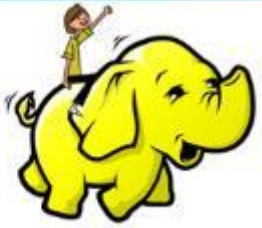
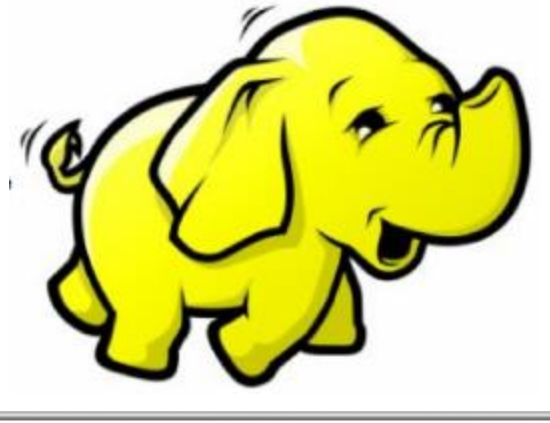
edureka!

Hadoop Administration



Hadoop Administration



Module 4: Backup, Recovery and Maintenance

Course Topics

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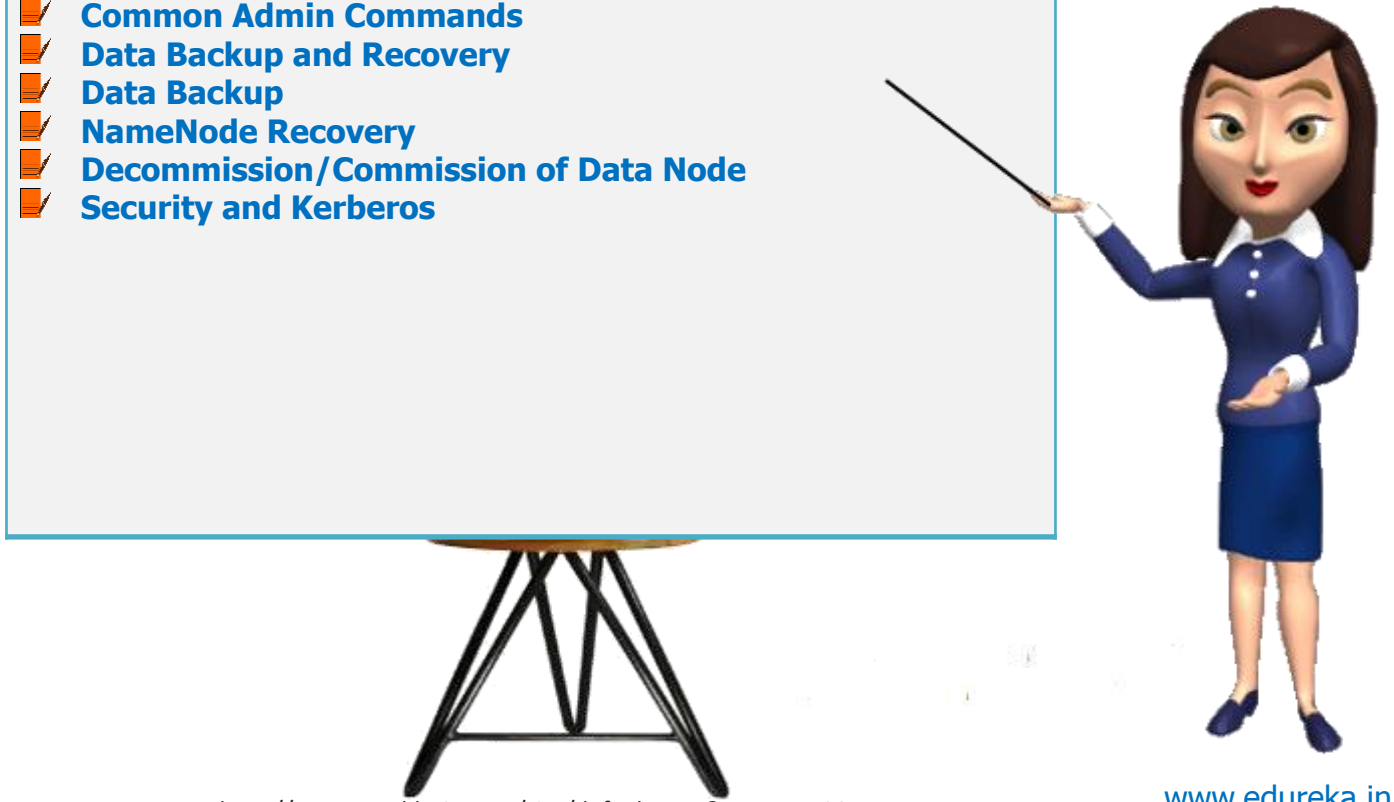
- **Module 1**
  - Understanding Big Data
  - Hadoop Components
- **Module 2**
  - Different Hadoop Server Roles
  - Hadoop Cluster Configuration
- **Module 3**
  - Hadoop Cluster Planning
  - Job Scheduling
- **Module 4**
  - **Securing your Hadoop Cluster**
  - **Backup and Recovery**
- **Module 5**
  - Hadoop 2.0 New Features
  - HDFS High Availability
- **Module 6**
  - Quorum Journal Manager (QJM)
  - Hadoop 2.0 - YARN
- **Module 7**
  - Oozie Workflow Scheduler
  - Hive and Hbase Administration
- **Module 8**
  - Hadoop Cluster Case Study
  - Hadoop Implementation

Topics of the day

- Let's Revise
- Common Admin Commands
- Data Backup and Recovery
- Data Backup
- NameNode Recovery
- Decommission/Commission of Data Node
- Security and Kerberos



http://www.pvsd.k12.ca.us/site/default.aspx?PageID=129

Let's Revise – Plan Your Hadoop CLuster

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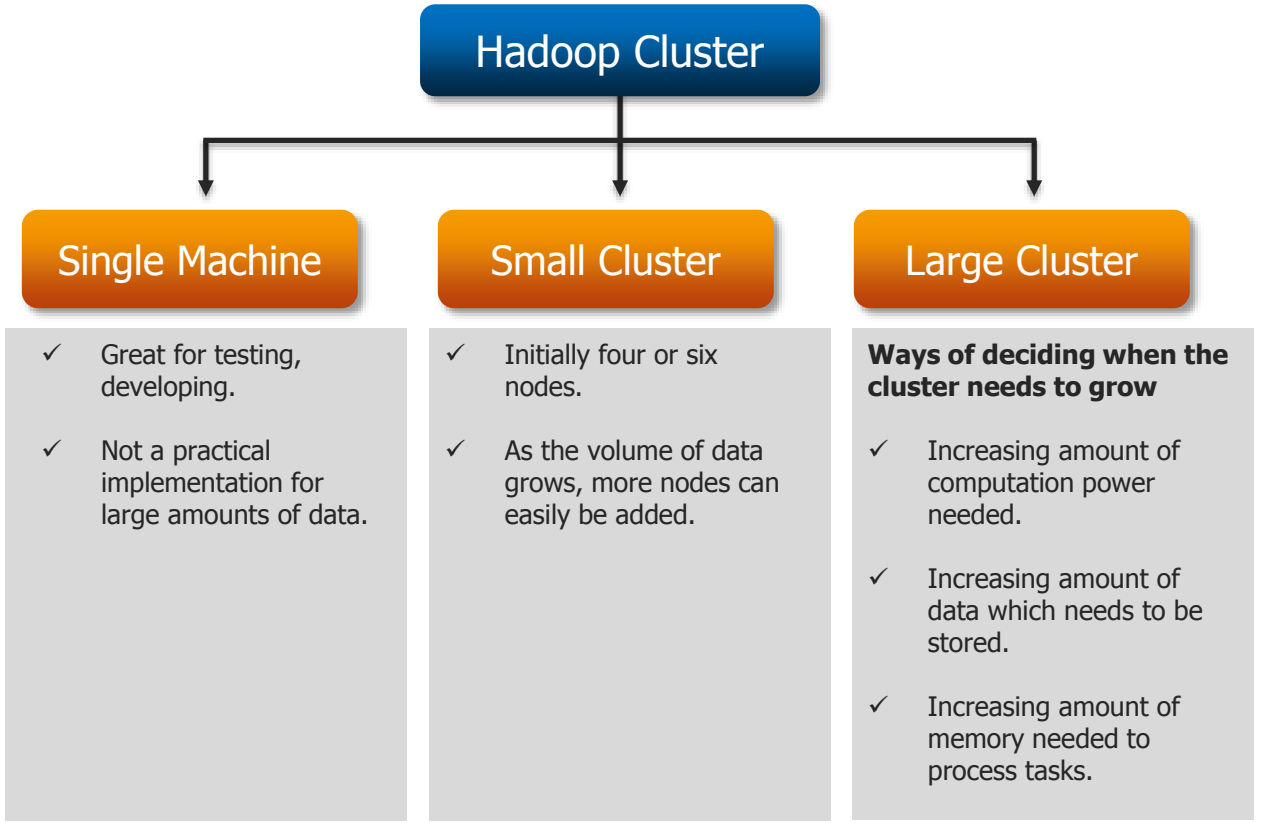
- ✓ Plan You Hadoop Cluster
- ✓ Schedulers and their benefits



