

E4S and Frank: A Platform for CI/CD with GPUs

Trilinos Users Group Meeting (TUG'23)

https://trilinos.github.io/trilinos_user-developer_group_meeting_2023.html

10am - 10:30am MT

CSRI, Sandia National Laboratories, Albuquerque, NM

Sameer Shende

Research Professor and Director,

Performance Research Laboratory, OACISS, University of Oregon

President and Director, ParaTools, Inc.

https://e4s.io/talks/E4S_Frank_TUG23.pdf



Para~~T~~ools

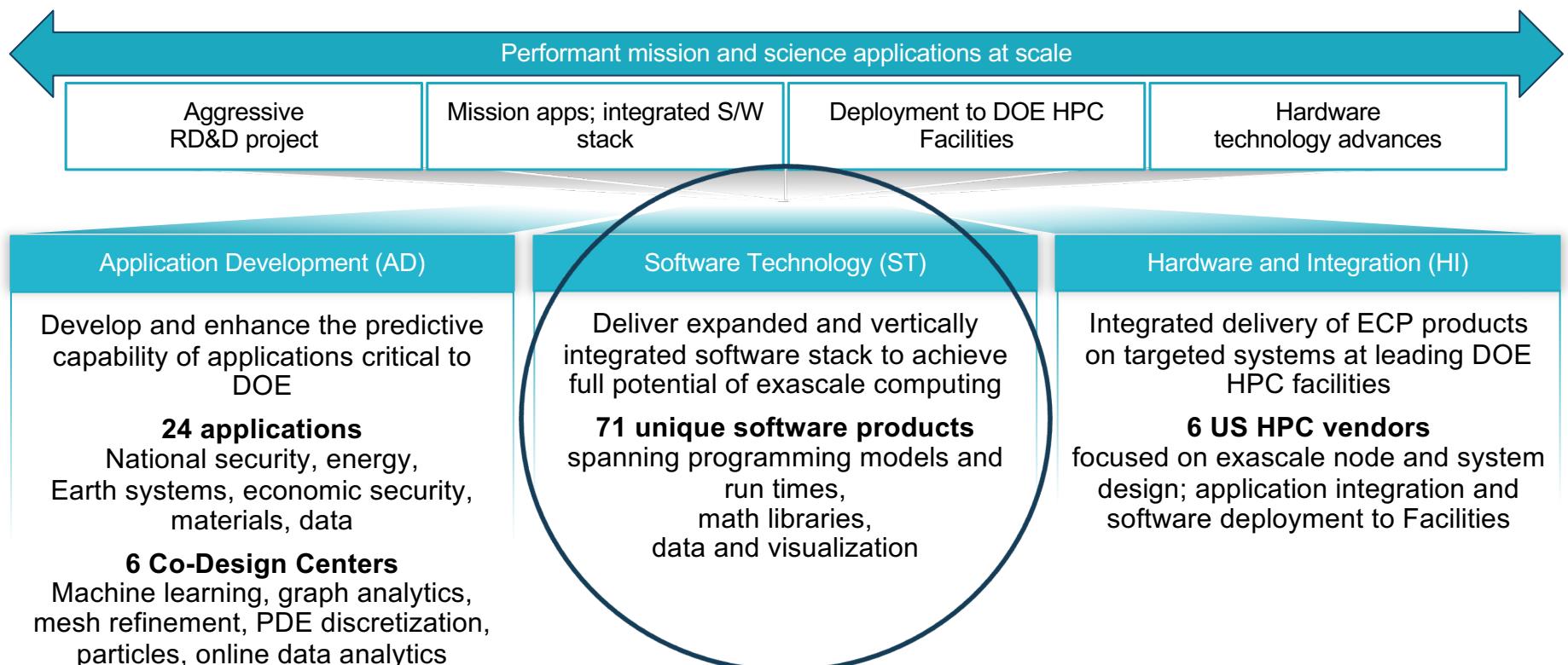
Challenges

- As our software gets more complex, it is getting harder to install and validate HPC tools and libraries correctly in an integrated and interoperable software stack
 - E4S and Frank – a platform for CI/CD!

Extreme-scale Scientific Software Stack (E4S)



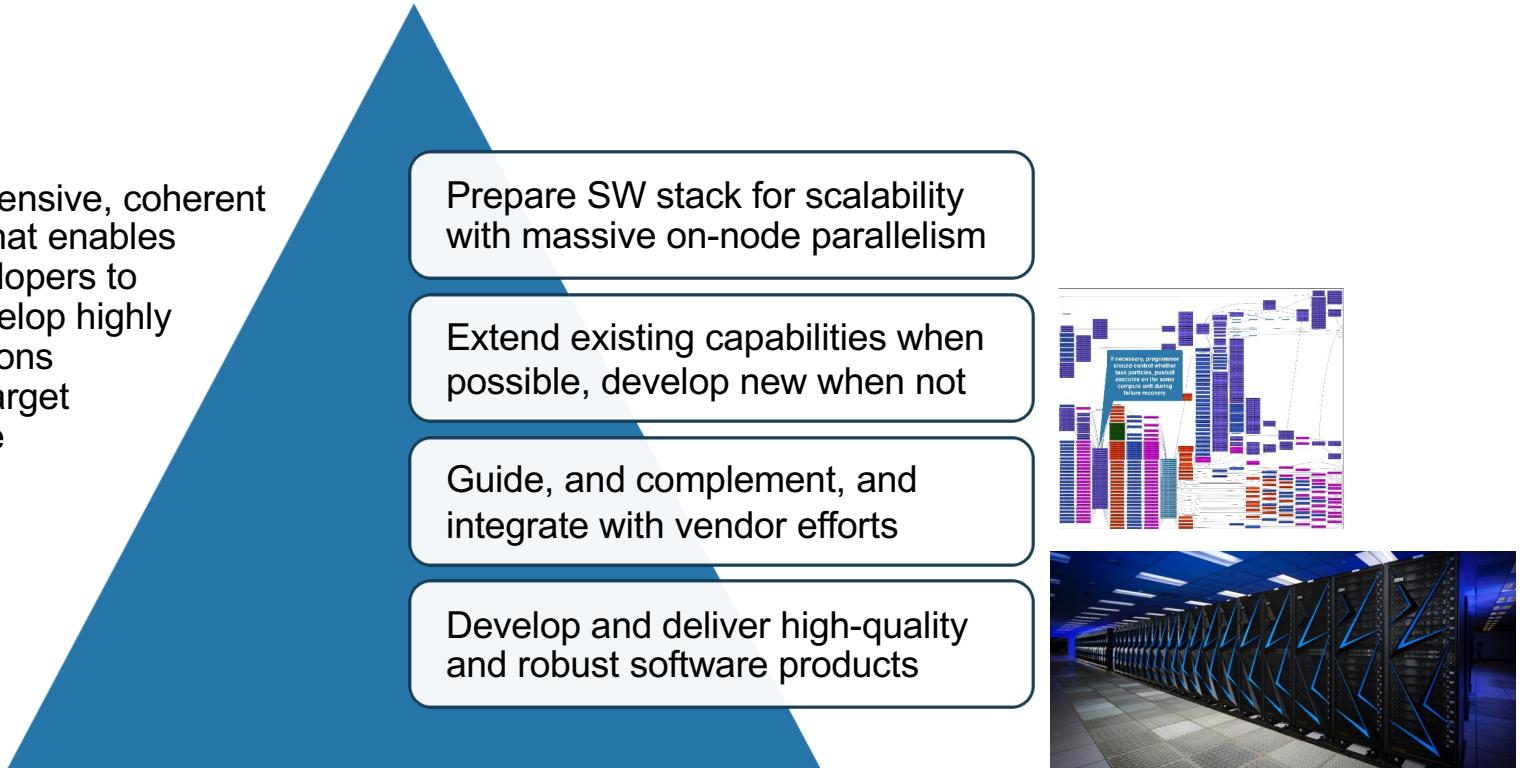
ECP's holistic approach uses co-design and integration to achieve exascale computing



ECP Software Technology (ST)

Goal

Build a comprehensive, coherent software stack that enables application developers to productively develop highly parallel applications that effectively target diverse exascale architectures



Extreme-scale Scientific Software Stack (E4S)

- **E4S**: HPC Software Ecosystem – a curated software portfolio
- A **Spack-based** distribution of software tested for interoperability and portability to multiple architectures with support for GPUs from NVIDIA, AMD, and Intel in each release
- Available from **source, containers, cloud, binary caches**
- Leverages and enhances SDK interoperability thrust
- Not a commercial product – an open resource for all
- Oct 2018: E4S 0.1 - 24 full, 24 partial release products
- Jan 2019: E4S 0.2 - 37 full, 10 partial release products
- Nov 2019: E4S 1.0 - 50 full, 5 partial release products
- Feb 2020: E4S 1.1 - 61 full release products
- Nov 2020: E4S 1.2 (aka, 20.10) - 67 full release products
- Feb 2021: E4S 21.02 - 67 full release, 4 partial release
- May 2021: E4S 21.05 - 76 full release products
- Aug 2021: E4S 21.08 - 88 full release products
- Nov 2021: E4S 21.11 - 91 full release products
- Feb 2022: E4S 22.02 – 100 full release products
- May 2022: E4S 22.05 – 101 full release products
- August 2022: E4S 22.08 – 102 full release products
- November 2022: E4S 22.11 – 103 full release products
- February 2023: E4S 23.02 – 106 full release products
- May 2023: E4S 23.05 – 109 full release products
- Aug 2023: E4S 23.08 – 115 full release products



<https://e4s.io>

Also include other products .e.g.,
AI: PyTorch, TensorFlow (CUDA, ROCm)
Co-Design: AMReX, Cabana, MFEM
EDA: Xyce



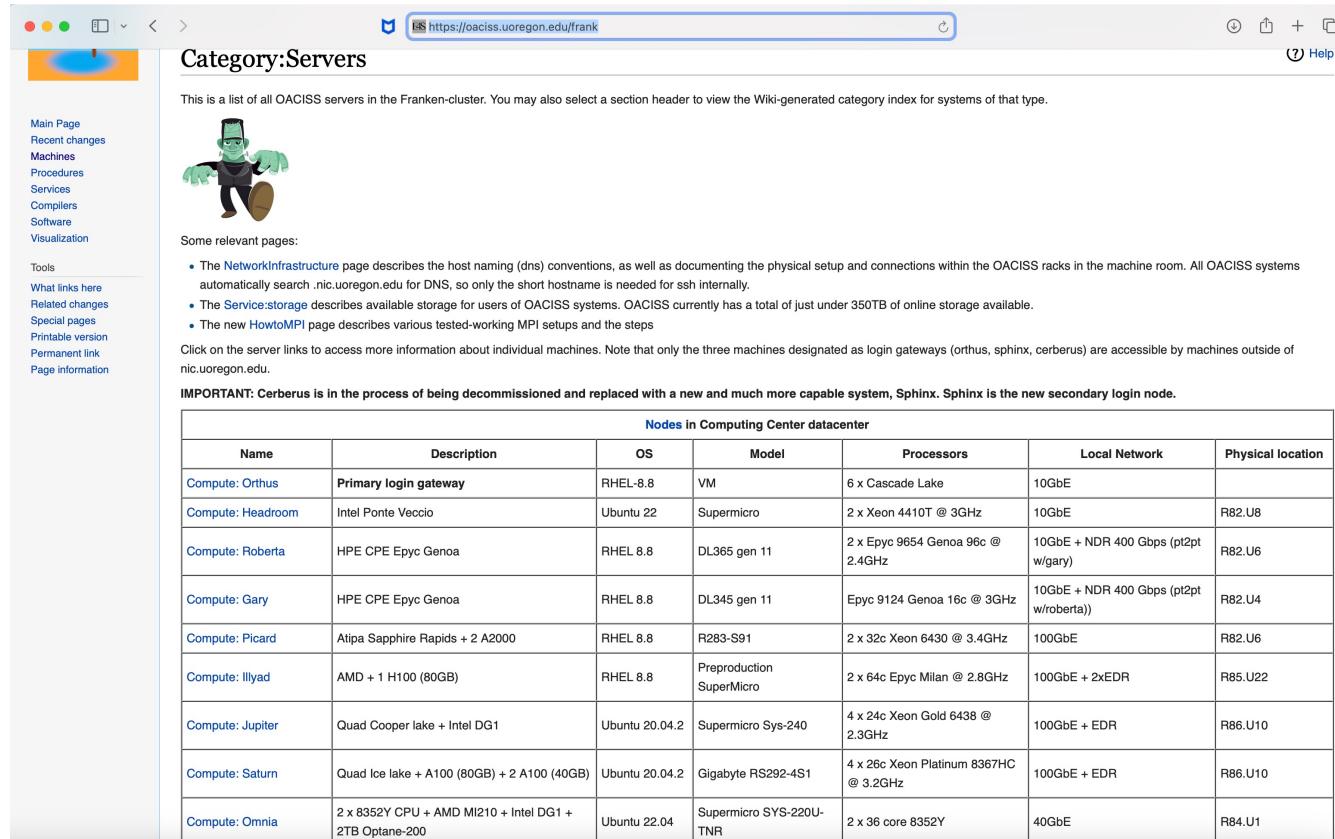
E4S: Extreme-scale Scientific Software Stack

