

Introduction to Parallel Processing

Tutorial : Spack

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What is Spack

- Package management tool
- Designed for supercomputers
 - You will not have sudo access on supercomputers
 - Cannot install with `sudo apt-get install`
 - Instead, must install locally
- <https://spack.readthedocs.io/en/latest/>

Installing Spack

- https://spack-tutorial.readthedocs.io/en/latest/tutorial_basics.html#basics-tutorial

```
[bienz@wheeler ~]$ git clone -c feature.manyFiles=true https://github.com/spack/spack.git ~/spack
Cloning into '/users/bienz/spack'...
remote: Enumerating objects: 392657, done.
remote: Counting objects: 100% (282/282), done.
remote: Compressing objects: 100% (193/193), done.
remote: Total 392657 (delta 109), reused 192 (delta 50), pack-reused 392375
Receiving objects: 100% (392657/392657), 191.40 MiB | 13.88 MiB/s, done.
Resolving deltas: 100% (157990/157990), done.
Checking out files: 100% (9796/9796), done.
```

```
[bienz@wheeler spack]$ cd ~/spack
[bienz@wheeler spack]$ . share/spack/setup-env.sh
[bienz@wheeler spack]$
```

Spack Environments

- Tip : always use environments!

```
[[bienz@wheeler ~]$ spack env create cs442
==> Created environment 'cs442' in /users/bienz/spack/var/spack/environments/cs442
==> You can activate this environment with:
==>   spack env activate cs442
[[bienz@wheeler ~]$ spack env activate cs442
[[bienz@wheeler ~]$ spack find
==> In environment cs442
==> No root specs
==> 0 installed packages
[[bienz@wheeler ~]$ despacktivate
[[bienz@wheeler ~]$
```

Installing a package with Spack

```
[bienz@wheeler ~]$ spack install kokkos
[+] /usr (external pkg-config-0.27.1-nfre45it3qatevgcmmulut6px7zhiomg)
[+] /usr (external openssl-1.0.2k-fips-dpf6wkmqjhagvhr4oy4au5xhhig62xq)
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/ncurses-6.3-sqb526lk66pfqgc5dvlyid4qwseof2bn
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/cmake-3.23.3-jqws41172h52sznzk4ya3wi2oodhk5p
==> Installing kokkos-3.6.01-tkxt33sbv4mkdol2g7kdrmmzsoex6mcz
==> No binary for kokkos-3.6.01-tkxt33sbv4mkdol2g7kdrmmzsoex6mcz found: installing from source
==> Fetching https://github.com/kokkos/kokkos/archive/3.6.01.tar.gz
==> No patches needed for kokkos
==> kokkos: Executing phase: 'cmake'
==> kokkos: Executing phase: 'build'
==> kokkos: Executing phase: 'install'
==> kokkos: Successfully installed kokkos-3.6.01-tkxt33sbv4mkdol2g7kdrmmzsoex6mcz
    Fetch: 2.15s.  Build: 21.78s.  Total: 23.93s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/kokkos-3.6.01-tkxt33sbv4mkdol2g7kdrmmzsoex6mcz
[bienz@wheeler ~]$
```


