

E4S: The Extreme-scale Scientific Software Stack Release 24.05

Release 24.05 notes

May 9, 2024



U.S. DEPARTMENT OF
ENERGY

Office of
Science

E4S 24.05: What's New?

- E4S includes 129+ HPC packages on ARM, x86_64, and ppc64le platforms, 128K+ binaries in E4S build Cache.
- E4S includes a comprehensive suite of AI/ML packages including DeepHyper, Google.generativeai (Gemini API), along with previously supported OpenAI (API), TorchBraid, Pandas, Scikit-Learn, JAX, PyTorch, TensorFlow, Horovod, OpenCV, and LBANN with support for GPUs.
- VSCodium (MIT License) Integrated Development Environment GUI now supported in containers and CSPs.
- E4S DocPortal updated with AI/ML tools.
- OS upgrade for containers: Ubuntu 22.04 LTS.
- Upgraded CUDA from version 11 to 12, ROCm upgraded from version 5.4 to 5.7.1.
- New tools: Laghos, Glvis, netcdf-fortran, fpm, e4s-cl, and e4s-alc.
- E4S includes new applications: Nek5000, Nekbone, Laghos and previously supported GROMACS, CP2K, Xyce, Quantum Espresso, ExaGo, LAMMPS, WARPX, Dealii, and OpenFOAM.
- Adaptive Computing's HPC Cloud on demand data center (ODDC) web-based platform for multi-user, multi-node ParaTools Pro for E4S images on AWS marketplace with support for aarch64 (Graviton) as well as x86_64 with NVIDIA GPUs with VNC based remote desktop and torque (qsub) for multi-node execution:

• <https://adaptivecomputing.com/>



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 125+ HPC, EDA (e.g., Xyce), and AI/ML packages (e.g., DeepHyper, TorchBraid, Scikit-Learn, Pandas, TensorFlow, PyTorch, JAX, Horovod, and LBANN).
- With E4S Spack binary build caches, E4S supports both bare-metal and containerized deployment for GPU based platforms.
 - X86_64, ppc64le (IBM Power 10), 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) and DOE LLVM containers.
- 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_Dec23.pdf
- E4S for commercial cloud platforms: AWS image supports MPI implementations and containers with remote desktop (DCV).
 - Intel MPI, NVHPC, MVAPICH2, MPICH, MPC, OpenMPI
- e4s-cl container launch tool allows binary distribution of applications by substituting MPI in the containerized app with the system MPI. A-la-carte tool to customize container images: e4s-alc.
- Quarterly releases: E4S 24.05 released on May 9, 2024: https://e4s.io/talks/E4S_24.05.pdf

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
- Nov 2023: E4S 23.11 – 120 full release products
- Feb 2024: E4S 24.02 – 122 full release products
- May 9, 2024: E4S 24.05 – 125 full release products

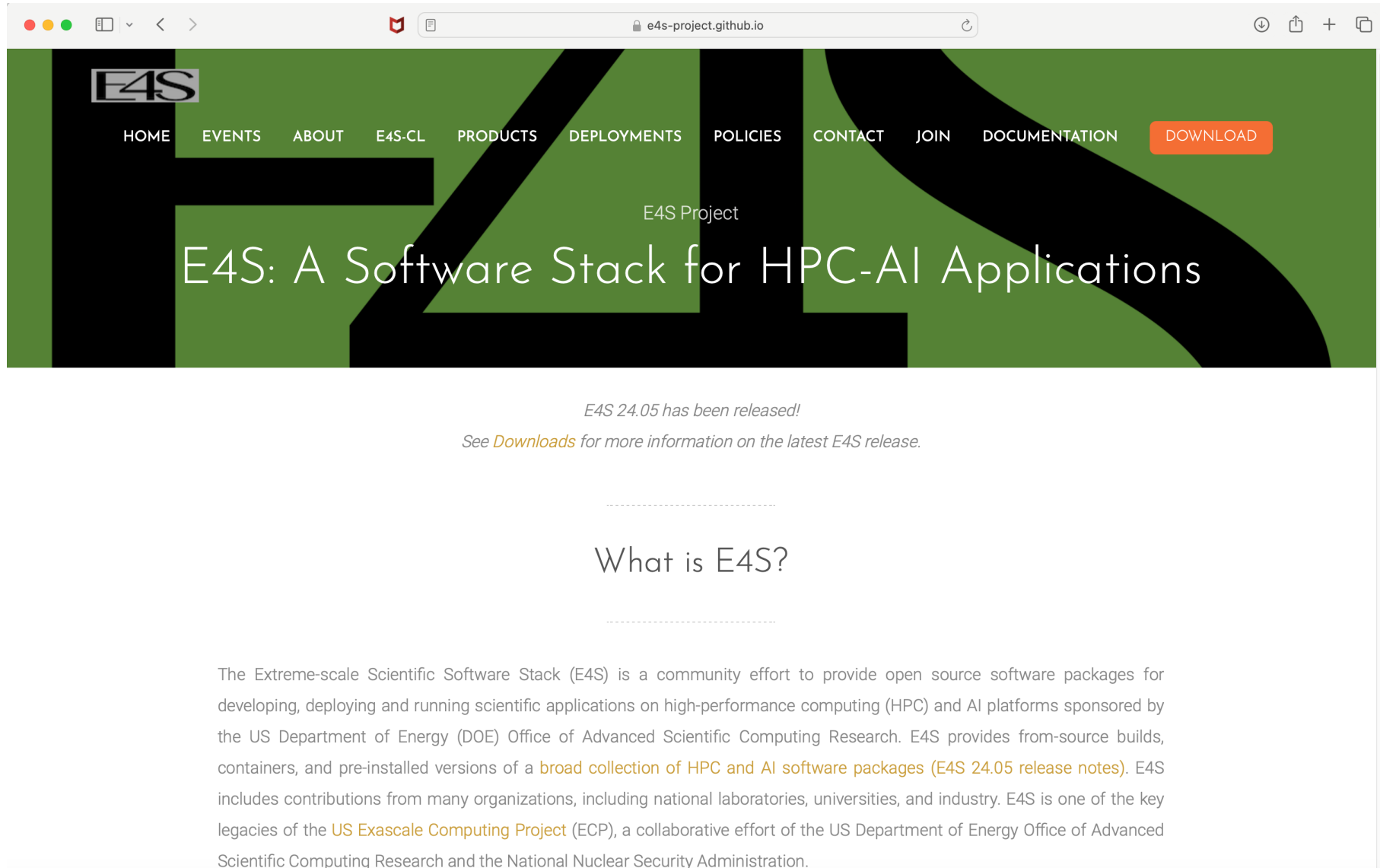


<https://e4s.io>

Lead: Sameer Shende
(U Oregon)

Also include other products .e.g.,
AI: DeepHyper, TorchBraid, Scikit-Learn, JAX,
PyTorch, TensorFlow, Horovod, LBANN
Co-Design: AMReX, Cabana, MFEM
EDA: Xyce

E4S Download from https://e4s.io



The screenshot shows the homepage of the E4S Project website. The browser address bar displays "e4s-project.github.io". The navigation menu includes links for HOME, EVENTS, ABOUT, E4S-CL, PRODUCTS, DEPLOYMENTS, POLICIES, CONTACT, JOIN, DOCUMENTATION, and a prominent orange DOWNLOAD button. The main heading reads "E4S Project" followed by "E4S: A Software Stack for HPC-AI Applications". A notice states "E4S 24.05 has been released!" with a link to "Downloads" for more information. Below this is a section titled "What is E4S?" which describes the project as a community effort to provide open source software packages for HPC and AI, sponsored by the US Department of Energy. It mentions contributions from national laboratories, universities, and industry, and identifies E4S as a legacy of the US Exascale Computing Project (ECP).

E4S Container Download from https://e4s.io


The screenshot shows a web browser window with the URL <https://e4s-project.github.io/download.html>. The website has a green and black header with the E4S logo and a navigation menu: HOME, EVENTS, ABOUT, E4S-CL, PRODUCTS, DEPLOYMENTS, POLICIES, CONTACT, JOIN, DOCUMENTATION, and a prominent orange DOWNLOAD button.

Acquiring E4S Containers

The current E4S container offerings include Docker and Singularity images capable of running on X86_64, PPC64LE, and AARCH64 architectures. Our full E4S Release images are based on Ubuntu 20.04 (x86_64, aarch64, ppc64le). In addition to offering a full E4S image containing a comprehensive selection of E4S software released on a quarterly cycle, we also offer a set of minimal base images suitable for use in Continuous Integration (CI) pipelines where Spack is used to build packages.


Docker images are available on the [E4S Docker Hub](#).

Please see the [E4S 24.05 Release Notes](#).



Container Releases

- [📄 Docker Downloads - CUDA](#)
- [📄 Docker Downloads - ROCm](#)
- [📄 Docker Downloads - OneAPI](#)



From source with Spack

[🔗 Visit the Spack Project](#)

Spack contains packages for all of the products listed in the E4S 24.05 Full Release category (see above Release Notes). General instructions for building software with Spack can be found at the Spack website. Questions



E4S Container Download from https://e4s.io

The screenshot shows a web browser window with the URL <https://e4s-project.github.io/download.html>. The page content is as follows:

- Container Releases** (indicated by a download icon):
 - [Docker Downloads - CUDA](#) (highlighted with a blue box)
 - [Docker Downloads - ROCm](#)
 - [Docker Downloads - OneAPI](#)
 - [Singularity x86_64 Download - CUDA 80](#)
 - [Singularity x86_64 Download - CUDA 90](#)
 - [Singularity ppc64le Download - CUDA 70](#)
 - [Singularity aarch64 Download - CUDA 75](#)
 - [Singularity aarch64 Download - CUDA 80](#)
 - [Singularity aarch64 Download - CUDA 90](#)
 - [Singularity x86_64 Download - ROCm gfx90a](#)
 - [Singularity x86_64 Download - ROCm gfx908](#)
 - [Singularity x86_64 Download - OneAPI](#)
 - [OVA Download](#)
- From source with Spack** (indicated by a code icon):
 - [Visit the Spack Project](#)
 - Text: "Spack contains packages for all of the products listed in the E4S 24.05 Full Release category (see above Release Notes). General instructions for building software with Spack can be found at the Spack website. Questions concerning building those packages are deferred to the associated package development team."

- Separate full featured Singularity images for 3 GPU architectures
- GPU full featured images for
 - x86_64 (Intel, AMD, NVIDIA)
 - ppc64le (NVIDIA)
 - aarch64 (NVIDIA)
- Full featured images available on Dockerhub
- 125+ products on 3 architectures



Download E4S 24.02 GPU Container Images: AMD, Intel, and NVIDIA

Note on Container Images

Container images contain binary versions of the Full Release packages listed above. Full-featured GPU-enabled container images are available from Dockerhub:

```
# docker pull ecpe4s/e4s-cuda:24.05
# docker pull ecpe4s/e4s-rocm:24.05
# docker pull ecpe4s/e4s-oneapi:24.05
```

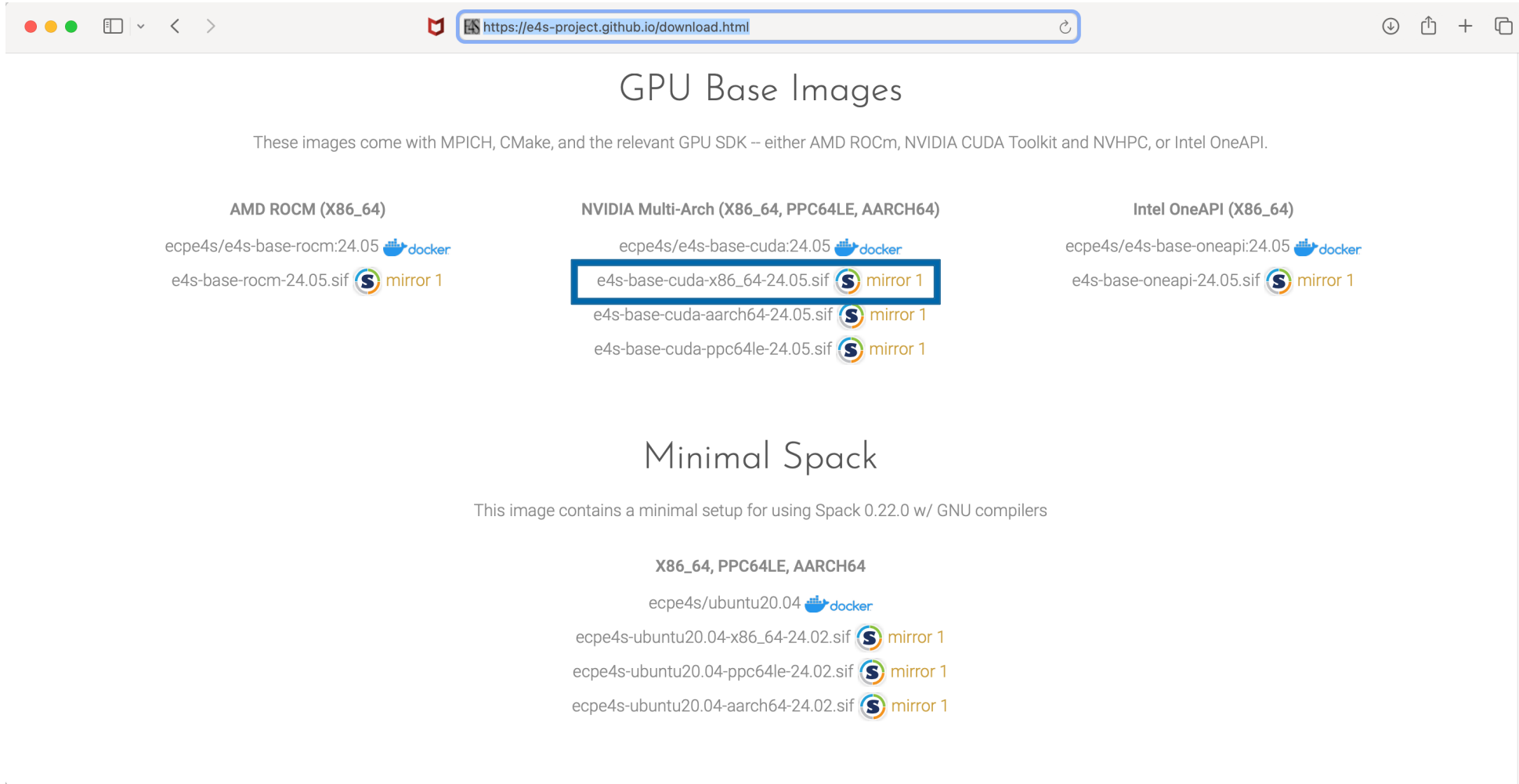
E4S Full GPU Images

These images contain a full Spack-based deployment of E4S, including GPU-enabled packages for NVIDIA, AMD, or Intel GPUs.

These images also contain TensorFlow, PyTorch, and TAU.

AMD ROCm (x86_64)	NVIDIA CUDA (X86_64, PPC64LE, AARCH64)	Intel OneAPI (x86_64)
ecpe4s/e4s-rocm:24.05	ecpe4s/e4s-cuda:24.05	ecpe4s/e4s-oneapi:24.05
e4s-rocm90a-x86_64-24.05.sif mirror 1	e4s-cuda80-x86_64-24.05.sif mirror 1	e4s-oneapi-x86_64-24.05.sif mirror 1
e4s-rocm908-x86_64-24.05.sif mirror 1	e4s-cuda90-x86_64-24.05.sif mirror 1	
	e4s-cuda70-ppc64le-24.05.sif mirror 1	
	e4s-cuda75-aarch64-24.05.sif mirror 1	
	e4s-cuda80-aarch64-24.05.sif mirror 1	
	e4s-cuda90-aarch64-24.05.sif mirror 1	



E4S base container images allow users to customize their containers







The screenshot shows a web browser window with the URL <https://e4s-project.github.io/download.html>. The page is titled "GPU Base Images" and contains the following content:

These images come with MPICH, CMake, and the relevant GPU SDK -- either AMD ROCm, NVIDIA CUDA Toolkit and NVHPC, or Intel OneAPI.



AMD ROCM (X86_64)

- ecpe4s/e4s-base-rocm:24.05 
- e4s-base-rocm-24.05.sif 

NVIDIA Multi-Arch (X86_64, PPC64LE, AARCH64)

- ecpe4s/e4s-base-cuda:24.05 
- e4s-base-cuda-x86_64-24.05.sif **
- e4s-base-cuda-aarch64-24.05.sif 
- e4s-base-cuda-ppc64le-24.05.sif 





Intel OneAPI (X86_64)

- ecpe4s/e4s-base-oneapi:24.05 
- e4s-base-oneapi-24.05.sif 

Minimal Spack

This image contains a minimal setup for using Spack 0.22.0 w/ GNU compilers

X86_64, PPC64LE, AARCH64

- ecpe4s/ubuntu20.04 
- ecpe4s-ubuntu20.04-x86_64-24.02.sif 
- ecpe4s-ubuntu20.04-ppc64le-24.02.sif 
- ecpe4s-ubuntu20.04-aarch64-24.02.sif 

- Intel oneAPI
- AMD ROCm
- NVIDIA NVHPC and CUDA

e4s-alc: a new tool to customize container images. Version 1.0.2

The screenshot displays the GitHub repository page for `E4S-Project/e4s-alc`. The repository is public and has 3 stars and 4 watchers. The main content area shows a list of files and folders, including `docs`, `e4s_alc`, `examples`, `.gitignore`, `.readthedocs.yml`, `CHANGELOG`, `LICENSE`, `Makefile`, `README.md`, and `pyproject.toml`. The 'About' section on the right provides a description of the tool and lists its features. The 'Releases' section shows the latest release, 'E4S-ALC release v1.0.2', which is highlighted with a blue box.

File/Folder	Commit Message	Time Ago
docs	post release	3 days ago
e4s_alc	propagated changes	2 days ago
examples	did base changed to remove have modules.yaml in the co...	3 days ago
.gitignore	Merge branch 'main' into restructure	10 months ago
.readthedocs.yml	added readthedocs config file	last year
CHANGELOG	update changelog	5 days ago
LICENSE	Initial commit	last year
Makefile	quick fix	10 months ago
README.md	updated readme to specify Singularity definition file supp...	3 weeks ago
pyproject.toml	added tool.setuptools_scm banner in pyproject.toml	2 weeks ago

About
E4S à la carte is a tool that allows a user to customize a container image by adding packages to it. These can be system packages and Spack packages.

- Readme
- MIT license
- Activity
- Custom properties
- 3 stars
- 4 watching
- 0 forks

Report repository

Releases 3

- E4S-ALC release v1.0.2** (Latest) 5 days ago
- + 2 releases

Packages
No packages published
[Publish your first package](#)

Add to a base image:

- Spack packages
- OS packages
- Tarballs
- Can create a Dockerfile
- Can create Singularity definition file

E4S DOE LLVM and CI images

The screenshot shows a web browser window with the address bar containing <https://e4s-project.github.io/download.html>. The page title is "DOE LLVM E4S Image". Below the title, a paragraph states: "This multi-architecture image contains E4S products compiled with DOE LLVM 16 and Flang using Spack".

Under the heading "Multi-Arch (X86_64, PPC64LE, AARCH64)", there are four entries, each with a Docker icon and a mirror icon:

- ecpe4s/e4s-doe-llvm:23.05
- e4s-doe-llvm-x86_64-23.05.sif mirror 1
- e4s-doe-llvm-aarch64-23.05.sif mirror 1
- e4s-doe-llvm-ppc64le-23.05.sif mirror 1

The next section is titled "Continuous Integration Images". It contains two paragraphs: "These are barebones operating system images which contain only essential build tools and python packages needed by Spack." and "These images are intended to be used in continuous integration workflows where Spack is first cloned and then used to build and test software."

Below this, there are three columns of images, each with a header: "X86_64", "PPC64LE", and "AARCH64". Each column lists several image names, each followed by Docker and GitHub icons:

- X86_64:**
 - ecpe4s/ubuntu22.04-runner-x86_64
 - ecpe4s/ubuntu20.04-runner-x86_64
 - ecpe4s/ubuntu18.04-runner-x86_64
 - ecpe4s/rhel8-runner-x86_64
 - ecpe4s/rhel7-runner-x86_64
- PPC64LE:**
 - ecpe4s/ubuntu22.04-runner-ppc64le
 - ecpe4s/ubuntu20.04-runner-ppc64le
 - ecpe4s/ubuntu18.04-runner-ppc64le
 - ecpe4s/rhel8-runner-ppc64le
 - ecpe4s/rhel7-runner-ppc64le
- AARCH64:**
 - ecpe4s/ubuntu22.04-runner-aarch64
 - ecpe4s/ubuntu20.04-runner-aarch64
 - ecpe4s/rhel8-runner-aarch64



<https://e4s.io>

E4S Facility Deployment and AWS EC2 Image

Custom Images

- ecpe4s/waggle-ml
- ecpe4s/exawind-snapshot
- ecpe4s/superlu_sc

E4S Facility Deployment

- NERSC
- OLCF

AWS EC2 Image

The E4S 24.05 release is also available on [AWS](#) as an EC2 AMI with ID `ami-0e752117cfa13cb9b` in the US-West-2 (Oregon) region.



E4S 24.05 Detailed Documentation for Bare-metal Installation

HOME EVENTS ABOUT E4S-CL PRODUCTS DEPLOYMENTS POLICIES CONTACT JOIN DOCUMENTATION DOWNLOAD

Extreme-scale Scientific Software Stack (E4S) version 24.05

E4S v24.05, includes more than 120 HPC-AI products that are commonly used by scientific applications.