Common Admin Commands

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Cluster Balancing – usually after adding new Data Nodes

```
hadoop balancer [–threshold <threshold>]
```

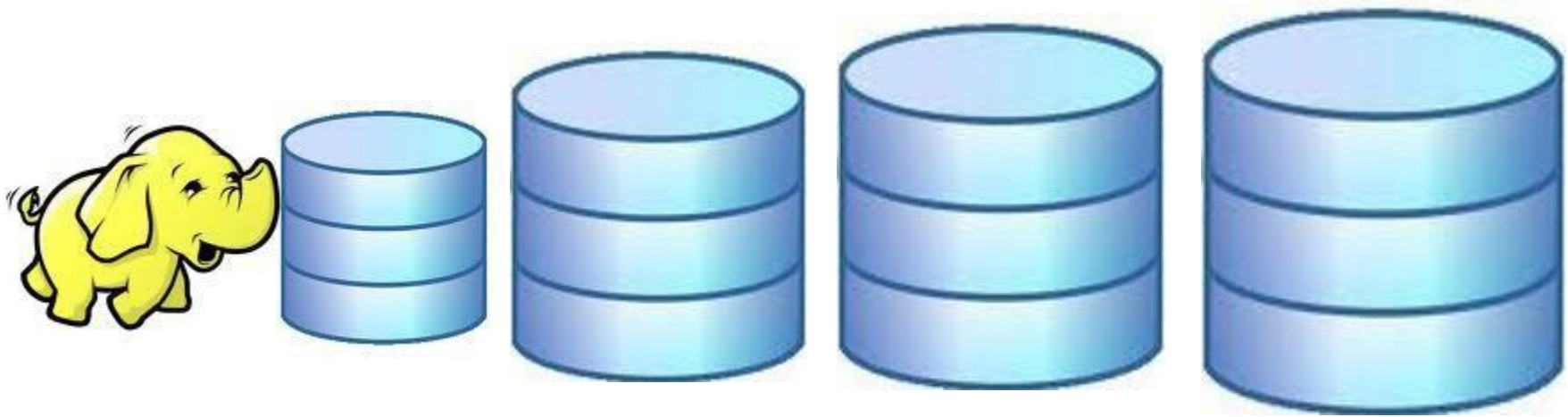
HDFS Admin Client

```
hadoop dfsadmin –metasave <filename>
```

MapReduce Admin

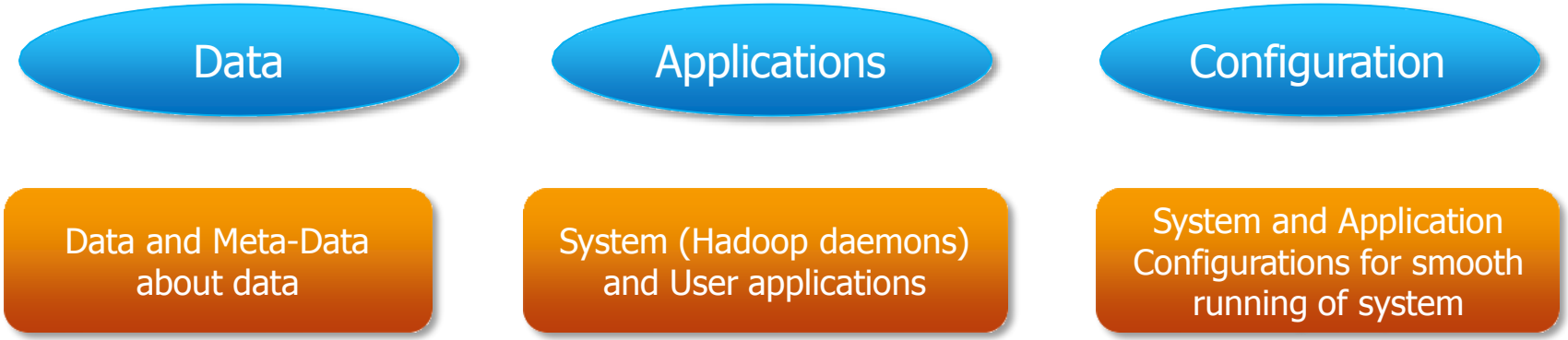
```
yarn mradmin -refreshQueuesAcls
```

Data Backup and Recovery



- ✓ **Terabytes and Petabytes of data**
  - ✓ Risk of data loss – Data Backup
  - ✓ Problem of backup – What data to backup, backup frequency, size of the backup
  - ✓ Consistency
- ✓ **Possible solutions**
  - ✓ Distributed Copy (**distcp**)
  - ✓ Parallel copy to another cluster – Parallel Data Ingestion (**Flume**)

Data Backup


Data
Applications
Configuration
Data and Meta-Data about data
System (Hadoop daemons) and User applications
System and Application Configurations for smooth running of system

HDFS – Fundamental (Recap)

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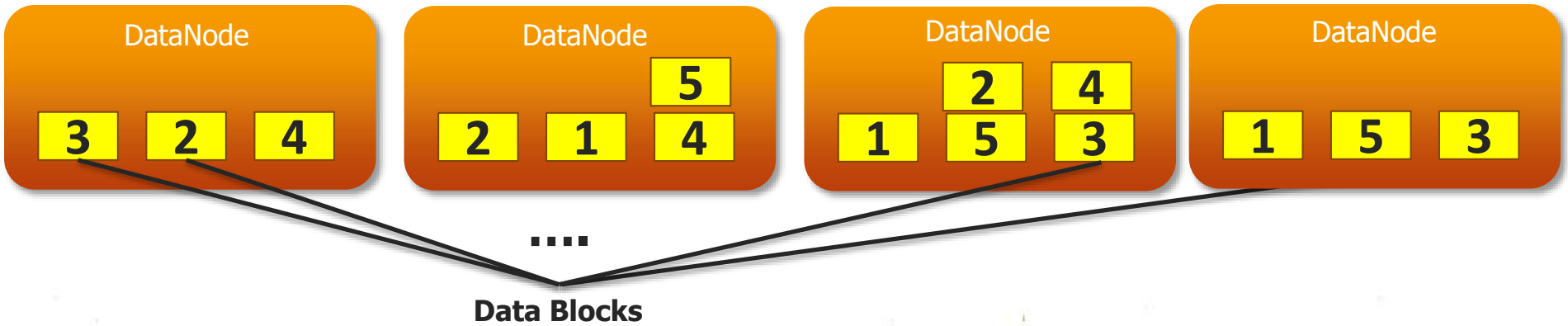
NameNode
(Stores metadata only)

METADATA:
/user/doug/hinfo -> 1 3 5
/user/doug/pdetail -> 4 2

NameNode: Keeps track of overall file directory structure and the placement of Data Block

DataNodes:
Store Blocks from files



For Replication Factor = 3

Annie's Question

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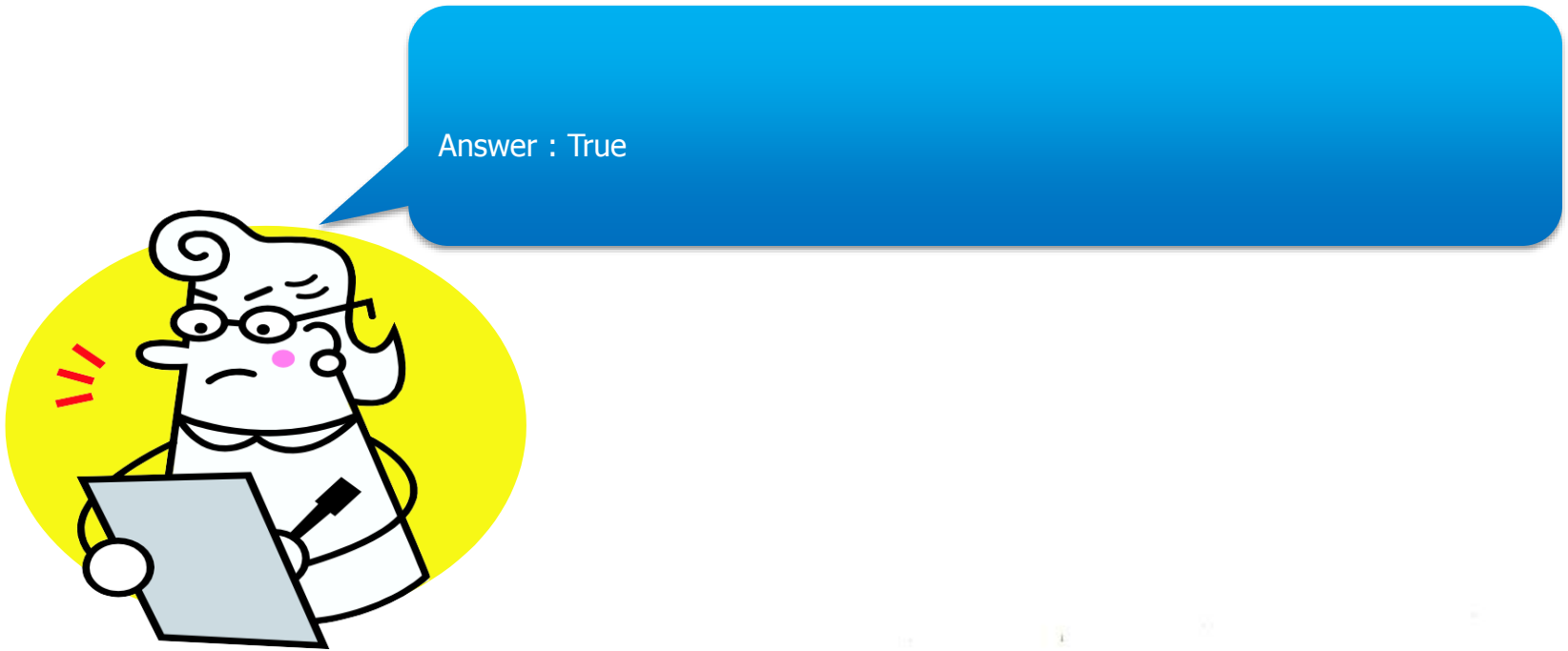
Blocks are replicated to nodes throughout the cluster according to Replication Factor.

a) True
b) False

Annie’s Answer

edureka!



