A Comparison of Library Tracking Methods in High Performance Computing

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Poster Seminar

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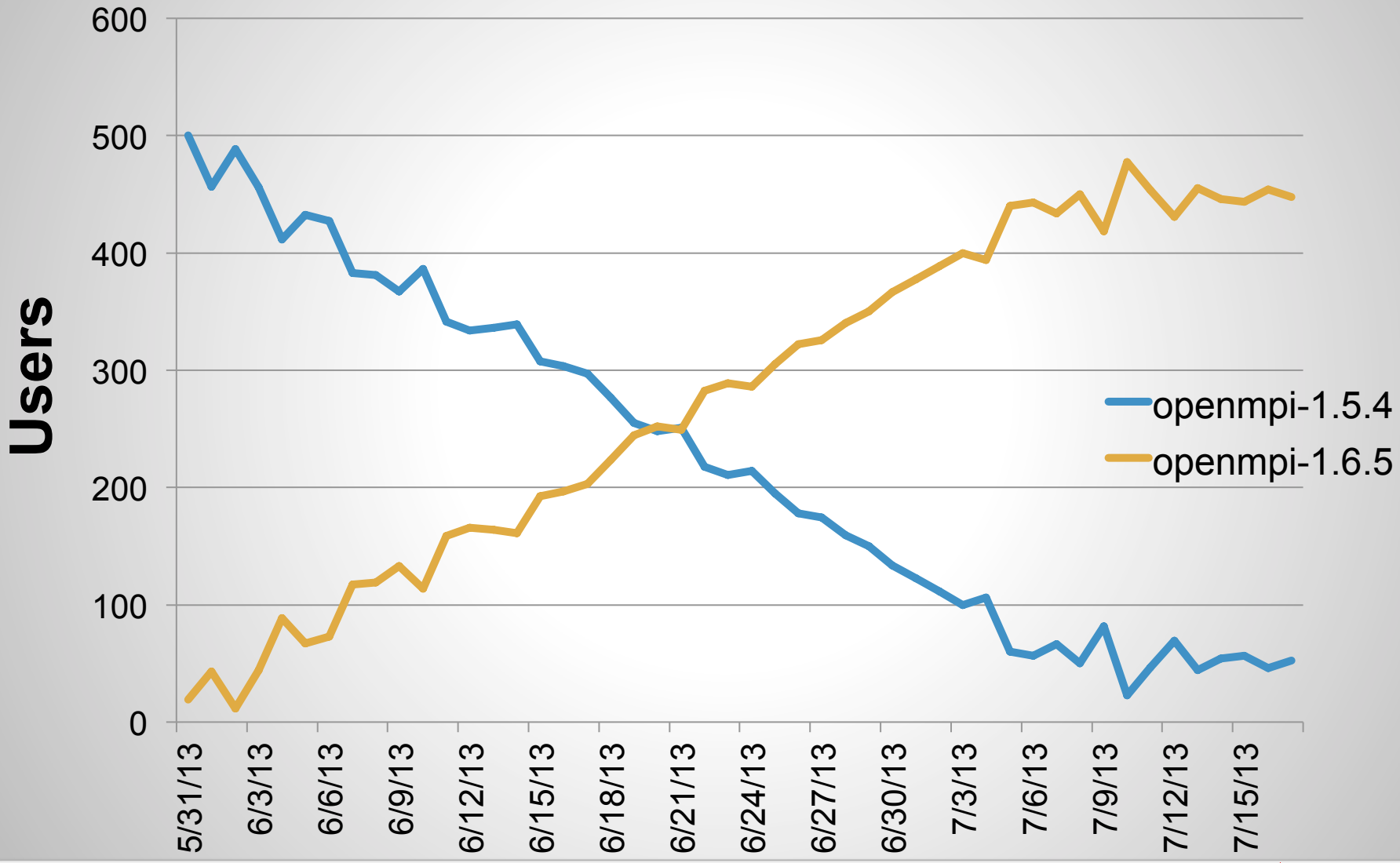
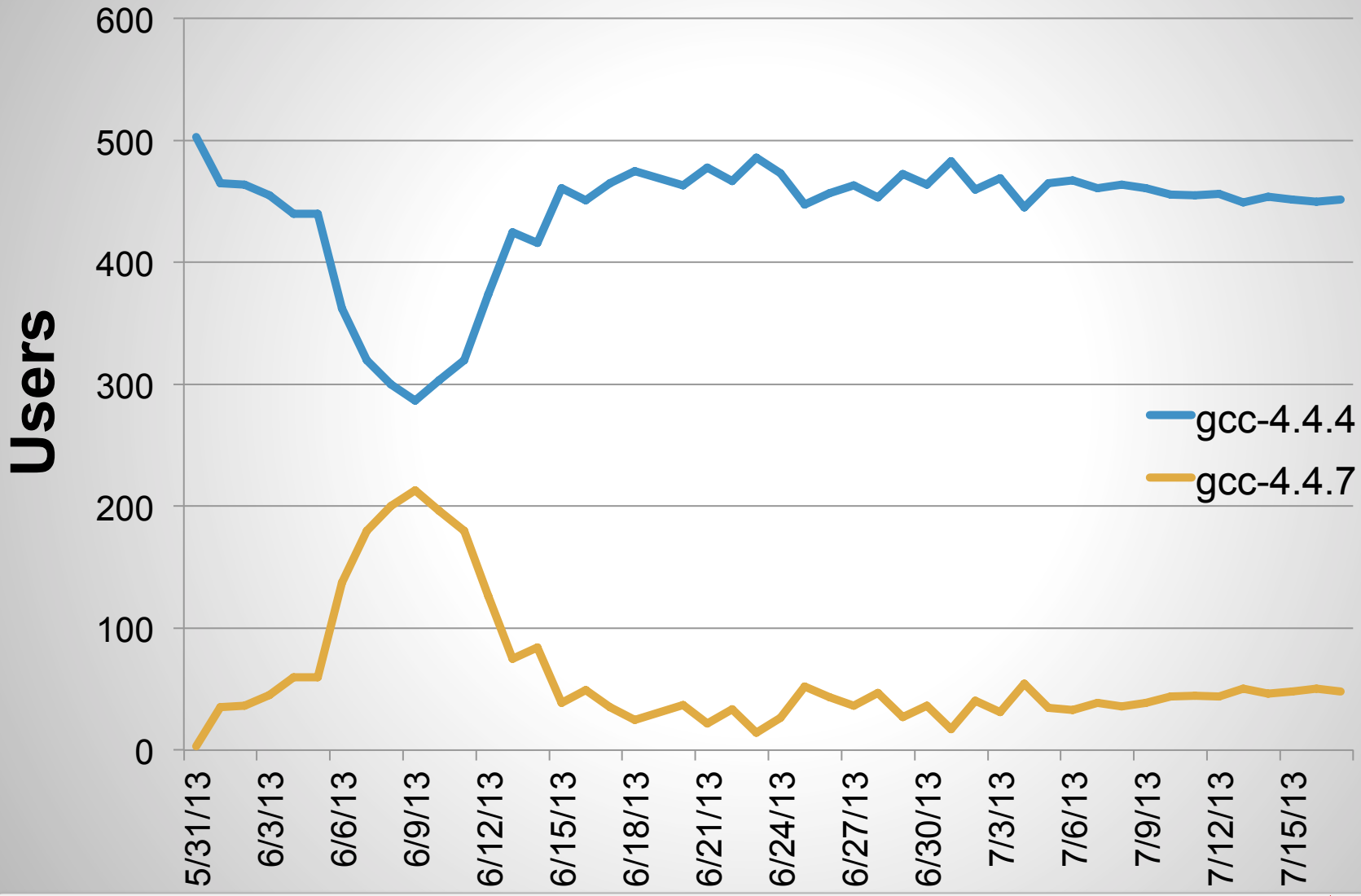
Need for a Library Tracking Utility

