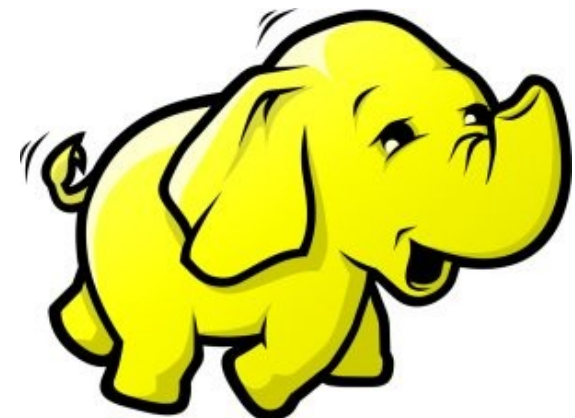# HDFS 簡介
Introduction to Hadoop Distributed File System

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What is HDFS ??
什麼是 *HDFS ??*

- **Hadoop Distributed File System**
  - 實現類似 Google File System 分散式檔案系統
  - Reference from Google File System.
  - 一個易於擴充的分散式檔案系統，目的為對大量資料進行分析
  - A scalable distributed file system for large data analysis .
  - 運作於廉價的普通硬體上，又可以提供容錯功能
  - based on commodity hardware with high fault-tolerant.
  - 給大量的用戶提供總體性能較高的服務
  - It have better overall performance to serve large amount of users.

Features of HDFS ...
HDFS 的特色是 ...

- **硬體錯誤容忍能力   Fault Tolerance**
  - 硬體錯誤是正常而非異常
  - Failure is the norm rather than exception
  - 自動恢復或故障排除
  - automatic recovery or report failure

- **串流式的資料存取   Streaming data access**
  - 批次處理多於用戶交互處理
  - Batch processing rather than interactive user access.
  - 高 Throughput 而非低 Latency
  - High aggregate data bandwidth (throughput)

Features of HDFS ...
HDFS 的特色是 ...

- **大規模資料集 Large data sets and files**
  - 支援 Petabytes 等級的磁碟空間
  - Support Petabytes size

- **一致性模型 Coherency Model**
  - 一次寫入，多次存取 Write-once-read-many
  - 簡化一致性處理問題 This assumption simplifies coherency

- **在地運算 Data Locality**
  - 到資料的節點上計算 **>** 將資料從遠端複製過來計算
  - "move compute to data" > "move data to compute"

- **異質平台移植性 Heterogeneous**
  - 即使硬體不同也可移植、擴充
  - HDFS could be deployed on different hardware

How HDFS manage data ...
HDFS 如何管理資料 ...

