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# **Pungi Documentation**

***Release 4.1.17***

**Daniel Mach**

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## ABOUT PUNGI

*Pungi* is a distribution compose tool.

Composes are release snapshots that contain release deliverables such as:

- installation trees
  - RPMs
  - repodata
  - comps
- (bootable) ISOs
- kickstart trees
  - anaconda images
  - images for PXE boot



### 1.1 Tool overview

*Pungi* consists of multiple separate executables backed by a common library.

The main entry-point is the `pungi-koji` script. It loads the compose configuration and kicks off the process. Composing itself is done in phases. Each phase is responsible for generating some artifacts on disk and updating the `compose` object that is threaded through all the phases.

*Pungi* itself does not actually do that much. Most of the actual work is delegated to separate executables. *Pungi* just makes sure that all the commands are invoked in the appropriate order and with correct arguments. It also moves the artifacts to correct locations.

### 1.2 Links

- Upstream GIT: <https://pagure.io/pungi/>
- Issue tracker: <https://pagure.io/pungi/issues>
- Questions can be asked on `#fedora-releng` IRC channel on FreeNode

## 1.3 Origin of name

The name *Pungi* comes from the instrument used to charm snakes. *Anaconda* being the software Pungi was manipulating, and anaconda being a snake, led to the referential naming.

The first name, which was suggested by Seth Vidal, was *FIST*, *Fedora Installation <Something> Tool*. That name was quickly discarded and replaced with Pungi.

There was also a bit of an inside joke that when said aloud, it could sound like punji, which is a sharpened stick at the bottom of a trap. Kind of like software. . .



## CONTRIBUTING TO PUNGI

### 2.1 Set up development environment

In order to work on *Pungi*, you should install recent version of *Fedora*. These packages will have to installed:

- createrepo
- createrepo\_c
- cvs
- genisoimage
- gettext
- git
- isomd5sum
- jigdo
- kobo
- kobo-rpmlib
- koji
- libselinux-python
- lorax
- python-jsonschema
- python-kickstart
- python-lockfile
- python-lxml
- python2-multilib
- python-productmd
- repoview
- syslinux
- yum
- yum-utils

For running unit tests, these packages are recommended as well:

- python-mock

- python-nose
- python-nose-cov

While being difficult, it is possible to work on *Pungi* using *virtualenv*. Install *python-virtualenvwrapper* and use following steps. It will link system libraries into the virtual environment and install all packages preferably from PyPI or from tarball. You will still need to install all of the non-Python packages above as they are used by calling an executable.

```
$ mkvirtualenv pungienv
$ for pkg in koji rpm rpmUtils pykickstart selinux createrepo yum urlgrabber; do ln -
↪vs "$(deactivate && python -c 'import os, '$pkg'; print os.path.dirname('$pkg'.__
↪file__'))" "$(virtualenvwrapper_get_site_packages_dir)"; done
$ for pkg in _selinux deltarpm _deltarpm krbV sqlitecachec _sqlitecache; do ln -vs "
↪$(deactivate && python -c 'import os, '$pkg'; print '$pkg'.__file__')" "
↪$(virtualenvwrapper_get_site_packages_dir)"; done
$ PYCURL_SSL_LIBRARY=nss pip install pycurl --no-binary :all:
$ pip install lxml pyopenssl mock sphinx setuptools nose nose-cov productmd
↪jsonschema requests lockfile python-multilib kobo
```

Now you should be able to run all existing tests.

## 2.2 Developing

Currently the development workflow for Pungi is on master branch:

- Make your own fork at <https://pagure.io/pungi>
- Clone your fork locally (replacing \$USERNAME with your own):

```
git clone git@pagure.io:forks/$USERNAME/pungi.git
```

- cd into your local clone and add the remote upstream for rebasing:

```
cd pungi
git remote add upstream git@pagure.io:pungi.git
```

---

**Note:** This workflow assumes that you never `git commit` directly to the master branch of your fork. This will make more sense when we cover rebasing below.

