APACHE kafka®

A distributed streaming platform

Need of Messaging Systems

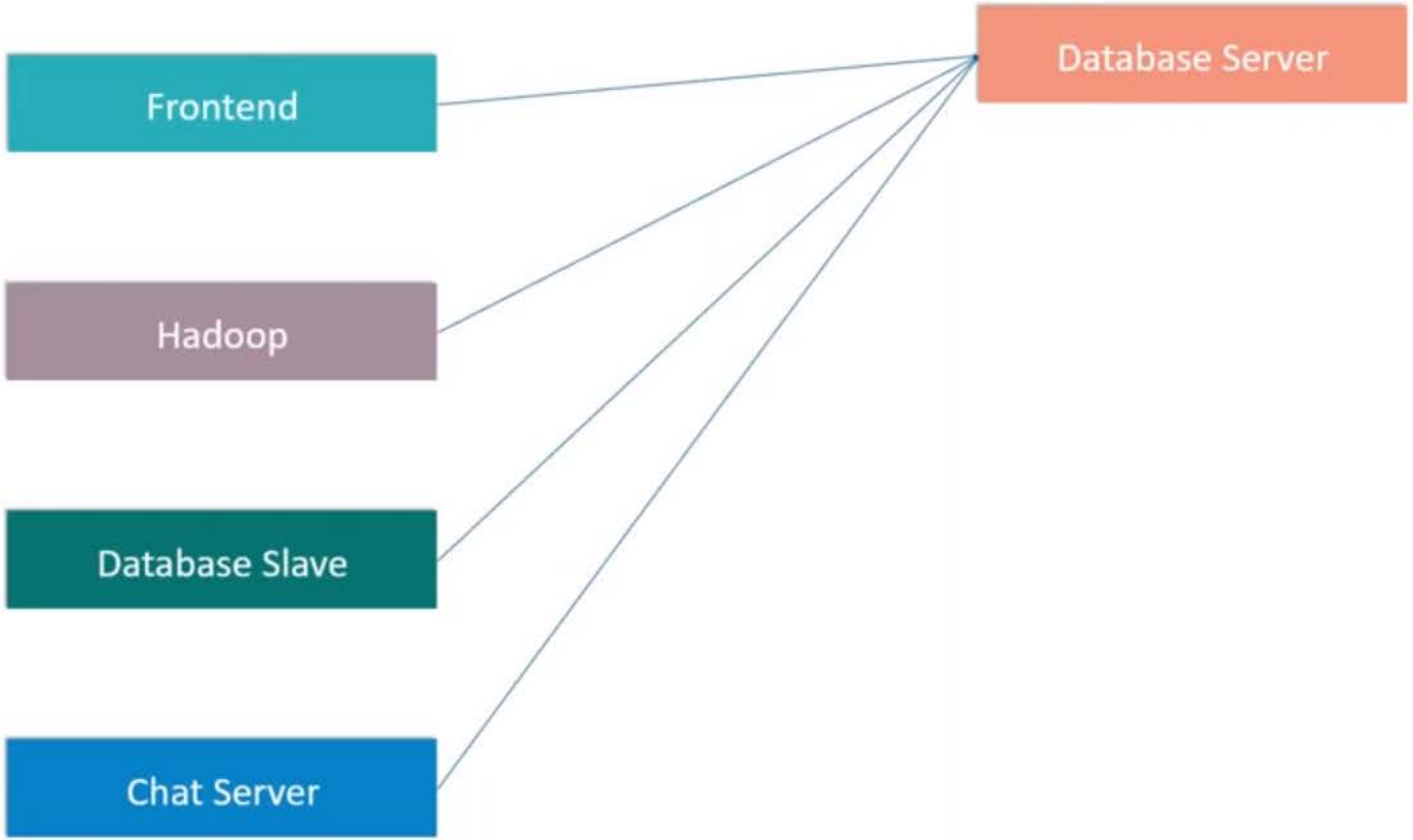
Data Pipelines

Communication is required between different systems in the real-time scenario, which is done by using data pipelines.

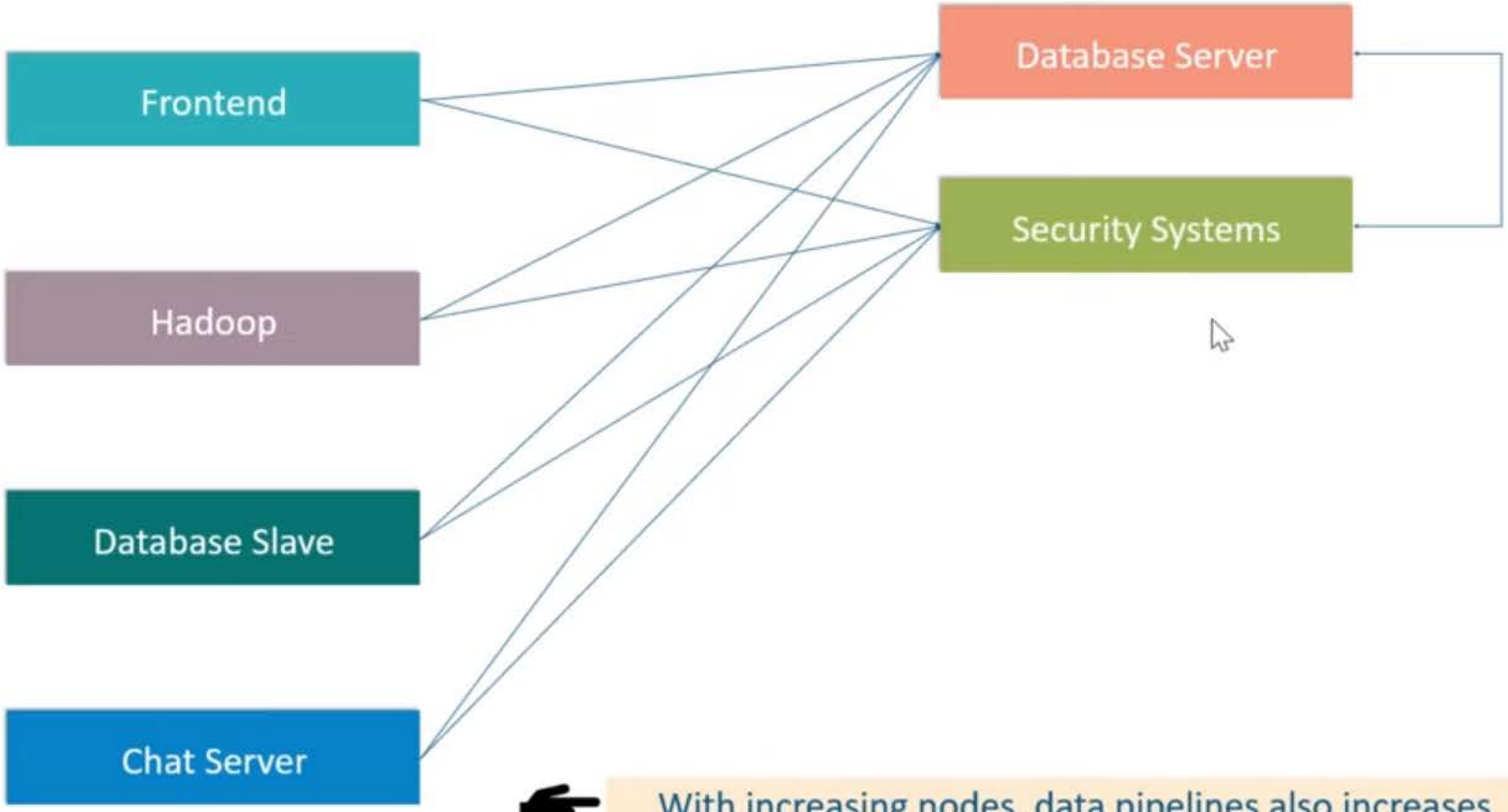
For Example: Chat Server needs to communicate with Database Server for storing messages

