Scuba

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Local builds made easy, using Docker.

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INTRODUCTION

Scuba makes it easier to use Docker containers in everyday development. It is intended to allow a developer to commit an environment setup where the entire build environment is encapsulated in a Docker container.

Its purpose is to lower the barrier to using Docker for everyday builds. Scuba keeps you from having to remember a complex docker run command line, and turns this:

```
$ docker run -it --rm -v $(pwd):/build:z -w /build -u $(id -u):$(id -g) gcc:5.1 make_

→myprogram
```

into this:

\$ scuba make myprogram

Scuba references a .scuba.yml file which is intended to be checked-in to your project's version control, which ensures that all developers are always using the exact correct version of the the Docker build environment for a given commit.

TWO

INSTALLATION

2.1 Install via pip

Scuba is hosted at PyPI, and installation via pip is the perferred method.

To install:

```
$ sudo pip install scuba
```

To install with argcomplete (for *Bash Completion* support):

```
$ sudo pip install scuba[argcomplete]
```

To uninstall:

```
$ sudo pip uninstall scuba
```

2.2 Install from source

Scuba can be built from source on Linux only (due to the fact that scubainit must be compiled):

- 1. Run make to build scubainit
- 2. Run ./run_unit_tests.py to run the unit tests
- 3. Run sudo python setup.py install to install scuba
- 4. Run ./run_full_tests.py to test the installed version of scuba

If musl-libc is installed, it can be used to reduce the size of scubainit, by overriding the CC environment variable in step 1:

```
CC=/usr/local/musl/bin/musl-gcc make
```

Note: Note that installing from source in this manner can lead to an installation with increased startup times for Scbua. See #71 for more details. This can be remedied by forcing a wheel to be installed, as such:

```
export CC=/usr/local/musl/bin/musl-gcc # (optional)
sudo pip install wheel
python setup.py bdist_wheel
sudo pip install dist/scuba-<version>-py3-none-any.whl
```

CONFIGURATION

Configuration is done using a YAML file named .scuba.yml in the root directory of your project. It is expected that .scuba.yml will be checked-in to version control.

An example .scuba.yml file might look like this:

```
image: gcc:5.1

aliases:
  build: make -j4
```

In this example, running scuba build foo would execute make -j4 foo in a gcc:5.1 Docker container.

3.1 Scuba YAML File Reference

.scuba.yml is a YAML file which defines project-specific settings, allowing a project to use Scuba as part of manual command-line interaction. As with many other YAML file schemas, most options are controlled by top-level keys.

3.1.1 Top-level keys

Key	Scuba Version	Description	Alias
image	(all)	Docker image to run	Can override
environment	2.3.0	Environment variables	Can extend or over- ride
docker_args	2.8.0	Additional arguments to docker run	Can extend or over- ride
volumes	2.9.0	Additional volumes to mount	Can extend or over- ride
aliases	1.1.0	Command/script aliases	
hooks	1.7.0	Hook scripts run during startup	
shell	2.6.0	Override container shell path	Can override
entrypoint	2.4.0	Override container ENTRYPOINT path	Can override

image

The image node defines the Docker image from which Scuba containers are created.

Example:

```
image: debian:8.2
```

The image node is usually necessary but, as of scuba 2.5, can be omitted for .scuba.yml files in which only the aliases are intended to be used.

environment

The optional environment node (added in v2.3.0) allows environment variables to be specified. This can be either a mapping (dictionary), or a list of KEY=VALUE pairs. If a value is not specified, the value is taken from the external environment.

Examples:

```
environment:
   F00: "This is foo"
   SECRET:
```

```
environment:
```

- FOO=This is foo
- SECRET

docker_args

The optional docker_args node (added in v2.8.0) allows additional docker arguments to be specified.

Example:

```
docker_args: --privileged -v "/tmp/hello world:/tmp/hello world"
```

The value of docker_args is parsed as shell command line arguments using shlex.split.

The previous example could be equivalently written in YAML's single-quoted style:

```
docker_args: '--privileged -v "/tmp/hello world:/tmp/hello world"'
```

volumes

The optional volumes node (added in v2.9.0) allows additional bind-mounts to be specified. As of v2.13.0, named volumes are also supported.

volumes is a mapping (dictionary) where each key is the container-path. In the simple form, the value is a string, which can be:

- An absolute or relative path which results in a bind-mount.
- A Docker volume name.

