On-demand File Caching with GlusterFS

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Agenda

- This is an entry level Development talk
  - Different approach using Gluster components
- Problem
  - Investigation experiments
- Where Gluster fits in
  - Current and Future scenarios
  - Fops overview
- Gluster observations and some issues
  - Examples

Problem statement

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- Problems:
  - Is it still relevant to use additional nodes to analyze data faster?
  - How **applications** accessing data through the DFSs at LAN/**WAN** levels are **impacted**?
  - Should **locality** be considered as a **major concern** to **design a DFS**?

- In summary: **Validate the assumption** about the impact that **metadata/data traffic and latency** have into **wide area** scenarios when **executing parallel applications**.

Investigation through experimentation

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- Investigation method:
  - We conducted experiments with:
    - HDFS and Lustre
    - Different scenarios within **LANs(-)** and **WANs(/)**:
      - CD-M, C-D-M
      - CD/M, C-D/M, CD-M/CD, C-D-M/C, C/D-M
    - Running **3 M/R applications** (grep, writer, sort)
      - Fixed 8GB file size with 16, 32, 64 nodes
      - **Scaled** the file size **8-128GB** with **64 nodes**
    - Main reference measured: **runtime**, among others

Invest. findings

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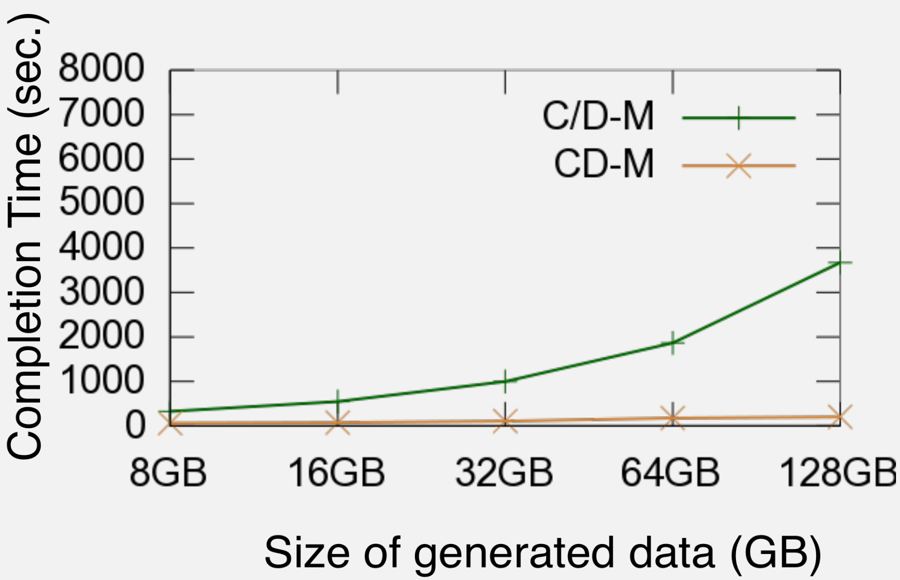
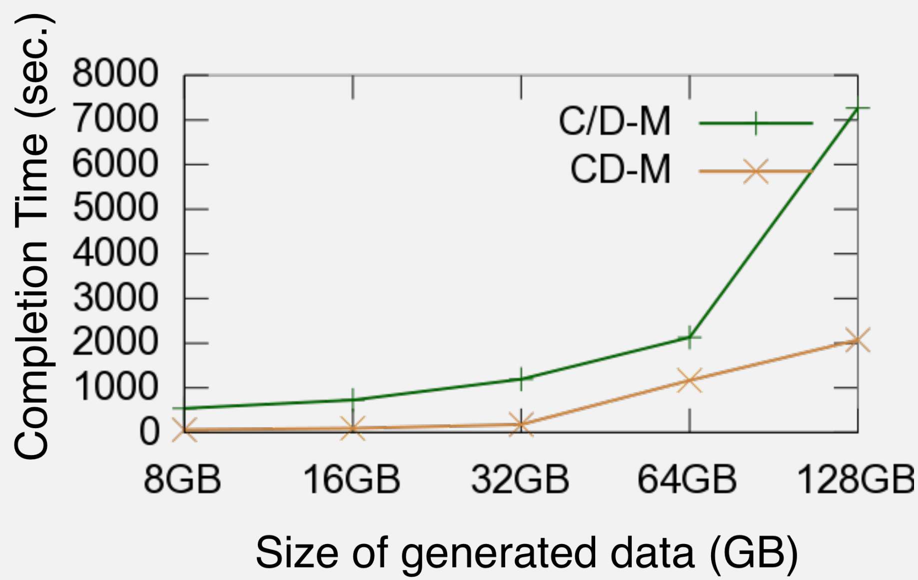
- Exploring **bigger file sizes** with the best and worst scenarios: Sort application