Increase in number of Nodes

Similarly, there may be many applications wanting to access the Database Server



Increase in number of Nodes

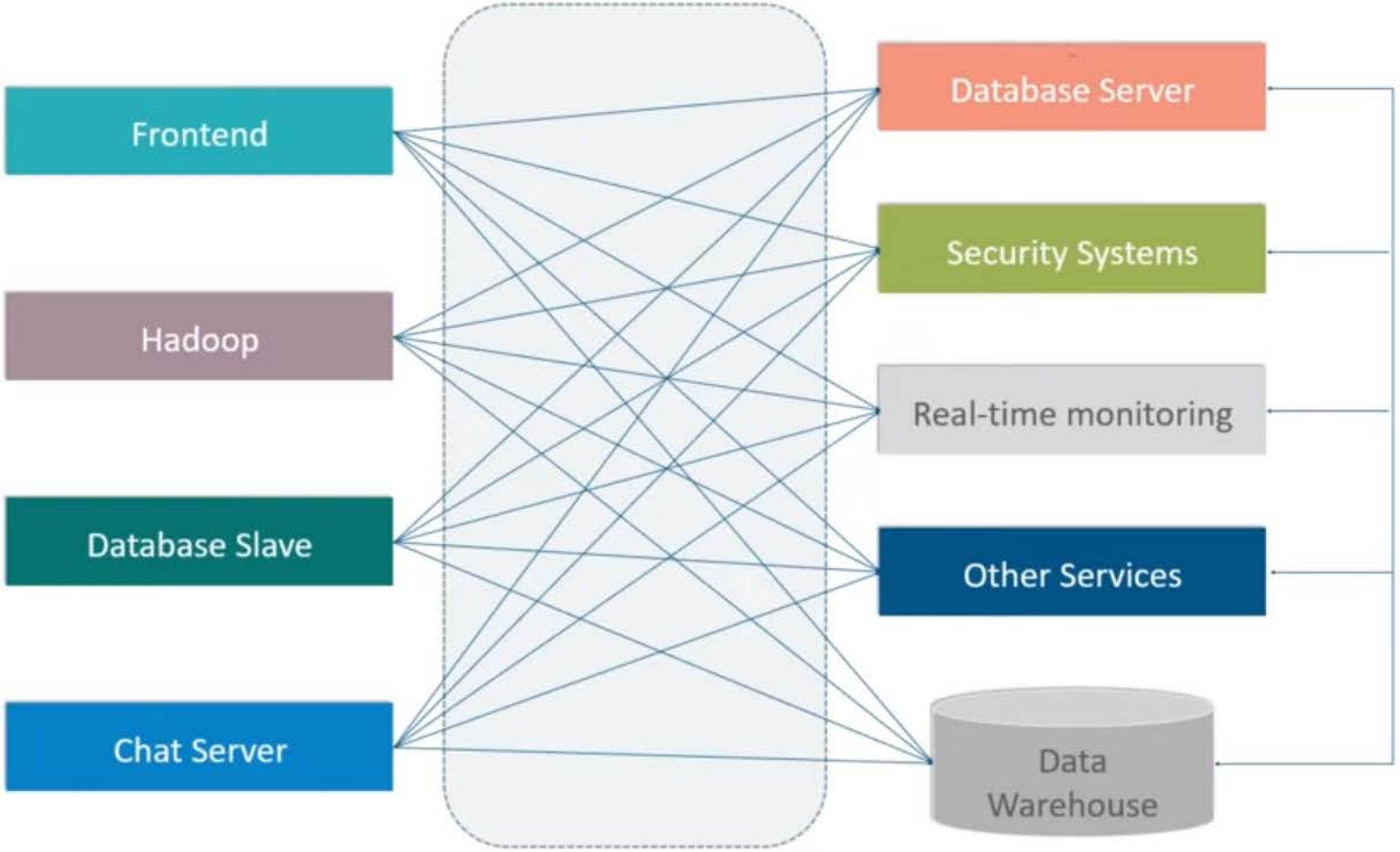


These applications might also be communicating with Security Systems

With increasing nodes, data pipelines also increases

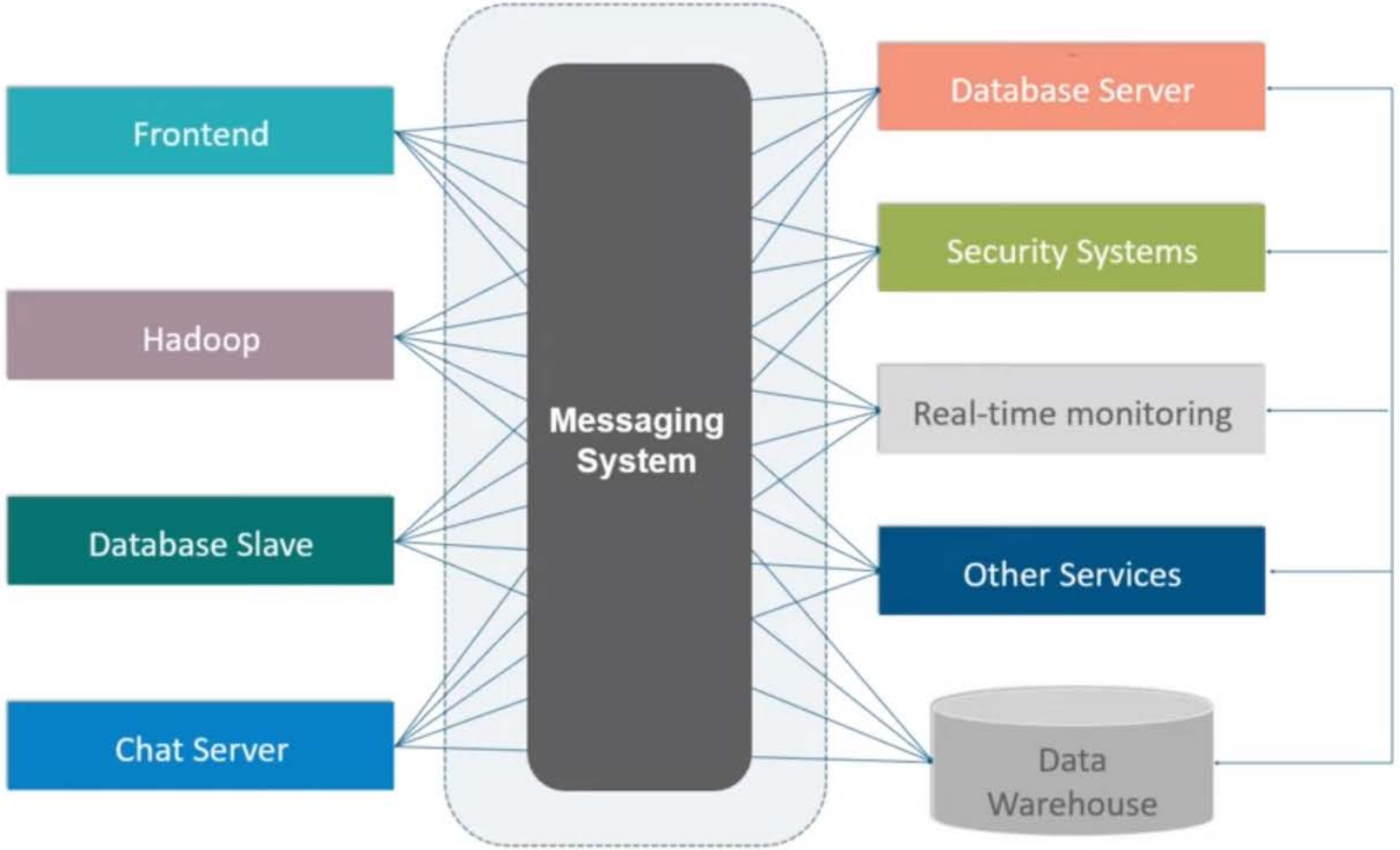
Complex Data Pipelines

Similarly, applications may also be communicating with Real-time monitoring and Other services in real-time scenario



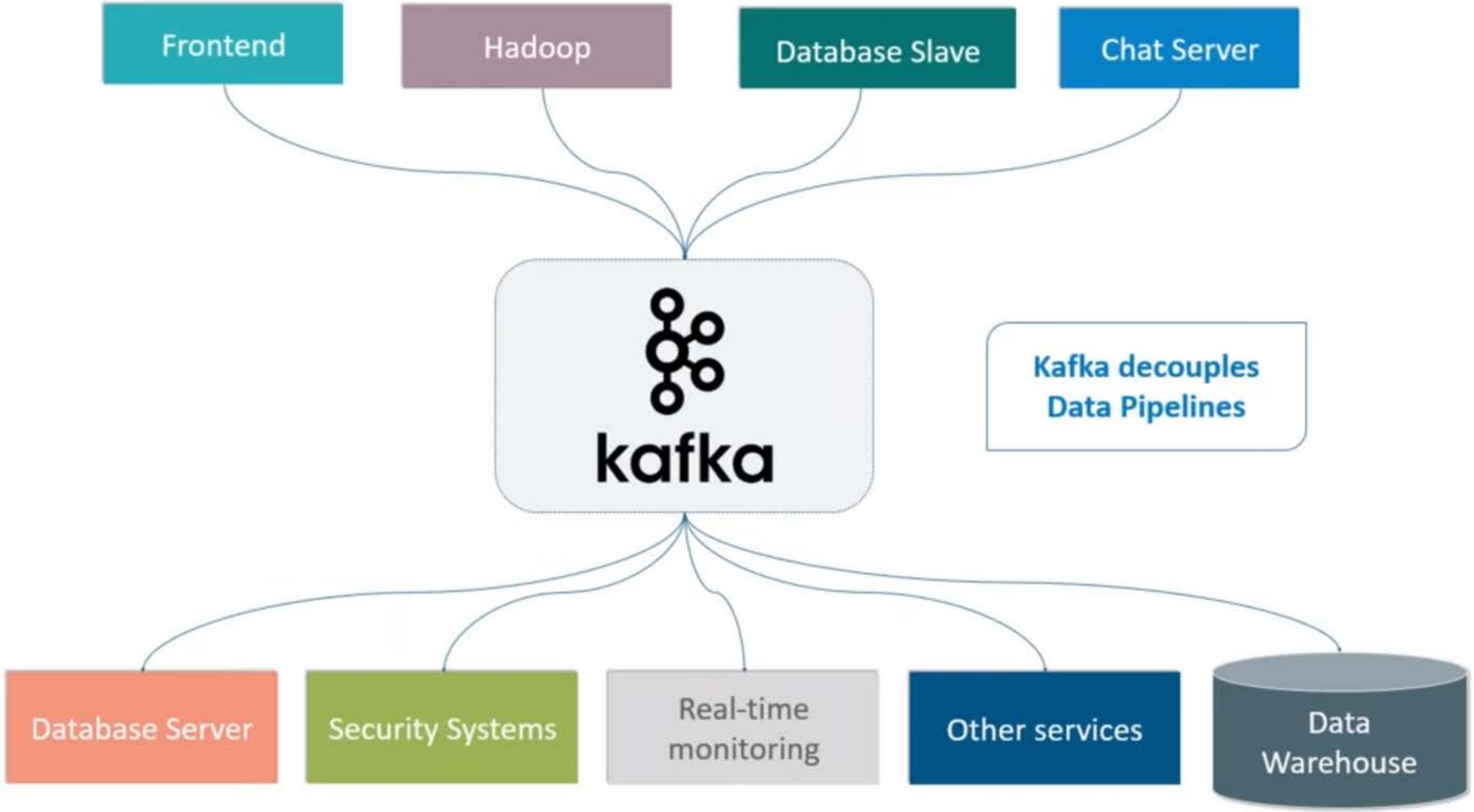
Solution to the Complex Data Pipelines

Messaging Systems helps managing the complexity of the pipelines



Let’s See How Kafka Solves the Problem

Kafka Decouples Data Pipelines



What is Kafka?