Annie's Question

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Replication can be configured with the :
a) dfs.replication parameter in hdfs-site.xml
b) fs.replication parameter in core-site.xml
c) fs.replication parameter in mapred-site.xml

Annie's Answer

edureka!

Answer : dfs.replication parameter in hdfs-site.xml

Backup options – In-built in Hadoop

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hadoop distcp hdfs://<source NN> hdfs://<target NN>

distcp

Flume

Parallel Data ingestion

Data Loading Using Flume

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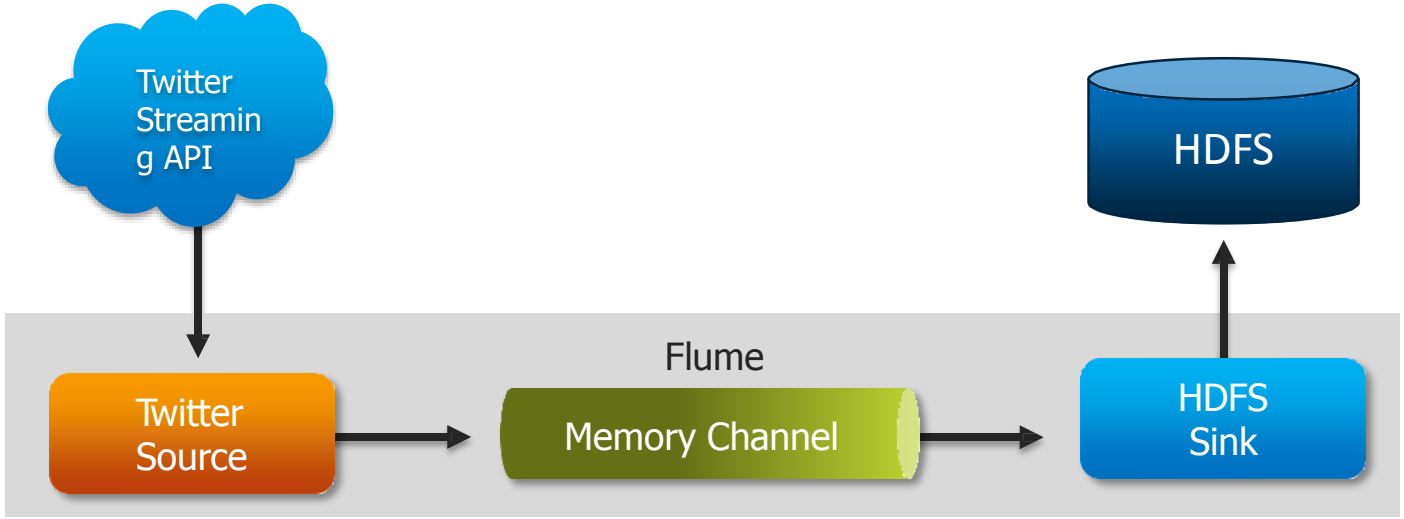
- ✓ Flume is a distributed, reliable, and available service for efficiently collecting, aggregating, and moving large amounts of streaming event data.



Annie's Question

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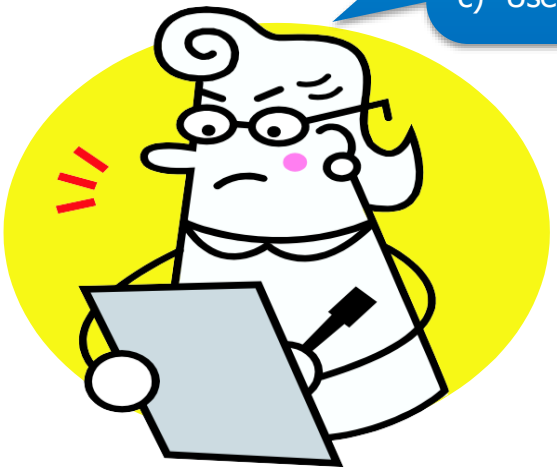
How to take the complete (full copy of Dataset) backup of the HDFS?

a) Use a third party Storage tool to copy disks
b) Use OS **'cp'** command
c) Use **'hadoop dfs -copyToLocal'**



Annie’s Answer

Answer : Use 'hadoop dfs -copyToLocal

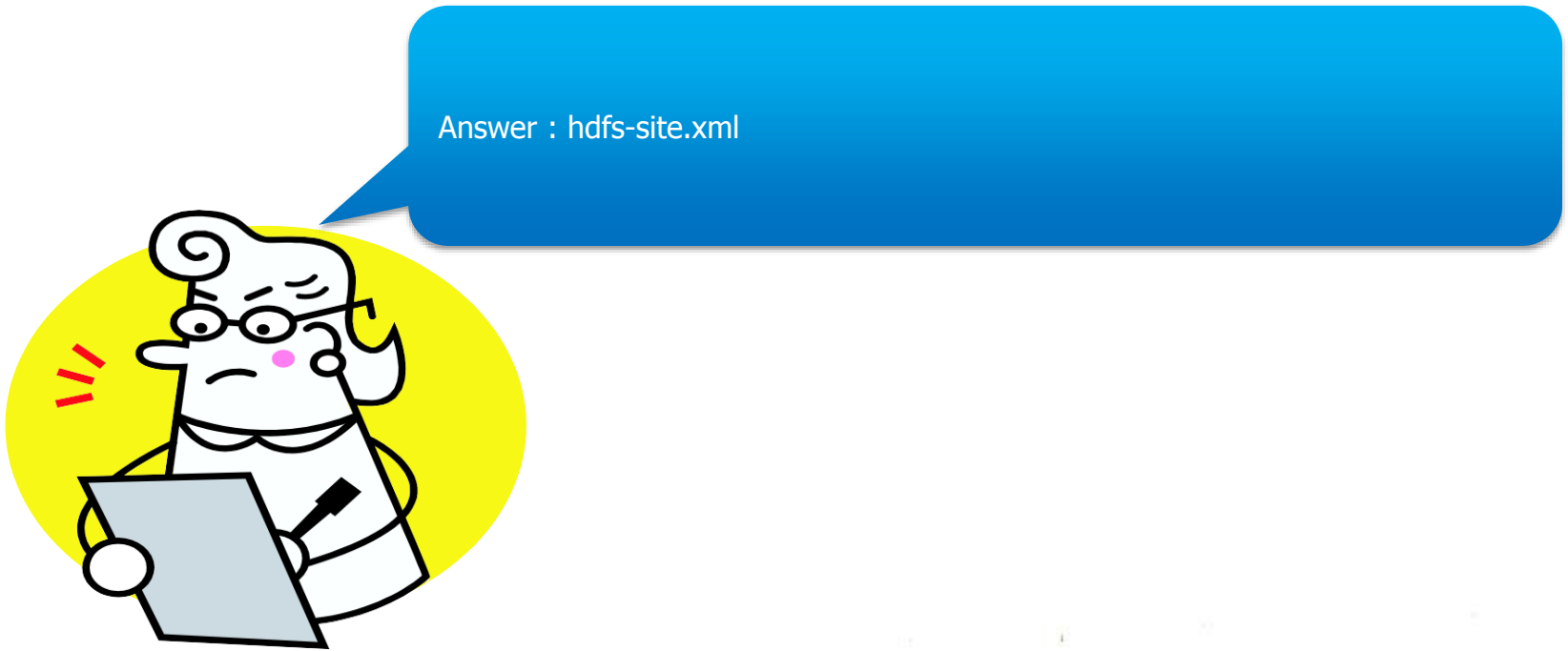
Annie's Question

edureka!

You can edit Property 'dfs.block.size' in
a) hdfs-site.xml
b) core-site.xml

Annie's Answer

edureka!



Annie's Question

edureka!

The Hadoop tool for cluster to cluster copy is:

a) sqoop
b) Dfsadmin
c) distcp

Annie’s Answer

edureka!

Answer : distcp

Possible Problems - breakdown/failure causes

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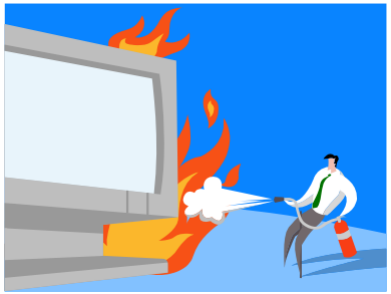
- ✓ **Application or User related**
  - ✓ Inadvertent Data deletion
  - ✓ Corrupted Writes

- ✓ **Data Center/Hardware Issues**
  - ✓ Natural disaster (Storm, Hurricane)
  - ✓ Network or Power outages
  - ✓ Disk crash or corruption
  - ✓ Rack failure
  - ✓ Server Hardware failure/crash



Safeguard Application level Problems

edureka!

