

# The Performance Analysis of Cache Architecture based on Alluxio over Virtualized Infrastructure

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- Background
- Related Works
- Motivation
- Experiments
- Results
- Conclusion
- Future Work

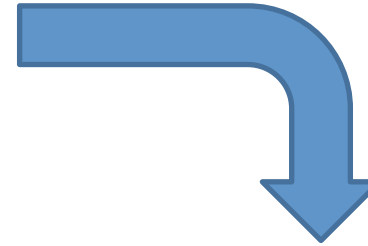
- Cloud Computing
  - Computing as a service
  - Application of resources on demand and payment on demand
- Virtualization
  - Integrates and encapsulates the resources
  - Provide the resource in piece
  - Transparent to users

## Traditional Architecture

Compute Node  
Data Node

Compute Node  
Data Node

Compute Node  
Data Node



## Decoupling vs Traditional

### Advantage:

- **More flexible**
- **Overall cost is reduced**

### Shortcoming:

- **Performance decline**

## Decoupling architecture of computing and storage

### Compute cluster

Compute  
Node

Compute  
Node

Compute  
Node

Internet

### Data Center (Object Storage)

Data Node

Data Node

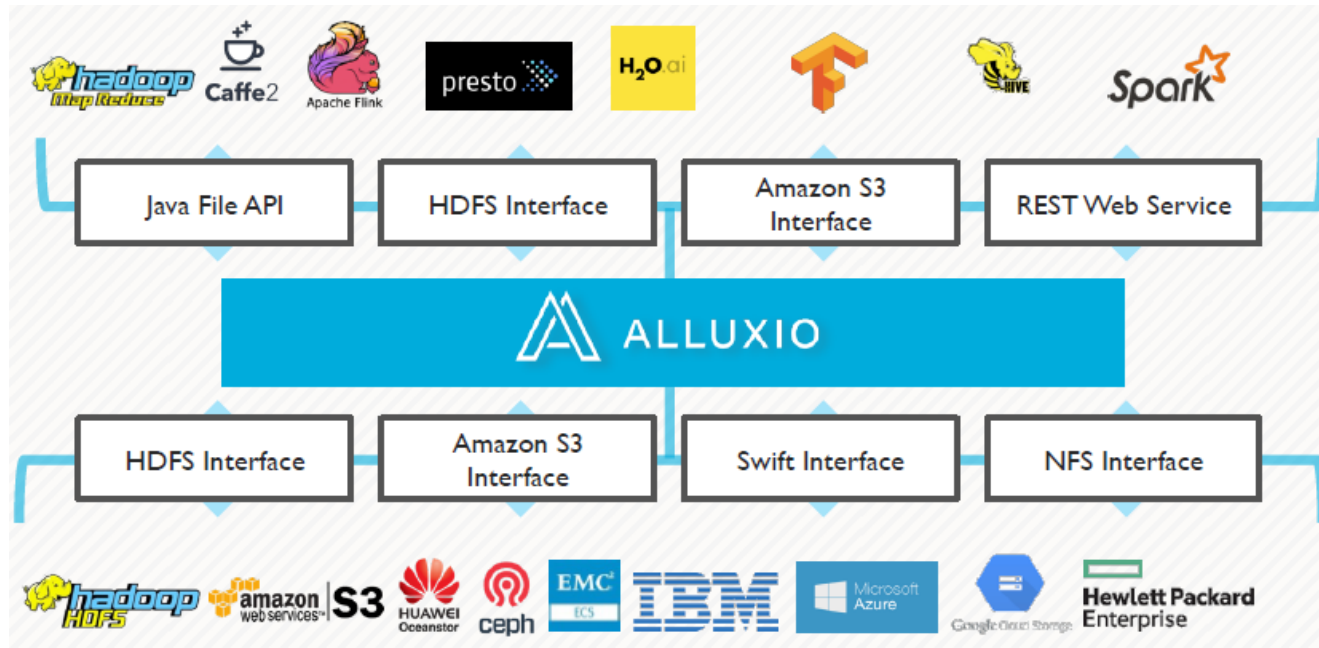
Data Node

For making up the loss of performance

- Traditional optimization method
  - Speed up the shuffle part of jobs with SSDs
  - [kambatla2014truth] [ruan2017improving]
- Reduce the frequency of accessing the object storage
  - Construct the cache layer between applications and object storage
  - [shankar2017performance] [qureshi2014cache]