- **Apache Kafka** is a distributed *publish-subscribe* messaging system
- It was originally developed at LinkedIn and later on became a part of Apache Project
- Kafka is fast, scalable, durable, fault-tolerant and distributed by design

Kafka @LinkedIn

- *1100+ commodity machines*
- *31,000+ topics*
- *350,000+ partitions*

- *675 billion messages/day*
- *150 TB/day in*
- *580 TB/day out*

Peak Load

- *10.5 million messages/sec*
- *18.5 GB/sec Inbound*
- *70.5 GB/sec Outbound*

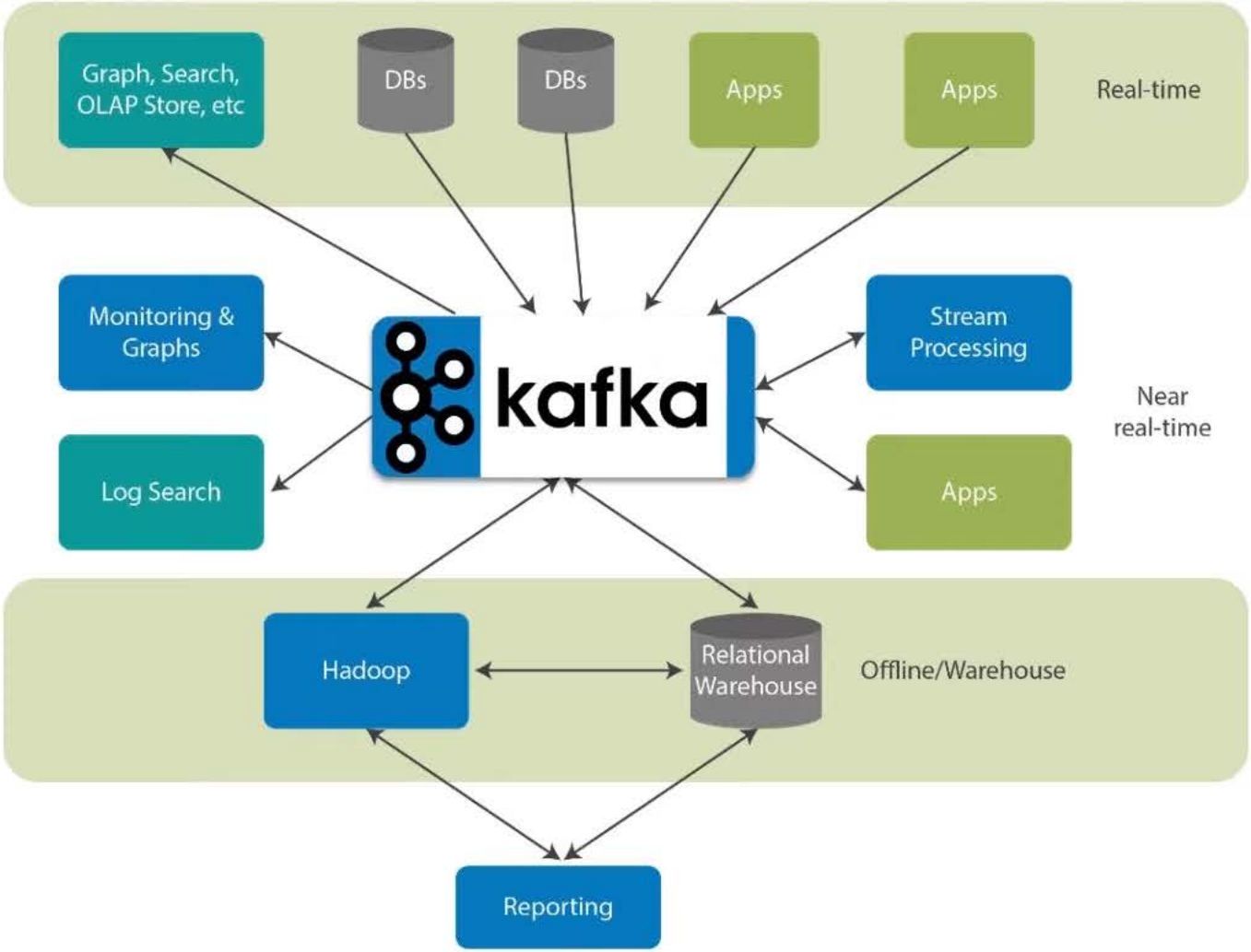


Fig: A modern stream-centric data architecture built around Kafka

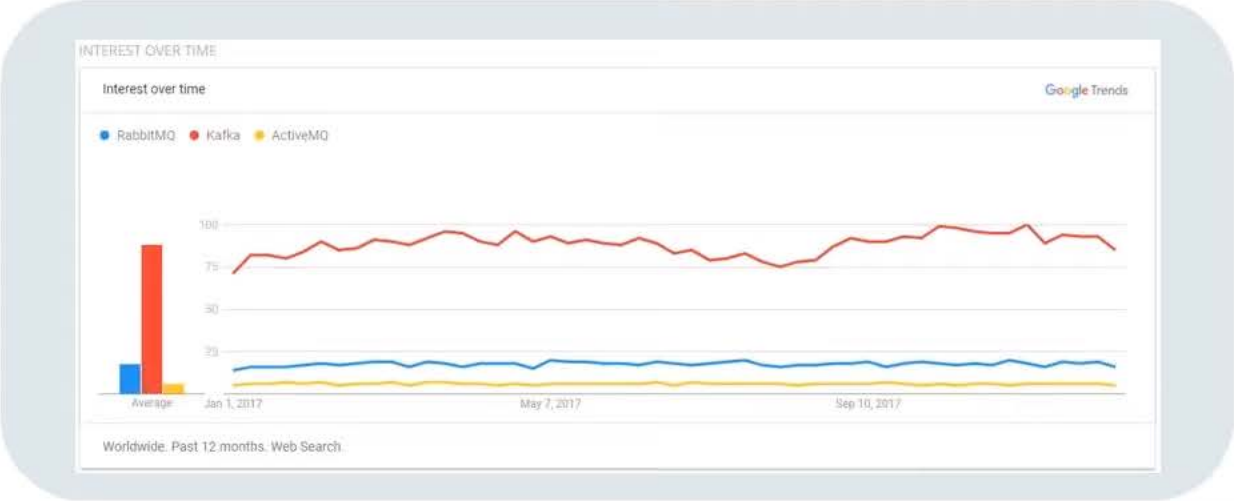
Kafka Growth Exploding

- More than **1/3** of all Fortune **500** companies use **Kafka**.
- These companies includes the top ten travel companies, **7** of top ten banks, **8** of top ten insurance companies, **9** of top ten telecom companies.
- **LinkedIn**, **Microsoft** and **Netflix** process billions of messages a day with Kafka (1,000,000,000,000).
- **Kafka** is used for **real-time streams** of data & used to collect big data for **real time analysis**.

86% of respondents reported that the number of their systems that use Kafka is increasing

20% reported that the number is "growing a lot!"

