The WAF build system

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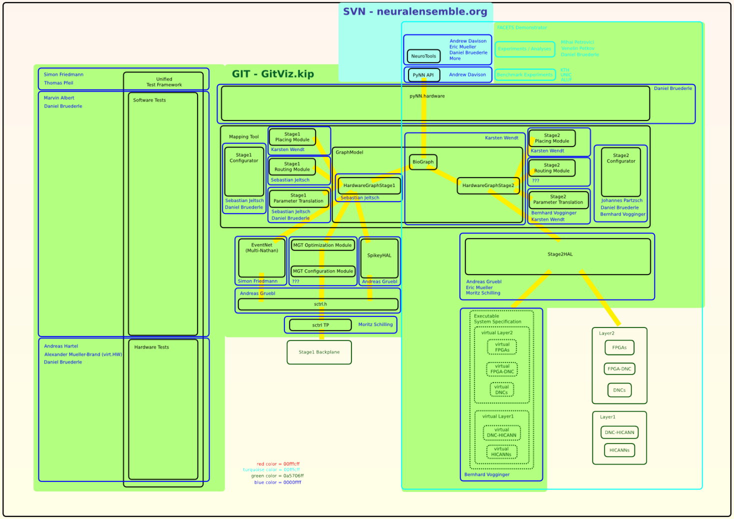
~~Work~~Buildflow



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- low-level code
- many many layers

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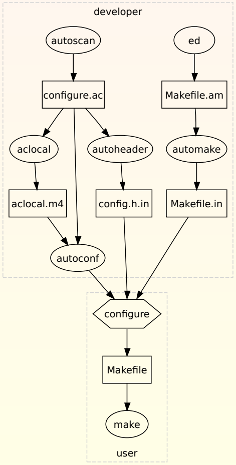
What we expect from our build system:

- flexibility
    - integration of existing workflows
    - access to well established libraries
    - extensibility
- power
- usability

GNU Build System

- + few dependencies on user side (shell scripts)
- + generates standard make files
- + widely used

- – platform dependent (bash scripts)
- – autoconf-configure is slow
  Often: $t_{\text{configure}} >> t_{\text{make}}$.
- – another scripting language



CMake

+ generates standard make files
+ platform independent
+ cross compilation
+ parallel build

– CMake scripting language
– file content change detection via fs time stamp

Projects using CMake: Boost, Blender, LLVM, KDE, MySQL, ...

WAF

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- supports build variants

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- Good documentation & active development

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- integrates unit testing into the build flow
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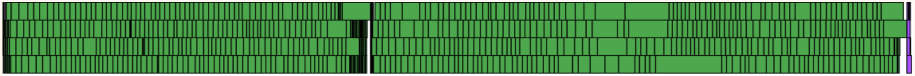
- Good documentation & active development
- Fast and small memory footprint
  - as fast as make and 15x faster than SCons
  - 10x less function calls than SCons

Samba 4



Parallel build representation for samba/source3 with 4 jobs on a dual-core cpu

- Build time 5min $\Rightarrow$ 35s

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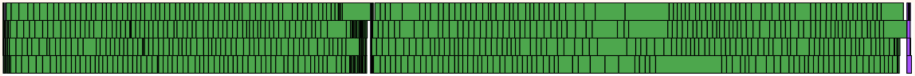

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- Build size reduction
  - check object file duplication
  - extensive shared-object and rpath use

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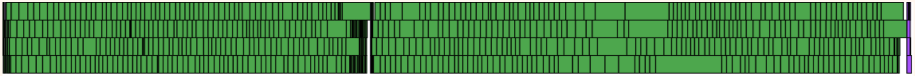

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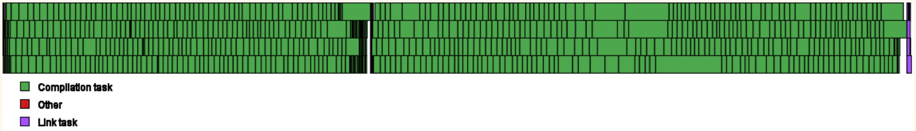