---

- create a topic branch based on master:

```
git branch my_topic_branch master
git checkout my_topic_branch
```

- Make edits, changes, add new features, etc. and then make sure to pull from upstream master and rebase before submitting a pull request:

```
# lets just say you edited setup.py for sake of argument
git checkout my_topic_branch

# make changes to setup.py
git add setup.py
git commit -s -m "added awesome feature to setup.py"
```

```
# now we rebase
git checkout master
git pull --rebase upstream master
git push origin master
git push origin --tags
git checkout my_topic_branch
git rebase master

# resolve merge conflicts if any as a result of your development in
# your topic branch
git push origin my_topic_branch
```

**Note:** In order to for your commit to be merged, you must sign-off on it. Use `-s` option when running `git commit`.

- Create pull request in the [pagure.io](https://pagure.io) web UI
- For convenience, here is a bash shell function that can be placed in your `~/.bashrc` and called such as `pullupstream pungi-4-devel` that will automate a large portion of the rebase steps from above:

```
pullupstream () {
  if [[ -z "$1" ]]; then
    printf "Error: must specify a branch name (e.g. - master, devel)\n"
  else
    pullup_startbranch=$(git describe --contains --all HEAD)
    git checkout $1
    git pull --rebase upstream master
    git push origin $1
    git push origin --tags
    git checkout ${pullup_startbranch}
  fi
}
```

## 2.3 Testing

You must write unit tests for any new code (except for trivial changes). Any code without sufficient test coverage may not be merged.

To run all existing tests, suggested method is to use `nosetests`. With additional options, it can generate code coverage. To make sure even tests from executable files are run, don't forget to use the `--exe` option.

```
$ make test
$ make test-cover

# Running single test file
$ python tests/test_arch.py [TestCase...]
```

In the `tests/` directory there is a shell script `test_compose.sh` that you can use to try and create a miniature compose on dummy data. The actual data will be created by running `make test-data` in project root.

```
$ make test-data
$ make test-commpose
```

This testing compose does not actually use all phases that are available, and there is no checking that the result is correct. It only tells you whether it crashed or not.

---

**Note:** Even when it finishes successfully, it may print errors about `repoclosure` on *Server-Gluster.x86\_64* in *test* phase. This is not a bug.

---

## 2.4 Documenting

You must write documentation for any new features and functional changes. Any code without sufficient documentation may not be merged.

To generate the documentation, run `make doc` in project root.

## TESTING PUNGI

### 3.1 Test Data

Tests require test data and not all of it is available in git. You must create test repositories before running the tests:

```
make test-data
```

Requirements: createrepo\_c, rpmbuild

### 3.2 Unit Tests

Unit tests cover functionality of Pungi python modules. You can run all of them at once:

```
make test
```

which is shortcut to:

```
python2 setup.py test
python3 setup.py test
```

You can alternatively run individual tests:

```
cd tests
./<test>.py [<class>[.<test>]]
```

### 3.3 Functional Tests

Because compose is quite complex process and not everything is covered with unit tests yet, the easiest way how to test if your changes did not break anything badly is to start a compose on a relatively small and well defined package set:

```
cd tests
./test_compose.sh
```



## CONFIG FILE FORMAT

The configuration file parser is provided by [kobo](#)

The file follows a Python-like format. It consists of a sequence of variables that have a value assigned to them.

```
variable = value
```

The variable names must follow the same convention as Python code: start with a letter and consist of letters, digits and underscores only.

The values can be either an integer, float, boolean (`True` or `False`), a string or `None`. Strings must be enclosed in either single or double quotes.

Complex types are supported as well.

A list is enclosed in square brackets and items are separated with commas. There can be a comma after the last item as well.

```
a_list = [1,
          2,
          3,
          ]
```

A tuple works like a list, but is enclosed in parenthesis.

```
a_tuple = (1, "one")
```

A dictionary is wrapped in brackets, and consists of `key: value` pairs separated by commas. The keys can only be formed from basic types (int, float, string).

```
a_dict = {
    'foo': 'bar',
    1: None
}
```

The value assigned to a variable can also be taken from another variable.

```
one = 1
another = one
```

Anything on a line after a `#` symbol is ignored and functions as a comment.

### 4.1 Importing other files

It is possible to include another configuration file. The files are looked up relative to the currently processed file.

The general structure of import is:

```
from FILENAME import WHAT
```

The FILENAME should be just the base name of the file without extension (which must be `.conf`). WHAT can either be a comma separated list of variables or `*`.

```
# Opens constants.conf and brings PI and E into current scope.
from constants import PI, E

# Opens common.conf and brings everything defined in that file into current
# file as well.
from common import *
```

---

**Note:** Pungi will copy the configuration file given on command line into the `logs/` directory. Only this single file will be copied, not any included ones. (Copying included files requires a fix in kobo library.)

The JSON-formatted dump of configuration is correct though.

