THE ELT LINUX DEVELOPMENT ENVIRONMENT

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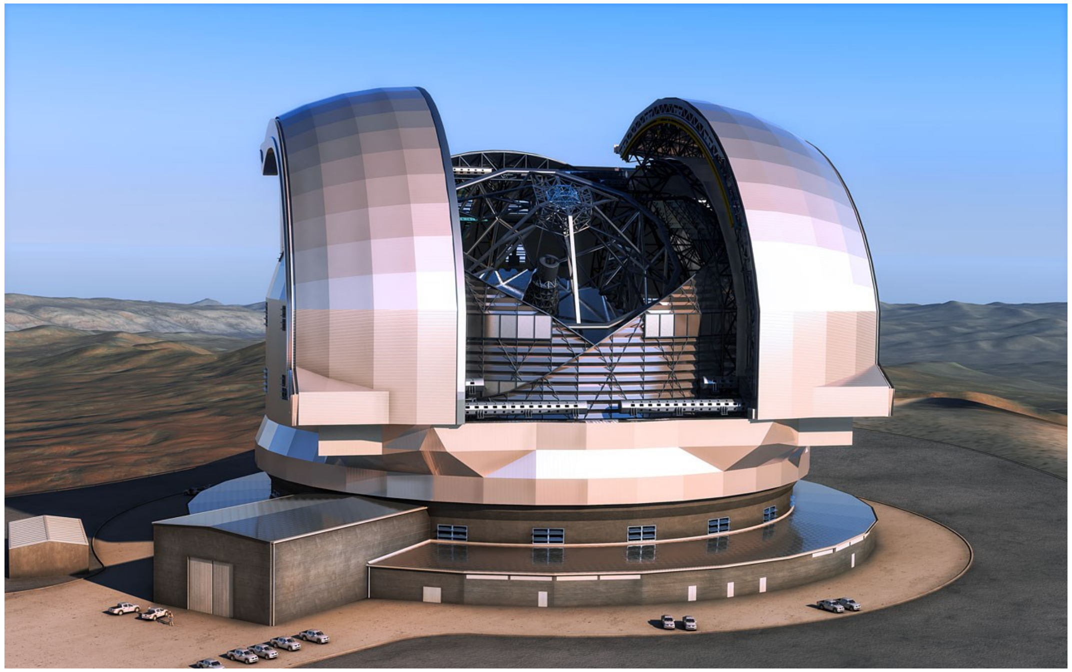
https://www.eso.org

The ELT



Extremely Large Telescope

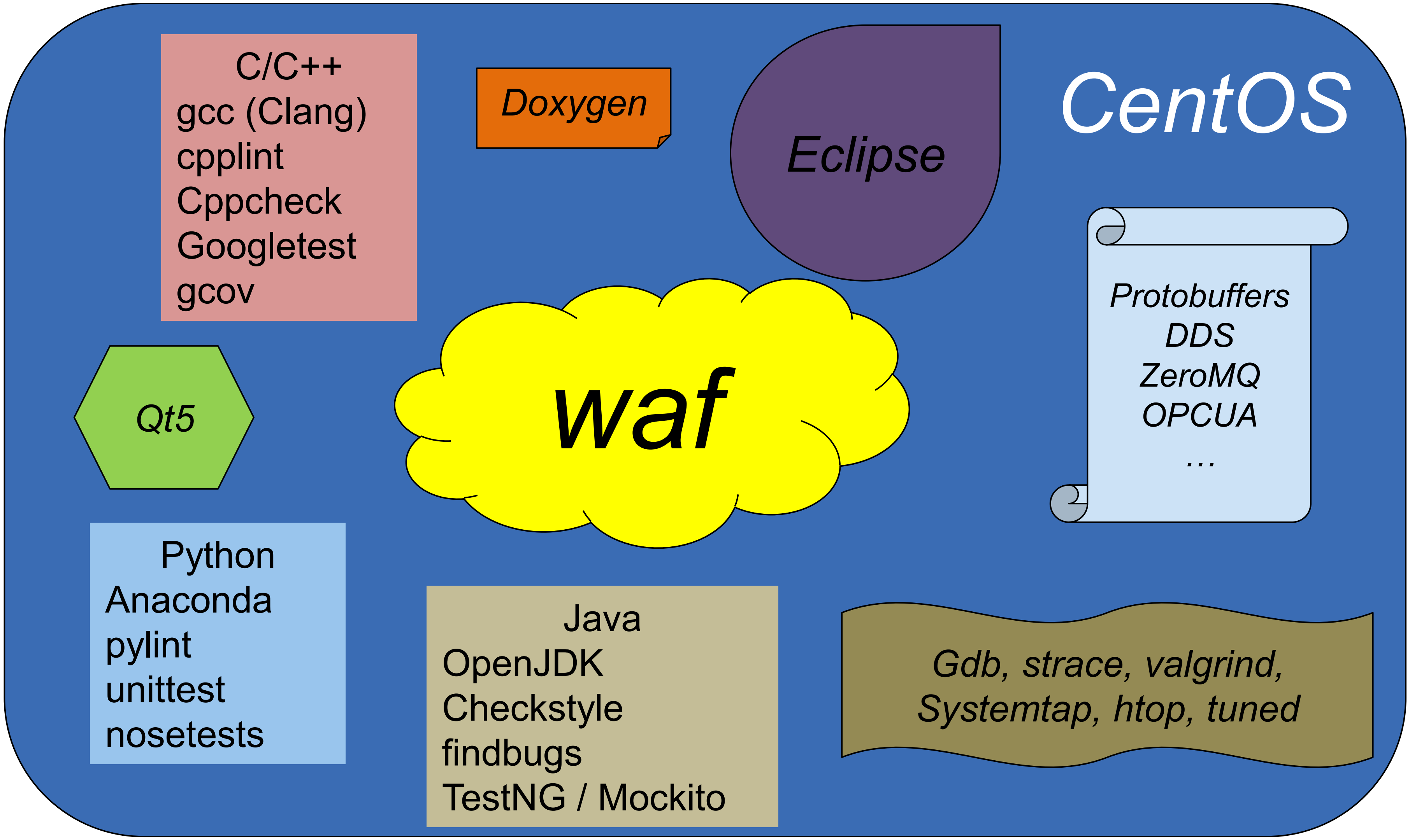
- 39m ground-based
- Cerro Armazones
- First stone May 2017
- First light expected 2024
- Largest optical/near-IR
- Exoplanets, star formations, protoplanetary systems