- E4S is a community effort to provide open-source software packages for developing, deploying and running scientific applications on HPC platforms.
- E4S has built a comprehensive, coherent software stack that enables application developers to productively develop highly parallel applications that effectively target diverse exascale architectures.
- E4S provides a curated, Spack based software distribution of 100+ HPC, 50+ EDA (e.g., Xyce), and AI/ML packages (e.g., TensorFlow, PyTorch).
- With E4S Spack binary build caches, E4S supports both bare-metal and containerized deployment for GPU based platforms.
 - X86_64, ppc64le (IBM Power 9), aarch64 (ARM64) with support for GPUs from NVIDIA, AMD, and Intel
 - HPC and AI/ML packages are optimized for GPUs and CPUs.
- Container images on DockerHub and E4S website of pre-built binaries of ECP ST products.
- Base images and full featured containers (with GPU support).
- Commercial support for E4S through ParaTools, Inc. for installation, maintaining an issue tracker, and ECP AD engagement.
 - <https://dashboard.e4s.io> https://e4s.io/talks/E4S_Support_Sep23.pdf
- e4s-cl container launch tool allows binary distribution of applications by substituting MPI in the containerized app with the system MPI. e4s-alc is a tool to create custom container images from base images
- Quarterly releases: E4S 23.08 released on August 31, 2023: https://e4s.io/talks/E4S_23.08.pdf
- E4S for commercial cloud platforms: AWS image supports MPI implementations and containers with remote desktop (DCV).
 - Intel MPI, NVHPC, MVAPICH2, MPICH, MPC, OpenMPI

Frank: A platform for CI/CD at U. Oregon

- Features GPUs from:
 - Intel (Data Center GPU Max 1100/PVC, DG1, DG2)
 - AMD (MI210, MI100, MI50, MI25)
 - NVIDIA (H100, A100 PCIe 80GB, A100 PCIe 40GB, A100 SXM4, A2000, V100 SXM2, P100...)
- Features CPUs from:
 - Intel (Sapphire Rapids, IceLake, CooperLake,...)
 - AMD (Epyc Genoa, Milan, Rome, ...)
 - IBM (Power 10, Power 9, Power 8, ...)
 - ARM (NVIDIA Orin, Xavier, Tegra, Apple M1, M2, SoftIron, ...)
- Operating Systems
 - RHEL, SLES, Ubuntu, Debian, Mac OS X, AIX
 - HPE Cray Programming Environment (CPE)
- Fileservers
 - IBM Spectrum Scale (GPFS) GS4S all NVMe
 - BeeGFS
 - NFS

Frank: A platform for CI/CD at U. Oregon



This is a list of all OACISS servers in the Franken-cluster. You may also select a section header to view the Wiki-generated category index for systems of that type.

Some relevant pages:

- The [NetworkInfrastructure](#) page describes the host naming (dns) conventions, as well as documenting the physical setup and connections within the OACISS racks in the machine room. All OACISS systems automatically search .nic.uoregon.edu for DNS, so only the short hostname is needed for ssh internally.
- The [Service:storage](#) describes available storage for users of OACISS systems. OACISS currently has a total of just under 350TB of online storage available.
- The new [HowtoMPI](#) page describes various tested-working MPI setups and the steps

Click on the server links to access more information about individual machines. Note that only the three machines designated as login gateways (orthus, sphinx, cerberus) are accessible by machines outside of nic.uoregon.edu.

IMPORTANT: Cerberus is in the process of being decommissioned and replaced with a new and much more capable system, Sphinx. Sphinx is the new secondary login node.

Nodes in Computing Center datacenter						
Name	Description	OS	Model	Processors	Local Network	Physical location
Compute: Orthus	Primary login gateway	RHEL-8.8	VM	6 x Cascade Lake	10GbE	
Compute: Headroom	Intel Ponte Vecchio	Ubuntu 22	Supermicro	2 x Xeon 4410T @ 3GHz	10GbE	R82.U8
Compute: Roberta	HPE CPE Epyc Genoa	RHEL 8.8	DL365 gen 11	2 x Epyc 9654 Genoa 96c @ 2.4GHz	10GbE + NDR 400 Gbps (pt2pt w/roberta)	R82.U6
Compute: Gary	HPE CPE Epyc Genoa	RHEL 8.8	DL345 gen 11	Epyc 9124 Genoa 16c @ 3GHz	10GbE + NDR 400 Gbps (pt2pt w/roberta))	R82.U4
Compute: Picard	Atipa Sapphire Rapids + 2 A2000	RHEL 8.8	R283-S91	2 x 32c Xeon 6430 @ 3.4GHz	100GbE	R82.U6
Compute: Illyad	AMD + 1 H100 (80GB)	RHEL 8.8	Preproduction SuperMicro	2 x 64c Epyc Milan @ 2.8GHz	100GbE + 2xEDR	R85.U22
Compute: Jupiter	Quad Cooper lake + Intel DG1	Ubuntu 20.04.2	Supermicro Sys-240	4 x 24c Xeon Gold 6438 @ 2.3GHz	100GbE + EDR	R86.U10
Compute: Saturn	Quad Ice lake + A100 (80GB) + 2 A100 (40GB)	Ubuntu 20.04.2	Gigabyte RS292-4S1	4 x 26c Xeon Platinum 8367HC @ 3.2GHz	100GbE + EDR	R86.U10
Compute: Omnia	2 x 8352Y CPU + AMD MI210 + Intel DG1 + 2TB Optane-200	Ubuntu 22.04	Supermicro SYS-220U-TNR	2 x 36 core 8352Y	40GbE	R84.U1

Frank: A platform for CI/CD at U. Oregon



The screenshot shows a web browser window with the URL <https://oaciss.uoregon.edu/frank> in the address bar. The page displays a table of 20 compute resources, each with a name, hardware configuration, operating system, and network details.

Compute:	Hardware Configuration	OS	Network	Notes		
Gilgamesh	AMD + 2 MI210 + A100 (40GB)	RHEL 8.8	Preproduction SuperMicro	2 x 24c Epyc Milan 7413 @ 2.6GHz	100GbE + 2xEDR	R85.U26
Instinct	MI100+M40+A770 all in one	Ubuntu 20.04.2	Supermicro SC747	2 x 64c Epyc Milan 7763	10GbE	R85.U6
Mammatus	P10 system	Ubuntu 20.04.2	IBM S1022	10c P10	10GbE	R86.U31
Reptar	2x6248R CPU + AMD + nVidia	RHEL 8.8	Supermicro 7049	2 x 24c Xeon Gold 6248R @ 2.9GHz	10GbE + 100GbE	R84.U37
Voltar	A100 (80GB) + P100 + V100 GPU node	RHEL 8.8	Cascade Lake GPU server	2 x 16c Xeon Gold 6226R @ 2.9GHz	10GbE + EDR	R86.U26
Mothra	Intel + 2 x A770 (DG-2)	Ubuntu 22.04	Cascade Lake GPU server	2 x 24c Xeon Gold 6248R @ 3.0GHz	10GbE	R84.U3
Cyclops	IBM Power9 + 4 V100	RHEL 8.8	IBM AC922	2 x 20c Power9 @ 3.66GHz	10GbE + 2xHDR (200 Gbps)	R86.18
Gorgon	IBM Power9 + 4 V100	RHEL 8.8	IBM AC922	2 x 20c Power9 @ 3.66GHz	10GbE + 2xHDR (200 Gbps)	R86.U16
Medusa	IBM Power9	RHEL 8.8	IBM AC922	2 x 20c Power9 @ 3.66GHz	10GbE	R86.U14
Typhon	IBM Power9	RHEL 8.8	IBM AC922	2 x 20c Power9 @ 3.66GHz	10GbE	R86.U12
Delphi	Intel + GV100	RHEL 8.8	Intel SDP	2 x 18c Xeon E5-2697 v4	100GbE	R86.U35
Godzilla	Broadwell + 3 x M40	RHEL 8.8	Broadwell GPU server	2 x 14c Xeon E5-2680v4 @ 2.3GHz	40GbE + EDR	R85.U6
Centaur	IBM Power8 + 2 K80	Ubuntu 20.04	IBM S822LC	2 x 20c Power8 @ 3.5GHz	10GbE	R85.U18
Minotaur	IBM Power8 + 2 K80	Ubuntu 20.04	IBM S822LC	2 x 20c Power8 @ 3.5GHz	10GbE	R85.U20
Eagle	IBM Power9 + 2 x T4	RHEL 8.8	IBM IC922	2 x 16c Power9 @ 2.1GHz	10GbE + 2xEDR	R86.U24
Pegasus	Compute node	RHEL 8.8	Intel Skylake server	2 x 18c Xeon Gold 6140 @ 2.3GHz	100GbE + EDR	R86.U22
Vina	Raptor Talos II	Ubuntu 20.04	Talos workstation	2 x 22c Power9 @ 2.2GHz	10GbE	R84.U44
Pike	Raptor Talos II + MI25	Ubuntu 20.04	Talos workstation	2 x 22c Power9 @ 2.2GHz	10GbE	R84.U29
Cumulus-AIX.stor	AIX machine	AIX 7.2	IBM S-924 server	2 x 20c Power9 @ 3.6GHz	10GbE	R85.U10
Nimbus-AIX.stor	AIX machine	AIX 7.2	IBM S-924 server	2 x 20c Power9 @ 3.6GHz	10GbE	R85.U14
Mammatus-AIX.stor	AIX system	AIX 7.3	IBM S1022	10c P10	100GbE	R86.U31