Specifying Package Version

- `spack install <packagename>@<version>`

```
[bienz@wheeler ~]$ spack versions kokkos
==> Safe versions (already checksummed):
    develop master 3.6.01 3.6.00 3.5.00 3.4.01 3.4.00 3.3.01 3.3.00 3.2.01 3.2.00 3.1.01 3.1.00 3.0.00
==> Remote versions (not yet checksummed):
==> Warning: Found no unchecksummed versions for kokkos
[bienz@wheeler ~]$ spack install kokkos@3.1.01
[+] /usr (external pkg-config-0.27.1-nfre45it3qatevgcmmulut6px7zhiomg)
[+] /usr (external openssl-1.0.2k-fips-dpf6wkmqjhagvhr4oy4au5xhhig62xq)
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/ncurses-6.3-sqb526lk66pfqgc5dvlyid4qwseof2bn
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/cmake-3.23.3-jqws41l72h52sznzk4ya3wi2oodhk5p
==> Installing kokkos-3.1.01-m4yajjqe7tup7uswotf7m4jlp1tlj2xr
==> No binary for kokkos-3.1.01-m4yajjqe7tup7uswotf7m4jlp1tlj2xr found: installing from source
==> Fetching https://mirror.spack.io/_source-cache/archive/ff/ff5024ebe8570887d00246e2793667e0d796b08c77a8227fe271127d36eec9dd.tar.gz
==> No patches needed for kokkos
==> kokkos: Executing phase: 'cmake'
==> kokkos: Executing phase: 'build'
==> kokkos: Executing phase: 'install'
==> kokkos: Successfully installed kokkos-3.1.01-m4yajjqe7tup7uswotf7m4jlp1tlj2xr
    Fetch: 0.91s. Build: 9.79s. Total: 10.70s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/kokkos-3.1.01-m4yajjqe7tup7uswotf7m4jlp1tlj2xr
[bienz@wheeler ~]$
```

Specify Compiler

- `spack install <packagename> %<compiler>`

```
[bienz@wheeler ~]$ spack install kokkos %gcc
[+] /usr (external pkg-config-0.27.1-nfre45it3qatevgcmmulut6px7zhiomg)
[+] /usr (external openssl-1.0.2k-fips-dpf6wkmqjhagvhr4oy4au5xhhig62xq)
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/ncurses-6.3-sqb526lk66pfqgc5dvlyid4qwseof2bn
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/cmake-3.23.3-jqws41172h52sznzk4ya3wi2oodhk5p
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/kokkos-3.6.01-tkxt33sbv4mkdol2g7kdrmmzsoex6mcz
[bienz@wheeler ~]$
```


If package already installed, won't reinstall from source

```
[bienz@wheeler ~]$ spack install kokkos@3.6.01
[+] /usr (external pkg-config-0.27.1-nfre45it3qatevgcmmulut6px7zhiomg)
[+] /usr (external openssl-1.0.2k-fips-dpf6wkmqjhagvhr4oy4au5xhhig62xq)
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/ncurses-6.3-sqb526lk66pfqgc5dvlyid4qwseof2bn
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/cmake-3.23.3-jqws41172h52sznzk4ya3wi2oodhk5p
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/kokkos-3.6.01-tkxt33sbv4mkdol2g7kdrmmzsoex6mcz
[bienz@wheeler ~]$
```


Specify Compiler Version

```
[bienz@wheeler ~]$ spack compiler find
==> Found no new compilers
==> Compilers are defined in the following files:
    /etc/spack/compilers.yaml
[bienz@wheeler ~]$ cat /etc/spack/compilers.yaml
compilers:
- compiler:
  spec: clang@3.4.2
  paths:
    cc: /bin/clang
    cxx: /bin/clang++
    f77: null
    fc: null
  flags: {}
  operating_system: centos7
  target: x86_64
  modules: []
  environment: {}
  extra_rpaths: []
- compiler:
  spec: clang@7.1.0
  paths:
    cc: /opt/spack/opt/spack/linux-centos7-nehalem/gcc-4.8.5/llvm-7.1.0-oi2dqdx7do3tzdhi7gsikr5hzw3uigxu/bin/clang
    cxx: /opt/spack/opt/spack/linux-centos7-nehalem/gcc-4.8.5/llvm-7.1.0-oi2dqdx7do3tzdhi7gsikr5hzw3uigxu/bin/clang++
    f77: null
    fc: null
  flags: {}
  operating_system: centos7
  target: x86_64
  modules: []
  environment: {}
```

