

E4S: The Extreme-scale Scientific Software Stack Release 23.02



Release 23.02 notes

February 28, 2023

E4S 23.02: What's New?

- E4S supports Hopper architecture H100 (sm90) GPUs from NVIDIA with CUDA 12.0 and NVHPC 23.1
 - AI/ML frameworks such as TensorFlow and PyTorch support for A100 as well as H100 GPUs is integrated in E4S 23.02
- E4S supports a Julia software stack:
 - CUDA
 - MPI
- E4S supports EDA tools
 - Xyce in containers on x86_64, ppc64le, aarch64
 - Cloud EDA on AWS [<https://e4s.io/eda>] with 50+ EDA tools (Xschem, Xyce, OpenROAD, OpenFASOC, OpenLane, ...)
- E4S supports and ships with ROCm 5.4.3 with support for MI100 as well as MI210/MI250X AMD GPUs
 - AI/ML frameworks TensorFlow and PyTorch support these new GPU architectures with ROCm 5.4.3
- E4S supports updates to 106 HPC packages on x86_64, aarch64, and ppc64le
- 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).
- 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_Jan23.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 23.02 released on February 28, 2023: https://e4s.io/talks/E4S_23.02.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 a single distribution
- 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



<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



E4S 23.02 container images now available!
See [Downloads](#) for more information on E4S 23.02.

What is E4S?

The Extreme-scale Scientific Software Stack (E4S) is a community effort to provide open source software packages for developing, deploying and running scientific applications on high-performance computing (HPC) platforms. E4S provides from-source builds and containers of a [broad collection of HPC software packages](#).

E4S Download from https://e4s.io



Acquiring E4S Containers

The current E4S container offerings include Docker images based on Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, Ubuntu 18.04 (Bionic), and Ubuntu 20.04 (Focal Fossa) for Continuous Integration. Our images can run on X86_64, PPC64LE, and AARCH64 depending on the particular image. Our full E4S Release images (not for Continuous Integration) 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 23.02 Release Notes](#).



Container Releases



From source with Spack

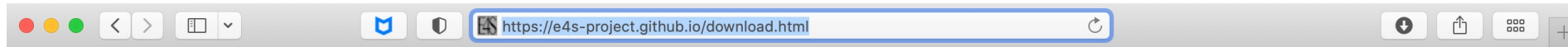
Download E4S 23.02 GPU Container Images: NVIDIA, AMD, Intel

- 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

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:

Download E4S 23.02 GPU Container Images: NVIDIA and AMD



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:23.02
```

```
# docker pull ecpe4s/e4s-rocm:23.02
```

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)


ecpe4s/e4s-rocm:23.02 


e4s-rocm-x86_64-23.02.sif 

NVIDIA CUDA (X86_64, PPC64LE, AARCH64)

ecpe4s/e4s-cuda:23.02 

e4s-cuda-x86_64-23.02.sif 

e4s-cuda-ppc64le-23.02.sif 

e4s-cuda-aarch64-23.02.sif 

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:23.02
- e4s-base-rocm-x86_64-23.02.sif mirror 1

NVIDIA Multi-Arch (X86_64, PPC64LE, AARCH64)

- ecpe4s/e4s-base-cuda:23.02 (highlighted with a blue box)
- e4s-base-cuda-x86_64-23.02.sif mirror 1
- e4s-base-cuda-aarch64-23.02.sif mirror 1
- e4s-base-cuda-ppc64le-23.02.sif mirror 1

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_64-23.02.sif mirror 1
- ecpe4s-ubuntu20.04-ppc64le-23.02.sif mirror 1
- ecpe4s-ubuntu20.04-aarch64-23.02.sif mirror 1

E4S 23.02 LLVM and CI images



LLVM DOE E4S Image

This image contains many E4S products compiled with LLVM-DOE@13 using Spack

ecpe4s/llvm-doe-e4s docker
e4s-llvm-x86_64.sif mirror 1 mirror 2

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 docker	ecpe4s/ubuntu22.04-runner-ppc64le	ecpe4s/ubuntu22.04-runner-aarch64
GitHub	docker GitHub	docker GitHub
ecpe4s/ubuntu20.04-runner-x86_64 docker	ecpe4s/ubuntu20.04-runner-ppc64le	ecpe4s/ubuntu20.04-runner-aarch64
GitHub	docker GitHub	docker GitHub
ecpe4s/ubuntu18.04-runner-x86_64 docker	ecpe4s/ubuntu18.04-runner-ppc64le	ecpe4s/rhel8-runner-aarch64 docker GitHub
GitHub	docker GitHub	
ecpe4s/rhel8-runner-x86_64 docker GitHub	ecpe4s/rhel8-runner-ppc64le docker GitHub	

E4S 23.02 Detailed Documentation for Bare-metal Installation



Extreme-scale Scientific Software Stack (E4S) version 23.02

Exascale Computing Project (ECP) Software Technologies (ST) software, Extreme-scale Scientific Software Stack (E4S) [v23.02](#), 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 v23.02 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 v23.02 Release Notes PDF.](#)

[E4S v23.02 Spack Environment Notes.](#)

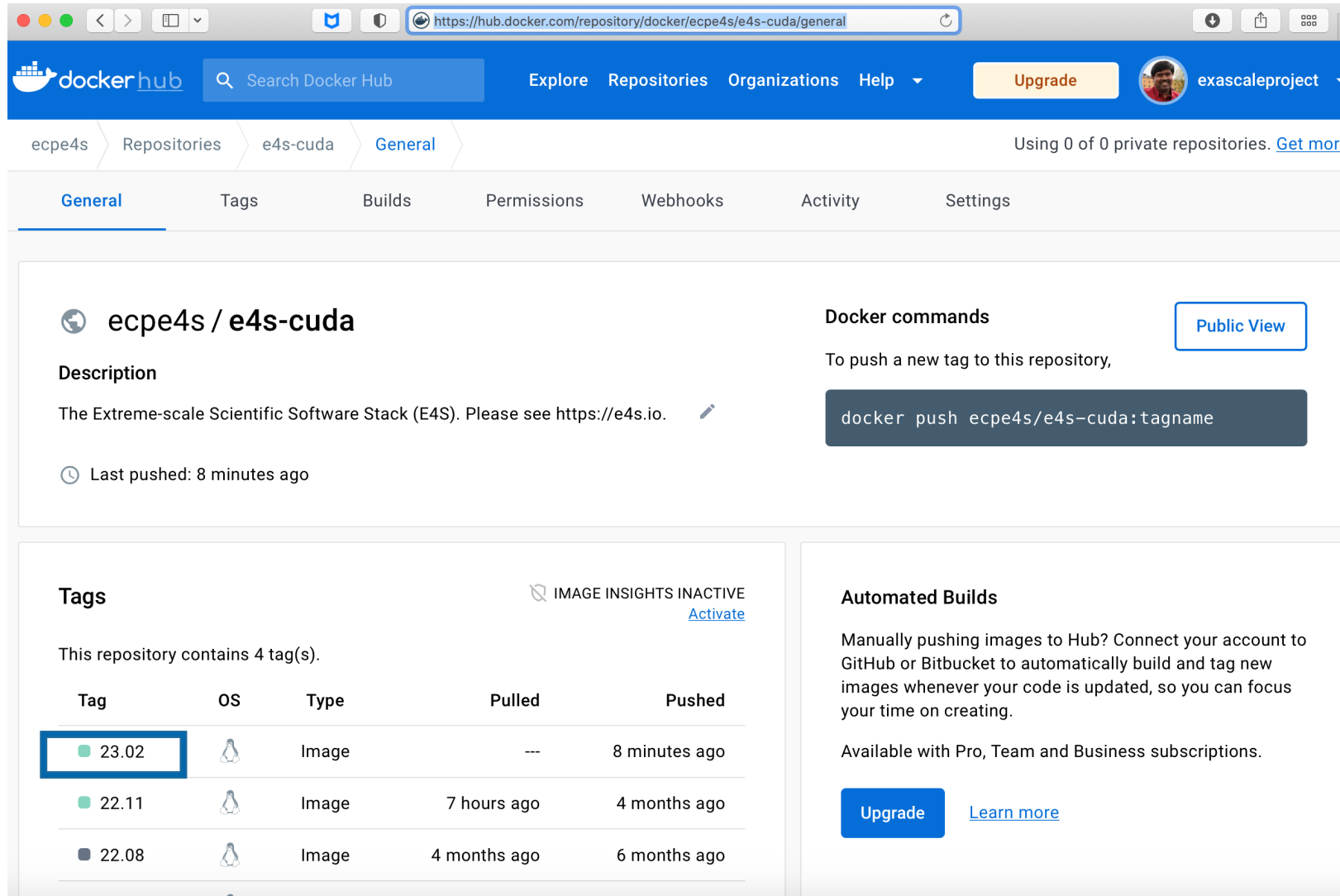
[E4S Manual Installation Instructions.](#)

[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 23.02 full featured container release on Dockerhub



The screenshot shows the Docker Hub interface for the repository `ecpe4s/e4s-cuda`. The page includes a navigation bar with the Docker Hub logo, a search bar, and links for Explore, Repositories, Organizations, and Help. The repository name is displayed as `ecpe4s / e4s-cuda` with a breadcrumb trail. Below the repository name, there are tabs for General, Tags, Builds, Permissions, Webhooks, Activity, and Settings. The main content area is divided into several sections: a description of the repository, Docker commands for pushing images, a list of tags, and information about automated builds. The `23.02` tag is highlighted in the tags list.

ecpe4s / e4s-cuda

Description

The Extreme-scale Scientific Software Stack (E4S). Please see <https://e4s.io>.

Last pushed: 8 minutes ago

Docker commands

To push a new tag to this repository,

