Building Streaming Application Using Kafka

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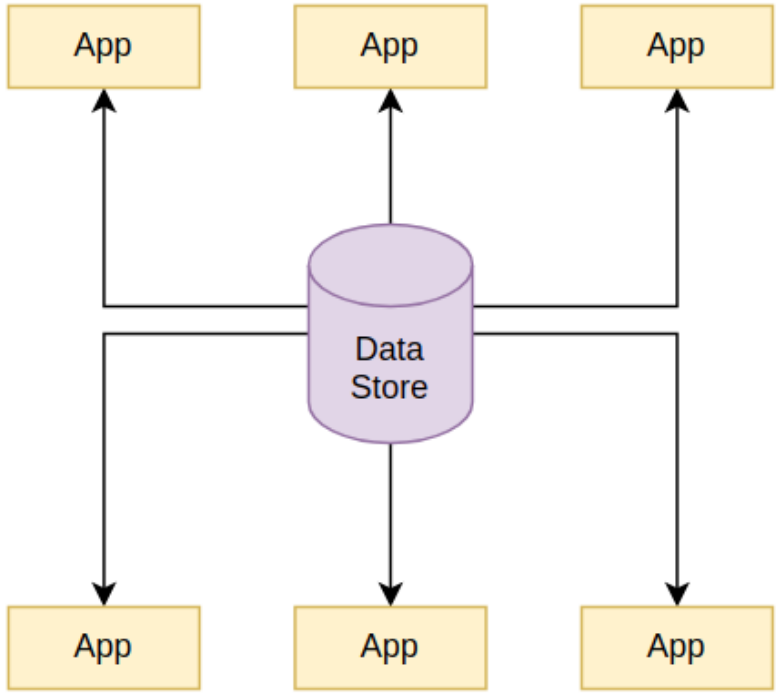
What is Kafka?

- Event-driven architecture: publisher – subscriber topology
- Not a client-server architecture:
  - multiple brokers playing the same role
  - any broker can be used to target the cluster (bootstrap server for producer/consumer)
- Used to build streaming applications and data pipeline
- High scalability, fault tolerant, support data retention
- Many options to configure and some require advanced expertise!

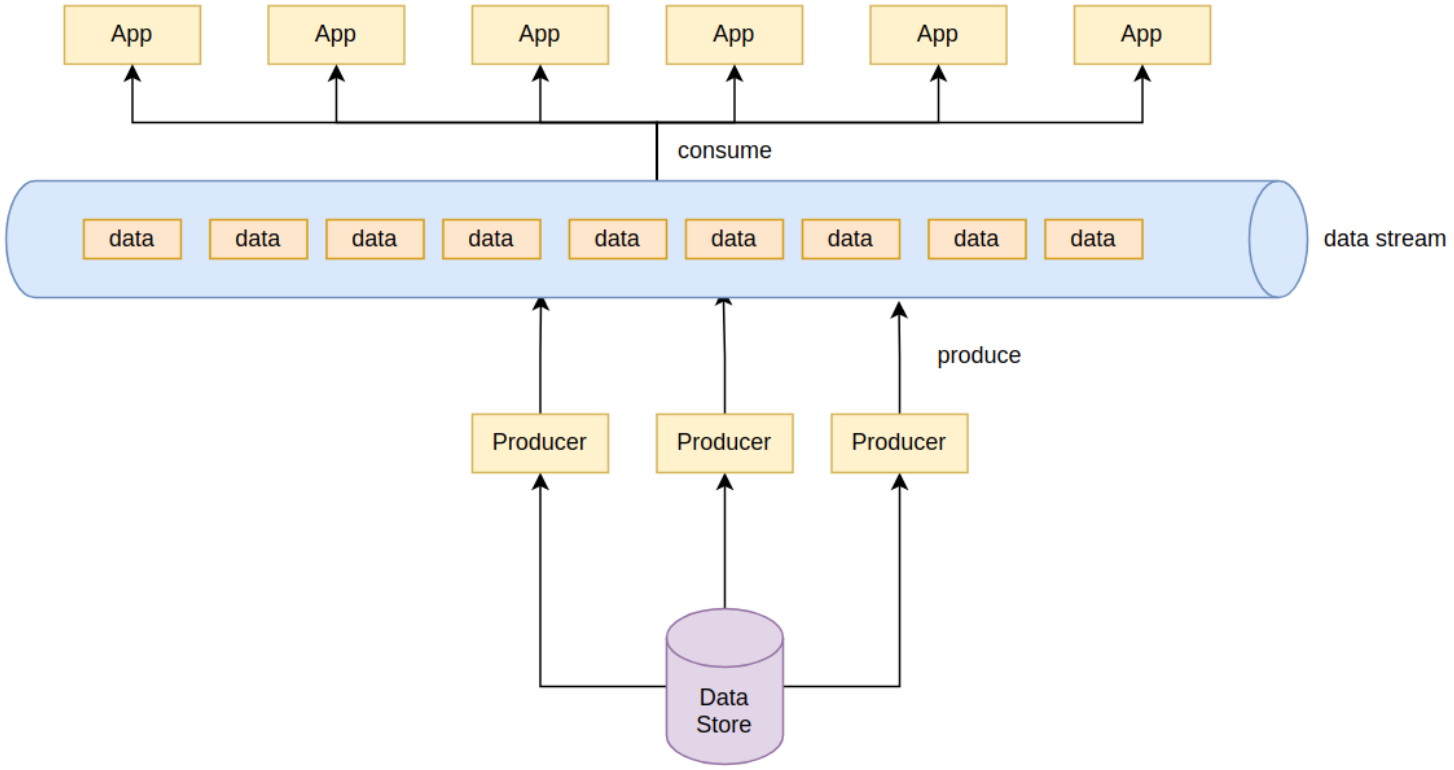
Flashback...

