

E4S: The Extreme-scale Scientific Software Stack Release 23.08



Release 23.08 notes

August 31, 2023

E4S 23.08: What's New?

- E4S includes support for Intel oneAPI 2023.2.0 software (BaseKit and HPCToolkit) in containers on x86_64 with support for HPC packages built with Intel compilers
- New platform: ARM64 (aarch64) with H100 (90) with CUDA 12.2 and NVHPC 23.7
- E4S includes support for CUDA architectures
 - 70 (V100), 80 (A100), and 90 (H100) under x86_64
 - 70 under ppc64, and
 - 75, 80, and 90 (H100) under aarch64
- E4S includes supports ROCm for gfx908 (MI100) and gfx90a (MI200) architectures under x86_64
- E4S includes support for DOE LLVM under x86_64, ppc64le, and aarch64
- E4S includes new applications: Ascent, Bricks, Blaspp, Camp, HDF5-vol-cache, HDF5-vol-log, Lapackpp, MGARD, pruners-ninja, Xyce (with pyimi), LBANN, Quantum Espresso, LAMMPS, WARPX, Dealii, and OpenFOAM
- E4S includes support for AI/ML frameworks such as TensorFlow 2.12.0 and PyTorch 2.0.0 support for A100 as well as H100 GPUs is integrated in E4S 23.08
- E4S supports updates to 115 HPC packages on x86_64, aarch64, and ppc64le, 100K+ binaries in E4S Spack Build Cache
- New E4S tools: e4s-alc (à la carte) customizes container images, e4s-cl (container launch) replaces MPI at runtime!
- Detailed documentation for installing E4S on bare-metal and using containers

E4S: Extreme-scale Scientific Software Stack

- E4S is a community effort to provide open-source software packages for developing, deploying and running scientific applications on HPC platforms.
- E4S has built a comprehensive, coherent software stack that enables application developers to productively develop highly parallel applications that effectively target diverse exascale architectures.
- E4S provides a curated, Spack based software distribution of 100+ HPC, EDA (e.g., Xyce), and AI/ML packages (e.g., TensorFlow, PyTorch).
- With E4S Spack binary build caches, E4S supports both bare-metal and containerized deployment for GPU based platforms.
 - X86_64, ppc64le (IBM Power 9), aarch64 (ARM64) with support for GPUs from NVIDIA, AMD, and Intel
 - HPC and AI/ML packages are optimized for GPUs and CPUs.
- Container images on DockerHub and E4S website of pre-built binaries of ECP ST products.
- Base images and full featured containers (with GPU support) 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_July23.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.
- Quarterly releases: E4S 23.08 released on Aug 31, 2023: https://e4s.io/talks/E4S_23.08.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

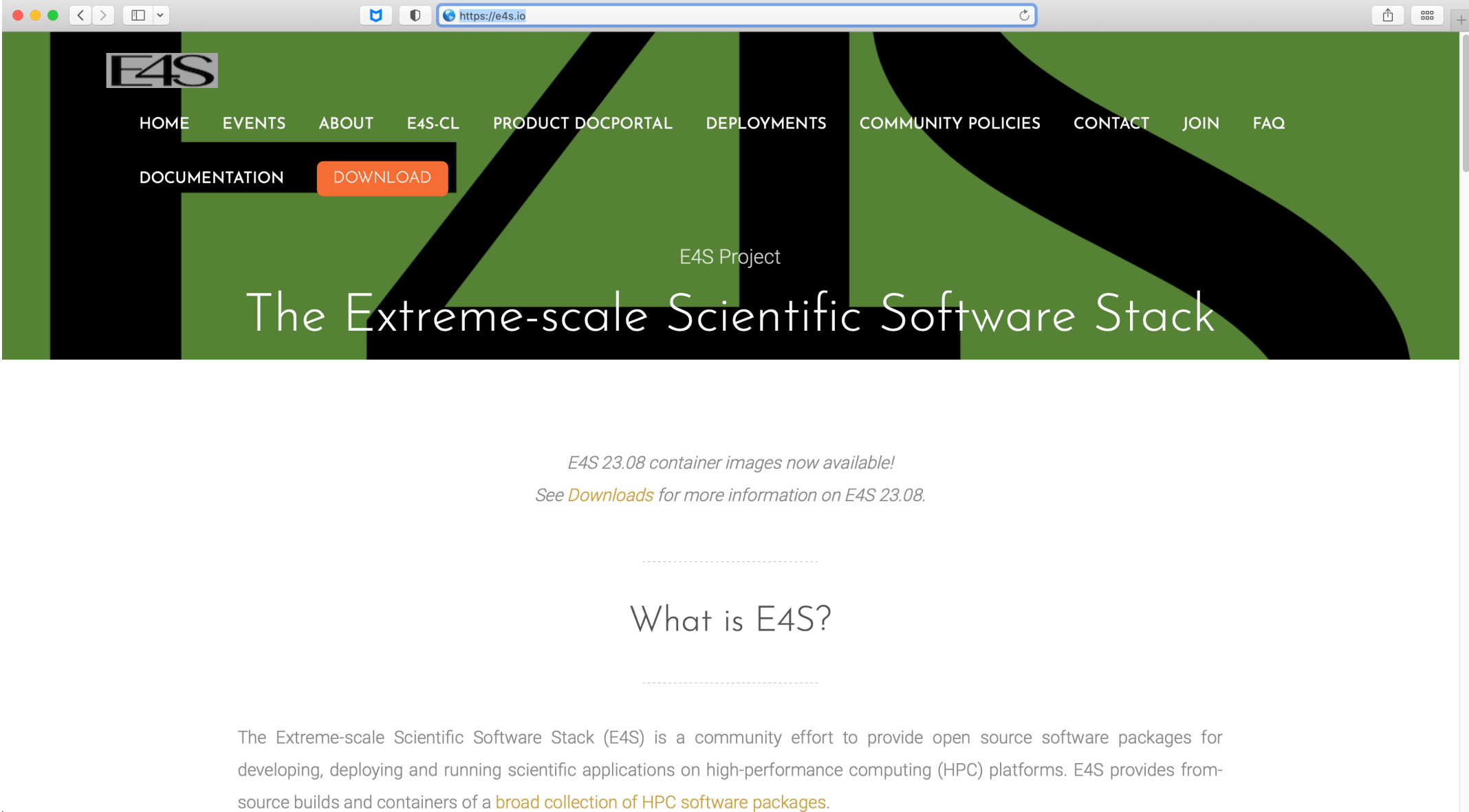


<https://e4s.io>

Lead: Sameer Shende
(U Oregon)

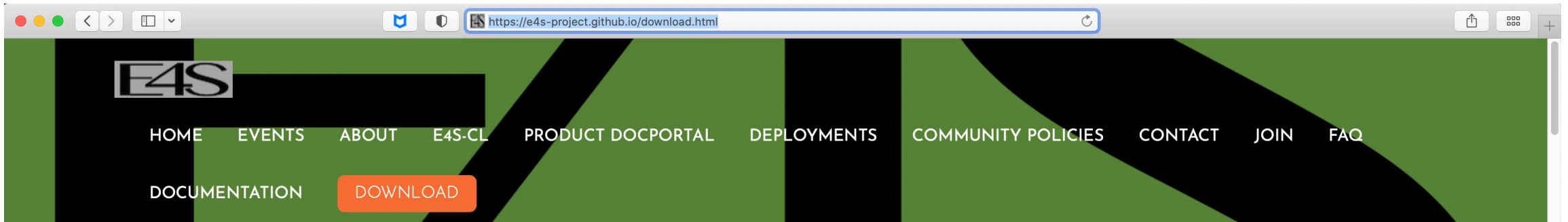
Also include other products .e.g.,
AI: PyTorch, TensorFlow (CUDA, ROCm)
Co-Design: AMReX, Cabana, MFEM
EDA: Xyce

E4S Download from https://e4s.io



The screenshot shows the E4S website homepage. At the top left is the E4S logo. A navigation menu includes links for HOME, EVENTS, ABOUT, E4S-CL, PRODUCT DOCPORTAL, DEPLOYMENTS, COMMUNITY POLICIES, CONTACT, JOIN, and FAQ. Below this is a secondary menu with DOCUMENTATION and a prominent orange DOWNLOAD button. The main header features the text "E4S Project" and "The Extreme-scale Scientific Software Stack" in large white font against a green and black background. Below the header, a message states "E4S 23.08 container images now available!" with a link to "Downloads" for more information. A section titled "What is E4S?" is separated by dashed lines. The text below explains that E4S is a community effort to provide open source software packages for HPC platforms, offering from-source builds and containers of a broad collection of HPC software packages.

E4S Container Download from <https://e4s.io>



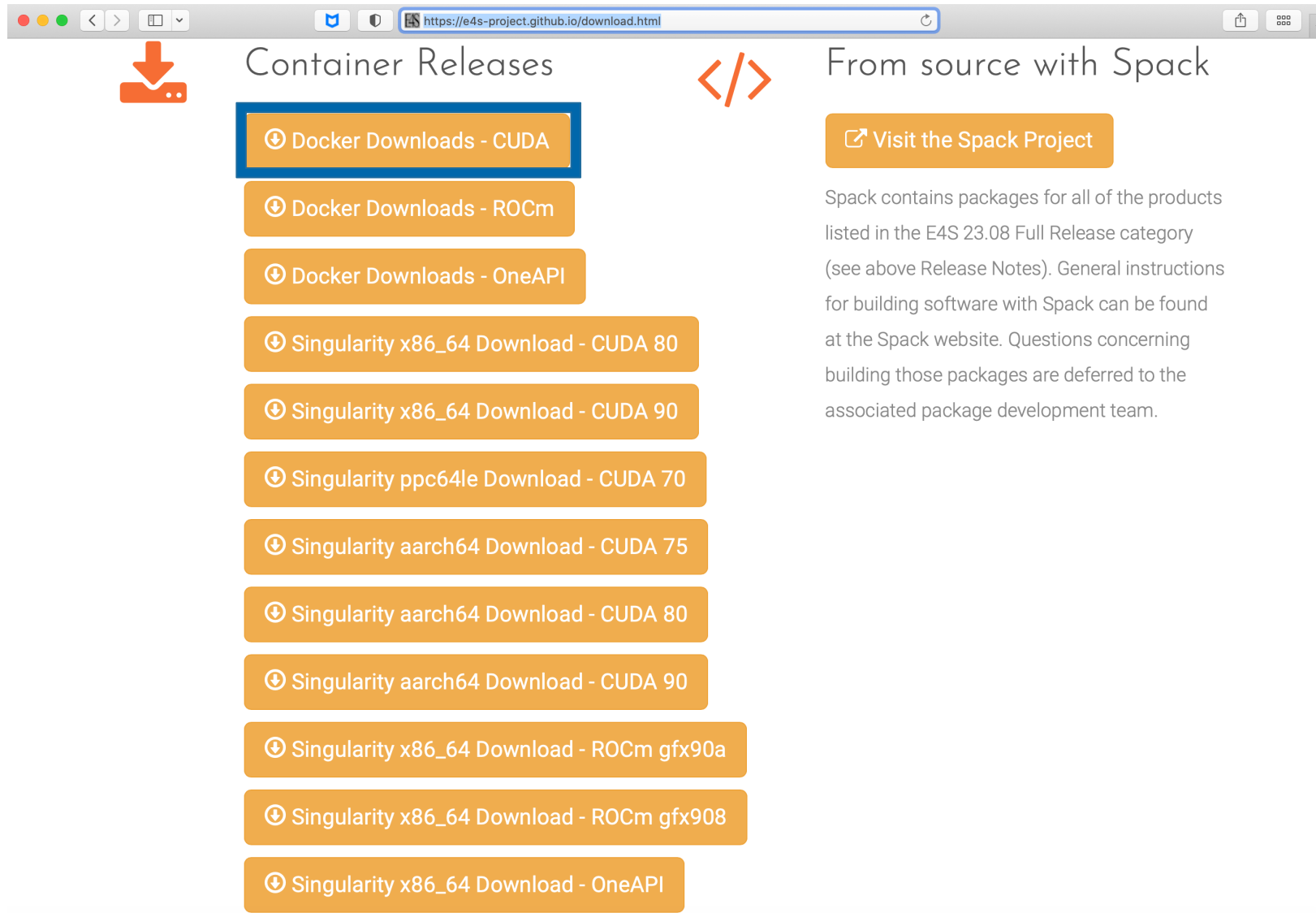
Acquiring E4S Containers

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 23.08 Release Notes](#).