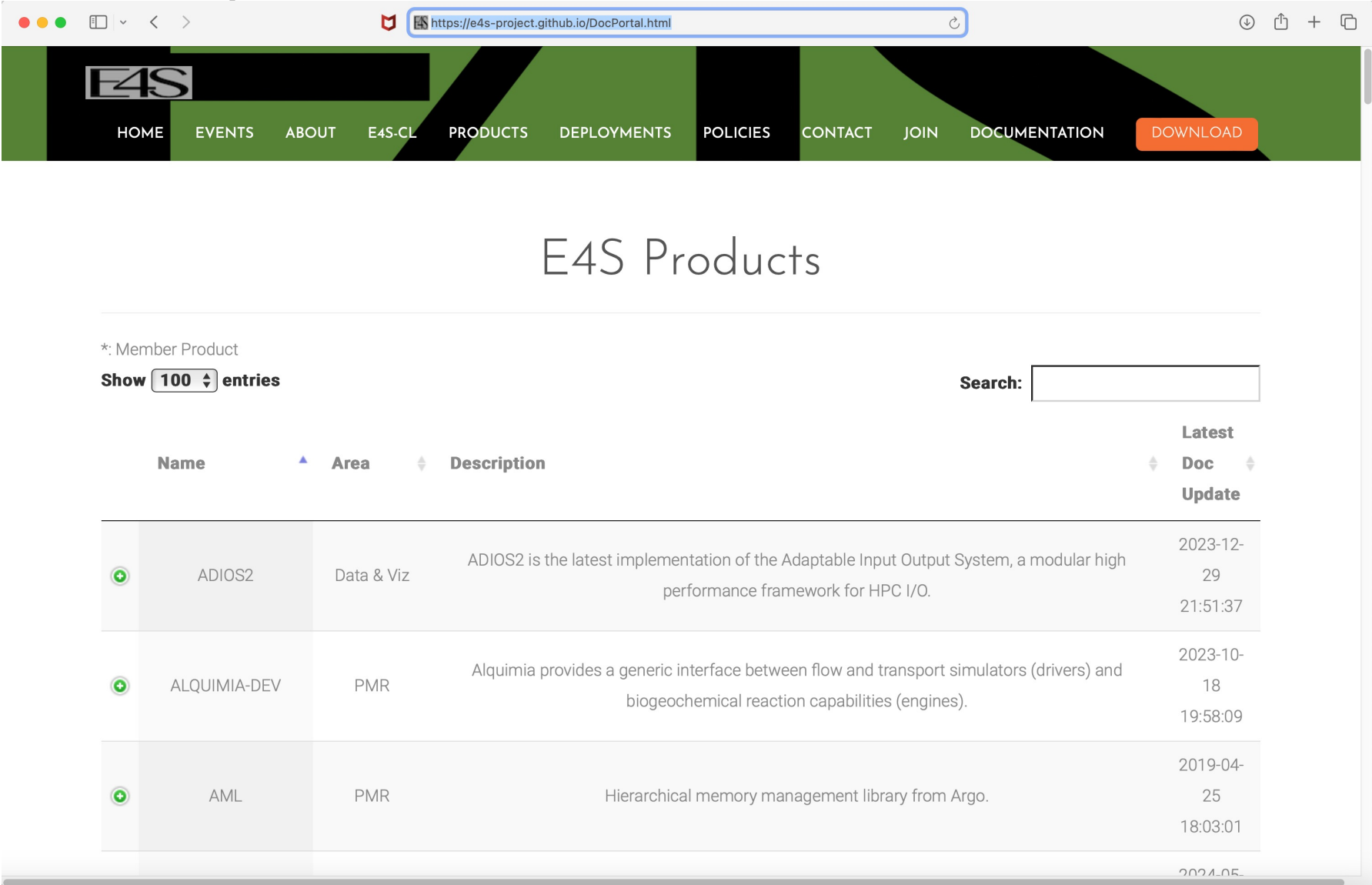
E4S ReadTheDocs: Full Documentation.

E4S ReadTheDocs: Support Guide.

- E4S Deployment Dashboard.
- E4S v24.05 Release Notes PDF.
- E4S v24.05 Spack Environment Notes.
- E4S Manual Installation Instructions.
- E4S Container Installation Instructions.
- Recipes for building E4S images from scratch.

Prebuilt binaries used in E4S images are stored in the E4S Build Cache.

E4S DocPortal Updated with AI/ML tools



The screenshot shows a web browser displaying the E4S DocPortal. The browser's address bar shows the URL <https://e4s-project.github.io/DocPortal.html>. The website has a green and black header with the E4S logo and a navigation menu with links: HOME, EVENTS, ABOUT, E4S-CL, PRODUCTS, DEPLOYMENTS, POLICIES, CONTACT, JOIN, DOCUMENTATION, and a DOWNLOAD button. The main content area is titled "E4S Products". Below the title, there is a note "*: Member Product", a "Show 100 entries" dropdown, and a search box. A table lists three products: ADIOS2, ALQUIMIA-DEV, and AML. Each row includes a green plus icon, the product name, the area, a description, and the latest documentation update date and time.

	Name	Area	Description	Latest Doc Update
+	ADIOS2	Data & Viz	ADIOS2 is the latest implementation of the Adaptable Input Output System, a modular high performance framework for HPC I/O.	2023-12-29 21:51:37
+	ALQUIMIA-DEV	PMR	Alquimia provides a generic interface between flow and transport simulators (drivers) and biogeochemical reaction capabilities (engines).	2023-10-18 19:58:09
+	AML	PMR	Hierarchical memory management library from Argo.	2019-04-25 18:03:01



<https://e4s.io>

E4S 24.05 full featured container release on Dockerhub

The screenshot shows the Docker Hub interface for the repository `ecpe4s/e4s-cuda`. The page is viewed on a browser with the URL `https://hub.docker.com/repository/docker/ecpe4s/e4s-cuda/tags`. The navigation bar includes 'docker hub', 'Explore', 'Repositories', and 'Organizations'. A search bar is present with the text 'Search Docker Hub'. The breadcrumb trail is `ecpe4s / Repositories / e4s-cuda / Tags`. The page is currently on the 'Tags' tab, with other tabs being 'General', 'Permissions', 'Webhooks', and 'Settings'. There are controls for 'Sort by' (set to 'Newest'), 'Filter Tags', and a 'Delete' button. Two tag sections are visible. The first section is for the `latest` tag, last pushed 2 days ago by `esw123`. It includes a terminal snippet `docker pull ecpe4s/e4s-cuda:latest` and a 'Copy' button. Below this is a table of architectures:

Digest	OS/ARCH	Last pull	Compressed Size
3bafca6f1d05	linux/amd64	---	54.54 GB
2533c9bcd6e4	linux/arm64/v8	---	46 GB
d832f13ca9c0	linux/ppc64le	---	36.67 GB

The second section is for the `24.05-cuda90` tag, also last pushed 2 days ago by `esw123`. It includes a terminal snippet `docker pull ecpe4s/e4s-cuda:24.05-cuda90` and a 'Copy' button. Below this is another table of architectures:

Digest	OS/ARCH	Last pull	Compressed Size
e67d4240cfed	linux/amd64	---	47.68 GB
e388df34d282	linux/arm64/v8	---	35.54 GB

Architectures:

- x86_64
- aarch64
- ppc64le

Software:

- CUDA 12.3
- NVHPC 24.3
- ROCm 5.7.1
- oneAPI 2024.0.2



```
docker pull ecpe4s/e4s-cuda:24.05
```

E4S 24.05 base container release on Dockerhub

The screenshot shows the Docker Hub interface for the repository `ecpe4s/e4s-base-cuda`. The page is viewed on a browser with the URL `https://hub.docker.com/repository/docker/ecpe4s/e4s-base-cuda/tags`. The navigation bar includes the Docker Hub logo, 'Explore', 'Repositories', and 'Organizations' tabs, along with a search bar and user profile 'E'. The breadcrumb trail is `ecpe4s / Repositories / e4s-base-cuda / Tags`. The 'Tags' tab is active, showing a list of tags. The 'latest' tag is selected, with a 'docker pull ecpe4s/e4s-base-cuda:latest' command and a 'Copy' button. Below it, a table lists the architectures and their compressed sizes. The '24.05' tag is also visible, with a 'docker pull ecpe4s/e4s-base-cuda:24.05' command and a 'Copy' button. Below it, a similar table lists the architectures and their compressed sizes.

Digest	OS/ARCH	Last pull	Compressed Size
d8c7558ed1ec	linux/amd64	---	17.97 GB
1b588efa148b	linux/arm64/v8	---	17.11 GB
1065f3ca8604	linux/ppc64le	---	14.91 GB

Digest	OS/ARCH	Last pull	Compressed Size
d8c7558ed1ec	linux/amd64	---	17.97 GB
1b588efa148b	linux/arm64/v8	---	17.11 GB
1065f3ca8604	linux/ppc64le	---	14.91 GB

Architectures:

- x86_64
- aarch64
- ppc64le



`docker pull ecpe4s/e4s-base-cuda`

E4S 24.05 ROCm release on Dockerhub

The screenshot shows the Docker Hub interface for the repository `ecpe4s/e4s-rocm`. The page is viewed on a browser with the URL `https://hub.docker.com/repository/docker/ecpe4s/e4s-rocm/tags`. The navigation bar includes 'dockerhub', 'Explore', 'Repositories', and 'Organizations'. The breadcrumb trail is `ecpe4s / Repositories / e4s-rocm / Tags`. The 'Tags' tab is selected, showing a list of tags. The tags are sorted by 'Newest'. The first tag is `latest`, pushed 2 days ago by `esw123`. The second tag is `24.05`, also pushed 2 days ago by `esw123`. The third tag is `24.05-gfx90a`, pushed 2 days ago by `esw123`. Each tag entry includes a checkbox, a 'Digest' field with a link to the digest, an 'OS/ARCH' field, a 'Last pull' field, and a 'Compressed Size' field. A 'docker pull' command is provided for each tag, along with a 'Copy' button.

Tag	Digest	OS/ARCH	Last pull	Compressed Size
<code>latest</code>	96cd66f29144	linux/amd64	---	36.31 GB
<code>24.05</code>	96cd66f29144	linux/amd64	---	36.31 GB
<code>24.05-gfx90a</code>				



`docker pull ecpe4s/e4s-rocm:24.05`

E4S 24.05 oneAPI release on Dockerhub

The screenshot shows the Docker Hub interface for the repository `ecpe4s/e4s-oneapi`. The page is viewed from the 'Tags' tab. Two tags are listed: `latest` and `24.05`. Both tags were pushed 2 days ago by user `esw123`. The `latest` tag has a digest of `ba29a2094e8e` and a compressed size of 20.53 GB. The `24.05` tag also has a digest of `ba29a2094e8e` and a compressed size of 20.53 GB. The OS/ARCH for both is `linux/amd64`. The 'Last pull' column is empty for both tags. A search bar and a 'Filter Tags' input are visible at the top of the tag list. A 'Delete' button is also present. The navigation bar at the top includes 'docker hub', 'Explore', 'Repositories', 'Organizations', and a search bar. The breadcrumb trail is `ecpe4s / Repositories / e4s-oneapi / Tags`. The user's profile icon 'E' is visible in the top right.

Tag	Digest	OS/ARCH	Last pull	Compressed Size
<code>latest</code>	<code>ba29a2094e8e</code>	<code>linux/amd64</code>	---	20.53 GB
<code>24.05</code>	<code>ba29a2094e8e</code>	<code>linux/amd64</code>	---	20.53 GB



`docker pull ecpe4s/e4s-oneapi`

24.05 Release: 129+ Official Products + dependencies (gcc, x86_64)

1: adios2	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/adios2-2.10.0-fhuiyladmsjw7zdpjd7mgameplxmmfsg
2: alquimia	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/alquimia-1.1.0-n5d3ne33zffjlogk6n7iqs6m7sfwxasc
3: aml	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/aml-0.2.1-sm2ewqj576lgrucxtmoh6gqkbjfxkiem
4: amrex	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/amrex-24.04-fl42ppt7g3573xeh3nnu7syg6vr6j4df
5: arborx	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/arborx-1.6-y7ixljvrlbc3vaeIntlb5mbvbk26jzfo
6: argobots	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/argobots-1.2-uyjbdlcm5wigztepqrjwbmbtg2ca6ami
7: ascent	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/ascent-0.9.2-dq5zu46qs5hv22wzc7e2jrozdfuhevbt
8: axom	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/axom-0.9.0-73k3merxjlpav5v5ihcj37oq3balc3jrl
9: bolt	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/bolt-2.0-qpw2avwvi7tnhj47hironbi2zspkn5cx
10: blaspp	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/blaspp-2023.11.05-pww7j6zd7msdt2ltyzmryjfu26klib6a
11: bricks	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/bricks-2023.08.25-bfuoywxc35gkrgilfub5fjcbp3kjchng
12: butterflypack	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/butterflypack-2.4.0-qbytiad2aoh5ktglk4ql7rlkxtpoktxh
13: cabana	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/cabana-0.6.0-gkqtbw66liat2ibpejcdwnm5swbhezmb
14: caliper	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/caliper-2.10.0-a2ep7ama3lfow5fauf7ffyhlpzcl6wq
15: camp	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/camp-2024.02.0-pqzl2rlh3nz6hpdzpzftpxm35zshbvl
16: chai	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/chai-2024.02.0-las35mttcz6kqovxiwix7py2g2z4hzqh
17: charliecloud	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/charliecloud-0.37-ikliebzc7m6spnzozqoplzav4inybt2
18: conduit	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/conduit-0.9.1-thvaheolv3ghtgzqu3wody6oxrwopere
19: cp2k	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/cp2k-2024.1-xt2k55iofzvzrlcwxdd5k5kcbk7cjh7b
20: cusz	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/cusz-0.3.1-vfez6urfthc7mydxtmi7vpumrbzjuxct
21: darshan-runtime	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/darshan-runtime-3.4.4-gtl7r3zgisttlt7vxz4cdoqgtfduhl
22: datatransferkit	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/datatransferkit-3.1.1-y2x5h7mkzpx5xezu5nown4y3j4fypxlzp
23: dealii	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/dealii-9.5.1-z5tmzgo5qqmrigga3fevfzn2otdp3sqq
24: dyninst	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/dyninst-13.0.0-q27acrq3hcrhkwwu76xxd2zjhn2hjap
25: e4s-alc	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/e4s-alc-1.0.1-d2heapw26w5s36zangfv26wexngpvw4s
26: e4s-cl	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/e4s-cl-1.0.3-3cvqfsyd7n7xi6qjpx5d4v3ksfo54d3e
27: ecp-data-vis-sdk	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/ecp-data-vis-sdk-1.0-wg5fy36scr4pkjlpbhshyqchgrjekoad
28: exago	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/exago-1.6.0-7bkxxgpk5uym5s3exqv66ode7az4n
29: exaworks	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/exaworks-0.1.0-mzvjjzj4vphquq5iv7tzmgnugw3i4ggx
30: faodel	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/faodel-1.2108.1-rdjkcdli4jxng72udz42jq2mfse2xi
31: flecsi	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/flecsi-2.2.1-uajf4jjvy7th3srmseb2qsrzqvscd25
32: flit	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/flit-2.1.0-cscnxxz6d45d7qpokzxp3j4agssblluv
33: flux-core	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/flux-core-0.61.2-aqnxfpazpprf5ws5cpmkp57qkjpchwsx
34: flux-sched	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/flux-sched-0.33.1-l67x2qr66uy7axlfjanjvyh64ppkm5bg
35: fortrilinos	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/fortrilinos-2.3.0-sjhghihagzmjgmamuxphx4kttzahir3i
36: gasnet	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/gasnet-2023.9.0-k7moh4hh75daydo4rwbdcuxmp73ctrft
37: ginkgo	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/ginkgo-1.7.0-bt5qfvajamxmexjj6rzz62m4o56lchug
38: globalarrays	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/globalarrays-5.8.2-6ajsibvoeieueutrrxi2deinncyruvy
39: gotcha	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/gotcha-1.0.6-fowofvm722ho3txcctewm4rzd7so6g3
40: gptune	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/gptune-4.0.0-jqwn3amkh55ae627vksisdishtwclr7
41: gromacs	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/gromacs-2024.1-ylm6fqy5rvm62dllqzbvvywhzognvprfn
42: h5bench	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/h5bench-1.4-sr3jfwtdmekw2s2d2oaiyyv6jfn6stz
43: hdf5	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/hdf5-1.14.3-o364hojddndkkioz3wmf3q567bcqivjo

GPU runtimes

- AMD (ROCm)
 - 5.7.1
- NVIDIA (CUDA)
 - 12.3
- NVHPC
 - 24.3
- Intel oneAPI
2024.0.2



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44:	hdf5-vol-cache	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/hdf5-vol-cache-v1.1-hlm7x7poznrjhjfgop6whzavftxlijj4
45:	hdf5-vol-async	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/hdf5-vol-async-1.7-566thbgt7n7zi3maicubfamq3vkm4nun
46:	hdf5-vol-log	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/hdf5-vol-log-1.4.0-b6a3340qxqbtavvwnib7wxc5tcu6xa1k
47:	heffte	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/heffte-2.4.0-cekkr45afwsnn2ovtivsiiiua5nrbg3w2
48:	hpctoolkit	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/hpctoolkit-2024.01.1-p7jxk6ayo4mkivobioj4c3x2tz7dsm3k
49:	hpx	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/hpx-1.9.1-iqhua6ztl47nz7ysyrvvqcih7e4u7jyk
50:	hypre	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/hypre-2.31.0-xxomsx3eg3q4qgd5xmui3phadg43h7nl
51:	kokkos	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/kokkos-4.3.00-fdzqphdxgo6srjcsqhwtlwrg663h4t5l
52:	kokkos-kernels	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/kokkos-kernels-4.3.00-j4w6nmiedb4jnhysk7c3lnmyisxcubi
53:	laghos	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/laghos-3.1-b7iajnooxa5blmufbtszvmc6rb52dvag
54:	lammps	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/lammps-20230802.3-a4dgzqvapienaliasstggpv7tdjeu3ri
55:	lapackpp	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/lapackpp-2023.11.05-ad4fc5dkkgfggms03esulu3ez52i6ys5
56:	lbann	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/lbann-0.104-6qylqaj2tr4favk2y5mt7clpntbmukb7
57:	legion	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/legion-24.03.0-rfinzjur4odnh3yf2tycgbi2zbuqmg7
58:	libcatalyst	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/libcatalyst-2.0.0-rc4-ja7hh6ezcg7rzuabxukwbcp7o47iues
59:	libnrm	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/libnrm-0.1.0-rlzyjb5irlidq3uq2ckmdek25pxzzdp
60:	libpressio	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/libpressio-0.95.1-bxf5clha6zj7js26pg2uiaufnxlnsinq
61:	libquo	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/libquo-1.4-k2oy73q6fvaxoycgrcuilh2kmpxtxn7ho
62:	loki	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/loki-0.1.7-4ngxknefhg3dh5mvngt2jvqlqorpi5iu7
63:	magma	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/magma-2.8.0-crudwg7htvkuj6ljrlkc3uouqyhyphooj
64:	mercury	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/mercury-2.3.1-zumkp4tcozd3qd5rj7xmymnev2sg3sg
65:	metall	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/metall-0.25-re6fv5xk774c7sgle5bmokjv6e7dbkss
66:	mfem	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/mfem-4.6.0-fvfh3g2vm4yl7tajdryuewnngsogkr4e
67:	mgard	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/mgard-2023-12-09-rxkl2uk3scasx6rqaiquarymwlecdheq
68:	mpark-variant	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/mpark-variant-1.4.0-dhvuog3rhmlvh3ec4xrpkyoonpejhjdq
69:	mpich	/usr/local/mpich/install/mpich
70:	mpifileutils	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/mpifileutils-0.11.1-5kseyh2jbrz7ksqsqsnaqqyqx7nt7xme
71:	nccmp	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/nccmp-1.9.1.0-zzzpb5llrpfriwap4plxltrtmnl2l5cc
72:	nco	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/nco-5.1.9-dfhtouuhfuvdd2qnlnyr46qchlnlvxt
73:	nek5000	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/nek5000-19.0-2wqmvu3d5zh5hyftxvh4v2ypxprshoc1
74:	nekbone	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/nekbone-17.0-emknoveznrxi76qppgwiodbjmt6k37
75:	netcdf-fortran	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/netcdf-fortran-4.6.1-j4bkapqsekkikoxz6v55q3u72e74njgb
76:	netlib-scalapack	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/netlib-scalapack-2.2.0-ku2qbneae6j7eppy7cjmxcqcny7kg4f
77:	nrm	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/nrm-0.1.0-7ro2g7vz2xw6hcbtopbmj5h6kocp5kwe
78:	omega-h	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/omega-h-9.34.13-gqp6exxu5xm2o7wb26e3kcnm3fn7ksuy
79:	openfoam	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/openfoam-2312-omwa2qxbucnuo4taadrsgx5qsrxmno1v
80:	openmpi	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/openmpi-5.0.3-2bvqh7ow6ymrr73ksmq3dzhmgwx4urf
81:	openpmd-api	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/openpmd-api-0.15.2-gnfn5u42ukhb7d4rwpr2uwxf2ctlriin
82:	papi	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/papi-7.1.0-aqrtxaaeaycqjvq7ggursnztzegwsu5d
83:	papyrus	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/papyrus-1.0.2-g7o6dht5tmvub2vtjlud2glvw5f5bt5s3
84:	parallel-netcdf	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/parallel-netcdf-1.12.3-hv5xg6awlelcv6ihffy5pfyljbat5fgt
85:	paraview	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/paraview-5.12.0-keknhbz3xhfsdu67psbykeslkyhxeod
86:	parsec	/spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/parsec-3.0.2209-vtb2hut5gwsbtvapidd2jxsbmqo5n6mv



