

Extreme Integration: Preparing El Capitan to Deliver on Mission

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The integration of El Capitan and its smaller siblings, including Tuolumne, has been a successful partnership between Lawrence Livermore, Hewlett Packard Enterprise, Advanced Micro Devices, and Red Hat. The complexity and scope of the El Capitan integration represents a significant increase in complexity and scope compared to previous systems.

This 5-year, \$600M project is funded by NA-114 Advanced Simulation and Computing.

Extreme-Scale System Integration Requires a Phased Approach

- Hardware schedules lead to a tiered system delivery of Infrastructure and Filesystem, Cabinets and Interconnect, and Compute Blades.
- Three-phase acceptance promotes system improvement over time and hardware validation while continually incentivizing maximum vendor engagement.

Merced and El Capitan Infrastructure Integration

- **131 days (3/24/23-9/22/23)**
 - Merced trucks 1-6
 - Merced install and acceptance testing

El Capitan Integration Olympus Cabinet

- **150 days (5/16/23-12/11/23)**
 - Row 0-10 install
 - Cable rows
 - Slingshot stabilization

El Capitan Acceptance, Benchmarking, and Transition to SCF

- Linpack and benchmark runs
- ED, IO, FS stabilization and acceptance testing
- CZ => RZ => SCF (program runs)

- **355 days (4/15/24-4/4/25)**

High-level overview of planning for major phases of El Capitan system integration.

Multidisciplinary Lab and Vendor Teams Energize Integration



(left) Members of the HPE Livermore site team prepare to install the final El Capitan compute blade. The blade was signed by the manufacturing staff at the HPE Chippewa Falls, WI manufacturing facility.



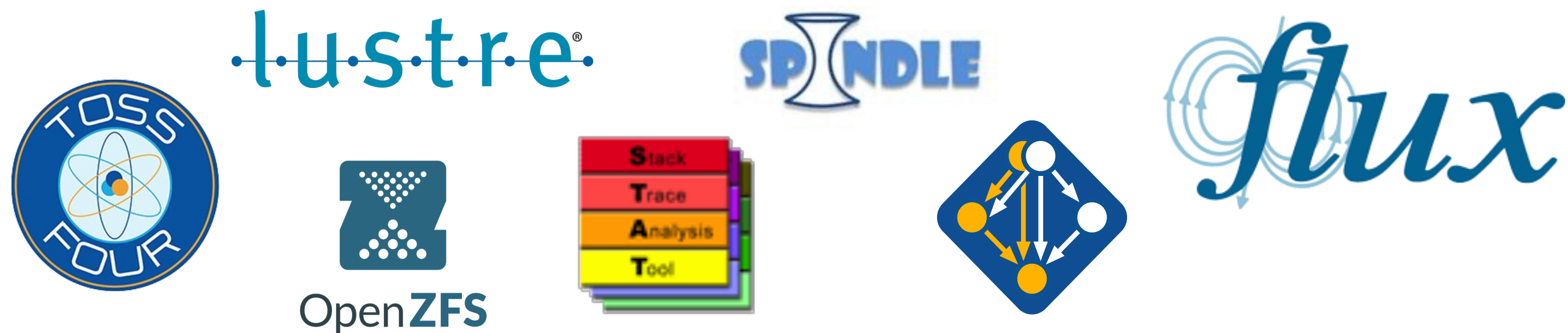
(right) Trung Tran, a Livermore Computing Operator, and Domanick Wood, an HPE technician, work together on an issue with an El Capitan blade.

Livermore Computing and vendor staff worked in close collaboration across a range of hardware and software disciplines from facility engineering to user environment. Bringing diverse skills to bear leads to an integrated system ready to deliver scientific results for national security.



Members of Livermore Computing assemble in front of the completed El Capitan and Tuolumne supercomputers.

LLNL Software Development Investment Brings Enhanced Capability to a Familiar Environment



Cutting-edge software unlocks the advanced features of El Capitan, while a familiar TOSS 4 user environment makes the capabilities immediately accessible to the user community.

Conclusions

Every system integration provides lessons for the future.

- Agile response to schedule uncertainty allows continued progress in the face of adversity.
- Blending LLNL software capability and experience with the best technology from private industry enables maximum mission delivery.
- True partnership, flexibility, and win-win mindset generate meaningfully better outcomes.
- Targeted software development efforts enable rapid response to changing HPC environments.

El Capitan Will Demonstrate Capability on Key NNSA Milestones this Year

Livermore Computing builds on its rich history of deploying the world's most capable computing platforms with the unprecedented scale of El Capitan