Listing 1: Example of simple-form volumes

```
volumes:
  /var/lib/foo: /host/foo # bind-mount: absolute path
  /var/lib/bar: ./bar # bind-mount: path relative to .scuba.yml dir
  /var/log: persist-logs # named volume
```

In the complex form, the value is a mapping with the following supported keys:

- hostpath: An absolute or relative path specifying a host bind-mount.
- name: The name of a named Docker volume.
- options: A comma-separated list of volume options.

hostpath and name are mutually-exclusive and one must be specified.

Listing 2: Example of complex-form volumes

```
volumes:
  /var/lib/foo:
  hostpath: /host/foo  # bind-mount
  options: ro,cached
  /var/log:
    name: persist-logs  # named volume
```

The paths (host or container) used in volume mappings can contain environment variables which are expanded in the host environment. For example, this configuration would map the user's /home/username/.config/application1 directory into the container at the same path.

```
volumes:
    $TEST_HOME/.config/application1: $TEST_HOME/.config/application1
```

If a referenced environment variable is not set, Scuba exits with a configuration error.

Volume container paths must be absolute.

Bind-mount host paths can be absolute or relative. If a relative path is used, it is interpreted as relative to the directory in which .scuba.yml is found. To avoid ambiguity with a named volume, relative paths must start with ./ or ../.

Bind-mount host directories which do not already exist are created as the current user before creating the container.

Note: Because variable expansion is now applied to all volume paths, if one desires to use a literal \$ character in a path, it must be written as \$\$.

Note: Docker named volumes are created with drwxr-xr-x (0755) permissions. If scuba is not run with --root, the scuba user will be unable to write to this directory. As a workaround, one can use a *root hook* to change permissions on the directory.

```
volumes:
   /foo: foo-volume
hooks:
   root: chmod 777 /foo
```

aliases

The optional aliases node is a mapping (dictionary) of bash-like aliases, where each key is an alias, and each value is the command that will be run when that alias is specified as the *user command* during scuba invocation. The command is parsed like a shell command-line, and additional user arguments from the command line are appended to the alias arguments. Aliases follow the *common script schema*.

Example:

```
aliases:
build: make -j4
```

In this example, \$ scuba build foo would execute make -j4 foo in the container.

Aliases can also extend/override various top-level keys. See *Alias-level keys*.

hooks

The optional hooks node is a mapping (dictionary) of "hook" scripts that run as part of scubainit before running the user command. They use the *common script schema*. The following hooks exist:

- root Runs just before scubainit switches from root to scubauser
- user Runs just before scubainit executes the user command

Example:

```
hooks:
    root:
    script:
        - 'echo "HOOK: This runs before we switch users"'
        - id
    user: 'echo "HOOK: After switching users, uid=$(id -u) gid=$(id -g)"'
```

shell

The optional shell node (added in v2.6.0) allows the default shell that Scuba uses in the container (/bin/sh) to be overridden by another shell. This is useful for images that do not have a shell located at /bin/sh.

Example:

```
shell: /busybox/sh
```

entrypoint

The optional entrypoint node (added in v2.4.0) allows the ENTRYPOINT of the Docker image to be overridden:

```
entrypoint: /another/script
```

The entrypoint can also be set to null, which is useful when an image's entrypoint is not suitable:

```
entrypoint:
```

3.1.2 Alias-level keys

Key	Scuba Version	Description
image	1.1.0	Override Docker image to run
environment	2.3.0	Extend / override environment variables
docker_args	2.8.0	Extend / override additional arguments to docker run
volumes	2.9.0	Extend / override additional volumes to mount
shell	2.6.0	Override container shell path
entrypoint	2.4.0	Override container ENTRYPOINT path
root	2.6.0	Run container as root

image

Aliases can override the global image, allowing aliases to use different images. Example:

```
image: default_image
aliases:

# This one inherits the default, top-level 'image' and specifies "script" as a string
default:
    script: cat /etc/os-release

# This one specifies a different image to use and specifies "script" as a list
different:
    image: alpine
    script:
    - cat /etc/os-release
```

environment

Aliases can add to the top-level environment and override its values using the same syntax:

```
environment:
   F00: "Top-level"
aliases:
   example:
    environment:
      F00: "Override"
      BAR: "New"
   script:
      - echo $F00 $BAR
```

docker_args

Aliases can extend the top-level docker_args. The following example will produce the docker arguments --privileged -v /tmp/bar:/tmp/bar when executing the example alias:

```
docker_args: --privileged
aliases:
    example:
    docker_args: -v /tmp/bar:/tmp/bar
    script:
        - ls -l /tmp/
```

