



75 **Los Alamos**
NATIONAL LABORATORY
— EST. 1943 —

Nuclear Meltdown?

Assessing the impact of the Meltdown/Spectre bug at Los Alamos National Laboratory

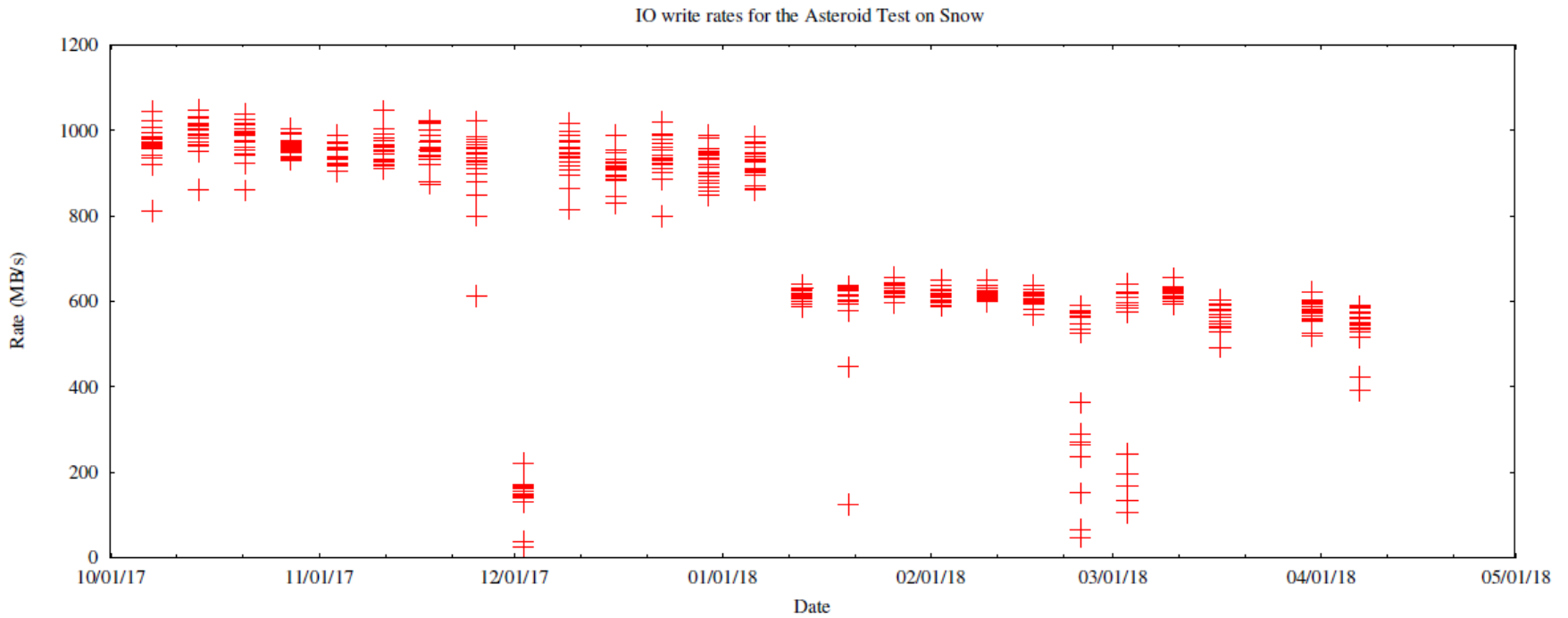
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May 24, 2018



