Spack Community BoF

CASS Community BOF days 2026

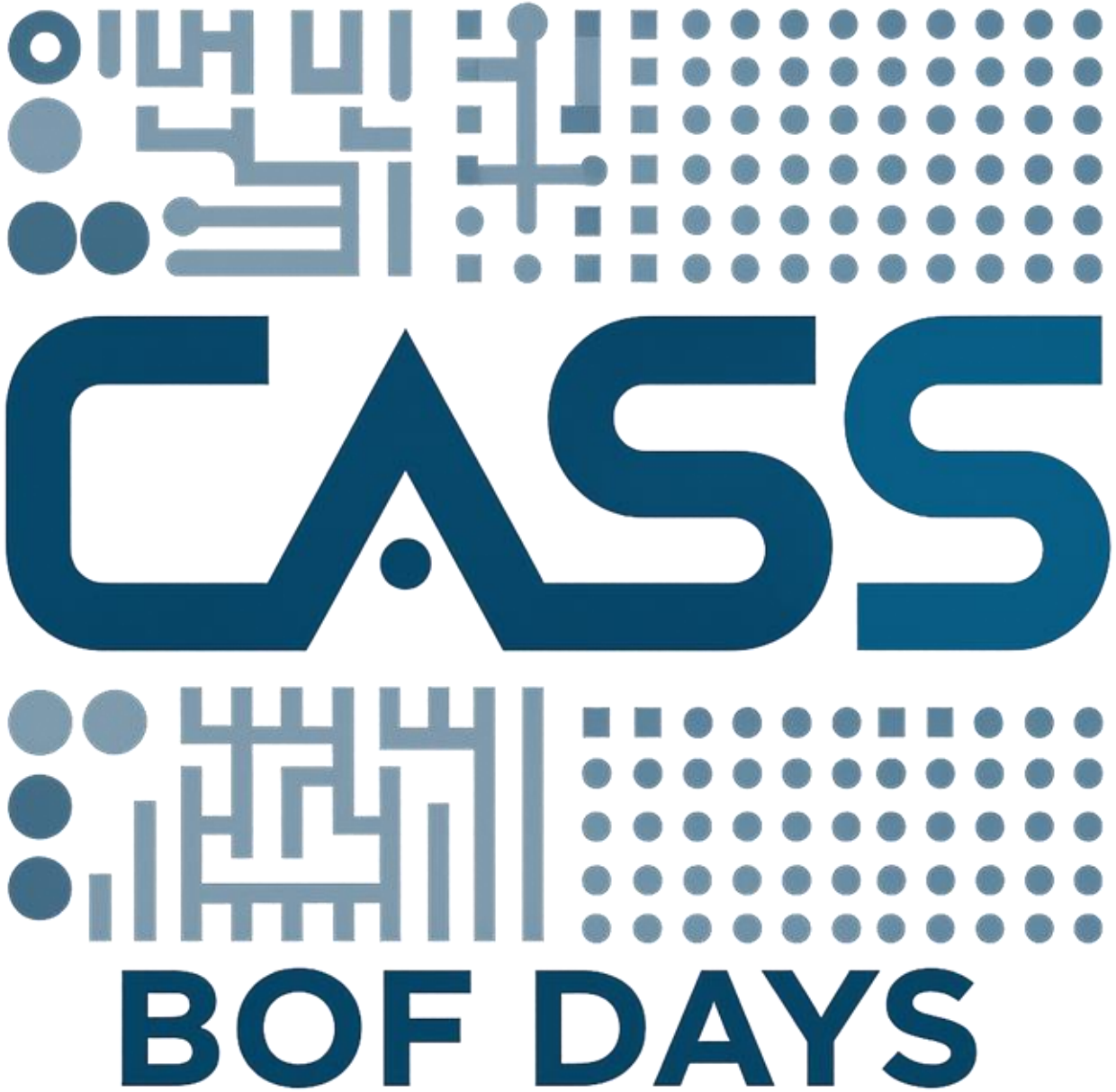
Lawrence Livermore National Laboratory
HPSF HIGH PERFORMANCE SOFTWARE FOUNDATION
LLNL-PRES-806064