```
docker push ecpe4s/e4s-cuda:tagname
```

Tags

IMAGE INSIGHTS INACTIVE [Activate](#)

This repository contains 4 tag(s).

Tag	OS	Type	Pulled	Pushed
23.02	Linux	Image	---	8 minutes ago
22.11	Linux	Image	7 hours ago	4 months ago
22.08	Linux	Image	4 months ago	6 months ago

Automated Builds

Manually pushing images to Hub? Connect your account to GitHub or Bitbucket to automatically build and tag new images whenever your code is updated, so you can focus your time on creating.

Available with Pro, Team and Business subscriptions.

[Upgrade](#) [Learn more](#)

E4S 23.02 full featured release on Dockerhub is multi-architecture

The screenshot shows the Docker Hub interface for the repository `ecpe4s/e4s-cuda`. The `Tags` tab is active, displaying a list of tags. The tag `23.02` is highlighted with a red box. Below the tag name, it indicates it was last pushed 9 minutes ago by `esw123`. A table lists the architectures and their compressed sizes for this tag. The tag `22.11` is also visible, last pushed 4 months ago, with its own table of architectures and sizes.

TAG	DIGEST	OS/ARCH	SCANNED	LAST PULL	COMPRESSED SIZE
23.02	bc56c453c8f2	linux/amd64	---	---	53.54 GB
	b3c6815c7664	linux/arm64/v8	---	---	44.75 GB
	3ae05ee81dc2	linux/ppc64le	---	---	40.41 GB
22.11	968cfc478e8d	linux/amd64	---	7 hours ago	44.61 GB
	482dd048cf67	linux/arm64/v8	---	---	28.66 GB
	5dddb0fb0b5c	linux/ppc64le	---	---	32.03 GB

Architectures:

- x86_64
- aarch64
- ppc64le

Software:

- CUDA 12.0
- NVHPC 23.1

E4S 23.02 base container release is multi-architecture as well

The screenshot shows the Docker Hub page for the repository `ecpe4s/e4s-base-cuda`. The page is titled "ecpe4s/e4s-base-cuda" and is updated 10 hours ago. It is described as "Extreme-scale Scientific Software Stack (E4S) [https://e4s.io] Ubuntu 20.04 image with CUDA." The repository has 159 pulls. The "Tags" tab is selected, showing a list of tags sorted by "Newest". The tag `23.02` is highlighted. Below the tag list, there is a table of tags with columns for TAG, DIGEST, OS/ARCH, SCANNED, LAST PULL, and COMPRESSED SIZE.

TAG	DIGEST	OS/ARCH	SCANNED	LAST PULL	COMPRESSED SIZE
23.02					
	7a81796486c0	linux/amd64	---	---	22.52 GB
	1dca2af44bf4	linux/arm64/v8	---	---	18.49 GB
	4560144b056d	linux/ppc64le	---	---	14.37 GB

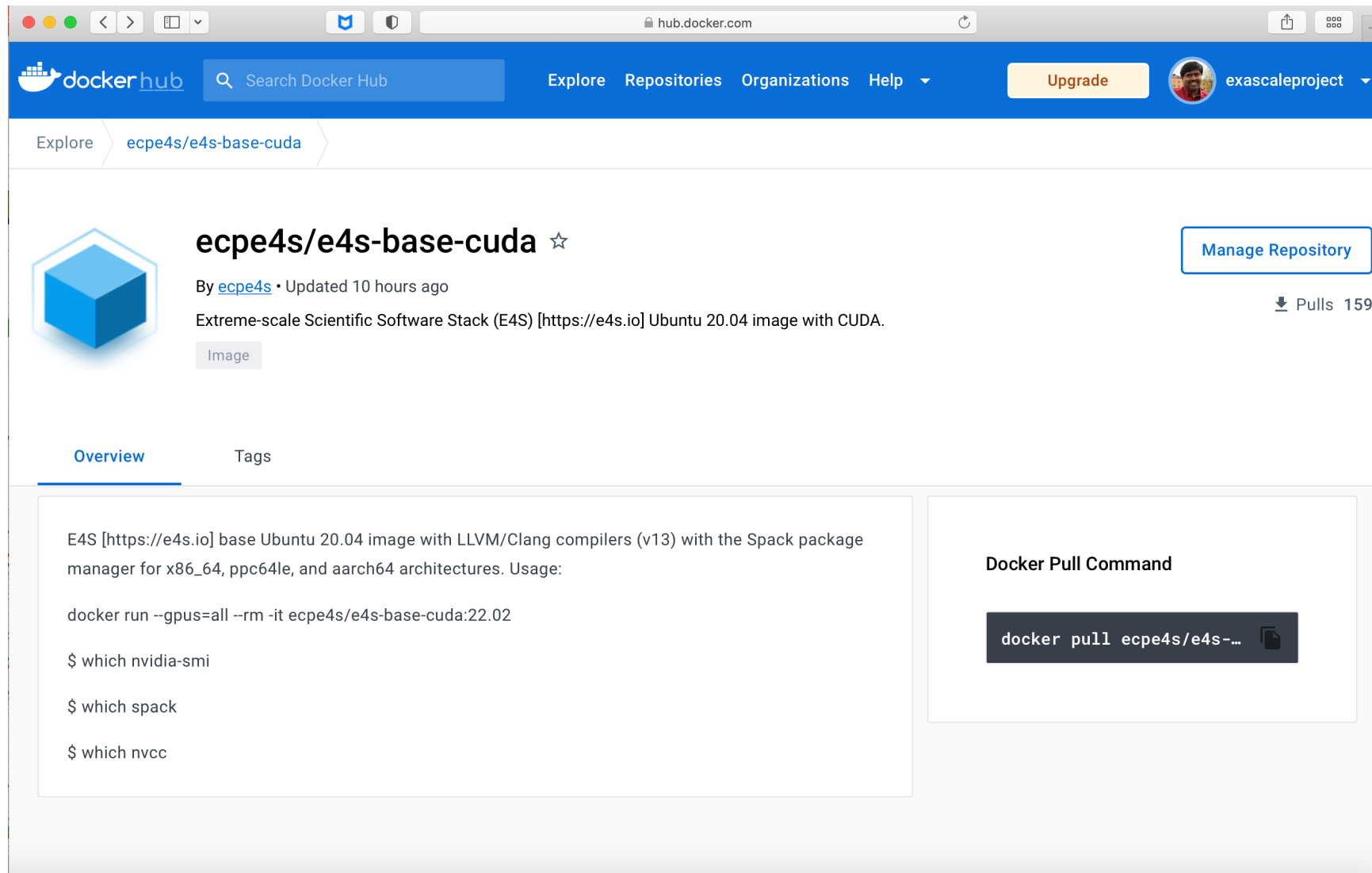
Architectures:

- x86_64
- aarch64
- ppc64le

Software:

- CUDA 12.0
- NVHPC 23.1

E4S 23.02 base container release on DockerHub



The screenshot shows the DockerHub page for the repository `ecpe4s/e4s-base-cuda`. The page includes a search bar, navigation links (Explore, Repositories, Organizations, Help), and a user profile for `exascaleproject`. The repository details section shows the repository name, a star icon, and a 'Manage Repository' button. Below this, it indicates the repository is by `ecpe4s` and was updated 10 hours ago. The description states it is an 'Extreme-scale Scientific Software Stack (E4S) [https://e4s.io] Ubuntu 20.04 image with CUDA.' There is a 'Pulls 159' indicator. The 'Overview' tab is active, showing a description of the E4S base Ubuntu 20.04 image with LLVM/Clang compilers (v13) and the Spack package manager for x86_64, ppc64le, and aarch64 architectures. Usage instructions are provided, including a `docker run` command and three `which` commands to verify the installation of `nvidia-smi`, `spack`, and `nvcc`. A 'Tags' tab is also visible. A 'Docker Pull Command' box contains the command `docker pull ecpe4s/e4s-...`.

Architectures:

- x86_64
- aarch64
- ppc64le

Software:

- CUDA 12.0
- NVHPC 23.1

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

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

- Create custom container images
- 1M+ downloads!

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

1: adios2	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/adios2-2.8.3-nubapcbybpwlgkin3rkko5izvfcsjsi5
2: alquimia	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/alquimia-1.0.10-od7x4tkdet73pfq4besx77csydguw3wf
3: aml	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/aml-0.2.0-inr7dxdl5ddocs522gnjqwfvhrnsf22un
4: amrex	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/amrex-23.02-s3xw2hy6ma3wx7dq6fgaxcv4izx5o7t7
5: arborx	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/arborx-1.3-nhu67mk22hg25q2stehtxpivkix4wpfq
6: archer	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/archer-2.0-fglk5kesgfmzgjtcjsr4dxumgtpkmy3
7: argobots	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/argobots-main-ofyr6ee43nejlz6z3ll7scq25xncmdgv
8: ascent	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/ascent-0.8.0-naiomvijdwsarev5kjsji6nhtproneys
9: axom	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/axom-0.7.0-shvk25oj3sbk7ddv5opw6ap5dqho7fgp
10: bolt	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/bolt-2.0-3osqry75nwhu2itp4udqj4xrqrdlxj3b
11: bricks	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/bricks-r0.1-ej6viooynwkuhll3x7a6t7u3lf7wzp4s
12: butterflypack	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/butterflypack-2.2.2-kplnowsy6nxfk3wc2mx5kifn37kyyic
13: cabana	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/cabana-0.5.0-lul72nwihipfnj7snw7riqenfk5aqzwc
14: caliper	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/caliper-2.9.0-cfoiwyzxvwchcc7xkse12ffkoosetsxu
15: chai	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/chai-2022.03.0-abollkdmz2hmxbtlnjrumbwzx57wesaa
16: charliecloud	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/charliecloud-0.30-vwuvo34pi264zmn3hnq2vt63irxdcdf
17: conduit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/conduit-0.8.6-rxg6cap3pncbryytdgnrmfsy25eywth
18: darshan-runtime	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/darshan-runtime-3.4.2-cciydntdlofmig2d2owb4hyvusxu3b
19: datatransferkit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/datatransferkit-3.1-rc3-fkxfbtbzc4lcltkau5xqrjgr664w7k
20: dealii	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/dealii-9.4.0-3xm3qzh5f77qaa26i6epkullrp3qdy4
21: dyninst	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/dyninst-12.2.1-h7cjc7atu6ppqm5de3luob34g23s6hpc
22: ecp-data-vis-sdk	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/ecp-data-vis-sdk-1.0-v5hsdt3ltighxzagpemt3xolokqupzdh
23: exaworks	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/exaworks-0.1.0-adwnmto76ml4jx3iwqesahws7u4wys7k
24: faodel	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/faodel-1.2108.1-cucsyvmftptykeckrizppl7daz5b2f7
25: flecsi	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/flecsi-2.1.0-2h23jn77e5acfeednpxerwmeutrza3rx
26: flit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/flit-2.1.0-bi5v4uhkzmayhrmumuj2w2on2yfp3z3u
27: flux-sched	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/flux-sched-0.26.0-h67gnvhilyblissrvluhdz5p4yyoj67
28: fortrilinos	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/fortrilinos-2.2.0-cozctrvtrgycyzg3eq3bj73xr7hayiey
29: gasnet	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/gasnet-2022.9.2-3butckp7jlpzphpoz6t5hdfjo62bzupxp
30: ginkgo	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/ginkgo-1.5.0-ldidl2tobha6ews36wk5anqdvhex2uf
31: globalarrays	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/globalarrays-5.8-4xbewu7l3cyxzxnhruwo5d2g3nahee2n
32: gotcha	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/gotcha-1.0.4-rtapu26myuembj7m5lmdabm27mchd3bj
33: gptune	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/gptune-3.0.0-rmddwp7d6nn67ddlace4mekkdwutaqs3
34: h5bench	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/h5bench-1.3-zo2fmcc2gmouj2fy6dclguekbvqyqfal
35: hdf5	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/hdf5-1.14.0-27iizuzgmi7klsicgigfylfuotbsrswl
36: hdf5-vol-async	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/hdf5-vol-async-1.4-rd5yyzhdbdruzjhl27j4bedccstq4fiq

GPU runtimes

- AMD (ROCm)
 - 5.4.3
- NVIDIA (CUDA)
 - 12.0
- NVHPC
 - 23.1

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

