OAK RIDGE National Laboratory

Frontier Training & Support

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OLCF User Meeting – October 18, 2022

ORNL is managed by UT-Battelle LLC for the US Department of Energy

U.S. DEPARTMENT OF ENERGY

Crusher Test and Development System (TDS)

- Crusher is OLCF's 192-node TDS with identical hardware as Frontier: https://docs.olcf.ornl.gov/systems/crusher_quick_start_guide.html

- Frontier Center for Accelerated Application Readiness (CAAR): https://www.olcf.ornl.gov/caar/frontier-caar/
- Exascale Computing Project (ECP): https://www.exascaleproject.org/research/

Application and software teams

- Work with HPE and AMD to deliver documentation & training
- Work with vendors and ECP to deliver Crusher Hackathons
- Support users through Jira tickets – with vendor bugs as needed
- Work with vendors to hold Crusher Office Hours (every Monday)

Training and support

2022 Crusher/Frontier Training Schedule

Items in blue were offered to all OLCF users.

Items in either blue or green have slides & recordings on the OLCF training archive.

Event/Session	Date
Crusher Training	January 13
Crusher Hackathon #1	February 9 – 11
Crusher Hackathon #2	February 15 – 17
AMD – Fine/Coarse Grained Memory + XNACK	March 11
AMD – Expanded rocprof Counters/Metrics	April 22
ECP AM – Crusher Lessons Learned	May 4
ECP AM – Debugging & Performance Profiling for Frontier	May 6
ECP BOF Days – Crusher Tips & Tricks	May 10
AMD – Fine/Coarse Grained Memory + XNACK	May 23
AMD – Expanded rocprof Counters/Metrics	June 2
Introduction to the Frontier Supercomputer	July 12
Introduction to HIP Programming	July 14
HIP for CUDA Programmers	July 21
Crusher Hackathon #3	August 2 – 4
OpenMP Offloading – Part 1: Offloading Basics	August 11
AMD – Understanding GPU Register Pressure/Spillage	August 22
OpenMP Offloading – Part 2: Data Movement & Optimizations	September 1
Crusher Hackathon #4	September 12 – 14
Hierarchical Roofline Analysis on AMD GPUs	October 11

Crusher Hackathons

Goal: Help CAAR and ECP teams drive toward their development goals and existing milestones.

- 3-day virtual events with dedicated support from OLCF, HPE, AMD, and ECP staff.
- Facilitated by Zoom for team breakout rooms + Slack for persistent communication.
- 4 hackathons held to date.
- Additional benefits to teams, vendors, OLCF, ECP, and future Frontier users

Crusher Hackathons

CAAR
ECP

2022 Crusher Hackathons			
#1	#2	#3	#4
February 9-11	February 15-17	August 2-4	September 12-14
CoMet	CANDLE	CoPA	CANDLE
ExaBiome	E3SM	E3SM	ExaAM
FUN3D	ExaAM	EXAALT	ExaBiome
GESTS	ExaSMR	EQSim	ExaLearn
LBPM	ExaStar	GAMESS	ExaSGD
LSMS	GAMESS	Ginkgo	ExaWind
NAMD	LatticeQCD	LatticeQCD	PETSc/TAO
NuCCOR	NWCHEMeX	PELE	QMCPACK
PIConGPU	PELE	VeloC/SZ	Subsurface
	WDMApp	WDMApp	WarpX

Crusher Hackathons

(Commonly-Encountered Issues → Documentation)

Slurm bindings

- Make sure processes and threads are mapped to the expected physical CPU cores and GPUs.
  https://docs.olcf.ornl.gov/systems/crusher_quick_start_guide.html#gpu-mapping

GPU atomics

- GPU HW atomics must be enabled but depends on memory type.
  https://docs.olcf.ornl.gov/systems/crusher_quick_start_guide.html#floating-point-fp-atomic-operations-and-coarse-fine-grained-memory-allocations

Managed/Unified memory

- XNACK must be enabled at compile- and run-time to use GPU page migration.
  https://docs.olcf.ornl.gov/systems/crusher_quick_start_guide.html#enabling-gpu-page-migration

GPU register usage

- This can affect performance in some applications.

  Slides: https://www.olcf.ornl.gov/wp-content/uploads/Intro_Register_pressure_ORNL_20220812_2083.pdf
  Recording: https://vimeo.com/742349001

Crusher Hackathons
(Additional Benefits)

- Gives OLCF, vendors, and ECP current snapshot of team progress as well as system and software status.
- Helps identify systems issues.
- Helps identify software/compiler issues.
- Feedback from users helps improve vendor tools (e.g., profilers)
- Opportunities for ECP ST teams to integrate with the ECP AD teams and to improve software and tools.

Upcoming OLCF Training Opportunities

- Still to come this year from the Preparing for Frontier series…
  - OpenMP – Part 3 (December 14)
  - Crusher/Frontier tips & lessons learned (date TBD)
  - Frontier early user experience talks (date TBD)

- Trainings and hackathons are expected to continue in 2023 as Frontier opens to our user allocation programs (DD, INCITE, ALCC).

- Keep an eye out for our **Frontier Training Workshop** that will be scheduled in early 2023.

For more information on previous and upcoming OLCF trainings, please stop by the table-top session on "OLCF Training" on Wednesday, October 19 from 1-3 PM (EDT).

Questions?

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