- ✓ **Safeguard from Application or User related**
  - ✓ Configure Name and Space Quotas
  - ✓ Access to only the 'must have' data

User Accounts and Quotas

edureka!

- ✓ **Create 'home' directory for each user**

  >hadoop fs -mkdir /user/username

  >hadoop fs -chown username:username /user/username

- ✓ **Configure space limits on the directory**

  >hadoop dfsadmin -setSpaceQuota 1t /user/username

Recover from Application level Problems

edureka!

- **Configure Trash server**
  - Configure Trash server using fs.trash.interval to set trash interval
    - When enabled, files are deleted into trash
  - Trash deletion only works through fs shell – programmatic deletes will not employ Trash
  - Trash is a per user directory for restores – each user has her own trash directory ".Trash"
  - Can be expunged:
  - >hadoop dfs -expunge

Safeguard from Data Center / Hardware failures

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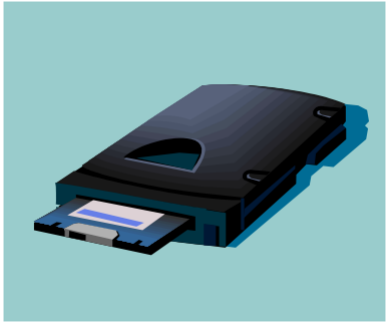
- **Safeguard from recoverable failures such as Power or complete loss in case of a disaster such as fire**
  - Backup the data and meta-data
  - Restore Storage
  - Server Recovery
  - Framework level features



NameNode Meta-Data backup

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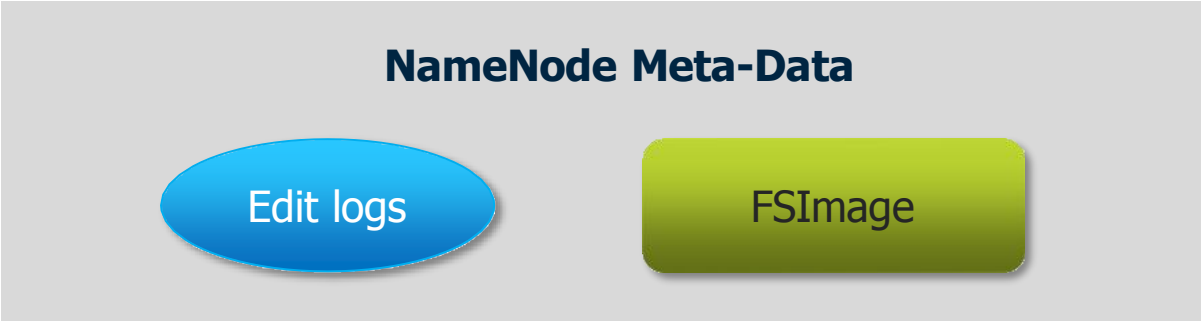
- **Best practice configuration**
  - Configure the NameNode to store multiple copies of its metadata.
    - For example, by keeping two copies of the edit log and FSImage, on two separate hard disks, you can avoid bringing down the NameNode if one of those disks fails.



Secondary NameNode

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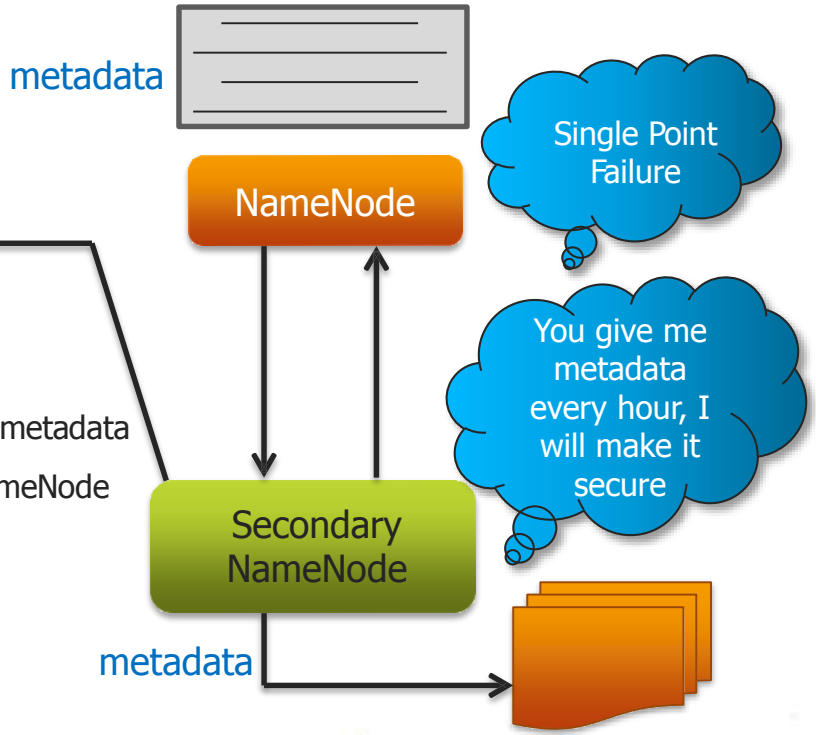
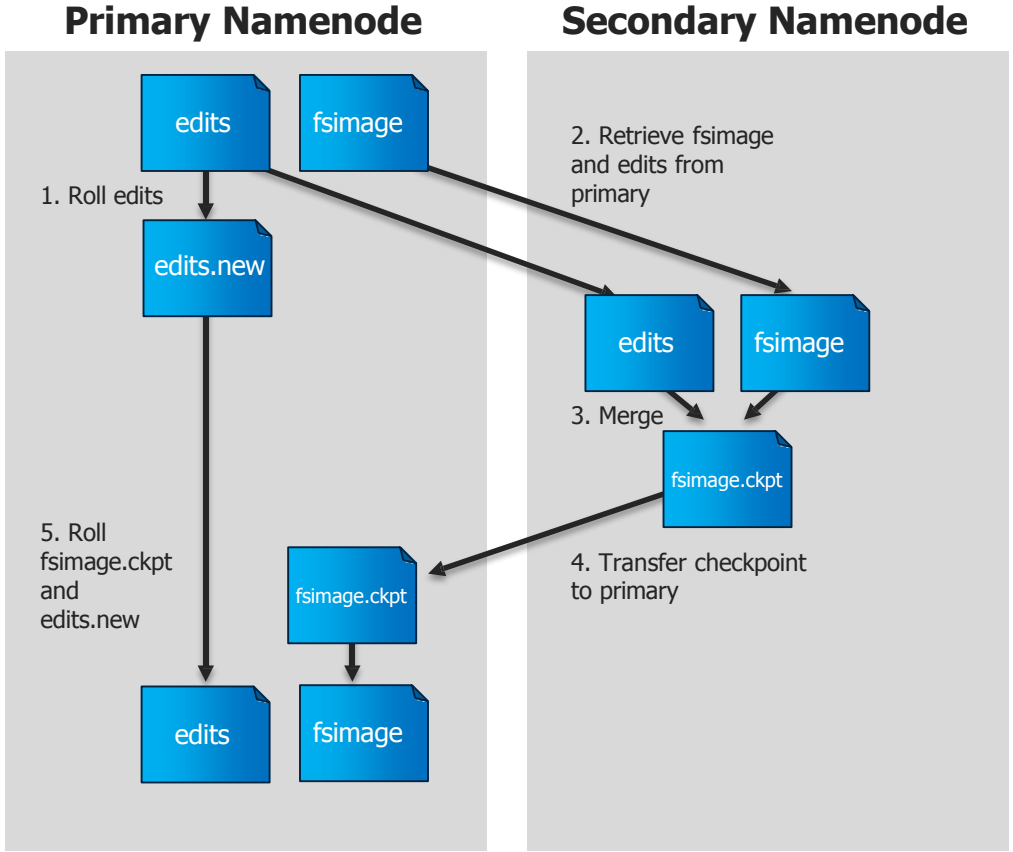
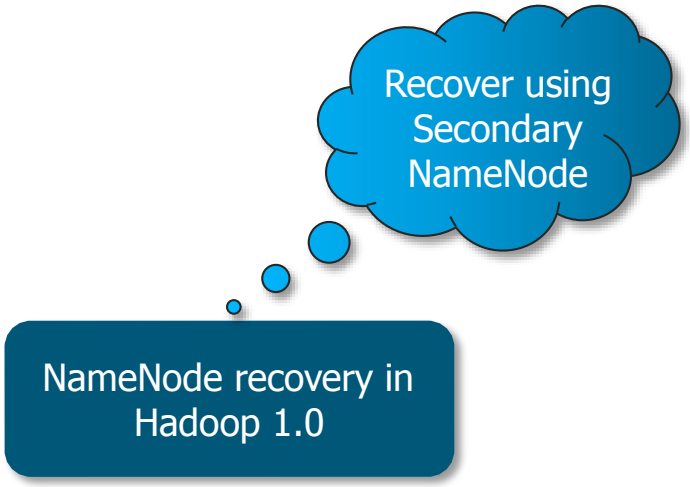
- **Secondary NameNode:**
  - Not a hot standby for the NameNode
  - Connects to NameNode every hour*
  - Housekeeping, backup of NemeNode metadata
  - Saved metadata can build a failed NameNode

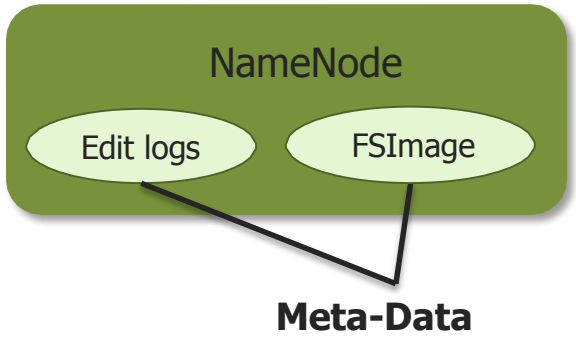


Secondary NameNode (Contd.)