- HPC requires the support of many software packages, and multiple versions must be supported at the same time
  - Issues
    - License availability
    - Additional licensing cost
    - Admin support
- No existing methods of tracking user software behavior
- Current user tracking methods don't typically illustrate true use
- Eliminate less utilized software and compiler options

Simulated New Software Version Acceptance



Simulated New Software Version Rejection



Potential Tracking Solutions

Automatic Library Tracking Database

- Developed at National Institute of Computational Science for use on Cray systems
- Presented at Cray User Group 2010
- Wraps the linker 'ld' and job launcher 'aprun'
- Stores to MySQL database

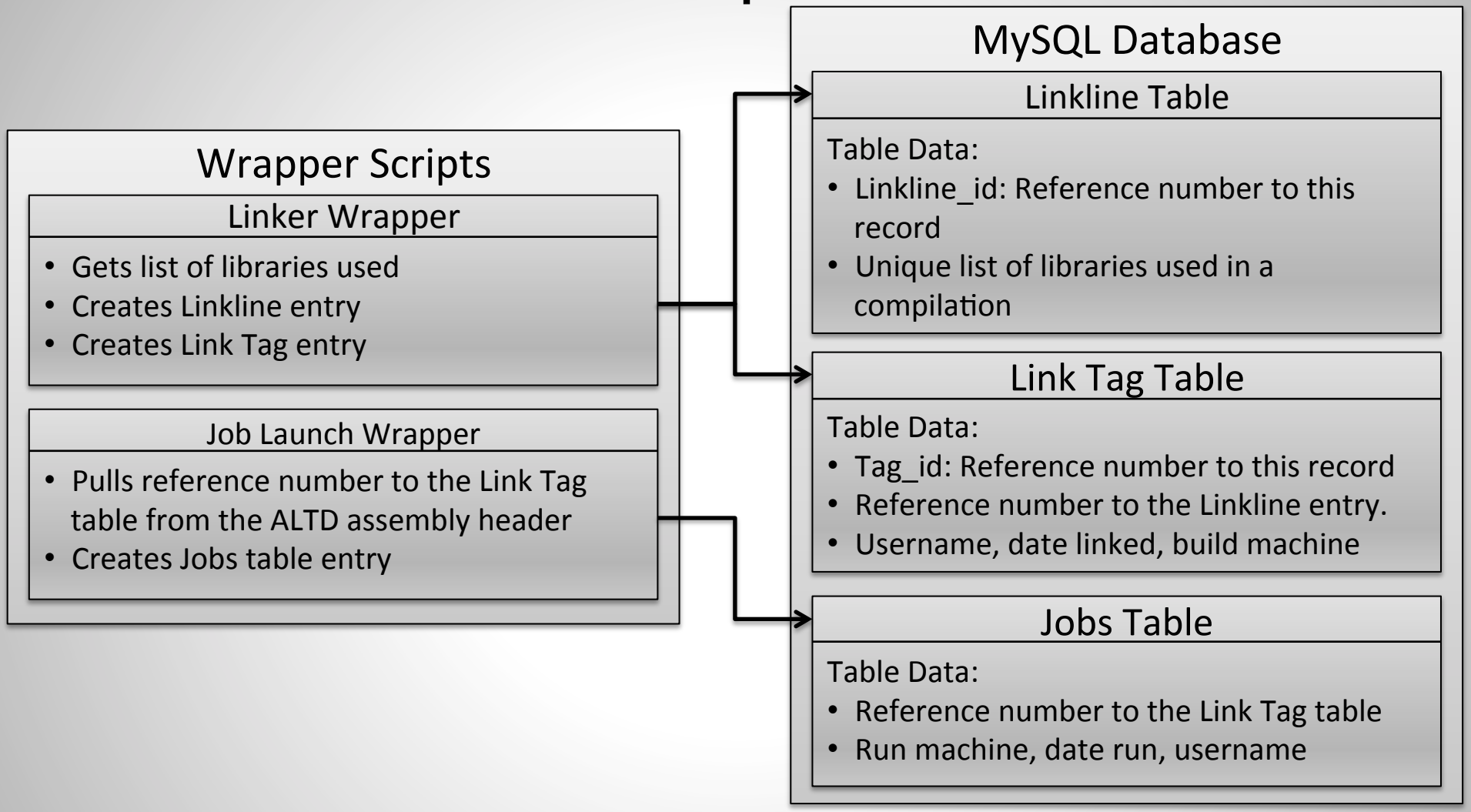
Linux Auditing Utility (auditd)

- System daemon
- Tracks specified files for access and or writes
- Stores to log files

Linux Auditing Utility (auditd)

- Provides log information on targeted files or directories
