On the Design and Implementation of a Simulator for Parallel File System Research

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PFSsim: Features and Essentials

Simulates general parallel file systems (PFSs) with:

- Convenient scheduling algorithm testing model
- High flexibility
- High fidelity

Built upon OMNeT++ simulation platform

- Can be integrated with INET and Disksim.
- Can be enhanced for parallel simulations.

Currently provide read-to-use support for PVFS2

- Lustre, Ceph, PanFS and GPFS will be supported soon.

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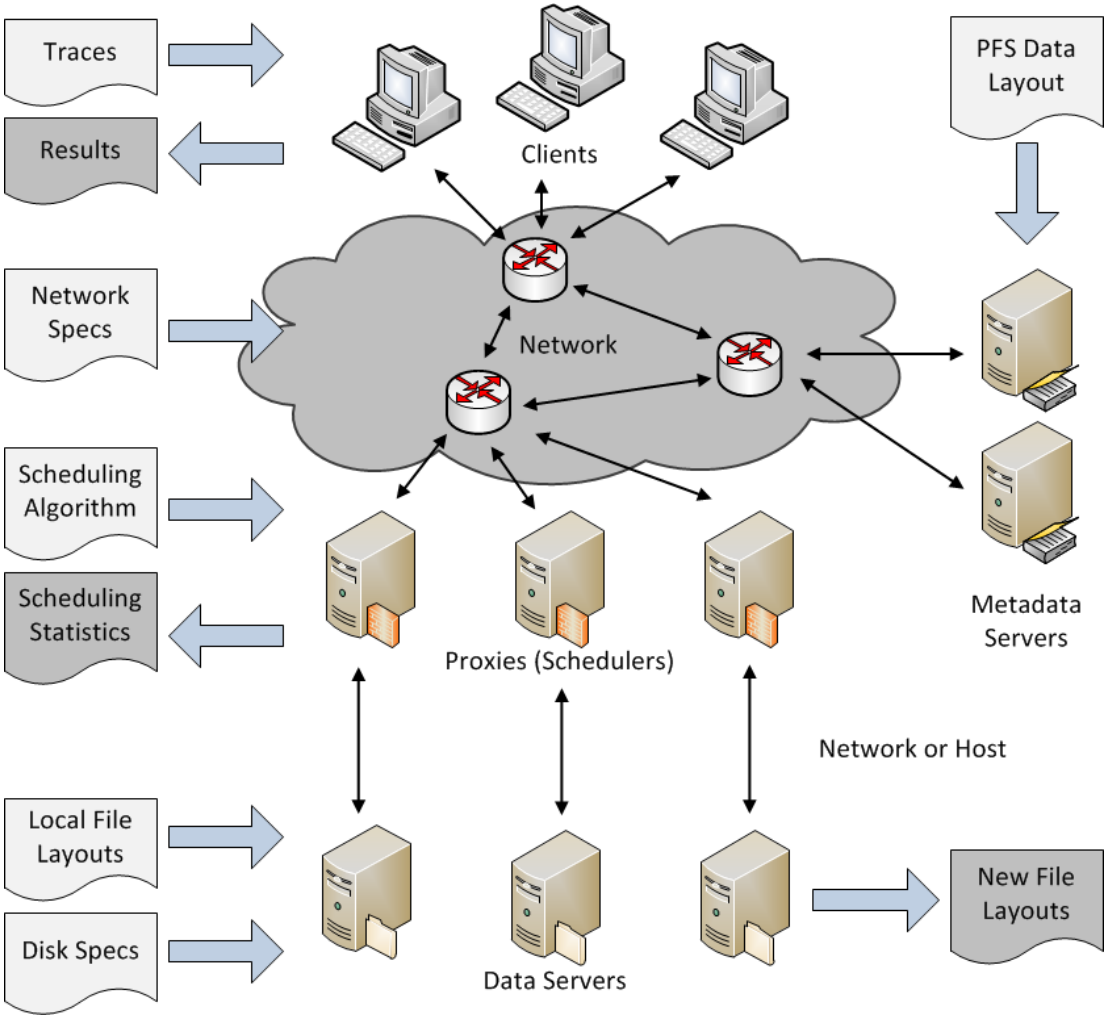
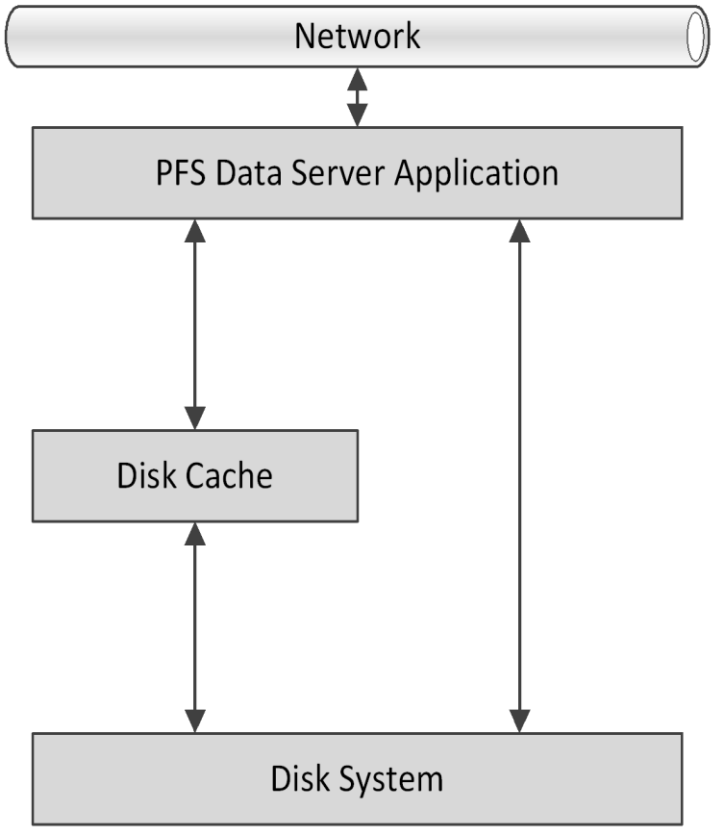
An Example Architecture of PFSsim