24.05 Release: 129+ Official Products + dependencies (gcc, x86_64)

```
87: pdt /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/pdt-3.25.2-ntyx5npeoedhytnmp2f2fjbqsbpwozwo
88: petsc /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/petsc-3.21.0-qeo4b4cvo35wnmrao7hpfvuk6sqit2ay
89: phist /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/phist-1.12.0-mzhuo2qv7rgc3crrxbsghivontvpgfl2
90: plasma /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/plasma-23.8.2-6sy2higf2u3lstk7xgnweid2gkiixili
91: plumed /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/plumed-2.9.0-k3gvo2opujkkuiuwaymg4mpvk2c46lrm
92: precice /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/precice-3.1.1-wdb2xo77ds3v6zfqsorc7p4egra5rwaf
93: pruners-ninja /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/pruners-ninja-1.0.1-symckmo6oovcfagoaexjmanwf53tkkx
94: pumi /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/pumi-2.2.8-aheswn3usl2uaaqyolbfjvfwbfnk7aar
95: py-cinemasci /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/py-cinemasci-1.3-yxek54vn476avt4i4ffrlfw6l2m3ste5
96: py-deephyper /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/py-deephyper-0.6.0-blk2npxp6cblh5tllhmlloyofdjl3avfmo
97: py-jupyterhub /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/py-jupyterhub-1.4.1-p3d3g7w33ka44mznqfngxjekk7vqb4zw
98: py-libensemble /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/py-libensemble-1.2.2-m4mzpiffllfv7psqeaxojla672zerrxir
99: py-parsl /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/py-parsl-2023.08.21-wvs7iiej4x4c3tm7rwwi4dn5i22aozq
100: py-radical-saga /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/py-radical-saga-1.47.0-6bb3j5mn4gwbawzvjwkb6u7cvtihav
101: qthreads /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/qthreads-1.18-zkyzsc3ekeyd33s5k4vb4hnmk6b2f2fbp2
102: quantum-espresso /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/quantum-espresso-7.3.1-4ifcespyaxqctcn7nvv4iozpf72rwhfl
103: raja /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/raja-2024.02.0-2njptptnlqcmofybw6vqokeca7pwl6iq
104: rempi /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/rempi-1.1.0-kpijbhup65kavzuxn626ix2k74c6volg
105: scr /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/scr-3.0.1-nrgb7ztgti4hdaiwbaecvjgejgemy6aj
106: slate /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/slate-2023.11.05-p55lqsgekdwnigjpisqyt3v4stz7xkww
107: slepc /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/slepc-3.21.0-tz3mwstqygi75v2cp71v6izgh5e2p6zs
108: stc /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/stc-0.9.0-6i6frrt2hsdjnn7avmsuli6qjxova6ogm
109: strumpack /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/strumpack-7.2.0-nnutidatsdqcs4yd4zgvsvzwqeha3wqth
110: sundials /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/sundials-7.0.0-kae4vjqlhsmup5gbg5fj7qhofu7nil
111: superlu-dist /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/superlu-dist-8.2.1-mpfgygo26xhcwraw3h3ggqqtwtq4glgi7
112: swig /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/swig-4.1.1-kxca6xdwutn47opikmgtzifx7lb24wxh
113: sz3 /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/sz3-3.1.7-oozjyrrquv5bfyvkwtkgjcmuuek44bry
114: tasmanian /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/tasmanian-8.0-neqt3xyiksojlknbm6pvsvtgdztjzr32
115: tau /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/tau-2.33.2-h7dgidkne2k3xqumof2ux5cr74qrkpvq
116: trilinos /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/trilinos-15.1.1-vwvbdhwmahq5s7dxc3fc6kpbth27alun
117: turbine /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/turbine-1.3.0-75xp3vorpsxgufs3c2gtg64b5ua4itij
118: umap /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/umap-2.1.0-qzrq5rtq4zf55sbw6ldfcvz26puhcxw3
119: umpire /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/umpire-2024.02.0-e4mqgdg53gnroe6lbnx53gykupxgann
120: unifyfs /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/unifyfs-2.0-ftlvq6v655adtpsu74sbf4mq75xgo5jd
121: upcxx /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/upcxx-2023.9.0-3qi64d5ssz3owl53y2tekvrrnon3ev3s7
122: variorum /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/variorum-0.7.0-bcijnkmkgbq7qxpwmckwlmixpusv3t3gb
123: veloc /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/veloc-1.7-koe3ykgxbza lhxhdm5uyj5qvpfomts2
124: visit /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/visit-3.3.3-mnudpebe6ppnov54hpc53dgwnyqqz6dc
125: vtk-m /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/vtk-m-2.1.0-wmxwujtmduiulmxcalaznuz4cz3pymzv
126: wannier90 /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/wannier90-3.1.0-iqefxuryg377waf74wpk76ra2cdey5r
127: warpx /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/warpx-23.08-5gt7i7cldkpm36qgal7zo6qozlhuvzr6
128: xyce /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/xyce-7.8.0-a7keyuythgdLekfknkmdm7vppggaauzcc
129: zfp /spack/opt/spack/linux-ubuntu22.04-x86_64/gcc-11.4.0/zfp-1.0.0-md2k77z73i2vwdhsxjssepmj54dyjey
```

Languages:

- Rust
- Julia with support for MPI, and CUDA
- Python

AI products

- TensorBraid
- DeepHyper
- OpenAI
- Tensorflow
- Pytorch
- JAX
- Horovod
- LBANN

EDA Tools:

- Xyce

3D Visualization

- Paraview
- VisIt
- TAU's paraprof
- Jupyter notebook ...



E4S Tools: e4s-chain-spack.sh

```
Singularity> rm -rf ~/tmp/spack
Singularity> . /etc/e4s/e4s-chain-spack.sh ~/tmp/spack
Cloning into '/home/users/sameer/tmp/spack'...
remote: Enumerating objects: 531987, done.
remote: Counting objects: 100% (180/180), done.
remote: Compressing objects: 100% (92/92), done.
remote: Total 531987 (delta 83), reused 139 (delta 60), pack-reused 531807
Receiving objects: 100% (531987/531987), 176.96 MiB | 32.95 MiB/s, done.
Resolving deltas: 100% (249575/249575), done.
Updating files: 100% (11224/11224), done.
Singularity> spack find valgrind
==> Error: No package matches the query: valgrind
Singularity> spack install valgrind
[+] /opt/intel/oneapi (external intel-oneapi-mpi-2021.11.0-2qi2xp2qs4kxwddgnibhixhgjmwvngvo)
[+] /spack/opt/spack/linux-ubuntu22.04-x86_64/oneapi-2024.0.2/gmake-4.4.1-zpg4uz3bbxf4ljfzxsm5uhhepceiwdwd
[+] /spack/opt/spack/linux-ubuntu22.04-x86_64/oneapi-2024.0.2/boost-1.84.0-zualrbvikg6f5cvkjif227s3mebjfnov
==> Installing valgrind-3.20.0-7t4aj3mw3fokiyun6ofcjpgxaj6teseas [4/4]
==> No binary for valgrind-3.20.0-7t4aj3mw3fokiyun6ofcjpgxaj6teseas found: installing from source
==> Fetching https://mirror.spack.io/_source-cache/archive/85/8536c031dbe078d342f121fa881a9ecd205cb5a78e639005ad570011bdb9f3c6.tar.bz2
==> Ran patch() for valgrind
==> valgrind: Executing phase: 'autoreconf'
==> valgrind: Executing phase: 'configure'
==> valgrind: Executing phase: 'build'
==> valgrind: Executing phase: 'install'
==> valgrind: Successfully installed valgrind-3.20.0-7t4aj3mw3fokiyun6ofcjpgxaj6teseas
  Stage: 3.53s. Autoreconf: 0.00s. Configure: 45.60s. Build: 28.97s. Install: 3.15s. Post-install: 1.32s. Total: 1m 22.86s
[+] /home/users/sameer/tmp/spack/opt/spack/linux-ubuntu22.04-x86_64/oneapi-2024.0.2/valgrind-3.20.0-7t4aj3mw3fokiyun6ofcjpgxaj6teseas
Singularity> spack load valgrind
Singularity> which valgrind
/home/users/sameer/tmp/spack/opt/spack/linux-ubuntu22.04-x86_64/oneapi-2024.0.2/valgrind-3.20.0-7t4aj3mw3fokiyun6ofcjpgxaj6teseas/bin/valgrind
Singularity> valgrind --help | head
usage: valgrind [options] prog-and-args

  tool-selection option, with default in [ ]:
  --tool=<name>          use the Valgrind tool named <name> [memcheck]

  basic user options for all Valgrind tools, with defaults in [ ]:
  -h --help              show this message
  --help-debug           show this message, plus debugging options
  --help-dyn-options     show the dynamically changeable options
  --version              show version
Singularity> █
```

e4s-chain-spack.sh allows a user to extend and add new tools to an existing Spack installation in a read-only filesystem in a container and chain both Spack installations!



E4S Support for AI/ML frameworks with NVIDIA GPUs

```

$ singularity run --nv e4s-24.05-cuda90-arm64.sif
Singularity> nvidia-smi
Thu May 9 10:17:49 2024
+-----+
| NVIDIA-SMI 535.146.02                Driver Version: 535.146.02   CUDA Version: 12.2   |
+-----+-----+-----+-----+-----+-----+
| GPU   Name                               Persistence-M   Bus-Id        Disp.A   Volatile Uncorr. ECC   |
| Fan  Temp  Perf              Pwr:Usage/Cap     Memory-Usage   GPU-Util    Compute M.   |
|                                           MIG M.         |
+-----+-----+-----+-----+-----+-----+
|  0   NVIDIA GH200 480GB                 Off           00000009:01:00.0 Off   |
| N/A   23C   P0               78W / 900W      25MiB / 97871MiB   0%         Default   |
|                                           Disabled      |
+-----+-----+-----+-----+-----+

+-----+
| Processes:                               |
| GPU   GI   CI        PID   Type   Process name                      GPU Memory |
|      ID   ID                                 |          Usage |
+-----+-----+-----+-----+-----+
|  0   N/A  N/A         17296   G   /usr/libexec/Xorg                  4MiB |
+-----+

Singularity> python
Python 3.10.12 (main, Nov 20 2023, 15:14:05) [GCC 11.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import tensorflow
>>> import torch
>>> torch.cuda.get_device_name(0)
'NVIDIA GH200 480GB'
>>> torch.cuda.get_arch_list()
['sm_75', 'sm_80', 'sm_90']
>>> torch.__version__
'2.3.0'
>>> tensorflow.__version__
'2.16.1'
>>>

```

E4S 24.05 supports NVIDIA Grace-Hopper GH200 GPUs with TensorFlow and PyTorch



E4S Support for AI/ML and Python tools

```
$ singularity run --nv e4s-24.05-cuda90-amd64.sif
Singularity> python
Python 3.10.12 (main, Nov 20 2023, 15:14:05) [GCC 11.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import openai
>>> import google.generativeai
>>> import tensorflow
>>> import torch
>>> import jax
>>> import torchbraid
>>> import deephyper
>>> import pandas
>>> import cv2
>>> import sklearn
>>> import open3d
>>> import numpy
>>> import scipy
>>> import matplotlib
>>> import plotly
>>> import seaborn
>>> import mpi4py
>>>
Singularity> grep Ubuntu /etc/os-release
PRETTY_NAME="Ubuntu 22.04.4 LTS"
NAME="Ubuntu"
Singularity> █
```


E4S 24.05 Support for GPUs: NVIDIA

```
$ singularity run --nv e4s-24.05-cuda90-amd64.sif
Singularity> spack find -x +cuda
-- linux-ubuntu22.04-x86_64 / gcc@11.4.0 -----
adios2@2.10.0      chai@2024.02.0    gromacs@2024.1    legion@24.03.0    petsc@3.21.0      superlu-dist@8.2.1  zfp@0.5.5
amrex@24.04        cusz@0.3.1        hefffte@2.4.0     libpressio@0.95.1 py-torch@2.2.2     tasmanian@8.0
arborx@1.6         ecp-data-vis-sdk@1.0 hpctoolkit@2024.01.1 magma@2.8.0        raja@2024.02.0    tau@2.33.2
axom@0.9.0         exago@1.6.0       hpx@1.9.1         mfem@4.6.0        slate@2023.11.05  trilinos@15.1.1
bricks@2023.08.25 flecsi@2.2.1       kokkos@4.3.00     mgard@2023-12-09 slepc@3.21.0       umpire@2024.02.0
cabana@0.6.0       flux-core@0.61.2  kokkos-kernels@4.3.00 papi@7.1.0        strumpack@7.2.0   upcxx@2023.9.0
caliper@2.10.0     ginkgo@1.7.0      lammps@20230802.3 parsec@3.0.2209   sundials@7.0.0    vtk-m@2.1.0
==> 43 installed packages
Singularity> spack find -x
-- linux-ubuntu22.04-x86_64 / gcc@11.4.0 -----
adios@1.13.1       darshan-runtime@3.4.4 h5bench@1.4        mercury@2.3.1     petsc@3.21.0      superlu@5.3.0
adios2@2.7.1       darshan-util@3.4.4   hdf5@1.12.3        metall@0.25       phist@1.12.0      superlu-dist@8.2.1
adios2@2.10.0      datatransferkit@3.1.1 hdf5-vol-async@1.7 netcdf@4.13.0     plasma@23.8.2     superlu-dist@8.2.1
alquimia@1.1.0     dealii@9.5.1         hdf5-vol-cache@v1.1 mpileaks@3.22.0   plumed@2.9.0      swig@4.0.2-fortran
aml@0.2.1           dyninst@13.0.0       hdf5-vol-log@1.4.0 mgard@2023-12-09 pruners-ninja@1.0.1 sz@2.1.12.5
amrex@24.04        e4s-alc@1.0.1        hefffte@2.4.0      mgard@2023-12-09 pumi@2.2.8         sz3@3.1.7
amrex@24.04        e4s-cl@1.0.3         hefffte@2.4.0      mpark-variant@1.4.0 pycinemas@1.3     tasmanian@8.0
arborx@1.6         ecp-data-vis-sdk@1.0 hpctoolkit@2024.01.1 mpich@4.1.2        py-deephyper@0.6.0 tau@2.33.2
arborx@1.6         ecp-data-vis-sdk@1.0 hpctoolkit@2024.01.1 hpfileutils@0.11.1 py-h5py@3.11.0    tau@2.33.2
argobots@1.2       exago@1.6.0          hpx@1.9.1          nccmp@1.9.1.0     py-jupyterhub@1.4.1 trilinos@13.0.1
ascent@0.9.2       exago@1.6.0          hpx@1.9.1          nco@5.1.9          py-libensemble@1.2.2 trilinos@15.1.1
axom@0.9.0         exaworks@0.1.0       hypre@2.31.0       nek5000@19.0      py-petsc4py@3.21.0 trilinos@15.1.1
axom@0.9.0         faodel@1.2108.1      kokkos@4.3.00      netcdf-fortran@4.6.1 py-torch@2.2.2    turbine@1.3.0
bolt@2.0           flecsi@2.2.1         kokkos-kernels@4.3.00 netlib-scalapack@2.2.0 py-warp@23.08     umap@2.1.0
boost@1.79.0       flit@2.1.0           kokkos-kernels@4.3.00 nrm@0.1.0         qthreads@1.18     umpire@2024.02.0
bricks@2023.08.25 flit@2.1.0           kokkos-kernels@4.3.00 nvhpc@24.3        quantum-espresso@7.3.1 umpire@2024.02.0
bricks@2023.08.25 flux-core@0.61.2     laghos@3.1         omega-h@9.34.13   raja@2024.02.0    unifyfs@2.0
butterflypack@2.4.0 flux-core@0.61.2     lammps@20230802.3  openfoam@2312     raja@2024.02.0    upcxx@2023.9.0
cabana@0.6.0       fortrilinos@2.3.0    lammps@20230802.3  openmpi@5.0.3     rempi@1.1.0        upcxx@2023.9.0
cabana@0.6.0       fpm@0.10.0          legion@24.03.0     openpmd-api@0.15.2 scr@3.0.1          variorum@0.7.0
caliper@2.10.0     gasnet@2023.9.0      legion@24.03.0     papi@7.1.0        slate@2023.11.05  veloc@1.7
caliper@2.10.0     ginkgo@1.7.0         libbann@0.104      papi@7.1.0        slate@2023.11.05  visit@3.3.3
chai@2024.02.0     ginkgo@1.7.0         libnrm@0.1.0       papyrus@1.0.2     slepc@3.21.0       vtk-m@2.0.0
chai@2024.02.0     globalarrays@5.8.2   libpressio@0.95.1  parallel-netcdf@1.12.3 slepc@3.21.0       vtk-m@2.1.0
charliecloud@0.37 glvis@4.2            libpressio@0.95.1  paraview@5.12.0   stc@0.9.0          wannier90@3.1.0
conduit@0.9.1      gmp@6.2.1           libquo@1.4         parsec@3.0.2209   strumpack@7.2.0    xyce@7.8.0
cp2k@2024.1        gotcha@1.0.6         libunwind@1.6.2    pdt@3.25.2        strumpack@7.2.0    zfp@0.5.5
cuda@11.8.0        gptune@4.0.0         loki@0.1.7         petsc@3.21.0      sundials@7.0.0    zfp@0.5.5
cuda@12.2.0        gromacs@2024.1       magma@2.8.0
cusz@0.3.1         gromacs@2024.1
==> 179 installed packages
```



E4S 24.05 Support for GPUs: NVIDIA (modules)

```
$ singularity run --nv e4s-24.05-cuda90-amd64.sif
Singularity> module avail
```

```
----- /spack/share/spack/lmod/linux-ubuntu22.04-x86_64/mpich/4.1.2-w2qwyv/Core -----
adios/1.13.1          flecsi/2.2.1-cuda90          mfem/4.6.0-cuda90          slate/2023.11.05-cuda90-openmp
adios2/2.7.1          flecsi/2.2.1                  mfem/4.6.0                  slate/2023.11.05-openmp (D)
adios2/2.10.0-cuda90 (D)   fortilinos/2.3.0             mpifileutils/0.11.1        slepc/3.21.0-cuda90
alquimia/1.1.0        ginkgo/1.7.0-cuda90-openmp   nccmp/1.9.1.0              slepc/3.21.0 (D)
amrex/24.04-cuda90    ginkgo/1.7.0-openmp          nco/5.1.9                   stc/0.9.0
amrex/24.04           globalarrays/5.8.2           nek5000/19.0                strumpack/7.2.0-cuda90-openmp
arborx/1.6-cuda90     glvis/4.2                     nekbone/17.0                strumpack/7.2.0-openmp (D)
arborx/1.6           gptune/4.0.0                 netcdf-fortran/4.6.1        sundials/7.0.0-cuda90
ascent/0.9.2-openmp  gromacs/2024.1-cuda90-openmp  netlib-scalapack/2.2.0     sundials/7.0.0 (D)
axom/0.9.0-cuda90-openmp  gromacs/2024.1-openmp (D)  omega-h/9.34.13            superlu-dist/8.2.1-cuda90
axom/0.9.0-openmp     h5bench/1.4                   openfoam/2312              superlu-dist/8.2.1 (D)
boost/1.79.0          hdf5-vol-async/1.7           openpmd-api/0.15.2         sz/2.1.12.5
bricks/2023.08.25-cuda hdf5-vol-cache/v1.1          papyrus/1.0.2              tasmanian/8.0-cuda90
bricks/2023.08.25 (D)   hdf5-vol-log/1.4.0           parallel-netcdf/1.12.3     tasmanian/8.0 (D)
butterflypack/2.4.0-openmp  hdf5/1.12.3                  paraview/5.12.0            tau/2.33.2-cuda
cabana/0.6.0-cuda90     heffte/2.4.0-cuda90          parsec/3.0.2209-cuda90     tau/2.33.2 (D)
cabana/0.6.0         heffte/2.4.0                  parsec/3.0.2209 (D)        trilinos/13.0.1
caliper/2.10.0-cuda90  hpctoolkit/2024.01.1-cuda    petsc/3.21.0-cuda90        trilinos/15.1.1-cuda90
caliper/2.10.0 (D)     hpctoolkit/2024.01.1 (D)    petsc/3.21.0 (D)          trilinos/15.1.1 (D)
chai/2024.02.0-cuda90  hpx/1.9.1-cuda90             phist/1.12.0-openmp        turbine/1.3.0
chai/2024.02.0 (D)    hpx/1.9.1 (D)                plumed/2.9.0               umpire/2024.02.0-cuda90
conduit/0.9.1          hypre/2.31.0                  pruners-ninja/1.0.1        umpire/2024.02.0 (D)
cp2k/2024.1-openmp    lammps/20230802.3-cuda90-openmp  pumi/2.2.8                unifyfs/2.0
darshan-runtime/3.4.4  lammps/20230802.3-openmp (D)  py-cinemasci/1.3          upcxx/2023.9.0-cuda90
datatransferkit/3.1.1  lbann/0.104                   py-h5py/3.11.0             upcxx/2023.9.0 (D)
dealii/9.5.1          libcatlyst/2.0.0-rc4         py-libensemble/1.2.2       veloc/1.7
dyninst/13.0.0-openmp  libnrm/0.1.0                  py-petsc4py/3.21.0         visit/3.3.3
ecp-data-vis-sdk/1.0-cuda90  libpressio/0.95.1-cuda90-openmp  py-torch/2.2.2-cuda90-openmp  vtk-m/2.0.0-openmp
ecp-data-vis-sdk/1.0 (D)  libpressio/0.95.1-openmp (D)  py-warpx/23.08            vtk-m/2.1.0-cuda90-openmp (D)
exago/1.6.0-cuda80     libquo/1.4                    quantum-espresso/7.3.1-openmp  wannier90/3.1.0
exago/1.6.0 (D)       mercury/2.3.1                 rempi/1.1.0                xyce/7.8.0
exaworks/0.1.0        metall/0.25                    scr/3.0.1
faodel/1.2108.1

----- /spack/share/spack/lmod/linux-ubuntu22.04-x86_64/Core -----
amL/0.2.1             flit/2.1.0                    kokkos/4.3.00-openmp (D)  nrm/0.1.0          raja/2024.02.0-cuda90
argobots/1.2         flux-core/0.61.2-cuda         legion/24.03.0              nvhpc/24.3         raja/2024.02.0 (D)
bolt/2.0              flux-core/0.61.2 (D)         libunwind/1.6.2            openmpi/5.0.3     superlu/5.3.0
charliecloud/0.37   fpm/0.10.0-openmp           loki/0.1.7                  papi/7.1.0-cuda   swig/4.0.2-fortran
cuda/11.8.0          gasnet/2023.9.0              magma/2.8.0-cuda90          papi/7.1.0 (D)   sz3/3.1.7
cuda/12.2.0 (D)      gmp/6.2.1                     mgard/2023-12-09-cuda90-openmp  pdt/3.25.2        umap/2.1.0
cusz/0.3.1-cuda90   gotcha/1.0.6                 mgard/2023-12-09-openmp (D)  plasma/23.8.2     variorum/0.7.0
darshan-util/3.4.4  kokkos-kernels/4.3.00-cuda90  mpark-variant/1.4.0        py-deephyper/0.6.0  zfp/0.5.5-cuda90
e4s-alc/1.0.1       kokkos-kernels/4.3.00-openmp (D)  mpich/4.1.2 (L)            py-jupyterhub/1.4.1  zfp/0.5.5 (D)
e4s-cl/1.0.3        kokkos/4.3.00-cuda90          mpich/4.1.2 (L)            qthreads/1.18
```