Frank: A platform for CI/CD at U. Oregon

https://oaciss.uoregon.edu/frank

Name	Description	OS	Model	Processor	Local Network	Physical location
Compute: KNL Grover	Intel Phi system	RHEL 8.8	Intel KNL server	68c Xeon Phi 7250 @ 1.4GHz	1GbE	R86.U20
Compute: Axis cluster	DL580 G7 nodes	RHEL 8.6	HP 4U compute nodes with Slurm	4 x 8c Xeon Nehalem @ 2.3GHz	10GbE	R82
Compute Nodes in Streisinger						
Compute: Sphinx	Secondary login gateway + cluster	Ubuntu-20	Dell T640	2 x 16c Cascade lake	10GbE	Str-470
Compute: Orin Cluster	NVidia AGX Orin	Ubuntu-20.04	Jetson Orin	12c ARM v8l rev 1	1GbE	Str-470 mini-rack adjacent
Compute: Xavier Cluster	NVidia Tegra 3	Ubuntu-18.04.3	Jetson TX-3	8c ARM v8l rev 0	1GbE	Str-470 mini-rack adjacent
Jetson ARM64 cluster	Tegra TX-2	Ubuntu-20.04	4 x Jetson-TX2	4c ARM V8l rev 3	1GbE	Str 470 mini-rack
Jetson ARM64 cluster	Tegra TX-1	Ubuntu-18.04.3	12 x Jetson-TX1	4c ARM V8l rev 1	1GbE	Str 470 mini-rack
Compute: OD1K	ARM64 v8	Ubuntu	Softiron	ARM64	1GbE	Str-470 mini-rack adjacent
Compute: Omicron	M1 Mac	OSX	M1 Mini	M1	1GbE	Str-470 foyer
Compute: M2 Mac cluster	M2 Mac	OSX	M2 Mini	M2	1GbE	Str-470 foyer
Compute: Lambda	M1 Ultra 20 core Mac Studio	OSX	Mac Studio	M1	1GbE	Str-470 foyer
Compute: Sever	Intel Xe	Ubuntu 20.04	XPS 13	Quad core i7 Gen11 @ 2.8GHz	10GbE	Str-470 foyer
Compute: Silicon	VLSI simulation node	Debian 10	Supermicro mobo	6c 3.6GHz Broadwell CPU	1GbE	Str-473
Compute: Echs	Intel box	Ubuntu 20	MSI X590	8 core i7-10700	2.5GbE	Str-470 foyer
Infrastructure Nodes						
Name	Description	Model	Processor	Network	Physical location	
Infrastructure:orion	VM host	SuperMicro	16c Xeon Platinum	10GbE	R35.U37	
Infrastructure:mecha	?	Silicon Mechanics	2x Xeon E5410	1GbE	R34.U37 left	
Infrastructure:mnemosyne	NFS Server	Supermicro X11	2 x Xeon 6248R	100GbE + EDR	R35.21	
Infrastructure:lighthouse	Backup infrastructure	Qlogic Comet	Core i5-10500 x6 @ 2.3GHz	1GbE	Str-470	

ComputeSkeleton - Outline for new machine entries

Spack PR Merge Jobs on Frank and AWS

The screenshot shows a web browser window with the URL <https://stats.e4s.io> in the address bar. The page title is "Summary". Key statistics displayed are:

- Beginning:** 2021-09-22 12:48 AM PDT
- Ending:** 2023-11-01 10:20 PM PDT
- Total Jobs:** 5,196,653

To the right of the statistics, the text "Over 5M jobs!" is visible.

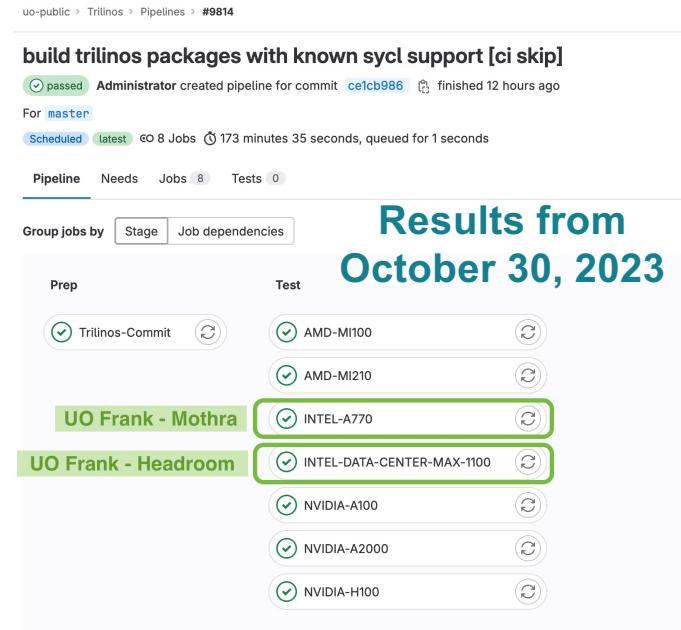
The page includes a "Navigation" section with links to various metrics:

- Pipeline Summary
- Pipeline failures over time
- Jobs per pipeline, overview
- Summary of Pipeline Errors
-
- UO Frank Node Descriptions
-
- UO Runners, Last 100 Completed Jobs
- AWS Runners, Last 100 Completed Jobs
-
- Job Times, Last 24 Hours
- Job Times, Last Week
- Job Times, Overview, All
- Runner System Failures, by Type, Last 24 Hours
- Runner System Failures, by Runner, Last 24 Hours

Trilinos: SYCL Enabled Builds Added to Nightly Testing

- SYCL-enabled builds of Trilinos now tested nightly on:
 - Intel Data Center Max 1100 GPU (PVC)
 - Intel A770

- Packages built:
 - Tpetra
 - Zoltan2
 - Ifpack2
 - Amesos2
 - Belos



Spack Developer Workflow Integration

Trilinos development branch nightly builds now orchestrated using **Spack developer workflow**

https://spack-tutorial.readthedocs.io/en/lanl19/tutorial_developer_workflows.html

```
69 if [[ ! -d $TRILINOS_ROOT ]]; then
70   cmd git clone https://github.com/$TRILINOS_REPO $TRILINOS_ROOT
71   cmd git -C $TRILINOS_ROOT checkout $TRILINOS_COMMIT
72 else
73   echo $TRILINOS_ROOT already exists, proceeding without clone and checkout
74 fi
75
76 cmd cd $TRILINOS_ROOT
77 cmd spack dev-build --quiet -j$BUILD_PARALLELISM $(cat $TARGET_ENV/spec.txt)
78 cmd spack env deactivate
79 HASH=$(spack find --format "{hash:7}" trilinos)
80
```

1. Clone Trilinos, checkout development branch

2. Spack development build

Script excerpt from <https://gitlab.e4s.io/uo-public/trilinos/-/blob/master/ci.sh>

Trilinos Ctests Run Post-build

https://gitlab.e4s.io/uo-public/trilinos/-/jobs/224286

uo-public > Trilinos > Jobs > #224286

Search job log

NVIDIA-H100

Duration: 173 minutes 26 seconds
Finished: 12 hours ago
Queued: 2 seconds
Timeout: 6h (from job) [?](#)
Job ID: #224286
Runner: #328 (WWb7HzjNF)
illyad-h100
Tags: h100 docker x86_64

Job artifacts [?](#)
These artifacts are the latest. They will not be deleted (even if expired) until newer artifacts are available.

Keep Download Browse

Commit ce1cb986 [�](#)
build trilinos packages with known sycl

```
620 259/269 Test #758: TpetraCore_guide_initializing_tpeta_with_teuchos_serial_MPI_4
..... Passed 3.41 sec
621
Trilinos TPetra CTests Running on NVIDIA H100
622 260/269 Test #759: TpetraCore_guide_map_contiguous_MPI_4
..... Passed 3.69 sec
623 Start 760: TpetraCore_guide_map_contiguous_and_uniform_MPI_4
624 261/269 Test #760: TpetraCore_guide_map_contiguous_and_uniform_MPI_4
..... Passed 3.53 sec
625 Start 761: TpetraCore_guide_map_contiguous_no_global_num_MPI_4
626 262/269 Test #761: TpetraCore_guide_map_contiguous_no_global_num_MPI_4
..... Passed 3.62 sec
627 Start 762: TpetraCore_guide_map_cyclic_MPI_4
628 263/269 Test #762: TpetraCore_guide_map_cyclic_MPI_4
..... Passed 3.52 sec
629 Start 763: TpetraCore_guide_vector_MPI_4
630 264/269 Test #763: TpetraCore_guide_vector_MPI_4
..... Passed 3.60 sec
631 Start 764: TpetraCore_guide_power_method_1_MPI_4
632 265/269 Test #764: TpetraCore_guide_power_method_1_MPI_4
..... Passed 5.68 sec
633 Start 765: TpetraCore_guide_parallel_vector_MPI_4
```

Automated CI Container Image Creation

<https://gitlab.e4s.io/uo-public/trilinos-images>

The screenshot shows a GitLab CI pipeline interface for a project named "Trilinos Images". The pipeline is titled "sycl image: use external kokkos" and has passed. It was created by an administrator for the "main" branch. The pipeline consists of 7 jobs and 0 tests. The interface includes sections for "Needs" and "Jobs".

The "Jobs" section is highlighted with green boxes and arrows pointing from "Dependency-1", "Dependency-2", and "Dependency-3" to a "CI-Images" section. The "CI-Images" section contains three items: "CUDA-Docker", "ROCM-Docker", and "SYCL-Docker".

At the bottom, a terminal log window shows the final steps of the pipeline:

```
65 #14 writing image sha256:48c6645b10e590ff17a9064e97caec7e818fe37072773cf778ed76775dd41  
29 done  
66 #14 naming to docker.io/esw123/trilinos-cuda:pipeline-9626 0.0s done
```

Automated CI Container Image Creation

- Automated generation of CI container images makes it easier to:
- Bring in changes from upstream Spack
- Bring in latest versions of Trilinos' dependencies
- Use of Spack developer workflows means nightly build configurations tested closely mimic the builds that end-users would install themselves if they use Spack

Trilinos nightly testing on 7 GPUs on Frank @ U. Oregon

The screenshot shows a GitLab pipeline interface for the Trilinos project. The pipeline is titled "build trilinos packages with known sycl support [ci skip]". It was created by an Administrator for the master branch and has 8 jobs scheduled, with a total estimated time of 173 minutes 38 seconds. The pipeline consists of two stages: Prep and Test. In the Prep stage, there is one job named "Trilinos-Commit". In the Test stage, there are seven jobs, each representing a different GPU configuration: AMD-MI100, AMD-MI210, INTEL-A770, INTEL-DATA-CENTER-MAX-1100, NVIDIA-A100, NVIDIA-A2000, and NVIDIA-H100. All jobs are marked as passed (green checkmarks). The interface includes a sidebar with project management options like Manage, Code, Build, Pipelines, Jobs, Pipeline schedules, Artifacts, Deploy, and Analyze. A search bar at the top is set to "Search or go to...". The bottom right corner features the ECP logo (Exascale Computing Project) and the number 18.