Download E4S 23.08 GPU Container Images: NVIDIA, AMD, Intel



Container Releases

- Docker Downloads - CUDA
- 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

From source with Spack

[Visit the Spack Project](#)

Spack contains packages for all of the products listed in the E4S 23.08 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
- 100+ products on 3 architectures

Download E4S 23.08 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:23.08
```

```
# docker pull ecpe4s/e4s-rocm:23.08
```

```
# docker pull ecpe4s/e4s-oneapi:23.08
```

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:23.08	ecpe4s/e4s-cuda:23.08	ecpe4s/e4s-oneapi:23.08
e4s-rocm90a-x86_64-23.08.sif mirror 1	e4s-cuda80-x86_64-23.08.sif mirror 1	e4s-oneapi-x86_64-23.08.sif mirror 1
e4s-rocm908-x86_64-23.08.sif mirror 1	e4s-cuda90-x86_64-23.08.sif mirror 1	
	e4s-cuda70-ppc64le-23.08.sif mirror 1	
	e4s-cuda75-aarch64-23.08.sif mirror 1	
	e4s-cuda80-aarch64-23.08.sif mirror 1	
	e4s-cuda90-aarch64-23.08.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:23.08
e4s-base-rocm-23.08.sif

NVIDIA Multi-Arch (X86_64, PPC64LE, AARCH64)
ecpe4s/e4s-base-cuda:23.08
e4s-base-cuda-x86_64-23.08.sif
e4s-base-cuda-aarch64-23.08.sif
e4s-base-cuda-ppc64le-23.08.sif

Intel OneAPI (X86_64)
ecpe4s/e4s-base-oneapi:23.08
e4s-base-oneapi-23.08.sif

Minimal Spack
This image contains a minimal setup for using Spack 0.18.0 w/ GNU compilers

X86_64, PPC64LE, AARCH64
ecpe4s/ubuntu20.04
ecpe4s-ubuntu20.04-x86_64-23.05.sif
ecpe4s-ubuntu20.04-ppc64le-23.05.sif
ecpe4s-ubuntu20.04-aarch64-23.05.sif

- Intel oneAPI
- AMD ROCm
- NVIDIA NVHPC and CUDA

e4s-alc: a new tool to customize container images

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E4S-Project / e4s-alc Public Notifications Fork 1 Star 2

<> Code Issues 2 Pull requests Actions Projects Security Insights

main 6 branches 0 tags Go to file Code

FrederickDeny updated README to show singularity support with svg to main 7474056 last week 94 commits

e4s_alc	Merge branch 'main' into development	last month
tests	commented why a test is commented out	2 months ago
.gitignore	Added Makefile to download python interpreter	last month
LICENSE	Initial commit	3 months ago
Makefile	Added Makefile to download python interpreter	last month
README.md	updated README to show singularity support with svg to main	last week
pyproject.toml	Slight correction of the description of alc in pyproject + update...	last month
tox.ini	barebones tox testing implemented	2 months ago

README.md

Operating Systems supported:

- Ubuntu ✓
- Red Hat ✓
- SUSE ✓

Backends supported:

- docker Docker ✓
- podman Podman ✓
- Singularity ✓

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 2 stars 4 watching 1 fork Report repository

Releases

No releases published

Packages

No packages published

Contributors 4

- FrederickDeny
- PlatinumCD Cameron Durbin
- spoutn1k Jean-Baptiste Skutnik
- sameershende Sameer Shende

Add to a base image:

- Spack packages
- OS packages
- Tarballs

E4S DOE LLVM and CI images

DOE LLVM E4S Image

This multi-architecture image contains E4S products compiled with DOE LLVM 16 and Flang using Spack

Multi-Arch (X86_64, PPC64LE, AARCH64)

- 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

Continuous Integration Images

These are barebones operating system images which contain only essential build tools and python packages needed by Spack.

These images are intended to be used in continuous integration workflows where Spack is first cloned and then used to build and test software.

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

E4S 23.08 Detailed Documentation for Bare-metal Installation

HOME EVENTS ABOUT E4S-CL PRODUCT DOCPORTAL DEPLOYMENTS COMMUNITY POLICIES CONTACT JOIN FAQ

DOCUMENTATION [DOWNLOAD](#)

Extreme-scale Scientific Software Stack (E4S) version 23.08

Exascale Computing Project (ECP) Software Technologies (ST) software, Extreme-scale Scientific Software Stack (E4S) [v23.08](#), includes a subset of ECP ST software products, and demonstrates the target approach for future delivery of the full ECP ST software stack. Also available are a number of ECP ST software products that support a Spack package, but are not yet fully interoperable. As the primary purpose of the v23.08 is demonstrating the ST software stack release approach, not all ECP ST software products were targeted for this release. Software products were targeted primarily based on existing Spack package maturity, location within the scientific software stack, and ECP SDK developer experience with the software. Each release will include additional software products, with the ultimate goal of including all ECP ST software products.

E4S ReadTheDocs: Full Documentation.

- [E4S ReadTheDocs: Support Guide.](#)
- [E4S Deployment Dashboard.](#)
- [E4S v23.08 Release Notes PDF.](#)
- [E4S v23.08 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 23.08 full featured container release on Dockerhub

ecpe4s/e4s-cuda Tags | Docker

https://hub.docker.com/r/ecpe4s/e4s-cuda/tags

docker hub ecpe4s/e4s-cuda Explore Repositories Organizations Help exascaleproject

Explore ecpe4s/e4s-cuda

ecpe4s/e4s-cuda ☆
By [ecpe4s](#) · Updated 6 hours ago
The Extreme-scale Scientific Software Stack (E4S). Please see <https://e4s.io>.
Pulls 1.2K

Manage Repository

Overview **Tags**

Sort by Newest Filter Tags

TAG	DIGEST	OS/ARCH	LAST PULL	COMPRESSED SIZE
latest				
Last pushed 6 hours ago by esw123				
	433861b06041	linux/amd64	4 hours ago	40.5 GB
	9eed3fbaf38a	linux/arm64/v8	---	28.62 GB
	2469be0ee635	linux/ppc64le	---	33.58 GB

TAG	DIGEST	OS/ARCH	LAST PULL	COMPRESSED SIZE
23.08				
Last pushed 6 hours ago by esw123				
	433861b06041	linux/amd64	4 hours ago	40.5 GB
	9eed3fbaf38a	linux/arm64/v8	---	28.62 GB
	2469be0ee635	linux/ppc64le	---	33.58 GB

Architectures:

- x86_64
- aarch64
- ppc64le

Software:

- CUDA 12.2
- NVHPC 23.7
- ROCm 5.4.4
- oneAPI 2023.2.0

E4S 23.08 base container release on Dockerhub

ecpe4s/e4s-base-cuda

By ecpe4s · Updated 3 months ago

Extreme-scale Scientific Software Stack (E4S) [https://e4s.io] Ubuntu 20.04 image with CUDA.

Manage Repository

Pulls 183

Overview **Tags**

Sort by Newest Filter Tags

TAG	DIGEST	OS/ARCH	LAST PULL	COMPRESSED SIZE
latest	5ebe7f77a321	linux/amd64	3 months ago	18.7 GB
	68b8a131065a	linux/arm64/v8	---	15.7 GB
	9e19967783fa	linux/ppc64le	---	14.37 GB

TAG	DIGEST	OS/ARCH	LAST PULL	COMPRESSED SIZE
23.05	5ebe7f77a321	linux/amd64	3 months ago	18.7 GB
	68b8a131065a	linux/arm64/v8	---	15.7 GB
	9e19967783fa	linux/ppc64le	---	14.37 GB

Architectures:

- x86_64
- aarch64
- ppc64le

Software:

- CUDA 12.2
- NVHPC 23.7
- ROCm 5.4.3
- oneAPI 2023.2.0

Minimal Spack base image on Dockerhub

docker hub Search for great content (e.g., Explore Repositories Organizations Help Upgrade exascaleproject

Explore ecpe4s/ubuntu18.04-spack

ecpe4s/ubuntu18.04-spack ☆
By ecpe4s · Updated a month ago
Container

Manage Repository
Pulls 1M+

Overview Tags

Advanced Image Management
View all your images and tags in this repository, clean up unused content, recover untagged images. Available with Pro, Team and Business subscriptions. [View preview](#)

Sort by Newest Filter Tags

TAG	DIGEST	OS/ARCH	LAST PULL	COMPRESSED SIZE
latest				
	95fb8df7019b	linux/amd64	a day ago	382 MB
	47903be536c0	linux/ppc64le	a month ago	371.9 MB

docker pull ecpe4s/ubuntu18.04-spa...

TAG	DIGEST	OS/ARCH	LAST PULL	COMPRESSED SIZE
0.17.1				
	95fb8df7019b	linux/amd64	a day ago	382 MB
	47903be536c0	linux/ppc64le	a month ago	371.9 MB

docker pull ecpe4s/ubuntu18.04-spa...

- Create custom container images
- 1M+ downloads!

23.08 Release: 100+ Official Products + dependencies (gcc, x86_64)

1:	adios2	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/adios2-2.9.1-far43js56ycfi2cy6y2epjk2vp2ablr6
2:	alquimia	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/alquimia-1.0.10-h347z1q6urstr2epiqszh2saotcc3yn
3:	aml	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/aml-0.2.1-4f25516ld2rtovvxkpv2jbfie65kajz6
4:	amrex	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/amrex-23.08-3si53alsnrdbu7svg3svarx5oz7wk6p2
5:	arborx	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/arborx-1.4.1-mu5qxhbthk5j3embxtbkbn6kws5pcvl3
6:	argobots	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/argobots-1.1-47geiwmrhlasqnyujuaxf2anhso7nye7
7:	ascent	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/ascent-0.9.1-tqcc5pd16gtoa7wz6nrcty4ae3gnkhgl
8:	axom	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/axom-0.7.0-2v65k4bljcygkdcbvwej5kpb2vyr7cr
9:	bolt	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/bolt-2.0-c577pz5bmjg3h7ahiaibtrdxwlowjdxj
10:	bricks	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/bricks-r0.1-6cswlmy6vczigezkihcj2jyhrtx2jr3
11:	butterflypack	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/butterflypack-2.2.2-sxrjw6dj3gspzkkh5h5inhpgqedcraa
12:	cabana	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/cabana-0.5.0-gigahmsbyyceqksjpsnidjzjfgo6lxd
13:	caliper	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/caliper-2.10.0-2j3uhvjs04ggp4tfbh4p4gnrgvh2bdip
14:	chai	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/chai-2022.03.0-3dqxqw4erm56k4iqecn6luynyxzu3ktc
15:	charliecloud	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/charliecloud-0.33-odryayhbj63fopzmgirnhrxqj43i6m
16:	conduit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/conduit-0.8.8-gfcoxwehbpt7p2brdt2lyx2srkxwfkdy
17:	cusz	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/cusz-0.3.1-foi23btwvsn52wwoof2yiska3m6g46u
18:	darshan-runtime	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/darshan-runtime-3.4.4-g56anmzgdwsyzn7yfyjchvqgnulkp6sm7
19:	datatransferkit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/datatransferkit-3.1-rc3-t2nhboqj4iyaxckvaj4x2gkgmxtdep
20:	dealii	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/dealii-9.4.2-d5zrj4eqn573ipmpgjsuzqougocsxlm
21:	dyninst	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/dyninst-12.3.0-nv7ubfc76tpmgtbvxkzdtkqcvtsyflwr
22:	ecp-data-vis-sdk	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/ecp-data-vis-sdk-1.0-lr5ipi5prqu27gxx6sgravzjgkwikbnl
23:	exaworks	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/exaworks-0.1.0-a6brhykv5shvshxyth36bizp6k6bl7t
24:	faodel	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/faodel-1.2108.1-njnyhnimpz47ngvdiknv6fsewif2rmhn
25:	flecsi	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/flecsi-2.2.1-hj3zesahhwq74qqtzjpbp6nxizn6p4jv
26:	flit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/flit-2.1.0-fxfoo4r6oz7w3hazikiv4wjiybl5ndki
27:	flux-sched	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/flux-sched-0.28.0-wjk33djit544fo76cvc7r7ctxmz7h6ao
28:	fortrilinos	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/fortrilinos-2.3.0-zmcbtqqfxtco3hp3ffk5rbeaskr42fq
29:	gasnet	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/gasnet-2023.3.0-uipqxqhwzlwqfirm5rtakhmdd6tfjs57
30:	ginkgo	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/ginkgo-1.6.0-hxtu5jewiaermskmtwwqjkkxhykgg6nc
31:	globalarrays	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/globalarrays-5.8.2-bzzmbw267nm6vi3daxxj623ppd72qral
32:	gotcha	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/gotcha-1.0.4-3azjmnyfyhwgdttsv5gb7p4njqibij2
33:	gptune	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/gptune-4.0.0-6in3ekqxcavp5vjllluuke3kw2kveyxr
34:	h5bench	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/h5bench-1.4-q6ajpaxohl52dwsr3g5kar2p3zjtlmzp
35:	hdf5	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/hdf5-1.14.2-sclefmr3wvileggckqwgimwodra772i
36:	hdf5-vol-async	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/hdf5-vol-async-1.7-zlhcgbf6nuuxy7n2myg33anij36gyhrr
37:	hdf5-vol-cache	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/hdf5-vol-cache-v1.1-artoumobakk4r3c6mnrwd3d3ff54elgr
38:	hdf5-vol-log	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/hdf5-vol-log-1.4.0-edluoqzvb6xaxf2mrgl2uo73fo2z6id
39:	heffte	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/heffte-2.3.0-icxscnnpusenvc354yidd4hnl7idmrw2

GPU runtimes

- AMD (ROCm)
 - 5.4.3
- NVIDIA (CUDA)
 - 12.2
- NVHPC
 - 23.7
- Intel oneAPI
 - 2023.2.0

23.08 Release: 100+ Official Products + dependencies (gcc, x86_64)

40: hpctoolkit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/hpctoolkit-2023.03.01-ueuj3p4ooiupy4zs5izc7fycmtt7io56
41: hpx	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/hpx-1.9.1-xevxpniefjbhuno4t7rm7kyxxpzjgdv
42: hypre	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/hypre-2.29.0-sdp2pxm23dz6tfvwdbycbtgkun5whsyy
43: kokkos	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/kokkos-4.1.00-kerum76mhhzn4nh6ixnhq533c3erbwrz
44: kokkos-kernels	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/kokkos-kernels-4.0.00-zjo7z5zm3evbk7asnnbu6cdv4re745bh
45: lammps	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/lammps-20230802-kgm2lzyrqp26ptsthcygh2qlrnmfy35u
46: lbann	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/lbann-0.102-pxta47nwdh3qlfvr2w3qp3s36l4yllylr
47: legion	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/legion-23.06.0-5oauy4mgyh6jk5jhcu5vzi7xfpe43xg
48: libcatalyst	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/libcatalyst-2.0.0-rc3-52p5gemtyyhlrpc3mw35zqhtt2fcry7l
49: libnrm	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/libnrm-0.1.0-ohbchkfevr4awqm6fm7uowgpofr7rprl
50: libpressio	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/libpressio-0.95.1-p636a6ygdnyahpuc2rfjhedclaibgovq
51: libquo	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/libquo-1.3.1-gp3qhb4vsuxsqfby3kbmlnyt35ka7xu
52: loki	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/loki-0.1.7-6ikcxqpfj2lzyqco3cnxywonupp62x5y
53: magma	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/magma-2.7.1-kdndj5ctyvobvhpnwqutajahxg5g27aq
54: mercury	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/mercury-2.3.0-obf2lrmq3x45qy5wsbl3i2g5tsiajjit
55: metall	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/metall-0.25-sdcewg3qhngug32t2clltnvardo36jm
56: mfem	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/mfem-4.5.2-lgkxswsawquofaxv7aynfaqibc7r7qpu
57: mgard	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/mgard-2023-03-31-ysa7siofnvsgtpd2h2r3ms2kjemsgunq
58: mpark-variant	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/mpark-variant-1.4.0-zue6she2sx452mb35zld7e4uk552mgir
59: mpich	/usr/local/mpich/install/mpich
60: mpifileutils	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/mpifileutils-0.11.1-jpavnuokmouz3dva4gnpxykbcltqc6y
61: nccmp	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/nccmp-1.9.1.0-cd54ucxziv6chu36dg5aabvuzod3bukf
62: nco	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/nco-5.1.6-olulfhjdirozgml4xcywn34tltkmltd
63: netlib-scalapack	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/netlib-scalapack-2.2.0-dr72ioeg652ajhpbgxina53wesyd5jiw
64: nrm	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/nrm-0.1.0-blbsj5rnt4jiiyfdxv6kwebrkolgxdcw3
65: omega-h	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/omega-h-9.34.13-w6iufcy5pww4ih27r67ieikaptv2hsee
66: openfoam	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/openfoam-2306-4jmlxvkziilidpe33mt6zpxvl7u55m
67: openmpi	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/openmpi-4.1.5-u632smjizh3xa3fkt3zt2xozsdhytul
68: openpm�-api	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/openpm�-api-0.15.1-zjwwe2e3hmwtk6nfehsoa6kzrqnhkwut
69: papi	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/papi-6.0.0-1-eld4xnd2k32lyddihtkjp36gsxpbksn
70: papyrus	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/papyrus-1.0.2-54flh7a2mlh2sn4hojtw6dchzrh4io7d
71: parallel-netcdf	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/parallel-netcdf-1.12.3-6aomvefhp23lsukxg5u5sx5gkw5cmcof
72: paraview	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/paraview-5.11.1-nectgjl5ejj6ttsrjhrzsjt2uj6chyr4
73: parsec	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/parsec-3.0.2209-4767wgpp2wmdegtxhvjwjqth6jrimhz
74: pdt	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/pdt-3.25.1-ogywo7fcmjnxjy62biwwgew7lfh32bzbv
75: petsc	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/petsc-3.19.4-icgkbr5dzgfkp5k7irz3v5d53n7codq7
76: phist	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/phist-1.11.2-gii6su2zcmkegx6hdh3qbuwbxmvouovr
77: plasma	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/plasma-22.9.29-q42qj3ty22auzvqhxrdeavzdvdososz
78: plumed	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/plumed-2.9.0-ss7pxy3yxakcruny6wxjap6v37lua4ux

23.08 Release: 100 Official Products + dependencies (gcc, x86_64)

79:	precice	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/precice-2.5.0-ai2dt3s3gv46sq2jun6veox4crkzo6qq
80:	pruners-ninja	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/pruners-ninja-1.0.1-4hm6eedkbcgrsjygtljvthayiyfnfixbm
81:	pumi	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/pumi-2.2.7-cwpr76e4ibn4bfzto3fbwol3ewn4bpbzw
82:	py-cinemasci	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/py-cinemasci-1.3-qaelng3axys3dpuhwzdxnaxzwiflhvvk
83:	py-jupyterhub	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/py-jupyterhub-1.4.1-jcfdmle2klu6ly5vrsgsa62b52jyo7hu
84:	py-libensemble	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/py-libensemble-0.10.2-js7q73macujw5ljgcnvowddopltlxff3
85:	py-parsl	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/py-parsl-1.2.0-mgc6vufpcldm5kr2f6gv4u2knejwfwf2m
86:	py-radical-saga	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/py-radical-saga-1.20.0-ngvwyrhjcootrtjshxtnnhlpq672fb3j
87:	qthreads	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/qthreads-1.18-zi33xgd63z2eaaze4qdpvhpu6di6xibel
88:	quantum-espresso	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/quantum-espresso-7.2-dxkivrcruzubqmrwaopp5u7wse77n2ub
89:	raja	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/raja-2022.10.4-ktx4pymi2m3wwoqozolicz6ob5jxzxn
90:	rempi	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/rempi-1.1.0-57slducebepwrwrprcu7kk56mkj73pqa
91:	scr	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/scr-3.0.1-ymymxl4jt3v5recqe6udltz3g3jw4opr
92:	slate	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/slate-2022.07.00-mbaucposl5s5673pub5gtgboxwecmpu3
93:	slepc	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/slepc-3.19.1-ij2f4fnibtmosfzgwlvvj3cy2g2y2rcd
94:	stc	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/stc-0.9.0-fuukyiybodwmsjnhlzt5euidcga3r4b
95:	strumpack	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/strumpack-7.1.3-d2n3cdpwl7o3ercjsd64lbnkdc43lct
96:	sundials	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/sundials-6.5.1-rebgldhth6lg5eotprxrdrqlr53ftu7n
97:	superlu-dist	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/superlu-dist-8.1.2-d7net4odb6pqazvssut4o47r2vkskyn
98:	swig	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/swig-4.1.1-ubo7yp6o6zgm4fh7rq3rgcn7wwk4q3ei
99:	sz3	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/sz3-3.1.7-zsycyxhj5r7e3x4kyllh3zozo5loofpq
100:	tasmanian	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/tasmanian-7.9-drwk24p6ne2cfhahr7sczcgkn3pqrbrqo
101:	tau	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/tau-2.32.1-lw5e7tbzhx5n5sbit6bejovssimvibil
102:	trilinos	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/trilinos-14.4.0-vkoeuhujbthn4e3tlfh47zqfgd3vuhecc
103:	turbine	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/turbine-1.3.0-mqj47n2drbcfxtgfpdl2ljhb7iioe7
104:	umap	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/umap-2.1.0-mbq5cjei7zkvt7c7zxn2berh6x34loxf
105:	umpire	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/umpire-2022.03.1-6lowfsl2rxtwfxs63lhomcst2y5zze7k
106:	unifyfs	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/unifyfs-1.1-gi3a2lkb53dszuy7pc2aklv5oltjbvun
107:	upcxx	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/upcxx-2023.3.0-i7ncdpo53ctmbciuf45zqssrjaj6d5hk
108:	variorum	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/variorum-0.6.0-kddqbq5byqytpxgqhcbsbwfhapeqsxu5l
109:	veloc	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/veloc-1.6-7dztk45fygfz5tnhgqrz4zowzkbpp2
110:	visit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/visit-3.3.3-dzacgpf36stq3u2f34hsfr62vqmtxo7a
111:	vtk-m	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/vtk-m-2.0.0-nefz7ttxvmsldi5ayvpl3gpomvm3q5uo
112:	wannier90	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/wannier90-3.1.0-ju5w7oi2d6zb2uaqymnp67w4vygzuu5s
113:	warpx	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/warpx-23.08-madvqpgfwjxth2q4ur4w2uayx5xg67m
114:	xyce	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/xyce-7.6.0-qwmjrypltbh5byztktxarjpkf57eaoqb
115:	zfp	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.4.0/zfp-1.0.0-eeh3vdoi7eqap55xutym6x6dldjjcbbx

Languages:

- Julia with support for MPI, and CUDA
- Python

AI products with GPU support

- Tensorflow
- Pytorch

EDA Tools:

- Xyce

3D Visualization

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

E4S 23.08 adds support for NVIDIA A100 (sm80), V100 (sm70), and H100 (sm90) GPUs

E4S Support for AI/ML frameworks with V100, A100, and H100 GPUs