```
37: heffte /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/heffte-2.3.0-4wfa7cv2prc6jpwtslzqa5cjmttd3brkv
38: hpctoolkit /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/hpctoolkit-2022.10.01-qxddea0x47zfgwxdp2zkqvratgmhyrt
39: hpx /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/hpx-1.8.1-wypr35o7d2jpbnmulqx4ss5tjeh43n2b
40: hypre /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/hypre-2.27.0-d2q2ozmxjzc37sb6rm5ay5yin73mbqnu
41: kokkos /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/kokkos-3.7.01-ocpxne3dvrosu52lo5e6ghaa5pcddtco
42: kokkos-kernels /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/kokkos-kernels-3.7.00-mxomtbi224lptveit6bokvwpxonjc27n
43: lammps /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/lammps-20221103-kjssj627izystqyockyvjbz4trljrop
44: legion /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/legion-21.03.0-3erf2k5pmdmoknfustdn443b5yv5xni4
45: libnrm /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/libnrm-0.1.0-w722g5lvr3ootoh5j42j2zs4ug2yjsh2
46: libpressio /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/libpressio-0.90.2-ldyfdmdrb5mzuwh252vwonz34bqud6aq
47: libquo /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/libquo-1.3.1-v6gw2uicfoiofinmzu2g5rhnmfzsf7
48: magma /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/magma-2.7.0-viznxiabcbvbwq5jnvje5ah3rn73fgva
49: mercury /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/mercury-2.2.0-6g4akiqin3jin42yunsdbectpz5l3nk2
50: metall /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/metall-0.23.1-sgxcgbq4qxgyx67pvm4jasxgutz5l23
51: mfem /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/mfem-4.5.0-qnnwtoc25ctaa5mk6lzmsyxj2xuue5re
52: mpark-variant /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/mpark-variant-1.4.0-uvwp4sm2fwhluf4teegfr3hju5l5tbbp
53: mpich /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/mpich-4.1-v4dkt2ix3bqppjynewjxkudxfiubr7b
54: mpifileutils /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/mpifileutils-0.11.1-c2veonah2syuz4phk57mn6yzzxwmhdcds
55: nccmp /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/nccmp-1.9.0.1-ngf7ke5zu6wyzewknqmusmy2vpoa4ifw
56: nco /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/nco-5.0.6-r3xbxkvrkmdjy7vekswzpiakd7mhdbw
57: netlib-scalapack /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/netlib-scalapack-2.2.0-5t7gxddf25mbdxvirhpg55bjoxc3y2k3
58: nrm /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/nrm-0.1.0-afxxttsabuhyjxvkgb6s44mesqdgaa6
59: omega-h /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/omega-h-9.34.13-obxpqlhpxpdctyvarthqepadiz44x5
60: openmpi /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/openmpi-4.1.4-gohyy3buwvtpvkrpisvej2iorqchnyzj
61: openpm�-api /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/openpm�-api-0.14.5-3in2543a4vfj4fewn7yjsfruaunbc5la
62: papi /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/papi-6.0.0.1-achx3tknnj2x5c5e7hx665apu3nynrmg
63: papyrus /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/papyrus-1.0.2-ayurdsox6t5wgks3vqc764z2hyinn2q5f
64: parallel-netcdf /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/parallel-netcdf-1.12.3-nznwrmp5iveotx62d47r7ctxquln7fqr
65: paraview /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/paraview-5.11.0-r3yq6hhuadnjufymbb632gjhidrxw53s
66: parsec /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/parsec-3.0.2209-g6p5llbgwghmpdjudxq3pm7i4chzsehd
67: pdt /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/pdt-3.25.1-lx67nrs24pkbnmj7am3t75swtowtfc5
68: petsc /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/petsc-3.18.3-wbx3oqmsogsk5celdhrdeixrbdsk6h3
69: phist /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/phist-1.11.2-ly3rm7wgjkd5rt pods42xcikw57ib2tk
70: plasma /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/plasma-22.9.29-a2w75e6l3vpeavtescidtqomqhna32l2
71: plumed /spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/plumed-2.8.1-75zn4e6akike5luf7d2bx6lbqvzujcmf
```

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

72: precice	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/precice-2.5.0-d75k3norm5smtgupyerul2zg77gewbq6
73: pumi	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/pumi-2.2.7-vtyyseohxw3c45yruhazpjhdhqp6ysex
74: py-cinemasci	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/py-cinemasci-1.3-eivaemojwnpgqsbusvrxpm7pkbvurrz7
75: py-jupyterhub	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/py-jupyterhub-1.4.1-nreb3q3wcczveo6zqw2zsqqiitgzlzfz
76: py-libensemble	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/py-libensemble-0.9.3-giornxmpnhh5dqes6lrjetg4lodvskdq
77: py-parsl	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/py-parsl-1.1.0-gmuzq4joeoobocxxh2w2656r3ga7vnr2
78: py-radical-saga	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/py-radical-saga-1.20.0-p4nvjdbz4aq727dsglwx2oedsnunhpsf
79: qthreads	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/qthreads-1.16-unsqzwmofxfr2bxhh24kh5rtfsgpwtem
80: quantum-espresso	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/quantum-espresso-7.1-kifrbk3grb4wryui3hwm7uxqarwpmjcl
81: raja	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/raja-2022.03.0-iaqvhwjthlmkjis2oyv5zifatwbjdp1
82: scr	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/scr-3.0.1-c6wuntarletoorrtki22lxutoodzri
83: slate	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/slate-2022.07.00-qe4fshhoyq3nutk3hpwbb55ci4xwztjt
84: slepc	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/slepc-3.18.2-v3aywpinj2nttfn6523lscjnal6rod3h
85: stc	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/stc-0.9.0-e3j5k45z6pbhky3tnz6ra4u34thbtjux
86: strumpack	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/strumpack-7.0.1-5a4spgocgkx6czoczcpb5jq6giw4f2a5
87: sundials	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/sundials-6.4.1-lxndi2jv64a7k2e45vokm6nzet76ujuv
88: superlu-dist	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/superlu-dist-8.1.2-mxp6x3svae7iihadikv3j4knfy3lt3fm
89: swig	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/swig-4.1.1-jnv74fa2osnbsvq3t5flhzbtuusqs5ry
90: sz	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/sz-2.1.12.2-j6a5qlch333v5db2jez7np36kfyqm5o
91: tasmanian	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/tasmanian-7.9-okxdjiopltizbo5iz2myu7dmpne52ses
92: tau	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/tau-2.32-zi7e6lcmysxmtddxpgj66zatwpt2ydd
93: trilinos	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/trilinos-13.4.1-x7hgo3xqfpmleyyeyqtmlh2llkfb5y7b
94: turbine	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/turbine-1.3.0-snfqzs6cuisfiq3u3rzpwm7p7sywpdbf
95: umap	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/umap-2.1.0-pcbzfhdfdgeifzm5xpsdsxfophmgfnyo
96: umpire	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/umpire-2022.03.1-dvb7ewnskq2l7qxi6jlfafaqxzlkr4q5
97: unifyfs	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/unifyfs-1.0.1-nvyafa6ywgzkgti7xw5abhb3c72ay5fx
98: upcxx	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/upcxx-2022.9.0-z2v2rs6jtegdm6vqc6y67g4vz146tbrf
99: variorum	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/variorum-0.6.0-gaxplhylvbvh2kap6fonqcovopqf5z2
100: veloc	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/veloc-1.6-yktuomgkxkr2e6znpjqr37ndqbulbadq
101: visit	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/visit-3.2.2-faqkznlvldztxeqlreackl3kbaqujcvp
102: vtk-m	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/vtk-m-1.9.0-ijy7ak5nqbvb2d7uvbenysigrdln2n
103: wannier90	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/wannier90-3.1.0-pxcs6esoy6dhjxdcbpc6motxqmy5milg
104: warpx	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/warpx-23.01-mdiv64h3yxblpekn2pjq3v2pdxzvm6v
105: xyce	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/xyce-7.5.0-ds5oq7hncqe32j5xgm3ajp5txnj4gyn6
106: zfp	/spack/opt/spack/linux-ubuntu20.04-x86_64/gcc-11.1.0/zfp-1.0.0-zcp6zihh33r2tlgqxyeqpsas6zytjcg

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 Support for CUDA variants on x86_64