Trilinos Tpetra ctests nightly testing on AMD MI210 on Frank

The screenshot shows a web-based interface for managing a pipeline. On the left, a sidebar menu includes options like Project, Manage, Code, Build, Pipelines, and Jobs (which is currently selected). The main area displays a terminal-like window showing the output of a job log for Trilinos Tpetra ctests. The log output is as follows:

```
628     Start 751: TpetraCore_guide_matrix_fill_1_MPI_4
629 263/266 Test #751: TpetraCore_guide_matrix_fill_1_MPI_4 ..... Passed 0.55 sec
630     Start 752: TpetraCore_guide_matrix_construct_heat2d_1_MPI_2
631 264/266 Test #752: TpetraCore_guide_matrix_construct_heat2d_1_MPI_2 ..... Passed 0.47 sec
632     Start 753: TpetraCore_guide_matrix_construct_heat2d_2_MPI_2
633 265/266 Test #753: TpetraCore_guide_matrix_construct_heat2d_2_MPI_2 ..... Passed 0.46 sec
634     Start 754: TpetraCore_guide_data_redist_1_MPI_4
635 266/266 Test #754: TpetraCore_guide_data_redist_1_MPI_4 ..... Passed 0.55 sec
636 100% tests passed, 0 tests failed out of 266
637 Subproject Time Summary:
638 Tpetra = 488.00 sec*proc (266 tests)
639 Total Test time (real) = 180.51 sec
640 + save ctest.out
641 Uploading artifacts for successful job
642 Uploading artifacts...
643 Uploading artifacts...
644 artifacts: found 3 matching artifact files and directories
645 WARNING: processPath: artifact path is not a subpath of project directory: /Trilinos/spack/k-configure-args.txt
646 WARNING: processPath: artifact path is not a subpath of project directory: /Trilinos/spack/k-build-01-cmake-out.txt
647 Uploading artifacts as "archive" to coordinator... 201 Created id=224191 responseStatus=201 Created token=64_Q3gsd
648 Cleaning up project directory and file based variables
649 Job succeeded
```

To the right of the log, there is a summary section titled "AMD-MI210" with the following details:

- Duration: 94 minutes 26 seconds
- Finished: 15 hours ago
- Queued: 1 second
- Timeout: 6h (from job)
- Job ID: #224191
- Runner: #325 (Z8fBaY42Q)
gilgamesh-mi200
- Tags: mi210 docker x86_64

Below this, there is a section for "Job artifacts" which states: "These artifacts are the latest. They will not be deleted (even if expired) until newer artifacts are available." It includes "Download" and "Browse" buttons.

Further down, there is a "Commit" section for "ce1cb986" which includes a link to "build trilinos packages with known sycl support [ci skip]". There is also a "Pipeline" section for "#9798" which is marked as "passed" for master.

At the bottom, there is a "Related jobs" section with links to other jobs: AMD-MI100, AMD-MI210, INTEL-A770, and INTEL-DATA-CENTER-MAX-1100.

Trilinos nightly testing on Intel Data Center GPU Max 1100 (PVC)

The screenshot shows a GitHub Actions pipeline interface. On the left, a sidebar lists project sections like Project, Manage, Code, Build, Pipelines, and Jobs (which is selected). The main area displays a terminal-like log of test results:

```
617 258/263 Test #353: TpetraCore_guide_vector_MPI_4 ..... Passed 0.19 sec
618      Start 354: TpetraCore_guide_power_method_1_MPI_4
619 259/263 Test #354: TpetraCore_guide_power_method_1_MPI_4 ..... Passed 0.21 sec
620      Start 355: TpetraCore_guide_matrix_fill_1_MPI_4
621 260/263 Test #355: TpetraCore_guide_matrix_fill_1_MPI_4 ..... Passed 0.18 sec
622      Start 356: TpetraCore_guide_matrix_construct_heat2d_1_MPI_2
623 261/263 Test #356: TpetraCore_guide_matrix_construct_heat2d_1_MPI_2 ..... Passed 0.18 sec
624      Start 357: TpetraCore_guide_matrix_construct_heat2d_2_MPI_2
625 262/263 Test #357: TpetraCore_guide_matrix_construct_heat2d_2_MPI_2 ..... Passed 0.19 sec
626      Start 358: TpetraCore_guide_data_redist_1_MPI_4
627 263/263 Test #358: TpetraCore_guide_data_redist_1_MPI_4 ..... Passed 0.21 sec
628 100% tests passed, 0 tests failed out of 263
629 Subproject Time Summary:
630 Tpetra    = 195.68 sec*proc (263 tests)
631 Total Test time (real) = 66.66 sec
632 + save ctst.out
634 Uploading artifacts for successful job
635 Uploading artifacts...
636 artifacts: found 3 matching artifact files and directories
637 WARNING: processPath: artifact path is not a subpath of project directory: /Trilinos/spack-k-configure-args.txt
638 WARNING: processPath: artifact path is not a subpath of project directory: /Trilinos/spack-k-build-01-cmake-out.txt
639 Uploading artifacts as "archive" to coordinator... 201 Created id=224193 responseStatus=201 Created token=64_KedSQ
641 Cleaning up project directory and file based variables
643 Job succeeded
```

On the right, detailed job statistics are shown:

- Duration: 10 minutes 59 seconds
- Finished: 17 hours ago
- Queued: 1 second
- Timeout: 6h (from job)
- Job ID: #224193
- Runner: #356 (vvge6WEMy)
headroom-intel-data-center-max-1100
- Tags: intel-data-center-max-1100, docker_x86_64

Job artifacts section indicates no deletions will occur until newer artifacts are available.

Commit ce1cb986: build trilinos packages with known sycl support [ci skip]

Pipeline #9798 (passed) for master

Related jobs: AMD-MI100, AMD-MI210, INTEL-A770

Trilinos nightly testing on NVIDIA H100 on Frank

The screenshot shows a CI pipeline interface with a sidebar and a main job details view.

Left Sidebar:

- Project: Trilinos
- Pinned: Your pinned items appear here.
- Manage
- Code
- Build
- Pipelines
 - Jobs (selected)
 - Pipeline schedules
 - Artifacts
- Deploy
- Analyze

Job Details View:

Job URL: <https://gitlab.e4s.io/uo-public/trilinos/-/jobs/224189>

Job Log:

```
..... Passed 3.51 sec
631 Start 764: TpetraCore_guide_power_method_1_MPI_4
632 265/269 Test #764: TpetraCore_guide_power_method_1_MPI_4 ..... .
..... Passed 5.70 sec
633 Start 765: TpetraCore_guide_matrix_fill_1_MPI_4
634 266/269 Test #765: TpetraCore_guide_matrix_fill_1_MPI_4 ..... .
..... Passed 3.55 sec
635 Start 766: TpetraCore_guide_matrix_construct_heat2d_1_MPI_2
636 267/269 Test #766: TpetraCore_guide_matrix_construct_heat2d_1_MPI_2 ..... .
..... Passed 4.97 sec
637 Start 767: TpetraCore_guide_matrix_construct_heat2d_2_MPI_2
638 268/269 Test #767: TpetraCore_guide_matrix_construct_heat2d_2_MPI_2 ..... .
..... Passed 3.21 sec
639 Start 768: TpetraCore_guide_data_redist_1_MPI_4
640 269/269 Test #768: TpetraCore_guide_data_redist_1_MPI_4 ..... .
..... Passed 3.57 sec
641 100% tests passed, 0 tests failed out of 269
642 Subproject Time Summary:
643 Tpetra = 3379.37 sec/proc (269 tests)
644 Total Test time (real) = 1099.31 sec
645 + save ctest.out
647 Uploading artifacts for successful job
648 Uploading artifacts...
649 artifacts: found 3 matching artifact files and directories
650 WARNING: processPath: artifact path is not a subpath of project directory: /Trilinos/spack-configure-args.txt
651 WARNING: processPath: artifact path is not a subpath of project directory: /Trilinos/spack-build-01-cmake-out.txt
652 Uploading artifacts as "archive" to coordinator... 201 Created id=224189 responseStatus=201 Created token=64_r3zDz
654 Cleaning up project directory and file based variables
656 Job succeeded
```

Right Panel: NVIDIA-H100

- Duration: 173 minutes 28 seconds
- Finished: 14 hours ago
- Queued: 2 seconds
- Timeout: 6h (from job) [?](#)
- Job ID: #224189
- Runner: #328 (WWb7HzjNF) iliyad-H100
- Tags: h100, docker, x86_64

Job artifacts [?](#)
These artifacts are the latest. They will not be deleted (even if expired) until newer artifacts are available.

[Download](#) [Browse](#)

Commit ce1cb986 [?](#)
build trilinos packages with known sycl support [ci skip]

Pipeline #9798 [passed](#) for master

[Test](#)

Related jobs

- AMD-MI100
- AMD-MI210
- INTEL-A770
- INTEL-DATA-CENTER-MAX-1100

Triaging errors with expanded tests on AMD GPUs

The screenshot shows a GitLab job log for the Trilinos project. The sidebar on the left is collapsed. The main area displays the log output for job #224449, which ran on an AMD-MI100. The log shows 2378 tests run, with 99% passing. A summary table provides time per test for various subprojects like Amesos, AztecOO, Belos, Epetra, etc. The log ends with a failure for Kokkos_CoreUnitTest_HIP_MPI_1.

Subproject	Time (sec)	Tests
Amesos	19.54	14
Amesos2	33.36	13
Anasazi	155.23	78
AztecOO	11.10	17
Belos	589.56	165
Epetra	30.20	64
EpetraExt	12.19	10
Ifpack	51.52	48
Ifpack2	183.10	58
Intrepid2	3441.12	364
Iisorropia	6.90	6
Kokkos	577.99	31
ML	46.32	35
MueLu	1024.16	128
NOX	187.58	111
Piro	148.04	17
Sacado	29.64	307
Shards	0.22	4
Stokhos	102.90	76
Stratimikos	47.20	49
Teko	169.06	19
Tempus	242.34	167
Thyra	39.20	82
Tpetra	729.48	279
Triutils	1.55	2
Zoltan	1300.64	57
Zoltan2	728.14	177
Total Test time (real)	= 5909.97 sec	
4 - Kokkos_CoreUnitTest_HIP_MPI_1	(Failed)	

- 2378 tests run
- 99% pass

SYCL Enabled Trilinos Issue #12420

- When Trilinos is built with external SYCL-enabled Kokkos, the build works
- When Trilinos is built with vendored SYCL-enabled Kokkos, the build fails
- We are using External Kokkos for now
- **Trilinos SYCL build failing: llvm-foreach: Error: Device name missing. #12420**
- <https://github.com/trilinos/Trilinos/issues/12420>

Other Trilinos issues filed

- **Kokkos: Configure error with -**

DKokkos_ARCH_INTEL_XEHP=ON #12016

- <https://github.com/trilinos/Trilinos/issues/12016>
- **ShyLU: ShyLU/ShyLUConfig.cmake:164 (include): could not find requested file:**

../ShyLU_Node/ShyLU_NodeConfig.cmake #12048

- <https://github.com/trilinos/Trilinos/issues/12048>

E4S installation Dashboard Progress: <https://dashboard.e4s.io>

The screenshot shows the ParaTools E4S Dashboard. At the top, there's a header with the title "ParaTools E4S Dashboard" and a timestamp "9/30/2023 - Test Results for Polaris, Frontier, and Perlmutter posted". Below the header, there's a "Quick Navigation" sidebar with links to Facility Deployment, Package Build Issues, Support, Application Engagement, and specific sections for each facility.

