Quick Start

Step 3: Install a Kafka Connector and Generate Sample Data



Confluent Quick Start

Step 3: Install a Kafka Connector and Generate Sample Data

- Run the second instance of the Kafka Connect Datagen connector to produce Kafka data to the users topic in AVRO format.
  - Click **Add connector**.
  - Select the DatagenConnector tile.
  - In the **Name** field, enter datagen-users as the name of the connector.

Confluent Quick Start

Step 3: Install a Kafka Connector and Generate Sample Data

- Enter the following configuration values:
  - **Key converter class:** org.apache.kafka.connect.storage.StringConverter
  - **kafka.topic:** users
  - **max.interval:** 1000
  - **quickstart:** users
- Click **Next**.

- Review the connector configuration and click **Launch**.

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

Create Streams and Tables

In this step, you use ksqlDB to create a stream for the pageviews topic and a table for the users topic.

- In the navigation bar, click **ksqlDB**.
- Select the ksqlDB application.
- Copy the following code into the editor window and click **Run query** to create the pageviews stream. Stream names are not case-sensitive.

```
CREATE STREAM pageviews WITH (KAFKA_TOPIC='pageviews', VALUE_FORMAT='AVRO');
```

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

Create Streams and Tables

- Copy the following code into the editor window and click **Run query** to create the users table. Table names are not case-sensitive.

```
CREATE TABLE users (id VARCHAR PRIMARY KEY) WITH (KAFKA_TOPIC='users', VALUE_FORMAT='AVRO');
```

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

Write Queries

- In this step, you create ksqlDB queries against the stream and the table you created above.
  - In the **Editor** tab, click **Add query properties** to add a custom query property.
  - Set the auto.offset.reset parameter to Earliest.
  - The setting instructs ksqlDB queries to read all available topic data from the beginning. This configuration is used for each subsequent query.

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

Write Queries

- In this step, you create ksqlDB queries against the stream and the table you created above.
  - Create the following queries.
    - Click **Stop** to stop the current running query.
    - Create a non-persistent query that returns data from a stream with the results limited to a maximum of three rows:
  - Enter the following query in the editor:

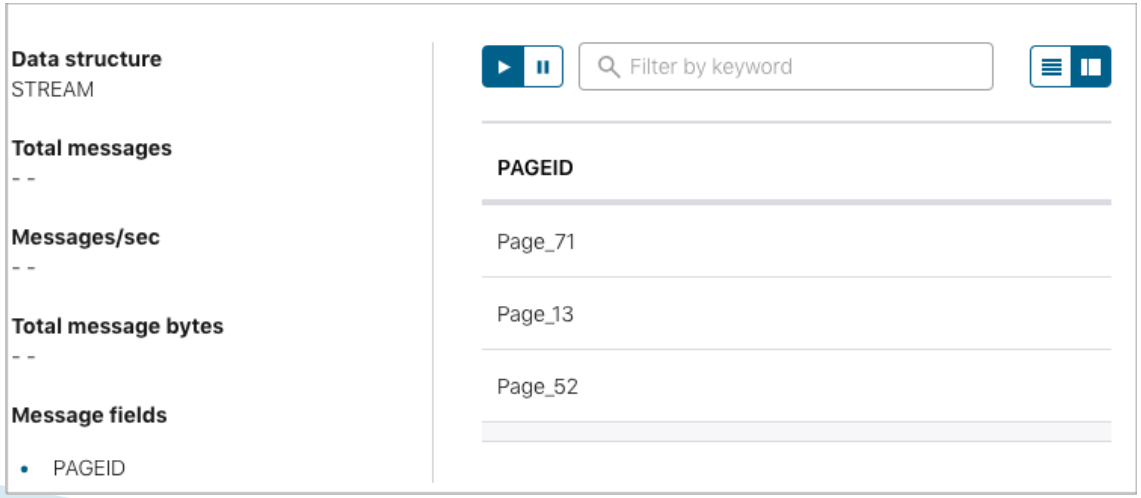
```
SELECT pageid FROM pageviews EMIT CHANGES LIMIT 3;
```

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

Write Queries

- In this step, you create ksqlDB queries against the stream and the table you created above.
  - Click **Run query**. Your output should resemble:



    - Click the **Card view** or **Table view** icon to change the output layout.