Where:

L: Module is loaded



E4S 24.05 Support for GPUs: AMD

```
$ singularity run e4s-24.05-rocm90a-amd64.sif
Singularity> spack find -x +rocm
-- linux-ubuntu22.04-x86_64 / gcc@11.4.0 -----
amrex@24.04      chai@2024.02.0    ginkgo@1.7.0      hypre@2.31.0      mfem@4.6.0        slate@2023.11.05  superlu-dist@8.2.1  umpire@2024.02.0
arborx@1.6      ecp-data-vis-sdk@1.0  heffte@2.4.0      kokkos@4.3.00    paraview@5.12.0   slepc@3.21.0     tasmanian@8.0      upcxx@2023.9.0
cabana@0.6.0    exago@1.6.0      hpctoolkit@2024.01.1  legion@24.03.0   petsc@3.21.0     strumpack@7.2.0  tau@2.33.2         vtk-m@2.1.0
caliper@2.10.0  gasnet@2023.9.0    hpx@1.9.1         magma@2.8.0      raja@2024.02.0   sundials@7.0.0   trilinos@15.1.1
==> 31 installed packages
Singularity> spack find -x
-- linux-ubuntu22.04-x86_64 / gcc@11.4.0 -----
adios@1.13.1     darshan-runtime@3.4.4  gmp@6.2.1         lbann@0.104       nrm@0.1.0         py-jupyterhub@1.4.1  sz3@3.1.7
adios2@2.7.1     darshan-util@3.4.4    gotcha@1.0.6      legion@24.03.0    nvhpc@24.3        py-libensemble@1.2.2  tasmanian@8.0
alquimia@1.1.0   datatransferkit@3.1.1  gptune@4.0.0      legion@24.03.0    omega-h@9.34.13  py-petsc4py@3.21.0  tasmanian@8.0
aml@0.2.1        dealii@9.5.1          gromacs@2024.1    libcatalyst@2.0.0-rc4  openfoam@2312    py-warpx@23.08      tau@2.33.2
amrex@24.04      dyninst@13.0.0        h5bench@1.4       libnm@0.1.0       openmpi@5.0.3    qthreads@1.18       tau@2.33.2
amrex@24.04      e4s-alc@1.0.1         hdf5@1.12.3       libpressio@0.95.1  openpmd-api@0.15.2  quantum-espresso@7.3.1  trilinos@13.0.1
arborx@1.6       e4s-cl@1.0.3          hdf5@1.14.3       libqu@1.4          papi@7.1.0        raja@2024.02.0      trilinos@15.1.1
arborx@1.6       ecp-data-vis-sdk@1.0  hdf5-vol-async@1.7  libunwind@1.6.2    papyrus@1.0.2     raja@2024.02.0      trilinos@15.1.1
argobots@1.2     ecp-data-vis-sdk@1.0  hdf5-vol-cache@v1.1  loki@0.1.7        parallel-netcdf@1.12.3  rempi@1.1.0         turbine@1.3.0
ascent@0.9.2     exago@1.6.0           hdf5-vol-log@1.4.0  magma@2.8.0       paraview@5.12.0   scr@3.0.1            umap@2.1.0
axom@0.9.0       exago@1.6.0           hdf5-vol-log@1.4.0  mercury@2.3.1     paraview@5.12.0   slate@2023.11.05    umpire@2024.02.0
bolt@2.0         exaworks@0.1.0        heffte@2.4.0       metall@0.25        parsec@3.0.2209    slate@2023.11.05    umpire@2024.02.0
boost@1.79.0     faodel@1.2108.1       heffte@2.4.0       mfem@4.6.0        pdt@3.25.2        slepc@3.21.0        unifyfs@2.0
bricks@2023.08.25  flecsi@2.2.1          hpctoolkit@2024.01.1  mfem@4.6.0        petsc@3.21.0     slepc@3.21.0        upcxx@2023.9.0
butterflypack@2.4.0  flit@2.1.0           hpctoolkit@2024.01.1  mgard@2023-12-09  petsc@3.21.0     stc@0.9.0           upcxx@2023.9.0
cabana@0.6.0     flux-core@0.61.2      hpx@1.9.1          mpark-variant@1.4.0  phist@1.12.0     strumpack@7.2.0     variorum@0.7.0
cabana@0.6.0     fortrilinos@2.3.0     hpx@1.9.1          mpich@4.1.2        plasma@23.8.2    strumpack@7.2.0     veloc@1.7
caliper@2.10.0   fpm@0.10.0            hypre@2.31.0       mpifileutils@0.11.1  plumed@2.9.0     sundials@7.0.0     visit@3.3.3
caliper@2.10.0   gasnet@2023.9.0       kokkos@4.3.00      nccmp@1.9.1.0     pruners-ninja@1.0.1  sundials@7.0.0     vtk-m@2.0.0
chai@2024.02.0   gasnet@2023.9.0       kokkos@4.3.00      nco@5.1.9          pumil@2.2.8       superlu@5.3.0       vtk-m@2.1.0
chai@2024.02.0   ginkgo@1.7.0          kokkos-kernels@4.3.00  nek5000@19.0      py-cinemasci@1.3  superlu-dist@8.2.1  wannier90@3.1.0
charliecloud@0.37  ginkgo@1.7.0          laghos@3.1         netcdf-fortran@4.6.1  py-deepphyper@0.6.0  swig@4.0.2-fortran  xyce@7.8.0
conduit@0.9.1    globalarrays@5.8.2    lammps@20230802.3  netlib-scalapack@2.2.0  py-h5py@3.11.0    sz@2.1.12.5        zfp@0.5.5
cp2k@2024.1      glvis@4.2
==> 167 installed packages
Singularity> █
```



E4S 24.05 Support for GPUs: AMD (modules)

Singularity> module avail

```
----- /spack/share/spack/lmod/linux-ubuntu22.04-x86_64/mpich/4.1.2-w2qwypv/Core -----
adios/1.13.1          fortrilinos/2.3.0          mfem/4.6.0-gfx90a          scr/3.0.1
alquimia/1.1.0       ginkgo/1.7.0-gfx90a-openmp mfem/4.6.0                  (D)  slate/2023.11.05-gfx90a-openmp
amrex/24.04-gfx90a   ginkgo/1.7.0-openmp      mpifileutils/0.11.1       (D)  slate/2023.11.05-openmp
amrex/24.04          (D)  globalarrays/5.8.2        nccmp/1.9.1.0             (D)  slepc/3.21.0-gfx90a
arborx/1.6-gfx90a   glvis/4.2                 nco/5.1.9                  (D)  slepc/3.21.0
arborx/1.6          (D)  gptune/4.0.0              nek5000/19.0              (D)  stc/0.9.0
axom/0.9.0-openmp  gromacs/2024.1-openmp     nekbone/17.0              strumpack/7.2.0-gfx90a-openmp
boost/1.79.0        h5bench/1.4               netcdf-fortran/4.6.1      strumpack/7.2.0-openmp      (D)
bricks/2023.08.25   hdf5-vol-async/1.7        netlib-scalapack/2.2.0    sundials/7.0.0-gfx90a
butterflypack/2.4.0-openmp hdf5-vol-cache/v1.1       omega-h/9.34.13           sundials/7.0.0              (D)
cabana/0.6.0-gfx90a-rocml hdf5-vol-log/1.4.0       openfoam/2312             superlu-dist/8.2.1-gfx90a
cabana/0.6.0        (D)  heffte/2.4.0-gfx90a      openpmd-api/0.15.2        superlu-dist/8.2.1          (D)
caliper/2.10.0-gfx90a heffte/2.4.0              (D)  papyrus/1.0.2             tasmanian/8.0-gfx90a
caliper/2.10.0      (D)  hpctoolkit/2024.01.1-rocml parsec/3.0.2209           tasmanian/8.0              (D)
chai/2024.02.0-gfx90a hpctoolkit/2024.01.1     (D)  petsc/3.21.0-gfx90a      tau/2.33.2-rocml
chai/2024.02.0      (D)  hpx/1.9.1-gfx90a         petsc/3.21.0              (D)  tau/2.33.2
conduit/0.9.1       hpx/1.9.1                 (D)  phist/1.12.0-openmp      trilinos/13.0.1
cp2k/2024.1-openmp hypre/2.31.0-gfx90a       plumed/2.9.0              trilinos/15.1.1-gfx90a
datatransferkit/3.1.1 hypre/2.31.0              (D)  precice/3.1.1            trilinos/15.1.1            (D)
dealii/9.5.1        laghos/3.1                pruners-ninja/1.0.1       turbine/1.3.0
dyninst/13.0.0-openmp lammps/20230802.3-openmp pumi/2.2.8                umpire/2024.02.0-gfx90a
ecp-data-vis-sdk/1.0-gfx90a lbann/0.104               py-h5py/3.11.0            umpire/2024.02.0           (D)
ecp-data-vis-sdk/1.0 (D)  libnrm/0.1.0             py-libensemble/1.2.2     upcxx/2023.9.0-gfx90a
exago/1.6.0-gfx90a  libpressio/0.95.1-openmp py-petsc4py/3.21.0       upcxx/2023.9.0            (D)
exago/1.6.0        (D)  libquo/1.4               py-warpx/23.08           wannier90/3.1.0
exaworks/0.1.0     mercury/2.3.1            quantum-espresso/7.3.1-openmp xyce/7.8.0
flecsi/2.2.1       metall/0.25              rempi/1.1.0
----- /spack/share/spack/lmod/linux-ubuntu22.04-x86_64/Core -----
aml/0.2.1            fpm/0.10.0-openmp         legion/24.03.0-gfx90a      nrm/0.1.0                   qthreads/1.18
argobots/1.2        gasnet/2023.9.0-gfx90a    legion/24.03.0            (D)  nvhpc/24.3                 raja/2024.02.0-gfx90a
bolt/2.0            gasnet/2023.9.0          (D)  libunwind/1.6.2           openmpi/5.0.3              raja/2024.02.0            (D)
charliecloud/0.37  gmp/6.2.1                 loki/0.1.7                papi/7.1.0                  superlu/5.3.0
e4s-alc/1.0.1       gotcha/1.0.6              magma/2.8.0-gfx90a        pdt/3.25.2                  swig/4.0.2-fortran
e4s-cl/1.0.3        kokkos-kernels/4.3.00-openmp mgard/2023-12-09-openmp  plasma/23.8.2               sz3/3.1.7
flit/2.1.0          kokkos/4.3.00-gfx90a     mpark-variant/1.4.0       py-deephyper/0.6.0         umap/2.1.0
flux-core/0.61.2   kokkos/4.3.00-openmp    (D)  mpich/4.1.2               (L)  py-jupyterhub/1.4.1       variorum/0.7.0
----- /spack/share/spack/lmod/linux-ubuntu22.04-x86_64/Core -----
```

Where:

L: Module is loaded

D: Default Module



E4S 24.05 Support for GPUs: Intel

```
$ singularity run e4s-24.05-oneapi-amd64.sif
Singularity> H1=$(spack find --format /{hash} +level_zero)
Singularity> H2=$(spack find --format /{hash} +sycl)
Singularity> spack find $H1 $H2
-- linux-ubuntu22.04-x86_64 / oneapi@2024.0.2 -----
amrex@24.04 blaspp@2023.11.05 ginkgo@1.7.0 kokkos@4.3.00 lapackpp@2023.11.05 slate@2023.11.05 tau@2.33.2
arborx@1.6 cabana@0.6.0 heffte@2.4.0 kokkos@4.3.00 petsc@3.21.0 sundials@7.0.0 upcxx@2023.9.0
==> 14 installed packages
Singularity> spack find -x
-- linux-ubuntu22.04-x86_64 / gcc@11.4.0 -----
hdf5@1.12.3 papi@7.1.0

-- linux-ubuntu22.04-x86_64 / oneapi@2024.0.2 -----
adios@1.13.1 datatransferkit@3.1.1 hdf5-vol-cache@v1.1 mgard@2023-12-09 pruners-ninja@1.0.1 sz3@3.1.7
adios2@2.8.3 dealii@9.5.1 hdf5-vol-log@1.4.0 mpark-variant@1.4.0 pumi@2.2.8 tasmanian@8.0
aml@0.2.1 e4s-alc@1.0.1 heffte@2.4.0 mpifileutils@0.11.1 py-cinemasci@1.7.0 tau@2.33.2
aml@0.2.1 e4s-cl@1.0.3 heffte@2.4.0 nccmp@1.9.1.0 py-h5py@3.11.0 tau@2.33.2
amrex@24.04 ecp-data-vis-sdk@1.0 hpx@1.9.1 nco@5.1.9 py-jupyterhub@1.4.1 trilinos@13.0.1
amrex@24.04 exago@1.6.0 hypre@2.31.0 nekbone@17.0 py-libensemble@1.2.2 trilinos@15.1.1
arborx@1.6 exaworks@0.1.0 intel-oneapi-mpi@2021.11.0 netcdf-fortran@4.6.1 py-petsc4py@3.21.0 turbine@1.3.0
arborx@1.6 faodel@1.2108.1 kokkos@4.3.00 netlib-scalapack@2.2.0 py-warp@23.08 umap@2.1.0
argobots@1.2 flecsi@2.2.1 kokkos-kernels@4.3.00 nrm@0.1.0 qthreads@1.18 umpire@2024.02.0
ascent@0.8.0 flit@2.1.0 kokkos-kernels@4.3.00 omega-h@9.34.13 raja@2024.02.0 unifyfs@2.0
axom@0.9.0 flux-core@0.61.2 kokkos-kernels@4.3.00 openmpi@5.0.3 rempi@1.1.0 upcxx@2023.9.0
bolt@2.0 fortilinos@2.3.0 laghos@3.1 openpmd-api@0.15.2 scr@3.0.1 upcxx@2023.9.0
boost@1.84.0 gasnet@2023.9.0 lammmps@20230802.3 papyrus@1.0.2 slate@2023.11.05 variorum@0.7.0
bricks@2023.08.25 ginkgo@1.7.0 lbann@0.104 parallel-netcdf@1.12.3 slate@2023.11.05 veloc@1.7
butterflypack@2.4.0 ginkgo@1.7.0 legion@24.03.0 paraview@5.12.0 slepc@3.21.0 vtk-m@1.7.1
cabana@0.6.0 globalarrays@5.8.2 libcatylist@2.0.0-rc4 pascal@3.0.2209 stc@0.9.0 wannier90@3.1.0
cabana@0.6.0 glvis@4.2 libnm@0.1.0 pdt@3.25.2 strumpack@7.2.0 sundials@7.0.0 xyce@7.8.0
caliper@2.10.0 gmp@6.2.1 libquo@1.4 libunwind@1.6.2 petsc@3.21.0 sundials@7.0.0 zfp@0.5.5
chai@2024.02.0 gotcha@1.0.6 libunwind@1.6.2 petsc@3.21.0 superlu@5.3.0
charliecloud@0.37 gptune@4.0.0 loki@0.1.7 phist@1.12.0 superlu-dist@8.2.1
conduit@0.9.1 gromacs@2024.1 mercury@2.3.1 plasma@23.8.2 swig@4.0.2-fortran
darshan-runtime@3.4.4 h5bench@1.4 metall@0.25 plumed@2.9.0 sz@2.1.12.5
darshan-util@3.4.4 hdf5-vol-async@1.7 mfem@4.6.0 precice@3.1.1

==> 135 installed packages
Singularity> which dpcpp
/opt/intel/oneapi/compiler/2024.0/bin/dpcpp
Singularity>
```

Use of Intel oneAPI BaseKit and HPCToolkit is subject to acceptance of Intel EULA by the user



E4S 24.05 Support for GPUs: Intel (modules)

```
$ singularity run e4s-24.05-oneapi-amd64.sif
Singularity> module avail
```

----- /spack/share/spack/lmod/linux-ubuntu22.04-x86_64/intel-oneapi-mpi/2021.11.0-vmuf6bv/Core -----					
adios/1.13.1		ginkgo/1.7.0-sycl-openmp (D)	ncnmp/1.9.1.0	slate/2023.11.05-openmp	
amrex/24.04-sycl		globalarrays/5.8.2	nco/5.1.9	slate/2023.11.05-sycl-openmp (D)	
amrex/24.04	(D)	glvis/4.2	nekbone/17.0	slepc/3.21.0	
arborx/1.6-sycl		gptune/4.0.0	netcdf-fortran/4.6.1	stc/0.9.0	
arborx/1.6	(D)	gromacs/2024.1-openmp	netlib-scalapack/2.2.0	strumpack/7.2.0-openmp	
axom/0.9.0-openmp		h5bench/1.4	omega-h/9.34.13	sundials/7.0.0-sycl	
boost/1.84.0		hdf5-vol-async/1.7	openpmd-api/0.15.2	sundials/7.0.0 (D)	
bricks/2023.08.25		hdf5-vol-cache/v1.1	papyrus/1.0.2	superlu-dist/8.2.1	
butterflypack/2.4.0-openmp		hdf5-vol-log/1.4.0	parsec/3.0.2209	tasmanian/8.0	
cabana/0.6.0-sycl		heffte/2.4.0-sycl	petsc/3.21.0-sycl	tau/2.33.2-level-zero	
cabana/0.6.0	(D)	heffte/2.4.0 (D)	petsc/3.21.0 (D)	tau/2.33.2 (D)	
caliper/2.10.0		hpx/1.9.1	phist/1.12.0-openmp	trilinos/13.0.1	
chai/2024.02.0		hypre/2.31.0	plumed/2.9.0	trilinos/15.1.1 (D)	
conduit/0.9.1		laghos/3.1	precice/3.1.1	turbine/1.3.0	
datatransferkit/3.1.1		lammps/20230802.3-openmp	pruners-ninja/1.0.1	umppire/2024.02.0	
dealii/9.5.1		lbann/0.104	pumi/2.2.8	upcxx/2023.9.0-level-zero	
ecp-data-vis-sdk/1.0		libnrm/0.1.0	py-h5py/3.11.0	upcxx/2023.9.0 (D)	
exago/1.6.0		libquo/1.4	py-libensemble/1.2.2	wannier90/3.1.0	
exaworks/0.1.0		mercury/2.3.1	py-petsc4py/3.21.0	xyce/7.8.0	
flecsi/2.2.1		metall/0.25	py-warpx/23.08		
fortrilinos/2.3.0		mfem/4.6.0	rempi/1.1.0		
ginkgo/1.7.0-openmp		mpifileutils/0.11.1	scr/3.0.1		
----- /spack/share/spack/lmod/linux-ubuntu22.04-x86_64/Core -----					
aml/0.2.1-level-zero	(D)	e4s-cl/1.0.3	intel-oneapi-mpi/2021.11.0 (L)	libunwind/1.6.2	papi/7.1.0
aml/0.2.1		flit/2.1.0	kokkos-kernels/4.3.00-openmp	loki/0.1.7	pdtd/3.25.2
argobots/1.2		flux-core/0.61.2	kokkos-kernels/4.3.00-sycl (D)	mgard/2023-12-09-openmp	plasma/23.8.2
bolt/2.0		gasnet/2023.9.0	kokkos/4.3.00-openmp	mpark-variant/1.4.0	py-jupyterhub/1.4.1
charliecloud/0.37		gmp/6.2.1	kokkos/4.3.00-sycl-openmp (D)	nrm/0.1.0	qthreads/1.18
e4s-alc/1.0.1		gotcha/1.0.6	legion/24.03.0	openmpi/5.0.3	raja/2024.02.0
					superlu/5.3.0
					swig/4.0.2-fortran
					sz3/3.1.7
					umap/2.1.0
					variorum/0.7.0
----- /opt/intel/oneapi/modulefiles -----					
advisor/latest		compiler32/latest	dpct/latest	intel_ipp_intel64/latest	mpi/latest
advisor/2024.0	(D)	compiler32/2024.0.2 (D)	dpct/2024.0.0 (D)	intel_ipp_intel64/2021.10 (D)	mpi/2021.11 (L,D)
ccl/latest		dal/latest	dpl/latest	intel_ippcp_intel64/latest	oclpga/latest
ccl/2021.11.2	(D)	dal/2024.0.0 (D)	dpl/2022.3 (D)	intel_ippcp_intel64/2021.9 (D)	oclpga/2024.0.0 (D)
compiler-rt/latest		debugger/latest	ifort/latest	itac/latest	tbb/latest
compiler-rt/2024.0.2	(D)	debugger/2024.0.0 (D)	ifort/2024.0.2 (D)	itac/2022.0 (D)	tbb/2021.11 (D)
compiler-rt32/latest		dev-utilities/latest	ifort32/latest	mkl/latest	vtune/latest
compiler-rt32/2024.0.2 (D)		dev-utilities/2024.0.0 (D)	ifort32/2024.0.2 (D)	mkl/2024.0 (D)	vtune/2024.0 (D)
compiler/latest		dnnl/latest	inspector/latest	mkl32/latest	
compiler/2024.0.2 (D)		dnnl/3.3.0 (D)	inspector/2024.0 (D)	mkl32/2024.0 (D)	

