Grid Data Service Simulator

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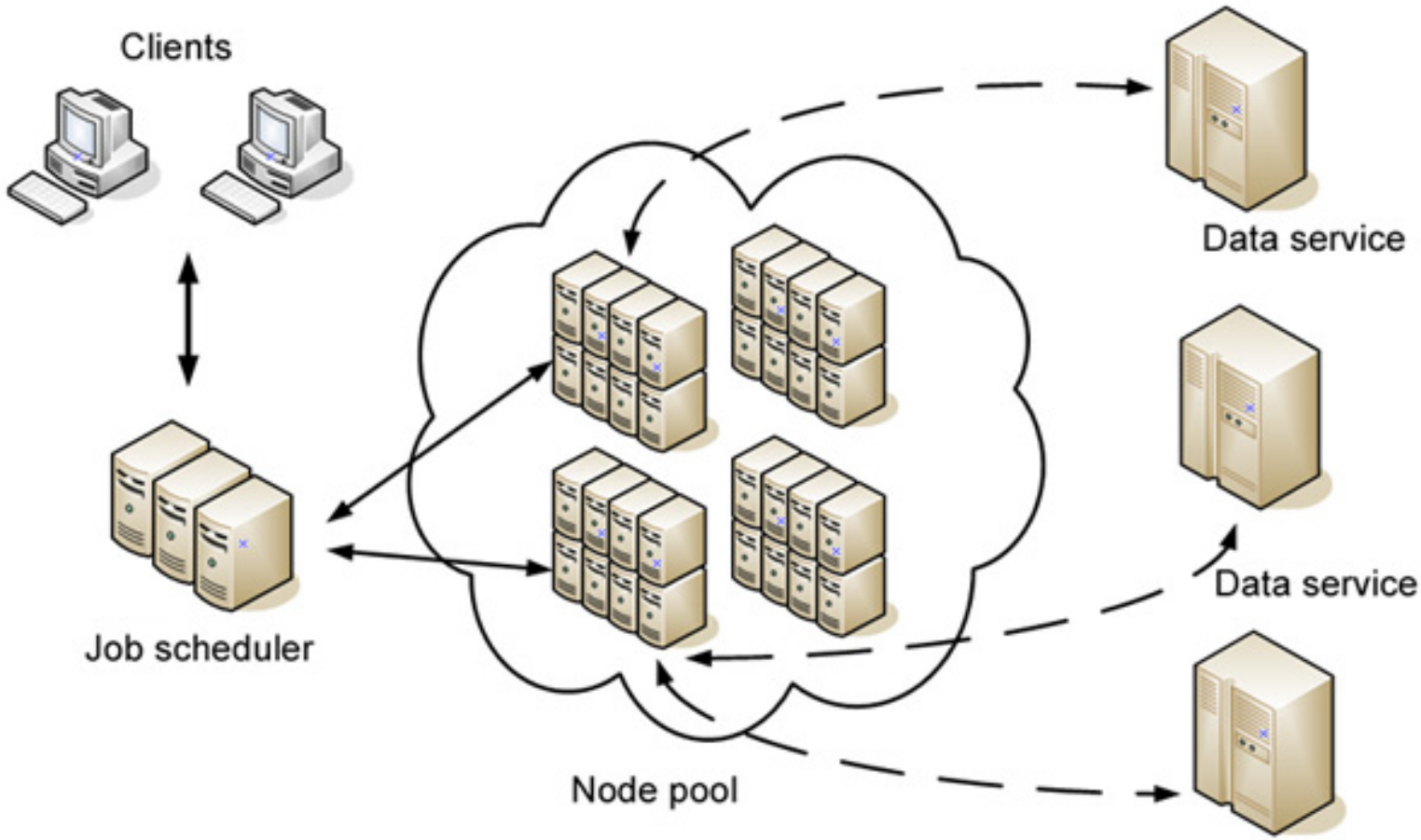
Motivation

- The data service is one of the most important services in the grid environment
- Performance tuning in the Grid is a difficult task
- Capacity planning is very complicated due to the amount of technologies available

Outline

- Overall structure of the simulation
- Structure of the simulation system devices
- Network emulation model
- Input and output of the simulation
- Initial performance evaluation results