HDFS / Sort



Lustre / Sort

Invest. findings

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- In most cases, accessing data through **WAN** leads to **worse performance** (as expected…)
- It was **better to use less nodes than** trying to **benefit from external WAN ones**
- The completion time for the **local scenarios with 16 nodes** is **similar** to the **WAN** ones using **2x or 4x** more nodes

Current WiP - GBFS

- Use **implicit striping** (propagation according to the access pattern)
  - **Avoiding unsolicited traffic** through local placement
  - Extending it **group-wide** (stripe into the group)

  - Using the **groups** to manage which data is stored locally (WAN, LAN, local node... you name it)
  - Having a persistent and volatile **LRU persistent caching per group.**

What about Gluster?

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- Using some of its translators:
  - **Posix + Server** translators as backend
  - **GBFS + Client** translators at the “client” side.

- Peer to peer way, with each node having a server(+brick) and client(s).

- At GBFS, additional info is provided about other subvols at start time as volume “options” (i.e.: groups each one is related to).

What about Gluster?

- Advantages: easy access to other nodes through the subvolumes (masking RPC comms)
- Easy installation over FSs/some DFSs
  - xattr size limits can be problematic
- Translators approach enables a good functionality granularity.

Scenario - phase 1

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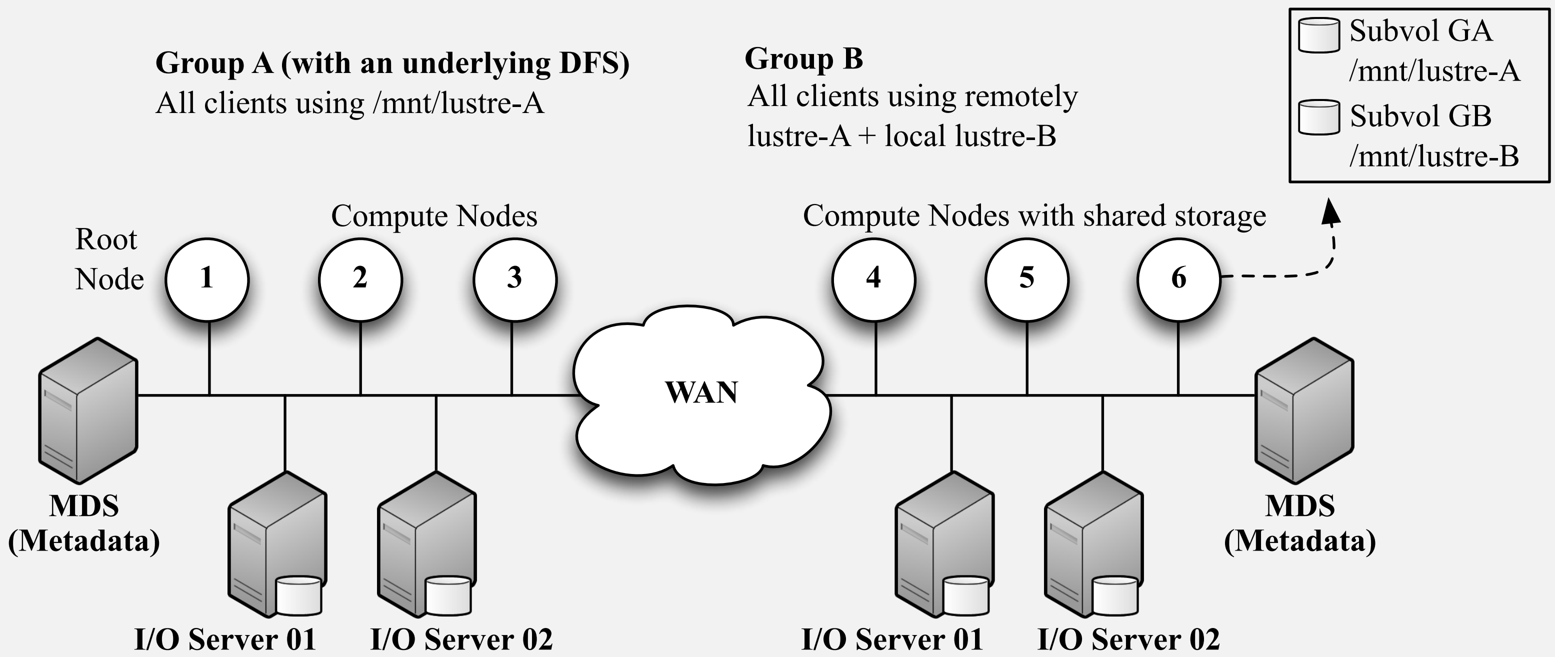
- Local DFSs at each side