Where:

- L: Module is loaded
- D: Default Module

Use of Intel oneAPI BaseKit and HPCToolkit is subject to acceptance of Intel EULA by the user



E4S 24.05 Support for GPUs: Intel Data Center GPU Max (aka PVC)

```
$ singularity run e4s-24.05-oneapi-amd64.sif
Singularity> clinfo -l
Platform #0: Intel(R) FPGA Emulation Platform for OpenCL(TM)
  -- Device #0: Intel(R) FPGA Emulation Device
Platform #1: Intel(R) OpenCL
  -- Device #0: Intel(R) Xeon(R) Silver 4410T
Platform #2: Intel(R) OpenCL Graphics
  -- Device #0: Intel(R) Data Center GPU Max 1100
Singularity> spack find -dl heffte+sycl
-- linux-ubuntu22.04-x86_64 / oneapi@2024.0.2 -----
dkawent heffte@2.4.0
biswww4   cmake@3.27.9
r4mair    curl@8.6.0
je4uymd   nghttp2@1.57.0
tjffj56   openssl@3.2.1
3sifbb5   ca-certificates-mozilla@2023-05-30
6xkucz    perl@5.38.0
x7anufu   berkeley-db@18.1.40
uqtwme    bzip2@1.0.8
7akrhoul  diffutils@3.10
bg6qww5   gdbm@1.23
5bu3onp   readline@8.2
ua57skc   pkgconf@1.9.5
s45qlot   ncurses@6.4
ypemcku   zlib-ng@2.1.6
d6bcnaw   gmake@4.4.1
rzaojfz   intel-oneapi-mkl@2024.0.0
rfpr243   intel-tbb@2021.9.0
6ii2fwq   hwloc@2.9.1
zxupvhj   libpciaccess@0.17
5a7ydse   libtool@2.4.7
s4zav25   findutils@4.9.0
wdc4qnd   m4@1.4.19
fcw37kn   libsigsegv@2.14
if4y4n2   util-macros@1.19.3
tgjrkey   libxml2@2.10.3
khmhytm   libiconv@1.17
36cbr64   xz@5.4.6
vmuf6bv   intel-oneapi-mpi@2021.11.0
flx6gxx   intel-oneapi-runtime@2024.0.2
6cqtndc   gcc-runtime@11.4.0

==> 1 installed package
Singularity> █
```

E4S 24.05 packages in oneAPI containers are now built with Intel compilers with Intel MPI



24.05 Release: 129+ Official Products + dependencies (gcc, ppc64le)

1:	adios2	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/adios2-2.10.0-4mywyu6vlmtzbxbcwgv3nujuigmjb3tq
2:	alquimia	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/alquimia-1.1.0-yrlpkjk3duxcvdjpk57kat3u35dsnqsg
3:	aml	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/aml-0.2.1-edhdhxpns72i7ofsm2pbqjimmrorsbp
4:	amrex	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/amrex-24.04-bwleaeu5zpcnzyrfviphfompmvax5rmv
5:	arborx	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/arborx-1.6-5b36lowtoilu2ybfwtcgzro5eyd3rnzg
6:	argobots	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/argobots-1.2-cjgy6obofkgaflnwsip76yfbpbeay6q6q
7:	ascent	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ascent-0.9.2-wj5omuqmprkb7dpsnlvgactjq57jbjk
8:	axom	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/axom-0.9.0-bhmt6aumzlkhtn4bbpng3dlpaam454am
9:	bolt	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/bolt-2.0-hidc2qb5hhsd6hj3tmkkzkobtkmeuh2p
10:	blaspp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/blaspp-2023.11.05-6qt76nm5das63yqzvw4gwapkwvojuw62j
11:	bricks	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/bricks-2023.08.25-rr4l3jiaiywhpb6hyzcp2bbqgnxns243
12:	butterflypack	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/butterflypack-2.4.0-m2xskltwx6ozcuh5gzdvt5fbpiskmq5h
13:	cabana	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/cabana-0.6.0-t4o4rifcz6vg7l4o64wix2u4criezvtx
14:	caliper	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/caliper-2.10.0-tcwrtpxnfvmlcatmukmlj2qgswgis2yj
15:	camp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/camp-2024.02.0-hizqxenz3rfcba7ban53nxtl3xtf3eb
16:	chai	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/chai-2024.02.0-gca7wviucemmenptd2tlhpw3f2m5h6sf
17:	charliecloud	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/charliecloud-0.37-ciit4l5dfobqxsmdwxsrjqsuego77fw
18:	conduit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/conduit-0.9.1-jyq2cfw6yubjd4epfm2rjz75glvlt2g
19:	cp2k	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/cp2k-2024.1-bpgb2kq3xinl25pj7dz4hv4vyrj7nf
20:	cusz	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/cusz-0.3.1-lav7dlxpjkm7ghhunwm3j3ttdivghgm7l
21:	darshan-runtime	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/darshan-runtime-3.4.4-icj7mpijxjr6bb3jodjggxm4b26p3zgi
22:	datatransferkit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/datatransferkit-3.1.1-kyyx2fqideedc2xcnl4q2gkol2gdfobw
23:	dyninst	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/dyninst-13.0.0-ir3mzxecf5oy6cax73eguc3wakru5rwn
24:	e4s-alc	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/e4s-alc-1.0.1-sr7ms5he5qskkk5d4di5w5catg5vdr3q
25:	e4s-cl	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/e4s-cl-1.0.3-axwr3nbv6fqpyng2m27gua3wnmkf47fr
26:	ecp-data-vis-sdk	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ecp-data-vis-sdk-1.0-hw5q2rqqtdyxw467jlrqx6wsdj7hcwrc
27:	exago	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/exago-1.6.0-yjrebei5otf7a6tpohjycr7t3a5vrvokw
28:	exaworks	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/exaworks-0.1.0-cnjtbt4fvscmgus5nnhh6wirdq2lxq7r
29:	faodel	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/faodel-1.2108.1-ur7lcltn3od3ujnx5gjdftd7fjafllfg
30:	flecsi	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flecsi-2.2.1-jkqf4nklyeb5pyxjfwr4msgqqhhcg62u
31:	flit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flit-2.1.0-pgppjuv4xcuudo4b72en7dknnvdkjnyusy
32:	flux-core	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flux-core-0.61.2-uqggildy4da6acaohij4jybgj6zuaico
33:	flux-sched	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flux-sched-0.33.1-q6nr6hh453qwgba3qidr37vkt7gk2ace
34:	fortrilinos	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/fortrilinos-2.3.0-lkg57u7lflggx2umgw4g3vbz7edog16m
35:	gasnet	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gasnet-2023.9.0-vlx5a2s453ll5isj3w3yen6e6b2dj4d4y
36:	ginkgo	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ginkgo-1.7.0-u5cyewkyz26l7gz6vxp7jy2g25q4gtel
37:	globalarrays	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/globalarrays-5.8.2-yhfh7qpapucntwvtyr/lmz2puznfbwxu
38:	gotcha	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gotcha-1.0.6-p5u2dmwm77x4ahrdbnpaviudu2znsixn
39:	gptune	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gptune-4.0.0-qktwtntxi33adkui1cjpwhqu46245f2yg
40:	gromacs	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gromacs-2024.1-u4evhzqw7vvdw5h4lee57ixdmdnw3f64
41:	h5bench	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/h5bench-1.4-psbgg5sepibb63bub6tdlqpmzxljyrwa
42:	hdf5	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-1.14.3-uj64b2j5ywkmojwgidwyhzuz7qsr2uj
43:	hdf5-vo-l-cache	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-vo-l-cache-v1.1-kkqkpxxwql2wlhkkdwewo6i6j3ob6

GPU runtimes for IBM Power

- CUDA 12.3
- NVHPC 24.3

Languages

- Julia with MPI and CUDA
- Python
- Rust

EDA Tools

- Xyce

CFD Tools

- OpenFOAM
- Nek5000

AI packages for NVIDIA GPU

- TensorFlow
- PyTorch
- LBANN



24.05 Release: 129+ Official Products + dependencies (gcc, ppc64le)

44: hdf5-vol-async	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-vol-async-1.7-rphrjjaaimhkkq3exdlijxzev5lzjqrc
45: hdf5-vol-log	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-vol-log-1.4.0-vzznu6hwc23psnw6ou5outp4hot3ji2p
46: heffte	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/heffte-2.4.0-rhu5c2refev3kvurytrvhaino7x7imej
47: hiop	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hiop-1.0.0-ih4gsmzsqm64tignzp4fhvcvarppqpkx
48: hpc toolkit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hpctoolkit-2024.01.1-g35avbvbj3jgbvillhs4mg5x7wdf5x26
49: hpx	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hpx-1.9.1-erambaukxm2httegyetd5yztkppbhn
50: hypre	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hypre-2.31.0-ezvr6ifagf3g7ufweqc5c2vlyzka63b
51: kokkos	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/kokkos-4.3.00-uu37sanqg7d2cyfssrelv4bgttk6d7tq
52: kokkos-kernels	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/kokkos-kernels-4.3.00-5dyqjybokzb7wiazns3g52hvv7365kj
53: laghos	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/laghos-3.1-sfyriqwy5536gm52y2kks5gcwmlitfon
54: lammps	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/lammps-20230802.3-z4ryzdnkxpp7ytfb3zvffhz6c3qron
55: lapackpp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/lapackpp-2023.11.05-xpwxq6rkmlqvzgroria4vpjblv5myjzj
56: lbann	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/lbann-0.104-l2pryljak27256xnnihbd3wnhta6yk7y
57: legion	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/legion-24.03.0-pot5up5muaf3y3e7j4uayp4v3vo7h6e6
58: libcatalyst	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libcatalyst-2.0.0-rc4-wg3z6wnrtwh47hnlva6duj5hbac3zpe
59: libnrm	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libnrm-0.1.0-47xh46x5ml2v4vp55mdi67qcb13nj3xr
60: libpressio	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libpressio-0.95.1-hjgiot6whwkawchjktfeq43dzi3ghsca
61: libquo	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libquo-1.4-cdeiq3wetcanqlmok7dutel6nwp4kqa
62: loki	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/loki-0.1.7-dwwe6amjkamklltgsa5r55gbvei3f5nm
63: magma	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/magma-2.8.0-o5u5szok4n7n7gdn4n54tf36u76x5bgj
64: mercury	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mercury-2.3.1-xvsbytg7t367b3tb7gjq7tnlm3otsedy
65: metall	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/metall-0.25-5iivbjyqjpvowr6l7sx73xnbth3dphuo
66: mfem	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mfem-4.6.0-t6jbf3uw36tllgeqbcx2xtpukdv2nw2
67: mgard	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mgard-2023-12-09-4ee5l7b2ncfkqrftdeeg45wp4qadwi53
68: mpark-variant	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mpark-variant-1.4.0-sei3mwwvskd4lfbywt42uif3gg37rhzw
69: mpich	/usr/local/mpich/install/mpich
70: mpifileutils	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mpifileutils-0.11.1-tcraj652kgyjsfch7ungznxan5ygyvpx
71: nccmp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nccmp-1.9.1.0-5yevvifo4f5jusyabvqb4joei3oplqx
72: nco	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nco-5.1.9-5oolyi3l7uvrno6oq2dznbp6rqidkz7
73: netcdf-c	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/netcdf-c-4.9.2-q2ccrgfelps5slzjto2l5lglguk2hhl
74: nek5000	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nek5000-19.0-ps5q5hqavhycikq5sroqjdjvulhcd5vh
75: nekbone	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nekbone-17.0-4vmrblchieq46b7dousyuwhb4nig24c5
76: netcdf-fortran	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/netcdf-fortran-4.6.1-qejpcvcjvjvdtmwreqyjhnxwy524cfvv
77: netlib-scalapack	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/netlib-scalapack-2.2.0-cicbt5pm7gnnpkqff6p443msaljvzv35
78: nrm	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nrm-0.1.0-nzpf55v4ueubh32edllbjd5qvfpsz5by
79: omega-h	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/omega-h-9.34.13-5zcdzuo3rqummrt056ee572dygn6incn
80: openfoam	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/openfoam-2312-g46ccuoauusyfllgjafiqkp7n5xcuuir
81: openmpi	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/openmpi-5.0.3-h5hjbaickcuuhqtd2uyxnhzhtg3nhiaic
82: openpmd-api	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/openpmd-api-0.15.2-r4qx34xrjkev72aj25ffiejndfztaanv
83: papi	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/papi-7.1.0-6hakrvhuqhrytltrecv7f2xrxjuc4p5qh
84: papyrus	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/papyrus-1.0.2-grgwkvgyt5fdj4hne6if3atmerrrqbk
85: parallel-netcdf	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/parallel-netcdf-1.12.3-653gdk6izl5edfk4ysp4sjsz2qhyfd7zs
86: paraview	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/paraview-5.12.0-vr5g7q2j1wo55nsjoh7rrijexyng74p



24.05 Release: 129+ Official Products + dependencies (gcc, ppc64le)

```
87: parsec /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/parsec-3.0.2209-twturaln4d77hdqf64ofunuu56piwibk
88: pdt /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/pdt-3.25.2-2n2lhyvn3nm2y2vowqmlj2673dutwctw
89: petsc /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/petsc-3.21.0-qxn7tpehgwoo522petq5wxzdxauhfhg
90: plasma /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/plasma-23.8.2-ca04i4s5672kifhbpup6xwgi52mis7ob
91: plumed /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/plumed-2.9.0-qxcydzenow7kbomzsj5fxyk3b2xwrqai
92: precice /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/precice-3.1.1-bfrw5vq7a3kqb35gzxvlzoptbwqzoc2z
93: pruners-ninja /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/pruners-ninja-1.0.1-dxhdaubpsx2d5mmccq65b2d3c6puudi
94: pumi /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/pumi-2.2.8-udnmla2lqh42zbdn6qghou6cemkh4n4i
95: py-cinemasci /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-cinemasci-1.3-bf32tfxe2noymbryi75la2ucji3mlgnj
96: py-deephyper /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-deephyper-0.6.0-lfitvur3t3w6xvdw7nxjlusubj7zefuj
97: py-jupyterhub /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-jupyterhub-1.4.1-2umgloyedcacxbxqrzajrvrk2yb7vrr
98: py-libensemble /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-libensemble-1.2.2-stqjpsm2zjbr3kr6du3u3qobnvlxvbs
99: py-parsl /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-parsl-2023.08.21-vvrbwbgthdhxLziwmw75uwjs4vmf2zo7
100: py-radical-saga /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-radical-saga-1.47.0-gdf2x57uw6d6ed3g4limwuwvtmfu2sg6
101: qthreads /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/qthreads-1.18-5vyo4usqqs4xchanya53x35bkbjn432i
102: quantum-espresso /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/quantum-espresso-7.3.1-tr5u7ypte5wvmv3quuttqoxqhrn4kdhej
103: raja /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/raja-2024.02.0-emku4lhtf7kmwkuv4h3nqu67f5bvwvh2
104: rempi /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/rempi-1.1.0-g7khmsbho6hgcskvekirusznufbykovd
105: scr /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/scr-3.0.1-ck7ty6dfpfegyfac34o2mjqfv4x23bid
106: slate /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/slate-2023.11.05-o5amlujl2hflttmmewz5nvxif3oe74wj
107: slepc /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/slepc-3.21.0-hpxryrwx2bkdckrawcm4h6ke5mpdwqtr
108: stc /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/stc-0.9.0-rksccd5aak46xbou3uznfwlxx2wgcjq
109: strumpack /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/strumpack-7.2.0-7timxa4warredcyfkq2bta2gnyf4lym
110: sundials /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/sundials-7.0.0-fayjxrppzaz2moyvakwmioimjrupyxzs
111: superlu-dist /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/superlu-dist-8.2.1-y7idnksf47vqgyolauq6o4s44zqbslbq
112: swig /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/swig-4.1.1-j5tfvxp1ktjzrm2kthhvhm3f7uibiu7
113: sz /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/sz-2.1.12.5-2xyh5o7acpyqyixkwlplu6pyri3vno5
114: sz3 /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/sz3-3.1.7-wvgazrocefekek7rfureaw7wydxxkj7
115: tasmanian /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/tasmanian-8.0-35x3bervcakfor3qk53rd3v2b3bolsyq
116: tau /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/tau-2.33.2-egc365hvetw246c7a2gv5qr2nfg4vdkr
117: trilinos /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/trilinos-15.1.1-ta5ituxhng3t34ucn5m3gqcnho67k5v
118: turbine /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/turbine-1.3.0-jmwoarv4odjqymvmvuo3szhay6fdx
119: umap /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/umap-2.1.0-tc6dxxesbekx4ma7qatzicgku2flziu
120: umpire /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/umpire-2024.02.0-5pcmc3ktm2anz52qdvkhuqcxmfrx5i2
121: unifyfs /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/unifyfs-2.0-3uqqozjnt4xekmmj5vzmvfom74y6gbc
122: upcxx /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/upcxx-2023.9.0-gnr7mpf4fvhe5e3pkgn4eibf2lxsbrwd
123: veloc /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/veloc-1.7-vpu5p6qwmkkd2ooofmked65a65ewnbc
124: visit /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/visit-3.3.3-jctbqnhkzclzehwnubc26fomaxfnv7xa
125: vtk-m /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/vtk-m-2.1.0-nubx22k6jgf2tsv75csote3unig6khzb
126: wannier90 /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/wannier90-3.1.0-5rdgw6le66arwuzzaxsnxg4qppyxtaj
127: warpx /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/warpx-23.08-bn5c5ovcjddfa6smplo6wikxmg5grcj
128: xyce /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/xyce-7.8.0-gm35vkgbdciou2cpv6tp5etraprq7vm
129: zfp /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/zfp-1.0.0-jvxcqpnzitfatcsu4rf25sgqcelzma73
```

Supports
IBM Power10 and
Power 9 processors



E4S 24.05 Support for GPUs: NVIDIA CUDA on IBM ppc64le

```
$ singularity run --nv e4s-24.05-cuda70-ppc64.sif
Singularity> spack find -x +cuda
-- linux-ubuntu20.04-ppc64le / gcc@9.4.0 -----
adios2@2.10.0      caliper@2.10.0      flux-core@0.61.2    hypre@2.31.0        magma@2.8.0         parsec@3.0.2209     sundials@7.0.0      vtk-m@2.1.0
amrex@24.04        chai@2024.02.0       ginkgo@1.7.0        kokkos@4.3.00       mfem@4.6.0         petsc@3.21.0        superlu-dist@8.2.1  zfp@0.5.5
arborx@1.6         cusz@0.3.1           gromacs@2024.1      kokkos-kernels@4.3.00 mgard@2023-12-09   raja@2024.02.0     tasmanian@8.0
axom@0.9.0         ecp-data-vis-sdk@1.0 heffte@2.4.0        lammmps@20230802.3  omega-h@9.34.13    slate@2023.11.05   tau@2.33.2
bricks@2023.08.25 exago@1.6.0          hpctoolkit@2024.01.1 lbann@0.104         papi@7.1.0         slepc@3.21.0       umpire@2024.02.0
cabana@0.6.0       flecsi@2.2.1         hpx@1.9.1           legion@24.03.0      paraview@5.12.0    strumpack@7.2.0    upcxx@2023.9.0
==> 44 installed packages
Singularity> spack find -x
-- linux-ubuntu20.04-ppc64le / gcc@9.4.0 -----
adios@1.13.1       cp2k@2024.1          glvis@4.2            lammmps@20230802.3  netcdf-fortran@4.6.1  py-deeppy@0.6.0     sz3@3.1.7
adios2@2.7.1      cuda@11.4.4          gmp@6.2.1            lammmps@20230802.3  netlib-scalapack@2.2.0 py-h5py@3.11.0     tasmanian@8.0
adios2@2.10.0     cusz@0.3.1           gotcha@1.0.6         lbann@0.104         nrm@0.1.0             py-jupyterhub@1.4.1 tasmanian@8.0
alquimia@1.1.0    darshan-runtime@3.4.4 gptune@4.0.0         lbann@0.104         nvhpc@24.1            py-libensemble@1.2.2 tau@2.33.2
aml@0.2.1         darshan-util@3.4.4   gromacs@2024.1       legion@24.03.0      omega-h@9.34.13      py-petsc4py@3.21.0 tau@2.33.2
amrex@24.04        datatransferkit@3.1.1 gromacs@2024.1       legion@24.03.0      omega-h@9.34.13      py-warpx@23.08     trilinos@13.0.1
amrex@24.04        dyninst@13.0.0       h5bench@1.4          libcatalyst@2.0.0-rc4 openfoam@2312        qthreads@1.18      trilinos@15.1.1
arborx@1.6         e4s-alc@1.0.1        hdf5@1.12.3         libnrm@0.1.0        openmpi@5.0.3        quantum-espresso@7.3.1 turbine@1.3.0
arborx@1.6         e4s-cl@1.0.3         hdf5@1.14.3         libpressio@0.95.1  openpmd-api@0.15.2   raja@2024.02.0     umap@2.1.0
argobots@1.2      ecp-data-vis-sdk@1.0 hdf5-vol-async@1.7  libquo@1.4          papi@7.1.0            raja@2024.02.0     umpire@2024.02.0
ascent@0.9.2      ecp-data-vis-sdk@1.0 hdf5-vol-cache@v1.1 libunwind@1.6.2     papi@7.1.0            rempi@1.1.0         umpire@2024.02.0
axom@0.9.0         exago@1.6.0          hdf5-vol-log@1.4.0  loki@0.1.7          papyrus@1.0.2        scr@3.0.1           unifyfs@2.0
axom@0.9.0         exago@1.6.0          hdf5-vol-log@1.4.0  magma@2.8.0         parallel-netcdf@1.12.3 slate@2023.11.05   upcxx@2023.9.0
bolt@2.0           exaworks@0.1.0       heffte@2.4.0        mercury@2.3.1       paraview@5.12.0      slate@2023.11.05   upcxx@2023.9.0
boost@1.84.0      faodel@1.2108.1     heffte@2.4.0        metall@0.25         paraview@5.12.0      slepc@3.21.0       veloc@1.7
bricks@2023.08.25 flecsi@2.2.1         hpctoolkit@2024.01.1 mfem@4.6.0          paraview@5.12.0      slepc@3.21.0       visit@3.3.3
bricks@2023.08.25 flecsi@2.2.1         hpctoolkit@2024.01.1 mfem@4.6.0          parsec@3.0.2209     stc@0.9.0           vtk-m@2.0.0
butterflypack@2.4.0 flit@2.1.0          hpx@1.9.1           mgard@2023-12-09   parsec@3.0.2209     strumpack@7.2.0    vtk-m@2.1.0
cabana@0.6.0       flux-core@0.61.2     hpx@1.9.1           mgard@2023-12-09   pdt@3.25.2           strumpack@7.2.0    wannier90@3.1.0
cabana@0.6.0       flux-core@0.61.2     hypre@2.31.0        mpark-variant@1.4.0 petsc@3.21.0         sundials@7.0.0     xyce@7.8.0
caliper@2.10.0    forttrilinos@2.3.0   hypre@2.31.0        mpich@4.1.2         petsc@3.21.0         sundials@7.0.0     zfp@0.5.5
caliper@2.10.0    fpm@0.10.0          kokkos@4.3.00       mpifileutils@0.11.1 plasma@23.8.2        superlu@5.3.0      zfp@0.5.5
chai@2024.02.0    gasnet@2023.9.0     kokkos@4.3.00       nccmp@1.9.1.0      plumed@2.9.0         superlu-dist@8.2.1 superlu-dist@8.2.1
chai@2024.02.0    ginkgo@1.7.0        kokkos-kernels@4.3.00 nco@5.1.9           pruners-ninja@1.0.1 superlu-dist@8.2.1 swig@4.0.2-fortran
charliecloud@0.37 ginkgo@1.7.0        kokkos-kernels@4.3.00 nek5000@19.0        pumi@2.2.8           swig@4.0.2-fortran sz@2.1.12.5
conduit@0.9.1     globalarrays@5.8.2   laghos@3.1          nekbone@17.0       py-cinemas@1.3      sz@2.1.12.5
==> 178 installed packages
Singularity> █
```