- Multiple applications access the same data at the same time and apply the same transformations/operations
  - Risk of bottleneck
  - Massive resources consumption
  - Duplication
  - Heavy to maintain
- Synchronous actions (read – write)
  - Time consuming
  - Not parallelable



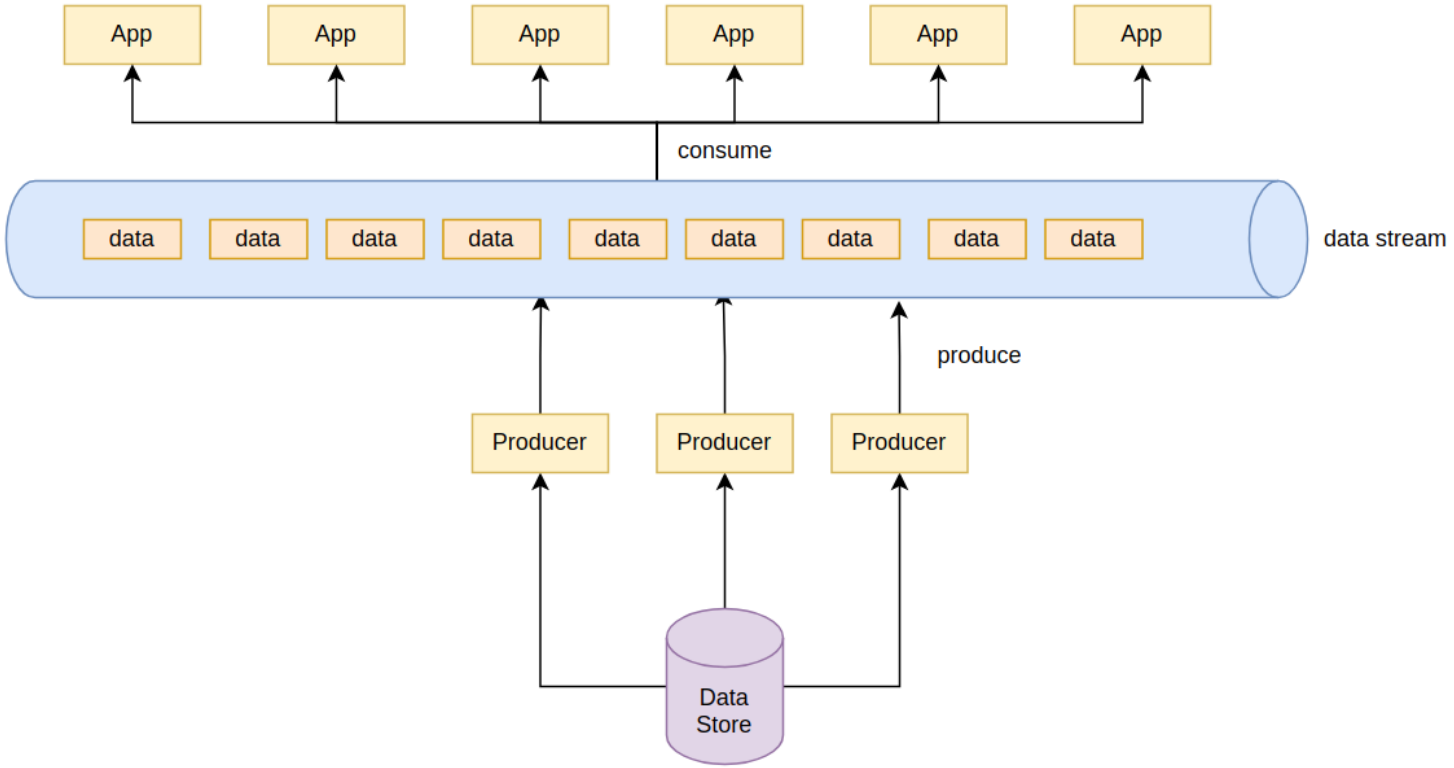
Kafka Architecture

- **Message queue**: data structure to store messages (events)
- **Producer**: application that publishes messages into the queue
- **Consumer**: application that reads messages from the queue



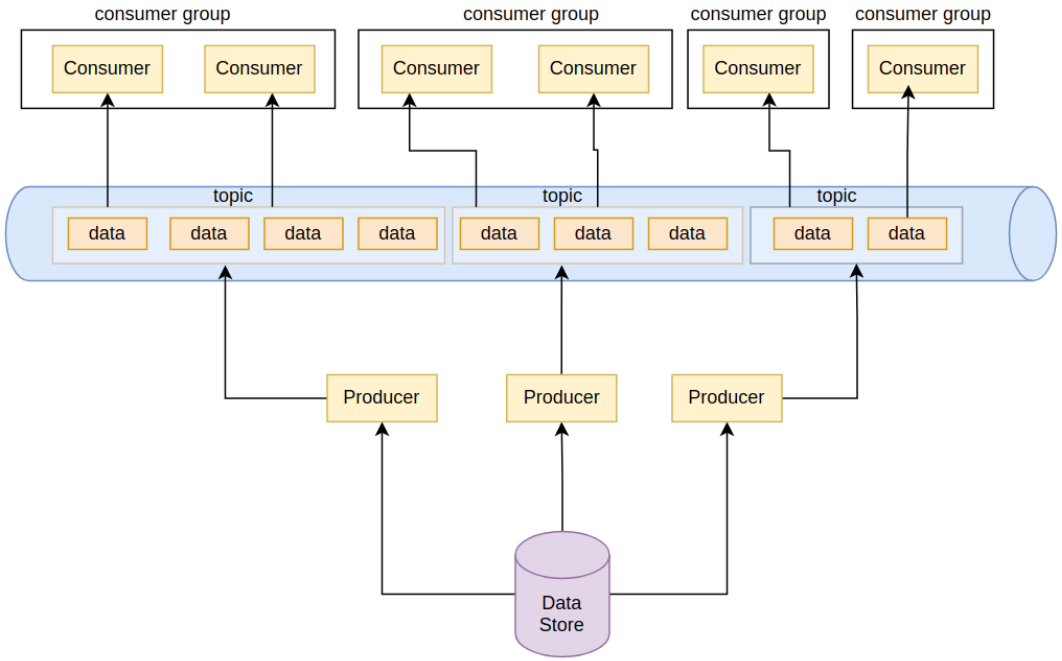
Kafka Architecture

- **Broker**: application that manages the data.
- **Zookeeper**: manage the infrastructure, the connectivity (network discovery) and meta data
- **Asynchronous actions**