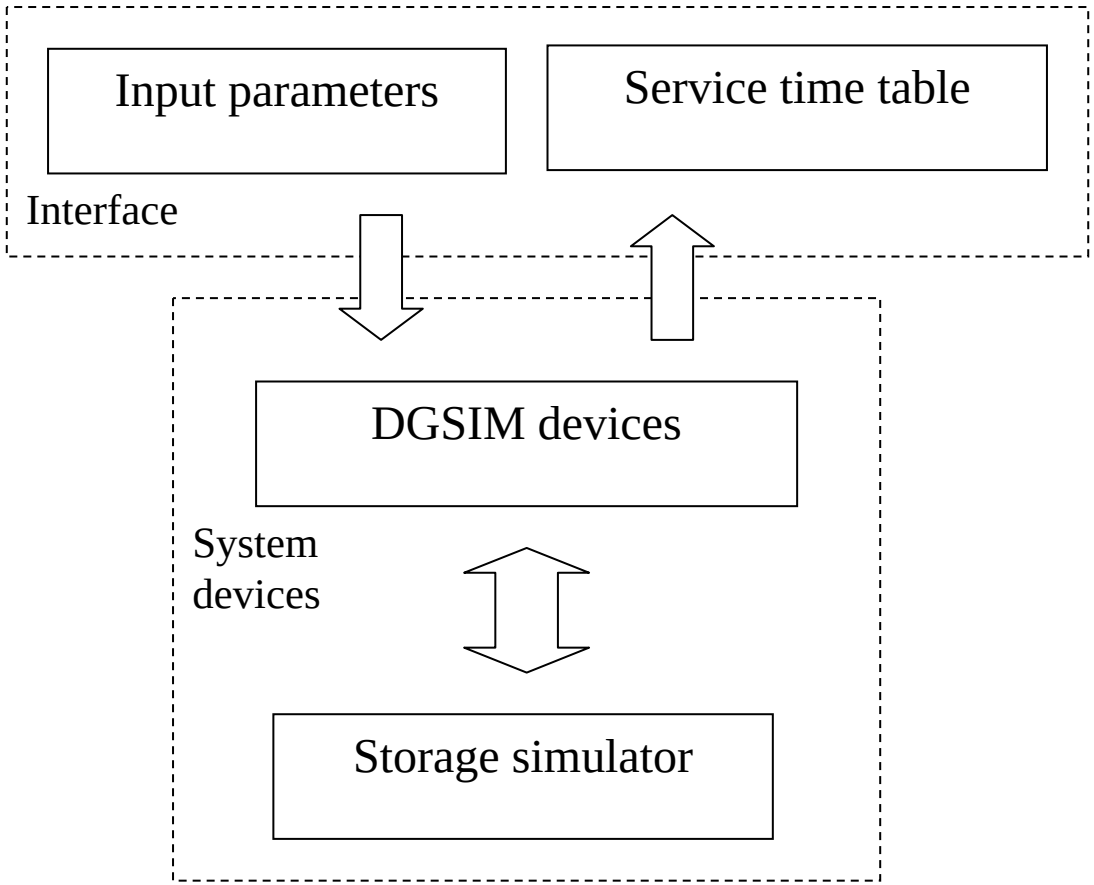
Grid service organization



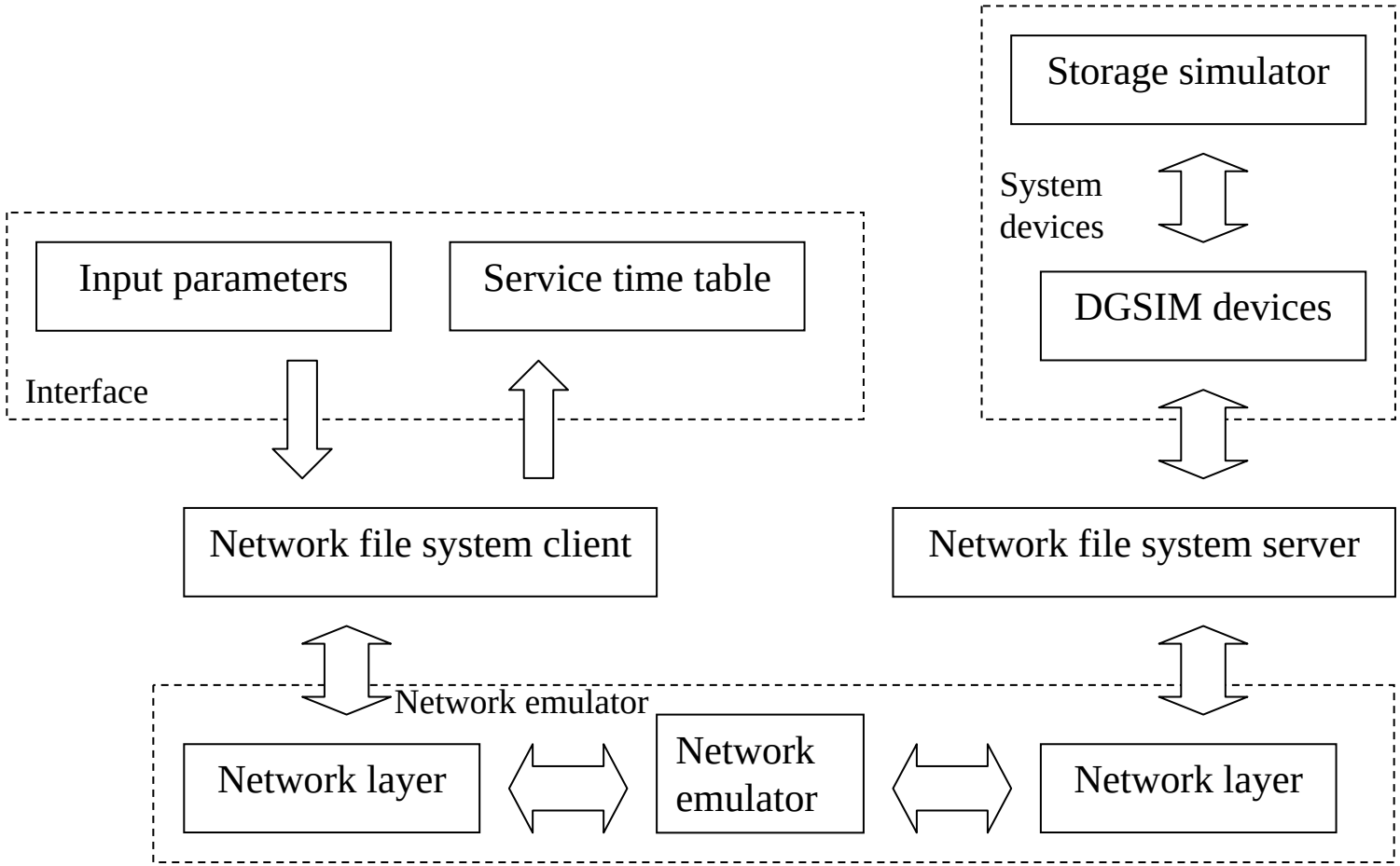
Overall structure

- The data service simulation is designed to run as a stand-alone application
- The simulator can also function as a service in the grid simulation
- Data service simulation could be categorized into
  - Local data service: where the data service is local to the computing nodes
  - Remote data service: where the data service is remote from the computing nodes