52% of organizations have at least 6 systems running Kafka



Source: Google Trends

Kafka Concepts

Kafka Terminologies

Producer

A ***producer*** can be any application who can publish messages to a topic

Consumer

A ***consumer*** can be any application that subscribes to a topic and consume the messages

Partition

Topics are *broken* up into *ordered commit logs* called ***partitions***

Broker

Kafka cluster is a set of servers, each of which is called a ***broker***

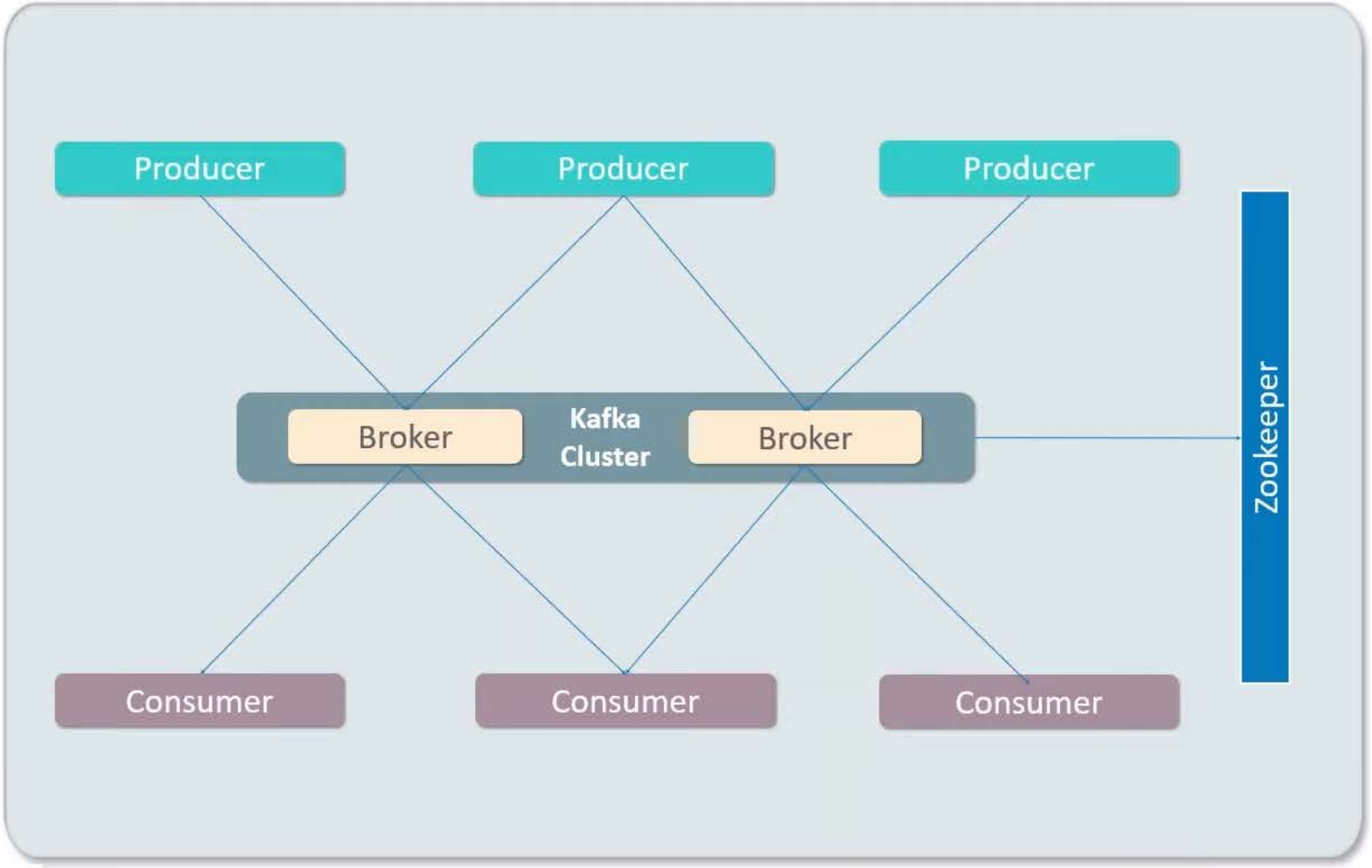
Topic

A ***topic*** is a category or *feed name* to which *records are published*

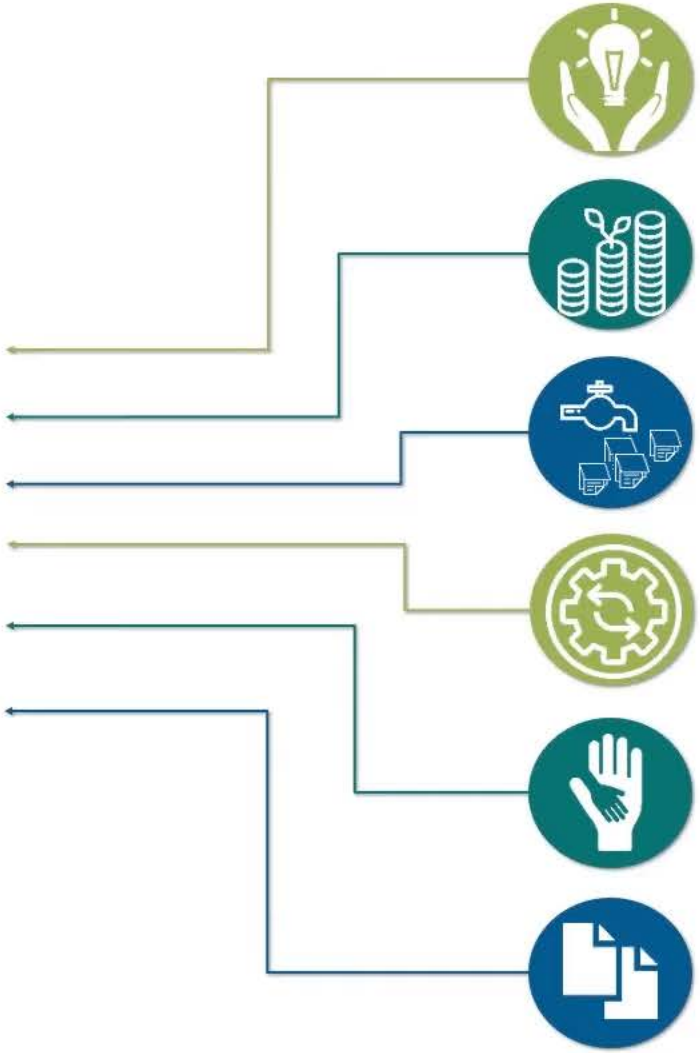
Zookeeper

ZooKeeper is used for managing and coordinating Kafka broker

Kafka Cluster



Kafka Features



High Throughput: Provides Support for Hundreds of thousands of messages with modest hardware

Scalability: Highly scalable distributed systems with no downtime

Data Loss: Kafka ensures no data loss once configured properly

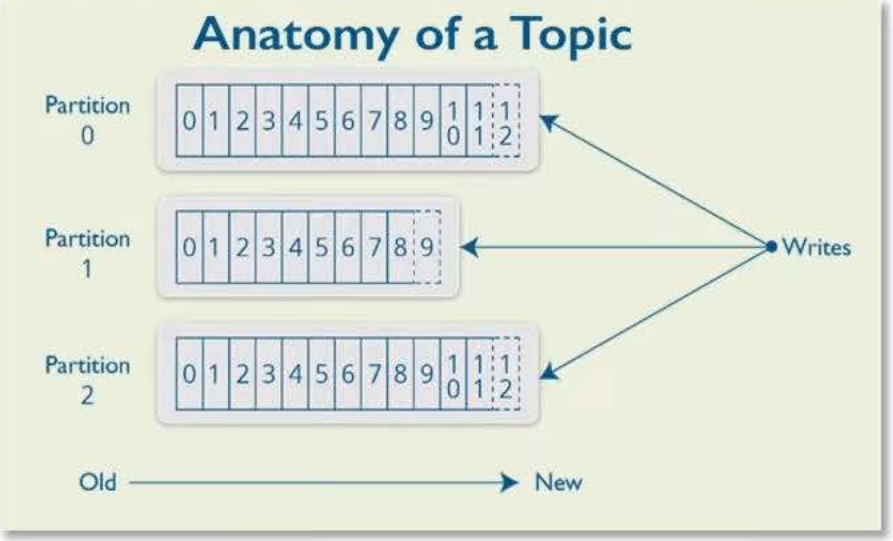
Stream Processing: Kafka can be used along with real time streaming applications like Spark and Storm

Durability: Provides support to persisting messages on disk

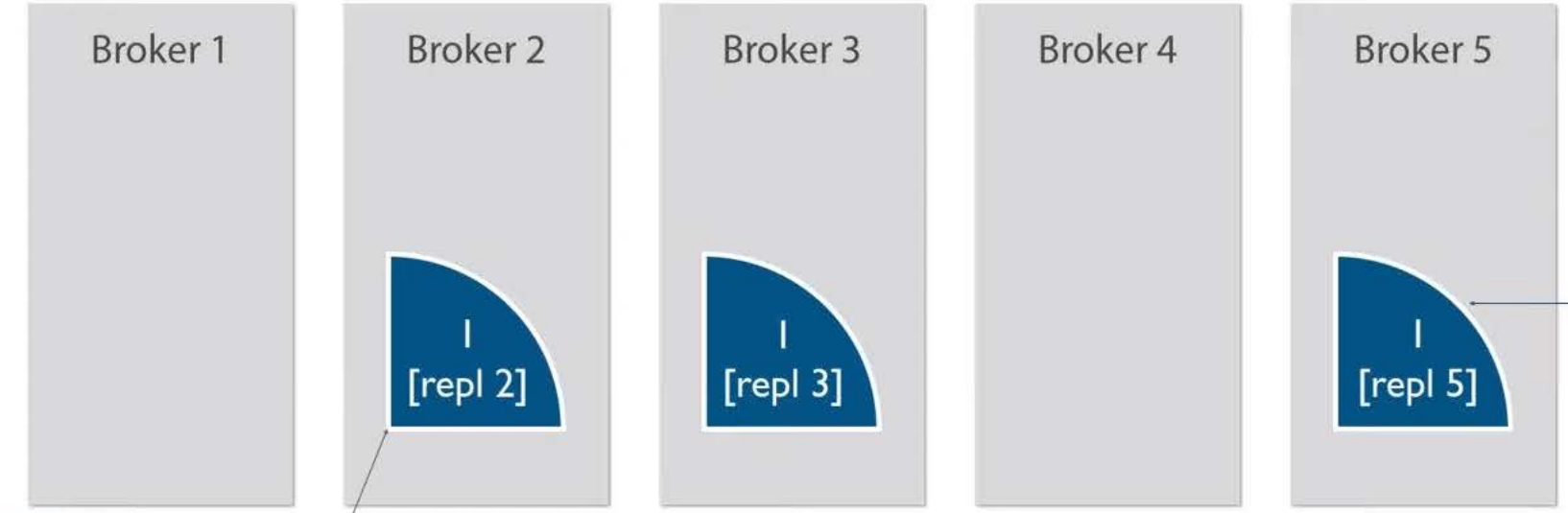
Replication: Messages can be replicated across clusters, which supports multiple subscribers

