Practical Hadoop with Pig

HDFS

HDFS has 3 main actors

The Name Node

The Name Node is “The Conductor”.

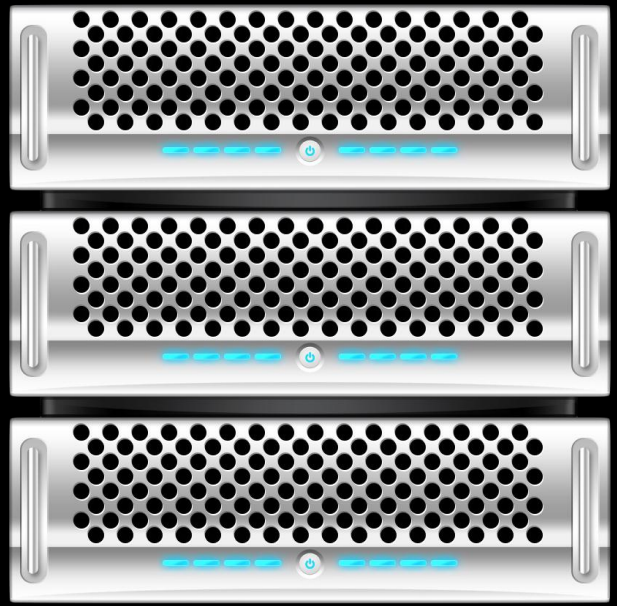
It directs the performance of the cluster.

The Data Nodes:

A Data Node stores blocks of data.

Clusters can contain thousands of Data Nodes.

*Yahoo has a 40,000 node cluster.



The Client

The client is a window to the cluster.

The Name Node

The heart of the System.

Maintains a virtual File Directory.

Tracks all the nodes.

Listens for “heartbeats” and “Block Reports”

If the NameNode is down, the cluster is offline.

Storing Data

The Data Nodes

Add a Data Node:

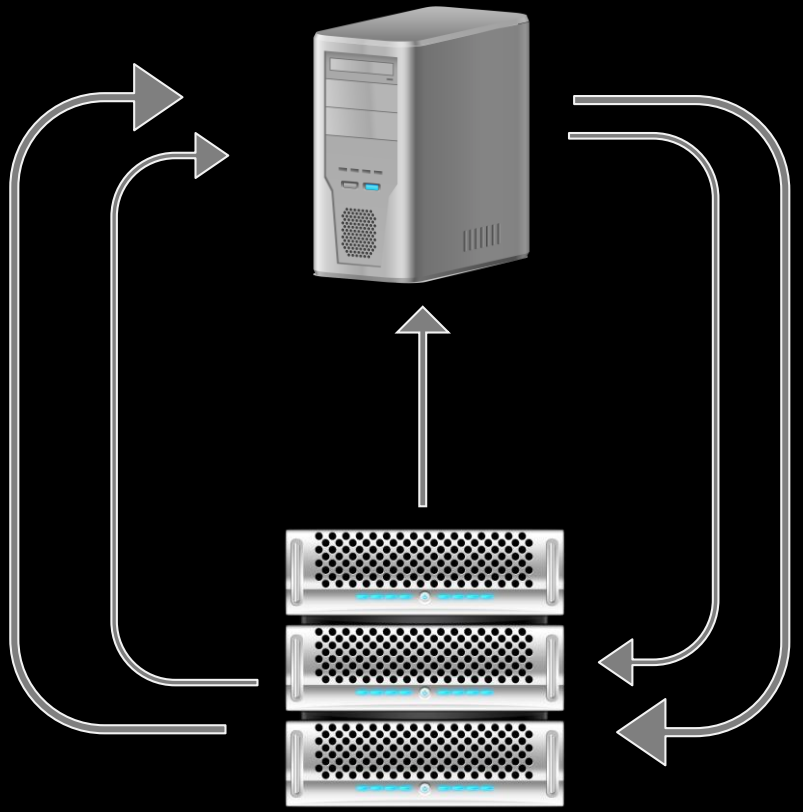
The Data Node says “Hello” to the Name Node.

The Name Node offers the Data Node a handshake with version requirements.

The Data Node replies back to the Name Node, “Okay”

The Name Node hands the Data Node a *NodeId* that it remembers.

The Data Node is now part of cluster and it checks in with the Name Node *every 3 seconds*.



Data Node Heartbeat:

The “check-in” is a simple HTTP Request/Response.