BOF Days

February 10 - 12, 2026

https://cass.community

The **Consortium for the Advancement of Scientific Software** (CASS)



https://cass.community/news/2026-02-10-cass-bof-days.html

CASS: Stewardship and Advancement of the Scientific Software Ecosystem

- **Inward-facing activities:** Strengthening software products
  - Improve development practices, sustainability, quality, and trustworthiness
  - Enhance user experience and integration within the broader ecosystem
- **Outward-facing activities:** Community engagement and discovery
  - Curate and evolve the software portfolio
  - Help teams connect with and grow their user communities
  - Enable the broader community to discover and adopt useful software

CASS Members

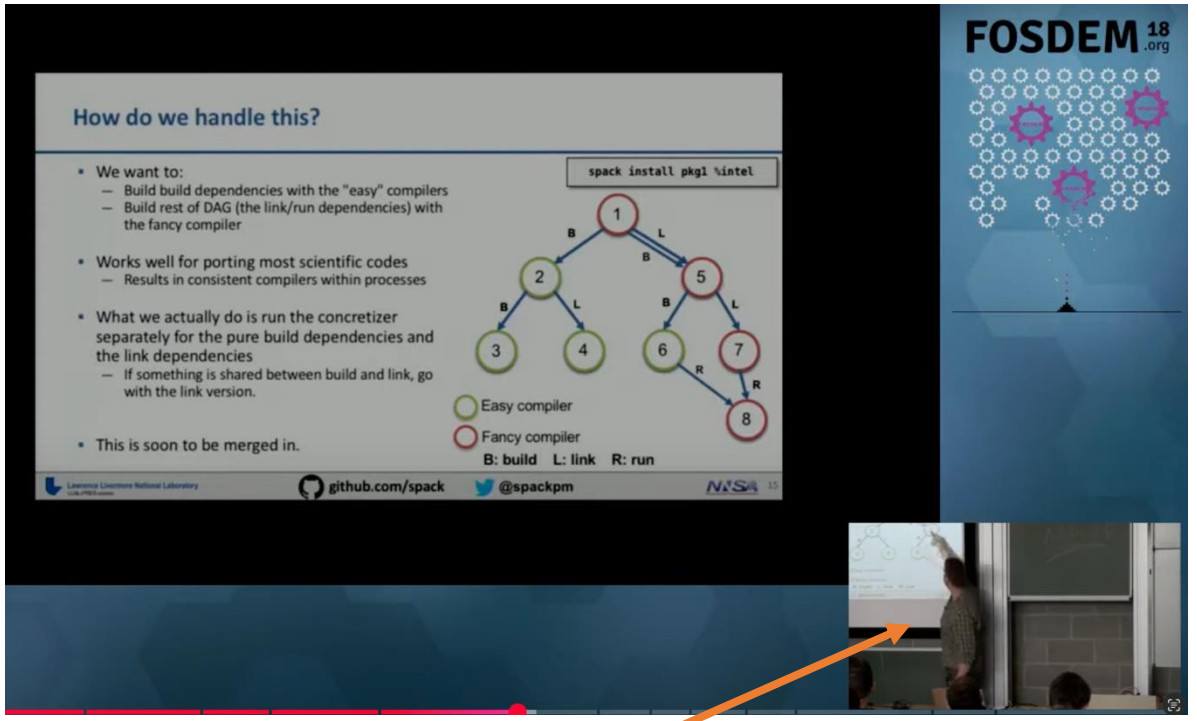
Sponsored by the Department of Energy, Office of Advanced Scientific Computing Research

Engage with CASS!

- Learn about CASS:
  - https://cass.community/about/
- Join the CASS Announcement list (low-volume):
  - http://eepurl.com/iRiSnY
- Find out more about our **software products**
  - Catalog: https://cass.community/software/
  - Collected as part of the Extreme-Scale Scientific Software Stack (E4S)
- Participate in **CASS Working Groups**
  - Impact Framework, Integration, Metrics, Software Ecosystem, User-Developer Experience, Workforce
  - https://cass.community/working-groups/

Spack v1.0 was released in July!

- We wanted:
  - ✓ 2020 New ASP-based concretizer
  - ✓ 2021 Reuse of existing installations
  - ✓ 2022 Stable production CI
  - ✓ 2022 Stable binary cache
  - ✓ 2025 Compiler dependencies
  - ✓ 2025 Separate builtin repo
  - ✓ 2025 Stable package API
- v1.0:
  - Changes the dependency model for compilers
  - Enables users to use entirely custom packages
  - Improves reproducibility
  - Improves stability 🤞
- This is the largest change to Spack… ever.