Facility Deployments - Summary

System	Deployment	Spack Details	Root Specs Installed	Spack Environment	Test Results
Polaris	E4S 23.08, PrgEnv-gnu	/soft/cecp/ParaTools/E4S/23.08/PrgEnv-gnu/spack /soft/cecp/ParaTools/E4S/23.08/PrgEnv-gnu/spack.yaml /soft/cecp/ParaTools/E4S/23.08/PrgEnv-gnu/cep-dav/spack.yaml /soft/cecp/ParaTools/E4S/23.08/PrgEnv-gnu/module-use.sh /soft/cecp/ParaTools/E4S/23.08/PrgEnv-gnu/start-spack.sh	131/144	spack.yaml	Testsuite
Frontier	E4S 23.08, PrgEnv-gnu	/sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/spack /sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/spack.yaml /sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/cep-dav/spack.yaml /sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/module-use.sh /sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/start-spack.sh	123/129	spack.yaml	Testsuite
Perlmutter	E4S 23.08, PrgEnv-gnu	/global/cfs/cdirs/m3896/shared/ParaTools/E4S/23.08/PrgEnv-gnu/spack /global/cfs/cdirs/m3896/shared/ParaTools/E4S/23.08/PrgEnv-gnu/spack.yaml /global/cfs/cdirs/m3896/shared/ParaTools/E4S/23.08/PrgEnv-gnu/cep-dav/spack.yaml /global/cfs/cdirs/m3896/shared/ParaTools/E4S/23.08/PrgEnv-gnu/module-use.sh /global/cfs/cdirs/m3896/shared/ParaTools/E4S/23.08/PrgEnv-gnu/start-spack.sh	125/145	spack.yaml	Testsuite

E4S 23.08 installation on Frontier at ORNL with Trilinos 14.4.0

```
[sameer@login03.frontier ~]$ module avail
```

----- /opt/cray/pe/lmod/modulefiles/mpi/gnu/8.0/ofi/1.0/cray-mpich/8.0 ----- cray-hdf5-parallel/1.12.1.5 cray-hdf5-parallel/1.12.2.1 (D) cray-hdf5-parallel/1.12.2.3 cray-hdf5-parallel/1.12.2.7 cray-mpixlate/1.0.0.6	cray-mpixlate/1.0.1.10 cray-mpixlate/1.0.1.11 cray-mpixlate/1.0.2 (D) cray-parallel-netcdf/1.12.2.5 cray-parallel-netcdf/1.12.3.1 (D)	cray-parallel-netcdf/1.12.3.3 cray-parallel-netcdf/1.12.3.7 craype-dl-plugin-ftr/22.06.1.2 craype-dl-plugin-py3/21.02.1.3 craype-dl-plugin-py3/21.04.1	craype-dl-plugin-py3/22.06.1.2 craype-dl-plugin-py3/22.08.1 craype-dl-plugin-py3/22.09.1 craype-dl-plugin-py3/22.12.1 (D)
----- /autofs/nccs-svm1_sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/spack/share/spack/lmod/linux-sles15-x86_64/cray-mpich/8.1.23/Core -----			
adios/1.13.1 adios2/2.9.1 (D) alquimia/1.0.10 amrex/23.08-rocm amrex/23.08 (D) arborx/1.4.1-rocm arborx/1.4.1 (D) ascent/0.9.0-openmp ascent/0.9.0 (D) axom/0.7.0-openmp (D) boost/1.83.0 (D) butterflypack/2.2.2-openmp (D) cabana/0.5.0-rocm cabana/0.5.0 (D) caliper/2.10.0-rocm caliper/2.10.0 (D) conduit/0.8.8 (D) darshan-runtime/3.4.4 (L,D) datatransferkit/3.1-rc3 (D) dyninst/12.3.0-openmp (D) ecp-data-vis-sdk/1.0-rocm ecp-data-vis-sdk/1.0 (D) exaworks/0.1.0 faodel/1.2108.1 (D) flecsi/2.2.1 fortrilinos/2.3.0 (D)	ginkgo/1.6.0-openmp (D) ginkgo/1.6.0-rocm-openmp (D) globalarrays/5.8.2 (D) h5bench/1.4 hdf5-vol-async/1.7 hdf5-vol-cache/v1.1 hdf5-vol-log/1.4.0 hdf5/1.14.0 (D) heffte/2.3.0-rocm (D) heffte/2.3.0 (D) hpctoolkit/2023.03.01-rocm (D) hpctoolkit/2023.03.01 (D) hpx/1.9.1 (D) hypre/2.29.0-rocm (D) hypre/2.29.0 (D) lammps/20230802-openmp (D) libcatalyst/2.0.0-rc3 (D) libnrm/0.1.0 (D) libresso/0.95.1-openmp (D) libquo/1.3.1 (D) mercury/2.3.0 (D) metall/0.25 (D) mfem/4.5.2-rocm (D) mfem/4.5.2 (D) mpfileutils/0.11.1 (D) nccmp/1.9.1.0 (D)	nco/5.1.6 (D) netlib-scalapack/2.2.0 (D) omega-h/9.34.13 (D) openfoam/2306 openpmd-api/0.15.1 (D) papyrus/1.0.2 (D) parallel-netcdf/1.12.3 (D) paraview/5.11.1-rocm (D) paraview/5.11.1 (D) parsec/3.0.2209 (D) petsc/3.19.4-rocm (D) petsc/3.19.4 (D) phist/1.11.2-openmp (D) plumed/2.9.0 (D) precice/2.5.0 (D) pruners-ninja/1.0.1 (D) pumi/2.2.7 (D) py-cinemasci/1.3 (D) py-h5py/3.8.0 (D) py-libensembl/0.10.2 (D) py-petsc4py/3.19.4 (D) py-warpx/23.08 (D) quantum-espresso/7.2-openmp (D) rempi/1.1.0 (D) slate/2022.07.00-openmp (D) slate/2022.07.00-rocm-openmp (D)	slepc/3.19.1-rocm (D) slepc/3.19.1 (D) stc/0.9.0 (D) strumpack/7.1.3-openmp (D) strumpack/7.1.3-rocm-openmp (D) sundials/6.5.1-rocm (D) sundials/6.5.1 (D) superlu-dist/8.1.2-rocm (D) superlu-dist/8.1.2 (D) sz/2.1.12.5 (D) tasmanian/7.9-rocm (D) tasmanian/7.9 (D) tau/2.32.1-rocm (D) tau/2.32.1 (D) trilinos/14.4.0-rocm (D) trilinos/14.4.0 (D) (D) unifyfs/1.0.1 (D) upcxx/2023.3.0-rocm (D) upcxx/2023.3.0 (D) veloc/1.6 (D) visit/3.3.3 (D) vtk-m/1.9.0-openmp (D) vtk-m/1.9.0-rocm (D) wannier90/3.1.0 (D) xyce/7.6.0 (D)
----- /sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/spack/share/spack/lmod/linux-sles15-x86_64/Core -----			
aml/0.2.1 (D) argobots/1.1 (D) bolt/2.0 (D) chai/2022.03.0-rocm chai/2022.03.0 (D) charliecloud/0.33 cray-mpich/8.1.23 (L,D) darshan-util/3.4.4 (D)	flit/2.1.0 (D) flux-core/0.53.0 (D) gasnet/2023.3.0-rocm (D) gasnet/2023.3.0 (D) gmp/6.2.1 (D) gotcha/1.0.4 (D) kokkos-kernels/4.0.00-openmp (D) kokkos/4.1.00-openmp (D)	kokkos/4.1.00-rocm (D) legion/23.06.0-rocm (D) legion/23.06.0 (D) libunwind/1.6.2 (D) loki/0.1.7 (D) magma/2.7.1-rocm (D) mgard/2023-03-31-openmp (D) mpark-variant/1.4.0 (D)	nrm/0.1.0 (D) openmpi/4.1.5 (D) papi/6.0.0.1 (D) pdt/3.25.1 (D) plasma/22.9.29 (D) qthreads/1.18 (D) raja/2022.10.4-openmp (D) raja/2022.10.4-rocm (D) superlu/5.3.0 (D) swig/4.0.2-fortran (D) sz3/3.1.7 (D) umap/2.1.0 (D) umpire/2022.03.1-rocm (D) umpire/2022.03.1 (D) variorum/0.6.0 (D) zfp/0.5.5 (D)

E4S 23.08 installation on Frontier at ORNL with Trilinos 14.4.0

```
[sameer@login03.frontier ~]$ module avail
```

----- /opt/cray/pe/lmod/modulefiles/mpi/gnu/8.0/ofi/1.0/cray-mpich/8.0 ----- cray-hdf5-parallel/1.12.1.5 cray-hdf5-parallel/1.12.2.1 (D) cray-hdf5-parallel/1.12.2.3 cray-hdf5-parallel/1.12.2.7 cray-mpixlate/1.0.0.6	cray-mpixlate/1.0.1.10 cray-mpixlate/1.0.1.11 cray-mpixlate/1.0.2 (D) cray-parallel-netcdf/1.12.2.5 cray-parallel-netcdf/1.12.3.1 (D)	cray-parallel-netcdf/1.12.3.3 cray-parallel-netcdf/1.12.3.7 craype-dl-plugin-ftr/22.06.1.2 craype-dl-plugin-py3/21.02.1.3 craype-dl-plugin-py3/21.04.1	craype-dl-plugin-py3/22.06.1.2 craype-dl-plugin-py3/22.08.1 craype-dl-plugin-py3/22.09.1 craype-dl-plugin-py3/22.12.1 (D)
----- /autofs/nccs-svm1_sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/spack/share/spack/lmod/linux-sles15-x86_64/cray-mpich/8.1.23/Core -----			
adios/1.13.1 adios2/2.9.1 (D) alquimia/1.0.10 amrex/23.08-rocm amrex/23.08 (D) arborx/1.4.1-rocm arborx/1.4.1 (D) ascent/0.9.0-openmp ascent/0.9.0 (D) axom/0.7.0-openmp (D) boost/1.83.0 (D) butterflypack/2.2.2-openmp (D) cabana/0.5.0-rocm cabana/0.5.0 (D) caliper/2.10.0-rocm caliper/2.10.0 (D) conduit/0.8.8 (D) darshan-runtime/3.4.4 (L,D) datatransferkit/3.1-rc3 (D) dyninst/12.3.0-openmp (D) ecp-data-vis-sdk/1.0-rocm ecp-data-vis-sdk/1.0 (D) exaworks/0.1.0 faodel/1.2108.1 (D) flecsi/2.2.1 fortrilinos/2.3.0 (D)	ginkgo/1.6.0-openmp (D) ginkgo/1.6.0-rocm-openmp (D) globalarrays/5.8.2 (D) h5bench/1.4 hdf5-vol-async/1.7 hdf5-vol-cache/v1.1 hdf5-vol-log/1.4.0 hdf5/1.14.0 (D) heffte/2.3.0-rocm (D) heffte/2.3.0 (D) hpctoolkit/2023.03.01-rocm (D) hpctoolkit/2023.03.01 (D) hpx/1.9.1 (D) hypre/2.29.0-rocm (D) hypre/2.29.0 (D) lammps/20230802-openmp (D) libcatalyst/2.0.0-rc3 (D) libnrm/0.1.0 (D) libresso/0.95.1-openmp (D) libquo/1.3.1 (D) mercury/2.3.0 (D) metall/0.25 (D) mfem/4.5.2-rocm (D) mfem/4.5.2 (D) mpfileutils/0.11.1 (D) nccmp/1.9.1.0 (D)	nco/5.1.6 (D) netlib-scalapack/2.2.0 (D) omega-h/9.34.13 (D) openfoam/2306 openpmd-api/0.15.1 (D) papyrus/1.0.2 (D) parallel-netcdf/1.12.3 (D) paraview/5.11.1-rocm (D) paraview/5.11.1 (D) parsec/3.0.2209 (D) petsc/3.19.4-rocm (D) petsc/3.19.4 (D) phist/1.11.2-openmp (D) plumed/2.9.0 (D) precice/2.5.0 (D) pruners-ninja/1.0.1 (D) pumi/2.2.7 (D) py-cinemasci/1.3 (D) py-h5py/3.8.0 (D) py-libensembl/0.10.2 (D) py-petsc4py/3.19.4 (D) py-warpx/23.08 (D) quantum-espresso/7.2-openmp (D) rempi/1.1.0 (D) slate/2022.07.00-openmp (D) slate/2022.07.00-rocm-openmp (D)	slepc/3.19.1-rocm (D) slepc/3.19.1 (D) stc/0.9.0 (D) strumpack/7.1.3-openmp (D) strumpack/7.1.3-rocm-openmp (D) sundials/6.5.1-rocm (D) sundials/6.5.1 (D) superlu-dist/8.1.2-rocm (D) superlu-dist/8.1.2 (D) sz/2.1.12.5 (D) tasmanian/7.9-rocm (D) tasmanian/7.9 (D) tau/2.32.1-rocm (D) tau/2.32.1 (D) trilinos/14.4.0-rocm (D) trilinos/14.4.0 (D) (D) unifyfs/1.0.1 (D) upcxx/2023.3.0-rocm (D) upcxx/2023.3.0 (D) veloc/1.6 (D) visit/3.3.3 (D) vtk-m/1.9.0-openmp (D) vtk-m/1.9.0-rocm (D) wannier90/3.1.0 (D) xyce/7.6.0 (D)
----- /sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/spack/share/spack/lmod/linux-sles15-x86_64/Core -----			
aml/0.2.1 (D) argobots/1.1 (D) bolt/2.0 (D) chai/2022.03.0-rocm chai/2022.03.0 (D) charliecloud/0.33 cray-mpich/8.1.23 (L,D) darshan-util/3.4.4 (D)	flit/2.1.0 (D) flux-core/0.53.0 (D) gasnet/2023.3.0-rocm (D) gasnet/2023.3.0 (D) gmp/6.2.1 (D) gotcha/1.0.4 (D) kokkos-kernels/4.0.00-openmp (D) kokkos/4.1.00-openmp (D)	kokkos/4.1.00-rocm (D) legion/23.06.0-rocm (D) legion/23.06.0 (D) libunwind/1.6.2 (D) loki/0.1.7 (D) magma/2.7.1-rocm (D) mgard/2023-03-31-openmp (D) mpark-variant/1.4.0 (D)	nrm/0.1.0 (D) openmpi/4.1.5 (D) papi/6.0.0.1 (D) pdt/3.25.1 (D) plasma/22.9.29 (D) qthreads/1.18 (D) raja/2022.10.4-openmp (D) raja/2022.10.4-rocm (D) superlu/5.3.0 (D) swig/4.0.2-fortran (D) sz3/3.1.7 (D) umap/2.1.0 (D) umpire/2022.03.1-rocm (D) umpire/2022.03.1 (D) variorum/0.6.0 (D) zfp/0.5.5 (D)