HDFS Architecture
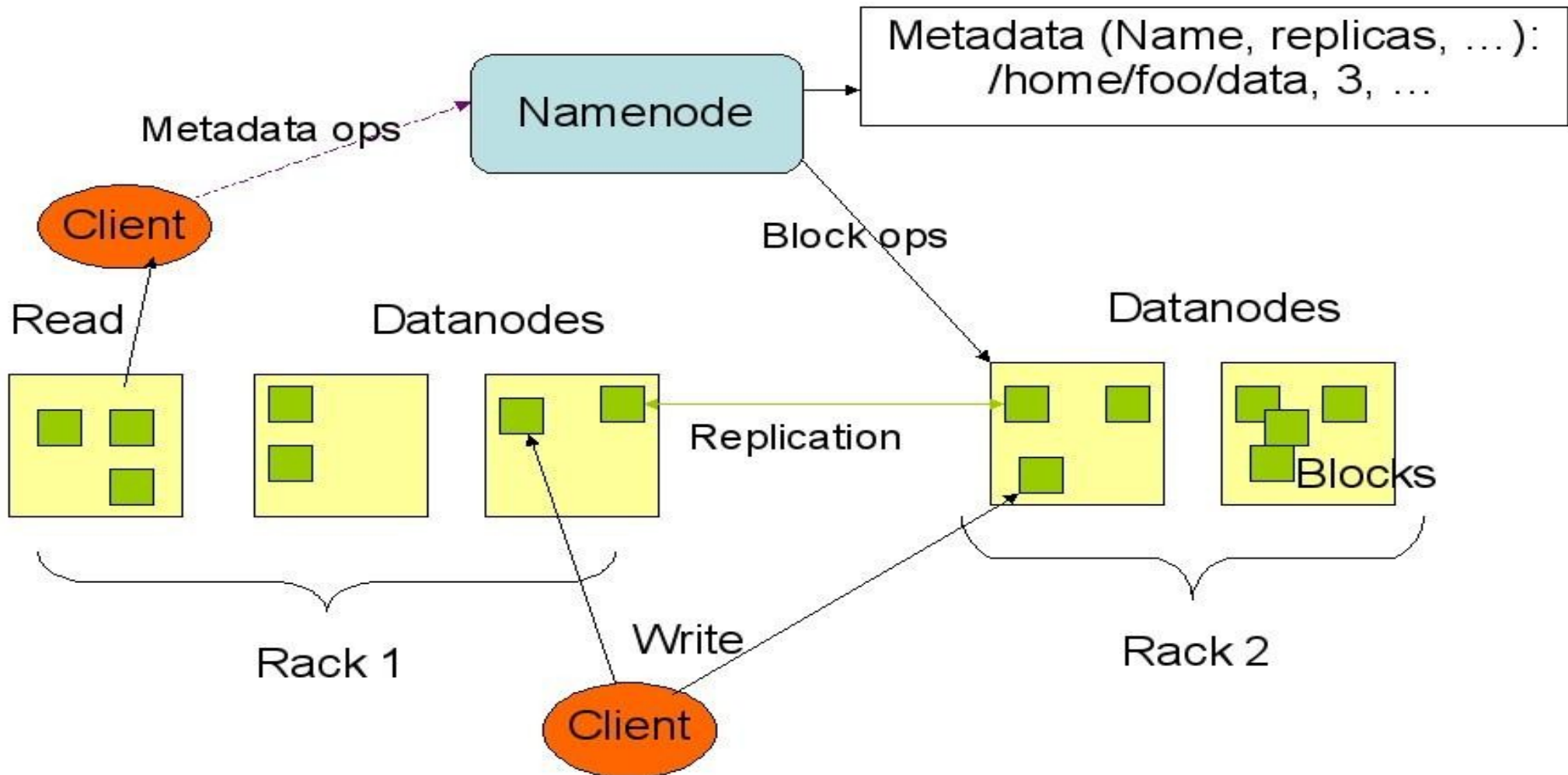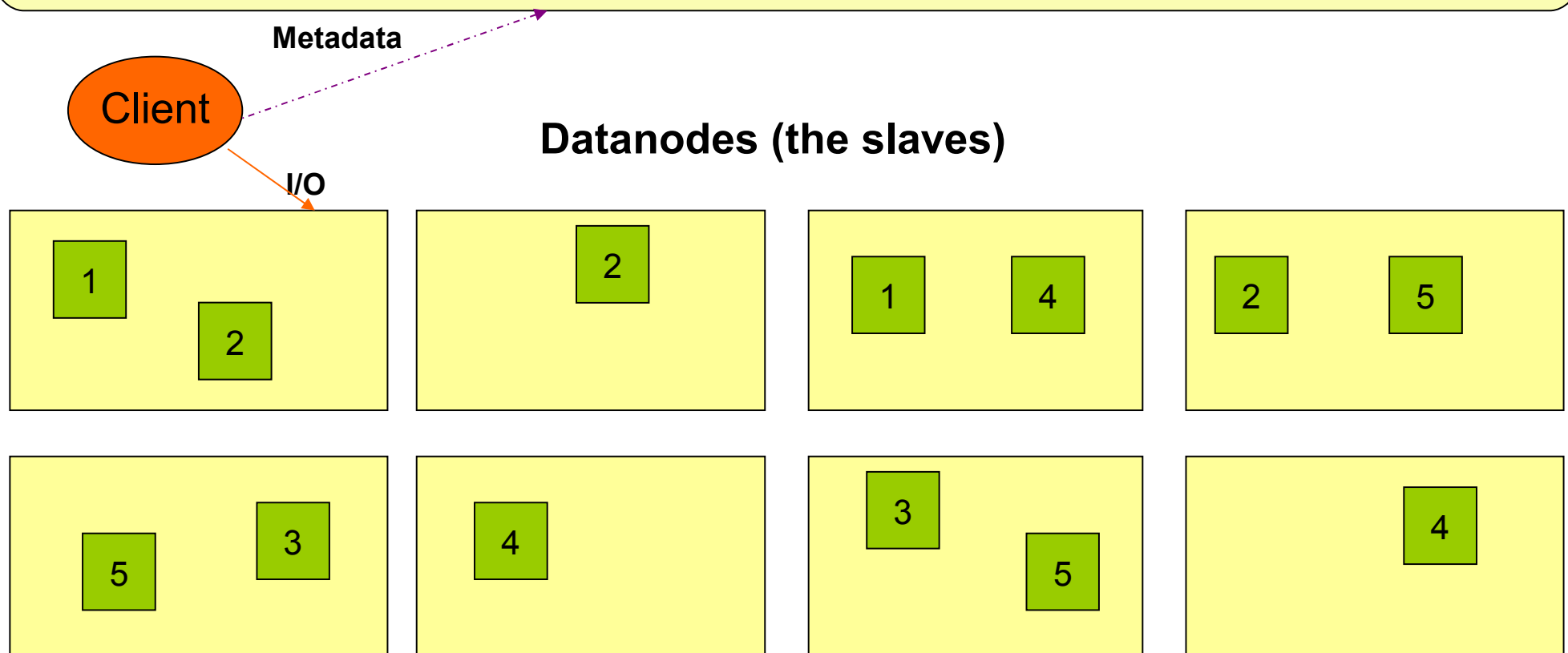
How does HDFS work ...
HDFS 如何運作 ...