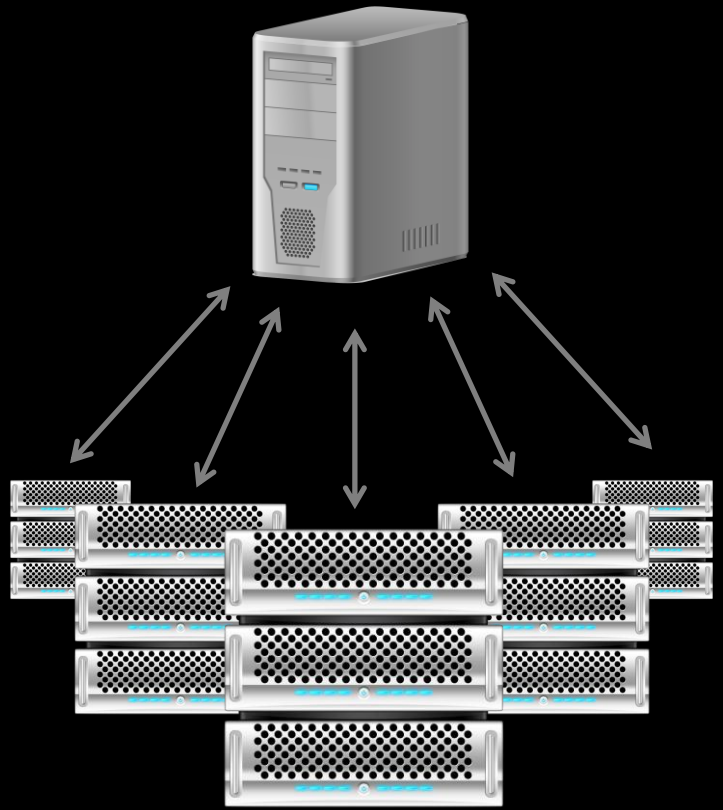
This "check-in" is very important communication protocol that guarantees the health of the cluster.

Block Reports – what data I have and is it okay.

Name Node controls the Data Nodes by issuing orders when they return and report their status.

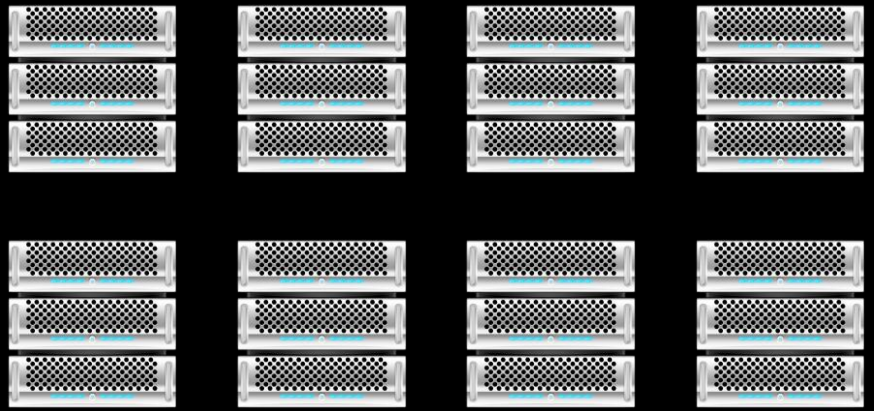
Replicate Data, *Delete* Data, *Verify* Data

Same process for all nodes within a cluster.



Writing Data

The client “tells” the NameNode the virtual directory location for the file.



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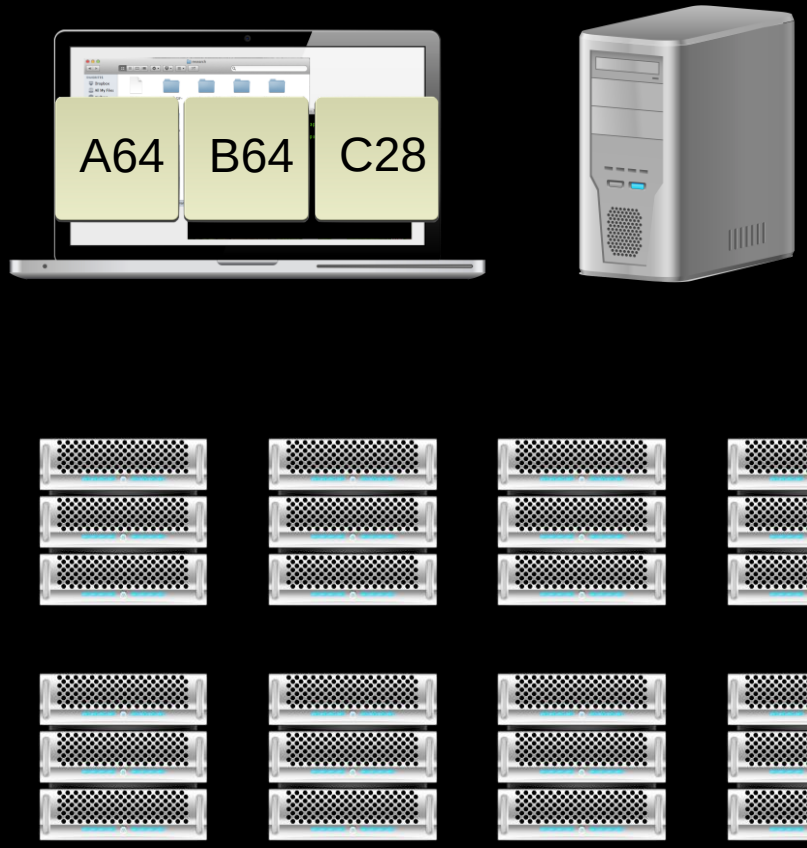
The Client breaks the file into 64MB “blocks”