---

## 4.2 Formatting strings

String interpolation is available as well. It uses a %-encoded format. See Python documentation for more details.

```
joined = "%s %s" % (var_a, var_b)

a_dict = {
    "fst": 1,
    "snd": 2,
}
another = "%(fst)s %(snd)s" % a_dict
```



## CONFIGURATION

Please read [productmd documentation](#) for [terminology](#) and other release and compose related details.

### 5.1 Minimal Config Example

```
# RELEASE
release_name = "Fedora"
release_short = "Fedora"
release_version = "23"

# GENERAL SETTINGS
comps_file = "comps-f23.xml"
variants_file = "variants-f23.xml"

# KOJI
koji_profile = "koji"
runroot = False

# PKGSET
sigkeys = [None]
pkgset_source = "koji"
pkgset_koji_tag = "f23"

# CREATEREPO
createrepo_checksum = "sha256"

# GATHER
gather_source = "comps"
gather_method = "deps"
greedy_method = "build"
check_deps = False

# BUILDINSTALL
bootable = True
buildinstall_method = "lorax"
```

### 5.2 Release

Following **mandatory** options describe a release.

### 5.2.1 Options

**release\_name** [mandatory] (*str*) – release name

**release\_short** [mandatory] (*str*) – release short name, without spaces and special characters

**release\_version** [mandatory] (*str*) – release version

**release\_type** = “ga” (*str*) – release type, “ga” or “updates”

**release\_is\_layered** = **False** (*bool*) – typically False for an operating system, True otherwise

**release\_internal** = **False** (*bool*) – whether the compose is meant for public consumption

### 5.2.2 Example

```
release_name = "Fedora"
release_short = "Fedora"
release_version = "23"
# release_type = "ga"
```

## 5.3 Base Product

Base product options are **optional** and we need to them only if we’re composing a layered product built on another (base) product.

### 5.3.1 Options

**base\_product\_name** (*str*) – base product name

**base\_product\_short** (*str*) – base product short name, without spaces and special characters

**base\_product\_version** (*str*) – base product **major** version

**base\_product\_type** = “ga” (*str*) – base product type, “ga”, “updates” etc., for full list see documentation of *productmd*.

### 5.3.2 Example

```
release_name = "RPM Fusion"
release_short = "rf"
release_version = "23.0"

release_is_layered = True

base_product_name = "Fedora"
base_product_short = "Fedora"
base_product_version = "23"
```

## 5.4 General Settings

### 5.4.1 Options

**comps\_file** [mandatory] (*scm\_dict*, *str* or *None*) – reference to comps XML file with installation groups

**variants\_file** [mandatory] (*scm\_dict* or *str*) – reference to variants XML file that defines release variants and architectures

**failable\_deliverables** [optional] (*list*) – list which deliverables on which variant and architecture can fail and not abort the whole compose. This only applies to `buildinstall` and `iso` parts. All other artifacts can be configured in their respective part of configuration.

Please note that `*` as a wildcard matches all architectures but `src`.

**comps\_filter\_environments** [optional] (*bool*) – When set to `False`, the comps files for variants will not have their environments filtered to match the variant.

**tree\_arches** ([*str*]) – list of architectures which should be included; if undefined, all architectures from `variants.xml` will be included

**tree\_variants** ([*str*]) – list of variants which should be included; if undefined, all variants from `variants.xml` will be included

**repoclosure\_backend** (*str*) – Select which tool should be used to run `repoclosure` over created repositories. By default `yum` is used, but you can switch to `dnf`. Please note that when `dnf` is used, the build dependencies check is skipped.

### 5.4.2 Example

```
comps_file = {
    "scm": "git",
    "repo": "https://git.fedorahosted.org/git/comps.git",
    "branch": None,
    "file": "comps-f23.xml.in",
}

variants_file = {
    "scm": "git",
    "repo": "https://pagure.io/pungi-fedora.git ",
    "branch": None,
    "file": "variants-fedora.xml",
}

failable_deliverables = [
    ('^.*$', {
        # Buildinstall can fail on any variant and any arch
        '*': ['buildinstall'],
        'src': ['buildinstall'],
        # Nothing on i386 blocks the compose
        'i386': ['buildinstall', 'iso', 'live'],
    })
]

tree_arches = ["x86_64"]
tree_variants = ["Server"]
```

## 5.5 Image Naming

Both image name and volume id are generated based on the configuration. Since the volume id is limited to 32 characters, there are more settings available. The process for generating volume id is to get a list of possible formats and try them sequentially until one fits in the length limit. If substitutions are configured, each attempted volume id will be modified by it.