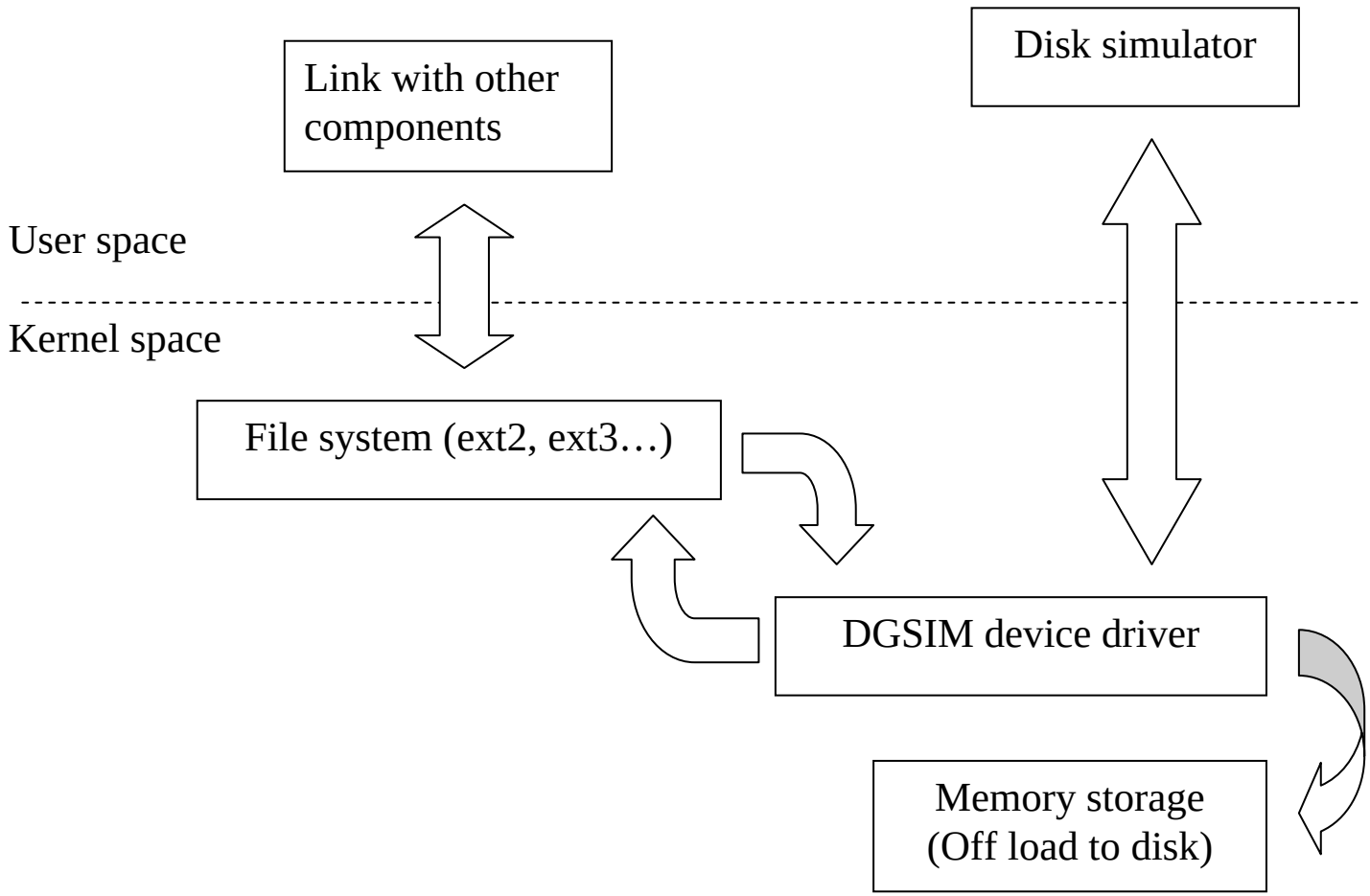
Local data service simulator



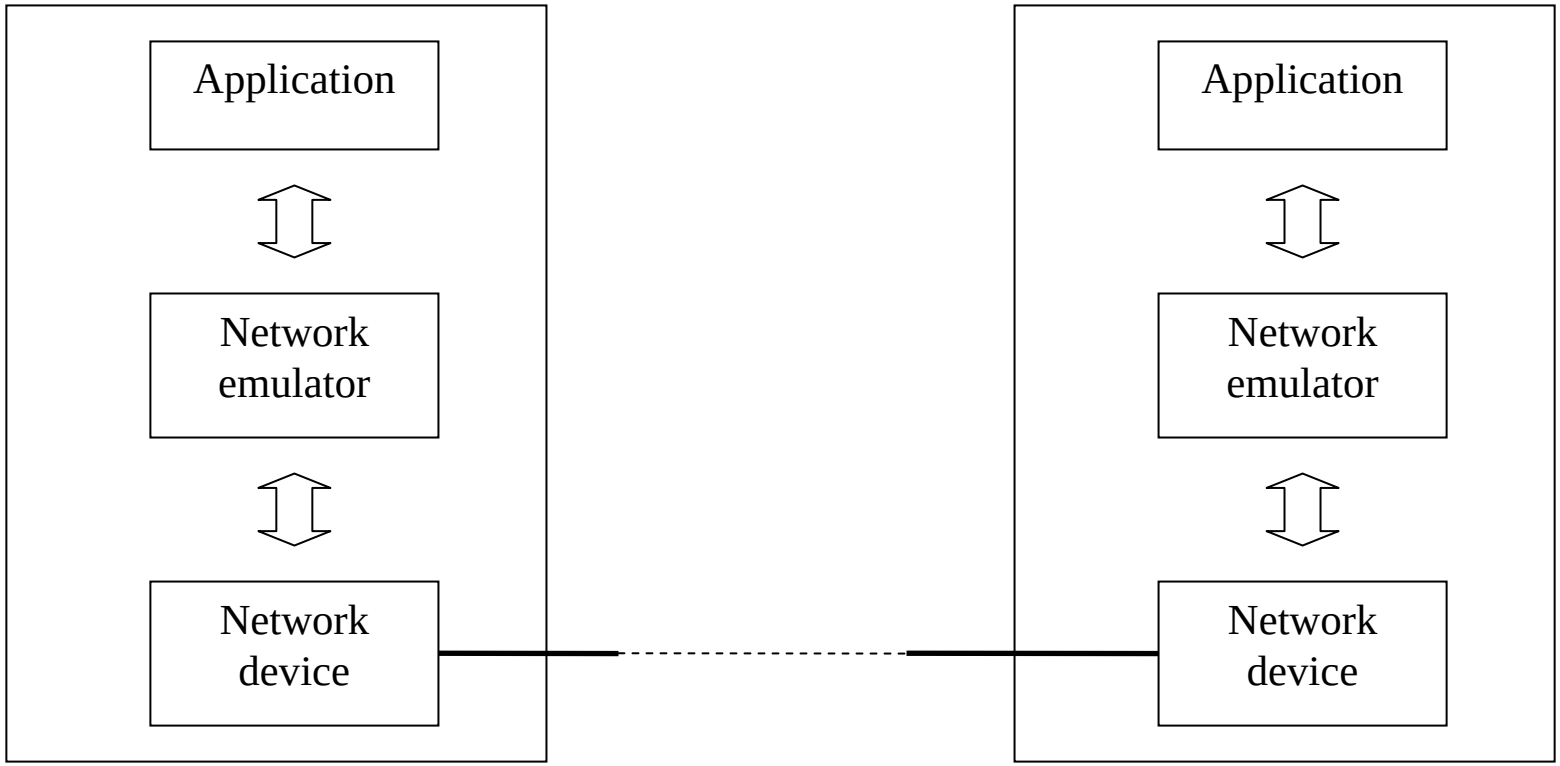
Remote data service simulator



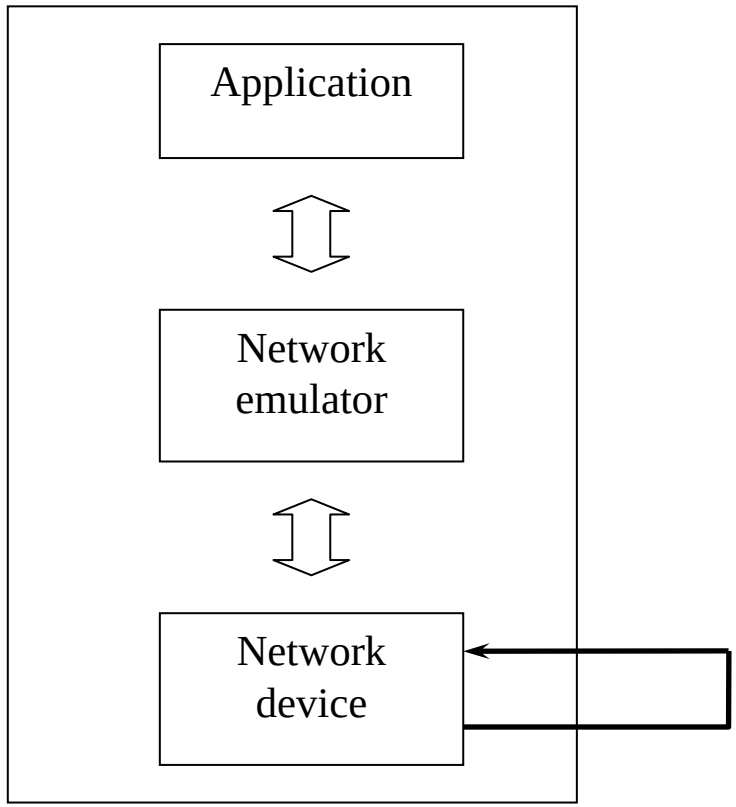
System devices structure



