(d) 三次考试中，如果没有请假旷考一次以及以上的，取消第四个月项目，以及重新听的资格。

(6) 学号申请：联系admin@laioffer.com

注意事项：三次考试中，如果有没有请假旷考一次以及以上的，取消重新听的资格。

Class 26 System Design 1

System/Solution/Product Design

E.g.:
Design a Twitter?
Design a Uber?
Design a short URL service?

1. Learn the correct design steps (e.g., Use case → Functionality → Architecture → ....)
2. Preparation:
   1) Basic database/network/OS knowledge
   2) **Basic knowledge about systems in practice**

Topics we will cover:

1. Storage
2. Computation
3. Web Applications

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Data Center

-- Cluster

(-- Rack)

-- Node/Server (节点)

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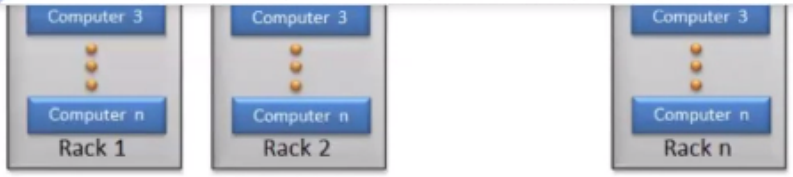


Distributed File System

1) Use file system interfaces to manage your data (files and directories)
2) Data is distributed in many machines
3) Examples: GFS (Google FileSystem), HDFS, Ceph FS, GlusterFS, MapR FS…
4) **When to use a DFS?**

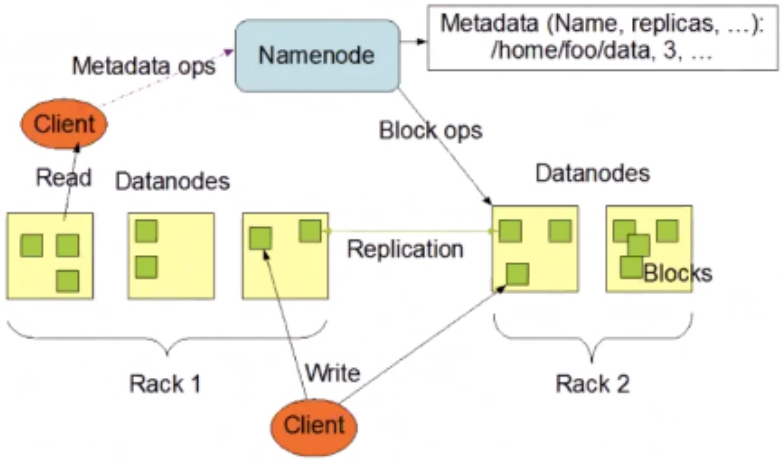
Example: Hadoop Distributed File System (HDFS)

I. Key features/assumptions

1. Scale up to **100+ PB** of storage and a single cluster of **several thousand servers**, supporting close to **a billion files and blocks**
2. Designed to run on **commodity hardware**
    a. Some components of HDFS is always non-functional

II. Architecture

HDFS Architecture



(http://hadoop.apache.org/docs/current/hadoop-project-dist/hadoop-hdfs/HdfsDesign.html)

Two roles:

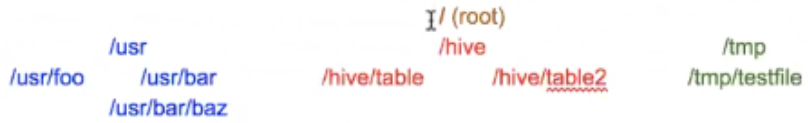
Master Node (NameNode in HDFS): manages file system's metadata (loaded into memory when it is serving)

Slave Nodes (DataNode in HDFS): stores the real data (persisted on disk)

From 1705105 shunxian cai to E...
1

(http://hadoop.apache.org/docs/current/hadoop-project-dist/hadoop-hdfs/HdfsDesign.html)

Two roles:
Master Node (NameNode in HDFS): manages file system's metadata (loaded into memory when it is serving)
Slave Nodes (DataNode in HDFS): stores the real data (persisted on disk)
1) How to serve as a File System?
In Master Node (NN):
Files and directories are represented on the NameNode by **inodes**. INodes record attributes like permissions, modification and access times, or namespace and disk space quotas.
Files/Directories organized as a **tree**:



But we cannot store real data in NN!

The file content is split into **blocks** (typically 128 megabytes), and each block is independently **replicated** at multiple DataNodes.
/users/sameerp/data/part-1 (1GB):
| block 1 (128MB) | block 2 (128MB) | .... | block 8 (128MB) |

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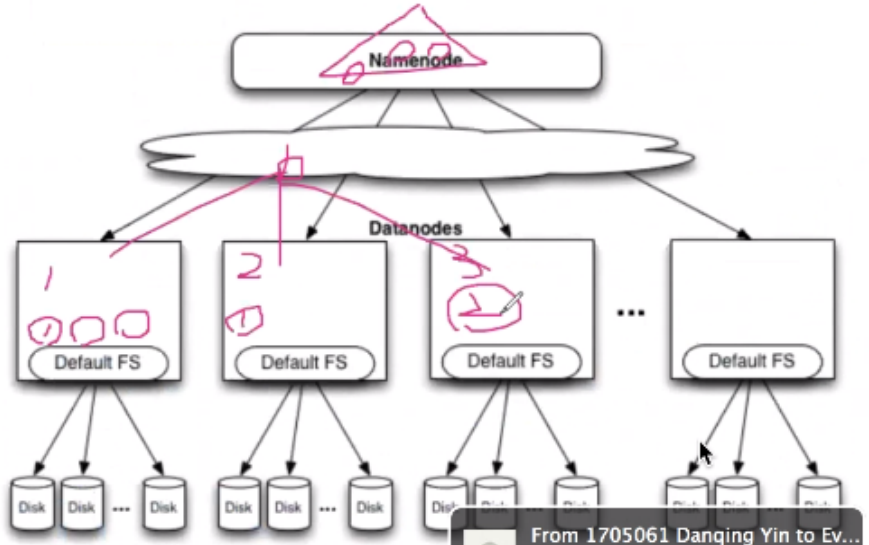

(https://developers.seagate.com)

From 1705061 Danqing Yin to Ev...
不care block里面到底是啥?

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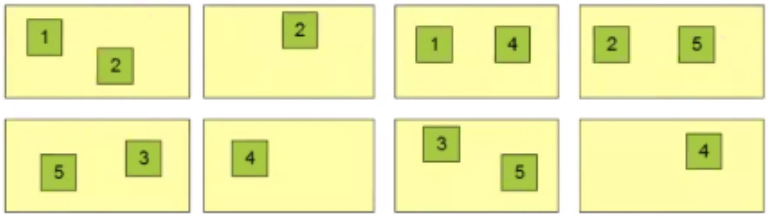
Block Replication:

Block Replication

Namenode (Filename, numReplicas, block-ids, ...)
/users/sameerp/data/part-0, r:2, {1,3},
/users/sameerp/data/part-1, r:3, {2,4,5}, ...

Datanodes



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(https://hadoop.apache.org/docs/current/hadoop-project-dist/hadoop-hdfs/HdfsDesign.html)

How to locate these blocks:

NN stores the **mapping** of blocks to DataNodes, and keep updating the mapping to guarantee its correctness.

1) what data structure for the block--DN mapping?
2) NN tracks the location of new blocks
3) NN monitors the health of datanodes (heartbeat from datanodes to namenode)

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