```
[Singularity> spack find +cuda cuda_arch=80
```

```
-- linux-ubuntu20.04-x86_64 / gcc@11.1.0 -----  
adios2@2.8.3      camp@2022.03.2    heffte@2.3.0      lapackpp@2022.07.00  raja@2022.03.0    trilinos@13.4.1  
amrex@23.02      chai@2022.03.0    hpx@1.8.1         magma@2.7.0         slate@2022.07.00  umpire@2022.03.1  
arborx@1.3       dealii@9.4.0      hypre@2.27.0      mfem@4.5.0         slepc@3.18.2      vtk-h@0.8.1  
ascent@0.8.0     ecp-data-vis-sdk@1.0  kokkos@3.7.00    omega-h@9.34.13    strumpack@7.0.1   vtk-m@1.7.1  
blaspp@2022.07.00 flecsi@2.1.0      kokkos@3.7.01    paraview@5.11.0    sundials@6.4.1    vtk-m@1.9.0  
caliper@2.9.0    ginkgo@1.5.0      kokkos@3.7.01    petsc@3.18.3       superlu-dist@8.1.2  zfp@0.5.5  
camp@2022.03.2   hdf5-vfd-gds@1.0.2  kokkos-kernels@3.7.00  py-torch@1.13.1    tasmanian@7.9  
==> 41 installed packages
```

```
[Singularity> spack find +cuda cuda_arch=90
```

```
-- linux-ubuntu20.04-x86_64 / gcc@11.1.0 -----  
blaspp@2022.07.00  chai@2022.03.0  heffte@2.3.0      mfem@4.5.0      raja@2022.03.0    sundials@6.4.1  
caliper@2.9.0     dealii@9.4.0    hpx@1.8.1         omega-h@9.34.13  slate@2022.07.00  superlu-dist@8.1.2  
camp@2022.03.2    flecsi@2.1.0    hypre@2.27.0      petsc@3.18.3    slepc@3.18.2     tasmanian@7.9  
camp@2022.03.2    ginkgo@1.5.0    lapackpp@2022.07.00  py-torch@1.13.1  strumpack@7.0.1  umpire@2022.03.1  
==> 24 installed packages
```

```
Singularity> █
```

E4S 23.02 adds support for NVIDIA A100 (sm80) as well as H100 (sm90) GPUs!

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

```
[Singularity> spack find +rocm amdgpu_target=gfx90a
-- linux-ubuntu20.04-x86_64 / gcc@11.1.0 -----
amrex@23.02      chai@2022.03.0    hpx@1.8.1        paraview@5.11.0   strumpack@7.0.1   umpire@2022.03.1
arborx@1.3      ecp-data-vis-sdk@1.0 hypre@2.27.0     petsc@3.18.3     sundials@6.4.1   upcxx@2022.9.0
blaspp@2022.07.00 gasnet@2022.9.2  kokkos@3.7.01    raja@2022.03.0   superlu-dist@8.1.2 vtk-m@1.9.0
camp@2022.03.2  ginkgo@1.5.0     lapackpp@2022.07.00 slate@2022.07.00 tasmanian@7.9
camp@2022.03.2  heffte@2.3.0     magma@2.7.0      slepc@3.18.2     trilinos@13.4.1
==> 28 installed packages
[Singularity> spack find +rocm amdgpu_target=gfx908
-- linux-ubuntu20.04-x86_64 / gcc@11.1.0 -----
amrex@23.02      chai@2022.03.0    hpx@1.8.1        paraview@5.11.0   strumpack@7.0.1   umpire@2022.03.1
arborx@1.3      ecp-data-vis-sdk@1.0 hypre@2.27.0     petsc@3.18.3     sundials@6.4.1   upcxx@2022.9.0
blaspp@2022.07.00 gasnet@2022.9.2  kokkos@3.7.01    raja@2022.03.0   superlu-dist@8.1.2 vtk-m@1.9.0
camp@2022.03.2  ginkgo@1.5.0     lapackpp@2022.07.00 slate@2022.07.00 tasmanian@7.9
camp@2022.03.2  heffte@2.3.0     magma@2.7.0      slepc@3.18.2     trilinos@13.4.1
==> 28 installed packages
Singularity> █
```

E4S 23.02 adds support for AMD MI100 (gfx908) as well as MI250X (gfx90a) GPUs!

E4S Support for AI/ML frameworks with 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__
'2.11.0'
[>>> import torch
[>>> torch.__version__
'1.13.1'
[>>> torch.cuda.get_device_name(torch.cuda.current_device())
'NVIDIA H100 PCIe'
>>> □
```

E4S 23.02 supports H100 GPUs with TensorFlow and PyTorch!