Secondary NameNode



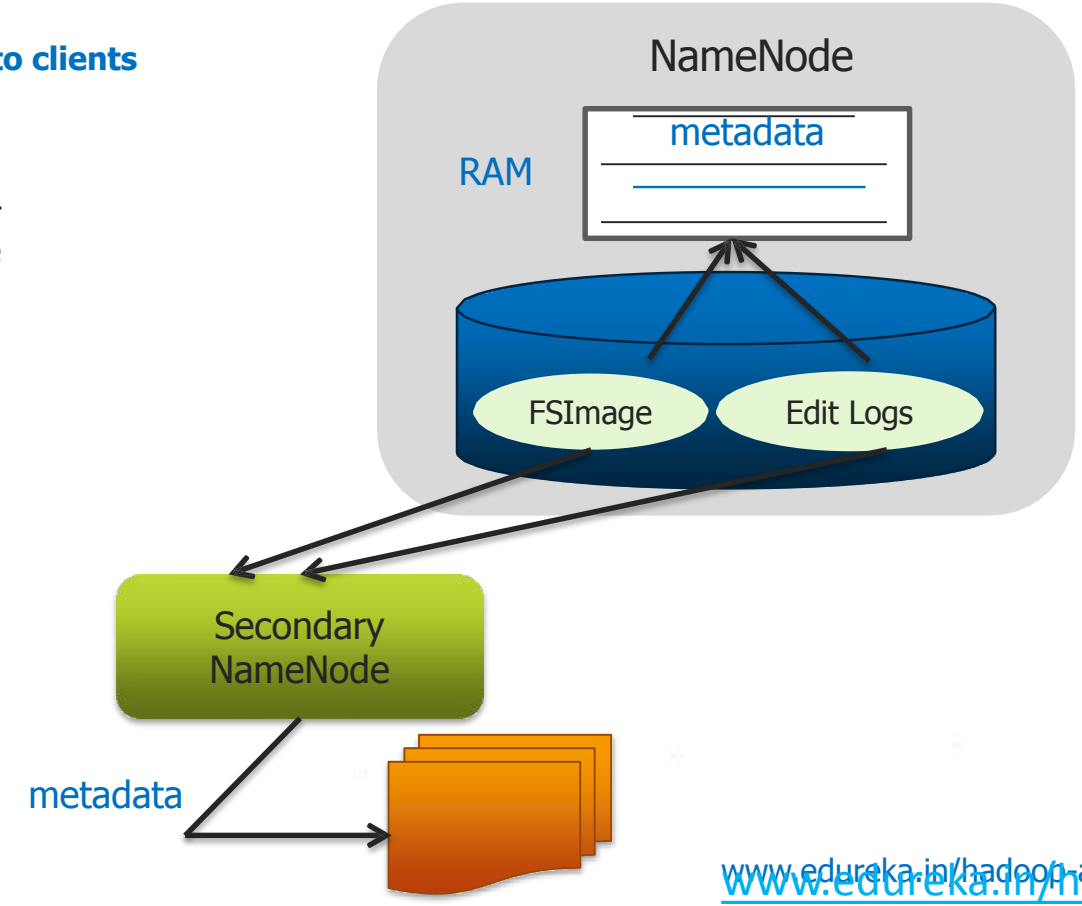


NameNode Safe mode

edureka!

- ✓ **Read only view of the filesystem to clients**

```
>hadoop dfsadmin –safemode get
>hadoop dfsadmin –safemode wait
>hadoop dfsadmin –safemode enter
>hadoop dfsadmin –safemode leave
```



Data Nodes and Recovery

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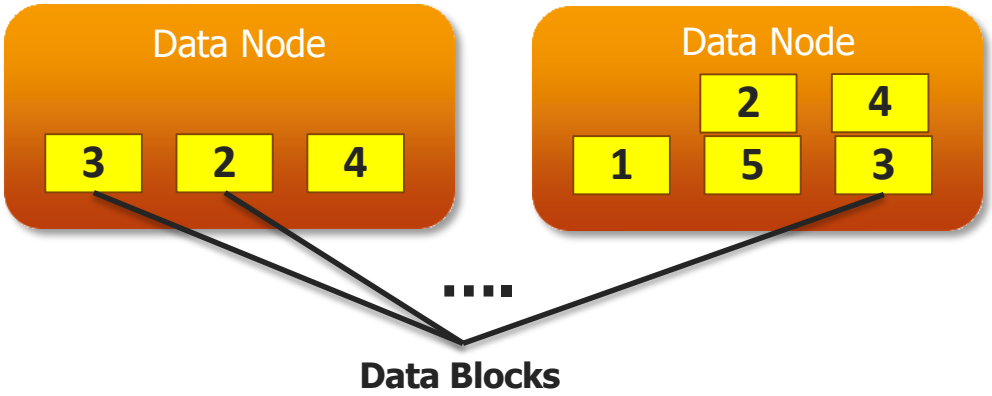
- ✓ **Data Nodes:**
  Store Blocks from files

- ✓ Monitor node health
- ✓ Examine data node block scanner reports (http://datanode:50075/blockScannerReport)
- ✓ Hadoop **fsck** to repair the file system



Annie’s Question

HDFS will automatically delete files in trash folders.

a) True
b) False

Annie’s Answer

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Answer : True

Commission / Decommission Data Nodes

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- ✓ **Add New Data Nodes**
- ✓ **Remove faulty Data Nodes**

Add (Commission) DataNodes

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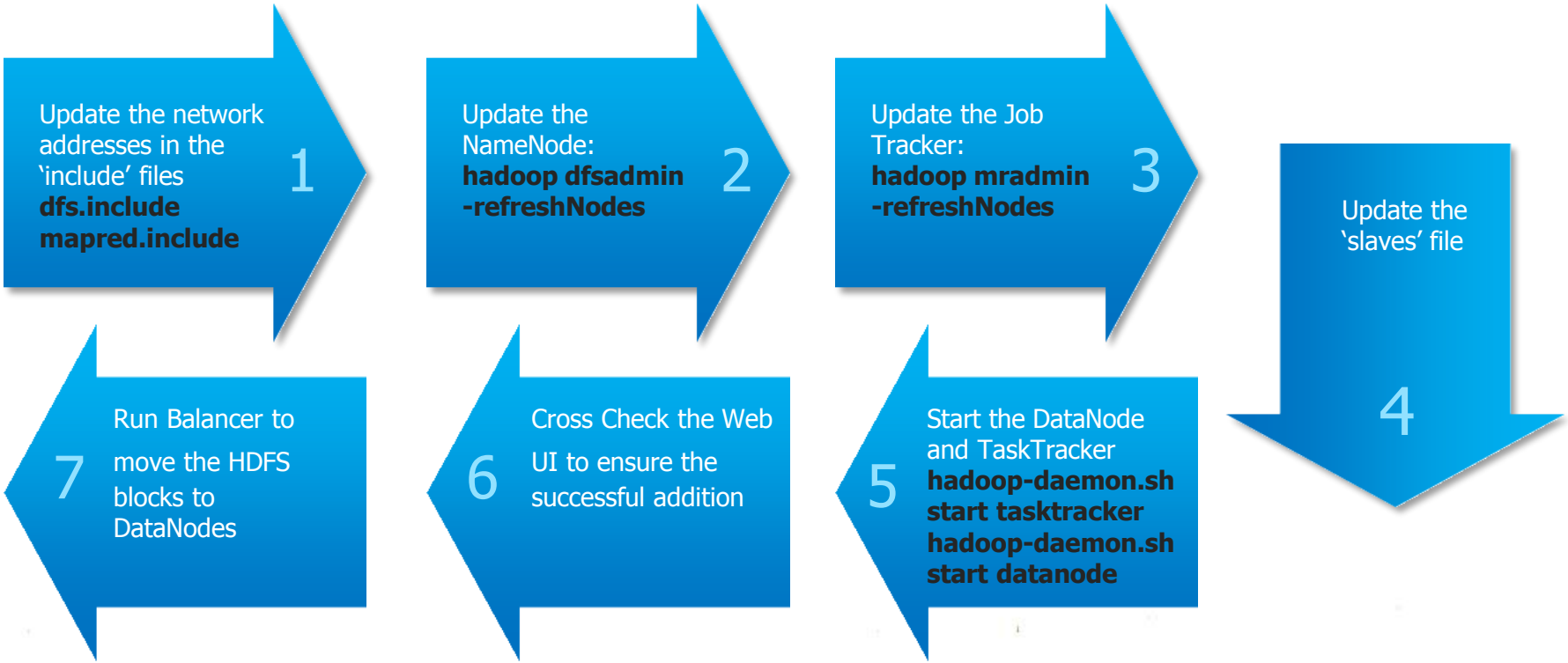