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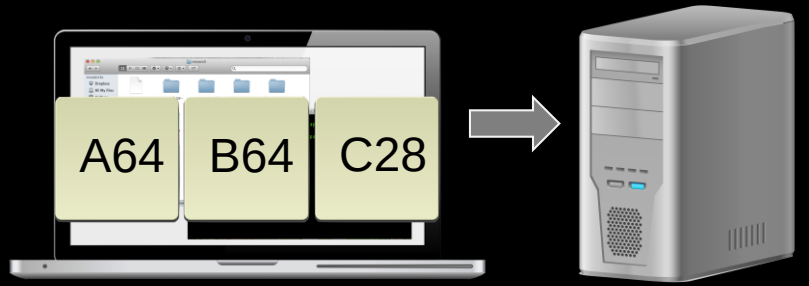

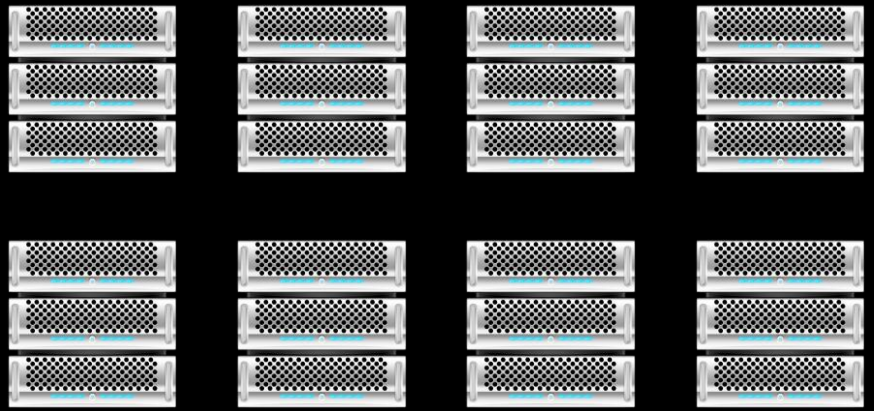

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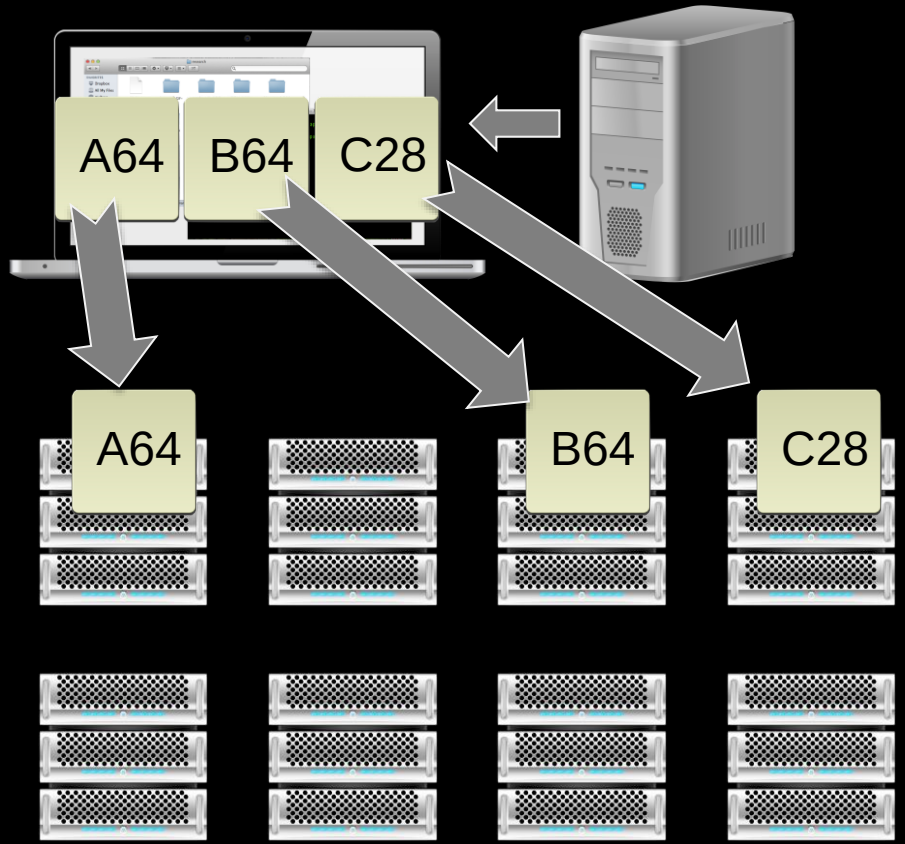