Specify Compiler Version

- `spack install <packagename> %<compiler>@<compiler_version>`

```
[bienz@wheeler ~]$ spack install kokkos %gcc@11.2.0
[+] /usr (external pkg-config-0.27.1-nfre45it3qatevgcmmulut6px7zhiomg)
[+] /usr (external openssl-1.0.2k-fips-dpf6wkmqjhagvhr4oy4au5xhhig62xq)
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/ncurses-6.3-sqb526lk66pfqgc5dvlyid4qwseof2bn
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/cmake-3.23.3-jqws41172h52sznzk4ya3wi2oodhk5p
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/kokkos-3.6.01-tkxt33sbv4mkd0l2g7kdrmmzsoex6mcz
[bienz@wheeler ~]$
```


Pass Compile Flags

```
[bienz@wheeler ~]$ spack install kokkos %gcc@11.2.0 cppflags="-O3"
[+] /usr (external pkg-config-0.27.1-jjqztfawccaweyncnnjgxaoiturr237w)
[+] /usr (external openssl-1.0.2k-fips-mccuqqeupjtazq6pwthqiwb3geaq57xz)
==> Installing ncurses-6.3-kbucdx4uwuwzcoihhsietetirorcbklm
==> No binary for ncurses-6.3-kbucdx4uwuwzcoihhsietetirorcbklm found: installing from source
==> Using cached archive: /users/bienz/spack/var/spack/cache/_source-cache/archive/97/97fc51ac2b085d4cde31ef4d2c3122c21abc217e9090a43a30fc5ec21684e059.tar.gz
==> No patches needed for ncurses
==> ncurses: Executing phase: 'autoreconf'
==> ncurses: Executing phase: 'configure'
==> ncurses: Executing phase: 'build'
==> ncurses: Executing phase: 'install'
==> ncurses: Successfully installed ncurses-6.3-kbucdx4uwuwzcoihhsietetirorcbklm
Fetch: 0.06s. Build: 2m 12.28s. Total: 2m 12.34s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/ncurses-6.3-kbucdx4uwuwzcoihhsietetirorcbklm
==> Installing cmake-3.23.3-ybsgzuwtkha4vr4kep6dn7mpvb3zfyxc
==> No binary for cmake-3.23.3-ybsgzuwtkha4vr4kep6dn7mpvb3zfyxc found: installing from source
==> Using cached archive: /users/bienz/spack/var/spack/cache/_source-cache/archive/06/06fefaf0ad94989724b56f733093c2623f6f84356e5beb955957f9ce3ee28809.tar.gz
==> No patches needed for cmake
==> cmake: Executing phase: 'bootstrap'
==> cmake: Executing phase: 'build'
==> cmake: Executing phase: 'install'
==> cmake: Successfully installed cmake-3.23.3-ybsgzuwtkha4vr4kep6dn7mpvb3zfyxc
Fetch: 0.13s. Build: 7m 50.74s. Total: 7m 50.87s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/cmake-3.23.3-ybsgzuwtkha4vr4kep6dn7mpvb3zfyxc
==> Installing kokkos-3.6.01-mnlevgfexmqnsif3klrdctbvbgbkfbp5
==> No binary for kokkos-3.6.01-mnlevgfexmqnsif3klrdctbvbgbkfbp5 found: installing from source
==> Using cached archive: /users/bienz/spack/var/spack/cache/_source-cache/archive/1b/1b80a70c5d641da9fefbbb652e857d7c7a76a0ebad1f477c253853e209deb8db.tar.gz
==> No patches needed for kokkos
==> kokkos: Executing phase: 'cmake'
==> kokkos: Executing phase: 'build'
==> kokkos: Executing phase: 'install'
==> kokkos: Successfully installed kokkos-3.6.01-mnlevgfexmqnsif3klrdctbvbgbkfbp5
```