Aliases can also opt to override the top-level docker_args, replacing it with a new value. This is achieved with the !override tag:

```
docker_args: -v /tmp/foo:/tmp/foo
aliases:
    example:
    docker_args: !override -v /tmp/bar:/tmp/bar
    script:
        - ls -l /tmp/
```

The content of the docker_args key is re-parsed as YAML in order to allow combining the !override tag with other tags; however, this requires quoting the value, since YAML forbids a plain-style scalar from beginning with a ! (see the spec). In the next example, the top-level alias is replaced with an explicit !!null tag, so that no additional arguments are passed to docker when executing the example alias:

```
docker_args: -v /tmp/foo:/tmp/foo
aliases:
    example:
        docker_args: !override '!!null'
        script:
            - ls -l /tmp/
```

volumes

Aliases can extend or override the top-level volumes:

```
volumes:
   /var/lib/foo: /host/foo
aliases:
   example:
    volumes:
        /var/lib/foo: /example/foo
        /var/lib/bar: /example/bar
        script:
        - ls -l /var/lib/foo /var/lib/bar
```

shell

Aliases can override the shell from the default or the top-level of the .scuba.yml file:

```
aliases:
    my_shell:
    shell: /bin/cool_shell
    script:
    - echo "This is executing in cool_shell"
    busybox_shell:
    script:
    - echo "This is executing in scuba's default shell"
```

entrypoint

An alias can override the image-default or top-level .scuba.yml entrypoint, which is most useful when an alias defines a special image.

```
aliases:
  build:
  image: build/image:1.2
  entrypoint:
```

root

The optional root node (added in v2.6.0) allows an alias to specify whether its container should be run as root:

```
aliases:
   root_check:
   root: true
   script:
    - echo 'Only root can do this!'
    - echo "I am UID $(id -u)"
    - cat /etc/shadow
```

3.1.3 Common script schema

Several parts of .scuba.yml which define "scripts" use a common schema. The *common script schema* can define a "script" in one of several forms:

The *simple* form is simply a single string value:

```
hooks:
user: echo hello
```

The complex form is a mapping, which must contain a script subkey, whose value is either single string value:

```
hooks:
root:
script: echo hello
```

... or a list of strings making up the script:

```
hooks:
    root:
    script:
        - 'echo hello!'
        - touch foo
        - 'echo goodbye :-('
```

Note that in any case, YAML strings do not need to be enclosed in quotes, unless there are "confusing" characters (like a colon). In any case, it is always safer to include quotes.

3.1.4 Accessing external YAML content

In addition to normal YAML syntax, an additional constructor, ! from_yaml, (added in v1.2.0) is available for use in .scuba.yml which allows a value to be retrieved from an external YAML file. It has the following syntax:

```
<code>!from_yaml</code> filename key
```

Arguments:

- filename The path of an external YAML file (relative to .scuba.yaml)
- key A dot-separated locator of the key to retrieve

This is useful for projects where a Docker image in which to build is already specified in another YAML file, for example in .gitlab-ci.yml. This eliminates the redundancy between the configuration files. An example which uses this:

Listing 3: .gitlab-ci.yml

```
image: gcc:5.1
```

Listing 4: .scuba.yml

```
image: !from_yaml .gitlab-ci.yml image
```

Here's a more elaborate example which defines multiple aliases which correspond to jobs defined by .gitlab-ci.yml:

Listing 5: .gitlab-ci.yml

```
build_c:
    image: gcc:5.1
    script:
    - make something
    - make something-else

build_py:
    image: python:3.7
    script:
    - setup.py bdist_wheel
```

Listing 6: .scuba.yml

```
# Note that 'image' is not necessary if only invoking aliases

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```

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```
aliases:
  build_c:
    image: !from_yaml .gitlab-ci.yml build_c.image
    script: !from_yaml .gitlab-ci.yml build_c.script
  build_py:
    image: !from_yaml .gitlab-ci.yml build_py.image
    script: !from_yaml .gitlab-ci.yml build_py.script
```

An easier but less-flexible method is to simply import the entire job's definition. This works becaue Scuba ignores unrecognized keys in an alias:

Listing 7: .scuba.yml

```
aliases:
  build_c: !from_yaml .gitlab-ci.yml build_c
  build_py: !from_yaml .gitlab-ci.yml build_py
```

This example which concatenates two jobs from .gitlab-ci.yml into a single alias. This works by flattening the effective script node that results by including two elements that are lists.