1st read from B

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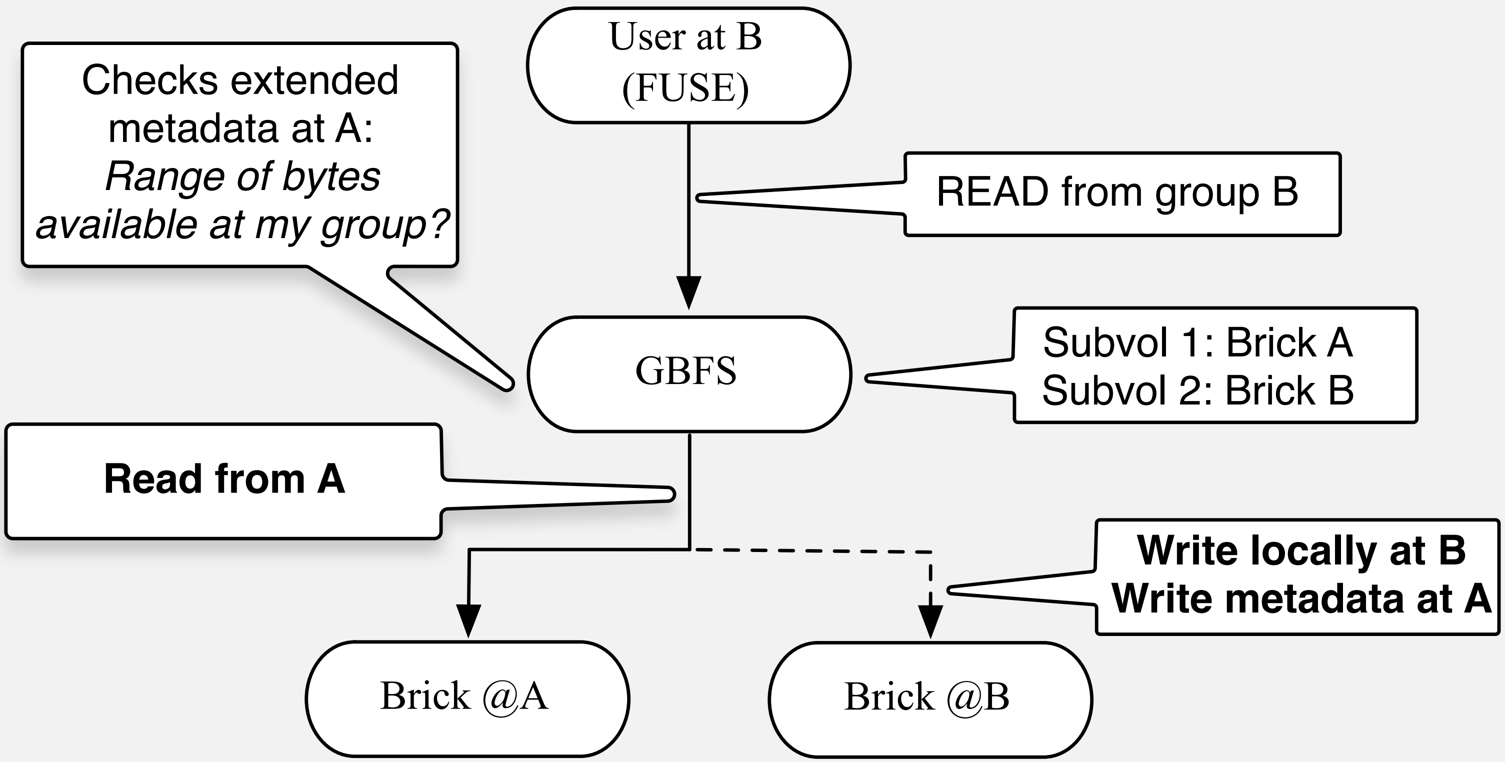
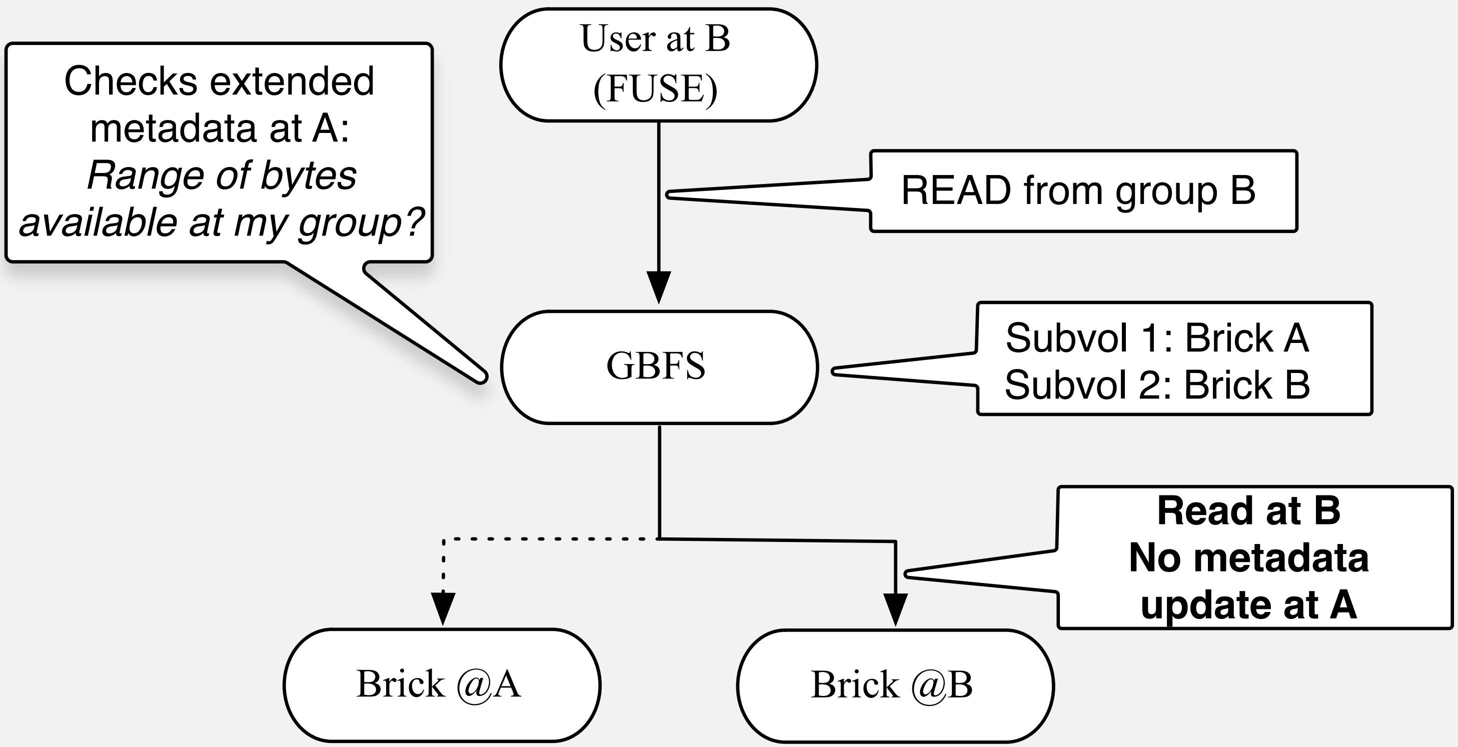


2nd read from B



Write

- Using same GFID, with sparse files
- Testing different algorithms/versions:
  - 1st: write centralized
    + overwrite metadata on write at A
  - 2nd: write locally
    + overwrite local metadata on write
    + **validate** local metadata on read
  - 3rd: write locally
    + **invalidate** metadata on write
- Going from centralized to distributed.