Enabling Other Packages

```

[[bienz@wheeler ~]$ spack install kokkos +hwloc
[+] /usr (external pkg-config-0.27.1-jjqztfawccaweyncnnjgxaoiturr237w)
[+] /usr (external openssl-1.0.2k-fips-mccuqqeupjtazq6pwithqiwb3geaq57xz)
[+] /usr (external m4-1.4.16-ludteikgttsu4fpqqcxfvoro2tmyluni)
[+] /usr (external pkg-config-0.27.1-nfre45it3gatevgcmmulut6px7zhiomg)
==> Installing util-macros-1.19.3-oljzqcukgqysjm5fej6l4i34xmvzvx6n
==> No binary for util-macros-1.19.3-oljzqcukgqysjm5fej6l4i34xmvzvx6n found: installing from source
==> Fetching https://mirror.spack.io/_source-cache/archive/0f/0f812e6e9d2786ba8f54b960ee563c0663ddbe2434bf24ff193f5feab1f31971.tar.bz2
==> No patches needed for util-macros
==> util-macros: Executing phase: 'autoreconf'
==> util-macros: Executing phase: 'configure'
==> util-macros: Executing phase: 'build'
==> util-macros: Executing phase: 'install'
==> util-macros: Successfully installed util-macros-1.19.3-oljzqcukgqysjm5fej6l4i34xmvzvx6n
    Fetch: 0.42s. Build: 1.86s. Total: 2.27s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/util-macros-1.19.3-oljzqcukgqysjm5fej6l4i34xmvzvx6n
==> Installing libiconv-1.16-k2daju6uww3xf5ss7wwh3s5voxdpoe7q
==> No binary for libiconv-1.16-k2daju6uww3xf5ss7wwh3s5voxdpoe7q found: installing from source
==> Fetching https://mirror.spack.io/_source-cache/archive/e6/e6a1b1b589654277ee790cce3734f07876ac4ccfaecbee8afa0b649cf529cc04.tar.gz
==> No patches needed for libiconv
==> libiconv: Executing phase: 'autoreconf'
==> libiconv: Executing phase: 'configure'
==> libiconv: Executing phase: 'build'
==> libiconv: Executing phase: 'install'
==> libiconv: Successfully installed libiconv-1.16-k2daju6uww3xf5ss7wwh3s5voxdpoe7q
    Fetch: 0.63s. Build: 45.00s. Total: 45.63s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/libiconv-1.16-k2daju6uww3xf5ss7wwh3s5voxdpoe7q
==> Installing xz-5.2.5-bbwhzsppeupmi5cdji4ce4ljixad5wtz
==> No binary for xz-5.2.5-bbwhzsppeupmi5cdji4ce4ljixad5wtz found: installing from source
==> Fetching https://mirror.spack.io/_source-cache/archive/51/5117f930900b341493827d63aa910ff5e011e0b994197c3b71c08a20228a42df.tar.bz2
==> No patches needed for xz
==> xz: Executing phase: 'autoreconf'