Listing 8: .gitlab-ci.yml

```
image: gcc:5.1

part1:
    script:
    - make something
part2:
    script:
    - make something-else
```

Listing 9: .scuba.yml

```
image: !from_yaml .gitlab-ci.yml image

aliases:
   all_parts:
     script:
     - !from_yaml .gitlab-ci.yml part1.script
     - !from_yaml .gitlab-ci.yml part2.script
```

Dots (.) in a YAML *path* can be escaped using a backslash (which must be doubled inside of quotes). This example shows how to reference job names containing a . character:

Listing 10: .gitlab-ci.yml

```
image: gcc:5.1

.part1:
    script:
    - make something
.part2:
    script:
```

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```
- make something-else
```

Listing 11: .scuba.yml

```
image: !from_yaml .gitlab-ci.yml image

aliases:
  build_part1: !from_yaml .gitlab-ci.yml "\\.part1.script"
  build_part2: !from_yaml .gitlab-ci.yml "\\.part2.script"
```

Additional examples can be found in the example directory.

FOUR

COMMAND-LINE INTERFACE

```
scuba [-h]

[-d DOCKER_ARG] [-e ENV_VAR] [--entrypoint ENTRYPOINT]

[--image IMAGE] [--shell SHELL] [-n] [-r] [-v] [-V]

COMMAND... | ALIAS...
```

Positional Arguments:

COMMAND

The command (and arguments) to run in the container

ALIAS

Alternatively, an alias to run

Options:

-h, --help Show help message and exit

-d DOCKER_ARG, --docker-arg DOCKER_ARG Pass additional arguments to docker run. These are appended to any docker_args from .scuba.yml.

DOCKER_ARG is the full argument to docker run. Note: The - in the DOCKER_ARG can confuse scuba's argument parsing. The solution is to use an equal sign: -d='--cpus=2'

This argument can be given multiple times.

-e ENV_VAR, --env ENV_VAR Environment variables to pass to docker. These are merged with (and override) any *environment* variables from .scuba.yml.

ENV VAR is given as KEY=value.

This argument can be given multiple times.

--entrypoint ENTRYPOINT Override the default ENTRYPOINT of the image

--image IMAGE Override Docker image specified in .scuba.yml

--shell SHELL Override shell used in Docker container

-n, --dry-run Don't actually invoke docker; just print the docker cmdline

-r, --root Run container as root

-v, --version Show scuba version and exit

-V, --verbose Be verbose

FIVE

BASH COMPLETION

Scuba supports command-line completion using the argcomplete package. Per the argcomplete README, command-line completion can be activated by:

- Running eval "\$(register-python-argcomplete scuba)" manually to enable completion *in the current* shell instance
- Adding eval "\$(register-python-argcomplete scuba)" to ~/.bash_completion
- Running activate-global-python-argcomplete --user to install the script ~/.bash_completion.d/ python-argcomplete.

Note: The generated file must be sourced, which is *not* the default behavior. Adding the following code block to ~/.bash_completion is one possible solution:

```
for bcfile in ~/.bash_completion.d/*; do
   [ -f "$bcfile" ] && . "$bcfile"
done
```

• Running activate-global-python-argcomplete as root (or sudo) to use argcomplete for all users

SIX

ENVIRONMENT

Scuba defines the following environment variables in the container:

• SCUBA_ROOT – ($added\ in\ v2.4.0$) The root of the scuba working directory mount; the directory where .scuba. yml was found

SEVEN

CHANGE LOG

All notable changes to this project will be documented in this file. This project adheres to Semantic Versioning.

7.1 2.13.0 - 2024-03-25

7.1.1 Added

- Added support for Python 3.12 (#244)
- Add explicit support for mounting named volumes (#250)
 - This officially restores and extends the (unsupported) pre-v2.12 behavior.

7.1.2 Changed

- Removed use of deprecated pkg_resources (#247)
- Rewrote scubainit in Rust (#232)

7.2 2.12.0 - 2023-09-15

7.2.1 Added

• Enable the use of relative paths in a volume hostpath (#227)

7.3 2.11.0 - 2023-09-09

7.3.1 Changed

- Introduced pyproject.toml and moved metadata from setup.py (#211)
- Added type annotations to scuba package and mypy checking in CI (#207)

7.3.2 Removed

• Drop support for Python 3.5 - 3.6 (#205)

7.3.3 Fixed

• Fixed bug causing invalid volume spec error on Docker 24.0.5 and newer (#217)

7.4 2.10.1 - 2023-03-07

7.4.1 Fixed

• Create directories for volumes as invoking user rather than root. (#201)

7.5 2.10.0 - 2022-01-12

7.5.1 Added

• Add ability to use environment variables in volume paths (#192)

7.6 2.9.0 - 2021-09-15

7.6.1 Added

• Add ability to specify volumes in .scuba.yml (#186)

7.7 2.8.0 - 2021-08-18

7.7.1 Added

• Add ability to specify additional docker arguments in .scuba.yml (#177)

7.7.2 Changed

• Switched testing framework from from nose to pytest

7.8 2.7.0 - 2020-06-08

7.8.1 Changed

• Switched to using argcomplete to provide Bash command line completion (#162)

7.9 2.6.1 - 2020-04-24

7.9.1 Fixed

- scubainit ignores matching passwd/group/shadow file entries when creating the user. This allows transparently running scuba as root. (#164)
- Fixed bug where scubainit incorrectly displayed the exit status of a failed hook script. (#165)
- Fixed bug where user home directory was not writable when scuba workdir existed below the home directory. (#169)

7.10 2.6.0 - 2020-03-25

7.10.1 Added

- Add ability to override the shell in which the scuba-generated script is run, via command line option (--shell) or via .scuba.yml (#159)
- Add ability to specify in .scuba.yml that a particular alias should run as root (#159)

7.11 2.5.0 - 2020-03-05

7.11.1 Changed

- Use username/groupname of invoking user inside container (#153)
- Ignore already existing UID/GIDs (#139)
- Allow top-level image to be omitted in .scuba.yml (#158)

7.11.2 Fixed

• Fixed deprecation error with collections.Mapping (#156)

7.8. 2.7.0 - 2020-06-08

7.11.3 Removed

• Drop support for Python 2 (#154)

7.12 2.4.2 - 2020-02-24

7.12.1 Changed

• Use GitHub Actions instead of Travis CI for publishing releases

7.13 2.4.1 - 2020-02-21

7.13.1 Added

• Cache yaml files loaded by !from_yaml

7.13.2 Removed

• Drop support for Python 3.4

7.14 2.4.0 - 2020-01-06

7.14.1 Added

- Enable scuba to override entrypoint via --entrypoint or .scuba.yml (#125)
- Add support for nested scripts (#128)
- Add SCUBA_ROOT environment variable (#129)
- Add support for escaped dots in !from_yml (#137)

7.14.2 Changed

- Don't run image entrypoint for each line in a mult-line alias (#121)
- Use yaml.SafeLoader for loading config (#133)

27

7.14.3 Removed

• Drop support for Python 2.6, 3.2, and 3.3 (#119, #130)

7.15 2.3.0 - 2018-09-10

7.15.1 Added

- Add -e/-env command-line option (#111)
- Add support for setting environment in .scuba.yml (#120)

7.15.2 Changed

• Implemented auto-versioning using Git and Travis (#112)

7.15.3 Fixed

• Copy scubainit to allow SELinux relabeling (#117)

7.16 2.2.0 - 2018-03-07

7.16.1 Changed

• Allow script to be a single string value in the "common script schema" which applies to hooks and aliases (#102)

7.16.2 Fixed

- Display nicer error message if no command is given and image doesn't specify a Cmd (#104)
- Don't mangle && in scripts (#100)