Write example

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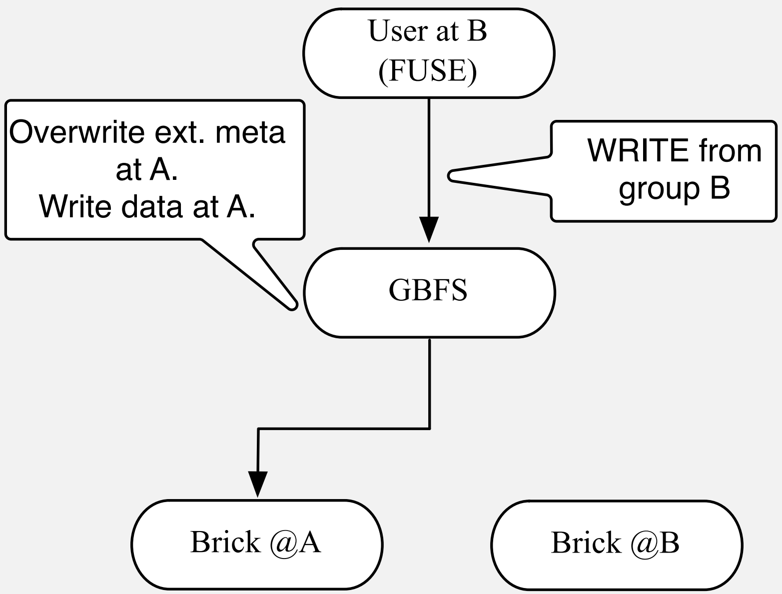
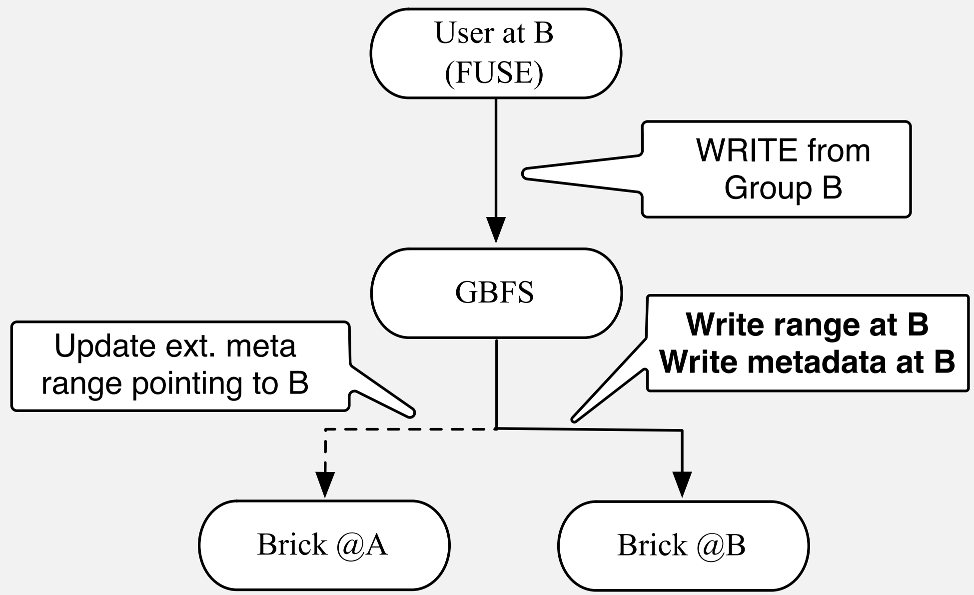
1st simple approach Central write



