

IceCube CVMFS Software and Spack

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Outline

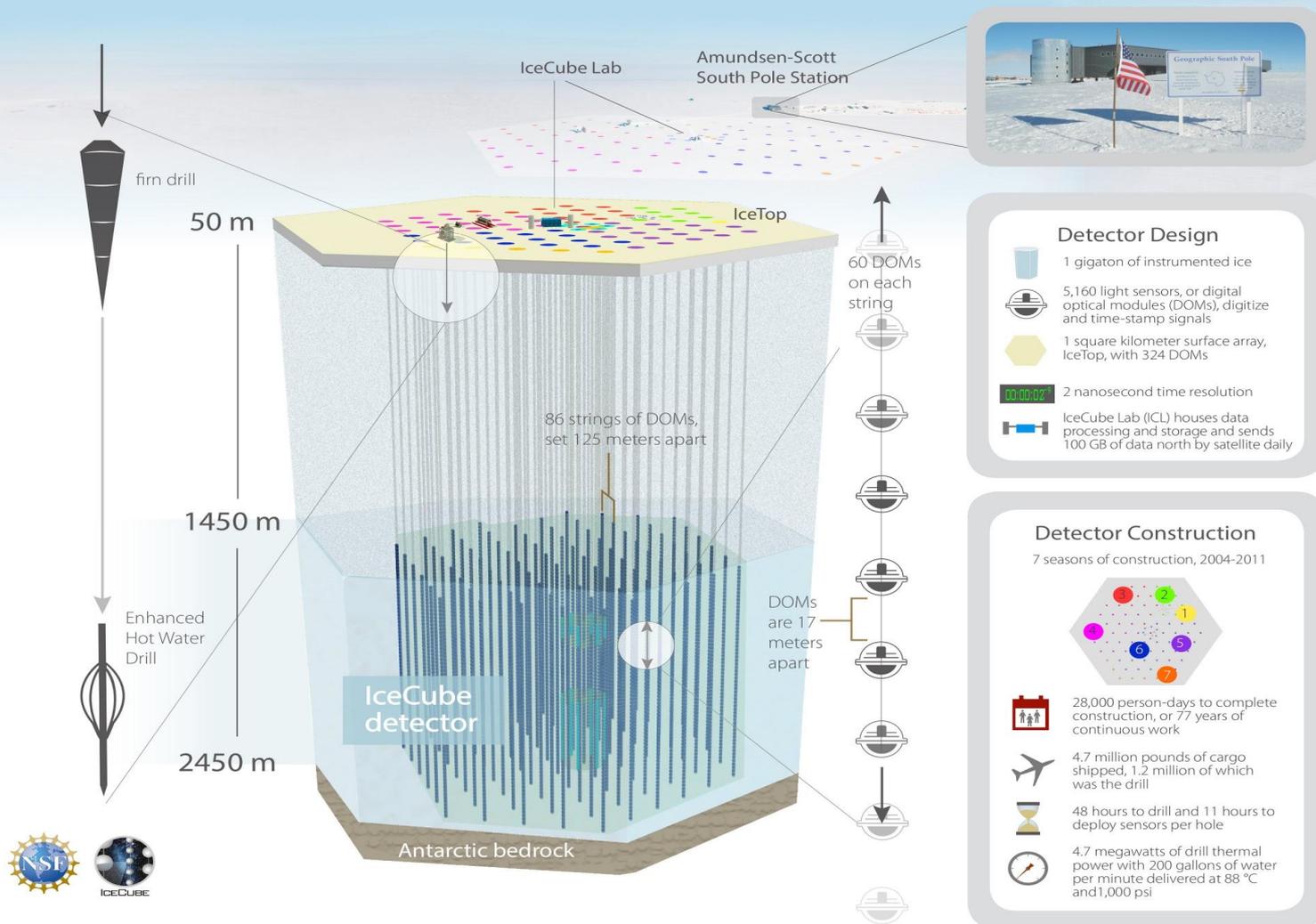
About IceCube

Our usage of Spack

Experiences

The IceCube Neutrino Observatory

Design and construction



Detector Design

- 1 gigaton of instrumented ice
- 5,160 light sensors, or digital optical modules (DOMs), digitize and time-stamp signals
- 1 square kilometer surface array, IceTop, with 324 DOMs
- 2 nanosecond time resolution
- IceCube Lab (ICL) houses data processing and storage and sends 100 GB of data north by satellite daily

Detector Construction

7 seasons of construction, 2004-2011

- 28,000 person-days to complete construction, or 77 years of continuous work
- 4.7 million pounds of cargo shipped, 1.2 million of which was the drill
- 48 hours to drill and 11 hours to deploy sensors per hole
- 4.7 megawatts of drill thermal power with 200 gallons of water per minute delivered at 88 °C and 1,000 psi



IceCube Requirements

Common software base for collaboration

- ~35 common software packages
- ~25 common python extensions
- ~5 custom software packages
- Single view of all packages

Advantages of Spack

- Don't have to maintain install scripts for common software - shared by community
- *gcc* compiler package available
 - requested by many users
- Automatically handles multi-platform installs
- Packages written in Python, our std language

How IceCube uses Spack

Build script:

1. Install spack and add private repo
2. *spack install* a compiler
3. *spack install* for each package
4. *spack view* symlinking all packages
5. Repeat 2-4 on each OS

Problems encountered

Figuring out dependencies

- Make sure packages use the exact version of a dependency we build

```
openblas@0.3.0 cpu_target=SSE_GENERIC  
virtual_machine=True
```

```
suite-sparse@5.2.0 ^openblas@0.3.0 cpu_target=SSE_GENERIC  
virtual_machine=True
```

- *spack spec* concretization shows what to expect

Problems encountered

Packages that need modification

- Lack of options: Root, many others
 - We need a non-X11 build
 - <https://github.com/spack/spack/pull/8428>
- Build errors: gnuplot, glib, ...
 - Was not happy with python build scripts
 - Modified package to not build docs or tests

Problems encountered

Unexpected happenings

- Package hashes change when updated
 - *git pull* on spack was a bad idea - forced rebuild of a large number of packages
 - This created a failure in dependency resolution (two packages with the same specs but different hashes), forcing a delete and start over approach

Good things

<https://github.com/spack/spack/pull/7152>

(merged 2 weeks ago)

- Fixes a bug with views and python packages
 - Previously: needed to globally activate package, or set PYTHONPATH
 - Now: adding python package to view “just works”

Wishlist

- External config files:
 - <https://github.com/spack/spack/pull/6903>
- Easier setup for external packages
 - Maybe a command to auto-register a package?
- Not having to specify the full spec of a dependency if it's already installed

Conclusions

IceCube is now using Spack for common software

Spack had some unexpected difficulties, but nothing that could not be worked around

Overall, happy to get majority of package installs from upstream / others