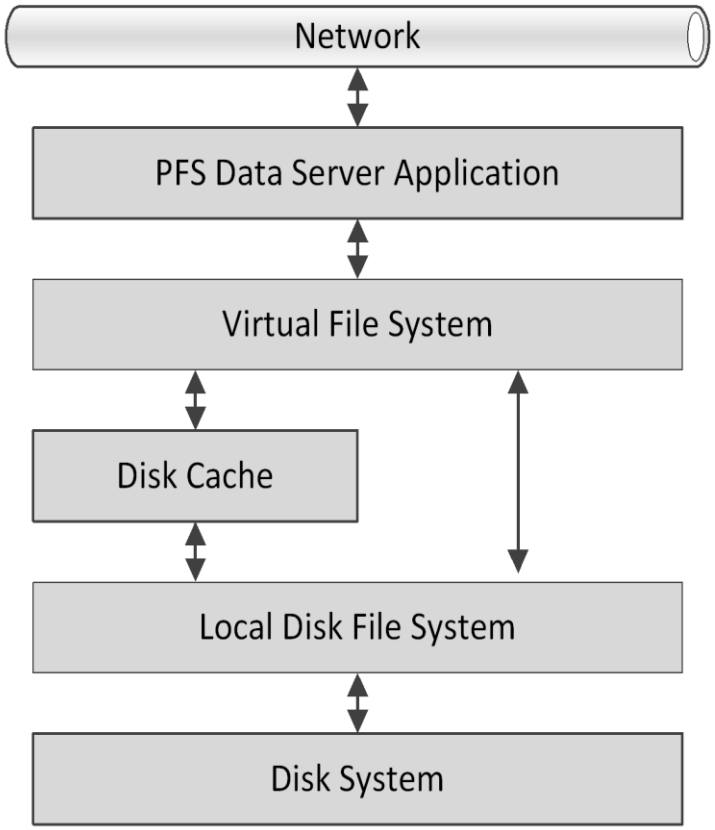
PFS Functionalities & Overheads

Metadata management	Metadata caching, metadata distribution.
Data placement strategy	Data stripe size, data distribution schemes.
Data replication model	Replication scheme, data consistency check.
Data caching policy	Data coherency management.