3rd approach, locally Invalid on write



Scenario - phase 2

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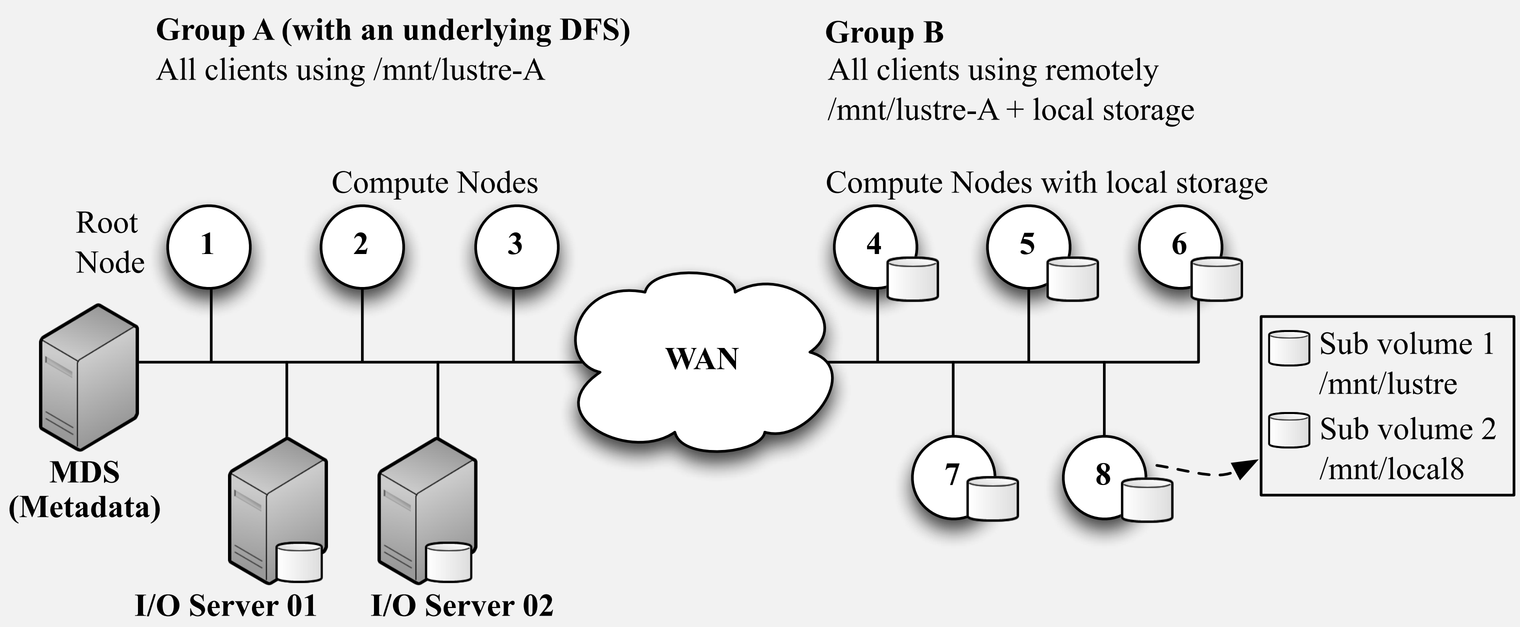
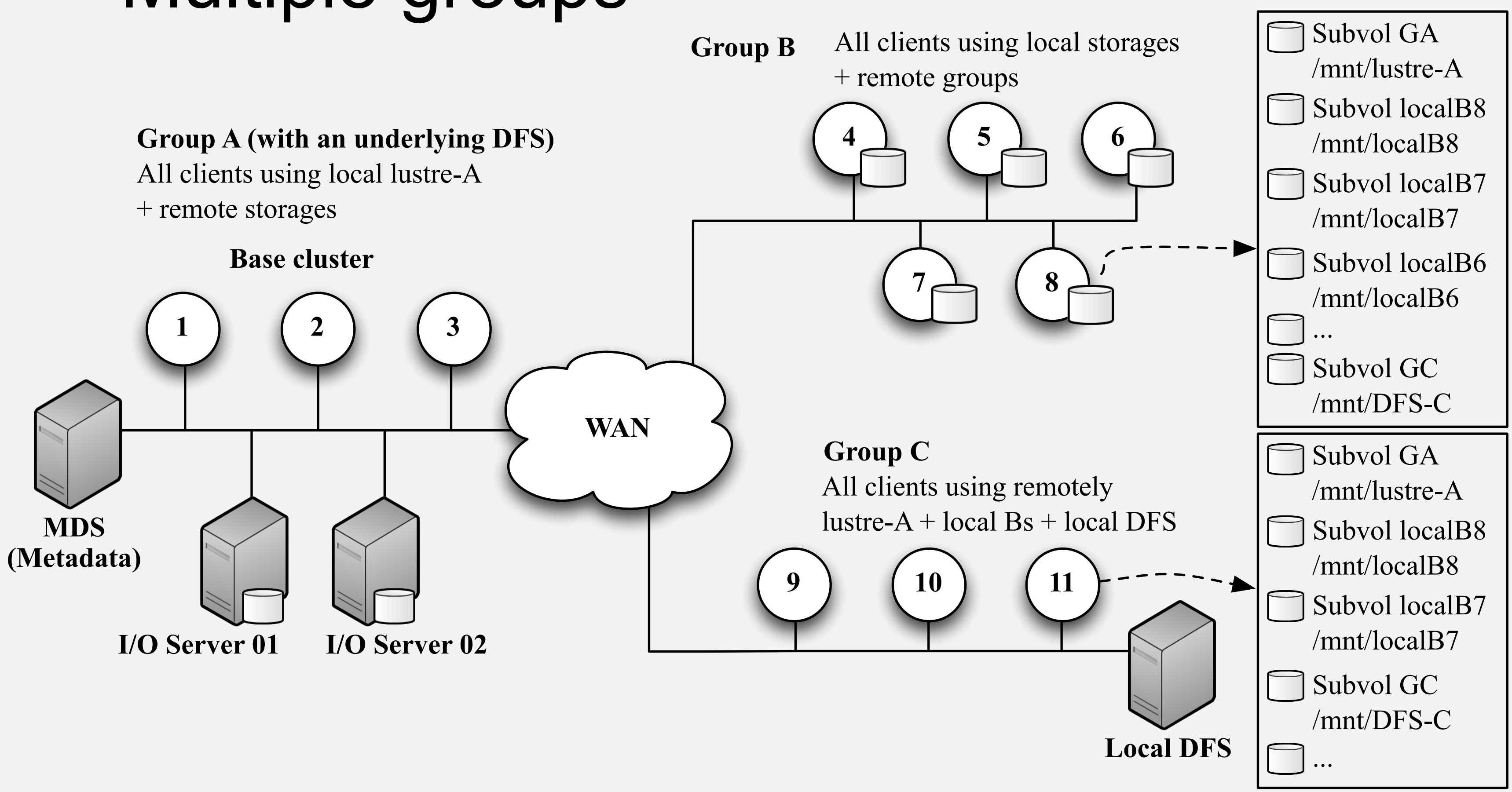
- Local storage at each node (at B)