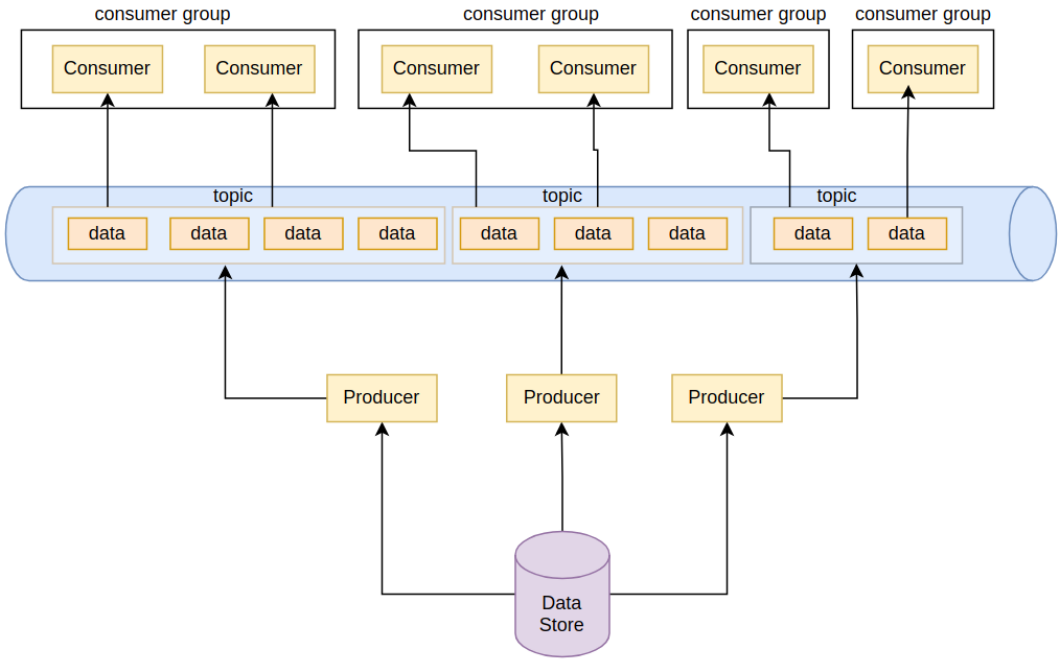
Kafka Architecture

- **Topic**: data structure to store the same type of data (for the same purpose)
- **Partition**: division of a topic. Each topic can have multiple partitions allowing horizontal scalability across many servers.
- **Offset**: unique identifier assigned to each message within partition. The position of the message in the partition.



Kafka Architecture

- **Consumer group**: group of applications/consumers that read the same topic – they work in parallel using partitions and offset paradigm
- **Multiple brokers**: data are stored on multiple nodes (replication)
- **Replication**: each message is stored on multiple nodes (replication factor) and has its own leader (broker)
  - fast and parallel read
  - fault tolerant, etc.



Kafka Architecture

- Only one broker per machine
  - Kafka doesn't support horizontal scalability at the machine level
- Each broker has its own ID (broker.id)
- Data retention period: keep data (in the log) for some period
- Programming language agnostic
- Sensitive to the data structure/format, serialization/deserialization