Data Server Architecture



(a) PFS based on physical disk



(b) PFS based on native FS

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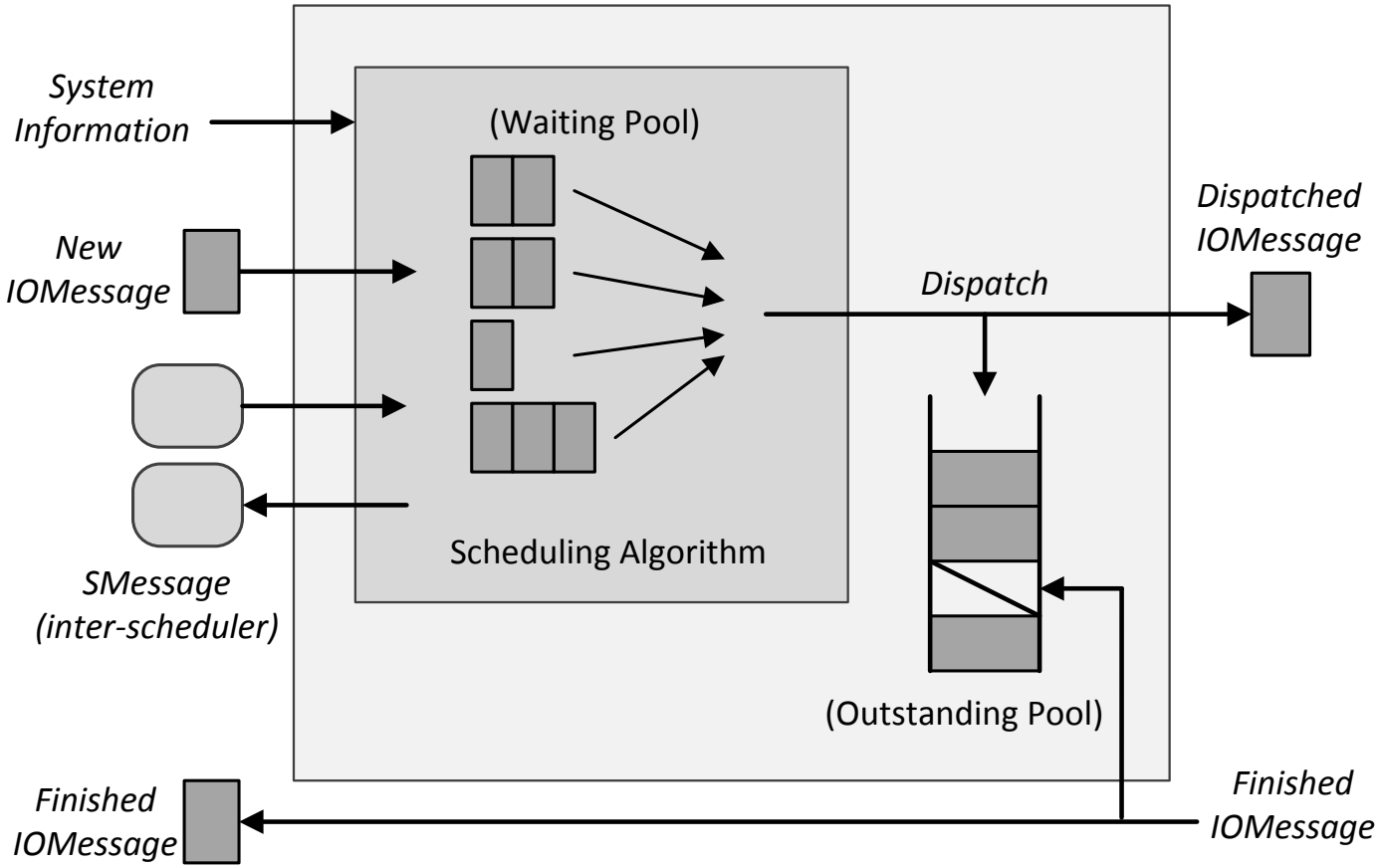
PFSsim Scheduler Framework