  - Object access and use
  - Stores to log files
  - Provides commands for searching log data
- Originally meant for security
- Root access required to add files to be tracked
- Log file is readable by a non-root linux group

ALTD Operation



ALTD Alterations

- Support added for wrapping mpirun and mvapich2 job launchers, while still allowing aprun
- Detects version of prefered MPI wrapped compiler and MPI executable and wraps accordingly
- Created script to query the database and collect the number of times a library has been compiled and run
- Made ALTD entries generic across servers

ALTD

Pros:

- Data is well organized into structured database
- Theoretical constant low overhead
- Tracks all libraries automatically

Cons:

- Requires a SQL database
- Tracks libraries used at compile time, not necessarily libraries used at run time

auditd

Pros:

- Standard Linux daemon
- Well tested by the Linux community
- Logs to a flat file

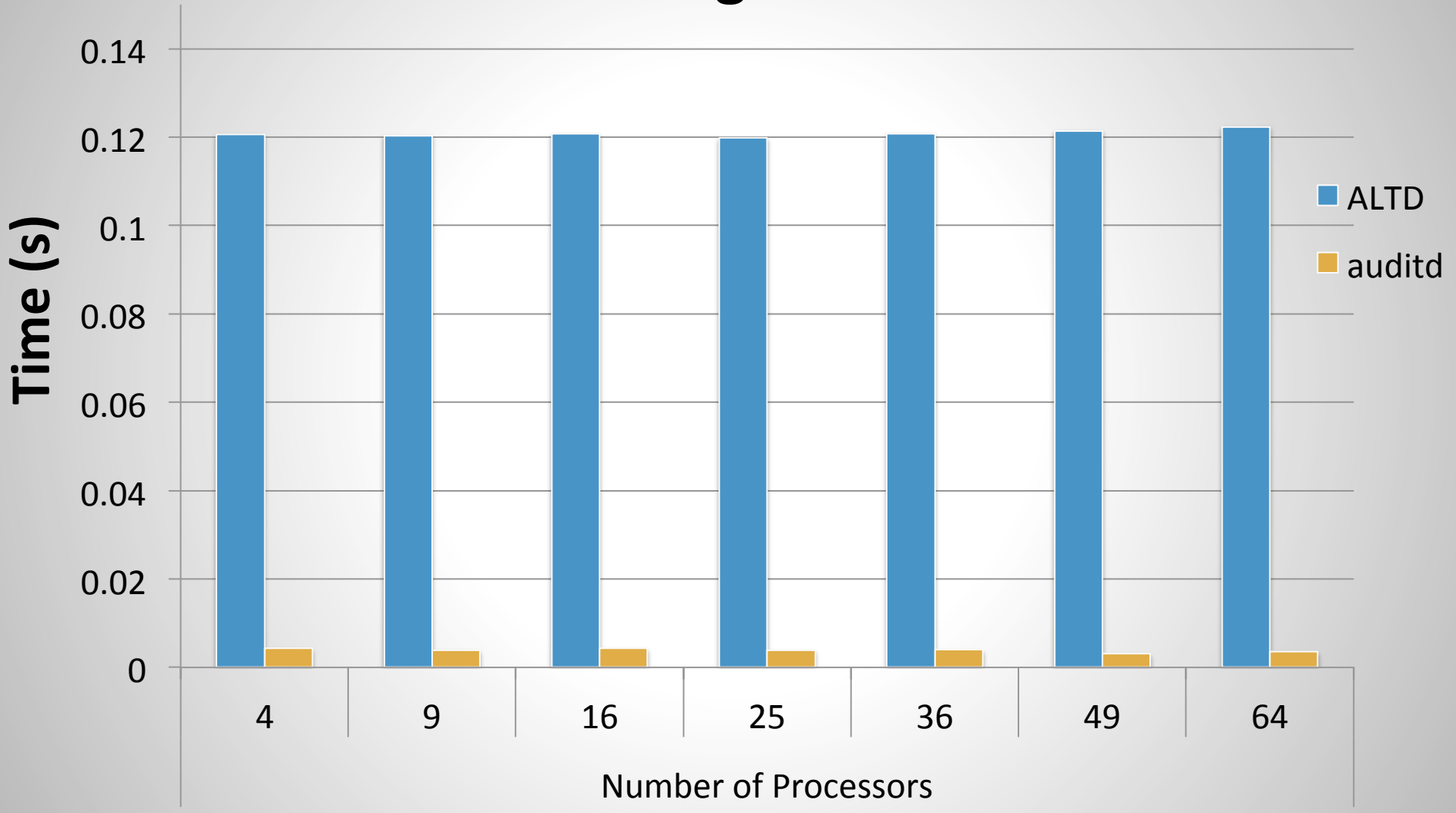
Cons:

- Dynamically linked libraries cannot be reliably tracked, the .so files are cached in memory and not read at every run
- Statically linked libraries can't be track at runtime as they are in the executable
- A single make can generate numerous log entries

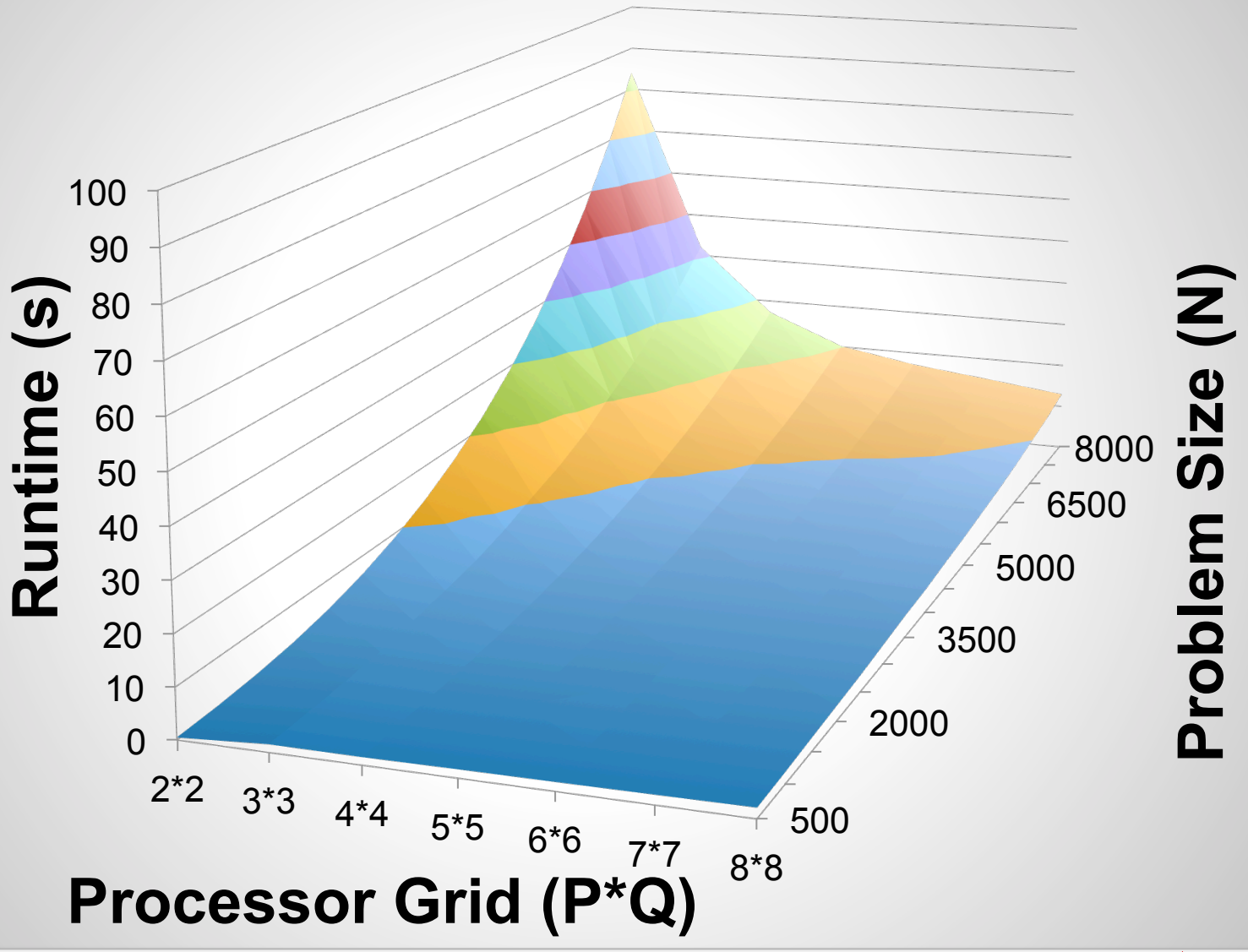
System Overhead Testing

- Interested in increase in compile and run time of different solutions over a control time
- Linpack was run while varying the problem size and the number of processors working on the problem
- A simple "do nothing" MPI program was also tested to investigate launch time more easily