Todd, presenting how simple all this would be at FOSDEM in 2018

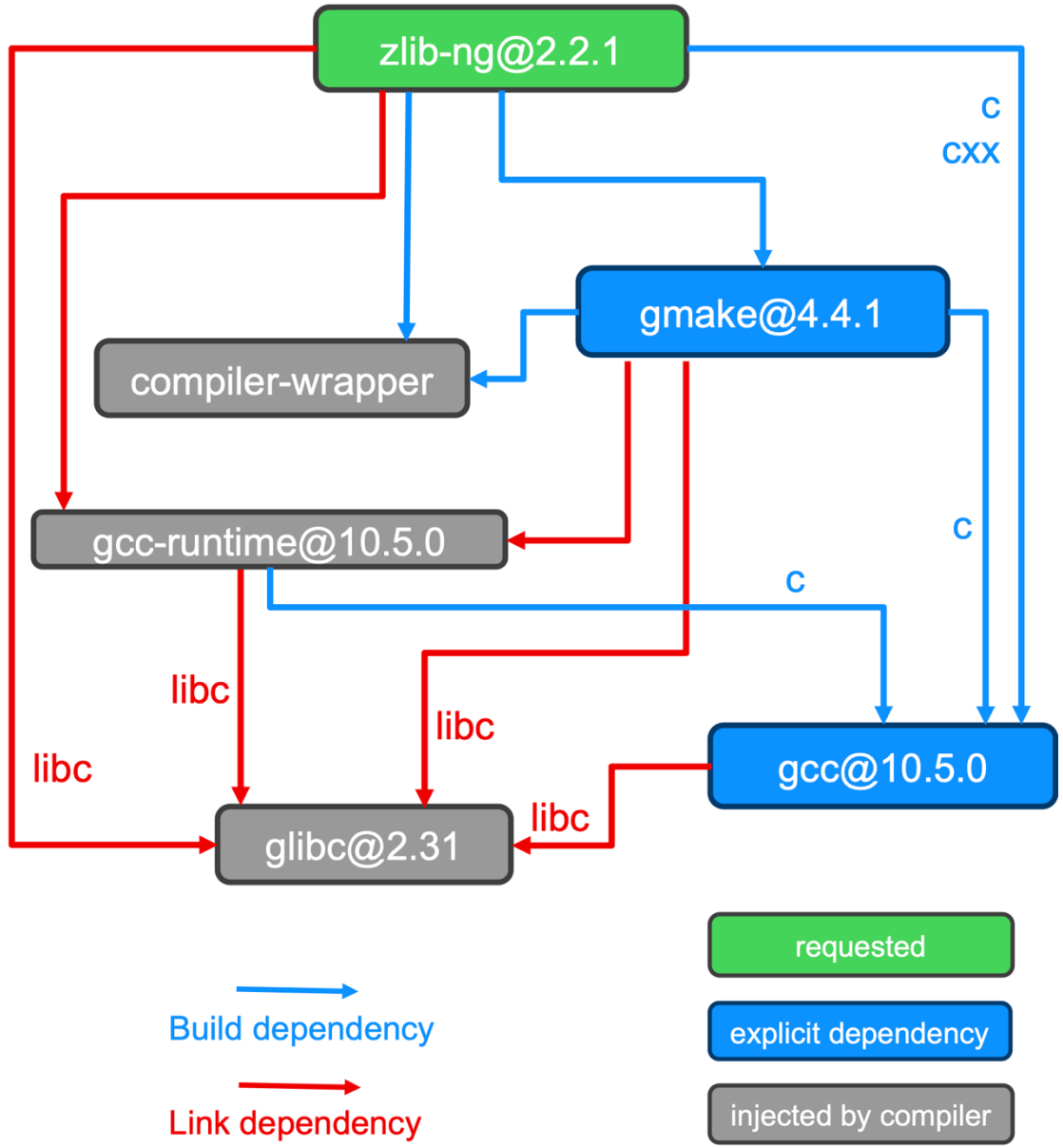
Spack v1.0 adds language dependencies

```
depends_on("c", type="build")
depends_on("cxx", type="build")
depends_on("fortran", type="build")
```