E4S 24.05 Support for GPUs: NVIDIA CUDA on ppc64le (modules)

```
$ singularity run --nv e4s-24.05-cuda70-ppc64.sif
Singularity> module avail
```

```
----- /spack/share/spack/lmod/linux-ubuntu20.04-ppc64le/mpich/4.1.2-nysjgwr/Core -----
adios/1.13.1          flecsi/2.2.1          (D)  mercury/2.3.1          rempi/1.1.0
adios2/2.7.1          fortrilinos/2.3.0    (D)  metall/0.25            scr/3.0.1
adios2/2.10.0-cuda70 (D)  ginkgo/1.7.0-cuda70-openmp (D)  mfem/4.6.0-cuda70     slate/2023.11.05-cuda70-openmp
alquimia/1.1.0        ginkgo/1.7.0-openmp (D)  mfem/4.6.0             (D)  slate/2023.11.05-openmp (D)
amrex/24.04-cuda70    globalarrays/5.8.2   (D)  mpifileutils/0.11.1    slepc/3.21.0-cuda70
amrex/24.04           glvis/4.2             (D)  nccmp/1.9.1.0          slepc/3.21.0          (D)
arborx/1.6-cuda70    gptune/4.0.0         (D)  nco/5.1.9              stc/0.9.0
arborx/1.6           gromacs/2024.1-cuda70-openmp (D)  nek5000/19.0          strumpack/7.2.0-cuda70-openmp
ascent/0.9.2-openmp  gromacs/2024.1-openmp (D)  nekbone/17.0          strumpack/7.2.0-openmp (D)
axom/0.9.0-cuda70-openmp (D)  h5bench/1.4          netcdf-fortran/4.6.1  sundials/7.0.0-cuda70
axom/0.9.0-openmp    hdf5-vol-async/1.7   (D)  netlib-scalapack/2.2.0 sundials/7.0.0       (D)
boost/1.84.0         hdf5-vol-cache/v1.1  (D)  omega-h/9.34.13-cuda70 superlu-dist/8.2.1-cuda70
bricks/2023.08.25-cuda (D)  hdf5-vol-log/1.4.0-threadsafe (D)  omega-h/9.34.13      (D)
bricks/2023.08.25    hdf5-vol-log/1.4.0   (D)  openfoam/2312         superlu-dist/8.2.1   (D)
butterflypack/2.4.0-openmp (D)  hdf5/1.12.3          openfoam/2312         sz/2.1.12.5
cabana/0.6.0-cuda70  hdf5/1.14.3          (D)  openpmd-api/0.15.2    tasmanian/8.0-cuda70
cabana/0.6.0         (D)  hdf5/1.14.3          (D)  papyrus/1.0.2         tasmanian/8.0       (D)
caliper/2.10.0-cuda70 (D)  heffte/2.4.0-cuda70  (D)  paraview/5.12.0-cuda70 tau/2.33.2-cuda
caliper/2.10.0       (D)  heffte/2.4.0         (D)  paraview/5.12.0      (D)  tau/2.33.2          (D)
chai/2024.02.0-cuda70 (D)  hpctoolkit/2024.01.1-cuda (D)  paraview/5.12.0      (D)  trilinos/13.0.1
chai/2024.02.0       (D)  hpctoolkit/2024.01.1 (D)  parsec/3.0.2209-cuda70 trilinos/15.1.1     (D)
conduit/0.9.1        hpx/1.9.1-cuda70     (D)  parsec/3.0.2209      (D)  turbine/1.3.0
cp2k/2024.1-openmp  hypre/2.31.0-cuda70  (D)  petsc/3.0.2209       (D)  umpire/2024.02.0-cuda70
darshan-runtime/3.4.4 (D)  hypre/2.31.0         (D)  petsc/3.21.0-cuda70  (D)  umpire/2024.02.0   (D)
datatransferkit/3.1.1 (D)  laghos/3.1           (D)  petsc/3.21.0         (D)  unifyfs/2.0
dyninst/13.0.0-openmp (D)  lammps/20230802.3-cuda70-openmp (D)  plumed/2.9.0         upcxx/2023.9.0-cuda70
ecp-data-vis-sdk/1.0-cuda70 (D)  lammps/20230802.3-openmp (D)  pruners-ninja/1.0.1  upcxx/2023.9.0     (D)
ecp-data-vis-sdk/1.0 (D)  lbann/0.104-cuda70   (D)  pumi/2.2.8           veloc/1.7
exago/1.6.0-cuda70   lbann/0.104          (D)  py-cinemasci/1.3     visit/3.3.3
exago/1.6.0         (D)  libcatalyst/2.0.0-rc4 (D)  py-h5py/3.11.0       vtk-m/2.0.0-openmp
exaworks/0.1.0      libnm/0.1.0          (D)  py-libensemble/1.2.2 vtk-m/2.1.0-cuda70-openmp (D)
faodel/1.2108.1     libpressio/0.95.1-openmp (D)  py-petsc4py/3.21.0  wannier90/3.1.0
flecsi/2.2.1-cuda70 libquo/1.4           (D)  py-warp/23.08        xyce/7.8.0
quantum-espresso/7.3.1-openmp
```

```
----- /spack/share/spack/lmod/linux-ubuntu20.04-ppc64le/Core -----
aml/0.2.1            flux-core/0.61.2-cuda (D)  legion/24.03.0-cuda70  nvhpc/24.1          raja/2024.02.0      (D)
argobots/1.2        flux-core/0.61.2     (D)  legion/24.03.0        (D)  openmpi/5.0.3        superlu/5.3.0
bolt/2.0            fpm/0.10.0-openmp   (D)  libunwind/1.6.2      (D)  papi/7.1.0-cuda      swig/4.0.2-fortran
charliecloud/0.37  gasnet/2023.9.0     (D)  loki/0.1.7           (D)  papi/7.1.0          (D)  sz3/3.1.7
cuda/11.4.4         gmp/6.2.1           (D)  magma/2.8.0-cuda70   (D)  pdt/3.25.2          umap/2.1.0
cusz/0.3.1-cuda70  gotcha/1.0.6        (D)  mgard/2023-12-09-cuda70-openmp (D)  plasma/23.8.2       zfp/0.5.5-cuda70
darshan-util/3.4.4 (D)  kokkos-kernels/4.3.00-cuda70 (D)  mgard/2023-12-09-openmp (D)  py-deepphyper/0.6.0  zfp/0.5.5          (D)
e4s-alc/1.0.1      kokkos-kernels/4.3.00-openmp (D)  mpark-variant/1.4.0  (D)  py-jupyterhub/1.4.1
e4s-cl/1.0.3       kokkos/4.3.00-cuda70 (D)  mpich/4.1.2          (L)  qthreads/1.18
flit/2.1.0         kokkos/4.3.00-openmp (D)  nrm/0.1.0           (L)  raja/2024.02.0-cuda70
```

Where:

L: Module is loaded



24.05 Release: 129+ Official Products + dependencies (gcc, aarch64)

1: adios2	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/adios2-2.10.0-6ghcc63h22rquuf4nx6tt54mauu2ixro
2: alquimia	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/alquimia-1.1.0-gvg6hbzzzvjf3av2ojirvcs4l2gnvmz5
3: aml	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/aml-0.2.1-5ikenqjgopmm57bwbhdupm66dbh6rf47
4: amrex	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/amrex-24.04-mvddhwhf7trh4tfc5moh563egz3e5cs
5: arborx	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/arborx-1.6-caj5jdiw62ozuuc4e3syshaqwn4mk4je
6: argobots	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/argobots-1.2-vbc2lyssji6a2visay3rldt2bkkimasc
7: ascent	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/ascent-0.9.2-gpofjh6z42zehtzhx4ynunsn6xg2tpwd
8: axom	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/axom-0.9.0-uuleud4nc3lvbystoa7o5wv7beomk75
9: bolt	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/bolt-2.0-2r42gybfzpol3a3w6ovuua07soy67kp4q
10: blaspp	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/blaspp-2023.11.05-f55qetuxxzixfobftmrmb3hq6dhr5mt
11: butterflypack	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/butterflypack-2.4.0-d7ab5yd3xengbeybs5tash3xgef22zdq
12: cabana	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/cabana-0.6.0-gjppai6hg2ff3cxbwbp6m6vodwhvgcz3
13: caliper	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/caliper-2.10.0-sdiesyq2qbvogxeus5y4fuu3vxxvyu3
14: camp	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/camp-2024.02.0-3mtlbtldjlfbg67sbtx4o3ortd5r6f627
15: chai	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/chai-2024.02.0-u2yq6ypb7unkdine2ezukiqvnlzbbtif
16: charliecloud	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/charliecloud-0.37-mciysr4it6aopbfctf3at672do4fjn53
17: conduit	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/conduit-0.9.1-ym22iakg77tiysk4rnkpt3bp2ak7m6k4
18: cp2k	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/cp2k-2024.1-jmtia5cqi6wzxyoivyyummzarcaty5yv
19: cusz	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/cusz-0.3.1-tlld3auwun5dpbtphovlfnmhk5iqmhug
20: darshan-runtime	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/darshan-runtime-3.4.4-emr4ohzxm5x6z4tetcijtyqgtgbrtbb4
21: datatransferkit	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/datatransferkit-3.1.1-qvezooq4jdrvpvLrbdhxobeirbmc6m6
22: dealii	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/dealii-9.5.1-eiohdqkviLdybne5wmla67qrmLhwgkty
23: dyninst	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/dyninst-13.0.0-4z3n5gys3tmx2alhpuyucjdx7wfh2gzl
24: e4s-alc	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/e4s-alc-1.0.1-3ev7dh6ka3hypewqrldkcke2i5e3ppqn
25: e4s-cl	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/e4s-cl-1.0.3-3etccdyighe7id7plgxan4xojlygg4mi
26: ecp-data-vis-sdk	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/ecp-data-vis-sdk-1.0-dhbsnnadpsk42ryapqfjgagzykwzfmux
27: exago	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/exago-1.6.0-2ml5o6mw6bwnlruo467sx6ddctu3jex
28: exaworks	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/exaworks-0.1.0-besrojhmzazyw5dovrazwbj6dv7o2wm
29: faodel	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/faodel-1.2108.1-fkp5y563leot4bhysuav17d53amu6il4
30: flecsi	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/flecsi-2.2.1-j4q3br4qfpld4hs3tsxiw2li4k2knivz
31: flit	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/flit-2.1.0-2lv57j4ld4obabdo4hullhvws4ytjju
32: flux-core	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/flux-core-0.61.2-ajft6dpvm33obtng6lejkyjayl74nvvv
33: flux-sched	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/flux-sched-0.33.1-4iw6tf53o2dr6zqhw46mftmsqnmkxc6
34: fortrilinos	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/fortrilinos-2.3.0-q4ymfaepxmumkbaehnew4xs276u63g5
35: gasnet	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/gasnet-2023.9.0-xiwypzsal5d2tpad35qepd7mp4muqlns
36: ginkgo	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/ginkgo-1.7.0-ci6owbjpwlotsi2zvdufy2whedakh4g
37: globalarrays	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/globalarrays-5.8.2-6ir4fzlkavggncstkjdj4yq6idi4hfps
38: gotcha	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/gotcha-1.0.6-vfxjvwkfrb3kht356vyzqkcjhqoimoit
39: gptune	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/gptune-4.0.0-qno43tcmumpsinjydpqjkddpfdp725g
40: gromacs	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/gromacs-2024.1-sejgfwcsj5w2wkrj6mppgnwh47dh47my
41: h5bench	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/h5bench-1.4-a5rulvpvng2x4hsvvg7afapsq6scc7l4
42: hdf5	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/hdf5-1.14.3-a5jhlbotlwlok7emxegh2n3rlo5bbi2u
43: hdf5-vol-cache	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/hdf5-vol-cache-v1.1-aojtklybnn7brnrpcu53bkpvbm7aem5b

GPU runtimes for aarch64

- CUDA 12.3
- NVHPC 24.3

Languages

- Julia with MPI and CUDA
- Rust
- Python

EDA

- Xyce

AI packages for NVIDIA GPU

- TensorFlow
- Torchbraid
- PyTorch
- JAX
- Horovod
- LBANN



24.05 Release: 129+ Official Products + dependencies (gcc, aarch64)

44:	hdf5-vol-async	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/hdf5-vol-async-1.7-j3f4uaydqckpj5hdg6i2b44t5s3yufdo
45:	hdf5-vol-log	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/hdf5-vol-log-1.4.0-eizpsgpmueskeqbl25a2slmu5sq2deqe
46:	heffte	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/heffte-2.4.0-wgtw2comz7mqhjbo5wrbnqdh17zxbok
47:	hiop	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/hiop-1.0.0-hz42rs5mgagel46dnqkmrukws25msyq
48:	hpctoolkit	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/hpctoolkit-2024.01.1-jowellvzehj lubxlh6qmknpxluffpul
49:	hpx	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/hpx-1.9.1-uszuanwdmr7ow3xzg6dnva3xonsocph
50:	hypre	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/hypre-2.31.0-2f4bdwlvqz2muy47b2z4v6n3pu4ysr4s
51:	kokkos	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/kokkos-4.3.00-27nigksrtxrz32ryotzjcrz24xfiuy5t
52:	kokkos-kernels	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/kokkos-kernels-4.3.00-afyzbfh6phlg4rslkksne4todflpcuy
53:	laghos	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/laghos-3.1-uycaf35oe2qp2ckzfiba6pazttrjyxfs
54:	lammps	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/lammps-20230802.3-bhu4p32awwnr6efdeiusk27en2e5yylv
55:	lapackpp	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/lapackpp-2023.11.05-y2qponsen5xua24bo lyqctquutdkv3u4
56:	lbann	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/lbann-0.104-qzuhlqxtcf7gwysxdu4wvmfjaziaxqns
57:	legion	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/legion-24.03.0-7ehhdi2gids5hipahw5bbn624gvzaefj
58:	libcatalyst	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/libcatalyst-2.0.0-rc4-t2rlrfpuxhvpves2tpjlch3txsvuyoa6
59:	libnrm	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/libnrm-0.1.0-erwut7zi7gydlufvowk5de6o6zgg3bp3
60:	libpressio	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/libpressio-0.95.1-mukxihp4kralpiivi3ddryb3m5dbuodv
61:	libquo	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/libquo-1.4-smoqjhw2akp2v3jobjdfg3pg4bnqrkdtg
62:	loki	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/loki-0.1.7-fx626uppfiudalsnwrwxghf7ybtzcly
63:	magma	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/magma-2.8.0-wynpg43h3q6br6jphkix4nygprdeb57
64:	mercury	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/mercury-2.3.1-ze3twh5lfjwxan233kgk7xzdeohi2zs
65:	metall	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/metall-0.25-lktiuohcugndo3iycl3yzoqzatl7aqf
66:	mfem	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/mfem-4.6.0-3lakzmxzbizkr7zk32tmz6vjvaezqqwy
67:	mgard	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/mgard-2023-12-09-6w3hnrowm6ws3nsqh7haaz2izxpiifbw
68:	mpark-variant	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/mpark-variant-1.4.0-zhfe553bd6vqjbpwqzv4tz2nccotjhca
69:	mpich	/usr/local/mpich/install/mpich
70:	mpifileutils	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/mpifileutils-0.11.1-dlexllldenlg3l2epfepgsqrfjyz3o2fz
71:	nccmp	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/nccmp-1.9.1.0-jta4ps6vueurjrlz4z5ojh65g4k7ruuj
72:	nco	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/nco-5.1.9-4datcziexpr6okv37t7ecrsjcdx5hibq
73:	netcdf-c	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/netcdf-c-4.9.2-ldjfltzldbtx3g7h7ukgsmu6x5r7ehsk
74:	nek5000	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/nek5000-19.0-u422ljvomagzo3ccxr7df5ceicpofiskx
75:	nekbone	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/nekbone-17.0-eyqxieob5a7b34kehrunlpzjincj4qc
76:	netcdf-fortran	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/netcdf-fortran-4.6.1-2m3i5jiejajrlefa7m7suup26pn743m
77:	netlib-scalapack	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/netlib-scalapack-2.2.0-4cfvnsqedcqexuemttducrvmpdv2ba3
78:	nrm	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/nrm-0.1.0-a4vpyi7molfeplaphkhmgx2j ravonza
79:	omega-h	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/omega-h-9.34.13-iwis47irwmamthl6yrn7bhi2xmp3lnt5
80:	openfoam	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/openfoam-2312-ueiiuvm4p6i4fdkevrskt5wyamrjyxa7
81:	openmpi	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/openmpi-5.0.3-e7lfno4p6apwr2j2bsxqufo6cm6lqt26
82:	openpmd-api	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/openpmd-api-0.15.2-2bh7fplnrw5eyggnlky5cra6uwpuuefp
83:	papi	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/papi-7.1.0-3cjyy3sglpak3ezodxnrrnosjqheojye3
84:	papyrus	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/papyrus-1.0.2-fce6d26ux5h3372pbnkjcruwasijixt
85:	parallel-netcdf	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/parallel-netcdf-1.12.3-rsvz6sky126tth22fw6mzay5fbyb5get
86:	paraview	/spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/paraview-5.12.0-knixiqkqipkw5nlm3ojuztwaoqizfunmh