E4S 23.08 installation on Frontier at ORNL

```
[sameer@login03.frontier ~]$ source /sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/start-spack.sh
Lmod is automatically replacing "cce/15.0.0" with "gcc/12.2.0".

Lmod is automatically replacing "PrgEnv-cray/8.3.3" with "PrgEnv-gnu/8.3.3".

Due to MODULEPATH changes, the following have been reloaded:
 1) cray-mpich/8.1.23  2) darshan-runtime/3.4.0

Due to MODULEPATH changes, the following have been reloaded:
 1) darshan-runtime/3.4.0

The following have been reloaded with a version change:
 1) gcc/12.2.0 => gcc/11.2.0

[sameer@login03.frontier ~]$ which spack
/sw/frontier/ums/ums002/E4S/23.08/PrgEnv-gnu/spack/bin/spack
[sameer@login03.frontier ~]$ spack find -x
-- linux-sles15-zen3 / gcc@11.2.0 --
adios@1.13.1           charliecloud@0.33      hdfbench@1.4          libnrm@0.1.0          papyrus@0.1.2          raja@2022.10.4          trilinos@14.4.0
adios2@2.9.1           conduit@0.8.8       hdf5@1.14.0          libresso@0.95.1       parallel-netcdf@0.1.12.3    rempi@0.1.0          turbine@1.3.0
alquimia@1.0.10        cray-mpich@8.1.23     hdf5-vol-async@0.1.7  libquo@0.1.3.1        paraview@0.11.1         slate@2022.07.00       umap@2.1.0
aml@0.2.1              darshan-runtime@0.3.4.4   hdf5-vol-async@0.1.7  libunwind@0.1.6.2     paraview@0.11.1         slate@2022.07.00       umpire@2022.03.1
amrex@23.08             darshan-util@0.3.4.4   hdf5-vol-cache@v1.1   loki@0.1.7           parsec@0.0.2209       slepc@0.3.19.1         umpire@2022.03.1
amrex@23.08             datatransferkit@0.3.1-rc3  hdf5-vol-cache@v1.1   magma@2.7.1          pdt@0.25.1            slepc@0.3.19.1         unifyfs@0.1.0
arborx@0.1.4.1          dyninst@0.12.3.0     hdf5-vol-log@0.1.4.0  mercury@0.2.3.0      petsc@0.3.19.4         stc@0.9.0            upcxx@2023.3.0
arborx@0.1.4.1          ecp-data-vis-sdk@0.1.0   hdf5-vol-log@0.1.4.0  metall@0.0.25       petsc@0.3.19.4         strumpack@0.7.1.3      upcxx@2023.3.0
argobots@0.1.1          ecp-data-vis-sdk@0.1.0   heffte@0.2.3.0        mfem@4.5.2            phist@0.1.1.2         strumpack@0.7.1.3      variorum@0.6.0
ascent@0.9.0            exaworks@0.1.0       heffte@0.2.3.0        mfem@4.5.2            plasma@0.22.9.29     sundials@0.6.5.1       veloci@0.1.6
ascent@0.9.0            faodel@0.1.2108.1   hpctoolkit@2023.03.01 mgard@2023-03-31      plumed@0.2.9.0        sundials@0.6.5.1       visit@0.3.3.3
axom@0.7.0              flecsi@0.2.2.1      hpctoolkit@2023.03.01 mpark-variant@0.1.4.0 mpcfileutils@0.0.11.1 pruners-ninja@0.1.0.1  superlu@0.3.0
bolt@2.0                flit@0.2.1.0       hpx@0.1.9.1          nccmp@0.1.9.1.0      pumi@0.2.2.7          superlu-dist@0.1.2     vtk-m@0.1.9.0
boost@0.1.83.0          flux-core@0.53.0    hypre@0.29.0          ncnc@0.5.1.6          py-cinemasci@0.1.3   swig@0.4.0.2-fortran  wannier@0.03.1.0
butterflypack@0.2.2.2   fortrilinos@0.2.3.0   hypre@0.29.0          netlib-scalapack@0.2.2.0 py-h5py@0.3.8.0        sz@0.2.1.12.5         xce@0.7.6.0
cabana@0.5.8             gasnet@2023.3.0     kokkos@0.4.1.00      nrm@0.0.1.0          py-libensemble@0.0.10.2 zfp@0.5.5
cabana@0.5.0             gasnet@0.2023.3.0   kokkos-kernels@0.4.0.0 omega-h@0.34.13      py-petsc4py@0.3.19.4  tasmanian@0.7.9
cabana@0.5.0             ginkgo@0.1.6.0      lammps@020230882    openfoam@02366       py-warpix@0.23.08    tasmanian@0.7.9
caliper@0.2.10.0         ginkgo@0.1.6.0      legion@023.06.0     openmpi@0.4.1.5      qthreads@0.1.18       tau@0.2.32.1
caliper@0.2.10.0         globalarrays@0.5.8.2  legion@023.06.0     openpm@0.0.15.1     quantum-espresso@0.7.2 tau@0.2.32.1
chai@02022.03.0          gmp@0.6.2.1       libcatalyst@02.0.0-rc3 papi@0.0.0.1          raja@2022.10.4        trilinos@14.4.0
chai@02022.03.0          gotcha@0.1.0.4     libcatalyst@02.0.0-rc3
==> 149 installed packages
[sameer@login03.frontier ~]$ spack find -x +rocm
-- linux-sles15-zen3 / gcc@11.2.0 --
amrex@23.08             caliper@0.2.10.0    ginkgo@0.1.6.0       kokkos@0.4.1.00      paraview@0.11.1       slepc@0.3.19.1       tasmanian@0.7.9
arborx@0.1.4.1           chai@02022.03.0    heffte@0.2.3.0       legion@023.06.0     petsc@0.3.19.4       strumpack@0.7.1.3     tau@0.2.32.1
cabana@0.5.0              ecp-data-vis-sdk@0.1.0  hpc toolkit@2023.03.01 magma@2.7.1          raja@2022.10.4       sundials@0.6.5.1       tasmanian@0.7.9
cabana@0.5.0              gasnet@0.2023.3.0   hypre@0.29.0          mfem@4.5.2            slate@2022.07.00     superlu-dist@0.8.1.2  trilinos@14.4.0
cabana@0.5.0              ginkgo@0.1.6.0      lammps@020230882    openfoam@02366       sundials@0.6.5.1       tasmanian@0.7.9
caliper@0.2.10.0          globalarrays@0.5.8.2  legion@023.06.0     openmpi@0.4.1.5      tasmanian@0.7.9
chai@02022.03.0           gmp@0.6.2.1       libcatalyst@02.0.0-rc3 openpm@0.0.15.1     qthreads@0.1.18       tau@0.2.32.1
chai@02022.03.0           gotcha@0.1.0.4     libcatalyst@02.0.0-rc3 quantum-espresso@0.7.2 tasmanian@0.7.9
==> 30 installed packages
```