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

```
1: adios2 /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/adios2-2.8.3-3fnxmdf3k3ikgu5z4w6jdvu22qr2kmuo
2: alquimia /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/alquimia-1.0.10-7p5izcaumienrnoeywaj3yn4ekqzxy
3: aml /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/aml-0.2.0-k3qoshcfi7lcfcaak3zwc743fcgx7rbx
4: amrex /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/amrex-23.02-ht3i4k3sxscjk7kpu4ompxp73i3gzicx
5: arborx /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/arborx-1.3-qsmnqjoforx6ixbjw64vwhavr3gvqvl
6: archer /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/archer-2.0.0-rr27rmq6zlgxfulep5wgzeocngt3shvv
7: argobots /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/argobots-main-jd3kjxsmgfenoqthza55bbnqlie7njkk
8: ascent /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ascent-0.8.0-07bfe5w3sfauxli6ieouzt3wchdwkgaq
9: axom /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/axom-0.7.0-hkcs75sgfx6pmzj4qztunxm7pfbhgs
10: bolt /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/bolt-2.0-2thdzkc3vtqofvdmocxsohpwdfmuwcca
11: butterflypack /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/butterflypack-2.2.2-z5h2oovx6gqkgeajncn3wbogat74njb
12: cabana /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/cabana-0.5.0-0aq5hkzzasd2635mvdvuhgxiuptzqgxp
13: caliper /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/caliper-2.9.0-bs3oajtfnhkyz4c7qdh7fgizqvnwxhm
14: chai /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/chai-2022.03.0-2g4vadbrrihmopdidiz7afyde6hhmjz
15: charliecloud /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/charliecloud-0.30-zapmcbpmws4o3sh7x4xgaukgbsabyciu
16: conduit /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/conduit-0.8.6-gxoays5dlf52yfon7qugunefibiv52
17: darshan-runtime /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/darshan-runtime-3.4.2-cbnodic6dcant7ydmxmtck32acp5tstd
18: datatransferkit /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/datatransferkit-3.1-rc3-jz5cu7llzem5gdszrzhzc55z5lcm5da5
19: dyninst /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/dyninst-12.2.1-nl5cijb4qlqzo5rev47pyxsg6rksulct
20: ecp-data-vis-sdk /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ecp-data-vis-sdk-1.0-uul24ntg6vvtfxukghnm2j4cloqbkro2
21: exaworks /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/exaworks-0.1.0-5d7iztblfyqs6ogmrfbdhztfcg2ldv6
22: faodel /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/faodel-1.2108.1-zjbhstr7pflzbrfxkuzbjyhwhbkcta7
23: flecsi /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flecsi-2.1.0-jt4zixen2qtpbls33gs3hcnsrbbjyw2w
24: flit /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flit-2.1.0-lwoh6mb5qukv3z3xhi2eok5i4dggdw2z
25: flux-sched /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/flux-sched-0.26.0-scwzowmjfdgstyvv4g6nqpxccfmyyf
26: fortrilinos /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/fortrilinos-2.2.0-s3vsdt5r25qbhfmw4gqj4g6cjinvcap46
27: gasnet /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gasnet-2022.9.2-cdddbclbrdivk2umogveyszcyygsv432
28: ginkgo /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/ginkgo-1.5.0-eddbyedjjexhspm3ukfh7dedydfcbrj7
29: globalarrays /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/globalarrays-5.8-xq2kqc775qab5s5tw4umszvrwjudpyv4
30: gotcha /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gotcha-1.0.4-2iikt3dito7pazr2euixcfgkssv52t2c
31: gptune /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/gptune-3.0.0-ypp6vwbfdk2g5cdzsgvzuomciaszx42i
32: h5bench /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/h5bench-1.3-il35zrekj6x3v3ui24obfzvqayuzqp4
33: hdf5 /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-1.14.0-ae3kowljffrgg2s2z6zchk5g3i6rfa6c
34: hdf5-vol-async /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hdf5-vol-async-1.4-ehehrb6tuy77smjyf5zs47fiypnaccs3
35: heffte /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/heffte-2.3.0-g4fscfuikh5kpslrnugmk3u7j4nmnzre
36: hpctoolkit /spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hpctoolkit-2022.10.01-rk6vi5k7rrucfy6stgsgzo5s55upmirh
```

GPU runtimes for IBM Power

- CUDA 12
- NVHPC 23.1

Languages

- Julia with MPI and CUDA
- Python

EDA Tools

- Xyce

AI packages for NVIDIA GPU

- TensorFlow
- PyTorch

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

37: hpx	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hpx-1.8.1-sz5gykq7azz2b2hmkliflgirlfl6rbce
38: hypre	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/hypre-2.27.0-jkkhvok4mb477yuh4yuh5llwg63g6uqx
39: kokkos	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/kokkos-3.7.01-ov4nnz7d57gs3ijp5obk2rjvw4vsp6gn
40: kokkos-kernels	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/kokkos-kernels-3.7.00-nwmj4dcs4zgf3ul3fzvpwi7wekn6uhlf
41: lammps	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/lammps-20221103-jr3rds5tfvh7k5c3f3nslokqmpqhdt6
42: legion	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/legion-21.03.0-pa4x27plz72z3yf54xykjhl4mb7htoyo
43: libnrm	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libnrm-0.1.0-scw77754mhcsfn7oxhkpgylcra5fteep
44: libpressio	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libpressio-0.90.2-k52y2rkalqdx45gyf3owrv4k2ov73dsn
45: libquo	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/libquo-1.3.1-aw45a7s3mflzcr5i6dtnwrzv2l3mlpb
46: magma	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/magma-2.7.0-qcnxaj3lfvvr35jpuolzwhv65a7k3mji
47: mercury	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mercury-2.2.0-5pfvrkk3uqumew5eqzsbsgexzbxkjwez
48: metall	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/metall-0.23.1-fs55t7vqb32e32lileploiz5re76qr2k
49: mfem	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mfem-4.5.0-hqmotggjln3zv5gybzvz7qltqhdy6dtr
50: mpark-variant	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mpark-variant-1.4.0-unlxd5bslawng2rgg7mzeqailm7jxyzy
51: mpich	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mpich-4.1-caz2jxqxui6dwkllcut7pyuubzim7o76
52: mpifileutils	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/mpifileutils-0.11.1-jjhhdmd4ls6wuuq76o53mxxujbp7tk7
53: nccmp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nccmp-1.9.0.1-yltqk3dtylmmrzgc64asquncffp2igm
54: nco	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nco-5.0.6-s6h5qufwh2ndmqrjkdhnweak6pyg7bmw
55: netcdf-c	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/netcdf-c-4.9.0-e74drxychna74hziibgmovoulgdqil4c
56: netlib-scalapack	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/netlib-scalapack-2.2.0-2m7hru44xky4kdgpphckhfkyxp4jfmnq
57: nrm	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/nrm-0.1.0-e6smi65b3bs4tjppjykn4ukmenzunloo
58: omega-h	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/omega-h-9.34.13-t6shxc3rmbyafrsdiojzvr4q632cqem
59: openmpi	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/openmpi-4.1.4-ih7bzoel7lxbu4oknuksoocmncvx64v
60: openpm�-api	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/openpm�-api-0.14.5-oxa2uqzvwwaydmuwm7p573iudyxwvqa
61: papi	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/papi-6.0.0.1-xjug5fip2x5geakdjitmc4h5gzf2hqns
62: papyrus	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/papyrus-1.0.2-s4mpt3scmvyktakat3obhsieme6at5m5
63: parallel-netcdf	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/parallel-netcdf-1.12.3-yuy3atnhffb2mjxlztykljfubvnzrjtp
64: paraview	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/paraview-5.11.0-v3yxtfqqx5ujkqvhrbydmua4rqdlncr7
65: parsec	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/parsec-3.0.2209-5vym6yqnvasyymbbcmfhzhakvwj77c2mp
66: pdt	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/pdt-3.25.1-rsjchybcj2rqz3g7qmb2kwvf6pxfwjql
67: petsc	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/petsc-3.18.3-kw3ondyb53m6yrtokhhlfhxpewts4sh
68: phist	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/phist-1.11.2-yq7aum2d5yz6z23t3gawbnjh6ertybky
69: plasma	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/plasma-22.9.29-c74s5wv4x72as2tcwpzyfd4s7s7nn4dm
70: plumed	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/plumed-2.8.1-mggpvmb6wwkqoajxqf6nyykecwaufka4
71: precice	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/precice-2.5.0-5eizyuz7jphkssqnl6525judl7suf4t
72: pumi	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/pumi-2.2.7-x3kitqacxhtpioi2qjkkps4ydw33arnj