```


Enabling Other Packages

```
==> No binary for xz-5.2.5-bbwhzsppeupmi5cdji4ce4ljixad5wtz found: installing from source
==> Fetching https://mirror.spack.io/_source-cache/archive/51/5117f930900b341493827d63aa910ff5e011e0b994197c3b71c08a20228a42df.tar.bz2
==> No patches needed for xz
==> xz: Executing phase: 'autoreconf'
==> xz: Executing phase: 'configure'
==> xz: Executing phase: 'build'
==> xz: Executing phase: 'install'
==> xz: Successfully installed xz-5.2.5-bbwhzsppeupmi5cdji4ce4ljixad5wtz
    Fetch: 0.57s. Build: 30.63s. Total: 31.20s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/xz-5.2.5-bbwhzsppeupmi5cdji4ce4ljixad5wtz
==> Installing zlib-1.2.12-sgb5cd2dq7efnv7xfejviff46u2i7nke
==> No binary for zlib-1.2.12-sgb5cd2dq7efnv7xfejviff46u2i7nke found: installing from source
==> Fetching https://mirror.spack.io/_source-cache/archive/91/91844808532e5ce316b3c010929493c0244f3d37593afd6de04f71821d5136d9.tar.gz
==> Applied patch /users/bienz/spack/var/spack/repos/builtin/packages/zlib/configure-cc.patch
==> zlib: Executing phase: 'install'
==> zlib: Successfully installed zlib-1.2.12-sgb5cd2dq7efnv7xfejviff46u2i7nke
    Fetch: 0.54s. Build: 3.17s. Total: 3.71s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/zlib-1.2.12-sgb5cd2dq7efnv7xfejviff46u2i7nke
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/ncurses-6.3-kbucdx4wuuzcoihhsietetirorcbklm
==> Installing libtool-2.4.7-b7d6pdwaoev4ugxwgrrzjmyf7hflb4xv
==> No binary for libtool-2.4.7-b7d6pdwaoev4ugxwgrrzjmyf7hflb4xv found: installing from source
==> Fetching https://mirror.spack.io/_source-cache/archive/04/04e96c2404ea70c590c546eba4202a4e12722c640016c12b9b2f1ce3d481e9a8.tar.gz
==> Ran patch() for libtool
==> libtool: Executing phase: 'autoreconf'
==> libtool: Executing phase: 'configure'
==> libtool: Executing phase: 'build'
==> libtool: Executing phase: 'install'
==> libtool: Successfully installed libtool-2.4.7-b7d6pdwaoev4ugxwgrrzjmyf7hflb4xv
    Fetch: 0.56s. Build: 18.39s. Total: 18.96s.
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/libtool-2.4.7-b7d6pdwaoev4ugxwgrrzjmyf7hflb4xv
==> Installing libxml2-2.10.1-yuetjrppip4u6hsl76idg4vwkkjulfaw
==> No binary for libxml2-2.10.1-yuetjrppip4u6hsl76idg4vwkkjulfaw found: installing from source
==> Fetching https://download.gnome.org/sources/libxml2/2.10/libxml2-2.10.1.tar.xz
```


Specify Version of Dependency

```
[bienz@wheeler ~]$ spack versions zlib
==> Safe versions (already checksummed):
  1.2.12  1.2.11  1.2.8  1.2.3
==> Remote versions (not yet checksummed):
  1.2.10  1.2.7   1.2.5.1 1.2.4.2 1.2.3.7 1.2.3.2 1.2.2.1 1.2.0.8 1.2.0.3 1.1.3 1.0.8 1.0.2 0.94 0.71
  1.2.9   1.2.6.1 1.2.5   1.2.4.1 1.2.3.6 1.2.3.1 1.2.2   1.2.0.7 1.2.0.2 1.1.2 1.0.7 1.0.1 0.93 0.9
  1.2.7.3 1.2.6   1.2.4.5 1.2.4   1.2.3.5 1.2.2.4 1.2.1.2 1.2.0.6 1.2.0.1 1.1.1 1.0.6 1.0-pre 0.92 0.8
  1.2.7.2 1.2.5.3 1.2.4.4 1.2.3.9 1.2.3.4 1.2.2.3 1.2.1.1 1.2.0.5 1.2.0   1.1.0 1.0.5 0.99 0.91
  1.2.7.1 1.2.5.2 1.2.4.3 1.2.3.8 1.2.3.3 1.2.2.2 1.2.1   1.2.0.4 1.1.4   1.0.9 1.0.4 0.95 0.79
[bienz@wheeler ~]$ spack install kokkos +hwloc ^zlib@1.2.11
==> Warning: using "zlib@1.2.11" which is a deprecated version
[+] /usr (external pkg-config-0.27.1-nfre45it3qatevgcmmulut6px7zhiomg)
[+] /usr (external openssl-1.0.2k-fips-dpf6wkmqjhagvhr4oy4au5xhhig62xq)
[+] /usr (external m4-1.4.16-ludteikgtsu4fpqqcxfvworo2tmyluni)
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/util-macros-1.19.3-oljzqcukgqysjm5fej6l4i34xmvzv6n
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/libiconv-1.16-k2daju6uww3xf5ss7wwh3s5voxdpoe7q
[+] /users/bienz/spack/opt/spack/linux-centos7-nehalem/gcc-11.2.0/xz-5.2.5-bbwhzsppeupmi5cdji4ce4ljixad5wtz
==> Installing zlib-1.2.11-pl65yyyvt4byuuymmhqzbt4xjp6f24c
==> No binary for zlib-1.2.11-pl65yyyvt4byuuymmhqzbt4xjp6f24c found: installing from source
==> Warning: zlib@1.2.11 is deprecated and may be removed in a future Spack release.
==> Fetch anyway? [y/N]
```