Use Cases

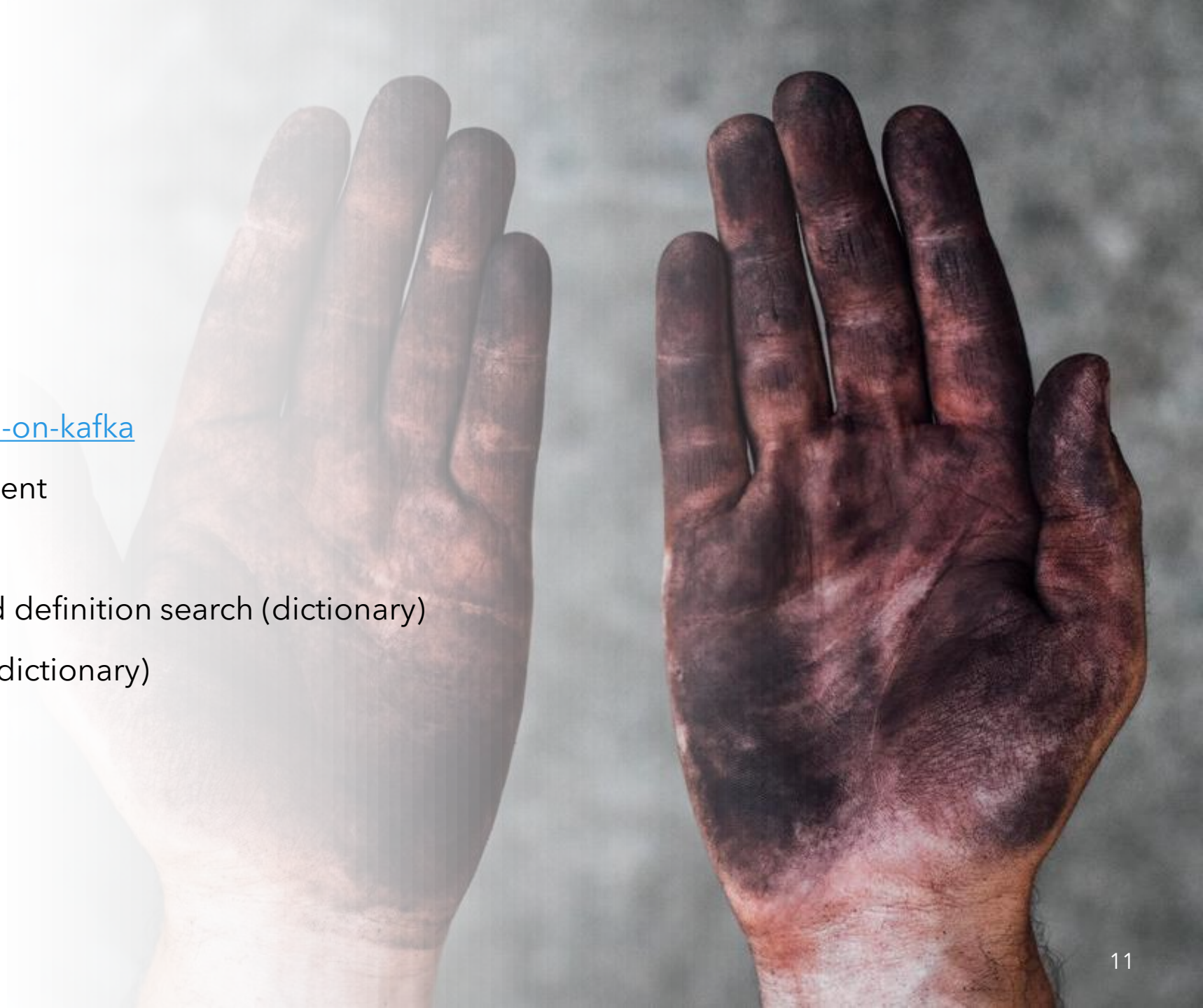
- Real-Time Data Streaming and Analytics
- Data Pipeline Modernisation (ETL)
- Microservices Communication
- Event Sourcing
- Log Aggregation
- Stream Processing (Kafka Stream API)

Use Cases

- Data Integration Across Systems (Kafka Connect)
- IoT Data Management
- Replication and Disaster Recovery
- Edge Computing

Hands-On

- https://github.com/osekoo/hands-on-kafka