```
Singularity> python
Python 3.8.10 (default, Nov 14 2022, 12:59:47)
[GCC 9.4.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> import numpy
>>> import scipy
>>> import matplotlib
>>> import tensorflow
>>> tensorflow.__version__
'2.12.0'
>>> import torch
>>> torch.__version__
'2.0.0'
>>> torch.cuda.get_device_name(torch.cuda.current_device())
'NVIDIA H100 PCIe'
>>> █
```

E4S 23.08 supports NVIDIA H100 GPUs with TensorFlow 2.12.0 and PyTorch 2.0.0

E4S 23.08 Intel oneAPI 2023.2.0: Packages built with Intel compilers

```
[Singularity> spack find -x
-- linux-ubuntu20.04-x86_64 / gcc@11.4.0 -----
hdf5@1.14.2  papi@6.0.0.1

-- linux-ubuntu20.04-x86_64 / oneapi@2023.2.1 -----
adios@1.13.1      conduit@0.8.8      hdf5-vol-log@1.4.0  mfem@4.5.2        pumi@2.2.7        sz@2.1.12.5
aml@0.2.1         darshan-runtime@3.4.4  heffte@2.3.0       mpark-variant@1.4.0  py-cinemasci@1.7.0  sz3@3.1.7
aml@0.2.1         darshan-util@3.4.4    hpx@1.9.1          mpich@4.1.2        py-h5py@3.8.0      tasmanian@7.9
amrex@23.08      datatransferkit@3.1-rc3  hypre@2.29.0       mpileaks@0.11.1     py-jupyterhub@1.4.1  tau@2.32.1
amrex@23.08      exaworks@0.1.0        kokkos@4.1.00      nccmp@1.9.1.0      py-libensemble@0.10.2  tau@2.32.1
arborx@1.4.1     faodel@1.2108.1       kokkos@4.1.00      netlib-scalapack@2.2.0  py-petsc4py@3.19.4  trilinos@14.4.0
arborx@1.4.1     flecsi@2.2.1          kokkos-kernels@4.0.00  nrm@0.1.0          py-warpx@23.08      turbine@1.3.0
argobots@1.1     flit@2.1.0            kokkos-kernels@4.0.00  omega-h@9.34.13    qthreads@1.18       umap@2.1.0
ascent@0.9.2     flux-core@0.53.0      lammps@20230802     openmpi@4.1.5       quantum-espresso@7.2  umpire@2022.03.1
axom@0.7.0       fortrilinos@2.3.0     lbann@0.102        papyrus@1.0.2      raja@2022.10.4      unifyfs@1.1
bolt@2.0         gasnet@2023.3.0       legion@23.06.0      parallel-netcdf@1.12.3  rempi@1.1.0         variorum@0.6.0
boost@1.83.0     ginkgo@1.6.0          libcatalyst@2.0.0-rc3  parsec@3.0.2209    scr@3.0.1           veloc@1.6
bricks@r0.1      globalarrays@5.8.2    libnm@0.1.0        pdt@3.25.1         slate@2022.07.00    vtk-m@2.0.0
butterflypack@2.2.2  gmp@6.2.1            libpressio@0.95.1   petsc@3.19.4       slepc@3.19.1       wannier90@3.1.0
cabana@0.5.0     gotcha@1.0.4          libquo@1.3.1        phist@1.11.2       stc@0.9.0           xyce@7.6.0
cabana@0.5.0     gptune@4.0.0          libunwind@1.6.2     plasma@22.9.29     strumpack@7.1.3     zfp@1.0.0
caliper@2.10.0    h5bench@1.4           loki@0.1.7          plumed@2.9.0       sundials@6.5.1     superlu@5.3.0
chai@2022.03.0   hdf5-vol-async@1.7    mercury@2.3.0       pruners-ninja@1.0.1  superlu-dist@8.1.2
charliecloud@0.33  hdf5-vol-cache@v1.1  metall@0.25

==> 113 installed packages
Singularity> █
```

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

E4S 23.05 Intel oneAPI 2023.2.0: Packages built with Intel compilers

Singularity> module avail

```
----- /spack/share/spack/lmod/linux-ubuntu20.04-x86_64/mpich/4.1.2/Core -----
adios/1.13.1
amrex/23.08-sycl
amrex/23.08 (D)
arborx/1.4.1-sycl
arborx/1.4.1 (D)
ascent/0.9.2-openmp
axom/0.7.0-openmp
boost/1.83.0
bricks/r0.1
butterflypack/2.2.2-openmp
cabana/0.5.0-sycl
cabana/0.5.0 (D)
caliper/2.10.0
conduit/0.8.8
darshan-runtime/3.4.4
datatransferkit/3.1-rc3
exaworks/0.1.0
faodel/1.2108.1
flecsi/2.2.1
fortrilinos/2.3.0
ginkgo/1.6.0-openmp
globalarrays/5.8.2
gptune/4.0.0
h5bench/1.4
hdf5-vol-async/1.7
hdf5-vol-cache/v1.1
hdf5-vol-log/1.4.0
hdf5/1.14.2
heffte/2.3.0
hpx/1.9.1
hypre/2.29.0
lammers/20230802-openmp
lbann/0.102
libcatalyst/2.0.0-rc3
libnrm/0.1.0
libpressio/0.95.1-openmp
libquo/1.3.1
mercury/2.3.0
metall/0.25
mfem/4.5.2
mpifileutils/0.11.1
nccmp/1.9.1.0
netlib-scalapack/2.2.0
omega-h/9.34.13
papyrus/1.0.2
parallel-netcdf/1.12.3
parsec/3.0.2209
petsc/3.19.4
phist/1.11.2-openmp
plumed/2.9.0
precice/2.5.0
pruners-ninja/1.0.1
pumi/2.2.7
py-cinemasci/1.7.0
py-h5py/3.8.0
py-libensemble/0.10.2
py-petsc4py/3.19.4
py-warpx/23.08
quantum-espresso/7.2-openmp
rempi/1.1.0
scr/3.0.1
slate/2022.07.00-openmp
slepc/3.19.1
stc/0.9.0
strumpack/7.1.3-openmp
sundials/6.5.1
superlu-dist/8.1.2
tasmanian/7.9
tau/2.32.1-level-zero
tau/2.32.1 (L,D)
trilinos/14.4.0
turbine/1.3.0
unifyfs/1.1
veloc/1.6
vtk-m/2.0.0
wannier90/3.1.0
xyce/7.6.0

----- /spack/share/spack/lmod/linux-ubuntu20.04-x86_64/Core -----
aml/0.2.1-level-zero
aml/0.2.1 (D)
argobots/1.1
bolt/2.0
chai/2022.03.0
charliecloud/0.33
darshan-util/3.4.4
flit/2.1.0
flux-core/0.53.0
gasnet/2023.3.0
gmp/6.2.1
gotcha/1.0.4
kokkos-kernels/4.0.00-openmp
kokkos-kernels/4.0.00-sycl (D)
kokkos/4.1.00-openmp
kokkos/4.1.00-sycl-openmp (D)
legion/23.06.0
libunwind/1.6.2 (L)
loki/0.1.7
mpark-variant/1.4.0
mpich/4.1.2 (L)
nrm/0.1.0
openmpi/4.1.5
papi/6.0.0.1 (L)
pdt/3.25.1 (L)
plasma/22.9.29
py-jupyterhub/1.4.1
qthreads/1.18
raja/2022.10.4-openmp
superlu/5.3.0
sz/2.1.12.5
sz3/3.1.7
umap/2.1.0
umpire/2022.03.1
variorum/0.6.0
zfp/1.0.0
```

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

E4S Support for ROCm variants for MI250X (gfx90a) on x86_64

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

```
-- linux-ubuntu20.04-x86_64 / gcc@11.4.0 -----
```

adios@1.13.1	datatransferkit@3.1-rc3	heffte@2.3.0	mfem@4.5.2	pruners-ninja@1.0.1	swig@4.0.2-fortran
adios2@2.9.1	dealii@9.4.2	heffte@2.3.0	mgard@2023-03-31	pumi@2.2.7	sz@2.1.12.5
alquimia@1.0.10	dyninst@12.3.0	hpctoolkit@2023.03.01	mpark-variant@1.4.0	py-cinemasci@1.3	sz3@3.1.7
aml@0.2.1	ecp-data-vis-sdk@1.0	hpctoolkit@2023.03.01	mpich@4.1.2	py-h5py@3.8.0	tasmanian@7.9
amrex@23.08	ecp-data-vis-sdk@1.0	hpx@1.9.1	mpifileutils@0.11.1	py-jupyterhub@1.4.1	tasmanian@7.9
amrex@23.08	exaworks@0.1.0	hpx@1.9.1	nccmp@1.9.1.0	py-libensemble@0.10.2	tau@2.32.1
arborx@1.4.1	faodel@1.2108.1	hypre@2.29.0	nco@5.1.6	py-petsc4py@3.19.4	tau@2.32.1
arborx@1.4.1	flecsi@2.2.1	hypre@2.29.0	netlib-scalapack@2.2.0	py-warpx@23.08	trilinos@14.4.0
argobots@1.1	flit@2.1.0	kokkos@4.1.00	nrm@0.1.0	qthreads@1.18	trilinos@14.4.0
ascent@0.9.1	flux-core@0.53.0	kokkos@4.1.00	omega-h@9.34.13	quantum-espresso@7.2	turbine@1.3.0
axom@0.7.0	fortrilinos@2.3.0	kokkos-kernels@4.0.00	openfoam@2306	raja@2022.10.4	umap@2.1.0
bolt@2.0	gasnet@2023.3.0	lammps@20230802	openmpi@4.1.5	raja@2022.10.4	umpire@2022.03.1
boost@1.79.0	gasnet@2023.3.0	lbann@0.102	openpmd-api@0.15.1	rempi@1.1.0	umpire@2022.03.1
bricks@r0.1	ginkgo@1.6.0	legion@23.06.0	papi@6.0.0.1	scr@3.0.1	unifyfs@1.1
butterflypack@2.2.2	ginkgo@1.6.0	legion@23.06.0	papyrus@1.0.2	slate@2022.07.00	upcxx@2023.3.0
cabana@0.5.0	globalarrays@5.8.2	libcatalyst@2.0.0-rc3	parallel-netcdf@1.12.3	slate@2022.07.00	upcxx@2023.3.0
cabana@0.5.0	gmp@6.2.1	libcatalyst@2.0.0-rc3	paraview@5.11.1	slepc@3.19.1	variorum@0.6.0
cabana@0.5.0	gotcha@1.0.4	libnrm@0.1.0	paraview@5.11.1	slepc@3.19.1	veloc@1.6
caliper@2.10.0	gptune@4.0.0	libpressio@0.95.1	paraview@5.11.1	stc@0.9.0	visit@3.3.3
caliper@2.10.0	h5bench@1.4	libquo@1.3.1	parsec@3.0.2209	strumpack@7.1.3	vtk-m@1.9.0
chai@2022.03.0	hdf5@1.12.2	libunwind@1.6.2	pdt@3.25.1	strumpack@7.1.3	vtk-m@2.0.0
chai@2022.03.0	hdf5@1.14.2	loki@0.1.7	petsc@3.19.4	sundials@6.5.1	wannier90@3.1.0
charliecloud@0.33	hdf5-vol-async@1.7	magma@2.7.1	petsc@3.19.4	sundials@6.5.1	xyce@7.6.0
conduit@0.8.8	hdf5-vol-cache@v1.1	mercury@2.3.0	phist@1.11.2	superlu@5.3.0	zfp@0.5.5
darshan-runtime@3.4.4	hdf5-vol-log@1.4.0	metall@0.25	plasma@22.9.29	superlu-dist@8.1.2	
darshan-util@3.4.4	hdf5-vol-log@1.4.0	mfem@4.5.2	plumed@2.9.0	superlu-dist@8.1.2	

```
==> 154 installed packages
```

```
Singularity> spack find +rocm
```

```
-- linux-ubuntu20.04-x86_64 / gcc@11.4.0 -----
```

amrex@23.08	camp@2022.10.1	hip@5.4.3	hpctoolkit@2023.03.01	lapackpp@2023.06.00	raja@2022.10.4	tasmanian@7.9
arborx@1.4.1	chai@2022.03.0	hipblas@5.4.3	hpx@1.9.1	legion@23.06.0	slate@2022.07.00	tau@2.32.1
blaspp@2023.06.00	ecp-data-vis-sdk@1.0	hipfft@5.4.3	hypre@2.29.0	magma@2.7.1	slepc@3.19.1	trilinos@14.4.0
cabana@0.5.0	gasnet@2023.3.0	hiprand@5.4.3	kokkos@3.7.01	mfem@4.5.2	strumpack@7.1.3	umpire@2022.03.1
cabana@0.5.0	ginkgo@1.6.0	hipsolver@5.4.3	kokkos@4.1.00	paraview@5.11.1	sundials@6.5.1	upcxx@2023.3.0
caliper@2.10.0	heffte@2.3.0	hipsparse@5.4.3	kokkos@4.1.00	petsc@3.19.4	superlu-dist@8.1.2	vtk-m@2.0.0

```
==> 42 installed packages
```

E4S Support for ROCm variants for MI250X (gfx90a) on x86_64

Singularity> module avail