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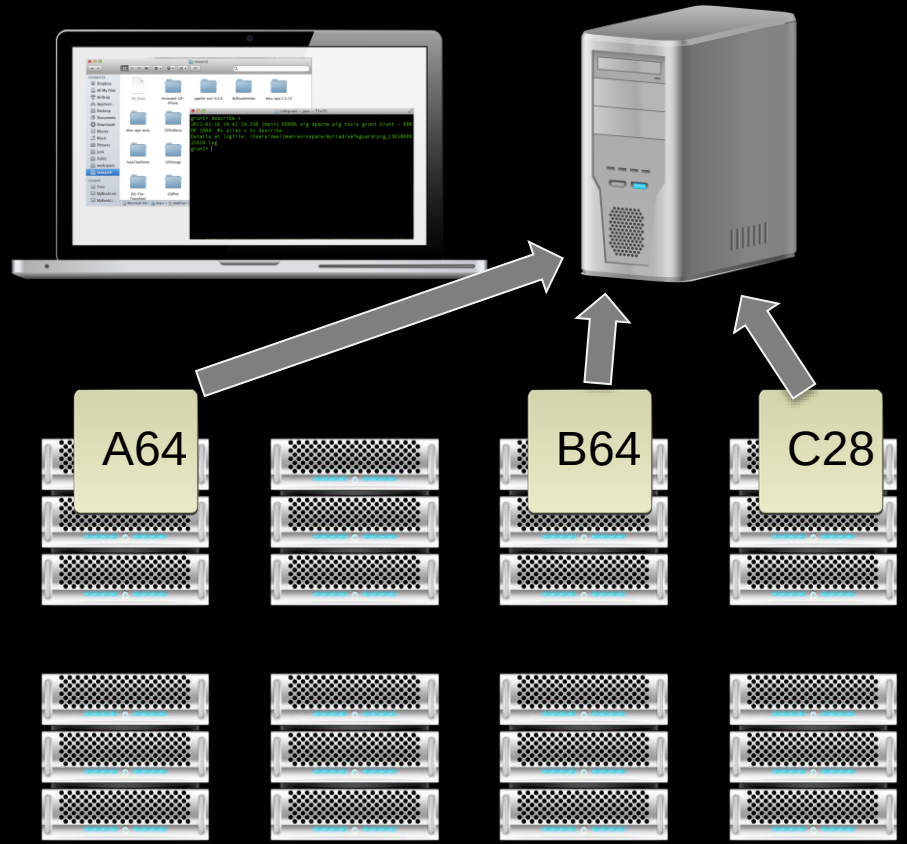

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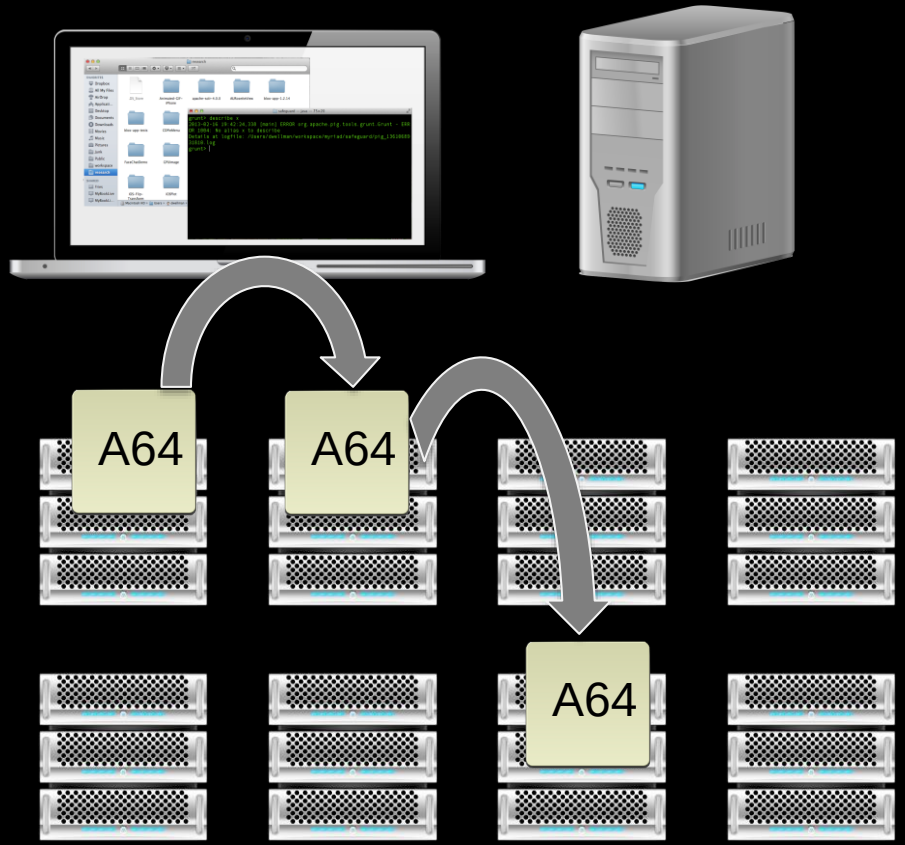
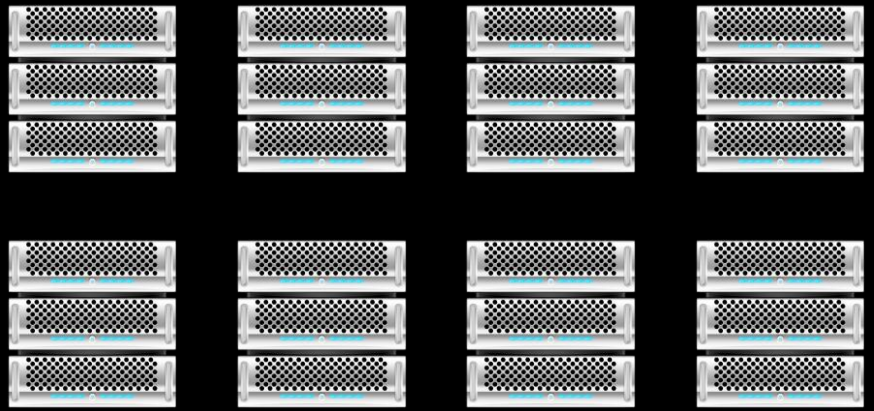
The NameNode tells the DataNode where to replicate the block.