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

Write Queries

- In this step, you create ksqlDB queries against the stream and the table you created above.
  - Create a persistent query (as a stream) that filters the PAGEVIEWS stream for female users. The results from this query are written to the Kafka PAGEVIEWS_FEMALE topic:
  - Enter the following query in the editor:

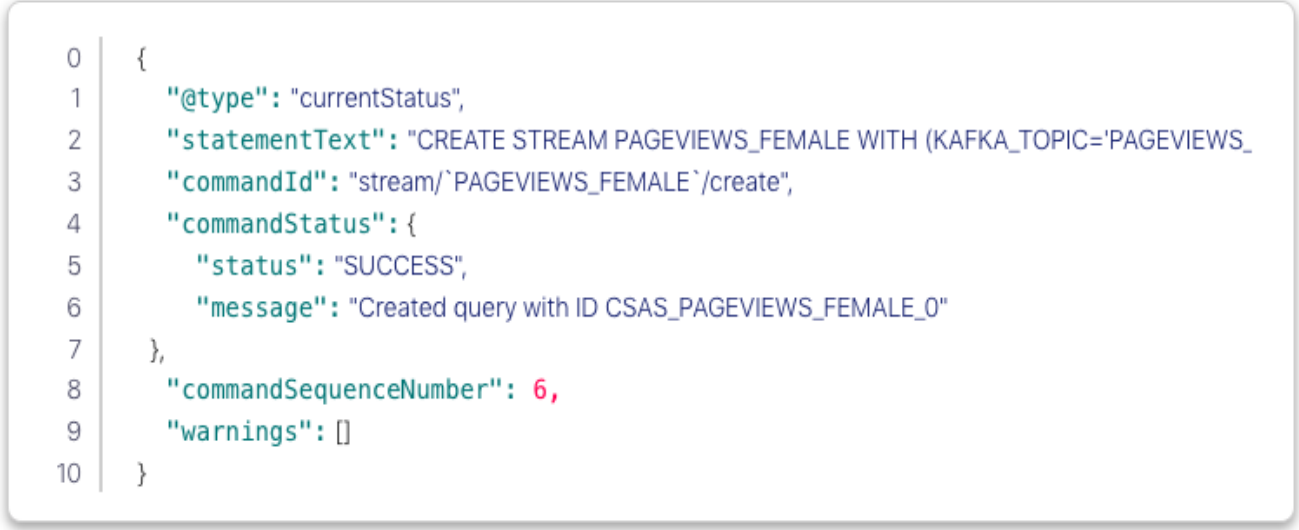
```
CREATE STREAM pageviews_female
  AS SELECT users.id AS userid, pageid, regionid
  FROM pageviews LEFT JOIN users ON pageviews.userid = users.id
  WHERE gender = 'FEMALE'
  EMIT CHANGES;
```

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

Write Queries

- In this step, you create ksqlDB queries against the stream and the table you created above.
  - Click **Run query**. Your output should resemble:



Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

- Create a persistent query where REGIONID ends with 8 or 9. Results from this query are written to the Kafka topic named pageviews_enriched_r8_r9 as explicitly specified in the query:
- Enter the following query in the editor:

```
CREATE STREAM pageviews_female_like_89
  WITH (KAFKA_TOPIC='pageviews_enriched_r8_r9', VALUE_FORMAT='AVRO')
  AS SELECT * FROM pageviews_female
  WHERE regionid LIKE '%_8' OR regionid LIKE '%_9'
  EMIT CHANGES;
```

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

- Click **Run query**. Your output should resemble:


```
{
  "@type": "currentStatus",
  "statementText": "CREATE STREAM PAGEVIEWS_FEMALE_LIKE_89 WITH (KAFKA_TOPIC='pag
  "commandId": "stream/`PAGEVIEWS_FEMALE_LIKE_89`/create",
  "commandStatus": {
    "status": "SUCCESS",
    "message": "Created query with ID CSAS_PAGEVIEWS_FEMALE_LIKE_89_7"
 },
  "commandSequenceNumber": 8,
  "warnings": []
}
```