- Preparing development environment
- Practice 1: Get started
- Practice 2: Implement online word definition search (dictionary)
- Practice 3: Homework (advanced dictionary)



PyCharm

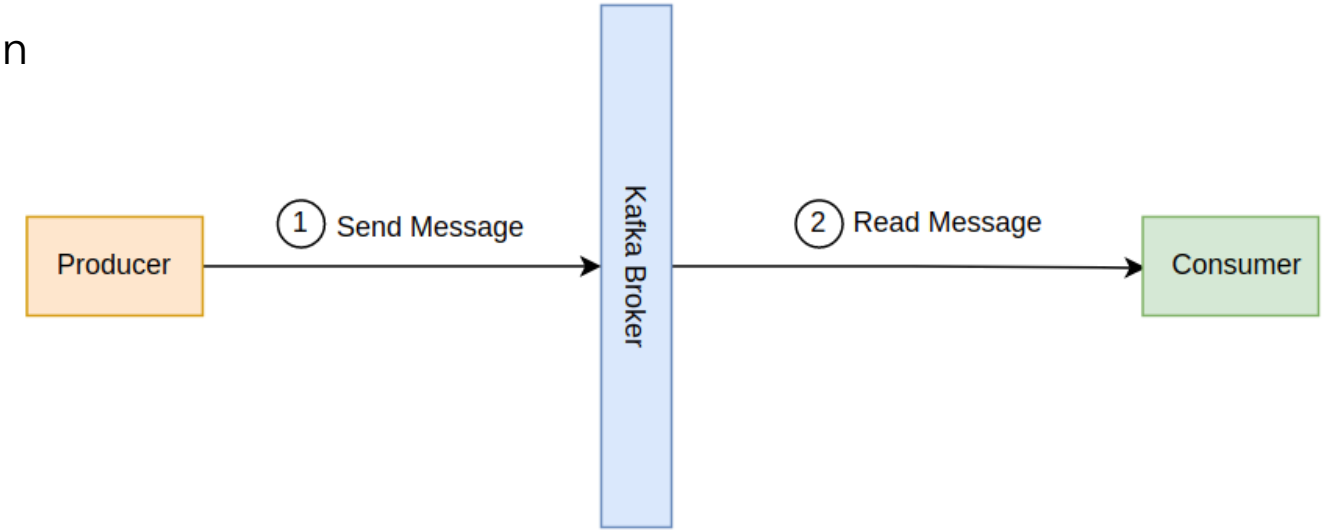
- Python Integrated Development Environment
- Multiple modules available for Python
- Enable debugging, Python applications packaging, etc.
- Even more...