Reading Data

The client tells the NameNode it would like to read a file.



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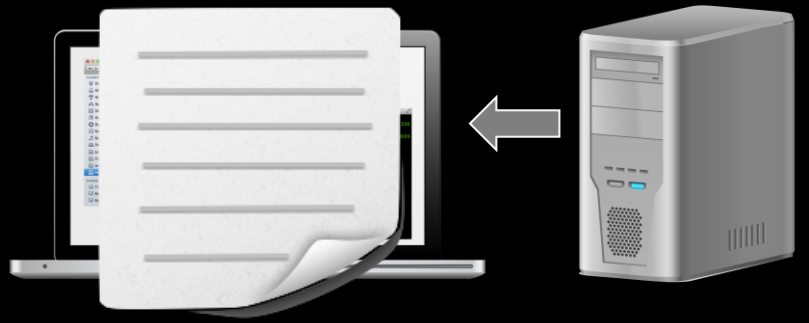
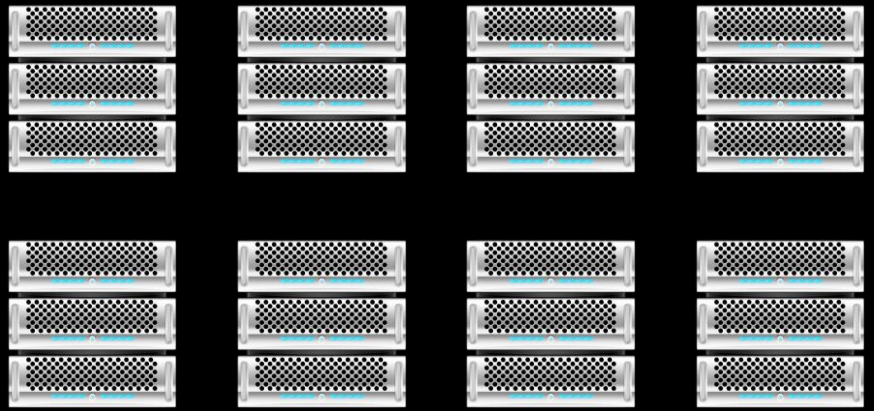
The NameNode reply's with the list of blocks and the nodes the blocks are on.





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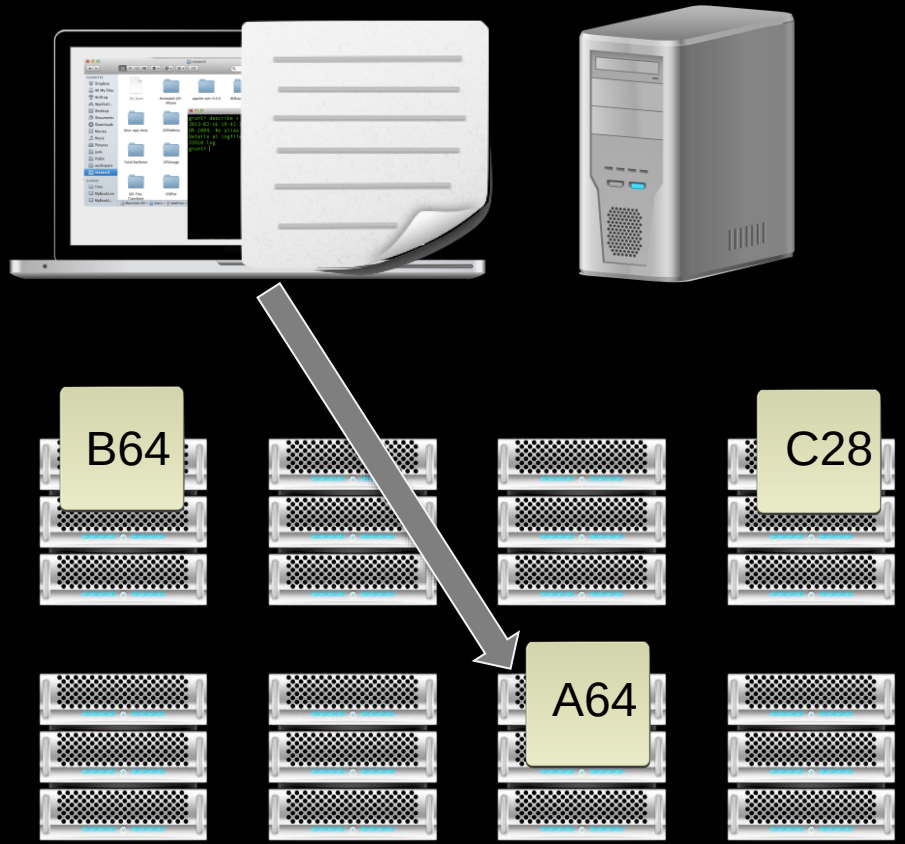