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

- Create a persistent query that counts the PAGEVIEWS for each REGION and GENDER combination in a tumbling window of 30 seconds when the count is greater than 1. Because the procedure is grouping and counting, the result is now a table, rather than a stream. Results from this query are written to a Kafka topic called PAGEVIEWS_REGIONS:
- Enter the following query in the editor:

```
CREATE TABLE pageviews_regions WITH (KEY_FORMAT='JSON')
  AS SELECT gender, regionid, COUNT(*) AS numusers
  FROM pageviews LEFT JOIN users ON pageviews.userid = users.id
  WINDOW TUMBLING (SIZE 30 SECOND)
  GROUP BY gender, regionid
  HAVING COUNT(*) > 1
  EMIT CHANGES;
```

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

- Click **Run query**. Your output should resemble:


```
{
  "@type": "currentStatus",
  "statementText": "CREATE TABLE PAGEVIEWS_REGIONS WITH (KAFKA_TOPIC='PAGEVIEWS_F
  "commandId": "table/`PAGEVIEWS_REGIONS`/create",
  "commandStatus": {
    "status": "SUCCESS",
    "message": "Created query with ID CTAS_PAGEVIEWS_REGIONS_9"
  },
  "commandSequenceNumber": 10,
  "warnings": []
}
```

Confluent Quick Start

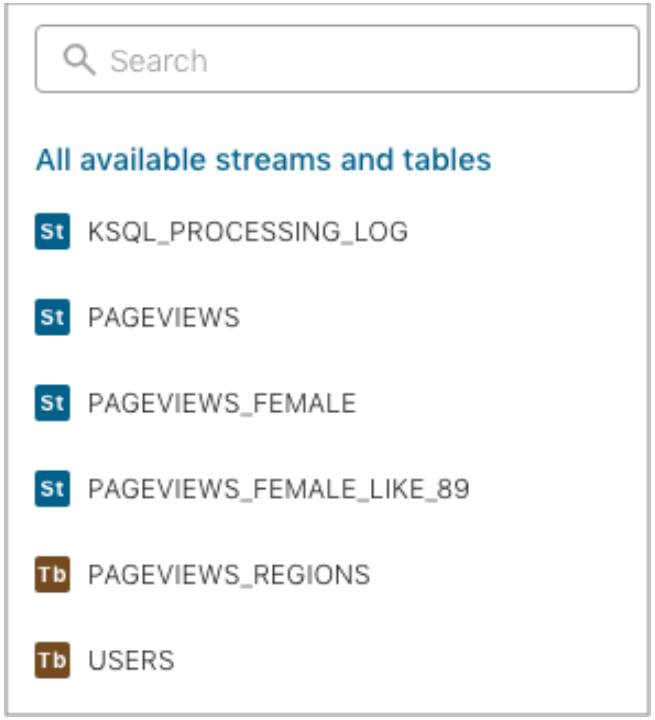
Step 4: Create and Write to a Stream and Table using ksqlDB

- Click the **Persistent queries** tab. You should see the following persisted queries:
  - PAGEVIEWS_FEMALE
  - PAGEVIEWS_FEMALE_LIKE_89
  - PAGEVIEWS_REGIONS

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

- Click the **Editor** tab. The **All available streams and tables** pane shows all of the streams and tables that you can access.



Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

- In the **All available streams and tables** section, click **KSQL_PROCESSING_LOG** to view the stream's schema, including nested data structures.

Confluent Quick Start

Step 4: Create and Write to a Stream and Table using ksqlDB

Run Queries

- In this step, you run the ksqlDB queries you save as streams and tables above in the previous section.
- In the **Streams** tab, select the PAGEVIEWS_FEMALE stream.
- Click **Query stream**.
- The editor opens, and streaming output of the query displays.
- Click **Stop** to stop the output generation.
- In the **Tables** tab, select PAGEVIEWS_REGIONS table.
- Click **Query table**.
- The editor opens, and streaming output of the query displays.
- Click **Stop** to stop the output generation.

Confluent Quick Start

Step 5: Monitor Consumer Lag

- In the navigation bar, click **Consumers** to view the consumers created by ksqlDB.
- Click the consumer group ID to view details for the _confluent-ksql-default_query_CSAS_PAGEVIEWS_FEMALE_5 consumer group.
- From the page, you can see the consumer lag and consumption values for your streaming query.

Confluent Quick Start

Step 6: Stop Confluent Platform

When you are done working with the local install, you can stop Confluent Platform.

- Stop Confluent Platform using the Confluent CLI confluent local services connect stop command.

  confluent local services stop

- Destroy the data in the Confluent Platform instance with the confluent local destroy command.

  confluent local destroy