- Spack has historically made these compilers available to every package
  - A compiler was actually “something that supports c + cxx + fortran + f77”
  - Made for a lot of special cases
  - Also makes for duplication of purely interpreted packages (e.g. python)
- Required in 1.0 if you want to use c, cxx, or fortran
  - No-op in v0.23 and prior as we prepared for this feature

Compiler Dependencies

- Compilers are now build dependencies
- Runtime libraries modeled as packages
  - gcc-runtime is injected as link dependency by gcc
  - packages depend on c, cxx,
    fortran virtuals, which are satisfied by gcc node
- glibc is an automatically detected external
  - Injected as a `libc` virtual dependency
  - Does not require user configuration
- Will eventually be able to choose implementations (e.g., musl)



Spack 1.x introduces *toolchains*

toolchains.yaml

```yaml
toolchains:
  clang_gfortran:
    - spec: %c=clang
      when: %c
    - spec: %cxx=clang
      when: %cxx
    - spec: %fortran=gcc
      when: %fortran
    - spec: cflags="-O3 -g"
    - spec: cxxflags="-O3 -g"
    - spec: fflags="-O3 -g"
```

```
spack install foo %clang_gfortran
```

```yaml
toolchains:
  intel_mvapich2:
    - spec: %c=intel-oneapi-compilers @2025.1.1
      when: %c
    - spec: %cxx=intel-oneapi-compilers @2025.1.1
      when: %cxx
    - spec: %fortran=intel-oneapi-compilers @2025.1.1
      when: %fortran
    - spec: %mpi=mvapich2 @2.3.7-1 +cuda
      when: %mpi
```

```
spack install foo %intel_mvapich2
```

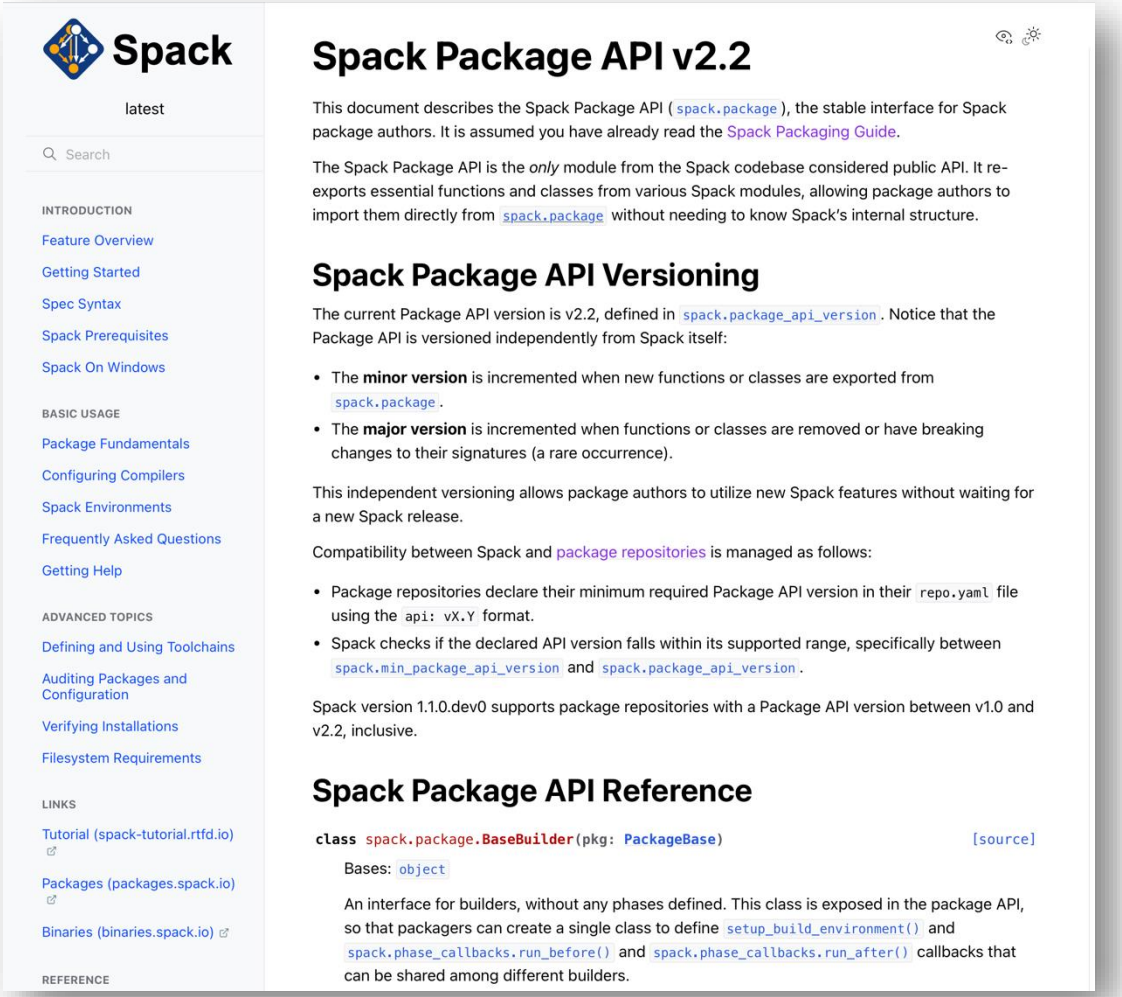
- Can lump many dependencies, flags together and use them with a single name
- Any spec in a toolchain can be *conditional*
  - Only apply when needed