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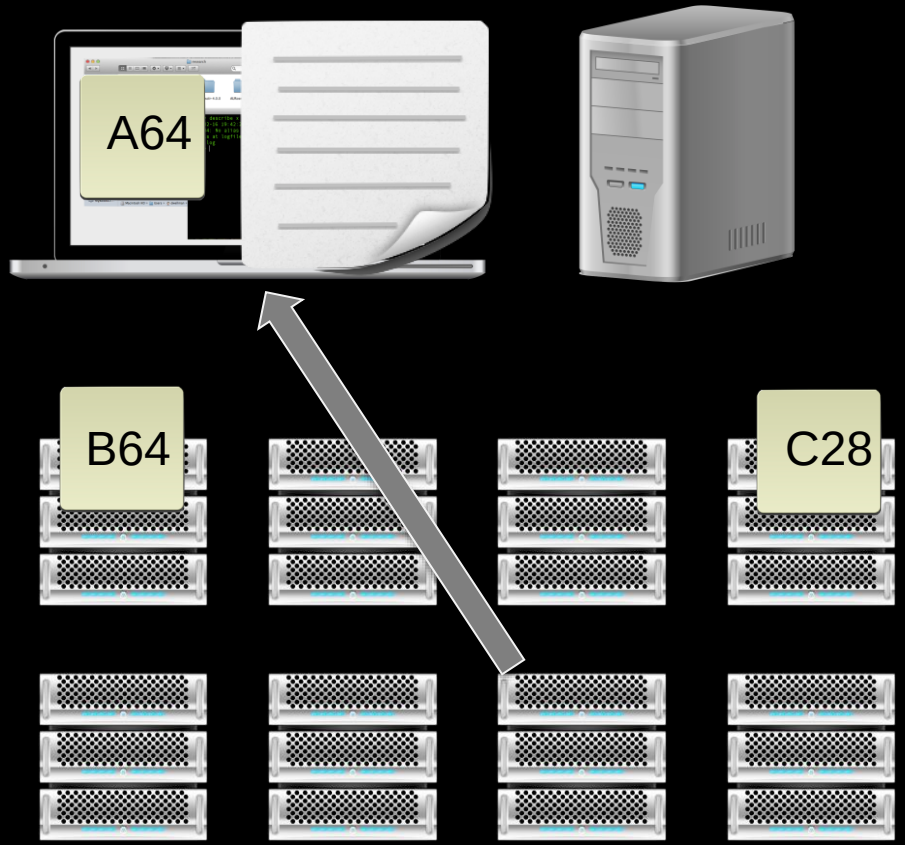