Docker

- Platform as a service (PaaS)
- OS abstraction
- Self-contained applications running in containers
- Simplify applications delivery/distribution
- Enable horizontal scaling

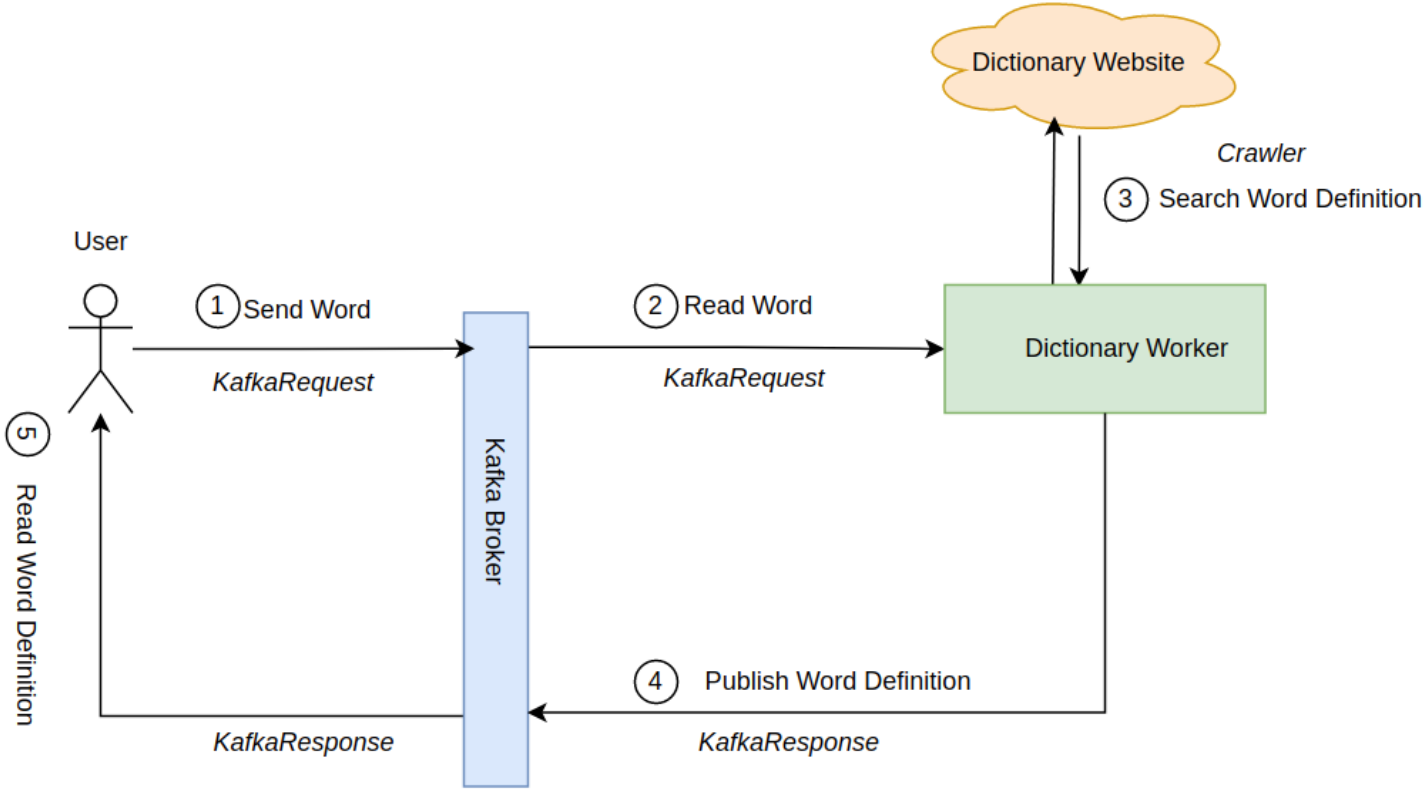
Practice 1: Get started

- Build a very simple Kafka based application
- Implement "*push-pull*" message queue