Splitting the package repository

- Spack is two things:
  - Command line tool `spack`
  - Package repository with 8,600+ recipes
- Community wanted
  - package updates without tool changes (e.g. new bugs)
  - tool updates without package changes (reproducibility)
- But coupling between tool and packages was tight
  1. Package classes are in core: `CMakePackage`, `AutotoolsBuilder`, etc.
  2. Compiler wrapper was not a package until recently
  3. Packages *live* in Spack's GitHub repository with a long (git) history

Spack now has a Stable Package API

- Repositories define API version used
  - Versioned *per commit*
- Spack defines API version(s) supported
  - Will complain if a repo is too new
- Packages can only import from:
  - spack.package
  - Core Python
- Any 1.x Spack will support the same package API as all prior 1.x versions
  - Won't break package API unless we bump the major version



https://spack.rtfd.io/en/latest/package_api.html

You can now specify the package repo version in an environment or config

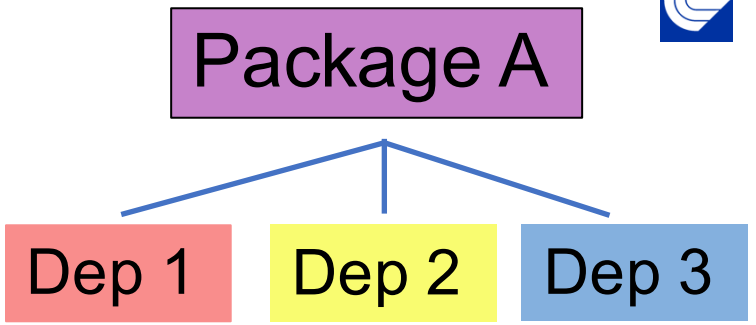
Pin a commit

```
spack:
  repos:
    builtin:
      git: https://github.com/spack/spack-packages.git
      commit: aec1e3051c0e9fc7ef8feadf766435d6f8921490
```

Work on a branch

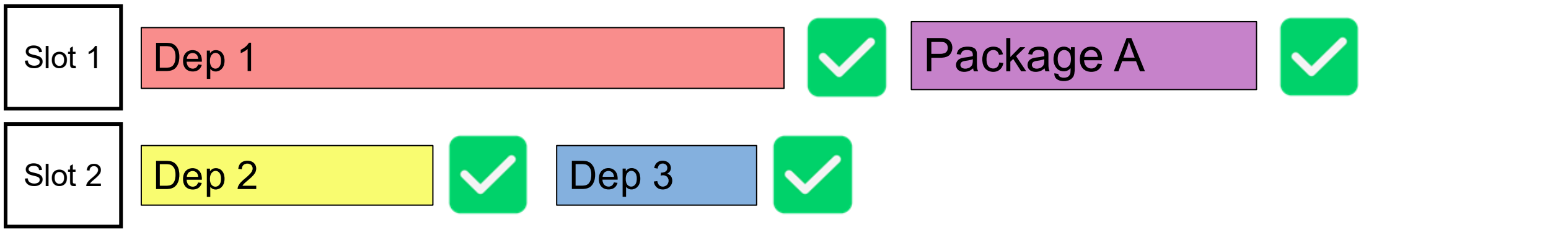
```
spack:
  repos:
    builtin:
      git: https://github.com/spack/spack-packages.git
      destination: /path/to/clone/of/spack-packages
      branch: develop
```

Bonus feature: Spack now supports concurrent builds!