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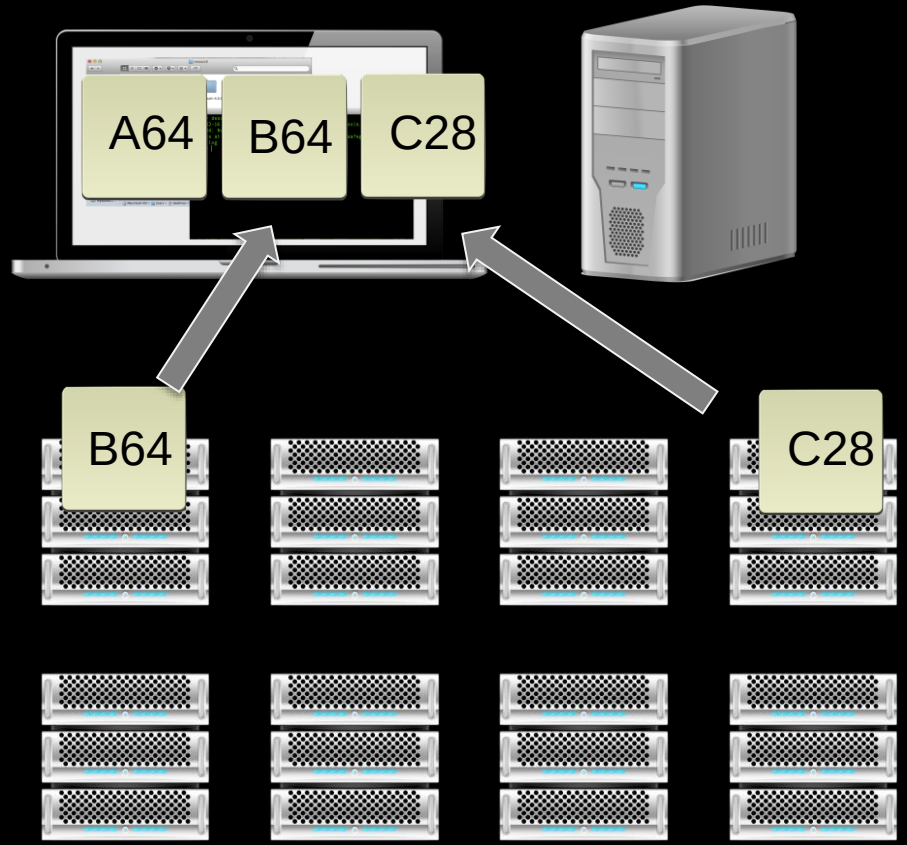
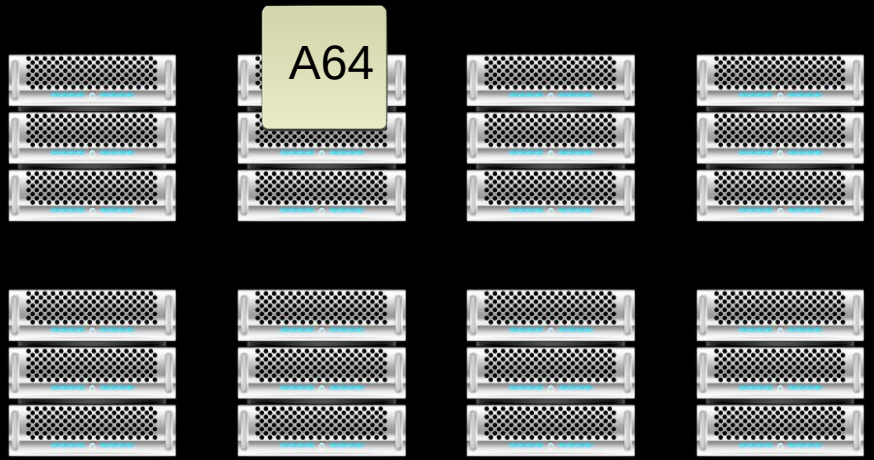
The client moves on to the next block in the sequence until the file has been read.



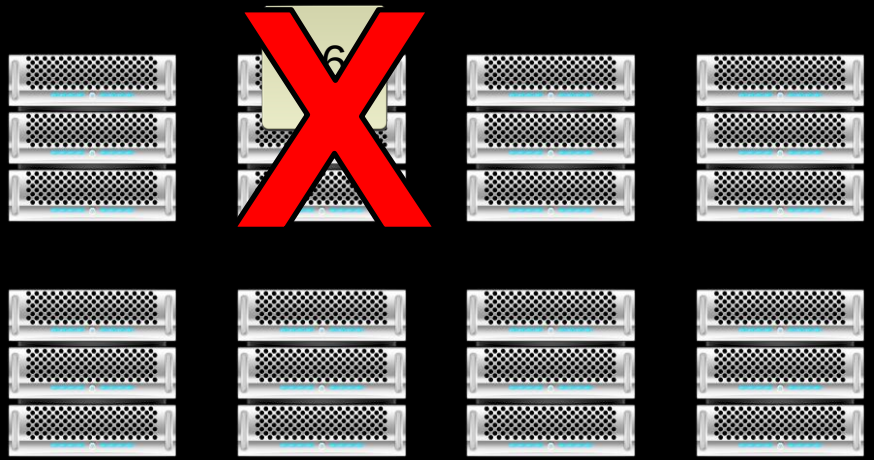
Failure Recovery

A Data Node Fails to “check-in”



A Data Node Fails to “check-in”

After 10 minutes the Name Node gives up on that Data Node.