```
----- /spack/share/spack/lmod/linux-ubuntu20.04-x86_64/mpich/4.1.2/Core -----
adios/1.13.1          ginkgo/1.6.0-gfx90a-openssl      mpifileutils/0.11.1             slate/2022.07.00-openssl      (D)
adios2/2.9.1          ginkgo/1.6.0-openssl              (D)                               nccmp/1.9.1.0
alquimia/1.0.10       globalarrays/5.8.2                nco/5.1.6                       slepc/3.19.1-gfx90a
amrex/23.08-gfx90a    gptune/4.0.0                      netlib-scalapack/2.2.0          slepc/3.19.1                  (D)
amrex/23.08           (D)                                h5bench/1.4                    omega-h/9.34.13               strumpack/7.1.3-gfx90a-openssl
arborx/1.4.1-gfx90a  hdf5-vol-async/1.7                openfoam/2306                   strumpack/7.1.3-openssl      (D)
arborx/1.4.1         (D)                                hdf5-vol-cache/v1.1            openpmd-api/0.15.1            sundials/6.5.1-gfx90a
ascent/0.9.1-openssl hdf5-vol-log/1.4.0                hdf5/1.12.2                    papyrus/1.0.2                 sundials/6.5.1                (D)
axom/0.7.0-openssl   hdf5/1.14.2                       (D)                             parallel-netcdf/1.12.3        superlu-dist/8.1.2-gfx90a
boost/1.79.0         heffte/2.3.0-gfx90a              (D)                             paraview/5.11.1-gfx90a       superlu-dist/8.1.2            (D)
bricks/r0.1          heffte/2.3.0                      (D)                             parsec/3.0.2209              sz/2.1.12.5
butterflypack/2.2.2-openssl hpctoolkit/2023.03.01-rocmlib    tasmanian/7.9-gfx90a
cabana/0.5.0-rocmlib hpctoolkit/2023.03.01              (D)                             petsc/3.19.4-gfx90a          tasmanian/7.9                 (D)
cabana/0.5.0-rocmlib hpx/1.9.1-gfx90a                  (D)                             petsc/3.19.4                 (D)                             tau/2.32.1-rocmlib           (L)
cabana/0.5.0         (D)                                hpx/1.9.1                      (D)                             phist/1.11.2-openssl        tau/2.32.1                    (D)
caliper/2.10.0-gfx90a hypre/2.29.0-gfx90a              (D)                             plumed/2.9.0                 trilinos/14.4.0-gfx90a
caliper/2.10.0      (D)                                hypre/2.29.0                   (D)                             precice/2.5.0                trilinos/14.4.0              (D)
conduit/0.8.8        lammps/20230802-openssl           pumi/2.2.7                      pruners-ninja/1.0.1          turbine/1.3.0
darshan-runtime/3.4.4 lbann/0.102                       py-cinemasci/1.3                pumi/2.2.7                    unifyfs/1.1
datatransferkit/3.1-rc3 libcatlyst/2.0.0-rc3              py-h5py/3.8.0                  py-cinemasci/1.3              upcxx/2023.3.0-gfx90a
dealii/9.4.2         libnrn/0.1.0                      py-libensemble/0.10.2          py-h5py/3.8.0                 upcxx/2023.3.0              (D)
dyninst/12.3.0-openssl ecp-data-vis-sdk/1.0-gfx90a        py-petsc4py/3.19.4             py-libensemble/0.10.2        veloc/1.6
ecp-data-vis-sdk/1.0-gfx90a libpressio/0.95.1-openssl         py-warpX/23.08                 py-petsc4py/3.19.4           visit/3.3.3
ecp-data-vis-sdk/1.0 (D)                                mercury/2.3.0                  quantum-espresso/7.2-openssl  py-warpX/23.08               vtk-m/1.9.0-openssl
exaworks/0.1.0       metall/0.25                       rempi/1.1.0                    quantum-espresso/7.2-openssl  vtk-m/2.0.0-gfx90a         (D)
faodel/1.2108.1      mfem/4.5.2-gfx90a                 scr/3.0.1                       rempi/1.1.0                   wannier90/3.1.0
flecsi/2.2.1         mfem/4.5.2                       (D)                               scr/3.0.1                     xyce/7.6.0
fortrilinos/2.3.0    (D)                               slate/2022.07.00-gfx90a-openssl
----- /spack/share/spack/lmod/linux-ubuntu20.04-x86_64/Core -----
aml/0.2.1             gmp/6.2.1                         mpark-variant/1.4.0            superlu/5.3.0
argobots/1.1         gotcha/1.0.4                      mpich/4.1.2                    (L)                             swig/4.0.2-fortran
bolt/2.0             kokkos-kernels/4.0.00-openssl      nrm/0.1.0                      sz3/3.1.7
chai/2022.03.0-gfx90a kokkos/4.1.00-gfx90a              openmpi/4.1.5                  umap/2.1.0
chai/2022.03.0      (D)                                kokkos/4.1.00-openssl          (D)                             papi/6.0.0.1                (L)
charliecloud/0.33   legion/23.06.0-gfx90a             pdt/3.25.1                    (L)                             umpire/2022.03.1-gfx90a
darshan-util/3.4.4  legion/23.06.0                   (D)                             plasma/22.9.29               umpire/2022.03.1            (D)
flit/2.1.0          libunwind/1.6.2                   (L)                             py-jupyterhub/1.4.1          variorum/0.6.0
flux-core/0.53.0    loki/0.1.7                        qthreads/1.18                  py-jupyterhub/1.4.1          zfp/0.5.5
gasnet/2023.3.0-gfx90a magma/2.7.1-gfx90a                raja/2022.10.4-gfx90a
----- /spack/share/spack/lmod/linux-ubuntu20.04-x86_64/Core -----
```

23.08 Release: 100+ Official Products + dependencies (gcc, ppc64le)

1: adios2	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/adios2-2.9.1-fmntcdanhhlgd74tw6gzxspmspo6g7oo
2: alquimia	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/alquimia-1.0.10-bnch5osgz6q25hibbv235cqzipl6go2s
3: aml	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/aml-0.2.1-r7vrnyusj5333l6zqso4o2vs3tusvza
4: amrex	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/amrex-23.08-qpezstmksaczoaaecxsoofhyn6wd2atf
5: arborx	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/arborx-1.4.1-eqpxt5x6w2urfzndmqkbjhs6o4hj6k7
6: argobots	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/argobots-1.1-6a5cjaou5ycauxkm4yscofwxw7pz7d2
7: ascent	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ascent-0.9.1-n4pfe3xn22yxoxqvcwrefv26x65vimat
8: axom	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/axom-0.7.0-hogyzun3t4yug3amztcddcmqv4w5lbq
9: blaspp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/blaspp-2023.06.00-im5lfsru56r7ycivx3gqktcaf7jyelxt
10: bolt	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/bolt-2.0-rf32zquv6up25q6vmfzqjdb5hny7oz
11: bricks	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/bricks-r0.1-72bxewewznr4hiw7b4vygagkdb52eao3
12: butterflypack	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/butterflypack-2.2.2-dvoqzlp6lyfw472k7kuohzlw7lz7uoj4
13: cabana	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/cabana-0.5.0-i3ph7xvdblfc6ujqwh3kvvkqexw5nfam2
14: caliper	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/caliper-2.10.0-kkg2gx7pfcizwmtq7nadwk lwkmasdtjh
15: camp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/camp-2022.10.1-j7f3g57y7272ywh4kyvpekveendi47ey
16: chai	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/chai-2022.03.0-nlhoabvwd7s6ixyc3f5wbqvetlf57sk
17: charliecloud	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/charliecloud-0.33-fasom2mtwf7j54vqlztklvnczjsvb6
18: conduit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/conduit-0.8.8-vp23pzylmrsurfi42kb5lh6gpdahmrd7
19: darshan-runtime	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/darshan-runtime-3.4.4-5ax4ghkbcv46jdn7n67rdb7qyk4kedo
20: datatransferkit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/datatransferkit-3.1-rc3-sdgooesvoido4eau7uu6gy4kp33wegen
21: dyninst	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/dyninst-12.3.0-pzw65pilda27y5liyqkc6v6es33jnkhd
22: ecp-data-vis-sdk	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ecp-data-vis-sdk-1.0-qvnpsgeks74gaywdinf7pppwswo2is
23: exaworks	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/exaworks-0.1.0-lbnfvau5dvn34j7l7d7o7ogy4qiglgjx
24: faodel	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/faodel-1.2108.1-dnr3nr63hn7avkrycnc4j42afb7enbn5g
25: flecsi	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flecsi-2.2.1-5mglwowwtgsuqfp5rmtmue6mprucpm2d
26: flit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flit-2.1.0-bu7zr264zfpfsfslce4ebknm63ugqa52g
27: flux-sched	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flux-sched-0.28.0-5usrz3d7a3usvmorz7rlyxvaqlam5ipd
28: fortrilinos	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/fortrilinos-2.3.0-aumd7aska5fw74g3uadpjjv6yvs6fnwi
29: gasnet	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gasnet-2023.3.0-r2ixqqbifetxotbdrok4xmkeizsb3zy4
30: ginkgo	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ginkgo-1.6.0-eima5hiibastgygsbyq33d2si2262s77
31: globalarrays	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/globalarrays-5.8.2-dm6l7rwjmt2xpkoosw6mulbhw65dstu5e
32: gotcha	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gotcha-1.0.4-bwy35eblx3wiortechdjhgsfjei4qld3f
33: gptune	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gptune-4.0.0-kgevmaioqy6fmx2oaa6hijpelps6i46
34: h5bench	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/h5bench-1.4-ihxmgpy4oazoce3imu262pws3vcwxldf
35: hdf5	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-1.14.2-pv5cv266dpt7gohhva2di2oifqz7dkbw
36: hdf5-vol-async	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-vol-async-1.7-xgldomi3ekz3nt62nhwy2r52ssinxw
37: hdf5-vol-cache	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-vol-cache-v1.1-6vgydqen3f75zxxzydiwx5rdvjji2di6
38: hdf5-vol-log	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-vol-log-1.4.0-qsh6w2xn65kve2jxih5cq4nh4jivezyt
39: heffte	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/heffte-2.3.0-wrrzvxsf27b5cygfpdqqlzbiui723i6

GPU runtimes for IBM Power

- CUDA 12.2
- NVHPC 23.7

Languages

- Julia with MPI and CUDA
- Python

EDA Tools

- Xyce

CFD Tools

- OpenFOAM

AI packages for NVIDIA GPU

- TensorFlow
- PyTorch
- LBANN

23.05 Release: 100+ Official Products + dependencies (gcc, ppc64le)