- Five-mirror design
- M1: 798 segments 1.4 meters wide 5cm thick (3 PACT, 6 ES, 12 WH)
  - Figure loop at 500Hz ~ 1Gbit/s traffic
- M4: 4 meters (~6000 actuators)
- Alt-azimuth mount with 6 LGS

Software challenges

- Components of very different scope:
  - Real-time performance
  - High level data handling and post-processing
- Long time project (> 30 years)
  - Maintenance
- Different developer base:
  - In-house / external
  - Engineers / scientists

DevEnv Overview



Build system challenges

- Single build system for C++ / Python /Java
  - Reliable partial builds
  - Full parallelization
  - Requires less specific knowledge
- Automatic dependency management
- Efficient and parallel
- Off-tree builds
- Ease of integration with new tools
- Logging and debugging support

waf

- Open source project started in 2005
- Entirely Python based (2.5 -> 3.6)
- Focus on:
  - Portability
  - Speed of execution
- Efficiency on condition of rebuilds
- Supports many languages and tools; expandable
- Users: Samba, RTEMS, Ardour, game companies

waf

- wscript: build scripts defining configuration, options and build steps
  - Python code
  - Interaction with the waf framework
- Command line execution of phases
  - configure
  - build
  - test
  - install / dist
  - Custom commands

waf: an example

```
def options(opt):
        opt.load('compiler_cxx python pyqt5 ')
def configure(conf):
        conf.load('compiler_cxx python pyqt5 ’)
        conf.check(header_name='stdio.h', features='cxx’)
        conf.check_python_version((3,5,0))
def build(bld):
        bld.shlib(source='a.cpp inc/a.h', target='alib’, export_includes=‘inc’)
        bld.program(source='m.cpp', target='app', use='alib’)
        bld.stlib(source='b.cpp', target='foo’)
        bld(features="py pyqt5",  source="src/test.py src/gui.ui",
                install_path="${PREFIX}/play/", install_from="src/")
```

wtools

- wscripts are readable and easy but still…
- wtools as a layer for:
  - Simplification for common tasks for users
  - Centralized maintenance and roll-out of new features
  - Easier to enforce certain practices
- Can reduce script to a single line:

```
from wtools.module import declare_cprogram

declare_cprogram(target=”foo”, use=”bar”)
```

- Tasks for primary artifacts and additional ones are created: tests, installation, linting …

wtools

- Based on set on conventions:
  - Directory structure, file positioning, file naming
- Currently supporting:
  - C/C++ program, shared and static library,
  - Python program and package,
  - Qt5 C++ or Python program
  - Java JAR packages.
- Custom modules that leverage full waf can be created for specific needs not included in wtools

Future challenges

- Early adoption with feedbacks
  - Implementation of new requests is easier
  - Very efficient resource-wise
- We need to help users to adapt to this new technology and maintain it actively to meet expectations
- What else we are looking at:
  - Containerization (Docker and LXC)
  - Deployment of applications