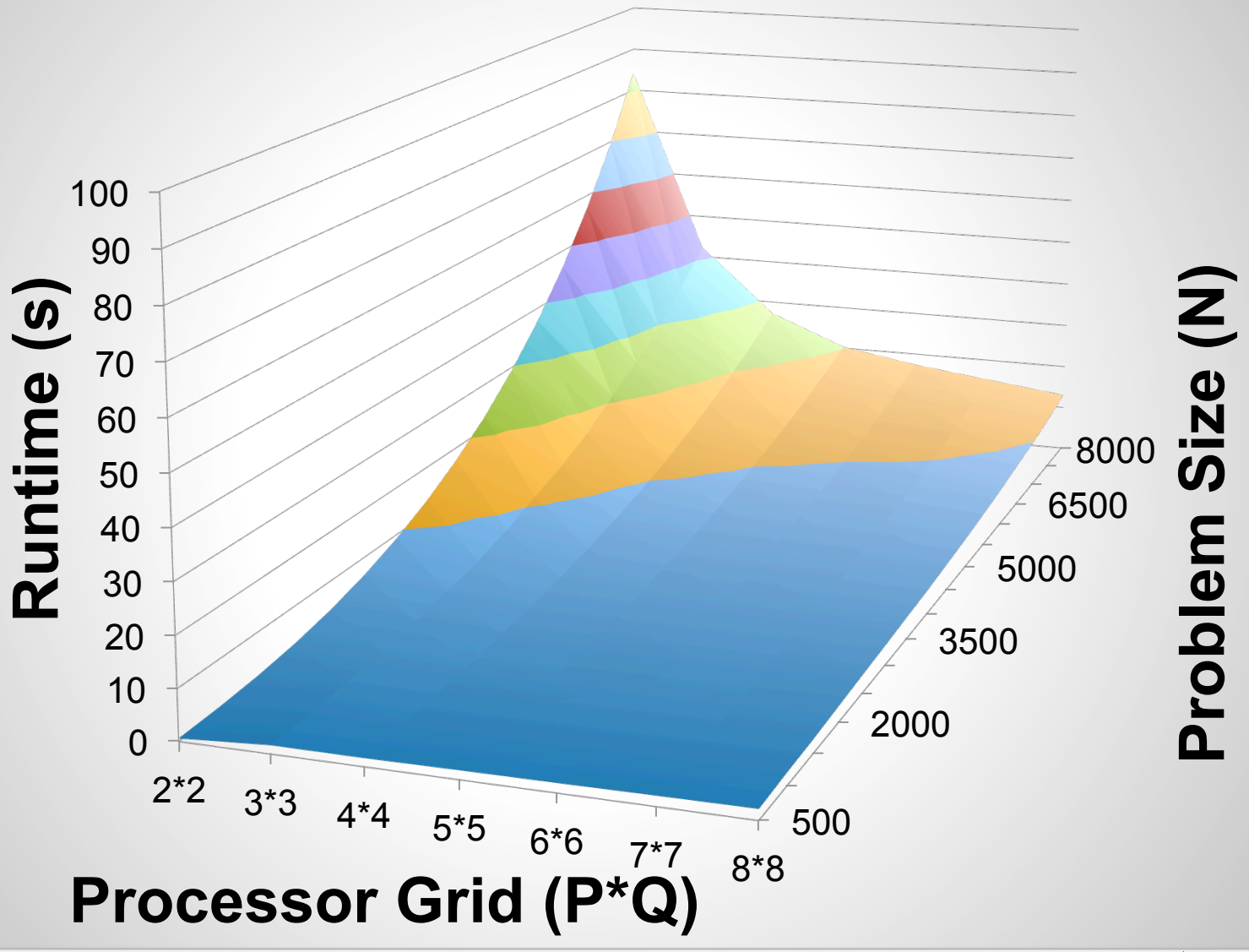
Additional Runtime for a Simple MPI Program