```
40: hpctoolkit /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hpctoolkit-2023.03.01-2fo3sixvdc346fbtcg27wan6o434k5xf
41: hpx /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hpx-1.9.1-dkvivgvhxiq7edgcxmpg5a5qnbdd7ci
42: hypre /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hypre-2.29.0-lnryfjvh7ouihh3ba66ynwf2quuf76oo
43: kokkos /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/kokkos-4.1.00-xdut7am4ucdpkpbjixqoujr2bvzbk2y
44: kokkos-kernels /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/kokkos-kernels-4.0.00-xdug52i4pallchdzuujxeejokh6wsbsb
45: lammps /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/lammps-20230802-7id76c2dvnwnjfsxd4udrsgo3h7hpgv
46: lapackpp /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/lapackpp-2023.06.00-rdevo3qtuka2xpslr7uyqtzhoy45gfem
47: lbann /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/lbann-0.102-wsqw54rddzov4jsz2y5mzdwbkz4vtphz
48: legion /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/legion-23.06.0-k6ppsztg7dg3vykhldol33vquixiht4n
49: libnrm /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libnrm-0.1.0-l3wh6ytblip3phpwlp4cvodmylz5mjff
50: libpressio /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libpressio-0.95.1-6gpjefm2pel3cfxbdsugm3qvkbwormr3
51: libquo /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libquo-1.3.1-wjytcfrpiyckfzjuhsy2cymvlbwd426v
52: loki /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/loki-0.1.7-akevesnxzqw2ric53bjgmcpetsuiqvwu
53: magma /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/magma-2.7.1-ludgihl5d5ylo6yup4nzf5u7x5ksgr7
54: mgard /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mgard-2023-03-31-uccwrcshppqurfuq76vkmngoqajwyivg
55: mercury /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mercury-2.3.0-qhr3kgwnsllzdxvlpgvzrurnkdp46
56: metall /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/metall-0.25-4dfzwnwe665xt3zyh6hoziz3vcosn725
57: mfem /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mfem-4.5.2-n2trv33r5pced5k3sktnfzqilgij57jo
58: mpark-variant /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mpark-variant-1.4.0-pb7bllo3rz53a6jymn5di7qvr lutjb6k
59: mpich /usr/local/mpich/install/mpich
60: mpifileutils /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mpifileutils-0.11.1-pki6kkkse6gar2cgznu2di3at7bimfqq
61: nccmp /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nccmp-1.9.1.0-hxpl46uurmfyevileg5vg5yavkkqfur
62: nco /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nco-5.1.6-7p6tkuly7ayxpg3wb5qs3vugacuky63
63: netcdf-c /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/netcdf-c-4.9.2-5oxchyljia5kwhwgc7uvqb344jno32x
64: netlib-scalapack /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/netlib-scalapack-2.2.0-cdubl3c3wns7occdfoi4bnznxlpqkwf2s
65: nrm /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nrm-0.1.0-p4gjkrmfngqhhk6fbhd7c4ut2abuxbc6
66: omega-h /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/omega-h-9.34.13-otlkzobhys2fz6zvuv22oy7c5a64uxqk
67: openfoam /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/openfoam-2306-mecv5otbypsjuqtblbu6qwaopxtujr
68: openmpi /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/openmpi-4.1.5-y66mdzcs2mqdzvneqbqne74kqptnq6
69: openpmd-api /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/openpmd-api-0.15.1-prrua5xqqdeellh3cw5nn72f37fbfatm
70: papi /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/papi-6.0.0-1-ixqqm5dbscagdckenk3cmns3oh65pjsn6
71: papyrus /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/papyrus-1.0.2-27xkaq4mjo3vcnqzeve6ixgcmum2lib6
72: parallel-netcdf /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/parallel-netcdf-1.12.3-qxc4all3evd6rqnttj5g5hde5c4224pg
73: parsec /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/parsec-3.0.2209-57v6x4eb2otv2wn6lzhpj6sqpsi4ssob
74: pdt /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/pdt-3.25.1-lyxbm24qtm7q47fahlpxel3bjmh62dom
75: petsc /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/petsc-3.19.4-vq5k7323l2snvgyhwkmnr12xwar72jc5
76: plasma /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/plasma-22.9.29-kvwohl5ry5zesmwhynh3z7tp7d7ffzxd
77: plumed /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/plumed-2.9.0-d46yxw35olel46iy6isw34waem2vqbos
78: precice /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/precice-2.5.0-hfdpuivnyvaqoeg3bzbply3sctcbkphp
```

23.08 Release: 100+ Official Products + dependencies (gcc, ppc64le)

79:	pruners-ninja	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/pruners-ninja-1.0.1-u2fyv6fsvhkapdmb4zp5gw7xk4ovndez
80:	pumi	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/pumi-2.2.7-ywq7yfcqnvcs5u734dfop7gmg2xnmjmm2
81:	py-cinemasci	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-cinemasci-1.3-gtfmjaixzezeq3h7tucfz72nql4agddgm
82:	py-jupyterhub	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-jupyterhub-1.4.1-us3uenhgj6gfzcrftyhjrd7skscbht6g
83:	py-libensemble	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-libensemble-0.10.2-magngkdqwbfnucewofbryq5ct73i6ixo
84:	py-parsl	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-parsl-1.2.0-zhoyo242j4szezqhx22a6ygab2ndoxztm
85:	py-radical-pilot	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-radical-pilot-1.20.0-h73p7qx75ncyumropazkvc5fsiffjbg
86:	py-radical-saga	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-radical-saga-1.20.0-swos7462zpedl7cjtalwbl4emmifixiqv
87:	qthreads	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/qthreads-1.18-tlre2u2xcnywiyfuq66lbtb3ttfippb
88:	quantum-espresso	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/quantum-espresso-7.2-dkjqqc6acgzg2mfm32wmg2jxyrgy2juv
89:	raja	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/raja-2022.10.4-tl75nctz7lxsftxdghkf3acgjtj45j
90:	scr	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/scr-3.0.1-7ikmhs4riaoz7ckzhxqqf3buqegg6h
91:	slate	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/slate-2022.07.00-ukoap7bu6u6rl5gfcrl6ao5eggrmzs6
92:	slpc	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/slpc-3.19.1-rexsgb5eewv3e73quvr4itbjeawpzc5o
93:	stc	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/stc-0.9.0-lpzb3ilyzpzjurgozgeqpl7xjboy6qs6
94:	strumpack	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/strumpack-7.1.3-zypyrv3fmrkraizrn7gtb2x5zwmfmemh
95:	sundials	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/sundials-6.5.1-ktmtx2tycstnooed5inbszwbwg5f5d2x
96:	superlu	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/superlu-5.3.0-vwvodbicahn7l3bhfpqsvdgp3k7utth5
97:	superlu-dist	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/superlu-dist-8.1.2-vkniltqc76qee4wtkvth2cqv6dw5y3ut
98:	swig	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/swig-4.1.1-cuzn7adeogwqbho7s2cque5eqbyfg3ng
99:	sz	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/sz-2.1.12.5-arzdfoe7n5w6zqoahpmb7oh3qtnhb7qq
100:	sz3	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/sz3-3.1.7-djuqrhkpax62lrvjwwkebpirifo5j5cvw
101:	tasmanian	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/tasmanian-7.9-v2vhrjzm732yutp3pabinr3tiiebr6rk
102:	tau	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/tau-2.32.1-dggv5o3s5ffmtkukqgrxegj2peperfvk
103:	trilinos	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/trilinos-14.4.0-e5flh444i6lmksdzcrigzujs6lijw7dk
104:	turbine	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/turbine-1.3.0-qt4bheqtvbmfdrccq7wjddjbxr7fdqmvc
105:	umap	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/umap-2.1.0-irdopxrdhmbjo7zw5bpdxrqqy6thyw
106:	umpire	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/umpire-2022.03.1-tv3wdhsp1bmzu4zzoyferauj2z62j4kb
107:	unifyfs	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/unifyfs-1.1-6oblndfmrta3v6aumb22v5dfod66pc3
108:	upcxx	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/upcxx-2023.3.0-w4iseanmqvlocsgd5eq5ktrbunxc5ugr
109:	veloc	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/veloc-1.6-m7aurzkswixvpe4jbsnlpz2f4z7zewkb
110:	visit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/visit-3.3.3-z4qip44ygviiizjm7hrwhs3xmf36kigh
111:	vtk-m	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/vtk-m-2.0.0-nsmeqotnvgoousbnpfmou75tfdkg44l
112:	wannier90	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/wannier90-3.1.0-3p7coumgs33ui4n2khhpsgmatdfi6s
113:	warpx	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/warpx-23.08-ds3vbijusrh5eir3m6urpvzaahpeb2sg
114:	xyce	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/xyce-7.6.0-hbp5qt2hxetnddp2pvqxxk5f7gxm7ba
115:	zfp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/zfp-1.0.0-c4mms5rrk5akqfeyakoarpbthb46ku

Tested on
IBM Power10 and
Power 9 processors

23.08 Release: 100+ Official Products + dependencies (gcc, aarch64)

1:	adios2	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/adios2-2.9.1-2b25whmpjyfymcp5kttfok6v5ow6aund
2:	alquimia	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/alquimia-1.0.10-qdfmokxkcrllqampdrwzncidqotfd477q
3:	aml	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/aml-0.2.1-kbwqxatdnlc6wqlb6bhawfc43vwdhdab
4:	amrex	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/amrex-23.08-r4aul3nfdk4yiwddcuheux5jniu475xos
5:	arborx	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/arborx-1.4.1-k2gweimskqcrievvp2macsxej7yn434y
6:	argobots	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/argobots-1.1-e2wx4n7jr755ck7nwo36pw3eefzkevpz
7:	ascent	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/ascent-0.9.2-bvfvbcaud7kcbxbt4m4peo4n4fngquna
8:	axom	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/axom-0.7.0-hvum52rzybjkbck6llu5wfxuh6kkhj4
9:	blaspp	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/blaspp-2023.06.00-t6ydy3umtw7h3nkkcvlffbbhw322gjwh
10:	bolt	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/bolt-2.0-ujrfjbq3dpe3glskjbq5tljlzlvvmuc
11:	bricks	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/bricks-r0.8-1-twmjbpnjn7nqvtpio6kz67b2heckfgs
12:	butterflypack	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/butterflypack-2.2.2-vuq53docy3p5kuxvlnr65svsmyuccjk
13:	cabana	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/cabana-0.5.0-xi7tyamoxnxw2onmi5jwxj4xb6irzb4t
14:	caliper	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/caliper-2.10.0-7jmgk2w3nyqyl7oxvofpnbfw77tu5fgo
15:	camp	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/camp-2022.10.1-wikzumyllici2edfyutvjhhh lupdkt5c
16:	chai	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/chai-2022.03.0-j3xm4cidjmkrodzlv5yur2xnxo6prdn
17:	charliecloud	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/charliecloud-0.33-e5sff3i2l7g53ykq7fepfjhtb4f4uoqh
18:	conduit	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/conduit-r0.8.8-cjdvimgk6miamzkrnihetksrumrotu4u
19:	darshan-runtime	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/darshan-runtime-3.4.4-xpi5jkkjora74qek4675sznhdbkdrrrr
20:	datatransferkit	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/datatransferkit-3.1-rc3-wsfdc3caacsocqbgnczfwzk7fn2hooyg
21:	dealii	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/dealii-9.4.2-fyysdszfpftiq7fqcw3hpq5yivrfaz4v
22:	dyninst	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/dyninst-12.3.0-ff2dtnzgjiey3hu4mzjknntbui7qqemd
23:	exaworks	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/exaworks-0.1.0-5kg3i7longim7hfwbihtkhoxbmd4hioq
24:	flecsi	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/flecsi-2.2.1-gt35pvfnppuwkniqk2hkfcwdhtjxutz7
25:	flit	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/flit-2.1.0-c4wqmk4n6yxvmmaskgp5dtx4n5d7uxiot
26:	flux-core	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/flux-core-0.53.0-7gwfapgad7ky4zqlhpm4todnslj4jvmv
27:	flux-sched	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/flux-sched-0.28.0-qzdry2b3i4wxum3kqze4jwmswf4ooz5z
28:	fortrilinos	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/fortrilinos-2.3.0-vstcnfjioz4fcxebutgrgpzwljucrsro
29:	gasnet	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/gasnet-2023.3.0-wll3acsggquumawdsbprb5cog7l4mkos
30:	ginkgo	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/ginkgo-1.6.0-qgl7qa6lwlzdzdnem6gr5p3eafezaqzc
31:	globalarrays	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/globalarrays-5.8.2-vzkxdiysndmxosdpu2gz7g5cgzwb4nq
32:	gotcha	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/gotcha-1.0.4-6mdj7fgv7af5gpglmlauqodhere2a6s3
33:	gptune	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/gptune-4.0.0-g6wcyqhe4qqjfbjrgasulwehprfukjrq
34:	h5bench	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/h5bench-1.4-llva32ph5yge23lbvztl4dbjiipkl4er
35:	hdf5	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/hdf5-1.14.2-n5ak2cbcueh6ck2ya4uvauapyaftqjdl