Namenode (the master)

Path and Filename – Replication , blocks
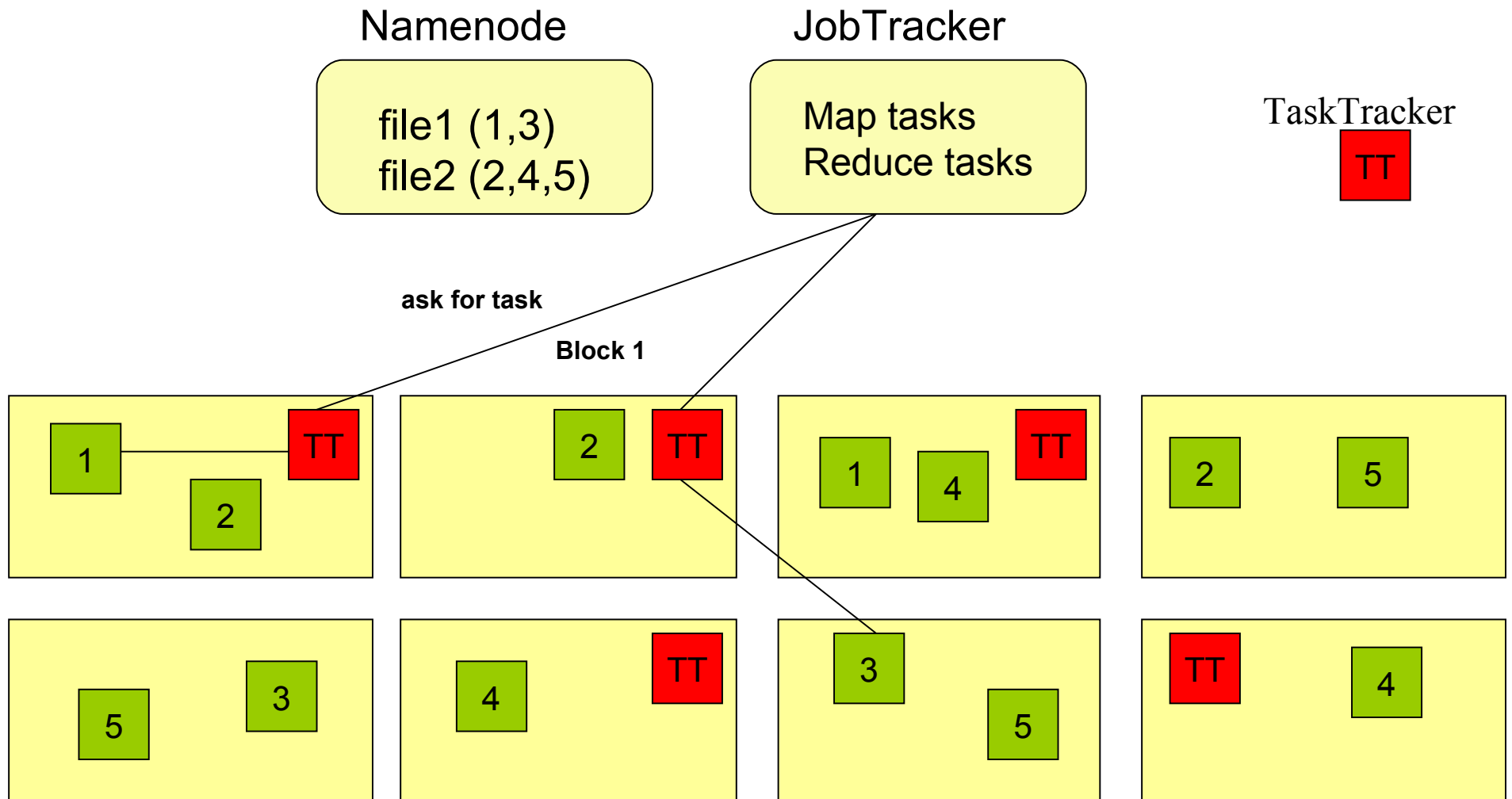
name:/users/joeYahoo/myFile - copies:2, blocks:{1,3}
name:/users/bobYahoo/someData.gzip, copies:3, blocks:{2,4,5}

