# Distributed File System

With the ever-growing technological expansion of the world, distributed systems are becoming more and more widespread. They are a vast and complex field of study in computer science. A distributed system in its most simplest definition is a group of computers working together to appear as a single computer to the end-user.

These machines have a shared state, operate concurrently and can fail independently without affecting the whole system's uptime.

In this assignment, you will build a simple distributed file system that supports reading and writing mp4 files while keeping files replicated for fault tolerance.

#### **Architecture**

DFS is a centralized distributed system having 2 types of machine nodes. First, the **Master Tracker** node. This node has a look-up table. The look-up table columns are *(file name, Data Keeper node, file path on that data node, is data node alive)*. Second, the **Data Keeper** nodes which are the actual nodes that have the data files. Both the **Master Tracker** and **Data Keeper** nodes should be multi-threaded to handle multiple requests simultaneously. (Check https://go.dev/tour/concurrency/11 for more about concurrency in Go)

Master Tracker

Node 1 Data Keeper Node 2 Data Keeper Node 3 Data Keeper Node N Data Keeper

#### Communication

All communication between **Master Tracker**, **Data Keepers** and **Clients** should be over gRPC. File transfers should be over tcp.

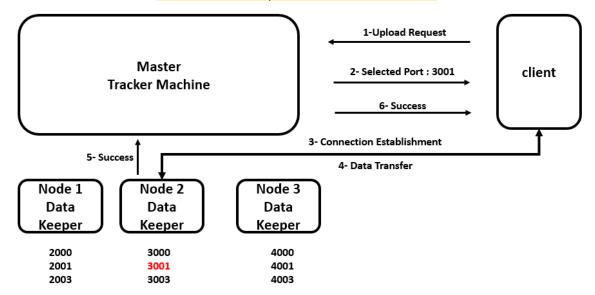
#### Heartbeats

Every 1 sec, each data keeper node sends a keepalive ping to the master tracker node. The master tracker node then updates the look-up table mentioned above. If one of the data keeper nodes is down it will change the corresponding cell in the 'is data node alive' column.

#### Uploading A file

For a client to upload a file to a cluster, the following protocol MUST be followed:

- 1. A client process MUST communicate with the master tracker node.
- 2. The master tracker responds with a port number of one of the data keeper nodes.
- 3. The client then constructs a communication with this port, and transfers the file to it.
- 4. When the transferring procedure is finished, the data keeper node will then notify the master tracker.
- 5. The master tracker then adds the file record to the main look-up table.
- 6. The master will notify the client with a successful message.
- 7. The master chooses 2 other nodes to replicate the file transferred.



## Replication

A separate thread on the **Master Tracker** should awake every (n=10) seconds and check for replication according to the below algorithm. Each file should exist on at least 3 alive data nodes.

initialization;

end

**getSourceMachine** is a function that takes a file record, then gets the source machine and the file path on that machine.

**selectMachineToCopyTo** returns a valid IP and a valid port of a machine to copy a file instance to

**notifyMachineDataTransfer** This function must notify both source and destination machine to start copying the file.

## Downloading A file

A client can download his mp4 files. The following protocol MUST be followed:

- 1. Client request from the Master Tracker to download a certain file name.
- 2. Master Tracker responds with a list of machines IPs and ports to download a file from.
- Client MUST request from every port uniformly. (Parallel download is considered a bonus)

#### Rules

- You are required to build the Master Tracker, Data Keeper and Client.
- Team consists of up to 4 members.
- Submission Due 11:59 PM, Saturday 16/03/2024 on https://forms.gle/SM5dZP4SEBR9i2fn9
- Discussion will be on Sunday 17 Mar. during tutorial time.
- Plagiarism will result in zero grade.