36:	hdf5-vol-async	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/hdf5-vol-async-1.7-4zefuvdzhrjbrjdhjinkmvdwnr5ikia
37:	hdf5-vol-cache	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/hdf5-vol-cache-v1.1-bjhevbcwsee4uxy4bxf7o2w7ex5uith
38:	hdf5-vol-log	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/hdf5-vol-log-1.4.0-qebkyvolrqb3j6ioyvcjwybyb774bmmg
39:	heffte	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/heffte-2.3.0-hf6vmpvxrwrpk5vjn4oxlh7jvfpnzocb

GPU runtimes for aarch64

- CUDA 12.2
- NVHPC 23.7

Languages

- Julia with MPI and CUDA
- Python

EDA

- Xyce

AI packages for NVIDIA GPU

- TensorFlow
- PyTorch

23.08 Release: 100+ Official Products + dependencies (gcc, aarch64)

40:	hpctoolkit	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/hpctoolkit-2023.03.01-pp7y3lq2gwigeays5snwgctbrdmts5my
41:	hpx	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/hpx-1.9.1-hte6qfsrqzdrpxljiahk6v2kqsgluxme
42:	hypre	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/hypre-2.29.0-oq673celrtj46omn64yfur6u62e2kscl
43:	kokkos	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/kokkos-4.1.00-webwekgucjr3invtf3cz5yrgjexqkmc
44:	kokkos-kernels	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/kokkos-kernels-4.0.00-d66w6jwbwsy2avf2ilp3gpuwsqnf12
45:	lammps	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/lammps-20230802-po63fldobb5zrj42f42dsb6kpxvufmat
46:	lapackpp	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/lapackpp-2023.06.00-2k4lwlzv57ulf3zi7wp5k7s25akxxi43
47:	lbann	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/lbann-0.102-oefbg5mcxgbuuds435zvx3ni5rxvf5q
48:	legion	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/legion-23.06.0-y77d2pkmsquit7cvlpwzfbxbudqjac6v
49:	libnrm	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/libnrm-0.1.0-jjkxt3jhr44vlme4qoetajo5iwijs7rn7
50:	libpressio	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/libpressio-0.95.1-5vw5dmigqrw4q3lugdxx6fx53o7o3utq
51:	libquo	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/libquo-1.3.1-5l3lcj7ptossgb3ck7htlgriuey7t53y
52:	loki	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/loki-0.1.7-ewcd5yrluvxbrw2p3zjcgtt6urype2mz
53:	magma	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/magma-2.7.1-xjcmf4caek5g5dphgkqswtnykiummft
54:	mercury	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/mercury-2.3.0-jq5xvtnrxu7jrqvdyrxxkqygvrvcg3na
55:	metall	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/metall-0.25-adjrvmk5vd4fn4mq6lrdzwb5wp6ssl42
56:	mfem	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/mfem-4.5.2-7qsr5r7blsvuix2c3o4i5eqm2be5fpcb
57:	mgard	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/mgard-2023-03-31-tcp6ejkzf6khvm3zxmmy3l3xwy344le
58:	mpark-variant	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/mpark-variant-1.4.0-qhqdp3aoagehf5r6goqmo7tbp5qouza
59:	mpich	/usr/local/mpich/install/mpich
60:	mpifileutils	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/mpifileutils-0.11.1-zujiloknlzytrcnc2vssyfg3mtf73ejd
61:	nccmp	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/nccmp-1.9.1.0-wamdtlqar5wlkfse5gh4iegsh4bebfru
62:	nco	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/nco-5.1.6-w2ys3b5pz37k23n2sgafrnrlrd4ymwrm
63:	netcdf-c	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/netcdf-c-4.9.2-5gzyg7qru52jp7tku3rprn5j3trzthub
64:	netlib-scalapack	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/netlib-scalapack-2.2.0-lo76fq46frlyusjeiejqkyiphohggnb
65:	nrm	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/nrm-0.1.0-qjzr4ezqgrz227qalmfhnthartoplz3d
66:	omega-h	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/omega-h-9.34.13-qqblcwe6tvdebuckjvpfgo3tlzhsmcp
67:	openfoam	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/openfoam-2306-cxhf5ocjs6rcfka422nlroiqlfj5znvp5
68:	openmpi	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/openmpi-4.1.5-5k7zvqxswf5wug4kxxeegydtzrclnw37
69:	openpmd-api	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/openpmd-api-0.15.1-visesf5dwyh3e5geftzeri4n24gdylj2
70:	papi	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/papi-6.0.0.1-trhsrmpkb4gs7nse7puj6vveahz6izeq
71:	papyrus	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/papyrus-1.0.2-y4g6khotbjw42zrpyc5x2ycfjm5sjxdb
72:	parallel-netcdf	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/parallel-netcdf-1.12.3-5dhg6xr6uomagq7xq5l5u6fpxqbgdn4
73:	paraview	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/paraview-5.11.1-7hjbattnnq3v7owl7tpq5qddmsxh4dqr
74:	parsec	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/parsec-3.0.2209-kpt565yrxhnaag6srfeysasymupsm6wx
75:	pdt	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/pdt-3.25.1-arkgraj45uncnfnl6ftybgge4rwdlj
76:	petsc	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/petsc-3.19.4-7vdkxjllxoxantyliaaopqs2nomtgf6f
77:	phist	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/phist-1.11.2-f7fc3h5uzpxz2b6c7h75fjprpocstsjkj
78:	plasma	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/plasma-22.9.29-3nduaqppwjnavvcfqndw4tb6szrrquf

23.08 Release: 100+ Official Products + dependencies (gcc, aarch64)

79:	plumed	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/plumed-2.9.0-saoi4lly3ryek7i3w3fzy4mlezpcrbxc
80:	precice	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/precice-2.5.0-fpcjqowoeu4kcx5oymoydsdprojx2tlu
81:	pruners-ninja	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/pruners-ninja-1.0.1-l2vb3petgbuqewunp3djsonc234r4eyd
82:	pumi	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/pumi-2.2.7-otv3vavivfz3iw6piucgyv475wo3h5pn
83:	py-cinemasci	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/py-cinemasci-1.7.0-pxcez5o3vdni7e2iobblmlewfajj5f7
84:	py-jupyterhub	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/py-jupyterhub-1.4.1-ptf3p5rm3nh5flwfdpv6k4syyu5t3v2d
85:	py-libensemble	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/py-libensemble-0.10.2-lvzdy3zmtjxkym5prrbz6bqyixslt5ia
86:	py-parsl	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/py-parsl-1.2.0-gmeqqgxy3gtjtqgigpfyk36keuyiupi
87:	py-radical-pilot	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/py-radical-pilot-1.20.0-i7ms3dwjxoz77uqvna4otighgkuzri7l
88:	py-radical-saga	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/py-radical-saga-1.20.0-g7k6ke5byl2nwickphjp7sjnkypmn2t2
89:	qthreads	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/qthreads-1.18-g6rg4755cloilr27b5fhxlhaddffigsdk
90:	quantum-espresso	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/quantum-espresso-7.2-nx2jmwmpv3ltgepiuvqv3mggbi6zqqdz
91:	raja	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/raja-2022.10.4-hmixr4jdkaz64bwa7zxietnyalqg4wlf
92:	rempi	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/rempi-1.1.0-cj2y3ppk2zfd3mm2impevx3mkhtmlmj
93:	scr	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/scr-3.0.1-6v24kxccxpseaseqr4lkumkyrzxp4nmq
94:	slate	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/slate-2022.07.00-rp4imnbhqlq4sdr6au73jddqolexs3l
95:	slepc	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/slepc-3.19.1-up6hdt3l3dl2o7gilsffobg6uyzdadj
96:	stc	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/stc-0.9.0-7rcnnp5potq4ce6rnitqpxhe4ycx4lsd
97:	strumpack	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/strumpack-7.1.3-wexysssqa2mghssdobbpkk4pqttycj
98:	sundials	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/sundials-6.5.1-2shaiupno5ig734uvalmbppwbvoiqdlak
99:	superlu	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/superlu-5.3.0-xajo7ljuvi6cf3o4dfdob5fglolit34
100:	superlu-dist	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/superlu-dist-8.1.2-qgotaxdnkhddrfxku7fpuirgkbutfm
101:	swig	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/swig-4.1.1-vygbckrdav7sqf3st3hzol6cg5rmrjtb
102:	sz	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/sz-2.1.12.5-avqtpvtxn5cxxjzb5gkr3ucxmphgq2oy
103:	sz3	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/sz3-3.1.7-hq3o4nlkllk2xy4osh54bf7pdejmjcs
104:	tasmanian	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/tasmanian-7.9-y2eymfvfqynu624tse6kpypm7ktzfn
105:	tau	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/tau-2.32.1-52zst4vwqpyrc76xchfu5tami2fywbsf
106:	trilinos	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/trilinos-14.4.0-gtjtnmmykcgucborjgh3t6lmmw5mh2rr
107:	turbine	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/turbine-1.3.0-j53lmacusfy2ujw2kh23j6dhtljastza
108:	umap	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/umap-2.1.0-2epopndqwk5ml157qd3cm77sfdjm5yt
109:	umpire	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/umpire-2022.03.1-l4e2kl5n6e7iksi7sjuparbluhpueffn
110:	upcxx	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/upcxx-2023.3.0-znkwwq7re4ffhw6sdtryppvlag652pka
111:	vtk-m	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/vtk-m-2.0.0-ha5acn52wk3rcq6lnupcn7mne3mndnpu
112:	wannier90	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/wannier90-3.1.0-rkwj5e6jwhfegzjxxcllu2qajy53fkgh
113:	warpx	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/warpx-23.08-fl7z5dlzkfj6migfl34obgtuqyj7j3d6
114:	xyce	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/xyce-7.6.0-hu7xshohm7bjmtlff3carnd6pstqgt4w
115:	zfp	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.4.0/zfp-1.0.0-fbkzp4ae4vkvpaaf243r2bokfma74m5rj

E4S Support for CUDA on aarch64

Singularity> spack find -x

-- linux-ubuntu20.04-aarch64 / gcc@11.4.0 -----

adios@1.13.1	darshan-util@3.4.4	hpctoolkit@2023.03.01	mgard@2023-03-31	plumed@2.9.0	superlu@5.3.0
adios2@2.9.1	datatransferkit@3.1-rc3	hpctoolkit@2023.03.01	mpark-variant@1.4.0	precice@2.5.0	superlu-dist@8.1.2
adios2@2.9.1	dealii@9.4.2	hpx@1.9.1	mpich@4.1.2	pruners-ninja@1.0.1	superlu-dist@8.1.2
alquimia@1.0.10	dealii@9.4.2	hpx@1.9.1	mpifileutils@0.11.1	pumi@2.2.7	swig@4.0.2-fortran
aml@0.2.1	dyninst@12.3.0	hypre@2.29.0	nccmp@1.9.1.0	py-cinemasci@1.7.0	sz@2.1.12.5
amrex@23.08	exaworks@0.1.0	hypre@2.29.0	nco@5.1.6	py-h5py@3.8.0	sz3@3.1.7
amrex@23.08	faodel@1.2108.1	kokkos@4.1.00	netlib-scalapack@2.2.0	py-jupyterhub@1.4.1	tasmanian@7.9
arborx@1.4.1	flecsi@2.1.0	kokkos@4.1.00	nrm@0.1.0	py-libensemble@0.10.2	tasmanian@7.9
arborx@1.4.1	flecsi@2.2.1	kokkos-kernels@4.0.00	nvhpc@23.7	py-petsc4py@3.19.4	tau@2.32.1
argobots@1.1	flit@2.1.0	kokkos-kernels@4.0.00	omega-h@9.34.13	py-warp@23.08	tau@2.32.1
ascent@0.9.2	flux-core@0.53.0	lammps@20230802	omega-h@9.34.13	py-warp@23.08	trilinos@14.4.0
axom@0.7.0	flux-core@0.53.0	lammps@20230802	openfoam@2306	py-warp@23.08	trilinos@14.4.0
bolt@2.0	fortrilinos@2.3.0	lbann@0.102	openmpi@4.1.5	qthreads@1.18	turbine@1.3.0
boost@1.79.0	gasnet@2023.3.0	legion@23.06.0	openpmd-api@0.15.1	quantum-espresso@7.2	umap@2.1.0
bricks@r0.1	ginkgo@1.6.0	legion@23.06.0	papi@6.0.0.1	raja@2022.10.4	umpire@2022.03.1
bricks@r0.1	ginkgo@1.6.0	libcatalyst@2.0.0-rc3	papi@6.0.0.1	raja@2022.10.4	umpire@2022.03.1
butterflypack@2.2.2	globalarrays@5.8.2	libnrm@0.1.0	papyrus@1.0.2	rempi@1.1.0	unifyfs@1.1
cabana@0.5.0	gmp@6.2.1	libpressio@0.95.1	parallel-netcdf@1.12.3	scr@3.0.1	upcxx@2023.3.0
cabana@0.5.0	gotcha@1.0.4	libquo@1.3.1	paraview@5.11.1	slate@2022.07.00	upcxx@2023.3.0
caliper@2.10.0	gptune@4.0.0	libunwind@1.6.2	paraview@5.11.1	slate@2022.07.00	veloc@1.6
caliper@2.10.0	h5bench@1.4	loki@0.1.7	parsec@3.0.2209	slepc@3.19.1	vtk-m@2.0.0
chai@2022.03.0	hdf5@1.14.2	magma@2.7.1	parsec@3.0.2209	slepc@3.19.1	vtk-m@2.0.0
chai@2022.03.0	hdf5-vol-async@1.7	mercury@2.3.0	pdtd@3.25.1	stc@0.9.0	wannier90@3.1.0
charliecloud@0.33	hdf5-vol-cache@v1.1	metall@0.25	petsc@3.19.4	strumpack@7.1.3	xyce@7.6.0
conduit@0.8.8	hdf5-vol-log@1.4.0	mfem@4.5.2	petsc@3.19.4	strumpack@7.1.3	zfp@1.0.0
cuda@11.8.0	heffte@2.3.0	mfem@4.5.2	phist@1.11.2	sundials@6.5.1	zfp@1.0.0
darshan-runtime@3.4.4	heffte@2.3.0	mgard@2023-03-31	plasma@22.9.29	sundials@6.5.1	

==> 161 installed packages

Singularity> spack find +cuda

-- linux-ubuntu20.04-aarch64 / gcc@11.4.0 -----

adios2@2.9.1	camp@2022.10.1	heffte@2.3.0	kokkos@4.1.00	mfem@4.5.2	petsc@3.19.4	superlu-dist@8.1.2
amrex@23.08	camp@2022.10.1	hpctoolkit@2023.03.01	kokkos@4.1.00	mgard@2023-03-31	petsc@3.19.4	tasmanian@7.9
arborx@1.4.1	chai@2022.03.0	hpx@1.9.1	kokkos-kernels@4.0.00	nvcomp@2.2.0	raja@2022.10.4	tau@2.32.1
blaspp@2023.06.00	dealii@9.4.2	hwloc@2.9.1	lammps@20230802	omega-h@9.34.13	slate@2022.07.00	trilinos@14.4.0
bricks@r0.1	flecsi@2.2.1	hypre@2.29.0	lapackpp@2023.06.00	papi@6.0.0.1	slepc@3.19.1	umpire@2022.03.1
cabana@0.5.0	flux-core@0.53.0	kokkos@4.0.00	legion@23.06.0	paraview@5.11.1	strumpack@7.1.3	upcxx@2023.3.0
caliper@2.10.0	ginkgo@1.6.0	kokkos@4.1.00	magma@2.7.1	parsec@3.0.2209	sundials@6.5.1	vtk-m@2.0.0

==> 50 installed packages

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 0.21.0 hosted at U. Oregon

E4S Build Cache for Spack 0.21.0

To add this mirror to your Spack:

```
$> spack mirror add E4S https://cache.e4s.io  
$> spack buildcache keys -it
```

107,603 total packages
Last updated 2023-08-31 9:41 PST

All Arch PPC64LE X86_64 AARCH64

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

Search

[adiak@0.1.1](#) [adiak@0.2.1](#) [adiak@0.2.2](#) [adios2@2.5.0](#) [adios2@2.6.0](#) [adios2@2.7.0](#) [adios2@2.7.1](#) [adios2@2.8.0](#) [adios2@2.8.3](#)
[adios@1.13.1](#) [adlbox@0.9.2](#) [adlbox@1.0.0](#) [adol-c@2.7.2](#) [alquimia@1.0.10](#) [alquimia@1.0.9](#) [alsa-lib@1.2.3.2](#) [amg@1.2](#) [aml@0.1.0](#)
[aml@0.2.0](#) [amr-wind@ascent](#) [amr-wind@main](#) [amrex@20.07](#) [amrex@20.09](#) [amrex@20.10](#) [amrex@20.11](#) [amrex@20.12](#) [amrex@21.01](#)
[amrex@21.02](#) [amrex@21.03](#) [amrex@21.04](#) [amrex@21.05](#) [amrex@21.06](#) [amrex@21.07](#) [amrex@21.08](#) [amrex@21.09](#) [amrex@21.10](#)
[amrex@21.11](#) [amrex@21.12](#) [amrex@22.01](#) [amrex@22.02](#) [amrex@22.03](#) [amrex@22.04](#) [amrex@22.05](#) [amrex@22.08](#) [amrex@22.11](#)
[antlr@1.10.0](#) [antlr@1.10.7](#) [antlr@2.7.7](#) [apcomp@0.0.4](#) [arborx@0.9-beta](#) [arborx@1.0](#) [arborx@1.1](#) [arborx@1.2](#) [arborx@1.3](#)
[archer@2.0.0](#) [argobots@1.0](#) [argobots@1.0rc1](#) [argobots@1.0rc2](#) [argobots@1.1](#) [argobots@main](#) [arpack-ng@3.7.0](#) [arpack-ng@3.8.0](#)
[ascent@0.6.0](#) [ascent@0.7.0](#) [ascent@0.7.1](#) [ascent@0.8.0](#) [ascent@develop](#) [ascent@pantheon_ver](#) [asio@1.16.1](#) [asio@1.18.2](#) [asio@1.20.0](#)
[asio@1.21.0](#) [assimp@4.0.1](#) [assimp@5.0.1](#) [assimp@5.1.4](#) [assimp@5.2.2](#) [assimp@5.2.3](#) [assimp@5.2.4](#) [at-spi2-atk@2.38.0](#)

- Over 100K binaries!
- No need to recompile from source code.

E4S AWS image: US-West2 (OR)

The screenshot displays a desktop environment with several windows:

- ParaView 5.9.0:** Shows a 3D visualization of a mesh with a color scale for 'pressure' ranging from 0.0e+00 to 1.2e-38. The interface includes a Pipeline Browser, Properties panel, and a 3D view.
- TAU: ParaProf: Statistics for: node 0 - tauprofile.xml:** A table showing performance metrics for various components.

Name	Exclusive TI...	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
- Terminal:** Shows the output of the 'singularity run' command, listing installed modules such as 'adiak/0.2.1-4vc', 'amrex/21.11-rocml-6cm', and 'parmetis/4.0.3-vhi'.

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 options.
- KLayout 0.28.5**: A layout editor window showing a 3D rendering of a golden sphere with a large black letter 'K' on its surface.
- Terminal**: A terminal window showing the installation and configuration of EDA tools. The commands and output are as follows:

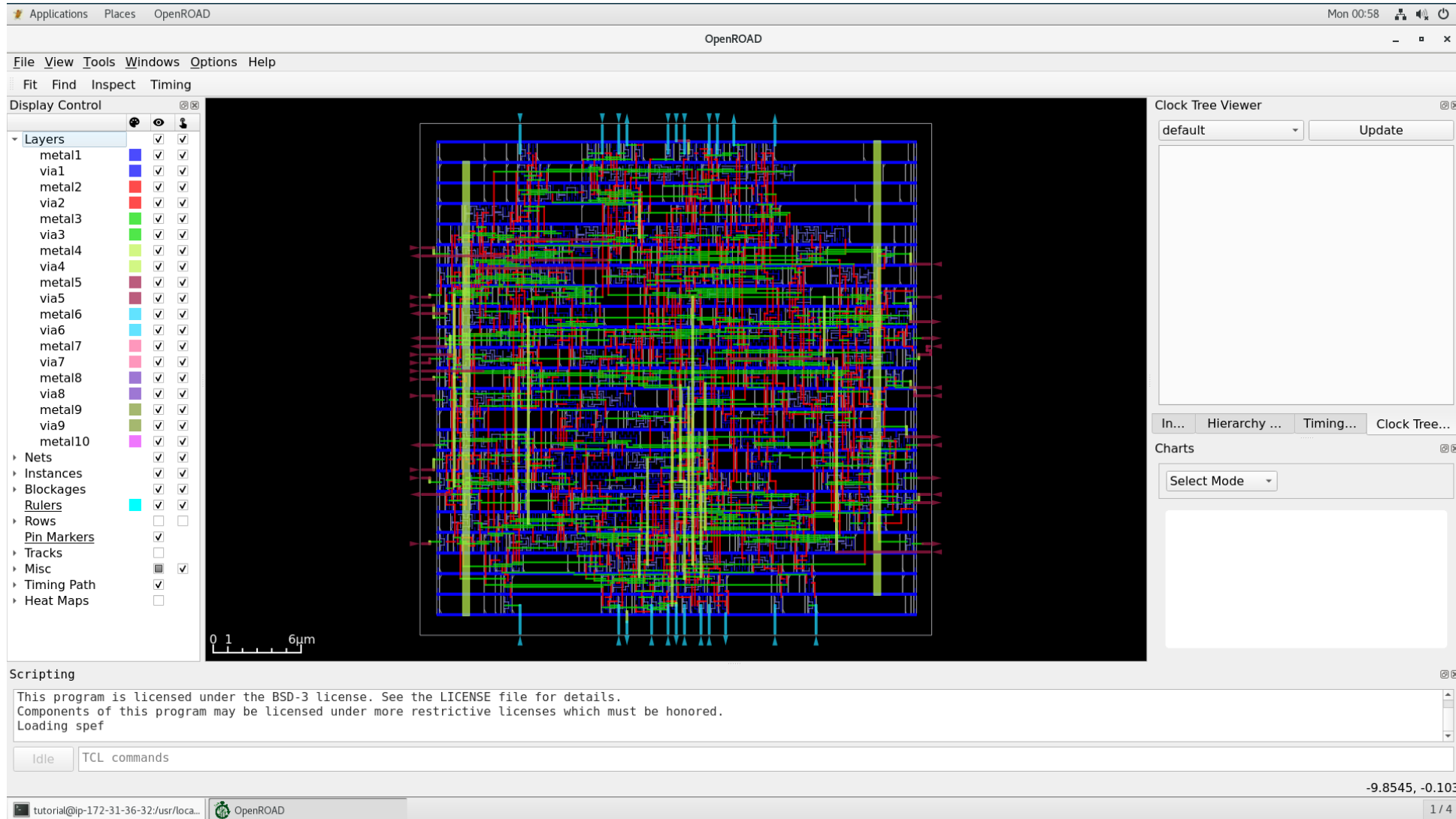