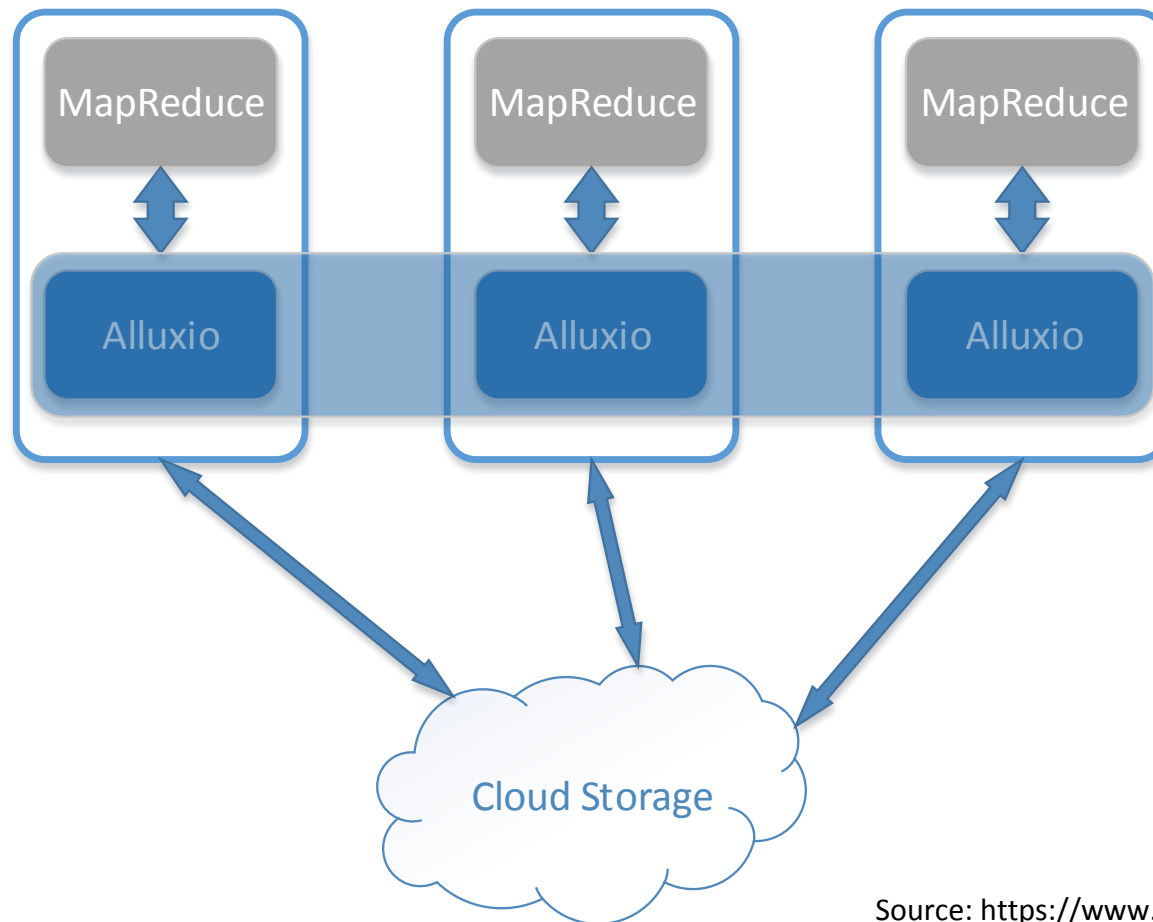
## Alluxio (Tachyon)

- The world's first memory speed virtual distributed storage system
- Resides between computation frameworks and storage systems



- Only concern about performance, do not care about cost
- Cost reduction is critical
- Question:
  - How to design the caching architecture to make the cost performance highest?

## System architecture





## Experimental environment

Experiment 1:

Platform: AWS

Servers: m3.2xlarge \* 4

Object storage: S3

Experiment 2:

Platform: G-Cloud

Servers: 8 cores & 30G  
memory \* 4

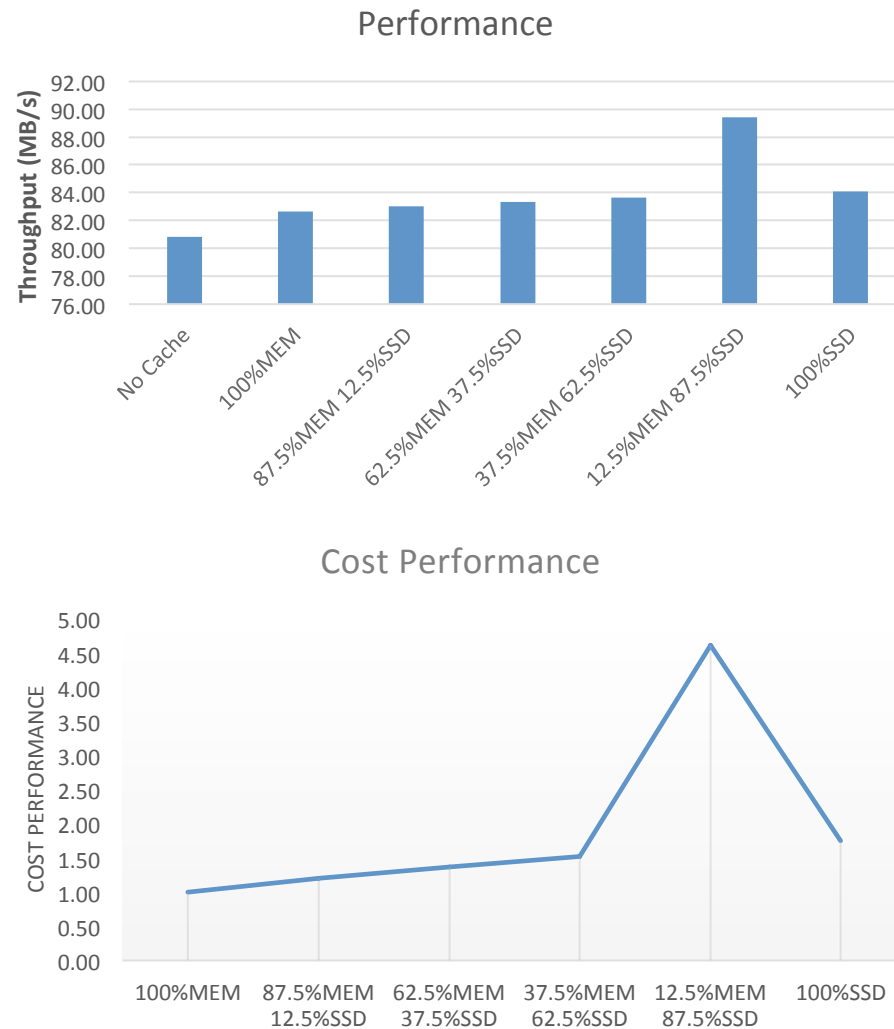
Object storage: Ceph

## Experimental scheme

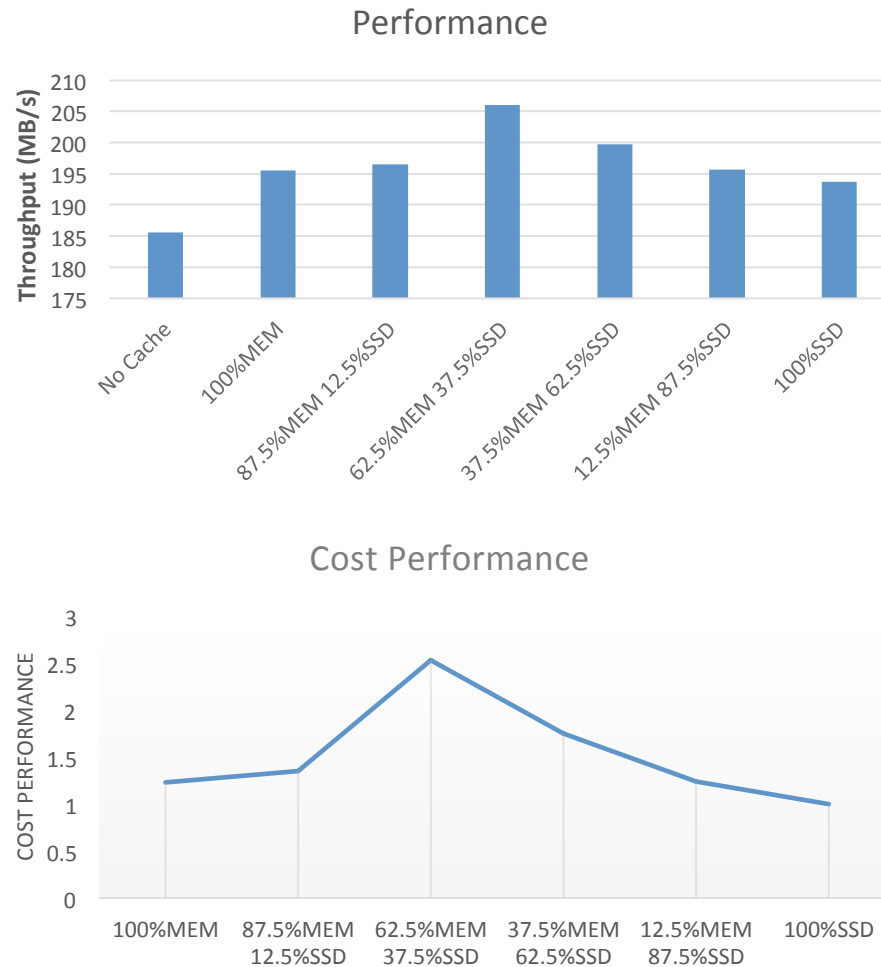
- Experiment 1:
  - Workload: Terasort \* 6
- Experiment 2:
  - Workload: Hive-Join \* 3
- Data Size: 120G
- Cost ratio of memory to SSD

|                 |     |     |     |     |     |     |
|-----------------|-----|-----|-----|-----|-----|-----|
| Memory :<br>SSD | 8:0 | 7:1 | 5:3 | 3:5 | 1:7 | 0:8 |
|-----------------|-----|-----|-----|-----|-----|-----|

## Experimental 1:



## Experimental 2:



- Hybrid cache architecture is recommended.
- For the workload with large size of output and small size of hot data, the cost ratio of memory to SSD in cache should be around 1:7
- For the workload with small size of output and large size of hot data, the cost ratio of memory to SSD in cache should be around 5:3

- Study several aspects that affect the cost performance, and try to give a configuration scheme with the best cost performance
- Increase workload types and application scenarios, so that the conclusion is closer to the real scene and has generality

Q & A

Thanks!



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