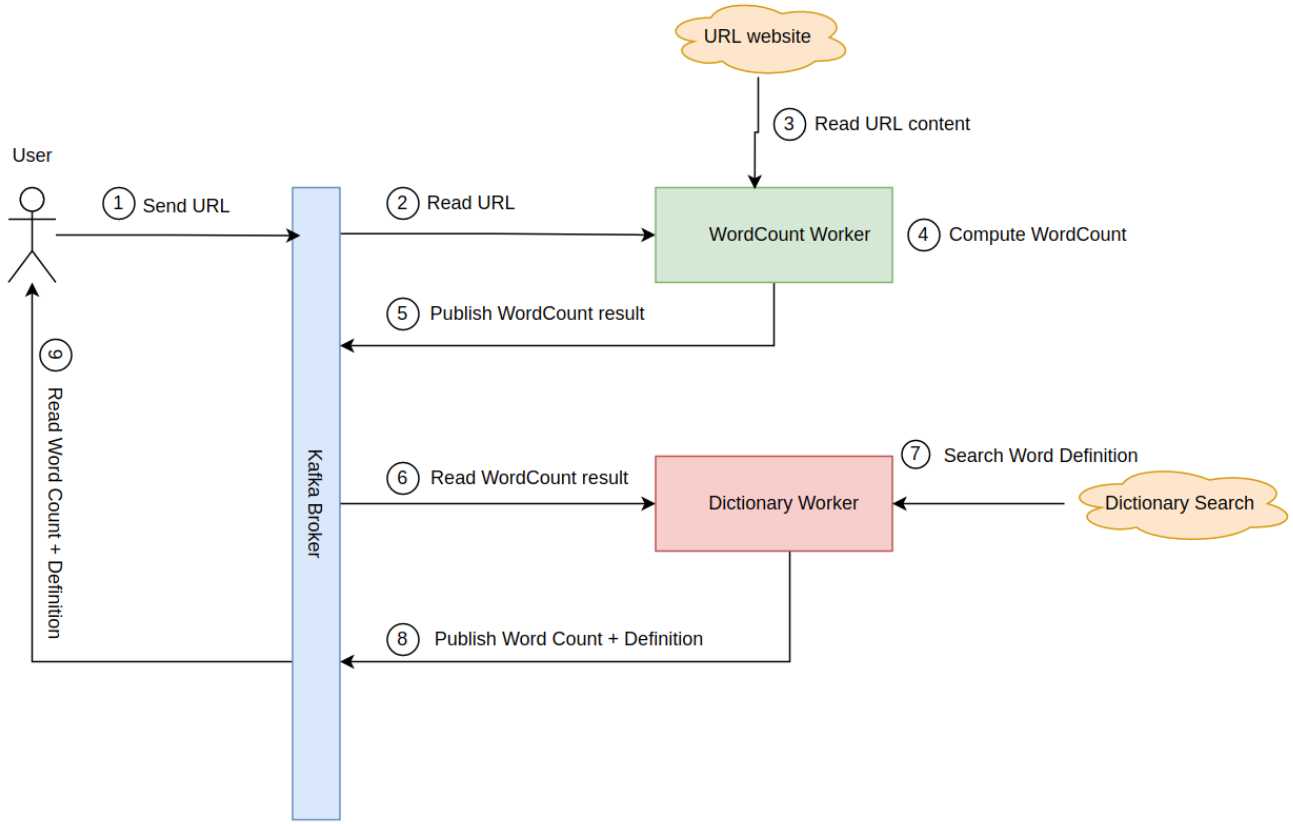
Practice 2: Online dictionary

- Build a Kafka based word definition search dictionary
- User specifies his nickname and the dictionary language (FR, EN)
- He/she interacts with the application by sending a word
- Our application search for the word definition by scrapping online dictionaries



Practice 3: Advanced dictionary

- Homework
- Searching word definition for website
- Extend language support (ES, CN, GE, etc.)
- Further details are available on Github



Troubleshooting

- Raise any question during the session or via email kodjo.klouvi@gmail.com