24.05 Release: 129+ Official Products + dependencies (gcc, aarch64)

```
87: parsec /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/parsec-3.0.2209-r4xhui5xwc4rdeczyprxifzxehg2sr43
88: pdt /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/pdt-3.25.2-ivmoilfn62eljhlxcm23uigwcyqlwxe
89: petsc /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/petsc-3.21.0-xcy6yvpkfrgucibu4mau5lduono5bp6o
90: phist /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/phist-1.12.0-h3i3r6ow6qtorbvzwsfaeyuzuxelnusj
91: plasma /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/plasma-23.8.2-fqak2syszks6mgtghogxiqfgk4yd5hfo
92: plumed /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/plumed-2.9.0-hlz37jxoumfhbrcrbd3mtdaaoe2tq57nx
93: precice /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/precice-3.1.1-bdig3zhdpcq7od6j3oxdvoohqzmuauqz
94: pruners-ninja /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/pruners-ninja-1.0.1-63u64he2lmhxo lao2mss4f24qmj f47w4
95: pumi /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/pumi-2.2.8-ml6oezslqss2hqznxafg6psatgtsjvspv
96: py-cinemasci /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/py-cinemasci-1.3-wdqx64i7vkcpcghhawtkhyw52gytc6al
97: py-deephyper /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/py-deephyper-0.6.0-ix47mwjembqihzziysmi4s35cbbuxgxm
98: py-jupyterhub /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/py-jupyterhub-1.4.1-wcwqckcsivk3tsvhein2ws3w5pphmvpn
99: py-libensemble /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/py-libensemble-1.2.2-zkccbmouf2d46bujwfaryydmok3xkyrr
100: py-parsl /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/py-parsl-2023.08.21-ms77xmlldr5hs3vlohh3o7ns3d4kzuc
101: py-radical-saga /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/py-radical-saga-1.47.0-4qmdkvnbnvfvclleyjcefb5mtzvnaolx
102: qthreads /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/qthreads-1.18-bm57wjgdsorzvynqupeinx3pwo6zxfd5
103: quantum-espresso /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/quantum-espresso-7.3.1-z7ea4yjnwr2f5ddl44dvgwcc7c2zkh
104: raja /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/raja-2024.02.0-obhlp6gmjbtodo3z4b3bhiucrlez2eak63
105: rempi /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/rempi-1.1.0-hpwq3dpeeb7sp6oq4soaffimjod4hs67
106: scr /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/scr-3.0.1-btrzdhg722likiqsjmx7wccxenshf26t
107: slate /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/slate-2023.11.05-4hioqk2r253sdlnumfvo7weenousvnb
108: slepc /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/slepc-3.21.0-oy3tpt5xldfjr4ja3fw2bvmzhbjm3qmi
109: stc /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/stc-0.9.0-w26jyjkjhy7jplcboerywxwz7c6kano2z
110: strumpack /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/strumpack-7.2.0-4gwaf4ct7ismtpcm6bmyv55lfdjw7io6
111: sundials /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/sundials-7.0.0-6x2hik7kisjvmcggllhsmw54r7n4y32sl
112: superlu-dist /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/superlu-dist-8.2.1-kotxw7gvg5255p7kjs6ppf545pkc7rkm
113: swig /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/swig-4.1.1-lvzc2pxnxbqijfsxmtwcmzoowueok5r
114: sz3 /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/sz3-3.1.7-xnapk3uhx7o5qaiddg662cbopv7qorifz
115: tasmanian /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/tasmanian-8.0-4b5qz6ncn54upq2n3wh5hlj5vp56hcxp
116: tau /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/tau-2.33.2-2shla7xbcuheaa47u2tbh3tyuej6no3c
117: trilinos /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/trilinos-15.1.1-ysnqypzikooecodn4jf52qhxupwg26l
118: turbine /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/turbine-1.3.0-c32cj7t4ko2hhheyq2amy4d5rx547jd2
119: umap /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/umap-2.1.0-4b6ddoyw2hyvprqaj4ipqz6nbdbitecp
120: umpire /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/umpire-2024.02.0-7ailt32jsiqwqpbq7qmqzvmwkviv6a
121: unifyfs /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/unifyfs-2.0-gygei64redfwz2aaegopvsg3ww2645od
122: upcxx /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/upcxx-2023.9.0-5havylu2zjpv2xlwsc45xongicem4r43
123: veloc /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/veloc-1.7-dnkgys2zc3zakdawnc7pjpu37fs4ndm
124: visit /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/visit-3.3.3-gbqv6cz4yvvt2jok2wgxy73uebyu6frv
125: vtk-m /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/vtk-m-2.1.0-acc67nis57rynnrhmygedk6mbd4n5nu
126: wannier90 /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/wannier90-3.1.0-awlltjw4gylq4ll2v2n6ygz5if5ddl7d
127: warpx /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/warpx-23.08-dsdppgi4n6h4qcienokmexwbe67eahbd
128: xyce /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/xyce-7.8.0-7xl4glfi4r4envhkuj47ahuylniswpb
129: zfp /spack/opt/spack/linux-ubuntu22.04-aarch64/gcc-11.4.0/zfp-1.0.0-mwlsmj2iommgwycsdk3hw4rcuygehk5w
```


E4S Support for GPUs: CUDA on aarch64

```
$ singularity run --nv e4s-24.05-cuda90-arm64.sif
[Singularity] spack find -x +cuda
-- linux-ubuntu22.04-aarch64 / gcc@11.4.0 -----
adios2@2.10.0   chai@2024.02.0   gromacs@2024.1   kokkos-kernels@4.3.00  mgard@2023-12-09  slepc@3.21.0     trilinos@15.1.1
amrex@24.04    cusz@0.3.1      heffte@2.4.0    lammps@20230802.3     papi@7.1.0        strumpack@7.2.0  umpire@2024.02.0
arborx@1.6     ecp-data-vis-sdk@1.0  hpctoolkit@2024.01.1  legion@24.03.0        parsec@3.0.2209   sundials@7.0.0   upcxx@2023.9.0
axom@0.9.0     flecsi@2.2.1    hypre@2.31.0    libpressio@0.95.1     petsc@3.21.0     superlu-dist@8.2.1  vtk-m@2.1.0
cabana@0.6.0   flux-core@0.61.2  magma@2.8.0     mfem@4.6.0            raja@2024.02.0   tasmanian@8.0     zfp@0.5.5
caliper@2.10.0 ginkgo@1.7.0    kokkos@4.3.00   mfem@4.6.0            raja@2024.02.0   tau@2.33.2
==> 41 installed packages
[Singularity] spack find -x
-- linux-ubuntu22.04-aarch64 / gcc@11.4.0 -----
adios@1.13.1    datatransferkit@3.1.1  hdf5-vol-async@1.7  mercury@2.3.1          petsc@3.21.0        sundials@7.0.0
adios2@2.7.1   dealii@9.5.1          hdf5-vol-cache@v1.7  metall@0.25            petsc@3.21.0        superlu@5.3.0
adios2@2.10.0  dyninst@13.0.0        hdf5-vol-log@1.4.0  mfem@4.6.0            phist@1.12.0       superlu-dist@8.2.1
alquimia@1.1.0 e4s-alc@1.0.1         heffte@2.4.0        mfem@4.6.0            plasma@23.8.2      superlu-dist@8.2.1
aml@0.2.1      e4s-cl@1.0.3         heffte@2.4.0        mgard@2023-12-09     plumed@2.9.0       swig@4.0.2-fortran
amrex@24.04    ecp-data-vis-sdk@1.0  hpctoolkit@2024.01.1  mgard@2023-12-09     precice@3.1.1      sz@2.1.12.5
amrex@24.04    ecp-data-vis-sdk@1.0  hpctoolkit@2024.01.1  mpark-variant@1.4.0  pruners-ninja@1.0.1  sz3@3.1.7
arborx@1.6     exago@1.6.0          hpctoolkit@2024.01.1  mpich@4.1.2           pumi@2.2.8         tasmanian@8.0
arborx@1.6     exaworks@0.1.0       hpx@1.9.1           mpi@4.1.2             py-cinemasci@1.3   tasmanian@8.0
argobots@1.2   faodel@1.2108.1     hypre@2.31.0        mpifileutils@0.11.1  py-deephyper@0.6.0  tau@2.33.2
ascent@0.9.2   flecsi@2.2.1         hypre@2.31.0        nccmp@1.9.1.0        py-h5py@3.11.0     tau@2.33.2
axom@0.9.0     flecsi@2.2.1         kokkos@4.3.00       nco@5.1.9            py-jupyterhub@1.4.1  trilinos@13.0.1
axom@0.9.0     flit@2.1.0          kokkos@4.3.00       nek5000@19.0         py-libensemble@1.2.2  trilinos@15.1.1
bolt@2.0       flux-core@0.61.2    kokkos-kernels@4.3.00  nekbone@17.0         py-petsc4py@3.21.0  trilinos@15.1.1
boost@1.79.0   flux-core@0.61.2    kokkos-kernels@4.3.00  netcdf-fortran@4.6.1  py-warpx@23.08     turbine@1.3.0
butterflypack@2.4.0  fortrilinos@2.3.0  laghos@3.1          netlib-scalapack@2.2.0  qthreads@1.18      umap@2.1.0
cabana@0.6.0    fpm@0.10.0          lammps@20230802.3   netlib-scalapack@2.2.0  quantum-espresso@7.3.1  umpire@2024.02.0
cabana@0.6.0    gasnet@2023.9.0     lammps@20230802.3   nrm@0.1.0            omega-h@9.34.13    umpire@2024.02.0
caliper@2.10.0  ginkgo@1.7.0        lbann@0.104         nvhpc@24.3           openfoam@2312      unifyfs@2.0
caliper@2.10.0  ginkgo@1.7.0        legion@24.03.0      openmpi@5.0.3        openfoam@2312      upcxx@2023.9.0
chai@2024.02.0  globalarrays@5.8.2  legion@24.03.0     openpm�-api@0.15.2   papi@7.1.0         upcxx@2023.9.0
chai@2024.02.0  glvis@4.2           libcatalyst@2.0.0-rc4  papi@7.1.0          slate@2023.11.05    veloc@1.7
charliecloud@0.37  gmp@6.2.1          libnm@0.1.0         papi@7.1.0          slate@2023.11.05    visit@3.3.3
conduit@0.9.1   gotcha@1.0.6        libpressio@0.95.1  papyrus@1.0.2        slepc@3.21.0       vtk-m@2.0.0
cp2k@2024.1    gptune@4.0.0        libpressio@0.95.1  parallel-netcdf@1.12.3  slepc@3.21.0      vtk-m@2.1.0
cuda@12.2.0    gromacs@2024.1     libquo@1.4          paraview@5.12.0     stc@0.9.0          wannier90@3.1.0
cusz@0.3.1     gromacs@2024.1     libunwind@1.6.2    parsec@3.0.2209     strumpack@7.2.0    xyce@7.8.0
darshan-runtime@3.4.4  h5bench@1.4       loki@0.1.7         parsec@3.0.2209     strumpack@7.2.0    zfp@0.5.5
darshan-util@3.4.4  hdf5@1.12.3        magma@2.8.0        pdt@3.25.2          sundials@7.0.0     zfp@0.5.5
==> 174 installed packages
Singularity> █
```



E4S 24.05 supports CUDA architectures 75 (T4), 80 (A100), as well as 90 (H100/GH200)

E4S Support for GPUs: CUDA on aarch64 (modules)

----- /spack/share/spack/lmod/linux-ubuntu22.04-aarch64/mpich/4.1.2-jbngz7b/Core -----			
adios/1.13.1	ginkgo/1.7.0-cuda90-openmp	metall/0.25	rempi/1.1.0
alquimia/1.1.0	ginkgo/1.7.0-openmp (D)	mfem/4.6.0-cuda90	scr/3.0.1
amrex/24.04-cuda90	globalarrays/5.8.2	mfem/4.6.0 (D)	slate/2023.11.05-cuda90-openmp
amrex/24.04 (D)	glvis/4.2	mpifileutils/0.11.1	slate/2023.11.05-openmp (D)
arborx/1.6-cuda90	gptune/4.0.0	nccmp/1.9.1.0	slepc/3.21.0-cuda90
arborx/1.6 (D)	gromacs/2024.1-cuda90-openmp	nco/5.1.9	slepc/3.21.0 (D)
axom/0.9.0-cuda90-openmp	gromacs/2024.1-openmp (D)	nek5000/19.0	stc/0.9.0
axom/0.9.0-openmp (D)	h5bench/1.4	nekbone/17.0	strumpack/7.2.0-cuda90-openmp
boost/1.79.0	hdf5-vol-async/1.7	netcdf-fortran/4.6.1	strumpack/7.2.0-openmp (D)
butterflypack/2.4.0-openmp	hdf5-vol-cache/v1.1	netlib-scalapack/2.2.0	sundials/7.0.0-cuda90
cabana/0.6.0-cuda90	hdf5-vol-log/1.4.0	omega-h/9.34.13	sundials/7.0.0 (D)
cabana/0.6.0 (D)	heffte/2.4.0-cuda90	openfoam/2312	superlu-dist/8.2.1-cuda90
caliper/2.10.0-cuda90	heffte/2.4.0 (D)	openpmd-api/0.15.2	superlu-dist/8.2.1 (D)
caliper/2.10.0 (D)	hpctoolkit/2024.01.1-cuda	papyrus/1.0.2	tasmanian/8.0-cuda90
chai/2024.02.0-cuda90	hpctoolkit/2024.01.1 (D)	parsec/3.0.2209-cuda90	tasmanian/8.0 (D)
chai/2024.02.0 (D)	hpx/1.9.1-cuda90	parsec/3.0.2209 (D)	tau/2.33.2-cuda
conduit/0.9.1	hpx/1.9.1 (D)	petsc/3.21.0-cuda90	tau/2.33.2 (D)
cp2k/2024.1-openmp	hypre/2.31.0-cuda90	petsc/3.21.0 (D)	trilinos/13.0.1
datatransferkit/3.1.1	hypre/2.31.0 (D)	phist/1.12.0-openmp	trilinos/15.1.1-cuda90
dealii/9.5.1	laghos/3.1	plumed/2.9.0	trilinos/15.1.1 (D)
dyninst/13.0.0-openmp	lammps/20230802.3-cuda90-openmp	precice/3.1.1	turbine/1.3.0
ecp-data-vis-sdk/1.0-cuda90	lammps/20230802.3-openmp (D)	pruners-ninja/1.0.1	umpire/2024.02.0-cuda90
ecp-data-vis-sdk/1.0 (D)	lbann/0.104	pumi/2.2.8	umpire/2024.02.0 (D)
exago/1.6.0	libnrm/0.1.0	py-h5py/3.11.0	upcxx/2023.9.0-cuda90
exaworks/0.1.0	libpressio/0.95.1-cuda90-openmp	py-libensemble/1.2.2	upcxx/2023.9.0 (D)
flecsi/2.2.1-cuda90	libpressio/0.95.1-openmp (D)	py-petsc4py/3.21.0	wannier90/3.1.0
flecsi/2.2.1 (D)	libquo/1.4	py-warpx/23.08	xyce/7.8.0
fortrilinos/2.3.0	mercury/2.3.1	quantum-espresso/7.3.1-openmp	
----- /spack/share/spack/lmod/linux-ubuntu22.04-aarch64/Core -----			
aml/0.2.1	fpm/0.10.0-openmp	loki/0.1.7	pdt/3.25.2
argobots/1.2	gasnet/2023.9.0	magma/2.8.0-cuda90	plasma/23.8.2
bolt/2.0	gmp/6.2.1	mgard/2023-12-09-cuda90-openmp	py-deepphyper/0.6.0
charliecloud/0.37	gotcha/1.0.6	mgard/2023-12-09-openmp (D)	py-jupyterhub/1.4.1
cuda/12.2.0	kokkos-kernels/4.3.00-cuda90	mpark-variant/1.4.0	qthreads/1.18
cusz/0.3.1-cuda90	kokkos-kernels/4.3.00-openmp (D)	mpich/4.1.2 (L)	raja/2024.02.0-cuda90
e4s-alc/1.0.1	kokkos/4.3.00-cuda90	nrm/0.1.0	raja/2024.02.0 (D)
e4s-cl/1.0.3	kokkos/4.3.00-openmp (D)	nvhpc/24.3	superlu/5.3.0
flit/2.1.0	legion/24.03.0-cuda70	openmpi/5.0.3	swig/4.0.2-fortran
flux-core/0.61.2-cuda	legion/24.03.0 (D)	papi/7.1.0-cuda	sz3/3.1.7
flux-core/0.61.2 (D)	libunwind/1.6.2	papi/7.1.0 (D)	umap/2.1.0

E4S 24.05 supports CUDA architectures 75 (T4), 80 (A100), as well as 90 (H100/GH200)



E4S DOE LLVM Release: x86_64, ppc64le, and aarch64

```
Singularity> spack find -x
```

```
-- linux-ubuntu20.04-x86_64 / clang@16.0.2 -----
```

```
adios@1.13.1 cabana@0.5.0 globalarrays@5.8.2 heffte@2.3.0 mfem@4.5.2 parsec@3.0.2209 sundials@6.5.1 umpire@2022.03.1  
aml@0.2.0 chai@2022.03.0 gmp@6.2.1 hypre@2.28.0 mpark-variant@1.4.0 pdt@3.25.1 superlu@5.3.0 upcxx@2023.3.0  
amrex@23.05 charliecloud@0.32 gotcha@1.0.4 legion@23.03.0 mpich@4.1.1 plumed@2.8.2 swig@4.0.2-fortran  
arborx@1.3 flit@2.1.0 h5bench@1.3 libnrm@0.1.0 nccmp@1.9.0.1 pumi@2.2.7 tasmanian@7.9  
argobots@1.1 flux-core@0.49.0 hdf5-vol-async@1.5 libquo@1.3.1 nco@5.1.5 qthreads@1.16 turbine@1.3.0  
bolt@2.0 gasnet@2023.3.0 hdf5-vol-log@1.4.0 libunwind@1.6.2 papyrus@1.0.2 stc@0.9.0 umap@2.1.0
```

```
-- linux-ubuntu20.04-x86_64 / gcc@11.1.0 -----
```

```
cmake@3.26.3 llvm-doe@16.0.2
```

```
Singularity> spack find -x
```

```
-- linux-ubuntu20.04-ppc64le / clang@16.0.2 -----
```

```
adios@1.13.1 cabana@0.5.0 globalarrays@5.8.2 heffte@2.3.0 mfem@4.5.2 parsec@3.0.2209 sundials@6.5.1 umpire@2022.03.1  
aml@0.2.0 chai@2022.03.0 gmp@6.2.1 hypre@2.28.0 mpark-variant@1.4.0 pdt@3.25.1 superlu@5.3.0 upcxx@2023.3.0  
amrex@23.05 charliecloud@0.32 gotcha@1.0.4 legion@23.03.0 mpich@4.1.1 plumed@2.8.2 swig@4.0.2-fortran  
arborx@1.3 flit@2.1.0 h5bench@1.3 libnrm@0.1.0 nccmp@1.9.0.1 pumi@2.2.7 tasmanian@7.9  
argobots@1.1 flux-core@0.49.0 hdf5-vol-async@1.5 libquo@1.3.1 nco@5.1.5 qthreads@1.16 turbine@1.3.0  
bolt@2.0 gasnet@2023.3.0 hdf5-vol-log@1.4.0 libunwind@1.6.2 papyrus@1.0.2 stc@0.9.0 umap@2.1.0
```

```
-- linux-ubuntu20.04-ppc64le / gcc@11.1.0 -----
```

```
cmake@3.26.3 llvm-doe@16.0.2
```

```
Singularity> spack find -x
```

```
-- linux-ubuntu20.04-aarch64 / clang@16.0.2 -----
```

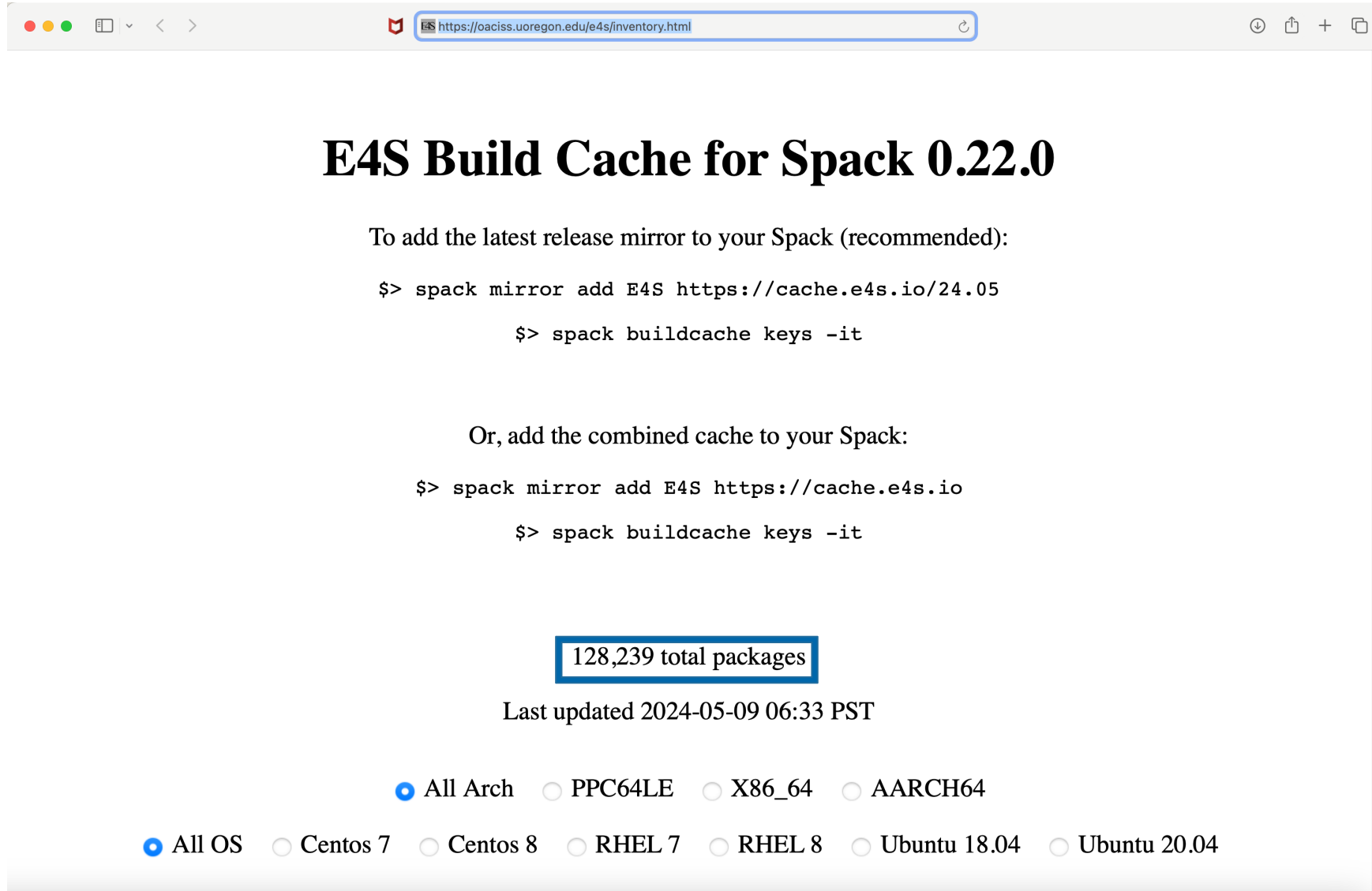
```
adios@1.13.1 cabana@0.5.0 globalarrays@5.8.2 heffte@2.3.0 mfem@4.5.2 parsec@3.0.2209 sundials@6.5.1 umpire@2022.03.1  
aml@0.2.0 chai@2022.03.0 gmp@6.2.1 hypre@2.28.0 mpark-variant@1.4.0 pdt@3.25.1 superlu@5.3.0 upcxx@2023.3.0  
amrex@23.05 charliecloud@0.32 gotcha@1.0.4 legion@23.03.0 mpich@4.1.1 plumed@2.8.2 swig@4.0.2-fortran  
arborx@1.3 flit@2.1.0 h5bench@1.3 libnrm@0.1.0 nccmp@1.9.0.1 pumi@2.2.7 tasmanian@7.9  
argobots@1.1 flux-core@0.49.0 hdf5-vol-async@1.5 libquo@1.3.1 nco@5.1.5 qthreads@1.16 turbine@1.3.0  
bolt@2.0 gasnet@2023.3.0 hdf5-vol-log@1.4.0 libunwind@1.6.2 papyrus@1.0.2 stc@0.9.0 umap@2.1.0
```

```
-- linux-ubuntu20.04-aarch64 / gcc@11.1.0 -----
```

```
cmake@3.26.3 llvm-doe@16.0.2
```