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

73:	py-cinemasci	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-cinemasci-1.3-l5s6teix3s33rptf3mug3piaoqafkyky
74:	py-jupyterhub	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-jupyterhub-1.4.1-5ushkvcpkith22jh3e2ogpql4omzf64
75:	py-libensemble	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-libensemble-0.9.3-zoct4wabl6jjkcetritrvfojft6s2vi
76:	py-parsl	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-parsl-1.1.0-j22rtxkucwqtcajjo6rlqsy7xbe52ti2
77:	py-radical-pilot	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-radical-pilot-1.20.0-b34p7wqwbwm23sajdfx2aqjilrugu6lv
78:	py-radical-saga	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/py-radical-saga-1.20.0-6wridazyrbmi3v22cbflkeq653bc6rka
79:	qthreads	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/qthreads-1.16-zgu6khhmxaasaqgcpp4qxs3h63xzzunt
80:	quantum-espresso	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/quantum-espresso-7.1-4htsxebxal6ngbjhhinh6jyatjkcrosf
81:	raja	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/raja-2022.03.0-zk7g22mqzpnfcptnobvfwlign64szzl5
82:	scr	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/scr-3.0.1-u5noc6h3fjfxkur7j2iihmvicvaibhgq
83:	slate	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/slate-2022.07.00-uyd6luj2ltjdnw6qukoqdalsqmyiccdm
84:	slepc	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/slepc-3.18.2-7z2hv4fayyfxkxrzovixnrxdk4s5ivbc
85:	stc	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/stc-0.9.0-i56537xhsswksxix64pybky2mstjmatk
86:	strumpack	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/strumpack-7.0.1-c4rzvqbg7mqadpfgz72ayw45ldfa6
87:	sundials	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/sundials-6.4.1-u7posdrvom6jpywkoenhxianxyhsnc6p
88:	superlu-dist	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/superlu-dist-8.1.2-w4atelx6t4vo37cdlybi2eh2a6s775x2
89:	swig	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/swig-4.1.1-vd2e67zxddsmpowdmqzifaruhiwezogj
90:	sz	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/sz-2.1.12.2-jmz7jngtvmoui5rkqcv7tlzspkh3baq3
91:	tasmanian	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/tasmanian-7.9-b4byfebe2irfqjpvxcu5nq5sqqllfyo25
92:	tau	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/tau-2.32-weovuw675deq564qe3zpz2irc6z6u3su
93:	trilinos	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/trilinos-13.4.1-pzejfobejmknscsb355lv7ovsrwv6ujan
94:	turbine	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/turbine-1.3.0-rvdipz5nq2hqk2mp7rd6kt7jmj3k3c7w
95:	umap	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/umap-2.1.0-dfplzphuupkwyhg4zb6w7nsftqyfsi2p
96:	umpire	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/umpire-2022.03.1-p5mkmidm7dgfts2akgbmmez3gyp4mlac
97:	unifyfs	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/unifyfs-1.0.1-mgbxxi6pq2p5qmchoxswbrbmfwvk6ve3
98:	upcxx	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/upcxx-2022.9.0-7kshcsvu563qj7akt7haqerekpfij7b5
99:	veloc	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/veloc-1.6-b2vuxi2nnjawmvodnmduxzi5k6mtiug
100:	visit	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/visit-3.2.2-kpkmu3znmo2dmfkqx2lqc5nkoqbw7tbq
101:	vtk-m	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/vtk-m-1.7.1-l3zdka6zgyvncdck6jl36t5py5emywzx
102:	wannier90	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/wannier90-3.1.0-rsz7cpi7u6yyyy2642jref2b3j54hd
103:	warpx	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/warpx-23.01-soztf67qv5ze5ny3xkslex7idkn3jr2y
104:	xyce	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/xyce-7.5.0-472hw4wjpsihxrnvcqr2wn2ce72uxt5
105:	yaksa	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/yaksa-0.2-rw7d43p72iyswnbanfpdkmfou6rhipvg
106:	zfp	/spack/opt/spack/linux-ubuntu20.04-ppc64le/gcc-9.4.0/zfp-1.0.0-c4yjifwg5bs7u54tuhq2y56zshr2zrfv

E4S Support for CUDA variants on ppc64le

```
[Singularity> uname -m
ppc64le
[Singularity> spack find +cuda
-- linux-ubuntu20.04-ppc64le / gcc@9.4.0 -----
adios2@2.8.3      camp@0.2.3      flux-core@0.47.0  kokkos@3.7.00   papi@6.0.0.1    slepc@3.18.2     umpire@6.0.0
amrex@23.02      camp@2022.03.2  ginkgo@1.5.0     kokkos@3.7.01   paraview@5.11.0  strumpack@7.0.1  umpire@2022.03.1
arborx@1.3       camp@2022.03.2  heffte@2.3.0    kokkos@3.7.01   petsc@3.18.3     sundials@6.4.1   vtk-h@0.8.1
ascent@0.8.0     chai@2022.03.0  hpctoolkit@2022.10.01  kokkos-kernels@3.7.00  petsc@3.18.3     superlu-dist@8.1.2  vtk-m@1.7.1
blaspp@2022.07.00  dray@0.1.8     hpx@1.8.1       lapackpp@2022.07.00  raja@0.14.0      tasmanian@7.9     zfp@0.5.5
cabana@0.5.0     ecp-data-vis-sdk@1.0  hwloc@2.9.0    magma@2.7.0     raja@2022.03.0   tau@2.32
caliper@2.9.0    flecsi@2.1.0   hypre@2.27.0    mfem@4.5.0      slate@2022.07.00  trilinos@13.4.1
==> 47 installed packages
Singularity> █
```