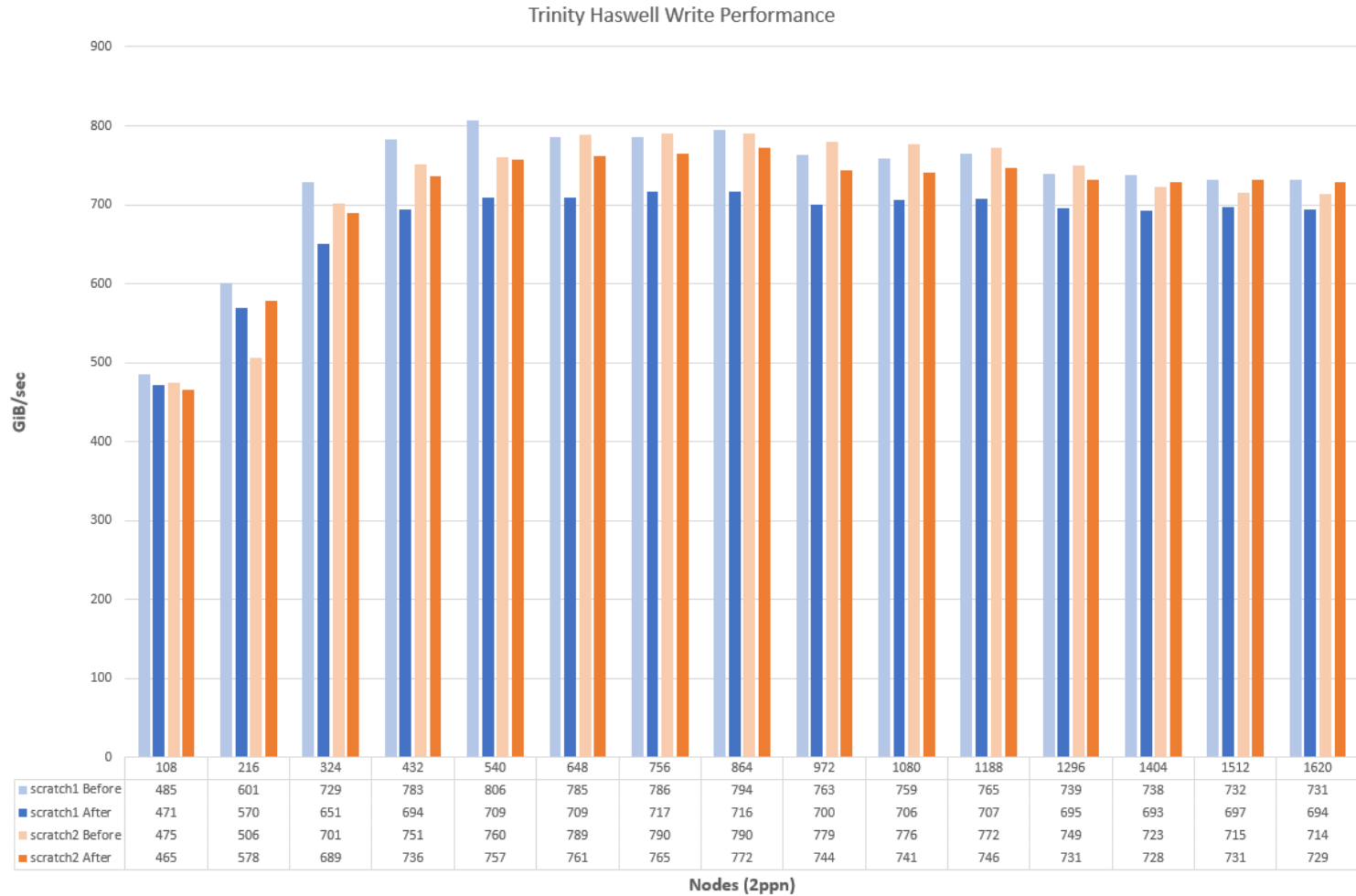
Operated by Los Alamos National Security, LLC for the U.S. Department of Energy's NNSA

- **XRAGE with asteroid code 64 PE w/bulkio**
 - 40% performance hit in I/O part of code
 - I/O accounts for 5% of job time