- Don't allocate tty if stdin is redirected (#95)

7.17 2.1.0 - 2017-04-03

7.17.1 Added

• Added --image option (#87)

7.15. 2.3.0 - 2018-09-10

7.18 2.0.1 - 2017-01-17

7.18.1 Fixed

• Fixed image entrypoint being ignored (#83)

7.19 2.0.0 - 2016-11-21

7.19.1 Added

- Added support for enhanced aliases (#67)
- Added support for per-alias image specification (#68)
- Add bash completion support (#69)

7.19.2 Changed

- All ancillary files are bind-mounted via single temp dir
- · Hook scripts are moved to hooks/ subdirectory
- User commands always executed via shell (#66)
- Top-level directory mounted at same path in container (#70)
- Alias names cannot contain spaces
- Improve distributions (#74, #75, #76, #78)

7.19.3 Removed

• Remove support for remote Docker instances (#64) Support for this was limited/broken as of 1.7.0 anyway; this officially removes support for it.

7.19.4 Fixed

• Fixed inability to run an image that doesn't yet exist locally, broken in 1.7.0 (#79)

7.20 1.7.0 - 2016-05-19

7.20.1 Added

• Add support for scubainit hooks

7.20.2 Changed

- scubainit re-implemented as a C program, which does the following:
 - Creates the scubauser user/group
 - Sets the umask
 - Switches users then *execs* the user command This is to provide more control during initialization, without the artifacts caused by the use of 'su' in the .scubainit from 1.3.
- scubauser now has a proper writable home directory in the container (#45)

7.21 1.6.0 - 2016-02-06

7.21.1 Added

• Add -d to pass arbitrary arguments to docker run

7.22 1.5.0 - 2016-02-01

7.22.1 Added

- Add -r option to run container as root
- Add automated testing (both unit and system tests)
- Add support for Python 2.6 3.5
- · Added to PyPI

7.22.2 Changed

- Scuba is now a package, and setup.py installs it as such, including an auto-generated console_script wrapper.
- --dry-run output now shows an actual docker command-line.
- Only pass --tty to docker if scuba's stdout is a TTY.

7.22.3 Fixed

- Better handle empty .scuba.yml and other YAML-related errors
- Fix numerous bugs when running under Python 3

7.21. 1.6.0 - 2016-02-06

7.23 1.4.0 - 2016-01-08

7.23.1 Added

• Added --verbose and --dry-run options

7.23.2 Removed

• umask is no longer set in the container. (See #24)

7.23.3 Fixed

• Problems introduced in v1.3.0 with Ctrl+C in images are fixed. The user command now runs as PID 1 again, as there is no more .scubainit script.

7.24 1.3.0 - 2016-01-07

7.24.1 Added

• Set umask in container to the same as the host (local Docker only)

7.24.2 Changed

- Change working directory from /build to /scubaroot
- Use .scubainit script to create scubauser user/group at container startup. This avoids the oddity of running as a uid not listed in /etc/passwd, avoiding various bugs (see issue 11). (local Docker only)

7.25 1.2.0 - 2015-12-27

7.25.1 Added

- Search up the directory hierarchy for .scuba.yml; this allows invoking scuba from a project subdirectory.
- Add !from_yaml support to YAML loading; this allows specifying image from an external YAML file (e.g. .gitlab-ci.yml).
- · Add CHANGELOG.md

7.25.2 Changed

• Show better error message when docker cannot be executed

7.26 1.1.2 - 2015-12-22

7.26.1 Fixed

• Don't pass --user option when remote docker is being used

7.27 1.1.1 - 2015-12-22

7.27.1 Fixed

• Fix bug when aliases is not found in .scuba.yml

7.28 1.1.0 - 2015-12-20

7.28.1 Added

• Support for Bash-like aliases, specified in .scuba.yml

7.29 1.0.0 - 2015-12-18

7.29.1 Removed

• Remove the command node from .scuba.yml spec; it limits the usefulness of scuba by limiting the user to one command. Now command is specified on command line after scuba.

7.29.2 Added

- Argument parsing to scuba (-v for version)
- Check for and reject extraneous nodes in .scuba.yml

7.30 0.1.0 - 2015-12-09

First versioned release

EIGHT

CONTRIBUTING GUIDE

This file is incomplete. Feel free to open an issue if there is missing information you desire.

8.1 Code Format

Scuba is compliant with the Black code style. Code format in PRs is verified by a GitHub action.

To check code formatting:

\$./code_format.py

To fix code formatting:

\$./code_format.py --fix