Kafka Components - Topics and Partitions

- A *topic* is a category or *feed name* to which *records are published*
- *Topics* are *broken* up into *ordered commit logs* called *partitions*
- Each *message* in a *partition* is assigned a *sequential id* called an *offset*
- Data in a topic is retained for a *configurable period of time*
- *Writes* to a partition *are* generally *sequential* thereby *reducing* the *number of hard disk seeks*
- *Reading messages* can either be from *beginning* & *also* can *rewind* or *skip* to any *point* in partition by *giving* an *offset value*



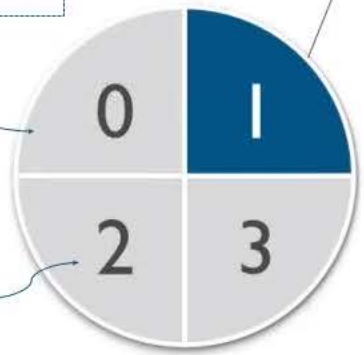
Kafka Components - Topics, Partitions & Replicas



For each partition Kafka Broker will elect one replica as the 'leader' of a partition

A topic configured to use 4 partitions

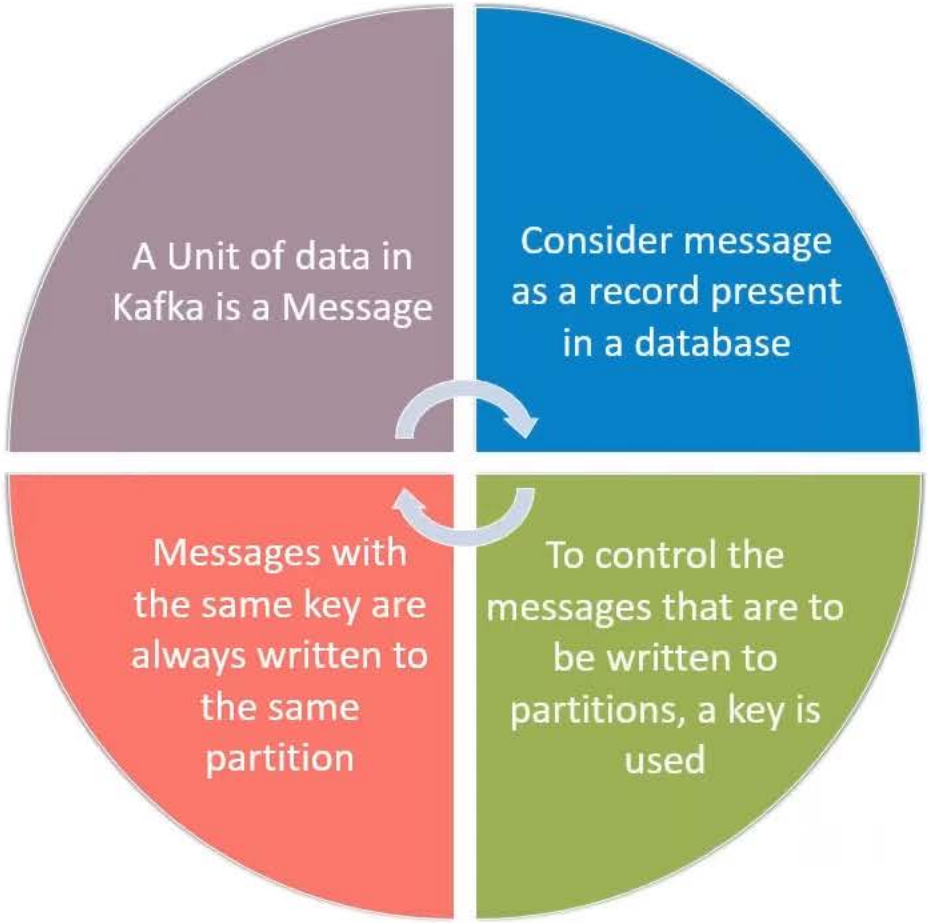
The ID of a replica is same as the ID of the broker that hosts it, i.e. [repl n] where n is the broker number that it resides in



Each partition has an ID

If say, replication factor of a topic is set to 3, then Kafka will create 3 identical replicas of each partition and place those replicas on available brokers in the cluster.

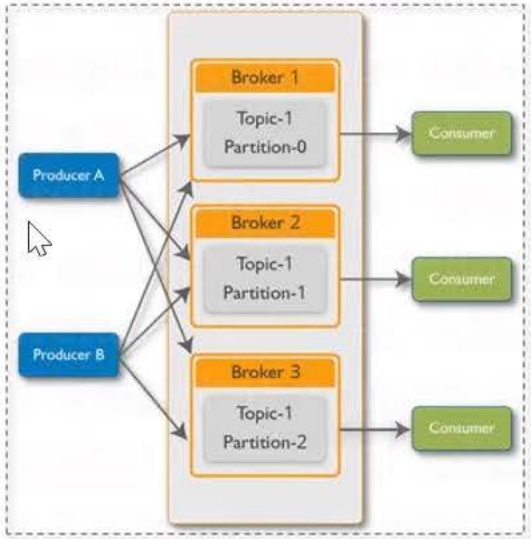
Kafka Components - Messages



Kafka Components - Producer

1

Producer (publisher or writer) publishes a new message to a **specific topic**

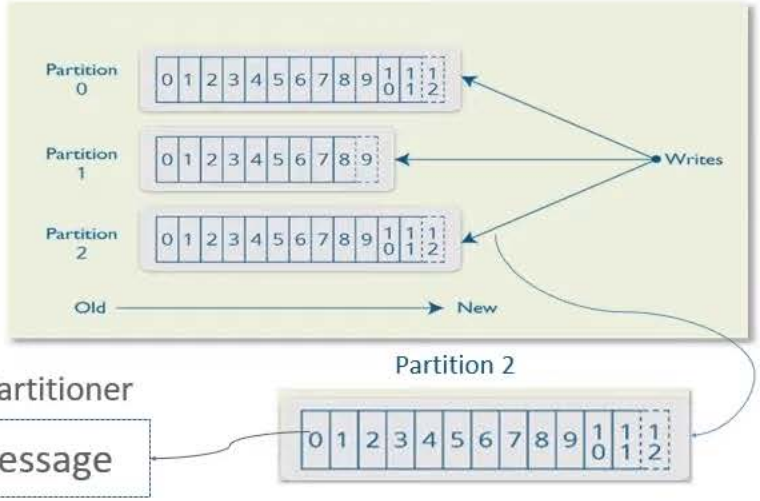


2

The producer does not care what partition a specific message is written to and will balance messages over every partition of a topic evenly

3

Directing messages to a partition is done using the **message key** and a **partitioner**, this will generate a hash of the key and map it to a partition