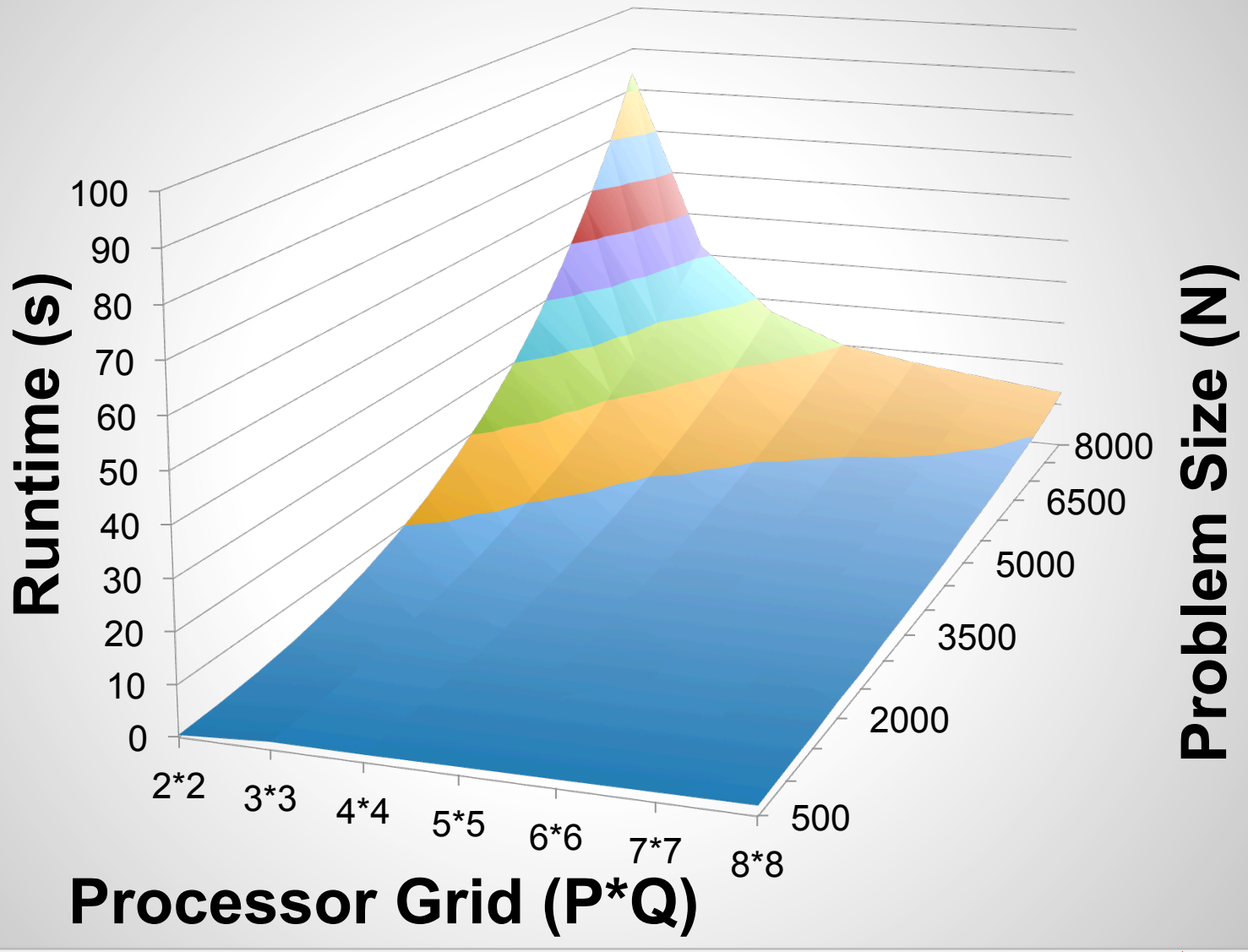
Linpack Runtime (Control)