Remove (Decommission) DataNodes

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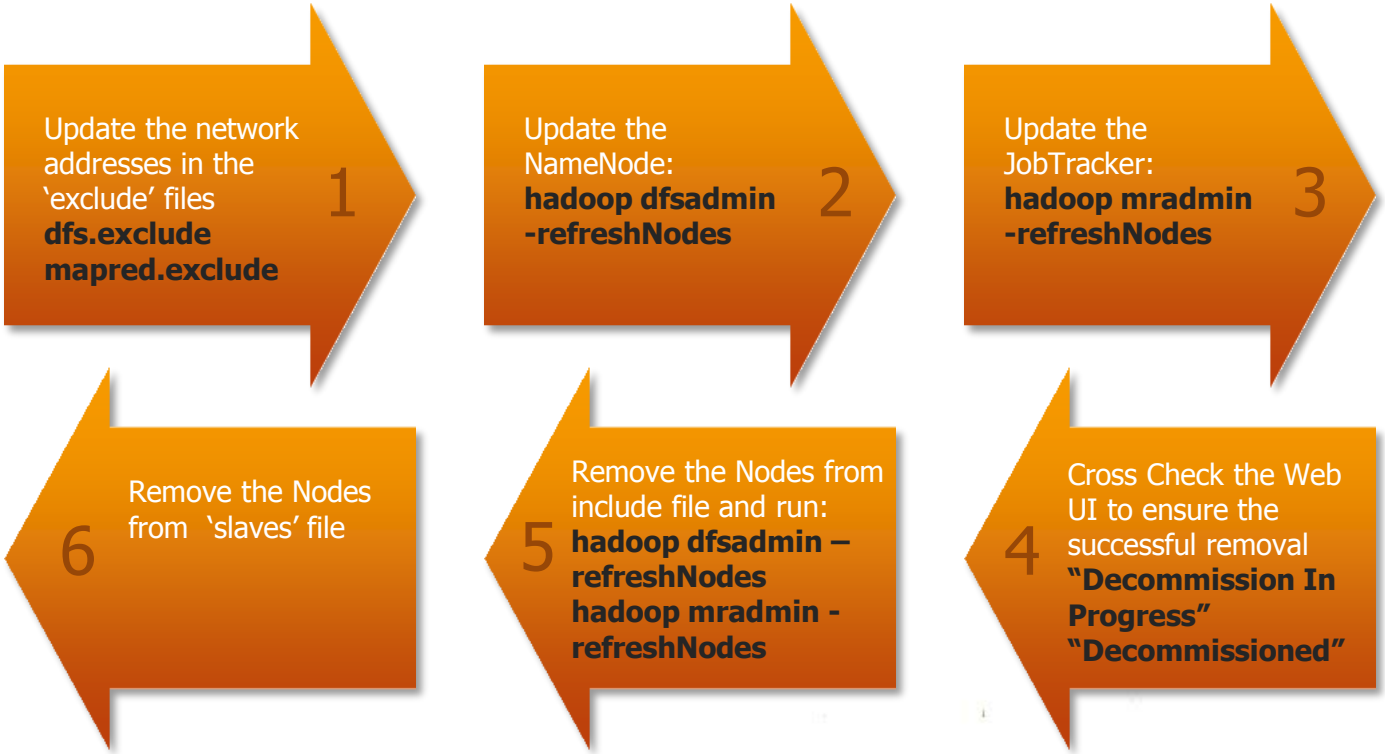

Annie's Question

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We can start the NameNode in recovery mode with:

a) namenode -recover
b) namenode –safemode
c) namenode -recovery

Annie's Answer

edureka!

Answer : namenode -recover

Annie's Question

edureka!

Secondary NameNode should run on a separate machine in a large production Hadoop Cluster.

a) True
b) False

Annie’s Answer

edureka!

Answer : True

Annie's Question

edureka!

To move blocks from old data nodes to new data nodes to balance the cluster, use:

a) Balancer
b) HDFS
c) SNN

Annie’s Answer

edureka!

Answer : Balancer

Cluster Membership

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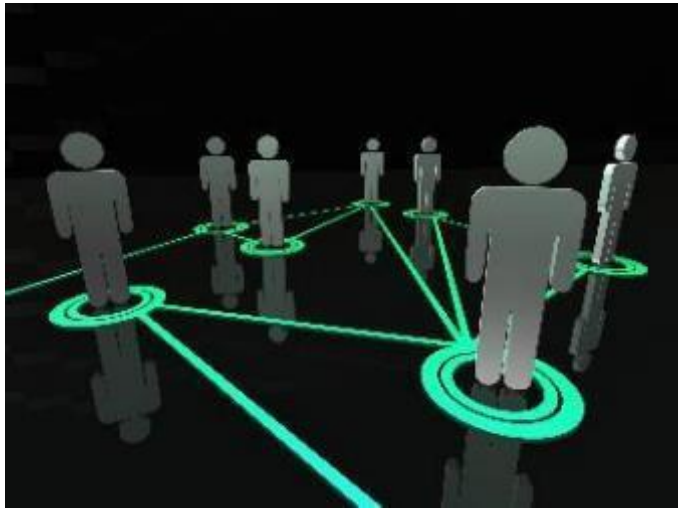
- ✓ **To aid the addition or removal of Data Nodes in a Cluster**
  - ✓ Create a file containing the authorized machines
    - ✓ For DataNodes: dfs.hosts and dfs.hosts.exclude
    - ✓ For JobTrackers: mapred.hosts and mapred.hosts.exclude



Upgrade guidelines

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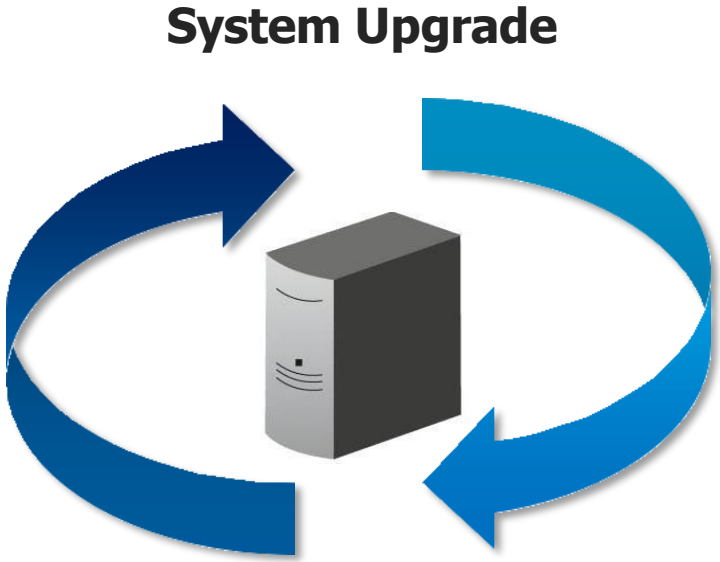
- ✓ Save name node meta-data offsite
- ✓ Test upgrade on smaller cluster before pushing out
- ✓ Data layout upgrades support roll-back but need to be careful
- ✓ Backup all or important data to remote
- ✓ location before upgrade



Storage Considerations

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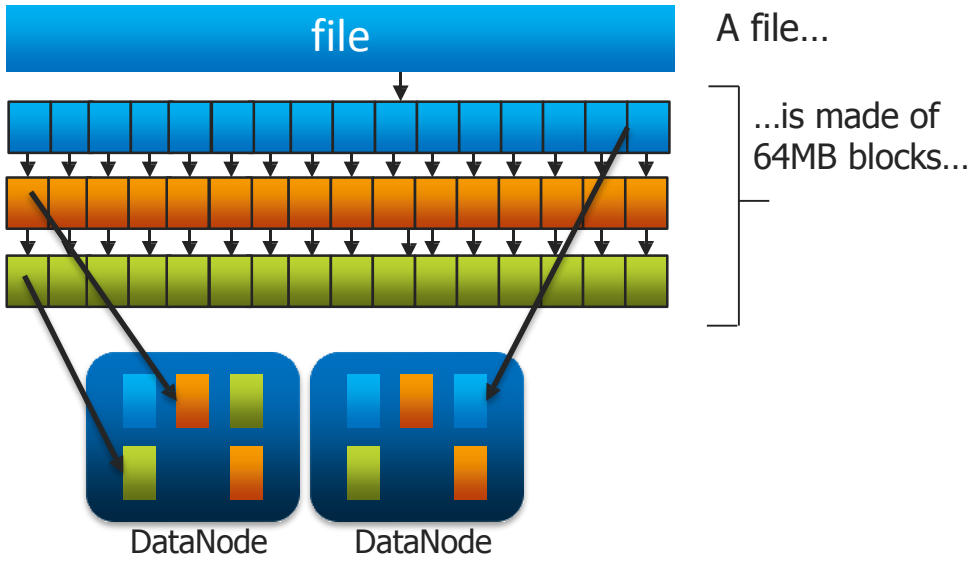
- **HDFS Block Size**
  - Property 'dfs.block.size' in hdfs-site.xml (default: 64 MB)
  - 128 MB or even 256 MB in real cluster implementations to ease Memory Pressure on NameNode and to provide more data to Mappers to work upon
- **I/O buffer size**
  - Property **'io.file.buffer.size'** in core-site.xml (default: 4 KB)
  - Performance benefits with 128 KB
- **Reserved storage space**
  - Property **'dfs.datanode.du.reserved'** to reserve storage for non-HDFS usage as by default DataNode try to use all the available storage volumes.