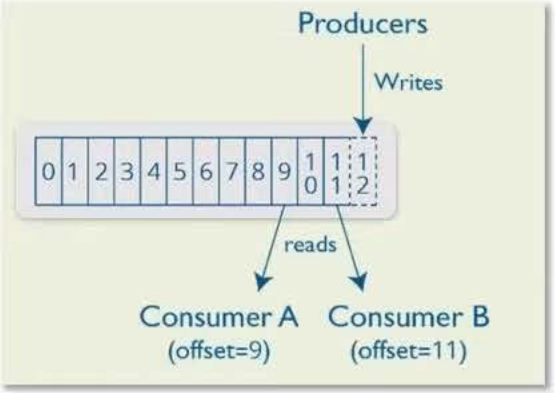


4

Every message a producer publishes in the form of a **key : value** pair

Kafka Components - Consumer

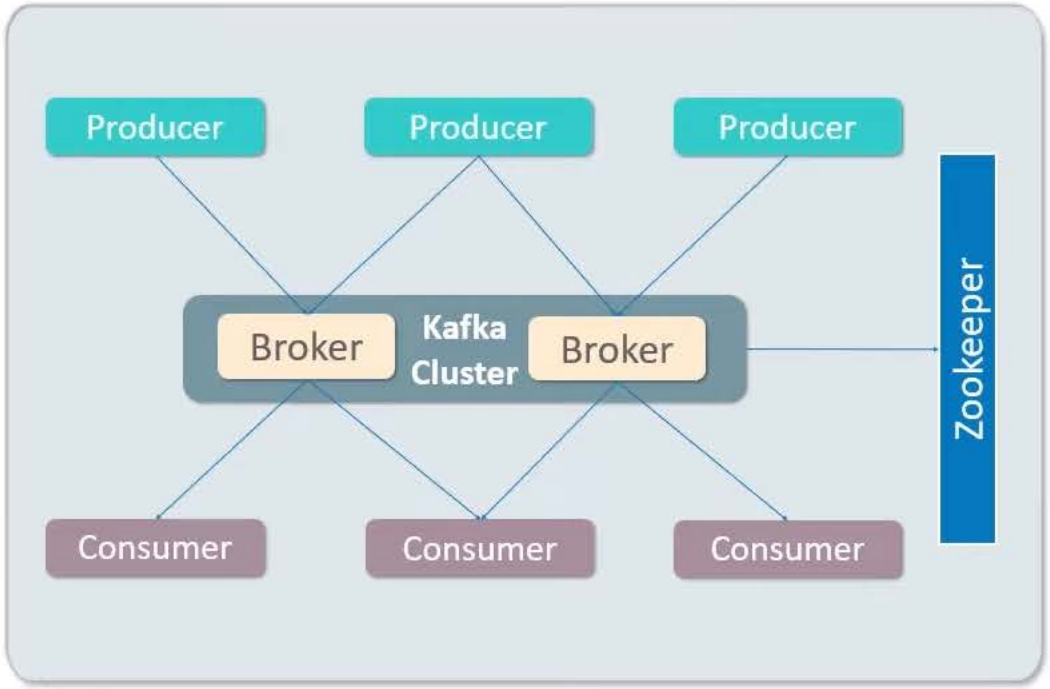
- *Consumers*(subscribers or readers) read messages
- The consumer subscribes to one or more topics and reads the messages sequentially
- The consumer keeps track of the messages it has consumed by keeping track on the offset of messages
- The *offset* is bit of metadata(an integer value that continually increases)that Kafka adds to each message as it is produced
- Each partition has a *unique offset* which is stored
- With the offset of the last consumed message, a consumer can *stop and restart without losing its current state*



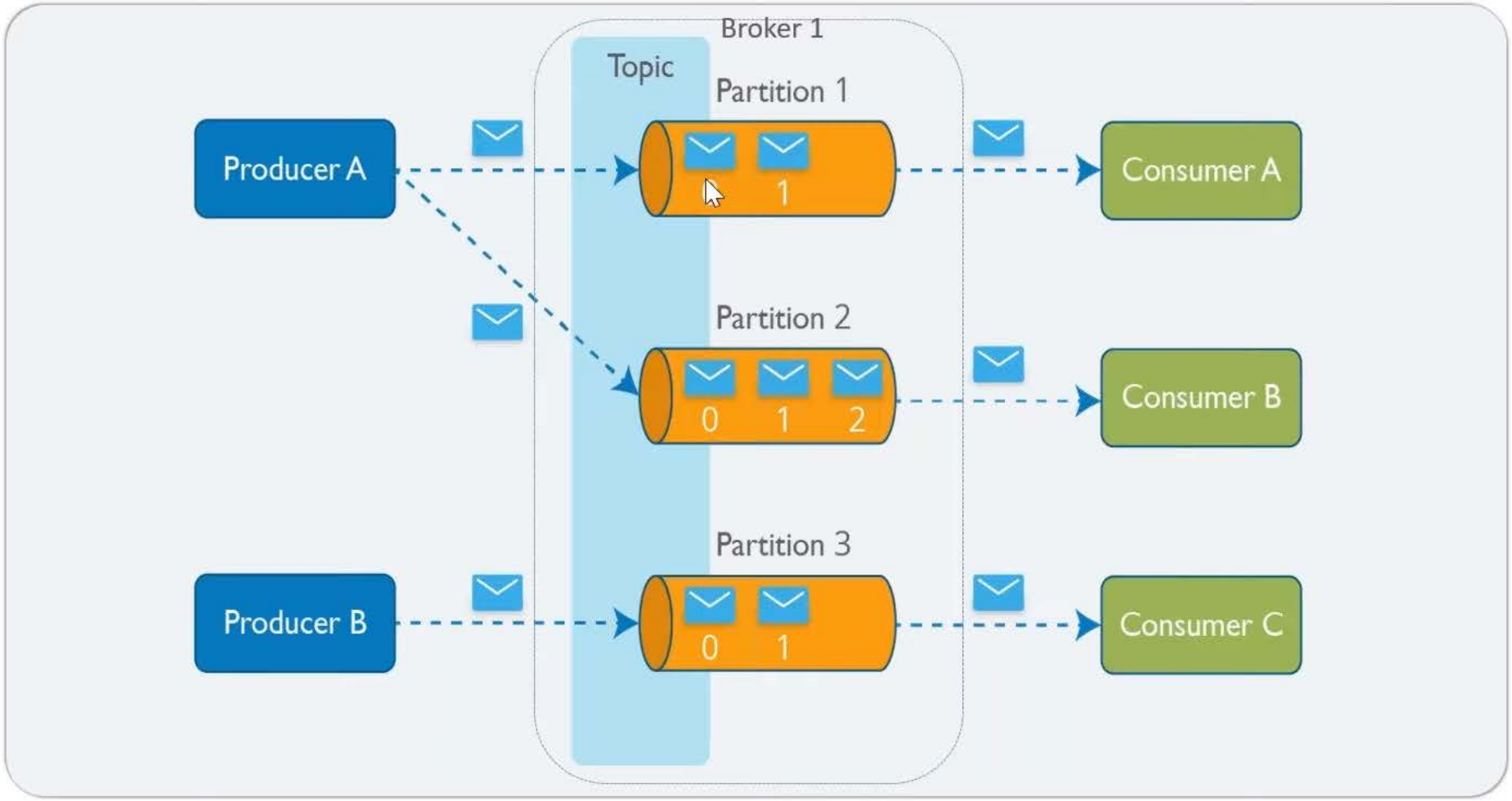
Kafka Components - ZooKeeper

ZooKeeper is used for managing and coordinating Kafka broker

- Zookeeper service is mainly used for co-ordinating between brokers in the Kafka cluster
- Kafka cluster is connected to ZooKeeper to get information about any failure nodes



Kafka Architecture



Let’s see some Use Cases of Kafka

Kafka - Use Cases

- Applications can produce messages using Kafka, without being concerned about the format of the messages
- Messages are sent and handled by a single application that can read all of them consistently, including :
  - A common formatting of messages using a common look
  - Send multiple messages in a single notification
  - Receive messages in a way that meets the users preferences

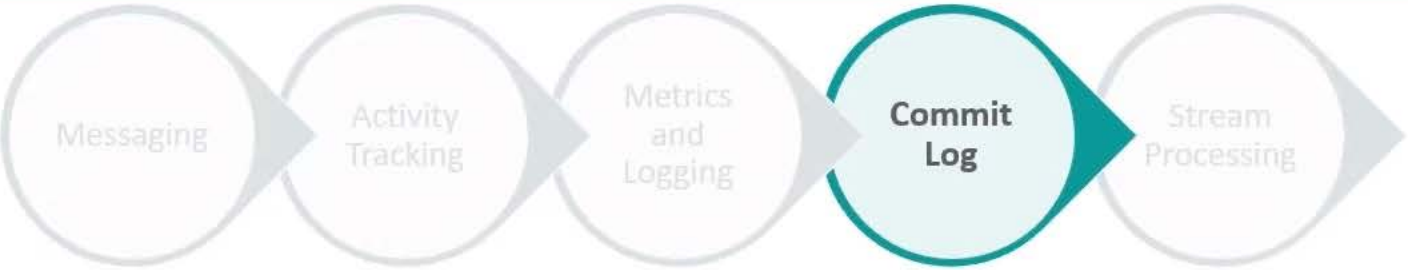
Kafka - Use Cases

- Originally Kafka was designed at LinkedIn, to track user activity
- When a user interacts with frontend applications, which generates messages regarding actions the user is taking
- Kafka keeps track of simple information like click tracking to complex information like data in a user's profile

Kafka - Use Cases

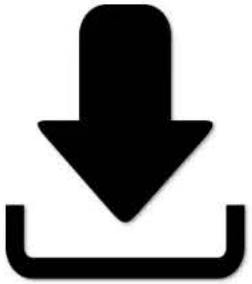
- Kafka is also ideal for collecting application's and system metrics and logs
- Applications publish metrics on a regular basis to a Kafka topic, and those metrics can be consumed by systems for monitoring and alerting
- Log messages can be published in the same way and routed to dedicated log search systems like Elasticsearch or security analysis applications

Kafka - Use Cases



- Database changes can be published to Kafka and applications can easily monitor this stream to receive live updates as they happen
- Kafka replicates database updates to a remote system for consolidating changes from multiple applications in a single database view
- Durable retention becomes useful providing a buffer for the changelog, meaning it can be replayed in the event of a failure of the consuming applications
- Log-compacted topics can be used to provide longer retention by only retaining a single change per key