```
[tutorial@ip-172-31-43-167 eda]$ module load eda
[tutorial@ip-172-31-43-167 eda]$ pwd
/usr/local/packages/eda
[tutorial@ip-172-31-43-167 eda]$ ls
act-022223          netgen-1.5          qucs-s-0.0.23
adms-022223        ngspice-39          rggen-021423
boost-1.80.0       nvc-021423          riscv-gnu-toolchain-rv32ia-021423
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           qrouter-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.

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
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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

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	Padring	https://github.com/donn/padring
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

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 displays the GitHub repository page for `E4S-Project/e4s-cl`. The repository is public and has 11 stars and 1 fork. The main content area shows a list of files and folders with their commit history:

File/Folder	Commit Message	Time
<code>.github/workflows</code>	Updated python	10 months ago
<code>assets/images</code>	Proper image conversion	last year
<code>docs</code>	Sameer report sync	last month
<code>e4s_cl</code>	Allow non-existing paths to source scripts	last month
<code>scripts</code>	Merge branch 'makefile-cleanup' into init-update	last month
<code>tests</code>	Merge branch 'makefile-cleanup' into init-update	last month
<code>.coveragerc</code>	Introduced the coverage tool	last year
<code>.gitignore</code>	Replace setup.py with pyproject.toml	2 months ago
<code>.gitlab-ci.yml</code>	added .gitlab-ci.yml file in order to use gitlab's continuous inte...	8 months ago
<code>.readthedocs.yaml</code>	Adapt documentation build to PEP518	2 months ago
<code>CHANGELOG</code>	Update CHANGELOG	last month
<code>LICENSE</code>	Updated LICENSE	2 years ago

The right sidebar shows the repository's metadata, including the description "Container manager for E4S", the documentation link `e4s-cl.readthedocs.io`, and a list of related technologies: containers, mpi, singularity-container, shifter, podman, apptainer, and e4s. The "Releases" section shows 9 releases, with the latest release, "E4S-CL release v1.0.2", highlighted in a blue box. This release was published on Mar 31 and is marked as the "Latest" version.

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

Release of custom E4S images: Waggle and SAGE projects

The screenshot shows the Docker Hub page for the repository `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 tags with columns for TAG, OS/ARCH, LAST PULL, and COMPRESSED SIZE. The 'latest' tag is highlighted with a blue border.

TAG	OS/ARCH	LAST PULL	COMPRESSED SIZE
latest	linux/amd64	3 days ago	9.15 GB
	linux/arm64	3 days ago	1.58 GB

`% docker pull ecpe4s/waggle-ml`

The screenshot shows the Argonne National Laboratory website for the SAGE project. The page title is "SAGE: A Software-Defined Sensor Network". The text describes SAGE as 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 the Argonne National Laboratory logo, navigation menus for CAREERS, NEWS, EVENTS, STAFF DIRECTORY, RESEARCH, WORK WITH US, COMMUNITY, and ABOUT US. A sidebar on the right lists navigation options for the MCS Division, including About MCS, Research, News, Events, and Publications. Social media sharing icons for Facebook, Twitter, LinkedIn, and Email are also present. The project status is listed as "Active".

SAGE: A Software-Defined Sensor Network

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

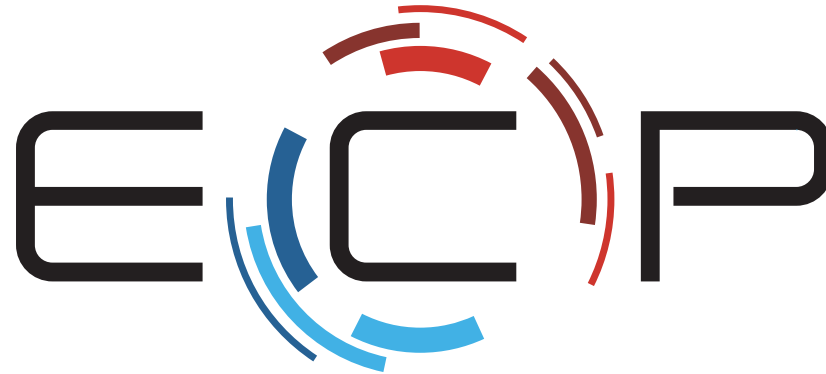
SAGE
A Software-Defined Sensor Network
Cyberinfrastructure for AI at the Edge

www.sagecontinuum.org

Thank you

<https://www.exascaleproject.org>

This research was supported by the Exascale Computing Project (17-SC-20-SC), a joint project of the U.S. Department of Energy's Office of Science and National Nuclear Security Administration, responsible for delivering a capable exascale ecosystem, including software, applications, and hardware technology, to support the nation's exascale computing imperative.



EXASCALE COMPUTING PROJECT

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