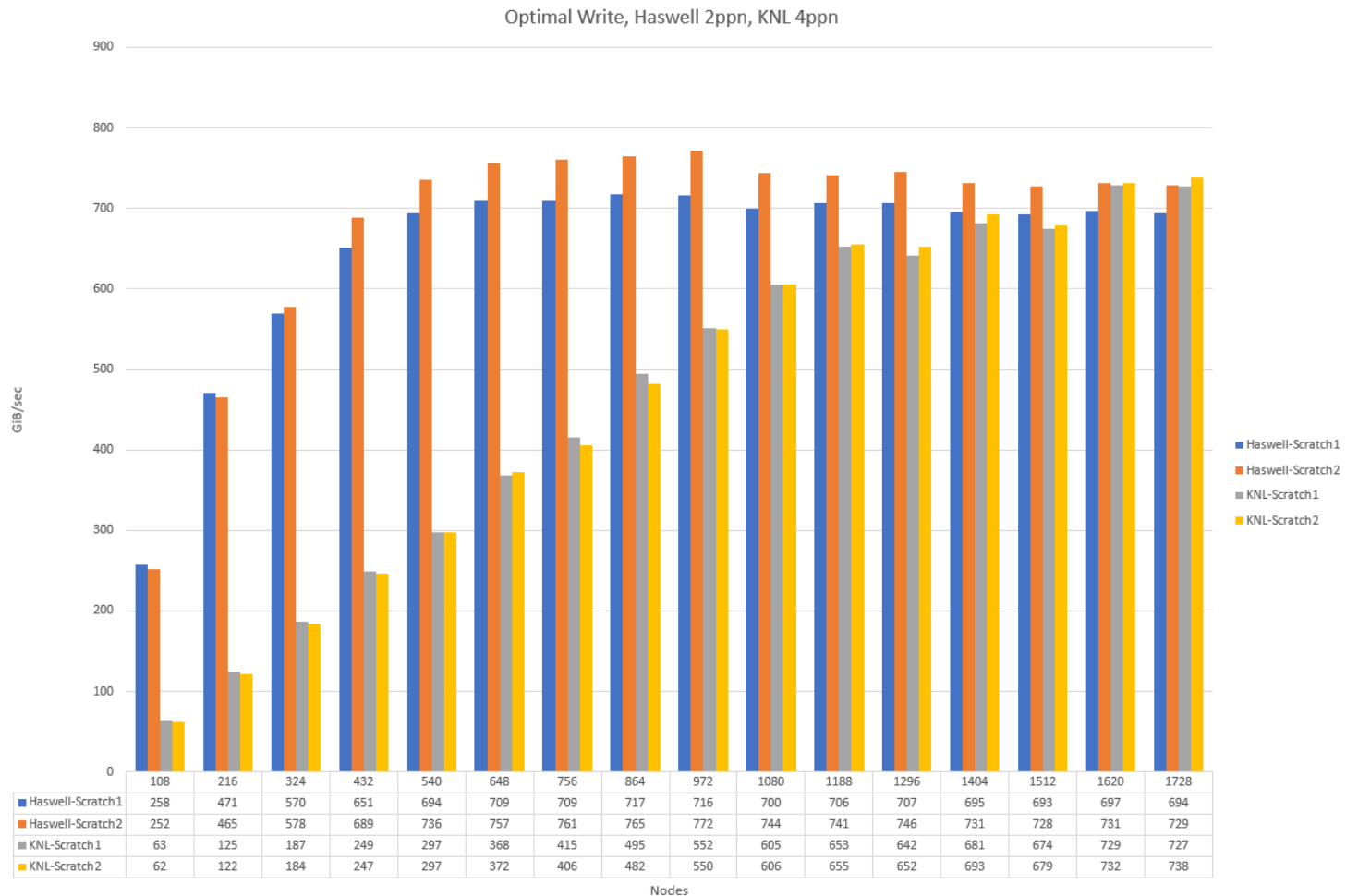


IOR to Lustre

- Well formed IO benchmarking of Lustre with IOR on Haswell
 - 5-7% average reduction from 9-22-2017 to 4-2-2018



- Well formed IO benchmarking of Lustre with IOR on Haswell and KNL
 - 5% average variation between scratch1 and scratch2



- **Code Development Efforts**

- 20% average, with some reports of up to 32% performance degradation
- High number of small file I/O

- **DataWarp**

- Stage In (Lustre to DataWarp) showed almost no impact.
- Stage Out (DataWarp to Lustre) showed impact commensurate with Lustre write performance decay

- **Jitter**

- No evidence of jitter-like cascading delays induced with scale.
- Impact does grow slightly with scale in some cases, but is inline with I/O scaling.

- **I/O library work**
 - Code improvements to bulkio and hio
 - High number of small file I/O
- **Consulting**
 - Advising users to examine and evaluate their I/O strategies.
- **Testing**
 - Improving our testing suite to do more fine grained performance evaluations.
- **Future Systems**
 - Heavy consideration of this type of vulnerability in the design, testing and acceptance.

- **Some instances of specific high impact.**
 - Particularly in poorly formed and small I/O
- **Overall lower than expected impact.**
 - Approaches noise band in many cases.
- **Mitigations are not expected to eliminate performance degradation.**
- **Expected performance gains are not seen as substantial enough to re-engineer codes.**
- **Ongoing tuning will address some portion of the lower performance.**
- **Future systems are not expected to have this vulnerability.**
- **New code validation, verification and certification is an involved process.**
 - Codes are revamped with each new system architecture.
- **User behavior has not changed**
 - Requested wall-clock times or checkpoint timings