Troubleshooting Master Node Issues

Master node performs cluster management tasks, but does not hold data or respond to data upload requests. Master nodes are responsible for certain critical tasks throughout the cluster, including creating or deleting indexes, tracking nodes, and allocating shards to nodes. There can only be one node serving as the elected master role at a time, the other two nodes are in failover stand-by to maintain quorum and cluster formation.
Master nodes perform the following cluster management tasks:

- **Track all nodes in the cluster.**
- **Track the number of indexes in the cluster.**
- **Track the number of shards belonging to each index.**
- **Maintain routing information for nodes in the cluster and other cluster management activities.**
- **Update the cluster state after state changes, such as creating an index and adding or removing nodes in the cluster.**
- **Replicate changes to the cluster state across all nodes in the cluster.**
- **Monitor the health of all cluster nodes by sending *heartbeat signals*, periodic signals that monitor the availability of the data nodes in the cluster.**

Reference Readings:
https://docs.aws.amazon.com/opensearch-service/latest/developerguide/managedomains-dedicatedmasternodes.html
https://www.elastic.co/guide/en/elasticsearch/reference/current/modules-node.html#master-node
https://opensearch.org/docs/1.1/opensearch/cluster/
https://w.amazon.com/bin/view/Search/A9/Swift/Ops/Procedures/QuorumLoss
https://repost.aws/knowledge-center/opensearch-node-crash
https://w.amazon.com/bin/view/Search/A9/Swift/Ops/Procedures/MasterCPUMaxORMasterJVMMax/

Troubleshooting Master Scenarios

Scenario 1: Opensearch master node failed and didn't recover MasterUnreachable:

Step 1:

- Try to see if the node is part of the cluster or not. If it part of the cluster then try to bounce the node to bring back the master node.

Run the following commands:
tumbler $REGION aes domain dp node shell -b curl -a 'localhost:9200' -D $DI —instance-id $EC2ID
Step 2:

- Try to ping SDPD agent using the command:

tumbler run $REGION aes domain dp node sdpdagent ping-agent -D $DI —ip-address $ipaddress
Step 3:

- If SDPD agent is not responding then try to see if the OS is up on the node or not.

```
tumbler $r aes domain dp node shell -b "curl" --args " -s
localhost:9200/_cluster/health?local=true\&pretty" -D $d -I $instance-id
```
Step 4:

- If OS is not running on the node. Then we need to terminate the fault node and replace the node. (NOTE: Need to get confirmation from the customer)

```
tumbler $r aes domain dp node terminate-instance -D $d -i $id --skip-diagnose
```

- New node will up Automatically. Check whether the node is able to ping the OpenSearch using:

```
tumbler $r aes domain dp node shell -b curl -a 'localhost:9200' -D $d --instance-id
```

Scenario 2: Snapshot Issue

Restart of a master node during snapshot can lead to hanging snapshots :

When a snapshot operation on a particular shard finishes, the data node where this shard resides sends an update shard status request to the master node to indicate that the operation on the shard is done. When the master node receives the command it queues cluster state update task and acknowledges the receipt of the command to the data node.

The update snapshot shard status tasks have relatively low priority, so during cluster instability they tend to get stuck at the end of the queue. If the master node gets restarted before processing these tasks the information about the shards can be lost and the new master assumes that they are still in process while the data node thinks that these shards are already done.

Solution:

Step 1:

- For the cluster with more than 2 nodes or dedicated master node:
- Bounce ES on **one node at a time** from list of problematic node.

Step 2:
In case of 2 node domain, if a node ES is deactivated the master will not be elected because of the minimum_master_node constraint.
In that case we need a single node to become master by changing **minimum_master_node** cluster setting to 1

```
"discovery.zen.minimum_master_nodes": 1
```

Deactivate and Activate the node and once the snapshot is deleted, reset the **minimum_master_node** setting back to 2
`"discovery.zen.minimum_master_nodes": 2`
If the shards are still not moving to FAILED, bounce ES on the **elected master. Ensure other master nodes are active and can establish quorum to elect a new leader.**
Scenario-3:
Master node is down for sometime at the ES:
Step-1:
Node replacement: Run the Hawkeye Analysis to see if the node is replaced due to hardware issues. They can happen with any instance type, please note that hardware failures may inevitably occur in any environment and there are certain checks in AWS which detects this behavior and tries to bring up the node as early as possible which seems to have been the case here as well.
Step-2:
Performance Issues(High CPU and JVM): Check the two metrics the metrics MasterJVMMemoryPressure and MasterCPUUtilization for the cluster are same as that of the Active Master Node. And make Sure the MasterReachablefromNode metric is 1.
Master node Best Practices :
Make sure you have 3 dedicated master nodes as it provides two backup nodes in the event of a master node failure and the necessary quorum (2) to elect a new master.
Issue when the domain is having less than 2 Master nodes :
OpenSearch by default prohibits one master node and you will receive a validation exception if you try to create a domain with

only one dedicated master node.
If you have two dedicated master nodes, your cluster doesn't have the necessary quorum of nodes to elect a new master node in the event of a failure.

Issue when the domain is having more than 3 master nodes :

We will face some issues when the domain is having 4 master nodes when the service is deployed in Multiple AZ.
If one master node fails, you have the quorum (3) to elect a new master. If two nodes fail, you lose that quorum, just as you do with three dedicated master nodes.
In a three Availability Zone configuration, two AZs have one dedicated master node, and one AZ has two. If that AZ experiences a disruption, the remaining two AZs don't have the necessary quorum (3) to elect a new master.