Network emulation model



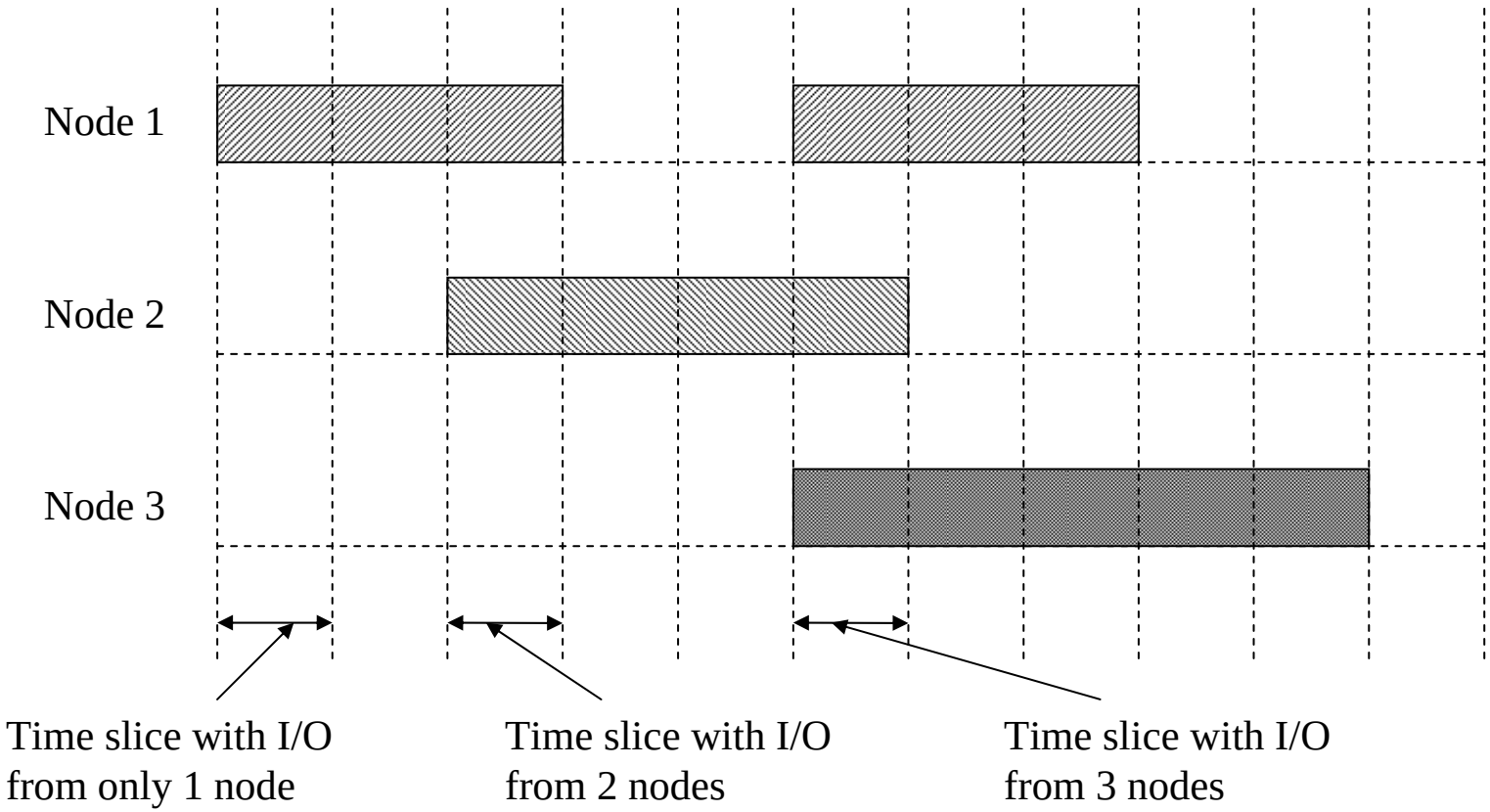
Network emulation model (cont.)



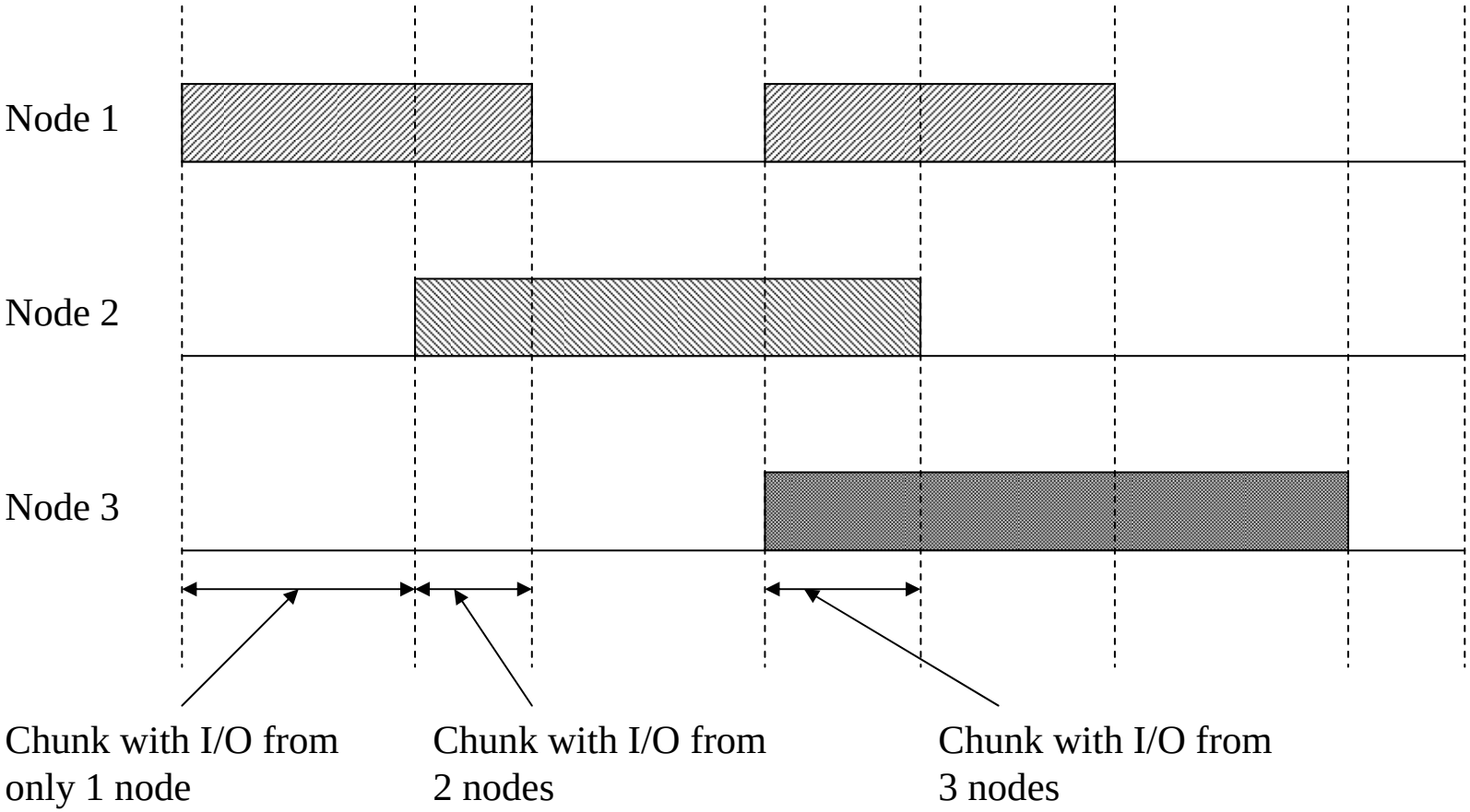
Input and output of the simulation

- The simulation could be run as a stand-alone application
- The simulation could be used as part of a larger grid simulation
  - The simulation needs data layout/configuration (time slices or chunks)
  - Performance results will be generated in a table format