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

```
1: adios2 /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/adios2-2.8.3-b3wi6yrke722ok66o6chrv5dgrxonl3p
2: alquimia /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/alquimia-1.0.10-4qqzoxozokivdnfkjv7o7knodpe2amzl4
3: aml /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/aml-0.2.0-hack5wdz26i34jk2swt4333cp2iwg5wp
4: amrex /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/amrex-23.02-6os4ef7k4g3ry6zxlbc3dqrkrxk3cj
5: arborx /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/arborx-1.3-d7bhot5l6u4h7aurclmi5a7b6a6cgbtc
6: archer /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/archer-2.0.0-pamgyel3f6xmabil4bbp3ncfjwong3jd
7: argobots /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/argobots-main-abqjumv667mqhc54lpr73grixuofusv7
8: ascent /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/ascent-0.8.0-xlohuk7lno776lfofgv7fh4bpysiqpt5
9: axom /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/axom-0.7.0-msx23eyqdxftztznjcvg7kcc44242l6b
10: bolt /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/bolt-2.0-udcposo7ucvsvaq24serdaeiuzdos3l
11: butterflypack /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/butterflypack-2.2.2-psvoz2sz67rafmlutdmvuydbx3w3f6y
12: cabana /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/cabana-0.5.0-4vmt5gzvhvzaxmtgymuvajby75cnaan4
13: caliper /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/caliper-2.9.0-uenbcmkylivpfqsuygulga5cv4rjiew4
14: chai /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/chai-2022.03.0-jaf3uldqcfybtjcuzaev27pvqqvqkd7m
15: charliecloud /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/charliecloud-0.30-rpwozola4x4cngntqnxixireos3tqgf2
16: conduit /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/conduit-0.8.6-fqso6neyt6u47nft5sfjfrjyupzcx25s
17: dealii /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/dealii-9.4.0-yj77ozeryq7jbkhjynjvstl3zvjldqbj
18: datatransferkit /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/datatransferkit-3.1-rc3-yn5euj5brulevhut4hcrtdrwfovponni
19: dyninst /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/dyninst-12.2.1-ww2xihmxrajhr2tcz6utvj4siyppg3rm
20: ecp-data-vis-sdk /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/ecp-data-vis-sdk-1.0-6qmpsam7voxwuvhhjpxuuhxijibgku2i
21: exaworks /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/exaworks-0.1.0-ha5qbdohz3wj5o2ok3qro5jpl6sf57n6
22: flecsi /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/flecsi-2.1.0-2iuntcpxijaiotxxn5gqp2prpwy4cr67
23: flit /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/flit-2.1.0-c6utquhr4fgprozvtchknhee3mpum6xx
24: flux-sched /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/flux-sched-0.26.0-wqaxuw3f6f4ocvth5hq4ftqeg5gtqatu
25: fortrilinos /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/fortrilinos-2.2.0-6eqti4z5nqhfnl6f6fcjiq4ug254ojyx
26: gasnet /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/gasnet-2022.9.2-4dhn3frk4fxzwwqpfqgvv3ncwrvtwanss
27: ginkgo /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/ginkgo-1.5.0-l3jpt55cncfybxzkgaa6ls4zjlmwaxi
28: globalarrays /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/globalarrays-5.8-5ehzt3mwejtn543qpyat7hkzbcbtz6j
29: gotcha /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/gotcha-1.0.4-gtc2ufwj76xwfmhvcjktivhry6zxstd
30: gptune /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/gptune-3.0.0-mlg2mo6t6wxgg4rkuxvn5kp4rzfcw2fd
31: h5bench /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/h5bench-1.3-a7reymvmochkmyih7f6e2dyyz3yg3i7b
32: hdf5 /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/hdf5-1.14.0-ixpcnwtl6dr7yzfnd2fkziltooomlmr
33: hdf5-vol-async /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/hdf5-vol-async-1.4-tuqj65y3cwe5swjtjfaumdzhnz2zstz
34: heffte /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/heffte-2.3.0-yq4vkhg4fseecfgmrmtev53pcc5osw
35: hpctoolkit /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/hpctoolkit-2022.10.01-tgpsn2xgghaygcpfquozmfft6nmxyjw
36: hypre /spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/hypre-2.27.0-ltt4gizloowjs65jyajl6ezgw3gbmmrg
```

GPU runtimes for aarch64

- CUDA 12
- NVHPC 23.1

Languages

- Julia with MPI and CUDA
- Python

EDA

- Xyce

AI packages for NVIDIA GPU

- TensorFlow
- PyTorch

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

37:	kokkos	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/kokkos-3.7.01-z3tvvgq5hwlvlpayftudtb4z3flkqjcx
38:	kokkos-kernels	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/kokkos-kernels-3.7.00-kn6bccwg2c7smicbv46sypz3swwzif52
39:	lammps	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/lammps-20221103-wntmfs4svb7iasdwlwk7c4u5lhhneim3
40:	legion	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/legion-21.03.0-4kwezfpvc5yyza23gtjob3cjjvuktcs
41:	libnrm	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/libnrm-0.1.0-m7pxu4j4yhd4tlscn3hystvsfxfli44m
42:	libpressio	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/libpressio-0.90.2-3pkxaohfsmf6vtobzbhbt35irh4xkb5fc
43:	libquo	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/libquo-1.3.1-yvg5s2gnbjlfulavqjnr6qsyoeck3rcb
44:	magma	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/magma-2.7.0-6o2jvneqf3ffgmohuzwp3gdnhaingrp5
45:	mercury	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/mercury-2.2.0-6ta6g36gr7gl5dook6g6mg7ml63wrete
46:	metall	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/metall-0.23.1-f5dwez2n42gf3yefxd7hpl3ohqdr4jd
47:	metis	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/metis-5.1.0-pdd4332qyb2e5i3ykjaaqgdz74aoemx
48:	mfem	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/mfem-4.5.0-7f4dcxn2l3kvtx4wizwuddkpr7amunxl
49:	mpark-variant	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/mpark-variant-1.4.0-nzcxqyjtds7jzmtwd2f5dnvhvwlbdew
50:	mpich	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/mpich-4.0.2-ngiippuljh3hj52gkxt562rencw73c3
51:	mpifileutils	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/mpifileutils-0.11.1-3unm24kzow35sihmmgr5bjtdhpp24rz
52:	netcdf-c	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/netcdf-c-4.9.0-ou26lpbtcbtwhcqhluqsrp547qpvv
53:	netlib-scalapack	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/netlib-scalapack-2.2.0-d5zvuhd774da6ruukbafj62pwq2fp4x7
54:	nccmp	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/nccmp-1.9.0.1-kzi6wbh4vhrs4lpuv6e7fapkra3m4hnb
55:	nco	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/nco-5.0.6-3lbuixsdtebnc6mgs6figocefhnknk
56:	nrm	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/nrm-0.1.0-oromof4iip4yev5japxvjm3zly3npl7
57:	omega-h	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/omega-h-9.34.13-qntld6tbe4qr5566spqgriz255qy2dwlh
58:	openmpi	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/openmpi-4.1.4-r2b7nvfabf6ydkpxhhi5gatf6annbus
59:	openpmc-api	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/openpmc-api-0.14.5-nv4cdtotkqd5u5ty4f3hjbdr7aendr3
60:	papi	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/papi-6.0.0.1-c44hqtqkrtyxqgfwwq2yseqzajdktnrdf
61:	papyrus	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/papyrus-1.0.2-sxan3pvrvy6evbtwbqwa3dfo75o67gjs
62:	parallel-netcdf	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/parallel-netcdf-1.12.3-l7f5w6dffccq2np6jx6lmtqk74uipol7r
63:	parmetis	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/parmetis-4.0.3-gv3yp7atilwiw5y2z7hj2hw3sdzymirb
64:	parsec	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/parsec-3.0.2209-n7jakbico7n3nrz4orxyskuiietsurat
65:	pdt	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/pdt-3.25.1-dtetja2hxykx45ysshw7ng6w6nzb4jlw
66:	petsc	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/petsc-3.18.3-tv5to4w7o2oq4ah3ilvy62gjxmlewyar
67:	plasma	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/plasma-22.9.29-pybvtwqfasonxgfhit7heuu6nlpq3dhh
68:	plumed	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/plumed-2.8.1-eq5wh6sj4exbbwudi5prashfge2pgg2i
69:	precice	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/precice-2.5.0-l44g4cg6vl2miadne23ucq2rwnw5ynj
70:	pumi	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/pumi-2.2.7-72gjhfnp2mtlamkkebih3zrbo3bahy4t
71:	py-cinemasci	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/py-cinemasci-1.3-wpananippv2wthubf7obcpf4kasckei6e
72:	py-jupyterhub	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/py-jupyterhub-1.4.1-rgzvmjszshb7ptgtdxuz2fxhez4w5utn7

