Iraya Use Case Design Document

This document contains a proposed design for the use case in Neil Ongkingco's Iraya Backend Engineer Interview Test.

General Overview

The system is designed to be a cluster of 5 nodes (1 parent VM and 4 worker VMs) using the Kubernetes and Docker cluster and container frameworks. Each node will host several software containers that will provide the functionality required to fulfill the responsibilities of the node.

In addition to the 5 nodes, the system uses a (key, value) NoSQL **FileStore** to store the raw document data (MongoDB) and a **Transactional Database** (SQL) for storing file info, computational results and transaction status for each document.

The **parent VM** has the following responsibilities:

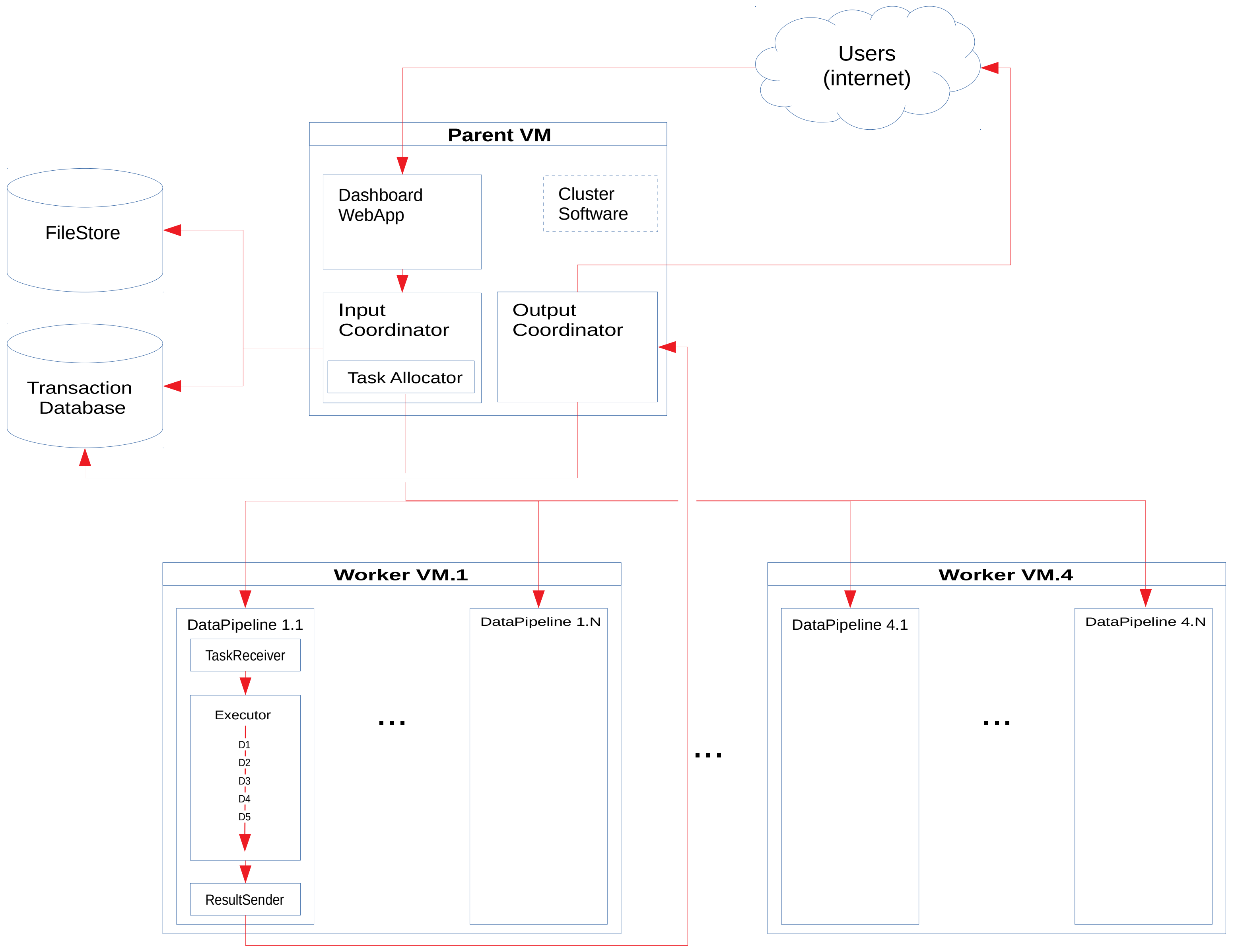
- host the container that provides the web interface to the users to upload their files
- store the uploaded documents to a **FileStore** and record the corresponding file information in the **Transaction Database**
- package and dispatch document processing tasks to the DataPipeline containers in the worker nodes
- receive and store the results computed by the workers into the transaction database
- provide notifications to the users on the progress of the document processing task (total progress, duplicate document and processing failure emails)

In addition the parent VM will also act as the master of the cluster and host the Kubernetes control plane.

The **worker nodes** will host several **DataPipeline** containers that will actually execute the steps of the data pipeline on the documents. These containers have the following responsibilities:

- Receive document processing tasks from the master node
- Send each document through the 5 steps (D1 to D5) of the data processing pipeline
- Package the results upon completion of the 5 step pipeline and send them to the parent VM for processing and storage
- Handle any failures in data processing by retrying or upon too many failures notify the master node of the failure of the task

General Architecture



The figure above shows the general architecture of the proposed design, and details the major components of the system as well as the high-level data-flows between the components of the system and the outside world.

The system consists of the following major components:

- **Parent Virtual Machine (Parent VM)**: The virtual machine that hosts the containers that coordinate the functions of the components in the worker nodes, as well as the WebApp container that runs the Web Dashboard that users will use to uploading documents. The Parent VM will also be the master node that hosts the Kubernetes control plane that manages the cluster. The parent node will host the following containers:
    - ***Dashboard WebApp***: runs the dashboard web application that the users will access to upload files
    - ***Input Coordinator***: receives the uploaded file from the Dashboard WebApp and then creates a unique *FileID* for the document, stores the document in the *FileStore* and creates a *task entry* in the Transaction database that gives a document a task *ID* and contains basic info on the file (*FileID*, name, size, type, date uploaded). The input coordinator is also responsible for detecting duplicate documents and sending the necessary email notifications to the users.

      The *Input Coordinator* will also have a *Task Allocator* subcomponent that package the document into *tasks* (task ID + document data) and allocate and send them to the worker nodes with the aim of balancing the processing load across all the *DataPipeline* containers in the system.
    - ***Output Coordinator***: receives the computed results for the document from the *DataPipeline* component on the worker VMs, stores the results in the *Transactional Database* using the corresponding transaction ID, as well as handling any errors caused by processing failures in the worker nodes. This includes notifying users of any documents that have failed to process after the appropriate number of retries.

- **Worker Virtual Machines 1 to 4 (Worker VM.1 to VM.4)**: These virtual machines will contain multiple instances of *DataPipeline* containers which will actually perform the data processing tasks on a document.
    - The ***DataPipeline*** containers have the following subcomponents:
        - *Task Receiver*: Receives the packaged task (task ID + document data) from the *Input Coordinator,* extracts the document data and passes it to the *Executor* for processing.
        - ***Executor***: Runs the steps D1 to D5 in succession to the document data and collects the results. The executor is also responsible for retrying a step (up to 3 times) in case of failure. The results (or failure) are then passed to the *ResultSender*.
        - ***ResultSender***: packages the results (or failure details) with the corresponding task ID and sends them to the *Output Coordinator* on the *Parent VM* for final processing.