Bigger group shot

- Multiple groups



Nodes addition on demand - concept

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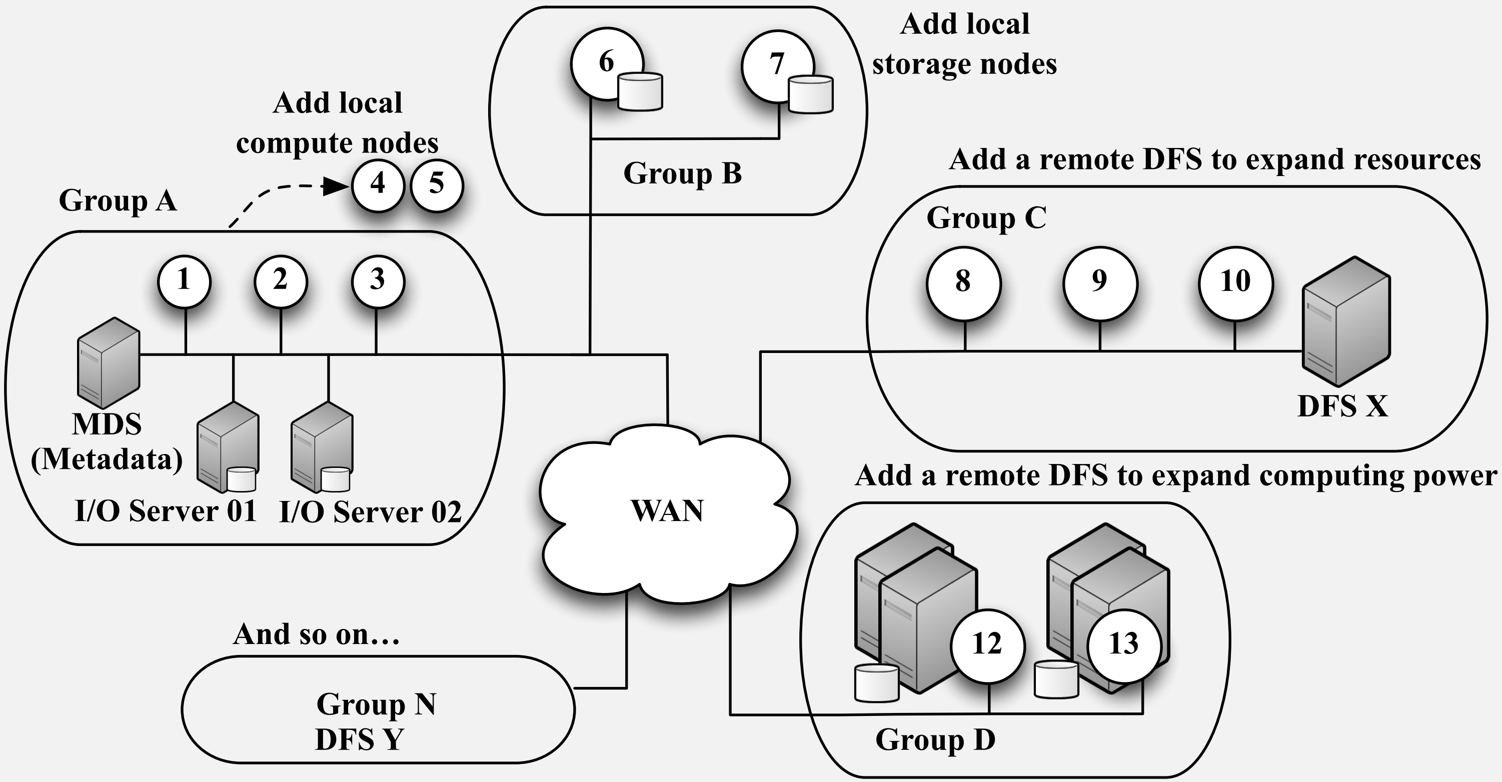
- Having an elastic addition and capacity



Gluster observations

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- More dev documentation would be helpful :)
  - “Translator 101” and “xlator_api_2” posts are very good
  - Main resources are Jeff Darcy blog entries, the gluster-devel list and the IRC.
- Few comments all over the code (as of 3.3 at least)
- Overall architecture of gluster communication protocols, client/server/bricks algorithms, etc.

Gluster observations

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- Complex translators like DHT and AFR details in terms of routines, schemes, comments would be helpful as well.
  - Ex: Algorithm about how each one keeps a unified namespace, for example (overall view).

- Common develop. techniques details can save a lot of time from contributors/new developers.

Common techniques

- fd_ctx and inode_ctx common usage;
- general use of local / private / *_ctx per translator;
- striping techniques used at current code;
- stubs/sync calls (pending at xlator_api_2 :))
- etc...

Common techniques

Example taken from gluster devel-list

--> Syncop flow:

```
read() {
  // pull in other content
  while(want more) {
    syncop_lookup()
    syncop_open()
    syncop_read()
    syncop_close()
  }
  return iovec / UNWIND
}
```

--> WIND / UNWIND flow:

```
read() {
    while(want more) {
      WIND _lookup()
    }
 }

 _lookup_cbk() {
      wind _open()
 }

 _read_lookup_cbk_open_cbk() {
      wind _read()
      add to priv/fd_ctx/local->iovec
 }

_read_lookup_cbk_open_cbk_read_cbk() {
      wind _close()
      UNWIND
 }
```

- Thanks

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