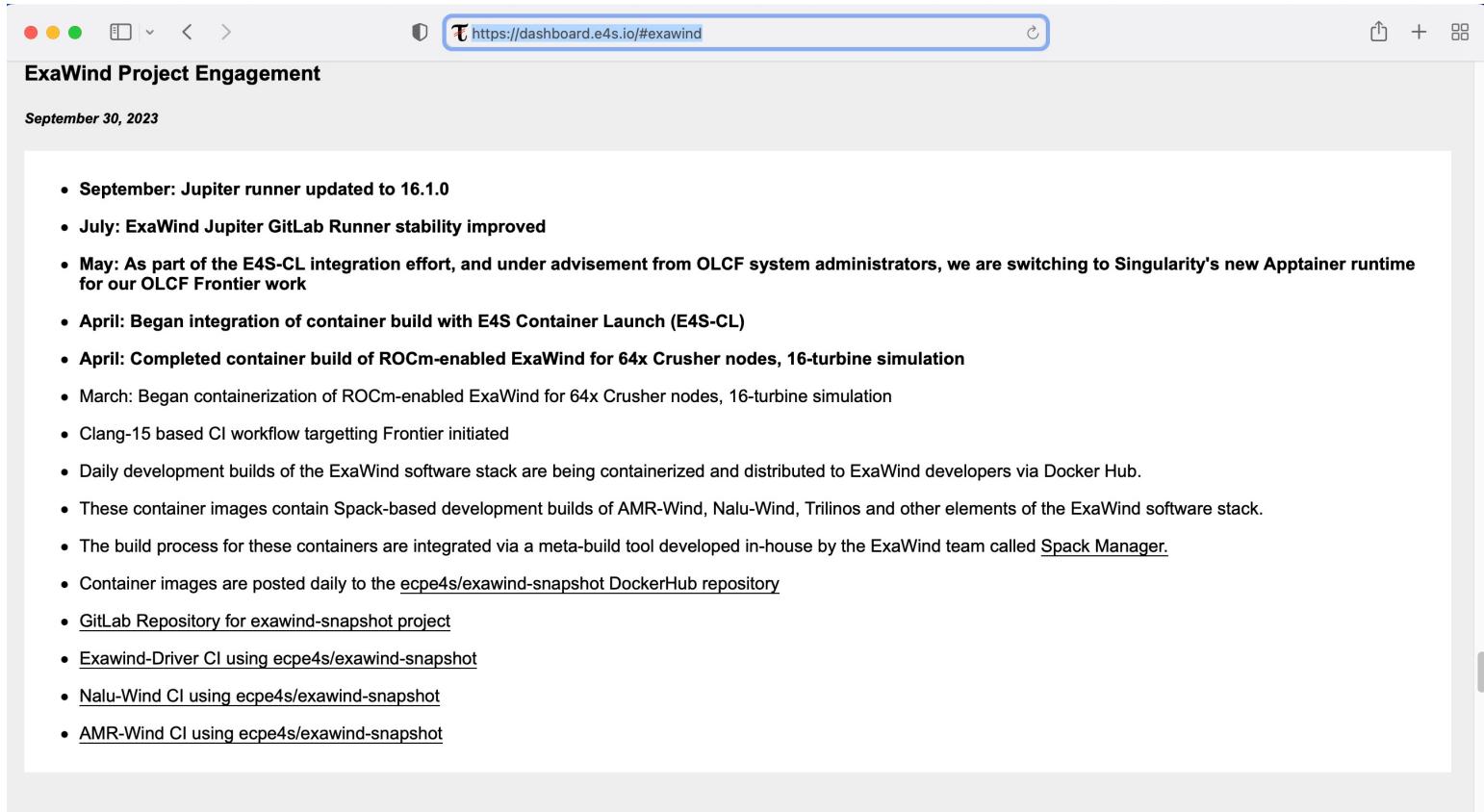
E4S 23.08 installation on Perlmutter at NERSC

```
sameer@perlmutter:login39:~> source /global/cfs/cdirs/m3896/shared/ParaTools/E4S/23.08/PrgEnv-gnu/start-spack.sh
sameer@perlmutter:login39:~> which spack
/global/cfs/cdirs/m3896/shared/ParaTools/E4S/23.08/PrgEnv-gnu/spack/bin/spack
sameer@perlmutter:login39:~> spack find -x
-- linux-sles15-zen3 / gcc@11.2.0 -----
adios@1.13.1      charliecloud@0.33      gotcha@1.0.4      kokkos-kernels@4.0.00  nccmp@1.9.1.0      pumi@2.2.7      superlu-dist@8.1.2
adios2@2.9.1      conduit@0.8.8       h5bench@1.4       kokkos-kernels@4.0.00  nco@5.1.6       py-cinemasci@1.3  superlu-dist@8.1.2
adios2@2.9.1      conduit@0.8.8       hdf5@1.14.2      lammps@20230802    netlib-scalapack@2.2.0  py-h5py@3.8.0     swig@4.0.2-fortran
alquimia@1.0.10   conduit@0.8.8       hdf5@1.14.2      lammps@20230802    nvhpc@23.7      py-jupyterhub@0.9.4  sz@2.1.12.5
aml@0.2.1         cray-mpich@8.1.25    hdf5-vol-async@1.7  legion@23.06.0    openfoam@2306      py-libensemble@0.10.2  sz3@3.1.7
amrex@23.08       cusz@0.3.1        hdf5-vol-async@1.7  legion@23.06.0    openmpi@4.1.5     py-petsc4py@3.19.4  tasmanian@7.9
amrex@23.08       darshan-runtime@3.4.4  hdf5-vol-cache@v1.1 librmr@0.1.0       openpmd-api@0.15.1  qthreads@1.18    tasmanian@7.9
arborx@1.4.1      darshan-util@3.4.4   hdf5-vol-cache@v1.1 libressio@0.95.1    papi@6.0.0.1     raja@2022.10.4    tau@2.32.1
arborx@1.4.1      datatransferkit@3.1-rc3  hdf5-vol-log@1.4.0 libressio@0.95.1    papi@6.0.0.1     raja@2022.10.4    trilinos@14.4.0
argobots@1.1      dyninst@12.3.0     hdf5-vol-log@1.4.0 libquo@1.3.1      papyrus@1.0.2    rempi@1.1.0
ascent@0.9.1      faodel@1.2108.1   hdf5-vol-log@1.4.0 libunwind@1.6.2    parallel-netcdf@1.12.3 scr@3.0.1
axom@0.7.0        flecsi@2.2.1      heffte@2.3.0       lokii@0.1.7      parsec@3.0.2209  slate@2022.07.00  umap@2.1.0
bolt@2.0          flecsi@2.2.1      heffte@2.3.0       magma@2.7.1      parsec@3.0.2209  slate@2022.07.00  umpire@2022.03.1
boost@1.83.0      flit@2.1.0       hpctoolkit@2023.03.01 mercury@2.3.0    pdt@3.25.1      slepc@3.19.1    variorum@0.6.0
butterflypack@2.2.2 flux-core@0.53.0   hpctoolkit@2023.03.01 metall@0.25      petsc@3.19.4    slepc@3.19.1    veloc@1.6
cabana@0.5.0      flux-core@0.53.0   hpx@1.9.1       mfem@4.5.2      petsc@3.19.4    stc@0.9.0      vtk-m@1.9.0
cabana@0.5.0      fortrilinos@2.3.0  hpx@1.9.1       mfem@4.5.2      phist@1.11.2    strumpack@7.1.3  wannier90@3.1.0
caliper@2.10.0    ginkgo@1.6.0     hypre@0.29.0     mgard@2023-03-31 plasma@22.9.29  strumpack@7.1.3  xyce@7.6.0
caliper@2.10.0    ginkgo@1.6.0     hypre@0.2.29.0   mgard@2023-03-31 plumed@2.9.0    sundials@6.5.1   zfp@0.5.5
chai@2022.03.0    globalarrays@5.8.2  kokkos@4.1.00    mpark-variant@1.4.0 precice@2.5.0    sundials@6.5.1   zfp@0.5.5
chai@2022.03.0    gmp@6.2.1       kokkos@4.1.00    mpfileutils@0.11.1 pruners-ninja@1.0.1 superlu@5.3.0
==> 147 installed packages
sameer@perlmutter:login39:~> spack find -x +cuda
-- linux-sles15-zen3 / gcc@11.2.0 -----
adios2@2.9.1      chai@2022.03.0  heffte@2.3.0       kokkos-kernels@4.0.00  mfem@4.5.2      raja@2022.10.4  superlu-dist@8.1.2
amrex@23.08       cusz@0.3.1     hpctoolkit@2023.03.01 lammps@20230802  mgard@2023-03-31 slate@2022.07.00 tasmanian@7.9
arborx@1.4.1      flecsi@2.2.1   hpx@1.9.1       legion@23.06.0    papi@6.0.0.1     slepc@3.19.1    tau@2.32.1
cabana@0.5.0      flux-core@0.53.0  hypre@0.2.29.0   libressio@0.95.1  parsec@3.0.2209 strumpack@7.1.3  umpire@2022.03.1
caliper@2.10.0    ginkgo@1.6.0     kokkos@4.1.00    magma@2.7.1      petsc@3.19.4    sundials@6.5.1
==> 35 installed packages
sameer@perlmutter:login39:~>
```

E4S 23.08 installation on Polaris at ALCF

```
|sameer@polaris-login-01:~> source /soft/ecp/ParaTools/E4S/23.08/PrgEnv-gnu/start-spack.sh
|sameer@polaris-login-01:~> which spack
/soft/ecp/ParaTools/E4S/23.08/PrgEnv-gnu/spack/bin/spack
|sameer@polaris-login-01:~> spack find -x
-- linux-sles15-zen3 / gcc@11.2.0 -----
adios@1.13.1      chai@2022.03.0      ginkgo@1.6.0      hptoolkit@2023.03.01  magma@2.7.1      parallel-netcdf@1.12.3  quantum-espresso@7.2  tasmanian@7.9
adios2@2.9.1      charliecloud@0.33   ginkgo@1.6.0      hpctoolkit@2023.03.01 metall@0.25    parsec@3.0.2209       raja@2022.10.4   tasmanian@7.9
adios2@2.9.1      conduit@0.8.8      globalarrays@5.8.2 hpx@1.9.1        mfem@4.5.2      parsec@3.0.2209       raja@2022.10.4   tau@2.32.1
alquimia@1.0.10   conduit@0.8.8      gmp@6.2.1       hpx@1.9.1        mfem@4.5.2      pdt@0.25.1        rempi@1.1.0     scr@3.0.1       trilinos@14.4.0
am1@0.2.1         conduit@0.8.8      gotcha@1.0.4    hpyre@0.29.0     mgard@2023-03-31 petsc@3.19.4       petsc@3.19.4    slate@2022.07.00
amrex@23.08       cray-mpich@8.1.16   gptune@0.4.0     hpyre@0.29.0     mgard@2023-03-31 petsc@3.19.4       petsc@3.19.4    slate@2022.07.00
amrex@23.08       cusz@0.3.1       h5bench@1.4     kokkos@4.1.00   mpark-variant@1.4.0 phist@1.11.2       slepc@3.19.1    umap@2.1.0
arborx@1.4.1      darshan-runtime@3.4.4  hdf5@1.14.0     kokkos@4.1.00   mpfileutils@0.11.1 plasma@22.9.29    slepc@3.19.1    umpire@2022.03.1
arborx@1.4.1      darshan-util@3.4.4   hdf5@1.14.0     kokkos-kernels@4.0.00 nccmp@1.9.1.0    plumed@2.9.0       slepc@3.19.1    umpire@2022.03.1
argobots@1.1      datatransferkit@3.1-rc3  hdf5-vol-async@1.7 kokkos-kernels@4.0.00 nco@5.1.6       precice@2.5.0      stc@0.9.0       upcxx@2023.3.0
ascent@0.9.0      dealii@0.9.4.2    hdf5-vol-async@1.7 lammps@20230802   netlib-scalapack@2.2.0 pruners-ninja@1.0.1 strumpack@7.1.3
axom@0.7.0        dyninst@12.3.0    hdf5-vol-async@1.7 lammps@20230802   nrm@0.1.0       pumi@2.2.7        strumpack@7.1.3
bolt@2.0          faodel@0.1.2108.1  hdf5-vol-cache@v1.1 legion@23.06.0   omega-h@0.34.13 py-cinemasci@1.3  sundials@6.5.1
boost@1.83.0      flecsi@0.2.2.1    hdf5-vol-cache@v1.1 legion@23.06.0   omega-h@0.34.13 py-h5py@03.8.0   sundials@6.5.1
butterflypack@2.2.2  flecsi@0.2.2.1  hdf5-vol-cache@v1.1 libcatalyst@02.0.0-rc3 openfoam@2306    py-jupyterhub@0.9.4 superlu@05.3.0
cabana@0.5.0      flit@0.2.1.0     hdf5-vol-log@1.4.0 libnrm@0.1.0    openmpi@4.1.5  py-jupyterlab@3.4.8 superlu-dist@8.1.2
cabana@0.5.0      flux-core@0.53.0   hdf5-vol-log@1.4.0 libpressio@0.95.1  openpmd-api@0.15.1 py-libensemble@0.10.2 superlu-dist@8.1.2
caliper@2.10.0    flux-core@0.53.0   hdf5-vol-log@1.4.0 libquo@1.3.1    papi@6.0.0.1    py-petsc4py@03.19.4 swig@4.0.2-fortran
caliper@2.10.0    fortrilinos@2.3.0   heffte@0.2.3.0    libunwind@1.6.2  papi@6.0.0.1    py-warpx@023.08
chai@2022.03.0    gasnet@2023.3.0   heffte@0.2.3.0    loki@0.1.7     papyrus@1.0.2  qthreads@1.18
==> 157 installed packages
|sameer@polaris-login-01:~> spack find -x +cuda
-- linux-sles15-zen3 / gcc@11.2.0 -----
adios2@2.9.1      caliper@2.10.0    flux-core@0.53.0   hpx@1.9.1       lammps@20230802  mgard@2023-03-31 petsc@3.19.4      strumpack@7.1.3
amrex@23.08       chai@2022.03.0   ginkgo@1.6.0      hpyre@02.29.0   legion@23.06.0  omega-h@0.34.13 raja@2022.10.4   sundials@6.5.1
arborx@1.4.1      cusz@0.3.1       heffte@0.2.3.0    kokkos@4.1.00   magma@2.7.1     papi@6.0.0.1    slate@2022.07.00
cabana@0.5.0      flecsi@0.2.2.1  hpctoolkit@2023.03.01 kokkos-kernels@4.0.00 mfem@4.5.2      parsec@3.0.2209
==> 36 installed packages
sameer@polaris-login-01:~>
```

Progress Report of E4S Support for ExaWind by ParaTools, Inc.