Time slice data layout



Chunk data layout



Service time table output

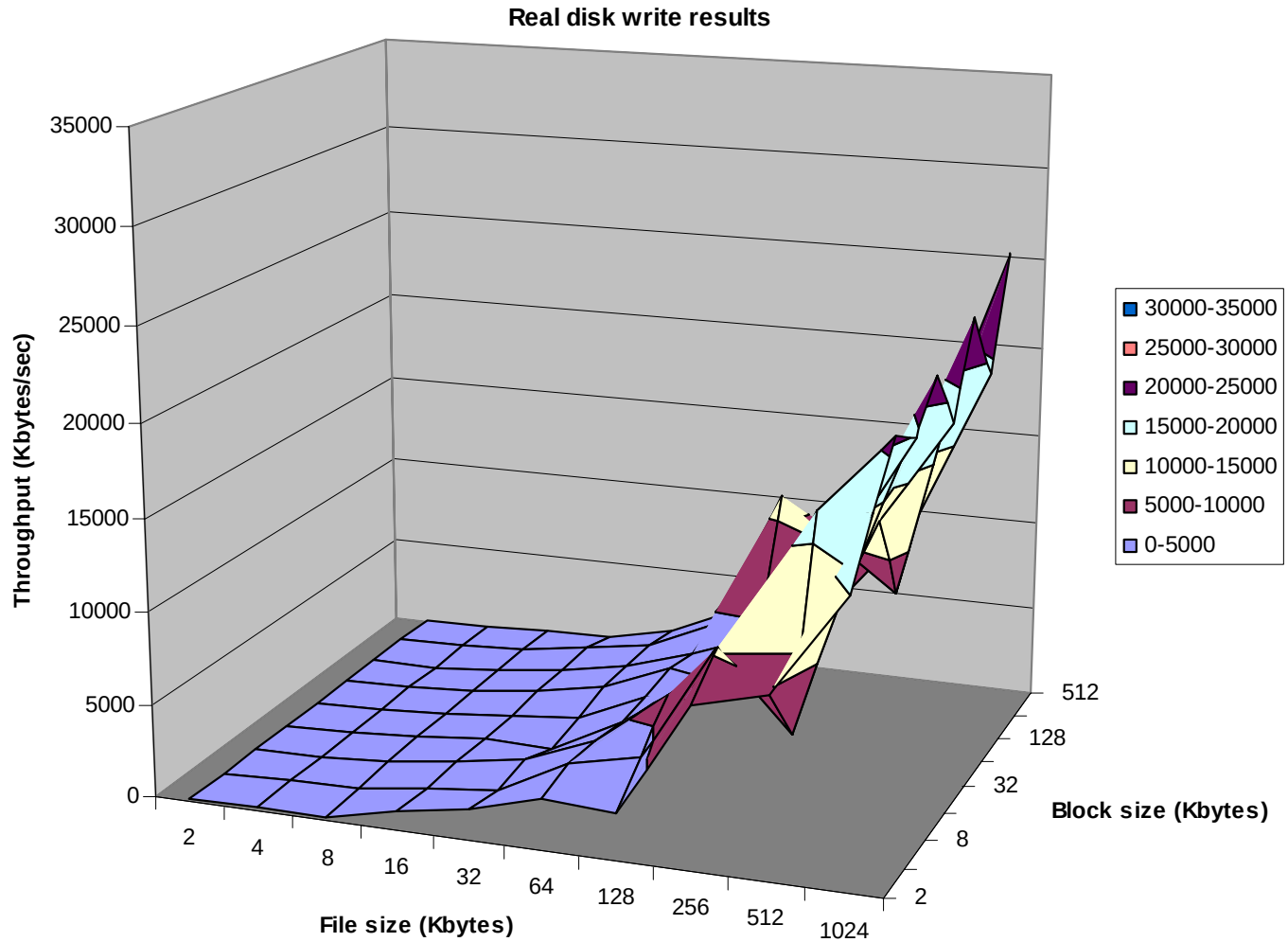
Number of Concurrent processes	Block size (Kbytes)	Data size (Kbytes)	I/O operation type	Service times (second)
1	512	1000	Write	0.068
1	512	10000	Write	0.21

Tentative format (may change in the future)