E4S Build Cache for Spack 0.22.0 hosted at U. Oregon



E4S Build Cache for Spack 0.22.0

To add the latest release mirror to your Spack (recommended):

```
$> spack mirror add E4S https://cache.e4s.io/24.05
```

```
$> spack buildcache keys -it
```

Or, add the combined cache to your Spack:

```
$> spack mirror add E4S https://cache.e4s.io
```

```
$> spack buildcache keys -it
```

128,239 total packages

Last updated 2024-05-09 06:33 PST

All Arch PPC64LE X86_64 AARCH64

All OS Centos 7 Centos 8 RHEL 7 RHEL 8 Ubuntu 18.04 Ubuntu 20.04

- Over 125K binaries!
- No need to recompile from source code

E4S 24.05 AWS image: ami-0e752117cfa13cb9b in US-West-2 (OR)

The screenshot displays a Linux desktop environment with the following components:

- Desktop Environment:** Includes icons for Home, Trash, Firefox, and Gnome-terminal.
- ParaView 5.9.0:** A 3D visualization window showing a mesh with a color scale for 'pressure' ranging from 0.0e+00 to 1.2e-38.
- Terminal Window:** Shows the execution of Singularity commands to load modules and run a simulation. The output lists various modules such as `adiak/0.2.1-4vc`, `amrex/21.11-rocm-6cm`, and `parmetis/4.0.3-vhi`.
- TAU ParaProf Statistics:** A window displaying performance statistics for node 0. The table below summarizes the data:

Name	Exclusive TIME	Inclusive TIME
.TAU application	8.784	218.852
Belos: Operation Op*x	0.629	0.706
Belos: PseudoBlockGmresSolMgr total solve time	0.615	65.591
Belos: ICGS[2]: Orthogonalization	0.22	18.854
Belos: Operation Op*x	1.672	2.32
Belos: Operation Prec*x	7.617	43.327
Ifpack2::Chebyshev::apply	4.76	25.865
Kokkos::parallel_for Kokkos::View::initialization [DualV	0.003	0.003
Kokkos::parallel_for Kokkos::View::initialization [MV::D	0.004	0.004
Kokkos::parallel_for Kokkos::View::initialization [export	0.002	0.002
Kokkos::parallel_for Kokkos::View::initialization [import	0.002	0.002

- ## E4S AWS
- Intel oneAPI
 - CUDA
 - NVHPC
 - ROCm
 - AWS DCV
 - Spack Build Cache
 - ECP: Nalu-Wind
 - Trinos
 - OpenFOAM
 - ParaView
 - TAU
 - Docker
 - Shifter
 - Charliecloud
 - E4S Singularity...

E4S for Commercial Cloud Platforms for EDA on AWS

- E4S: HPC Software Ecosystem – a curated software portfolio for Electronic Design Automation

The screenshot displays a Linux desktop environment with several windows open:

- Xschem - top.sch**: A schematic editor window showing a circuit diagram with components like PERP, VPP, CAP, RERAM, ES, VARACTORS, MIM, PFET, NFET, RES, DIODE, PNP, and NPN. It includes a 'Layers' menu and various simulation tools.
- Terminal**: A terminal window showing the installation and configuration of EDA tools. The commands and output are as follows:

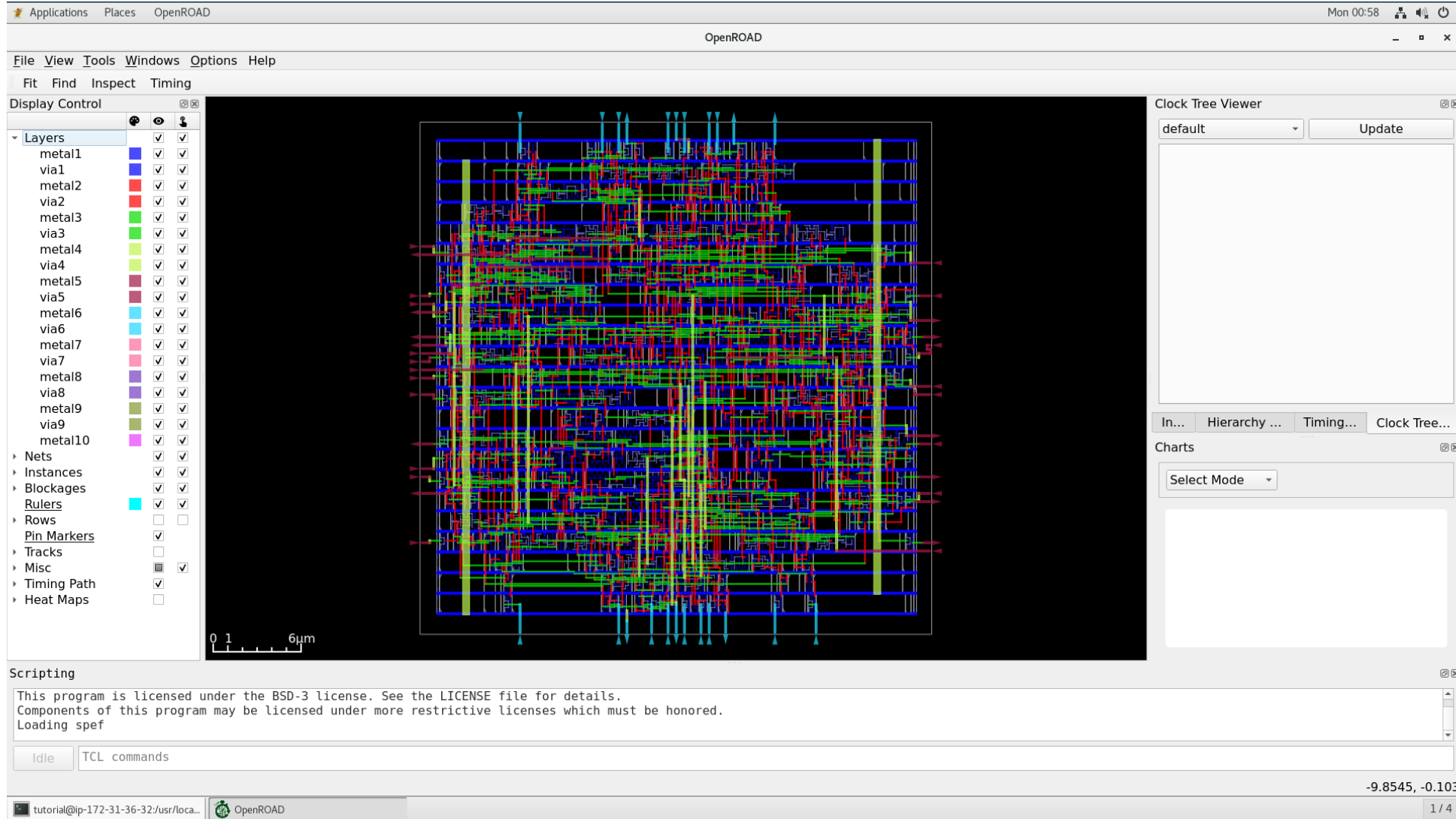

```
[tutorial@ip-172-31-43-167 eda]$ module load eda
[tutorial@ip-172-31-43-167 eda]$ pwd
/usr/local/packages/eda
[tutorial@ip-172-31-43-167 eda]$ ls
act-022223          netgen-1.5          qucs-s-0.0.23
adms-022223        ngspice-39          rggen-021423
boost-1.80.0       nvc-021423          riscv-gnu-toolchain-rv32ia-021423
fault-021423       open_pdks-1.0.393  SRC
gds3d-021423       openroad-021123    swift-5.7.3
ghdl-021423        opensta-021123     tar
graywolf-0.1.6     opentimer-021123   verilator-021423
gtkwave-gtk3-021423 or-tools-021123    xcircuit-3.10.30
irsim-9.7.116      padring-021423     xschem-021323
iverilog-021423    pcb-3.0.98          xscheme-gaw-021423
klayout-0.28.5     qflow-1.4           yosys-021123
magic-8.3           grouter-1.4
[tutorial@ip-172-31-43-167 eda]$ python3
Python 3.7.16 (default, Dec 15 2022, 23:24:54)
[GCC 7.3.1 20180712 (Red Hat 7.3.1-15)] on linux
Type "help", "copyright", "credits" or "license()" for more information.
>>> import openram
>>> import cocotb
>>> import amaranth
>>> import edalize
>>> import gdsfactory
2023-02-23 02:21:35.822 | INFO | gdsfactory.config:<module>:51 - Load '/home/tutorial/.local/lib/python3.7/site-packages/gdsfactory' 6.38.0
2023-02-23 02:21:35.876 | INFO | gdsfactory.technology.layer_views: _init_
:780 - Importing LayerViews from KLayout layer properties file: /home/tutorial/.local/lib/python3.7/site-packages/gdsfactory/generic_tech/klayout/tech/layers.lyp.
mp>>> import gdspys
>>> import pyverilog
>>> import spyci
>>> import volare
>>> import siliconcompiler
>>>
[tutorial@ip-172-31-43-167 eda]$ ls /usr/local/packages/eda/SRC/OpenLane/
AUTHORS.md      designs         install         pdks             requirements.txt
configuration   docker          Jenkinsfile    README.md        run_designs.py
CONTRIBUTING.md docs            klayoutrc      regression_results scripts
default.cvcrc   env.py          LICENSE        requirements_dev.txt tests
dependencies    flow.tcl       Makefile       requirements_lint.txt venv
[tutorial@ip-172-31-43-167 eda]$ magic --version
8.3.365
[tutorial@ip-172-31-43-167 eda]$ conda activate openfasoc
(openfasoc) [tutorial@ip-172-31-43-167 eda]$ magic --version
8.3.303
(openfasoc) [tutorial@ip-172-31-43-167 eda]$
```
- Qflow Manager**: A window showing a checklist of tasks for project setup, including Preparation, Synthesis, Placement, Static Timing Analysis, Routing, Post-Route STA, Migration, DRC, LVS, and GDS.
- KLayout 0.28.5**: A window showing a 3D visualization of a circuit component, with a large 'K' logo overlaid.

E4S EDA on AWS

- Magic
- ACT
- Klayout
- Qflow
- Xschem
- Xcircuit
- Yosys
- Volator
- OpenROAD
- OpenLane
- iVerilog
- Gtkwave
- Irsim
- Qrouter
- Fault
- GDS3D
- Rggen
- Python tools
 - Cocotb
 - Amaranth
 - Edalize
 - Gdsfactory
 - Gdspys
 - OpenRAM
 - Gdstk
 - Silicon compiler
 - Volare ...
- PDKs
 - GF
 - Skywater

E4S for Commercial Cloud Platforms for EDA on AWS

- E4S: HPC Software Ecosystem – a curated software portfolio for Electronic Design Automation. Microwatt CPU (IBM) in OpenROAD.



E4S EDA on AWS

- Magic
- ACT
- Klayout
- Qflow
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- Xcircuit
- Yosys
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- OpenROAD
- OpenLane
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 - Cocotb
 - Amaranth
 - Edalize
 - Gdsfactory
 - Gdspy
 - OpenRAM
 - Gdstk
 - Silicon compiler
 - Volare ...
- PDKs
 - GF
 - Skywater



OpenROAD GUI

E4S for Commercial Cloud Platforms for EDA on AWS

- E4S: HPC Software Ecosystem – a curated software portfolio for Electronic Design Automation

#	Packages currently in E4S	URL	#	Packages currently in E4S	URL
1	Magic	http://opencircuitdesign.com/magic/	13	Yosys	https://github.com/YosysHQ/yosys
2	Xyce	https://xyce.sandia.gov	14	Xcircuit	http://opencircuitdesign.com/xcircuit/
3	NGSPICE	https://ngspice.sourceforge.io	15	Graywolf	https://github.com/rubund/graywolf
4	KLayout	https://www.klayout.de	16	OpenSTA	https://github.com/The-OpenROAD-Project/OpenSTA
5	Qflow	http://opencircuitdesign.com/qflow	17	OpenTimer	https://github.com/OpenTimer/OpenTimer
6	OR-Tools	https://developers.google.com/optimization	18	Qrouter	http://opencircuitdesign.com/qrouter/
7	IRSIM	http://opencircuitdesign.com/irsim/	19	Xschem	https://github.com/silicon-vlsi-org/eda-xschem
8	OpenROAD	https://github.com/The-OpenROAD-Project/OpenROAD	20	RISC-V GNU Toolchain	https://github.com/riscv-collab/riscv-gnu-toolchain
9	OpenLane	https://openlane.readthedocs.io/	21	Fault: Design for Test	https://github.com/AUCOHL/Fault
10	OpenFASOC	https://openfasoc.readthedocs.io/	22	NVC	https://github.com/nickg/nvc
11	Open_PDKs	http://opencircuitdesign.com/open_pdks/	23	Amaranth	https://github.com/amaranth-lang/amaranth
12	Netgen	http://opencircuitdesign.com/netgen/	24	Cocotb	https://github.com/cocotb/cocotb



<https://e4s.io/eda>

E4S for Commercial Cloud Platforms for EDA on AWS

- E4S: HPC Software Ecosystem – a curated software portfolio for Electronic Design Automation

#	Packages currently in E4S	URL	#	Packages currently in E4S	URL
25	Covered	https://github.com/hpretl/verilog-covered	37	Padding	https://github.com/donn/padding
26	Edalize	https://github.com/olofk/edalize	38	Pyverilog	https://github.com/PyHDI/Pyverilog
27	Gaw3-xschem	https://github.com/StefanSchippers/xschem-gaw.git	39	OpenRAM	https://github.com/VLSIDA/OpenRAM
28	GDSFactory	https://github.com/gdsfactory/gdsfactory	40	Rggen	https://github.com/rggen/rggen
29	GDSPy	https://github.com/heitzmann/gdspy	41	Spyci	https://github.com/gmagno/spyci
30	GDS3D	https://github.com/trilomix/GDS3D	42	Volare	https://github.com/efabless/volare
31	Ghdl	https://github.com/ghdl/ghdl	43	Siliconcompiler	https://github.com/siliconcompiler/siliconcompiler
32	Gtkwave	https://github.com/gtkwave/gtkwave	44	Verilator	https://github.com/verilator/verilator
33	iic-osic	https://github.com/hpretl/iic-osic.git	45	Sky130	SkyWater Technologies 130nm CMOS PDK
34	Iverilog	https://github.com/steveicarus/iverilog.git	46	Actflow	https://github.com/asynclsi/actflow.git
35	Netlistsvg	https://github.com/nturley/netlistsvg	47	Qucs-s	https://github.com/Qucs
36	Ngspyce	https://github.com/ignamv/ngspyce	48	ADMS	https://github.com/Qucs/ADMS.git
			49	Gdstk	https://heitzmann.github.io/gdstk/
			50	xcell	https://github.com/asynclsi/xcell.git



<https://e4s.io/eda>

e4s-cl: A tool to simplify the launch of MPI jobs in E4S containers

- E4S containers support replacement of MPI libraries using MPICH ABI compatibility layer and Wi4MPI [CEA] for OpenMPI replacement.
- Applications binaries built using E4S can be launched with Singularity using MPI library substitution for efficient inter-node communications.
- e4s-cl is a new tool that simplifies the launch and MPI replacement.
 - e4s-cl init --backend [singularity|shifter|docker] --image <file> --source <startup_cmds.sh>
 - e4s-cl mpirun -np <N> <command>

- Usage:

```
% e4s-cl init --backend singularity --image ~/images/e4s-gpu-x86.sif --source ~/source.sh
% cat ~/source.sh
  . /spack/share/spack/setup-env.sh
  spack load trilinos+cuda cuda_arch=80
% e4s-cl mpirun -np 4 ./a.out
```



New release of e4s-cl on GitHub

The screenshot shows the GitHub repository page for E4S-Project/e4s-cl. The repository is public and has 7 branches, 10 tags, 3 forks, and 12 stars. The commit history shows a recent commit by FrederickDeny titled "post-release" with 1,399 commits. The repository structure includes folders for .github/workflows, assets/images, docs, e4s_cl, scripts, and tests, as well as files like .coveragerc, .gitignore, .gitlab-ci.yml, .readthedocs.yaml, CHANGELOG, LICENSE, Makefile, README.md, and pylintrc. The right sidebar shows the repository's description as a container manager for E4S, with links to documentation and various container engines. A new release, "E4S-CL release v1.0.3", is highlighted in a blue box, indicating it is the latest version, released 3 weeks ago.

File/Folder	Description	Time
.github/workflows	Updated python	2 years ago
assets/images	Proper image conversion	2 years ago
docs	post-release	3 weeks ago
e4s_cl	switches having a symlink of the script to copying the scri...	2 months ago
scripts	Bump shlex from 1.2.0 to 1.3.0 in /scripts/completion	4 months ago
tests	finished adapting pertinent singularity tests to barebones ...	2 months ago
.coveragerc	Introduced the coverage tool	2 years ago
.gitignore	updated gitignore to ignore build directories	3 months ago
.gitlab-ci.yml	added .gitlab-ci.yml file in order to use gitlab's continuou...	2 years ago
.readthedocs.yaml	Adapt documentation build to PEP518	last year
CHANGELOG	prepare release 1.0.3	3 weeks ago
LICENSE	Updated LICENSE	3 years ago
Makefile	corrected syntax issues with tabs/spaces that crashed th...	3 months ago
README.md	Update JB's email	9 months ago
pylintrc	Housekeeping; fix version and pylint config	last year

<https://github.com/E4S-Project/e4s-cl>



E4S: Open Source Development on GitHub

The screenshot shows the GitHub interface for the repository `E4S-Project / e4s`. The browser address bar displays `https://github.com/E4S-Project/e4s/tree/master/environments/24.05`. The page shows the file tree on the left, with the `environments/24.05` directory selected. The main content area displays the commit history for this directory, showing a commit by `eugenewalker` titled "Update README.md" from 3 days ago. Below the commit history is a table listing the files in the `24.05` environment.

Name	Last commit message	Last commit date
..		
amd64-gcc-cpu-ubuntu22.04	e4s 24.05	3 days ago
amd64-gcc-cuda-ubuntu22.04	e4s 24.05	3 days ago
amd64-gcc-rocm-ubuntu22.04	e4s 24.05	3 days ago
amd64-oneapi-ubuntu22.04	e4s 24.05	3 days ago
arm64-gcc-cpu-ubuntu22.04	e4s 24.05	3 days ago
arm64-gcc-cuda-ubuntu22.04	e4s 24.05	3 days ago
ppc64-gcc-cpu-ubuntu20.04	e4s 24.05	3 days ago
ppc64-gcc-cuda-ubuntu20.04	e4s 24.05	3 days ago
README.md	Update README.md	3 days ago

Below the table, the `README.md` file is displayed, showing the heading **E4S Release 24.05** and the text "May 2024 release of E4S".

<https://github.com/E4S-Project>



Release of custom E4S images: Waggle and SAGE projects

The screenshot shows the Docker Hub repository for 'ecpe4s/waggle-ml'. The repository is owned by 'ecpe4s' and was updated 13 days ago. It has 137 pulls. The 'Tags' section is active, showing a table of image tags:

TAG	OS/ARCH	LAST PULL	COMPRESSED SIZE
latest			
Last pushed 13 days ago by esaw123			
DIGEST			
ecdde88d2622	linux/amd64	3 days ago	9.15 GB
6985b191a048	linux/arm64	3 days ago	1.58 GB

% docker pull ecpe4s/waggle-ml

The screenshot shows the website for the SAGE project, part of the Mathematics and Computer Science Division at Argonne National Laboratory. The page title is 'SAGE: A Software-Defined Sensor Network'. A description states: 'SAGE will build a national research infrastructure of new sensors that support programmable edge computers and machine learning within an interconnected cyberinfrastructure, spanning multiple major science instruments'. The website features a navigation menu with 'RESEARCH', 'WORK WITH US', 'COMMUNITY', and 'ABOUT US'. A sidebar on the right lists 'MCS Division' with links to 'About MCS', 'Research', 'News', 'Events', and 'Publications'. Social media sharing icons for Facebook, Twitter, LinkedIn, and Email are also present. The footer includes 'PROJECT INFORMATION' with 'Status: Active'.

SAGE

A Software-Defined Sensor Network
Cyberinfrastructure for AI at the Edge

www.sagecontinuum.org

Thank you

<https://www.exascaleproject.org>

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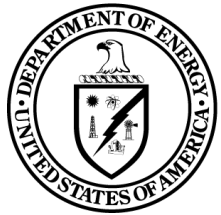


EXASCALE COMPUTING PROJECT

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