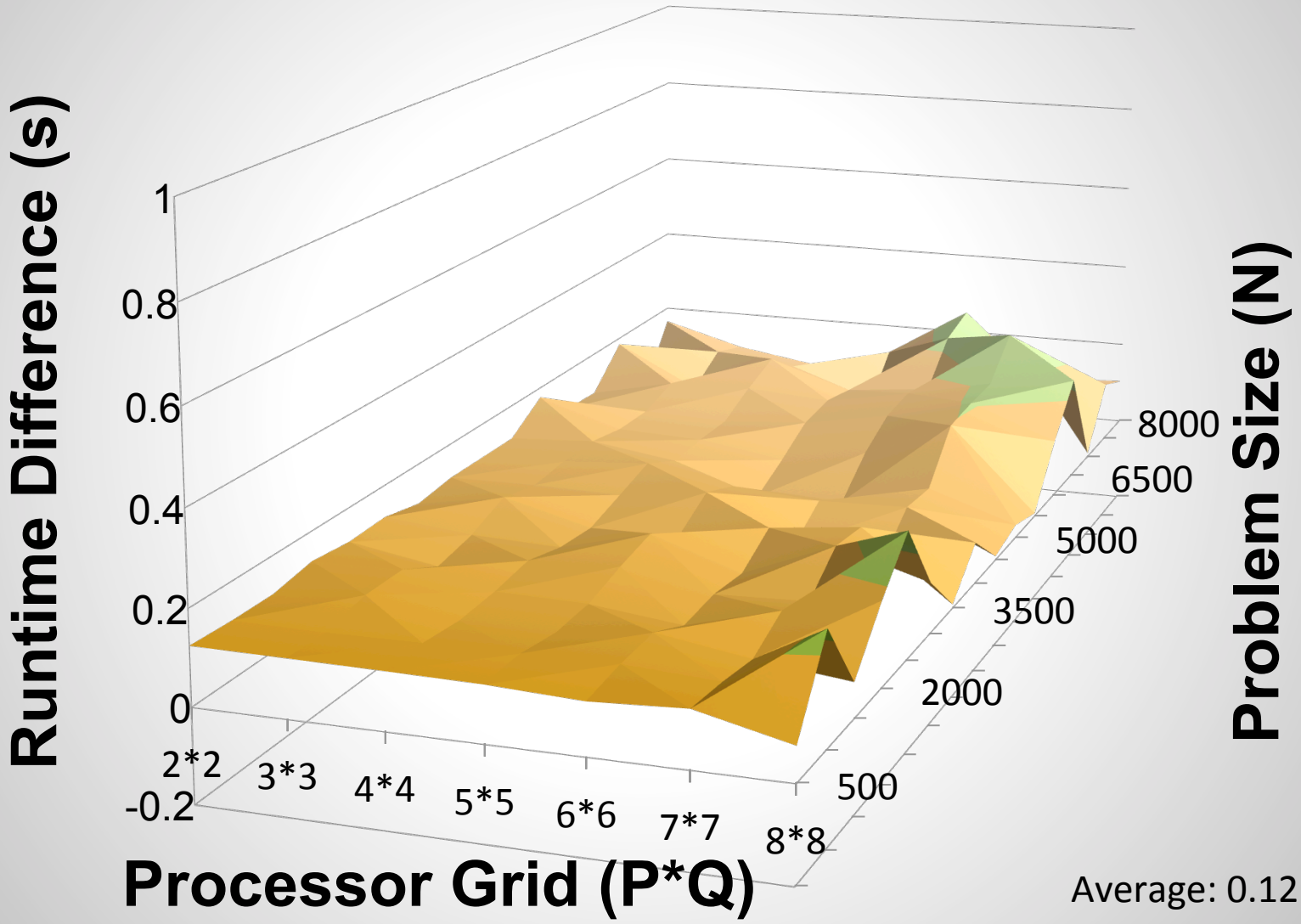
Linpack Runtime with ALTD



Linpack Runtime with auditd

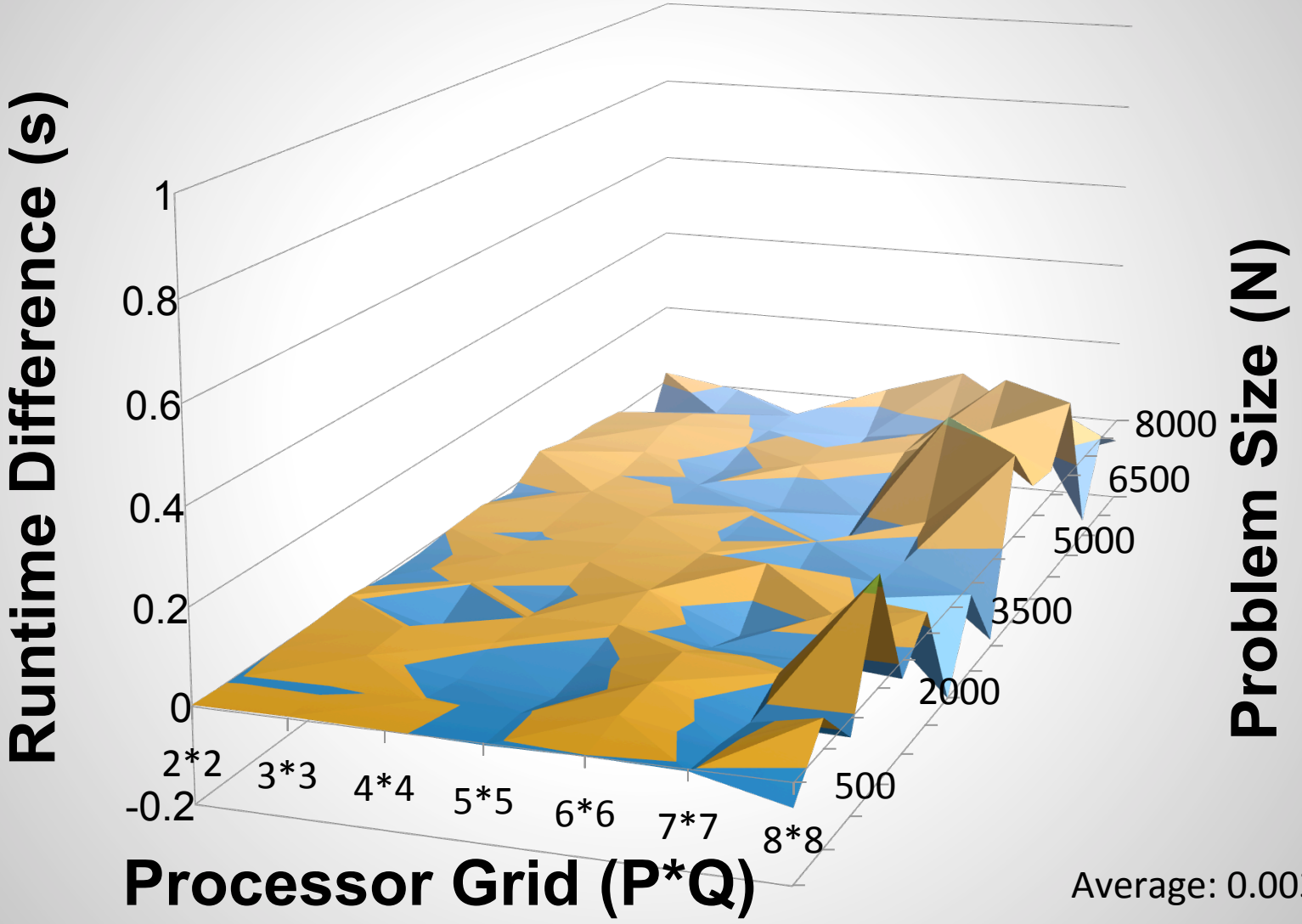


Additional Runtime for Linpack with ALTD



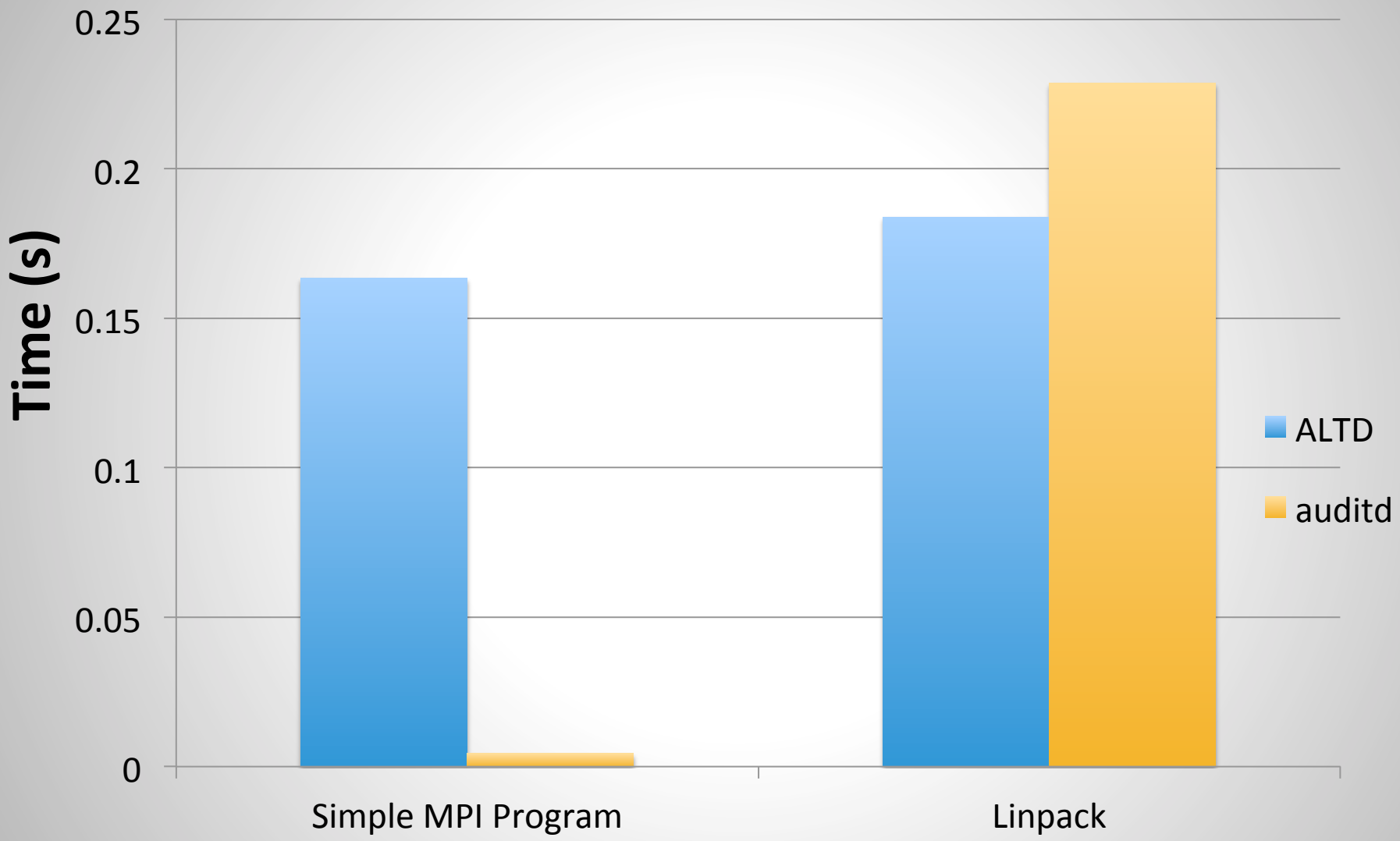
Average: 0.121 (s)

Additional Runtime for Linpack with auditd



Average: 0.00304 (s)

Additional Compilation Time Required



Summary

- ALTD
  - The Automatic Library Tracking Database has the potential to track libraries well in HPC
  - Performance overhead is minimal and seems to be constant, regardless of job size
  - Additions to the software have provided for simplicity in utilization and data evaluation.
- auditd
  - Outperforms ALTD in some cases but falls behind compiling larger programs
  - auditd is not sufficient to track all types of libraries during compilation and runtime

Thanks!

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