Parallel build representation for samba/source3 with 4 jobs on a dual-core cpu

- Build time 5min $\Rightarrow$ 35s
- Build size reduction
  - check object file duplication
  - extensive shared-object and rpath use
- full dependency checks
- cleaner build rules

wscript for this presentation

```
#!/usr/bin/env python
# encoding: utf-8

APPNAME="CodeJam4_WAF_pres"

top='.'

def configure(context):
    context.check_tool("tex")

def build(context):
    context.new_task_gen(
        features = "tex",
        source   = "main.tex",
        )
```

basic structure

```
#!/usr/bin/env python
APPNAME='basic_structure'
VERSION='0.1'
top='.'

def configure(context):
    pass

def build(context):
    pass
```

Installation

no installation needed

`Interpreter:`	installed version will not run on Python 3 yet
`OS:`	platform independence
`Admin:`	installation is cumbersome, and requires admin privileges
`Versions:`	avoid version conflicts (too old, too new, bugs)
`Size:`	the WAF file is small enough to be redistributed (about 90kB)

Configuration Phase (example1)

```
def configure(context):
    from Configure import ConfigurationError
    try:
        context.find_program(['touch', 'ls'], \
                mandatory=True)
        context.find_program('echo', var='ECHO', \
                mandatory=True)
    except ConfigurationError:
        context.check_message_2("programs not found")

    print context.env['ECHO']

    # execute custom tool
    context.check_tool('my_tool', tooldir='.')
```

Option Parser

```
def set_options(context):
    context.add_option('--foo', action='store', \
            default=False, help='Silly test')

    # c++ compiler path
    opt.tool_options('compiler_cxx')

    # python interpreter path
    opt.tool_options('python')

def configure(context):
    import Options
    print('the value of foo is %r' % Options.options.foo)
```

- easy to add options
- values are stored in the context variable

Task System

```
def build(context):
```

commands: `build`, `clean`, `install` and `uninstall` call `build()`
⇒ isolate targets from actual code

Execution control: targets are evaluated lazily

Parallel: task scheduling

FS abstraction: e.g. distributed build

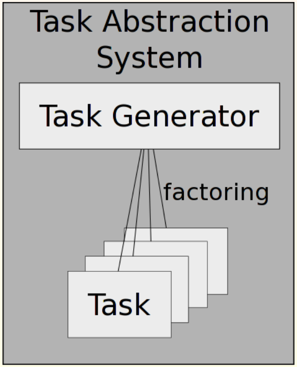
Language abstraction: flexibility and extensibility

Shell abstraction: platform independence

Task Abstraction Layer

abstraction layer between code execution (task) and declaration (task generators):

- `Task`:
  - abstract transformation unit
  - sequential constraints
  - require scheduler for parallel execution
- `Task generator`:
  - factory tasks creation
  - Handle global constraints (across tasks)
    - configuration set access
    - data sharing
    - OS abstraction



```
#!/usr/bin/env python
APPNAME='example2a'      # Task Generator
VERSION='0.1337'

build_rule='gcc ${SRC} -o ${TGT}'

import TaskGen
TaskGen.declare_chain(
        rule      = build_rule,
        ext_in    = '.c',
        ext_out   = '',
        reentrant = False)

def configure(context): pass

def build(context):
    context(source='t0.c', target='t0', rule=build_rule)
    context.new_task_gen(source='t1.c',
            target='t1',rule=build_rule)
    context(source='t2.c')
```

c/c++ support routines

```
#!/usr/bin/env python
APPNAME='example2b'      # Task Generator
VERSION='0.1337'

def set_options(context):
    context.tool_options('compiler_cc')

def configure(context):
    context.check_tool('compiler_cc')

def build(context):
    context(target='t', source='t.c', features='cc cprogram')
```

example4: demo

```
#!/usr/bin/env python
APPNAME='example4'     # shell usage & task translation
VERSION='0.1337'

def configure(context): pass

def build(bld):
    bld(rule='cp ${SRC} ${TGT}', source='wscript',
                  target='f1.txt', shell=False)
    bld(rule='cp ${SRC} ${TGT}', source='wscript',
                  target='f2.txt', shell=True)

    # commands containing '>','<' or '&' can not be executed
    #  => FALLBACK: shell usage
    bld(rule='cat ${SRC} > ${TGT}', source='wscript',
            target='f3.txt', shell=False)
```

FS interaction

```
def build(context):
    context.root        # root    (/) node
    context.path        # current (.) node

    etc   = context.root.find_dir('/etc')
    fstab = context.root.find_resource('/etc/fstab')
    context.root.ant_glob('etc/**/g*', dir=True,
                          src=False, bld=False)
```

Ant Globs (`http://ant.apache.org/manual/dirtasks.html`)