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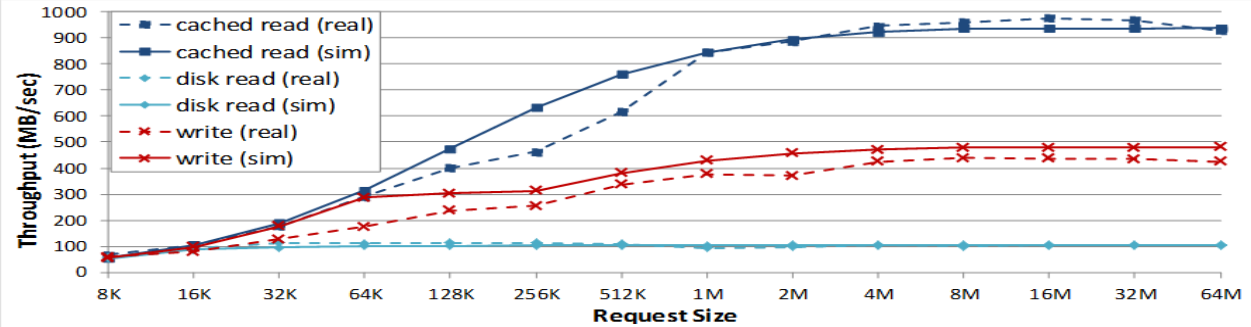
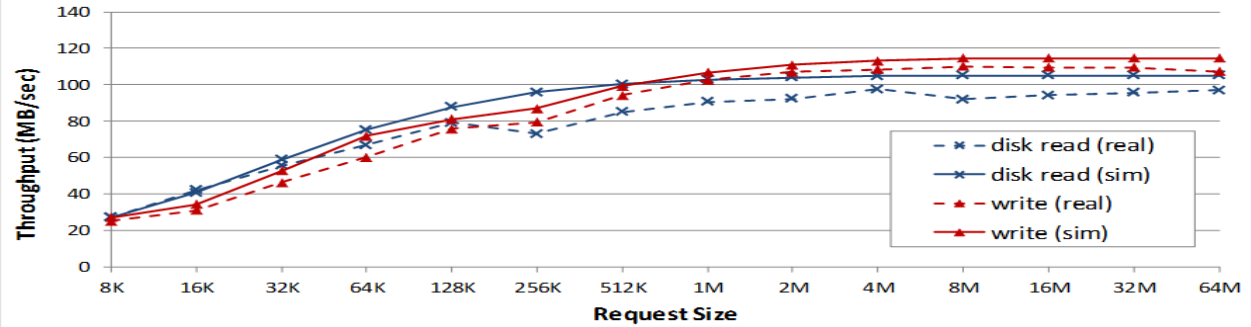
Validations: Single Client to Single Server



Average throughput of local single-server PFS read/write



Average throughput of remote single-server PFS read/write

PVFS2, IOR, 1 data server 1 metadata server and 1 client

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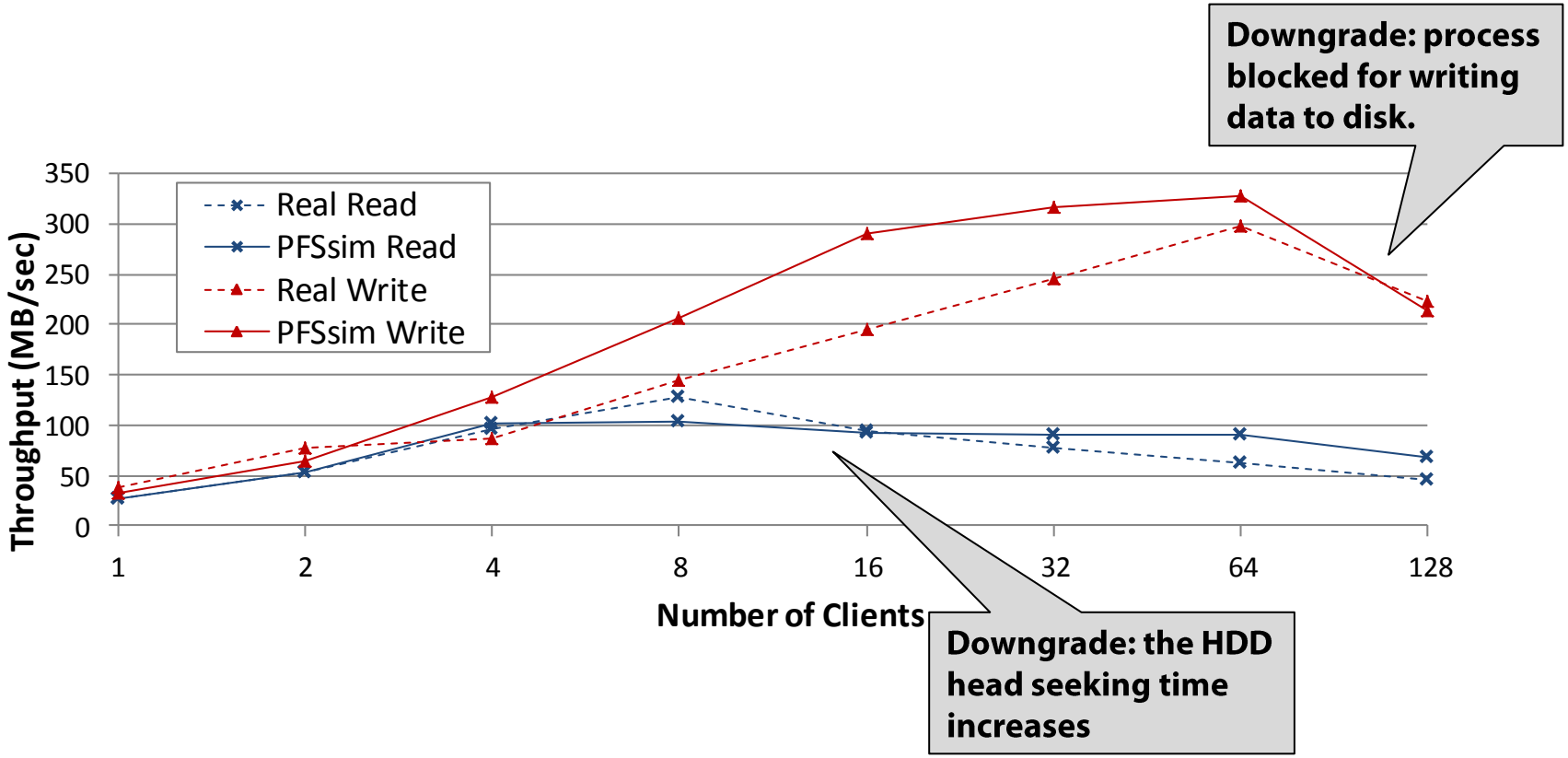
Validation: Multiple Clients to Multiple Servers