Spack Environment Files

```
[bienz@wheeler ~]$ spack config edit
```

```
# This is a Spack Environment file.  
#  
# It describes a set of packages to be installed, along with  
# configuration settings.  
spack:  
  # add package specs to the `specs` list  
  specs: [kokkos+hwloc, cmake%gcc]  
  view: true  
  concretizer:  
    unify: false  
~
```

```
"~/spack/var/spack/environments/cs442/spack.yaml" 10L, 254C
```

Create Environment from YAML file

```
[bienz@wheeler ~]$ spack config edit
[bienz@wheeler ~]$ cp /users/bienz/spack/var/spack/environments/cs442/spack.yaml ~/
/spack.yaml
[bienz@wheeler ~]$ despacktivate
spack env create [bienz@wheeler ~]$ spack env create cs542 spack.yaml
==> Created environment 'cs542' in /users/bienz/spack/var/spack/environments/cs542
==> You can activate this environment with:
==>   spack env activate cs542
[bienz@wheeler ~]$ spack env activate cs542
[bienz@wheeler ~]$
```


Create Environment from YAML file

```

spack env create [bienz@wheeler ~]$ spack env create cs542 spack.yaml
==> Created environment 'cs542' in /users/bienz/spack/var/spack/environments/cs542
==> You can activate this environment with:
==>   spack env activate cs542
[bienz@wheeler ~]$ spack env activate cs542
[bienz@wheeler ~]$ spack find
==> In environment cs542
==> Root specs
kokkos +hwloc

-- no arch / gcc -----
cmake%gcc

==> 0 installed packages
[bienz@wheeler ~]$ spack install
==> Starting concretization pool with 2 processes
==> Environment concretized in 34.75 seconds.
==> Concretized kokkos+hwloc
[+] wxnmtbq kokkos@3.6.0%gcc@11.2.0~aggressive_vectorization~compiler_warnings~
cuda~cuda_constexpr~cuda_lambda~cuda_ldg_intrinsic~cuda_relocatable_device_code~cu
da_uvm~debug~debug_bounds_check~debug_dualview_modify_check~deprecated_code~exampl
es~explicit_instantiation~hpx~hpx_async_dispatch+hwloc~ipo~memkind~numactl~openmp~
openmptarget~pic+profiling~profiling_load_print~pthread~qthread~rocm+serial+shared
~sycl~tests~tuning~wrapper build_type=RelWithDebInfo intel_gpu_arch=none std=14 ar
ch=linux-centos7-nehalem
[+] ybsgzuw ^cmake@3.23.3%gcc@11.2.0 cppflags="-O3" ~doc+ncurses+ownlibs~qt
build_type=Release arch=linux-centos7-nehalem
[+] kbucdx4 ^ncurses@6.3%gcc@11.2.0 cppflags="-O3" ~symlinks+termlib abi
=none arch=linux-centos7-nehalem
[+] jjqztfa ^pkg-config@0.27.1%gcc@11.2.0 cppflags="-O3" +internal_g
lib patches=49ffcd6 arch=linux-centos7-nehalem
[+] mccuqqe ^openssl@1.0.2k-fips%gcc@11.2.0 cppflags="-O3" ~docs~shared
certs=mozilla arch=linux-centos7-nehalem
[+] 3r5bqu4 ^hwloc@2.8.0%gcc@11.2.0~cairo~cuda~gl~libudev+libxml2~netloc~nvm
l~oneapi-level-zero~opencl+pci~rocm+shared arch=linux-centos7-nehalem
[+] pymz7uj ^libpciaccess@0.16%gcc@11.2.0 arch=linux-centos7-nehalem

```