- We *sort of* supported this already
  - But the user had to launch multiple spack processes
  - e.g., `srun -N 4 -n 16 spack install hdf5`

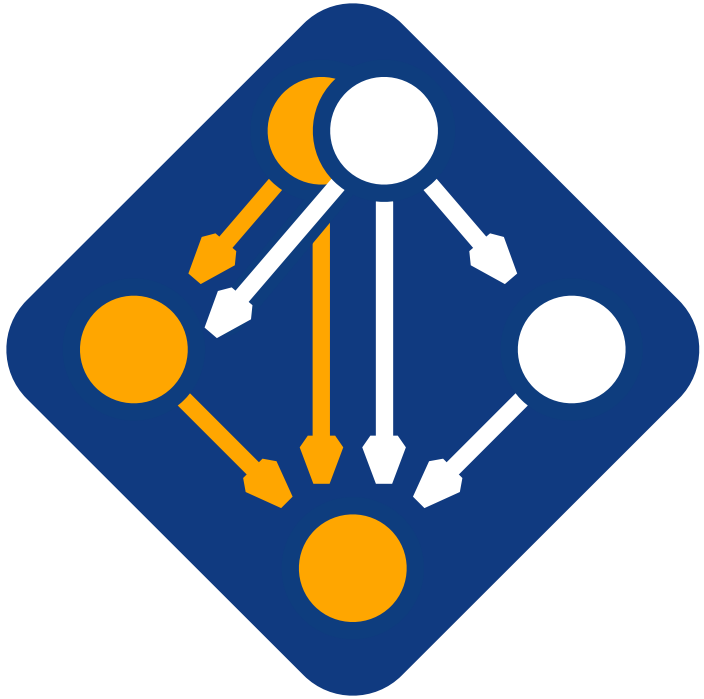
- Now spack handles on-node parallelism itself!
  - Spack now has a scheduler loop
  - Monitors dependencies, starts multiple processes, polls for completion
  - User can control max concurrent processes with '-p'



Spack v1.1.0 was released on November 14!

New Features:

1. More compiler control
   - Propagated compiler preferences with %%
   - Unmixing preferences
2. Customizable/overridable configuration scopes
3. Git fetching
4. External packages can have dependencies



Experimental Features:

5. New installer UI for parallel builds
6. Concretizer caching

github.com/spack/spack

Full release notes: https://github.com/spack/spack/releases/tag/v1.1.0

Compiler unmixing

- v1.0, support for compilers as nodes:
  - Made it much easier to mix language compiler on different packages
  - Did not offer options to constrain compiler selection when needed.
- v1.1 allows you to disable this:

```
> spack config add concretizer:compiler_mixing:false
```

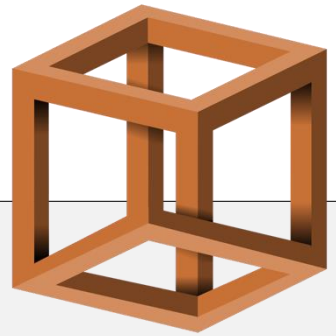
```
> spack spec chai%c=oneapi ^umpire%c=gcc
==> Error: failed to concretize `chai %c=oneapi ^umpire %c=gcc` for the following reasons:
    1. Compiler mixing is disabled
```

Propagated Compiler Prefences with %%

- %% now specifies:
  - a direct dependency for a node, *and*
  - a preference for its transitive link/run dependencies
- Like prefer: in configuration
- Enables you to:
  - prefer: for defaults
  - require: for exceptions

```
spack:
 definitions:
 - compilers: ["%%llvm_gfortran", "%%c,cxx,fortran=gcc"]

 specs:
 - matrix:
  - [mpileaks, hdf5, trilinos]
  - [$compilers]

 toolchains:
  llvm_gfortran:
  - spec: "%c=llvm"
    when: "%c"
  - spec: "%cxx=llvm"
    when: "%cxx"
  - spec: "%fortran=gcc"
    when: "%fortran"

 packages:
  callpath:
    require:
    - "%c=gcc"

 concretizer:
  unify: false
```