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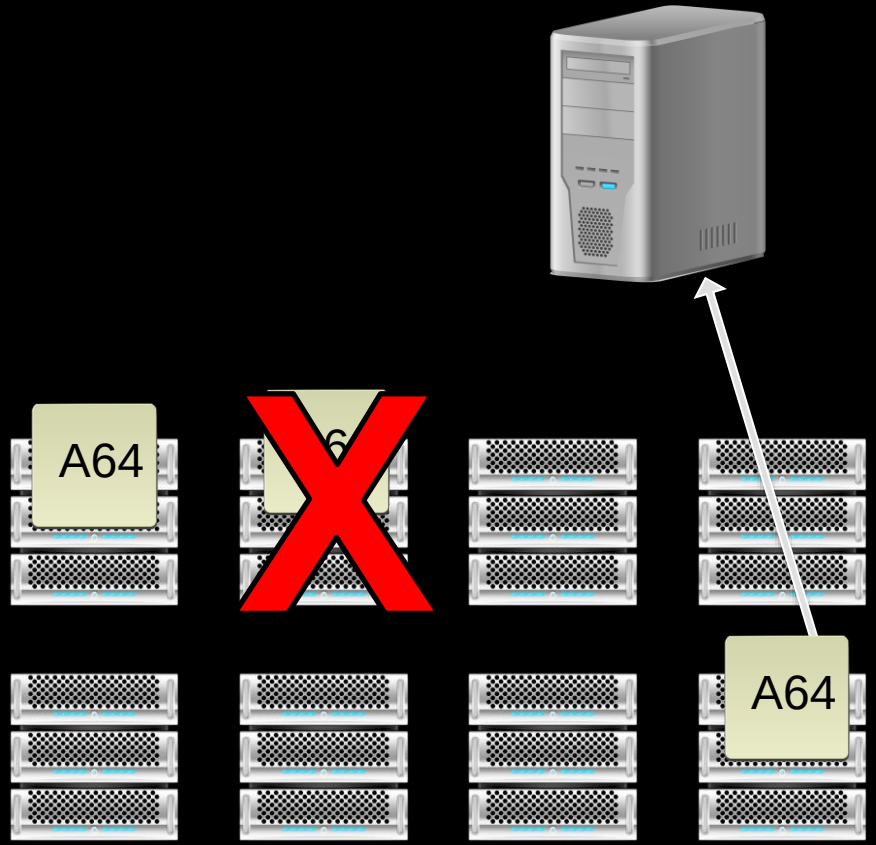

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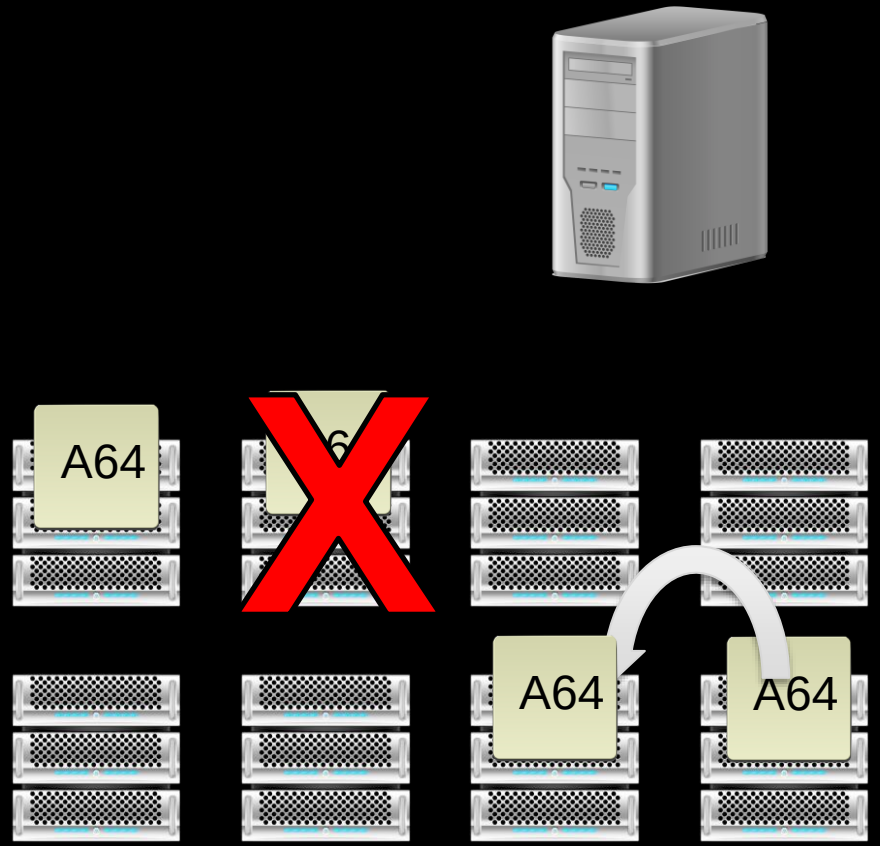
The Data Node replicates that block of data. (Just like a write)



Interacting with Hadoop

HDFS Shell Commands

HDFS Shell Commands.

```
> Hadoop fs –ls <args>
```

Same as unix or osx ls command.

```
/user/hadoop/file1
/user/hadoop/file2
...
```

HDFS Shell Commands.

```
> Hadoop fs –mkdir <path>
```

Creates directories in HDFS using path.

HDFS Shell Commands.

```
> hadoop fs -copyFromLocal <localsrc>
URI
```

Copy a file from your client to HDFS.

Similar to `put` command, except that the source is restricted to a local file reference.

HDFS Shell Commands.

```
> hadoop fs -cat <path>
```

Copies source paths to stdout.

HDFS Shell Commands.

```
> hadoop fs -copyToLocal URI
<localdst>
```

Copy a file from HDFS to your client.

Similar to `get` command, except that the destination is restricted to a local file reference.

HDFS Shell Commands.

```
cat
chgrp
chmod
chown
copyFromLocal
copyToLocal
cp
du
dus
expunge
get
getmerge
ls
lsr
mkdir
movefromLocal
mv
put
rm
rmr
setrep
stat
tail
test
text
touchz
```