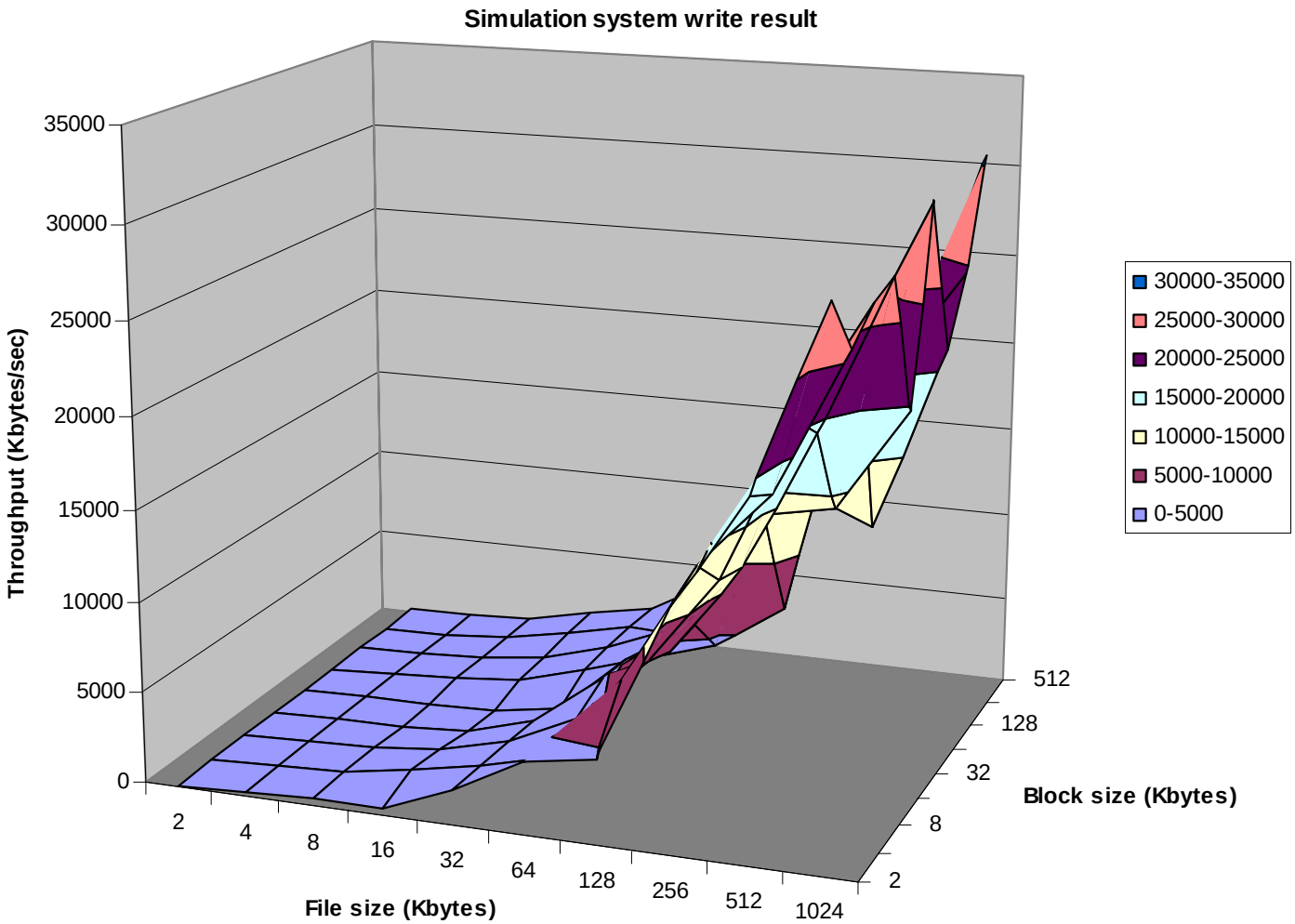
Experiment setup

- OS: Linux Red Hat Fedora Core 5
- Kernel: 2.16.15-4
- File system: ext 3
- Disk model: Hitachi HTS548040M9AT00
- Disk simulator: Disksim ver 3.0
- Work load: simple loop of raw I/O read/write with no CPU, block size increases from 2Kbytes to 512Kbytes, file size increases from 2Kbytes to 1Mbytes