Metadata

Client

I/O

Datanodes (the slaves)

About Data locality ...
HDFS 如何達成在地運算 ...

- Increase reliability and read bandwidth
  - robustness ： read replication while found any failure
  - High read bandwith ： distribute read （ but increase write bottlenet ）

Namenode

file1 (1,3)
file2 (2,4,5)

JobTracker

Map tasks
Reduce tasks

TaskTracker
TT

ask for task

Block 1

About Fault Tolerance ...
HDFS 如何達成容錯機制 ...

資料崩毀 Data Corrupt
網路或資料 節點失效 Network Fault DataNode Fault
名稱節點錯誤 NameNode Fault

- 資料完整性 Data integrity
  - checked with CRC32
  - 用副本取代出錯資料
  - Replcae corrupt block with replication one
- Heartbeat
  - Datanode send heartbeat to Namenode
- Metadata
  - FSImage 、 Editlog 為核心印象檔及日誌檔
  - FSImage – core file system mapping image
  - Editlog – like. SQL transaction log
  - 多份儲存，當名稱節點故障時可以手動復原
  - Multiple backups of FSImage and Editlog
  - Manually recovery while NameNode Fault

- **檔案一致性機制 Coherency model of files**
  - 刪除檔案＼新增寫入檔案＼讀取檔案皆由名稱節點負責
  - NameNode handle the operation of write, read and delete.
- **巨量空間及效能機制 Large Data Set and Performance**
  - 預設每個區塊大小以 64MB 為單位
  - By default, the block size is 64MB
  - 大區塊可提高存取效率
  - Bigger block size will enhance read performance
  - 檔案有可能大過一顆磁碟
  - Single file stored on HDFS might be larger than single physical disk of DataNode.
  - 區塊均勻散佈各節點以分散讀取流量
  - Fully distributed blocks increase throughput of reading.

POSIX like HDFS commands
與 POSIX 相似的操作指令 ...

```
jazz@hadoop:~$ hadoop fs
Usage: java FsShell
           [-ls <path>]
           [-lsr <path>]
           [-du <path>]
           [-dus <path>]
           [-count[-q] <path>]
           [-mv <src> <dst>]
           [-cp <src> <dst>]
           [-rm <path>]
           [-rmr <path>]
           [-expunge]
           [-put <localsrc> ... <dst>]
           [-copyFromLocal <localsrc> ... <dst>]
           [-moveFromLocal <localsrc> ... <dst>]
           [-get [-ignoreCrc] [-crc] <src> <localdst>]
           [-getmerge <src> <localdst> [addnl]]
           [-cat <src>]
           [-text <src>]
           [-copyToLocal [-ignoreCrc] [-crc] <src> <localdst>]
           [-moveToLocal [-crc] <src> <localdst>]
           [-mkdir <path>]
           [-setrep [-R] [-w] <rep> <path/file>]
           [-touchz <path>]
           [-test -[ezd] <path>]
           [-stat [format] <path>]
           [-tail [-f] <file>]
           [-chmod [-R] <MODE[,MODE]... | OCTALMODE> PATH...]
           [-chown [-R] [OWNER][:[GROUP]] PATH...]
           [-chgrp [-R] GROUP PATH...]
           [-help [cmd]]
```

Questions?

Slides - http://trac.nchc.org.tw/cloud

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