The screenshot shows a web browser window with the URL <https://dashboard.e4s.io/#exawind> in the address bar. The page title is "ExaWind Project Engagement". Below the title, the date "September 30, 2023" is displayed. The main content area contains a bulleted list of milestones and developments:

- September: Jupiter runner updated to 16.1.0
- July: ExaWind Jupiter GitLab Runner stability improved
- May: As part of the E4S-CL integration effort, and under advisement from OLCF system administrators, we are switching to Singularity's new Apptainer runtime for our OLCF Frontier work
- April: Began integration of container build with E4S Container Launch (E4S-CL)
- April: Completed container build of ROCm-enabled ExaWind for 64x Crusher nodes, 16-turbine simulation
- March: Began containerization of ROCm-enabled ExaWind for 64x Crusher nodes, 16-turbine simulation
- Clang-15 based CI workflow targeting Frontier initiated
- Daily development builds of the ExaWind software stack are being containerized and distributed to ExaWind developers via Docker Hub.
- These container images contain Spack-based development builds of AMR-Wind, Nalu-Wind, Trilinos and other elements of the ExaWind software stack.
- The build process for these containers are integrated via a meta-build tool developed in-house by the ExaWind team called [Spack Manager](#).
- Container images are posted daily to the [ecpe4s/exawind-snapshot DockerHub repository](#)
- [GitLab Repository for exawind-snapshot project](#)
- [Exawind-Driver CI using ecpe4s/exawind-snapshot](#)
- [Nalu-Wind CI using ecpe4s/exawind-snapshot](#)
- [AMR-Wind CI using ecpe4s/exawind-snapshot](#)

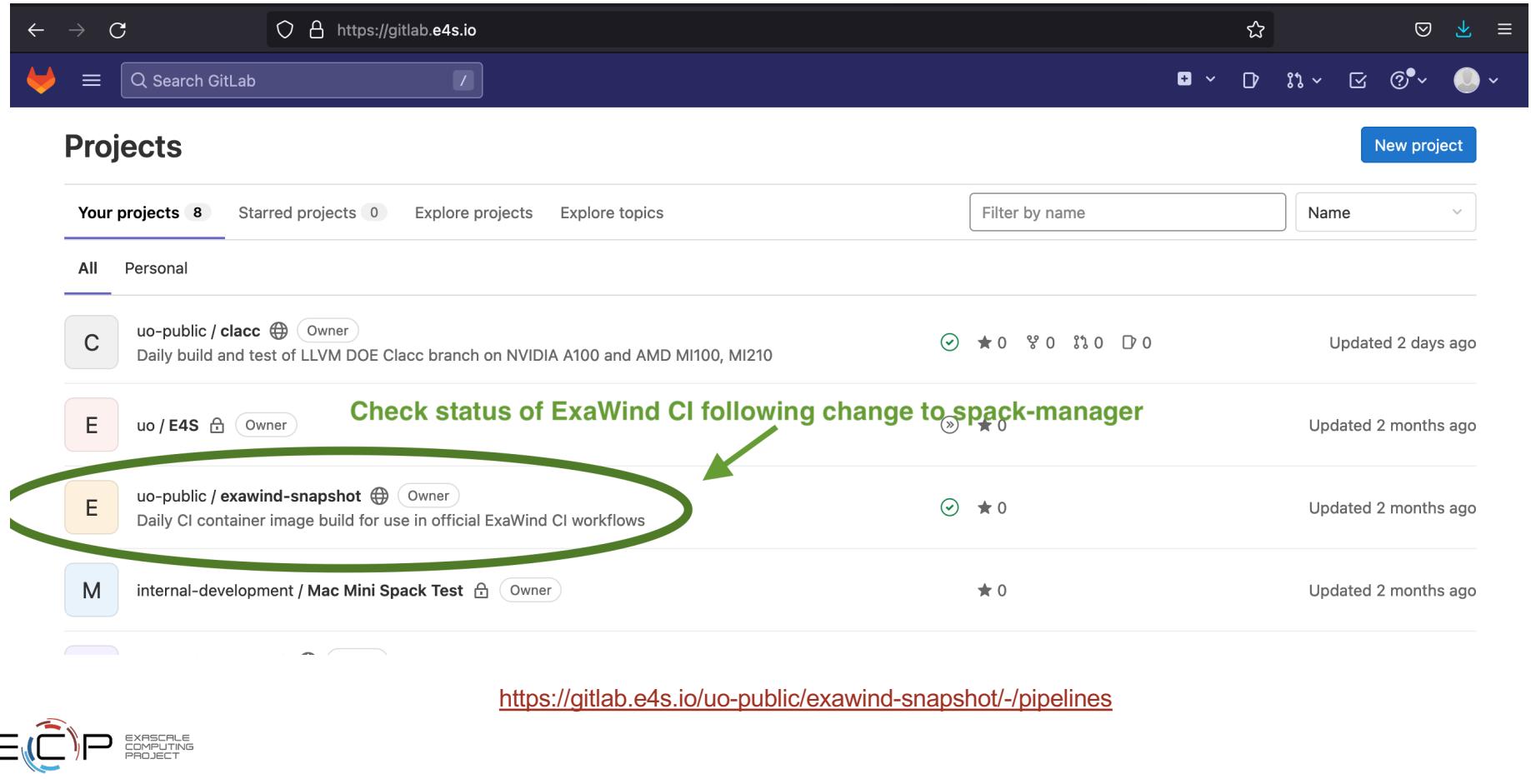
ExaWind CI: Container Image Artifacts on DockerHub

The screenshot shows the DockerHub interface for the repository `ecpe4s/exawind-snapshot`. The `Tags` tab is selected. Three container image artifacts are listed:

- latest**: Last pushed 16 hours ago by `esw123`. Digest: `0c34aa5c4339`. OS/ARCH: `linux/amd64`. Last pull: ---. Compressed size: 2.25 GB.
- 2022-09-27**: Last pushed 16 hours ago by `esw123`. Digest: `0c34aa5c4339`. OS/ARCH: `linux/amd64`. Last pull: ---. Compressed size: 2.25 GB.
- 2022-09-26**: Last pushed 2 days ago by `esw123`.

`docker pull ecpe4s/exawind-s...` links are provided for each tag. A green arrow points from the heading "ecpe4s/exawind-snapshot container artifact from successful CI" to the "latest" tag entry. Another green arrow points from the same heading to the "2022-09-27" tag entry. A third green arrow points from the same heading to the "2022-09-26" tag entry.

ExaWind CI: Exawind-Snapshot Project on gitlab.e4s.io



Check status of ExaWind CI following change to spack-manager

https://gitlab.e4s.io/uo-public/exawind-snapshot/-/pipelines

Project	Description	Last Updated
uo-public / clacc	Daily build and test of LLVM DOE Clacc branch on NVIDIA A100 and AMD MI100, MI210	Updated 2 days ago
E uo / E4S	Check status of ExaWind CI following change to spack-manager	Updated 2 months ago
E uo-public / exawind-snapshot	Daily CI container image build for use in official ExaWind CI workflows	Updated 2 months ago
M internal-development / Mac Mini Spack Test		Updated 2 months ago

Projects New project

Your projects 8 Starred projects 0 Explore projects Explore topics Filter by name Name

All Personal

C uo-public / clacc Owner Daily build and test of LLVM DOE Clacc branch on NVIDIA A100 and AMD MI100, MI210 ✓ ★ 0 0 0 0 0 Updated 2 days ago

E uo / E4S Owner Check status of ExaWind CI following change to spack-manager ✓ ★ 0 0 0 0 0 Updated 2 months ago

E uo-public / exawind-snapshot Owner Daily CI container image build for use in official ExaWind CI workflows ✓ ★ 0 0 0 0 0 Updated 2 months ago

M internal-development / Mac Mini Spack Test Owner ★ 0 0 0 0 0 Updated 2 months ago

https://gitlab.e4s.io/uo-public/exawind-snapshot/-/pipelines

Exawind daily snapshot at DockerHub

The screenshot shows a web browser window displaying the DockerHub page for the image `ecpe4s/exawind-snapshot:2023-11-01`. The URL in the address bar is `https://hub.docker.com/layers/ecpe4s/exawind-snapshot/2023-11-01/`. The DockerHub header includes the search bar, navigation links (Explore, Repositories, Organizations, Help), and the user account `exascaleproject`.

Image Details:

- DIGEST: sha256:7bbe22bf532892c90a16f01b56f8b5857b306e7ac81f9cbf73867b7c57316621
- OS/ARCH: linux/amd64
- COMPRESSED SIZE: 2.24 GB
- LAST PUSHED: 20 hours ago by `esw123`
- TYPE: Image

Image Layers:

Layer	Command	Size
1	ADD file ... in /	27.24 MB
2	CMD ["bash"]	0 B
3	ARG BASE_IMAGE	0 B
4	ARG BUILD_DATE	0 B
5	ARG BUILD_REPO	0 B

Vulnerabilities: (No vulnerabilities listed)

ExaWind CI: Container Image Artifacts on DockerHub

The screenshot shows the DockerHub interface for the repository `ecpe4s/exawind-snapshot`. The `Tags` tab is selected. Three container image artifacts are listed:

- latest**: Last pushed 16 hours ago by `esw123`.
DIGEST: `0c34aa5c4339`
OS/ARCH: `linux/amd64`
LAST PULL: ---
COMPRESSED SIZE: 2.25 GB
- 2022-09-27**: Last pushed 16 hours ago by `esw123`.
DIGEST: `0c34aa5c4339`
OS/ARCH: `linux/amd64`
LAST PULL: ---
COMPRESSED SIZE: 2.25 GB
- 2022-09-26**: Last pushed 2 days ago by `esw123`.
DIGEST: ---
OS/ARCH: ---
LAST PULL: ---
COMPRESSED SIZE: ---

A green arrow points from the heading "ecpe4s/exawind-snapshot container artifact from successful CI" to the `latest` tag entry.

`https://hub.docker.com/repository/docker/ecpe4s/exawind-snapshot/tags?page=1&ordering=last_updated`

Thank you

<https://www.exascaleproject.org>

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Thank you to all collaborators in the ECP and broader computational science communities. The work discussed in this presentation represents creative contributions of many people who are passionately working toward next-generation computational science.