Disaster Recovery

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Copying	Teeing
Data is copied from production to replica as a separate step after processing	Send data during ingest phase to production and replica clusters
✓ Consistent data between both sites ✓ Process once only	✓ Time delay is minimal between clusters ✓ Bandwidth required could be larger
✓ Time delay for RPO objectives to do incremental copy ✓ More bandwidth needed	✓ Requires re-processing data on both sides ✓ No consistency between sites

Security

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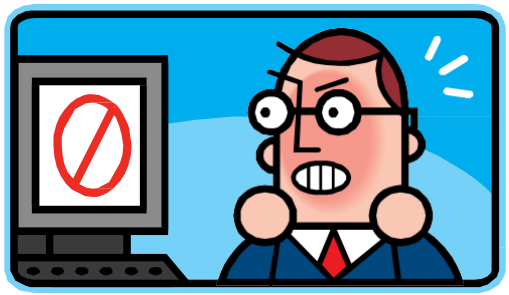
- ✓ The Hadoop ecosystem has only partially adopted Kerberos but many services remain unprotected and use trivial authentication systems.
- ✓ Service-level authorization and web proxy capabilities in YARN.
- ✓ Most security tools fail to scale and perform with big data environments.



Security – Simple Flow

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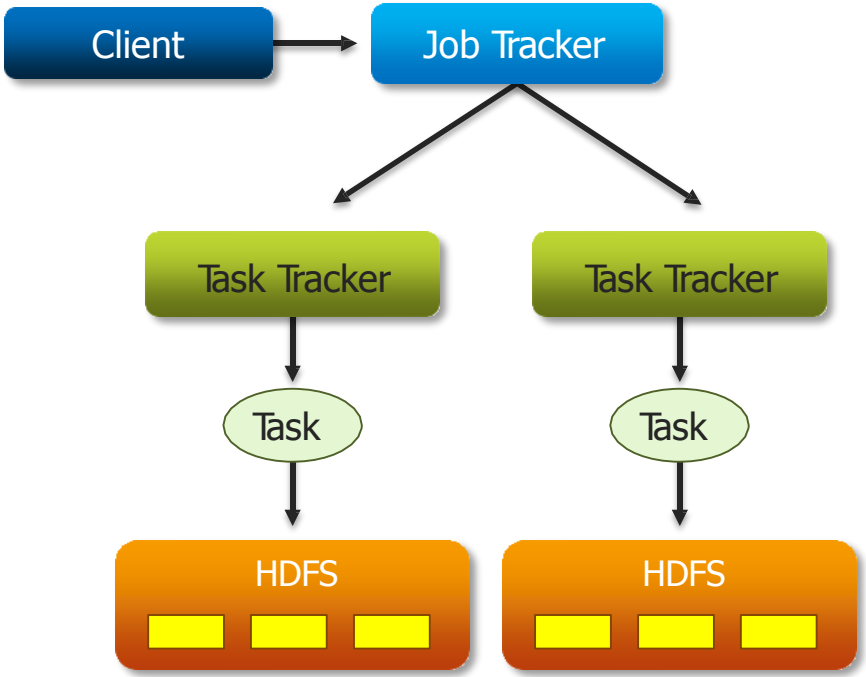
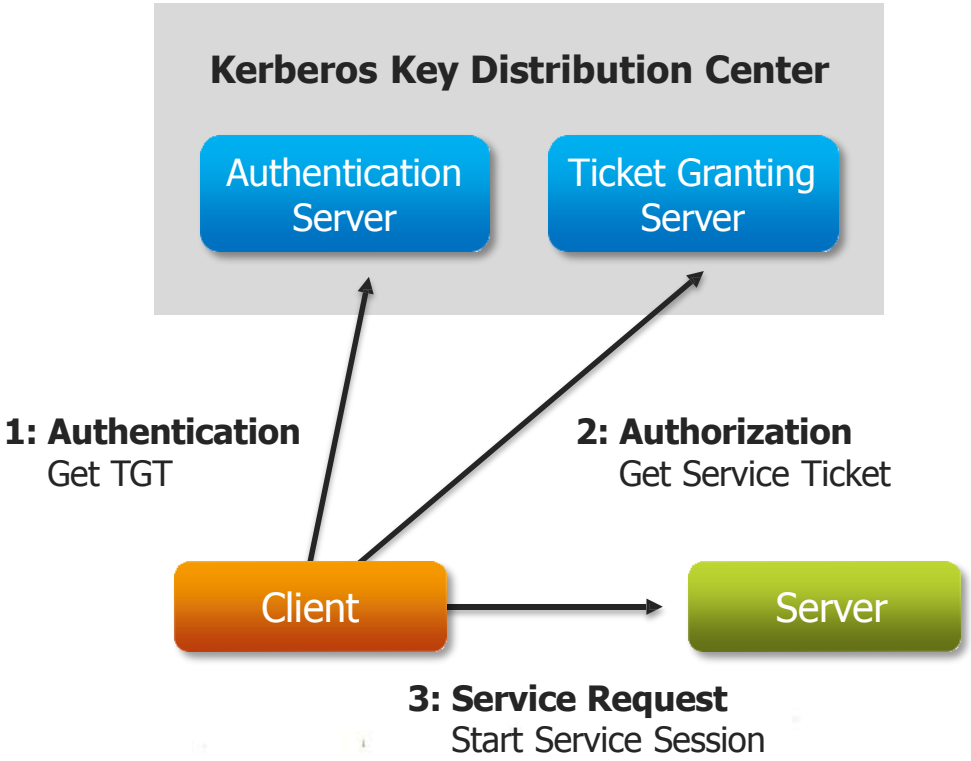
- ✓ **Security Risks**
- ✓ Insufficient Authentication
  - ✓ Do not authenticate users services
- ✓ No Privacy and No Integrity
  - ✓ Insecure Network Transport
  - ✓ No Message level security
- ✓ Arbitrary Code Execution
  - ✓ No User verification for MapReduce code execution, malicious users could submit a job



Kerberos to the rescue

edureka!

- ✓ **Kerberos Integration**
  - ✓ User Authentication
  - ✓ User and Group access control list at cluster level
- ✓ **Tokens**
  - ✓ Delegation
  - ✓ Job
  - ✓ Block Access
- ✓ **Simple Authentication and Security Layer (SASL) with RPC digest mechanism**



Annie's Question

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Running a HDFS command such as 'hadoop fs -ls' results in permission error, what can be the problem:

a) DataNode not available
b) 'You are trying to access 'Kerberos' enabled HDFS
c) Encrypted file system

Annie’s Answer

edureka!

Answer : You are trying to access 'Kerberos' enabled HDFS

Further Reading

Hadoop Operations Book

- ✓ http://www.amazon.in/Hadoop-Operations-Eric-Sammer/dp/1449327052

Haoop Definitive Guide

- ✓ http://www.amazon.in/Hadoop-Definitive-Guide-Tom-White/dp/1449311520

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Tasks for you

Attempt the following Assignments as discussed in the class:

- Do a graceful Addition and Removal of a Data node from the Cluster.
- How can you control jobs that are not submitted to a particular task tracker, but that node is used only as a DataNode?
- Bring a new NameNode up, without using data from secondary NameNode. You should not execute the NameNode -format command again.

Module 5 Pre - Work

Review Hadoop Blogs at
http://www.edureka.in/blog/?s=hadoop

Specially,

- http://www.edureka.in/blog/apache-hadoop-2-0-and-yarn/
- http://www.edureka.in/blog/hadoop-2-0-setting-up-a-single-node-cluster-in-15-minutes/

