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

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• 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
IOR to Lustre

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

• 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.
Actionable Work

• 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.
Conclusions

• 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