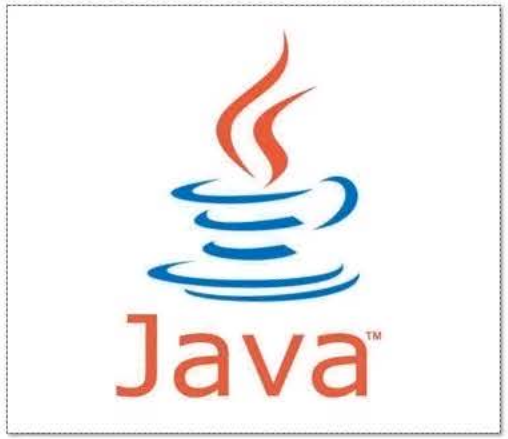
Kafka - Use Cases



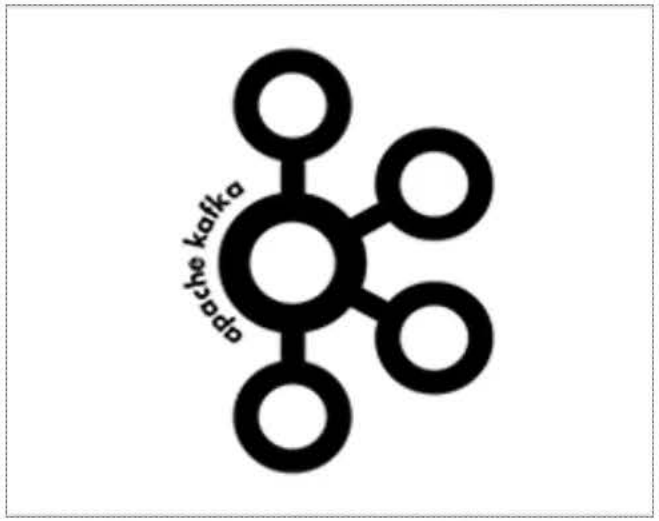
- Stream processing term is typically used to refer applications that provide similar functionality to map/reduce processing in Hadoop
- Stream processing operates on data in real-time, as quickly as messages are produced :
  - Write small applications to operate on Kafka messages,
  - Performing tasks such as counting metrics
  - Partitioning messages for efficient processing by other applications

Getting Started with Kafka

- **Prerequisites :**



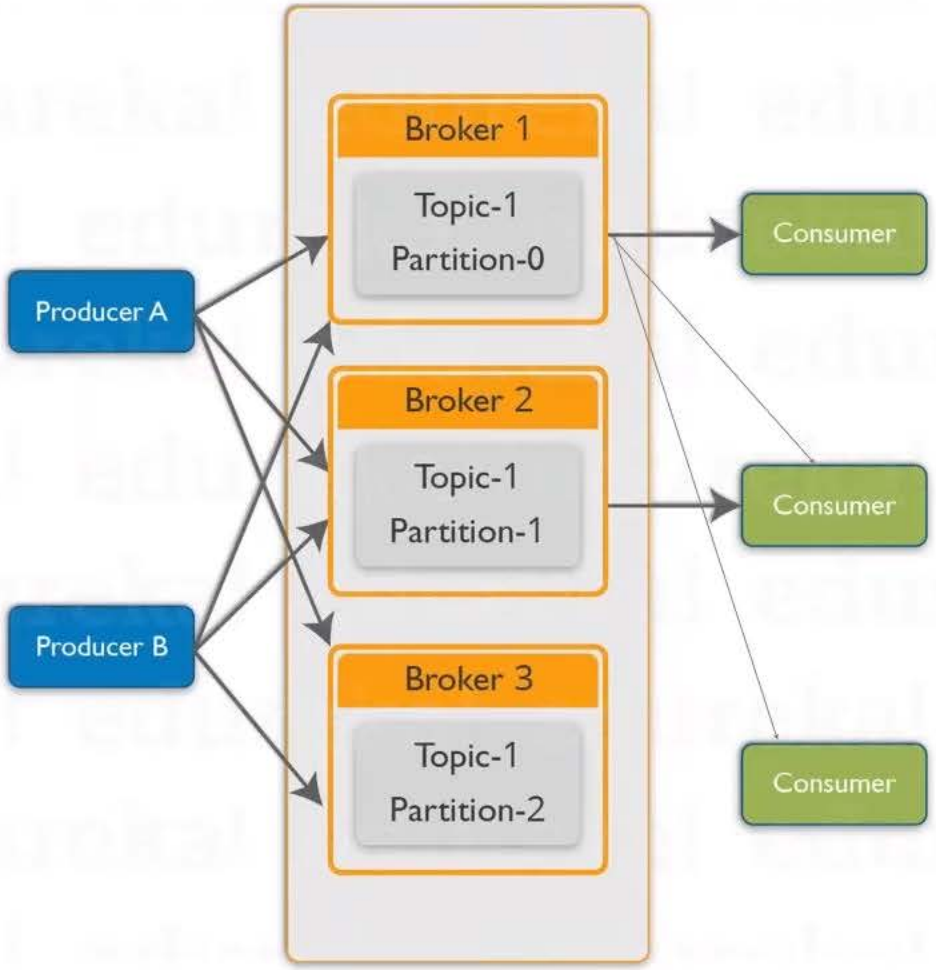
- **Components :**



Let’s Classify Different Types of Clusters in Kafka

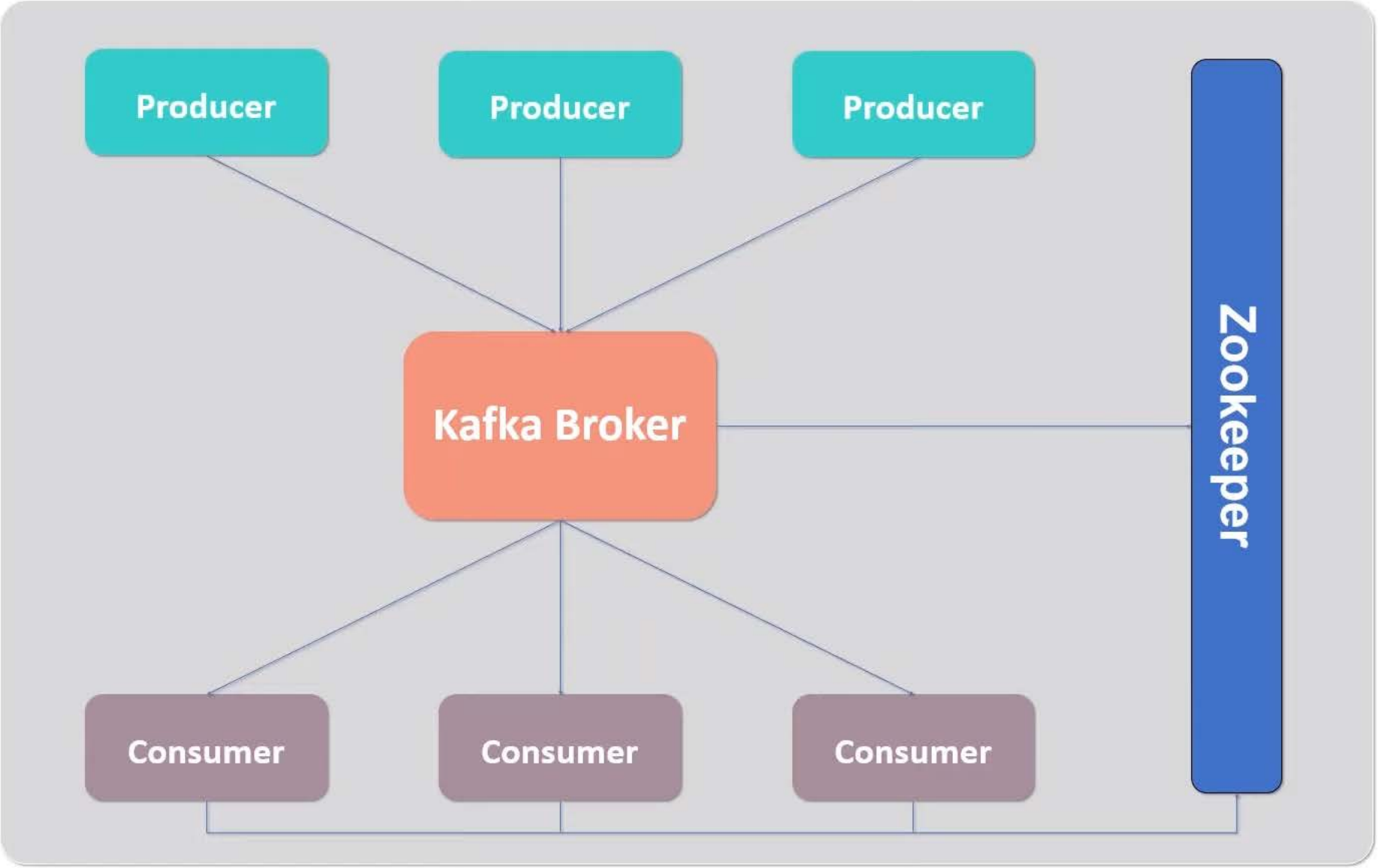
Kafka Cluster

- Kafka brokers are designed to operate as part of a cluster
- One broker will also function as the cluster controller
- Controller is responsible for administrative operations, like
  - Assigning partitions to brokers
  - Monitoring for broker failures in a cluster
- A particular partition is owned by a broker, and that broker is called the leader of the partition
- All consumers and producers operating on that partition must connect to the leader



