**HBase on Hadoop High Availability Cluster Documentation**

**Overview :**

* This documentation describes the setup of a highly available (HA) HBase cluster running on top of a Hadoop cluster with the following components:
* 2 HMaster nodes for HBase high availability
* 2 RegionServer nodes that also run Hadoop DataNode and NodeManager services for data locality
* ZooKeeper for coordination (pre-installed in the base image)

**Architecture :**

**Cluster Components**

**HMaster Nodes (2):**

* hmaster1 (active master)
* hmaster2 (standby master)

Both listen on port 16010 (mapped to different host ports)

**RegionServer Nodes (2):**

* rs1 - Runs RegionServer, DataNode, and NodeManager
* rs2 - Runs RegionServer, DataNode, and NodeManager

Both listen on port 16030 (mapped to different host ports)

**Underlying Hadoop Services:**

* HDFS (DataNodes running on RegionServers)
* YARN (NodeManagers running on RegionServers)
* ZooKeeper (pre-installed in base image)

**Implementation Details:**

* Base Image
* The setup builds upon a custom hadoop-ha:v1 image which includes:
* Hadoop cluster with HA configuration
* ZooKeeper installation
* Proper user setup (hadoop user)
* Docker Configuration
* Docker-compose.yml

**Key Features:**

Each service uses the same image but behaves differently based on hostname

Port mappings ensure all web UIs are accessible from host

Uses an external network for inter-container communication

**Key Design Decisions**

**Data Locality:**

* By running DataNodes on the same nodes as RegionServers, HBase can achieve better data locality
* NodeManagers are also colocated to enable computation near the data

**High Availability:**

* Two HMaster nodes provide failover capability
* ZooKeeper (from base image) coordinates master election
* Multiple RegionServers provide redundancy for data serving

**Service Separation:**

* Different containers for masters and region servers
* Each container specialized through entrypoint logic

**Port Mapping:**

* Each service's web UI mapped to unique host port for accessibility
* hmaster1: 16010 → 16010
* hmaster2: 16010 → 16011
* rs1: 16030 → 16030
* rs2: 16030 → 16031

**Deployment Steps:**

* Build the base Hadoop image (hadoop-ha:v1) with:
* Hadoop HA configuration
* ZooKeeper installation
* Proper user setup
* Build the HBase image:
* bash
* docker-compose build
* Create the network:
* bash
* docker network create optmized\_docker\_hadoop\_net
* Start the cluster:
* bash
* docker-compose up -d
* Verify services:
* Access HMaster Web UIs at:
* http://localhost:16010 (hmaster1)
* http://localhost:16011 (hmaster2)
* Access RegionServer Web UIs at:
* http://localhost:16030 (rs1)
* http://localhost:16031 (rs2)
* Configuration Files
* The setup requires these configuration files (not shown in provided code):
* hbase-site.xml - HBase configuration with:
* ZooKeeper quorum settings
* HDFS root directory
* HA-related properties
* hbase-env.sh - HBase environment variables
* regionservers - List of RegionServer hostnames (rs1, rs2)
* Maintenance Considerations
* Scaling:
* Add more RegionServer containers by copying the rs1/rs2 pattern
* Update the regionservers file in the image

**Monitoring:**

Use the web UIs for basic monitoring

Consider adding monitoring tools to the stack

Persistence:

Add volumes for HDFS data directories

Consider volume mounts for HBase WAL and data