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

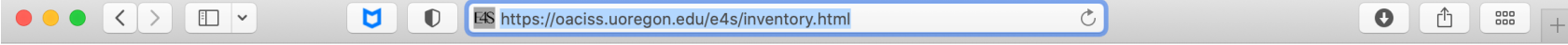
73:	py-libensemble	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/py-libensemble-0.9.3-a67zo4rhwqlcmvvugp4rvbxrvbnqlojz
74:	py-opentuner	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/py-opentuner-0.8.7-4pn4msp7qqcu5by53aaozqf7dhan6mmw
75:	py-parsl	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/py-parsl-1.1.0-ad3wsflhbb3g64stederalu7htqr22gsn
76:	py-radical-entk	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/py-radical-entk-1.20.0-mtxp7zwfafenwgncffncdfaadpzyzcc
77:	py-radical-pilot	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/py-radical-pilot-1.20.0-tntigqbn5bs7e7vfxnawzg75fsrn2vo3
78:	py-radical-saga	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/py-radical-saga-1.20.0-46ofmjooptydzbnsvamjr7i6b6ul4n7
79:	qthreads	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/qthreads-1.16-zj6pplftxpkotg4x7cqj5xq5dyaxrg2
80:	quantum-espresso	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/quantum-espresso-7.1-mcxmod2mi2khe2kkrtfw3zqps32hanz
81:	raja	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/raja-2022.03.0-pfgblltnrsfmp3ivgtomqzyk34h7fpp7
82:	scr	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/scr-3.0.1-onzrdmbx5c434vvvzvi5g225pdqcdigq
83:	slate	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/slate-2022.07.00-3oy3p6nyy4wc47ckwhb6qtirp6b2am2b
84:	slepc	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/slepc-3.18.2-fvafaiknbmttshvb2sdqfv7lid2t5gal
85:	stc	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/stc-0.9.0-ofdm2dqxbdqidfbq4i3dlpjo5ucww5of
86:	strumpack	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/strumpack-7.0.1-a5lbqwrhgtymlg7i6qfmp3us76fdljri
87:	sundials	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/sundials-6.4.1-oi4cweugfunvohluzegxrcnetkbziscv
88:	superlu-dist	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/superlu-dist-8.1.2-olduld4eshsagzxgvnrx73q3nhwktxm64
89:	swig	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/swig-4.1.1-o74mzbcvdvg3ae3n4mzokifhbaoncywqc
90:	sz	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/sz-2.1.12.2-qndzzh24zhpqwhgm5ux6pzvteyjdckn
91:	tasmanian	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/tasmanian-7.9-mjry4xvuh2vsvdrsgzzftcu2duozun4p
92:	tau	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/tau-2.32-l2slygu2bm67qk6twtyvcerdflr3ztfm
93:	trilinos	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/trilinos-13.4.1-lokkji3fvnjkqqk73ylkbuve3aczoih
94:	turbine	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/turbine-1.3.0-hh5sxft47sns5itjka6sulmvr2l2wfl
95:	umap	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/umap-2.1.0-c4do6mpg7q3dggjabiahffi5vmajaj6aq
96:	umpire	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/umpire-2022.03.1-ltqdwkoiep3fjgb47v7f7igv7y6s6sum
97:	unifyfs	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/unifyfs-1.0.1-4imx7l4ggzwm7pw7st2aegt3jw3spzhk
98:	upcxx	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/upcxx-2022.9.0-znmbjuqfqroyvu4w3gqofs2vekmqqbgz
99:	veloc	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/veloc-1.6-efunnoqduzkxskjqoi5wo7uclcf5p7vo
100:	visit	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/visit-3.2.2-6m6met233ynb2rahcqqobmlnkt6luzy
101:	vtk-m	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/vtk-m-1.7.1-zc5oxpmlsarwj7sjqddlxlkjv7q25o
102:	wannier90	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/wannier90-3.1.0-j2clku3qrbndlgfk4imqwcx6lju56ju
103:	warpx	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/warpx-23.01-emjk3fcz42hwpjohybik7figxu2fhmxu
104:	xyce	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/xyce-7.5.0-a6gp5etburyjhqs2gv74xubl23aicav4
105:	yaksa	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/yaksa-0.2-3a4aik2vgllpn6xvm7do6rfiekyjmqg7
106:	zfp	/spack/opt/spack/linux-ubuntu20.04-aarch64/gcc-11.1.0/zfp-1.0.0-xrx3l7rmv64ct3lajexhz2hjk2gyqad

E4S Support for CUDA variants on aarch64

```
Singularity> uname -m
aarch64
Singularity> spack find +cuda cuda_arch=80
-- linux-ubuntu20.04-aarch64 / gcc@11.1.0 -----
amrex@23.02      camp@2022.03.2  ginkgo@1.5.0   kokkos@3.7.01   omega-h@9.34.13  strumpack@7.0.1  umpire@2022.03.1
arborx@1.3      camp@2022.03.2  heffte@2.3.0   kokkos-kernels@3.7.00  petsc@3.18.3     sundials@6.4.1   vtk-h@0.8.1
ascent@0.8.0    chai@2022.03.0  hypre@2.27.0   lapackpp@2022.07.00  raja@2022.03.0   superlu-dist@8.1.2  vtk-m@1.7.1
blaspp@2022.07.00  dealii@9.4.0    kokkos@3.7.00  magma@2.7.0      slate@2022.07.00  tasmanian@7.9     trilinos@13.4.1
caliper@2.9.0    flecsi@2.1.0    kokkos@3.7.01  mfem@4.5.0      slepc@3.18.2     trilinos@13.4.1
==> 33 installed packages
Singularity> spack find +cuda cuda_arch=75
-- linux-ubuntu20.04-aarch64 / gcc@11.1.0 -----
amrex@23.02      camp@2022.03.2  ginkgo@1.5.0   kokkos@3.7.01   omega-h@9.34.13  strumpack@7.0.1  umpire@2022.03.1
arborx@1.3      camp@2022.03.2  heffte@2.3.0   kokkos-kernels@3.7.00  petsc@3.18.3     sundials@6.4.1   vtk-h@0.8.1
ascent@0.8.0    chai@2022.03.0  hypre@2.27.0   lapackpp@2022.07.00  raja@2022.03.0   superlu-dist@8.1.2  vtk-m@1.7.1
blaspp@2022.07.00  dealii@9.4.0    kokkos@3.7.00  magma@2.7.0      slate@2022.07.00  tasmanian@7.9     trilinos@13.4.1
caliper@2.9.0    flecsi@2.1.0    kokkos@3.7.01  mfem@4.5.0      slepc@3.18.2     trilinos@13.4.1
==> 33 installed packages
Singularity> █
```

Support for A100 and T4 GPUs under aarch64

E4S Build Cache for Spack 0.19.0



E4S Build Cache for Spack 0.19.1

To add this mirror to your Spack:

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

99,321 total packages

Last updated 2023-02-28 8:05 PST

- All Arch PPC64LE X86_64 AARCH64
- All OS Centos 7 Centos 8 RHEL 7 RHEL 8 Ubuntu 18.04 Ubuntu 20.04

- [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](#) [adlbc@0.9.2](#) [adlbc@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](#)

- Over 99,000 binaries!
- No need to recompile from source code.

E4S 23.02 AWS image: US-West2 (OR)

The screenshot displays a desktop environment with the following components:

- ParaView 5.9.0:** A 3D visualization of a mesh with a color scale for pressure, ranging from 0.0e+00 to 1.2e-38.
- Terminal Window:** Shows the execution of the Singularity command: `singularity run --/ecp.sing`. The output lists installed modules, including `amrex/21.11-rocm-6cm`.
- TAU Performance Statistics:** A table showing performance metrics for node 0. The table is as follows:

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 23.02 AWS

- Intel oneAPI
- CUDA
- NVHPC
- ROCm
- AWS DCV
- Spack Build Cache
- ECP: Nalu-Wind
- Trilinos 13.4.0
- 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 the following components:

- 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_dev.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 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

#	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	Xscheme	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
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

Product Solutions Open Source Pricing Search Sign in Sign up

E4S-Project / e4s-cl Public Notifications Fork 0 Star 5

Code Issues 3 Pull requests 1 Actions Projects Security Insights

master 7 branches 8 tags Go to file Code About

Container manager for E4S

Readme MIT license 5 stars 4 watching 0 forks

Releases 8

E4S-CL release v1.0.1 Latest 3 days ago + 7 releases

Commit	Message	Time
spoutn1k	Prepare release v1.0.1	3 days ago
b2c9299	Updated python	4 months ago
	Proper image conversion	5 months ago
	Prepare release v1.0.1	3 days ago
	Prepare release v1.0.1	3 days ago
	Unfreeze dependency version	3 months ago
	Reflect name changes in scripts	3 months ago
	Fail to fix safe_tar test; disabling it	last month
	Introduced the coverage tool	9 months ago

<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 image tags:

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

`% docker pull ecpe4s/waggle-ml`

The screenshot shows the website for the SAGE project, hosted by Argonne National Laboratory. The page title is "SAGE: A Software-Defined Sensor Network". The text describes the project as building 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 SAGE logo, which includes a stylized plant and the text "SAGE A Software-Defined Sensor Network Cyberinfrastructure for AI at the Edge". The website URL is www.sagecontinuum.org. A sidebar on the right contains a navigation menu for the MCS Division, including links for About MCS, Research, News, Events, and Publications. There are also social media sharing icons and project information indicating the status is "Active".

Thank you

<https://www.exascaleproject.org>

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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.