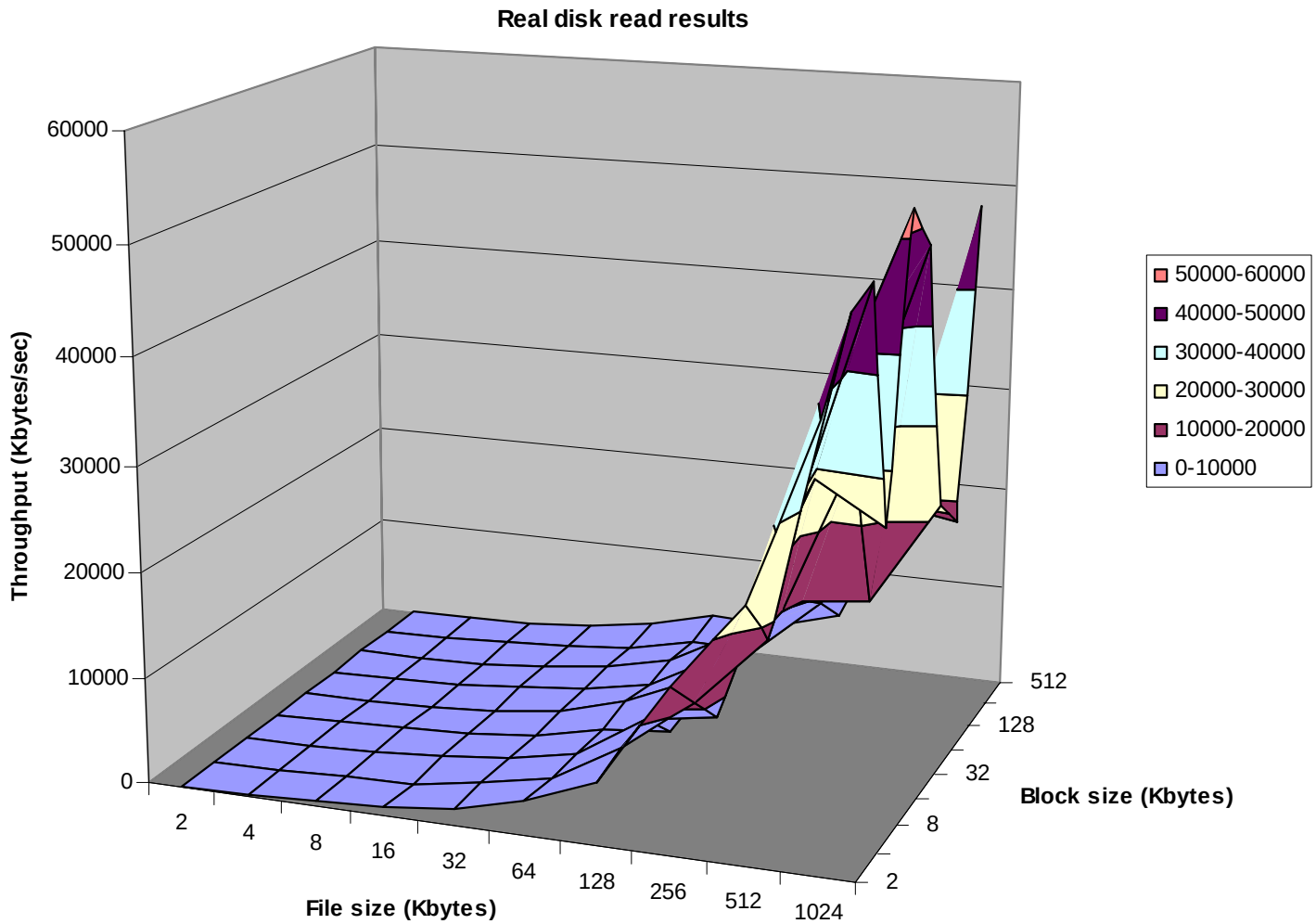
Real disk write performance



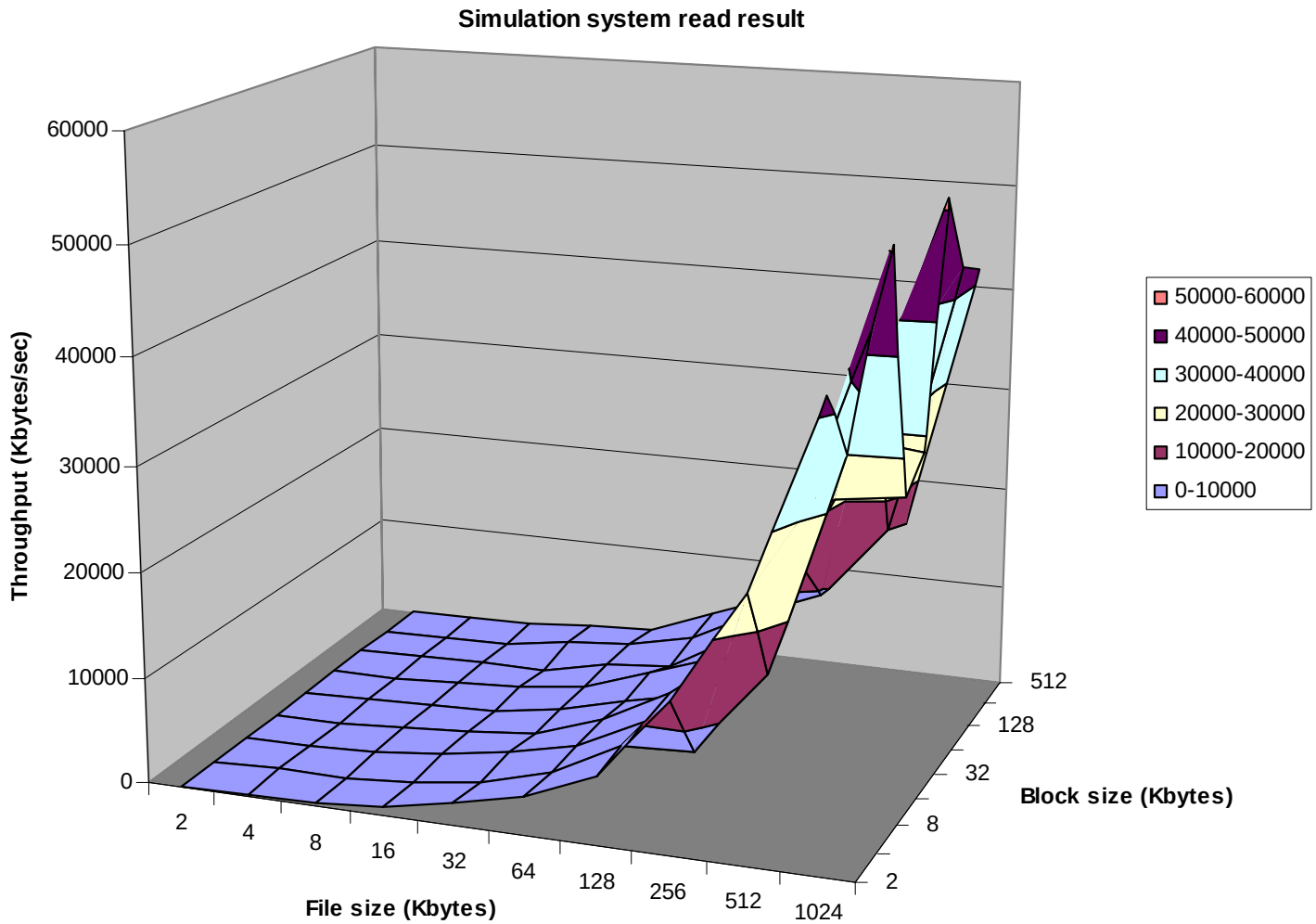
Simulation write performance



Real disk read performance



Simulation read performance



References

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- Griffin, J.L., et al. *Timing-accurate Storage Emulation*. in *Proceedings of the Conference on File and Storage Technologies (FAST)*. 2002. Monterey, CA.
- Griffin, J.L., *Timing-Accurate Storage Emulation: Evaluating Hypothetical Storage Components In Real Computer Systems*, in *Department of Electrical and Computer Engineering*. 2004, Carnegie Mellon University: Pittsburgh, Pennsylvania, 15213-3890. p. 202.
- Wang, Y. and D. Kaeli. *Execution-driven Simulation of Network Storage Systems*. in *Proceedings of the The IEEE Computer Society's 12th Annual International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunications Systems (MASCOTS'04)*. 2004.

Conclusions

- An accurate simulator will greatly help with many performance tuning tasks
- The simulator is designed so that additional storage arrays, network transports can be easily added
- The simulator allows many storage configuration experiments to be done without dealing with real equipments

Questions?