Type of Kafka Clusters

1. **Single Node-Single Broker Cluster**
2. Single Node-Multiple Broker Cluster
3. Multiple Nodes-Multiple Broker Cluster



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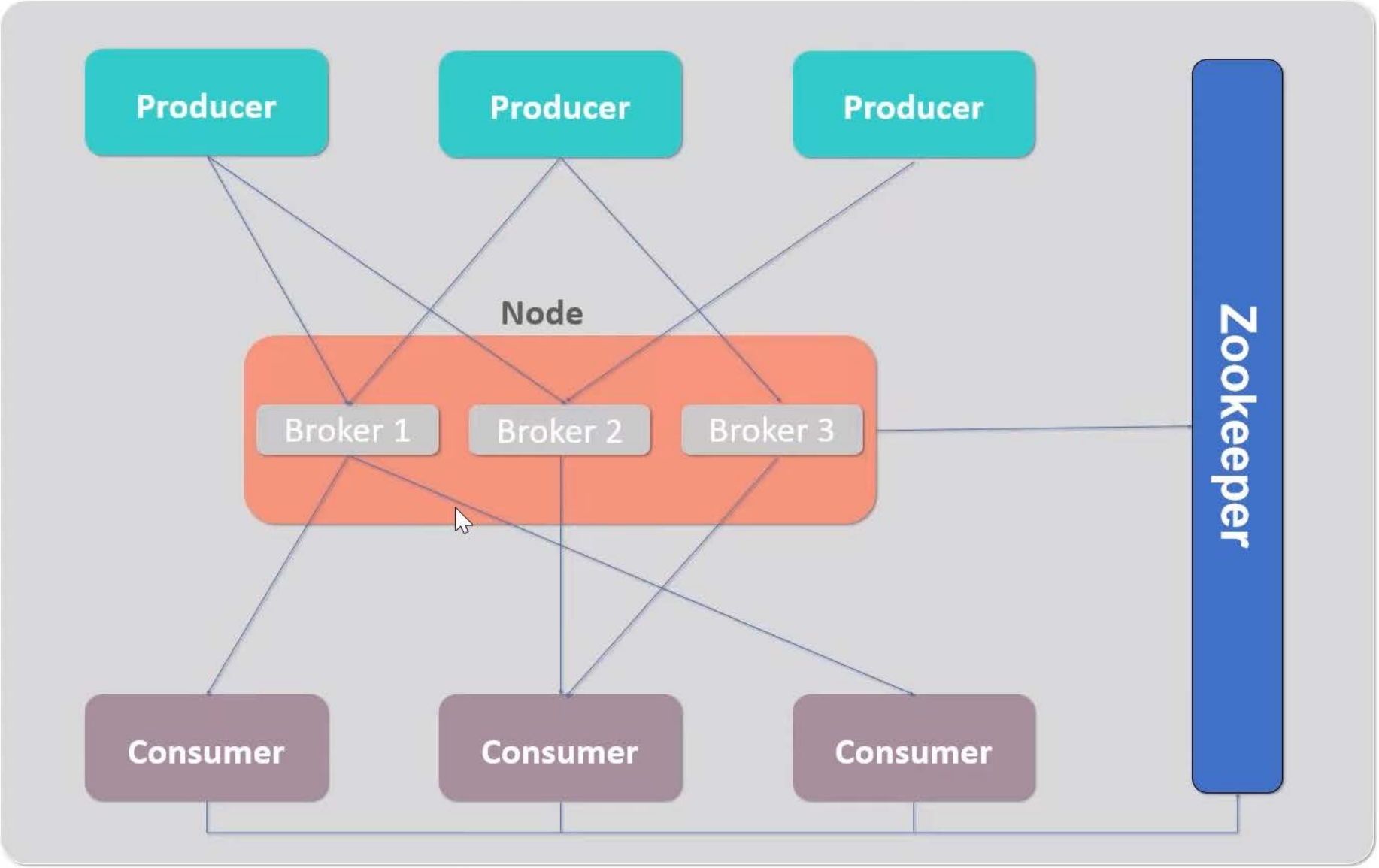

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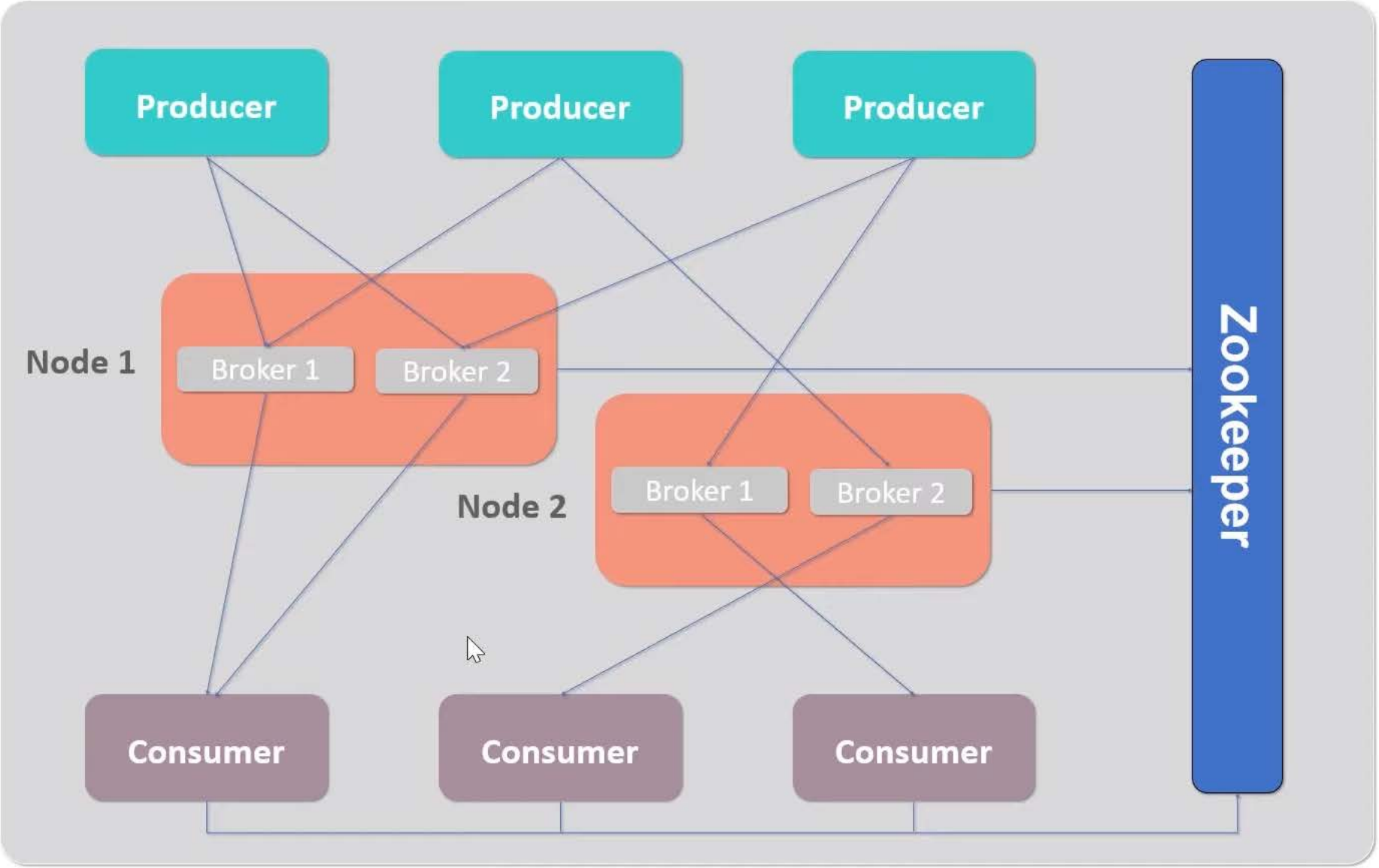


“DOCKER”

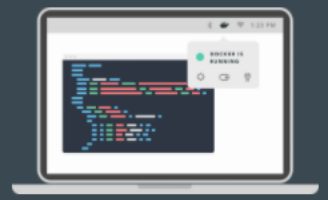
docker

Quick Start

1. Download
2. Clone
3. Build
4. Run
5. Ship

Welcome, ustapi

Let's get you started: you will need to download and install Docker to use the Docker command line interface (CLI).



Docker Desktop
The preferred choice for millions of developers that are building containerized applications

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Docker Desktop for Mac

Skip Tutorial | **Next Step**

docker

Quick Start

- ✓ Download
- 2 **Clone**
- 3 Build
- 4 Run
- 5 Ship

First, open a Mac terminal or Windows PowerShell and download a fun example.

This repository contains everything you need to create your first container.

```
git clone
https://github.com/docker/doodle.git
```

New to git? Install it here.

Previous | **Next Step**

docker

Quick Start

- Download
- Clone
- 3 **Build**
- 4 Run
- 5 Ship

Now let's build and tag a Docker image.

A Docker image is a private filesystem, just for your container. It provides all the files and code your container will need. Running the docker build command creates a Docker image using the Dockerfile. This built image is in your machine's local Docker image registry.

Mac Windows

```
cd doodle\cheers2019 ;
docker build -t ustapi/cheers2019 .
```

Previous **Next Step**

Venkat
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