Agenda of the Next Class

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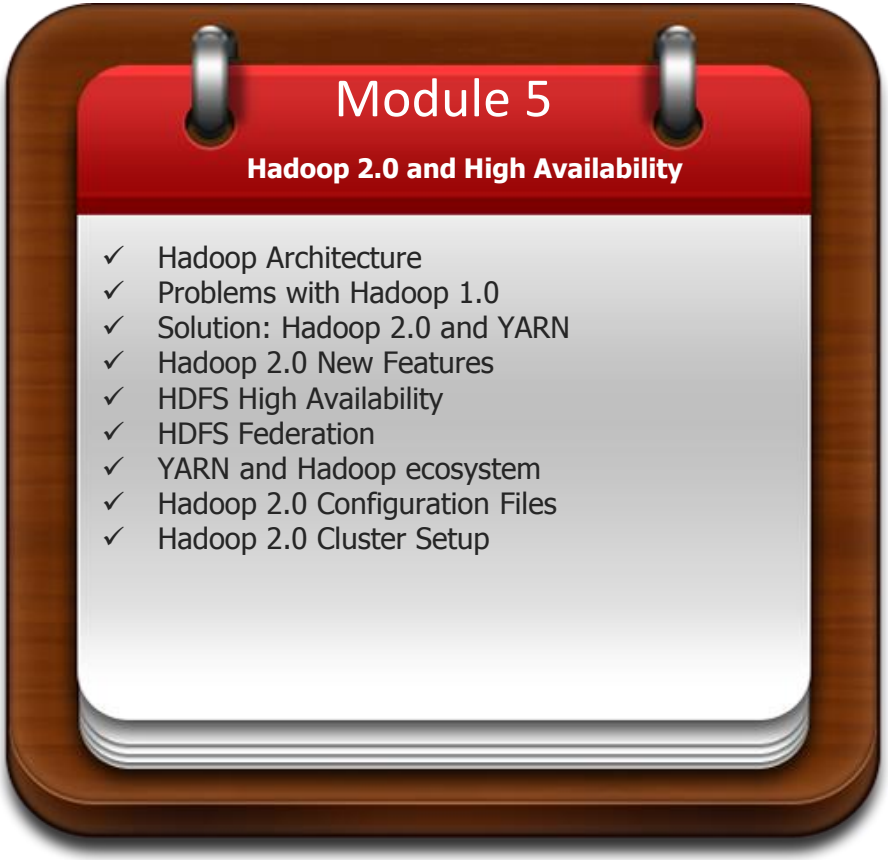
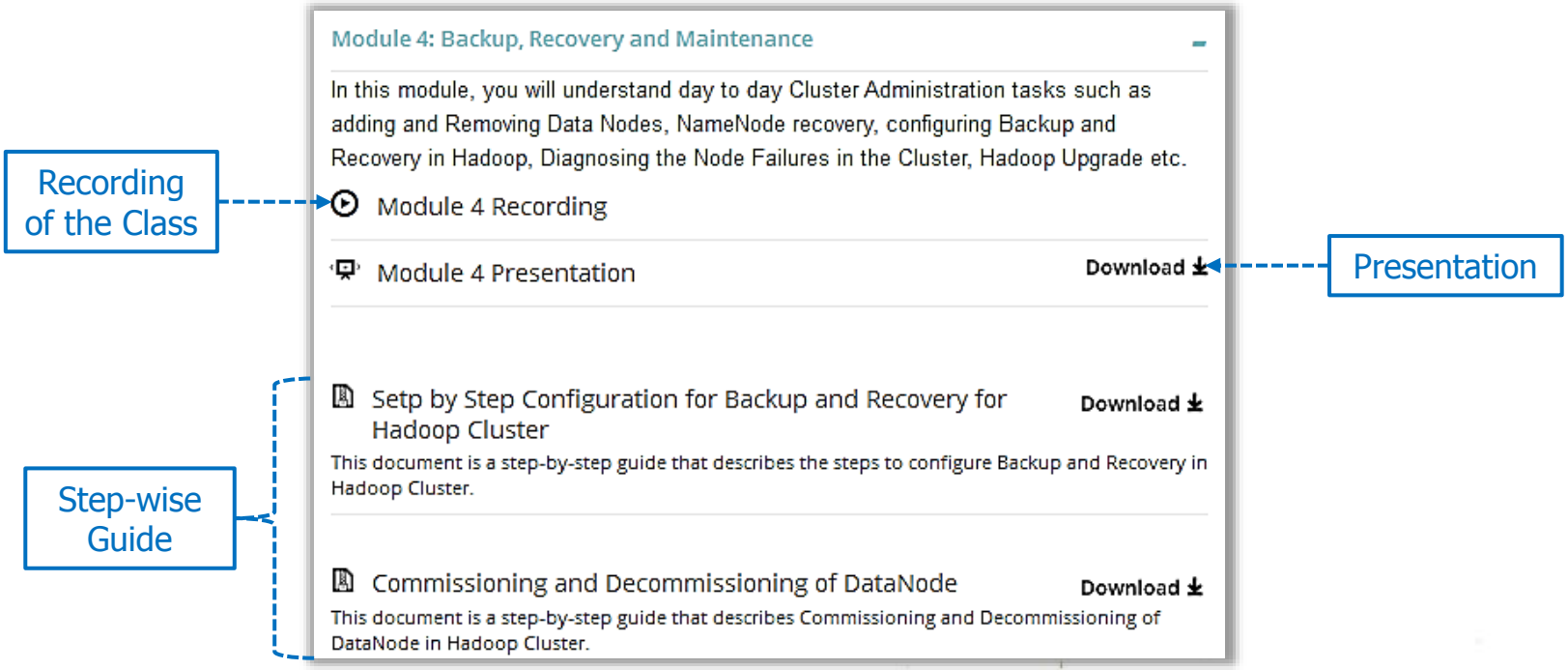


What's Within the LMS?



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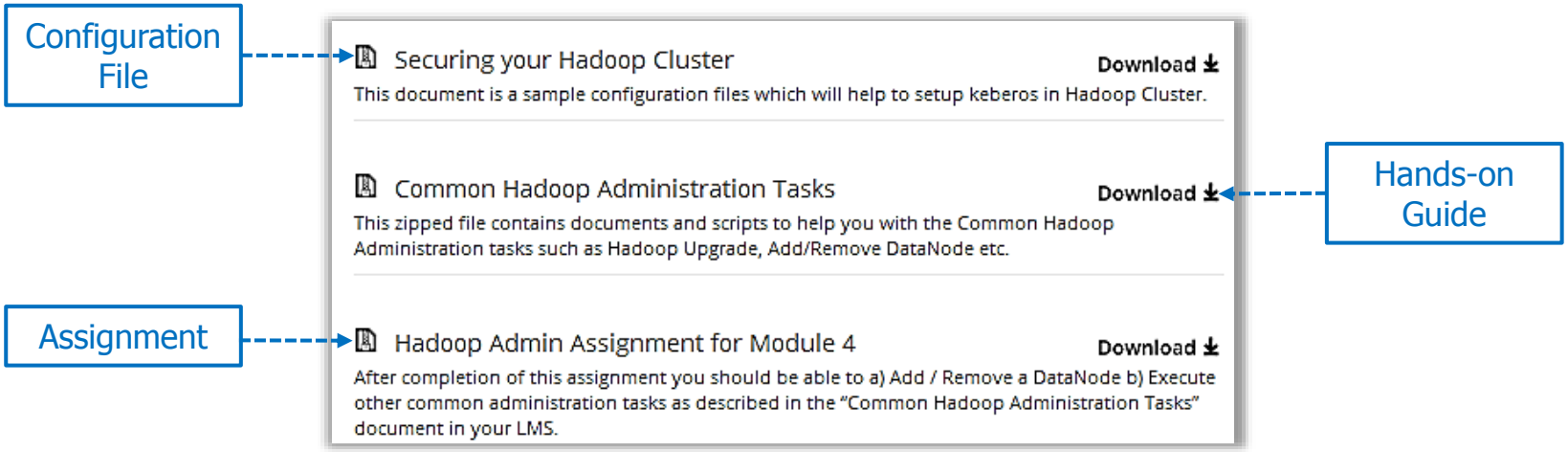

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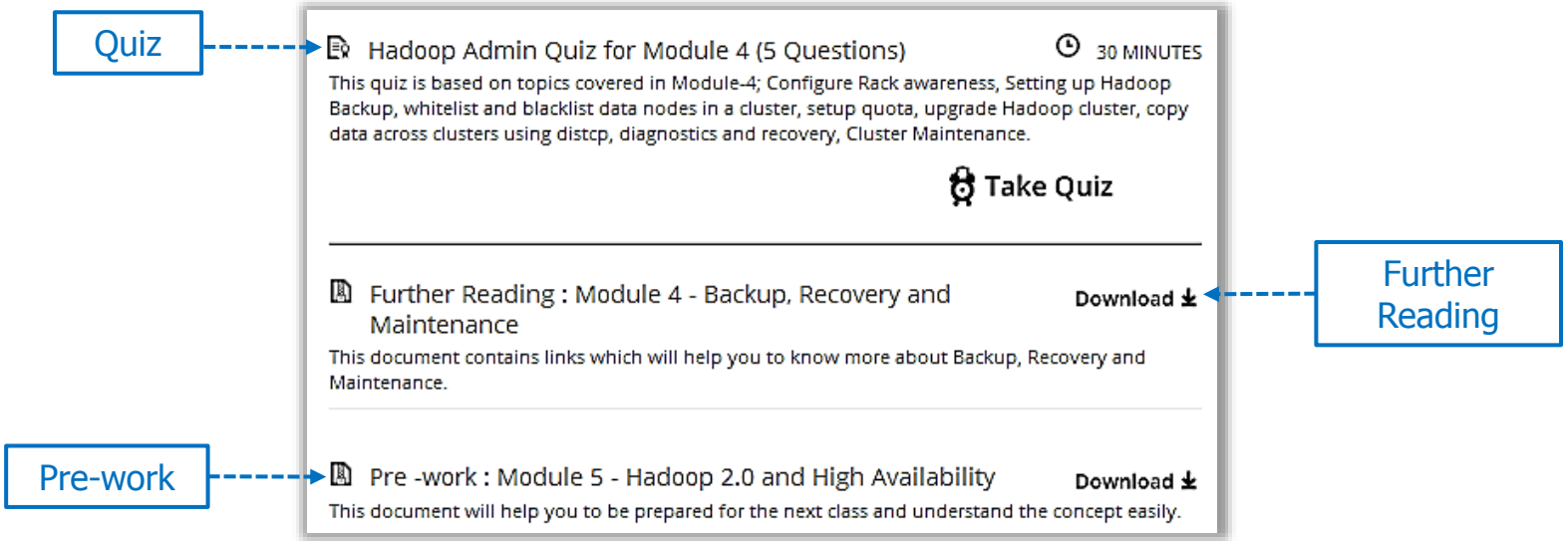

edureka!

Thank You

See You in Class Next Week