8 data servers, 1 metadata server

512MB I/O for each client, sequential access

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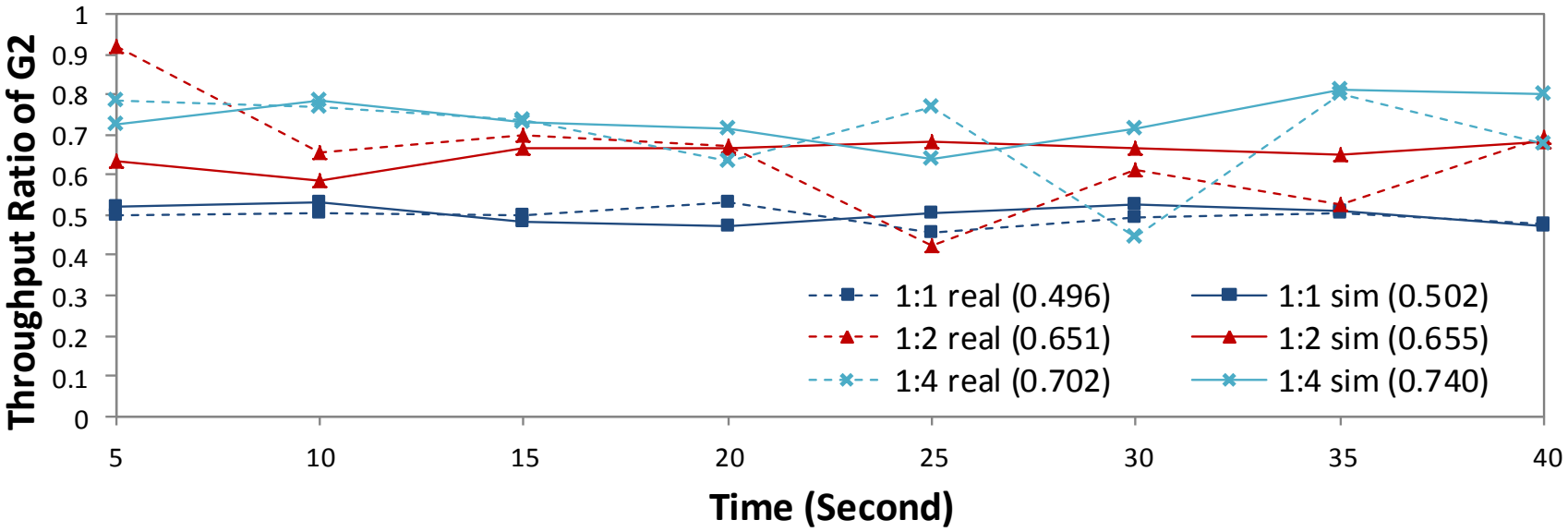
Validation: SFQ(4) I/O Scheduling



Different weight ratios in Start-time First Queueing(4) algorithm

Clients in 2 groups (G1 and G2), each with 16 clients

Schedulers are located on the per-server proxies

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Open Source Code

Code available at github:
www.github.com/myidpt/PFSsim

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Thank you!

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