Config scopes are now defined in configuration



- Much debate about ~/.spack
  - Can be a footgun for users
  - Hard for the owner of a spack instance or an env to have full control
- All config now stems from the spack instance
  - Instance (spack scope) has full control
  - User, site, system scopes are included
  - Environments can override with include:: []
- Envs and instance have full control!
  - Can customize how scopes behave

```
include:
  # user configuration scope
  - name: "user"
    path: "~/.spack"
    optional: true
    when: '"SPACK_DISABLE_LOCAL_CONFIG" not in env'

  # site configuration scope
  - name: "site"
    path: "$spack/etc/spack/site"
    optional: true

  # system configuration scope
  - name: "system"
    path: "/etc/spack"
    optional: true
    when: '"SPACK_DISABLE_LOCAL_CONFIG" not in env'
```

$spack/etc/spack

Including remote configuration from Git

```
include:
- git: https://github.com/spack/spack-configs
  branch: main
  when: os == "centos7"
  paths:
  - USC/config/config.yaml
  - USC/config/packages.yaml
```

- Much like remote repositories (added in v1.0)
- Can pin included configuration to a branch or commit

New Installer UI for parallel builds

```
[+] h6ce6ly gmake@4.4.1 /home/harmen/opt/linux-zen2/gmake-4.4.1-h6ce6lyjisykmc3u5s6mek32thio7pin
[+] uqjco4t util-macros@1.20.1 /home/harmen/opt/linux-zen2/util-macros-1.20.1-uqjco4tqxenptueobq5qbkggieysrp5u
Progress: 4/83  /: filter  v: logs  n/p: next/prev
[/] sjmydhp boost@1.88.0 staging
[/] ivlelhr libiconv@1.18 configure
[/] ilgps2i zstd@1.5.7 install
[/] gxytvc6 xz@5.6.3 configure
[/] ab3hpqc berkeley-db@18.1.40 configure
[+] 34yfszo libsigsegv@2.14 /home/harmen/opt/linux-zen2/libsigsegv-2.14-34yfszo5kr5sv7uv2gtk6iawgmq3a2pl
[/] xbvrehx gsl@2.8 configure
[/] 67pdlcf openblas@0.3.30 build
[+] 5tnnek5 libmd@1.1.0 /home/harmen/opt/linux-zen2/libmd-1.1.0-5tnnek5jh5gib7ntbv3vrhi2r5lr3imv
[/] tvo6sf2 libffi@3.5.2 build
[/] 6d7cdec pkgconf@2.5.1 build
[/] lonviug zlib-ng@2.2.4 build
```

- Multiple concurrent builds
- View live logs interactively
- Share a jobserver among builds
- Not yet feature complete

- Enable new installer with:

```
> spack config add config:installer:new
```

Spack v1.1.1 was released… yesterday!

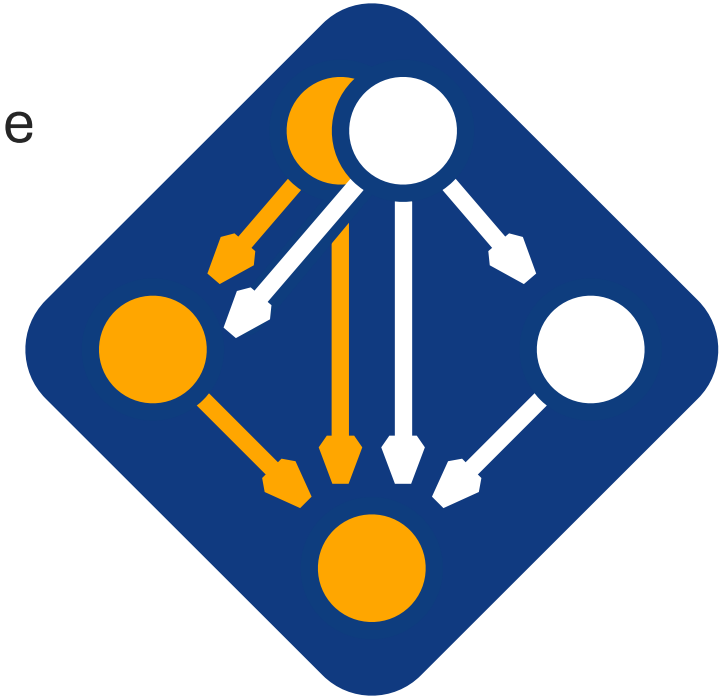
Usability enhancements:

- Experimental new installer is more feature-complete
- Python 3.14 support
- Better errors for missing/deprecated versions
- Better `spack info` display

Major concretization performance improvements

- Optimized solver encoding
- Reduced grounding size for solver

Numerous bugfixes



github.com/spack/spack

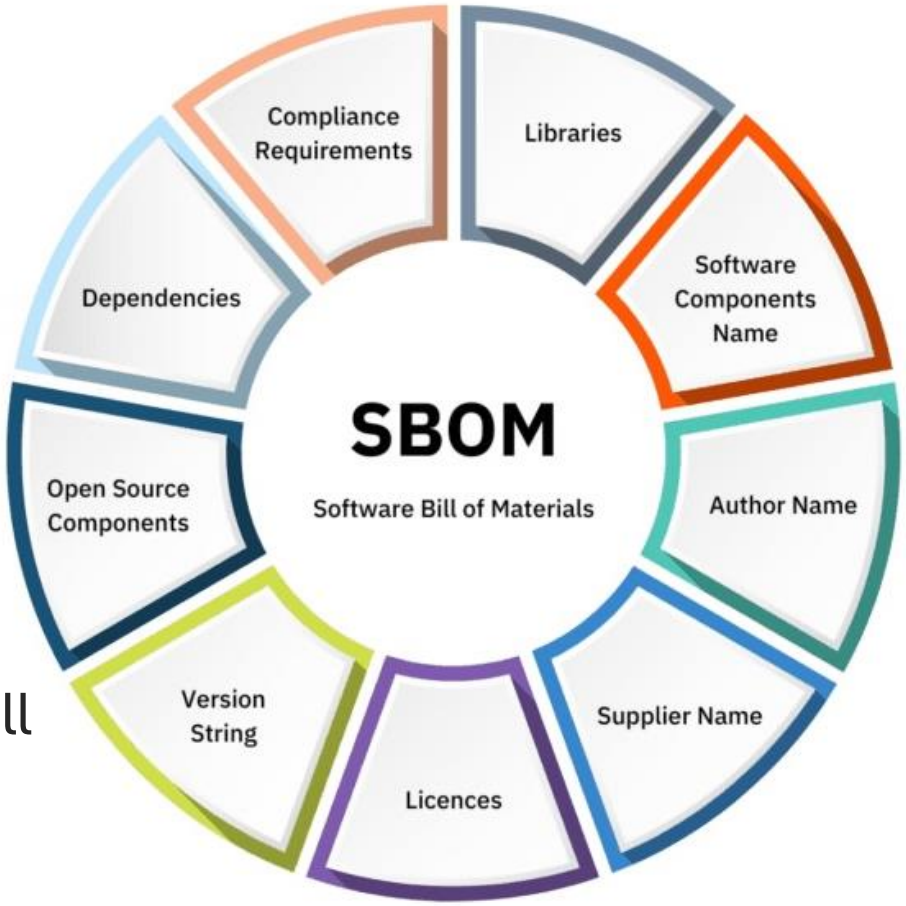
Full release notes: https://github.com/spack/spack/releases/tag/v1.1.1

Roadmap for v1.2 – next Spring

- pip install spack
- SBOMs and more detailed provenance
- Error message improvements
- Numerous performance improvements
  - Faster load, activate
- Including environments in other environments
- Buildcache views
- Fully featured new installer/concretization cache

SBOMs can provide detailed provenance for packages

- Software Bill of Materials (SBOM)
  - Versions, hashes, organization of origin, etc.
  - Executive order in the last administration encouraged projects to add for security
- SBOMs enable supply chain security
  - Scanning installations for CVEs
  - Understanding outdated versions
  - Understanding where software came from
- Plan: automatically generate SBOMs with spack install
  - Expose SBOM location for scanners
  - Disclose vulnerabilities
  - Make DevSecOps easy for Spack users



Join the Spack community!

at the 2nd annual Spack user meeting

Conference Info

2 days of Spack user meeting

Call for presentatons will go out in the next couple weeks.

and online

slack.spack.io

@spack@hpc.social

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github.com/spack/spack

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