For layered products, the candidate formats are first `image_volid_layered_product_formats` followed by `image_volid_formats`. Otherwise, only `image_volid_formats` are tried.

If no format matches the length limit, an error will be reported and compose aborted.

### 5.5.1 Options

There are a couple common format specifiers available for both the options:

- `compose_id`
- `release_short`
- `version`
- `date`
- `respin`
- `type`
- `type_suffix`
- `label`
- `label_major_version`
- `variant`
- `arch`
- `disc_type`

**image\_name\_format** [optional] (*str*) – Python’s format string to serve as template for image names

This format will be used for all phases generating images. Currently that means `createiso`, `live_images` and `buildinstall`.

Available extra keys are:

- `disc_num`
- `suffix`

**image\_volid\_formats** [optional] (*list*) – A list of format strings for generating volume id.

The extra available keys are:

- `base_product_short`
- `base_product_version`

**image\_volid\_layered\_product\_formats** [optional] (*list*) – A list of format strings for generating volume id for layered products. The keys available are the same as for `image_volid_formats`.

**volume\_id\_substitutions** [optional] (*dict*) – A mapping of string replacements to shorten the volume id.

**disc\_types** [optional] (*dict*) – A mapping for customizing `disc_type` used in image names.

Available keys are:

- `boot` – for `boot.iso` images created in *buildinstall* phase
- `live` – for images created by *live\_images* phase
- `dvd` – for images created by *createiso* phase
- `ostree` – for ostree installer images

Default values are the same as the keys.

## 5.5.2 Example

```
# Image name respecting Fedora's image naming policy
image_name_format = "%(release_short)s-%(variant)s-%(disc_type)s-%(arch)s-%(version)s
↳ %(suffix)s"
# Use the same format for volume id
image_volid_formats = [
    "%(release_short)s-%(variant)s-%(disc_type)s-%(arch)s-%(version)s"
]
# No special handling for layered products, use same format as for regular images
image_volid_layered_product_formats = []
# Replace "Cloud" with "C" in volume id etc.
volume_id_substitutions = {
    'Cloud': 'C',
    'Alpha': 'A',
    'Beta': 'B',
    'TC': 'T',
}

disc_types = {
    'boot': 'netinst',
    'live': 'Live',
    'dvd': 'DVD',
}
```

## 5.6 Signing

If you want to sign deliverables generated during pungi run like RPM wrapped images. You must provide few configuration options:

**signing\_command** [optional] (*str*) – Command that will be run with a koji build as a single argument. This command must not require any user interaction. If you need to pass a password for a signing key to the command, do this via command line option of the command and use string formatting syntax `%(signing_key_password)s`. (See **signing\_key\_password\_file**).

**signing\_key\_id** [optional] (*str*) – ID of the key that will be used for the signing. This ID will be used when crafting koji paths to signed files (`kojipkgs.fedoraproject.org/packages/NAME/VER/REL/data/signed/KEYID/..`).

**signing\_key\_password\_file** [optional] (*str*) – Path to a file with password that will be formatted into **signing\_command** string via `%(signing_key_password)s` string format syntax (if used). Because pungi config is usually stored in git and is part of compose logs we don't want password to be included directly in the config. Note: If `-` string is used instead of a filename, then you will be asked for the password interactively right after pungi starts.

### 5.6.1 Example

```
signing_command = '~/git/releeng/scripts/sigulsign_unsigned.py -vv --password=
↳%(signing_key_password)s fedora-24'
signing_key_id = '81b46521'
signing_key_password_file = '~/password_for_fedora-24_key'
```

## 5.7 Git URLs

In multiple places the config requires URL of a Git repository to download some file from. This URL is passed on to *Koji*. It is possible to specify which commit to use using this syntax:

```
git://git.example.com/git/repo-name.git?#<rev_spec>
```

The `<rev_spec>` pattern can be replaced with actual commit SHA, a tag name, `HEAD` to indicate that tip of default branch should be used or `origin/<branch_name>` to use tip of arbitrary branch.

If the URL specifies a branch or `HEAD`, *Pungi* will replace it with the actual commit SHA. This will later show up in *Koji* tasks and help with tracing what particular inputs were used.

---

**Note:** The `origin` must be specified because of the way *Koji* works with the repository. It will clone the repository then switch to requested state with `git reset --hard REF`. Since no local branches are created, we need to use full specification including the name of the remote.

---

## 5.8 Createrepo Settings

### 5.8.1 Options

**createrepo\_checksum** (*str*) – specify checksum type for createrepo; expected values: `sha512`, `sha256`, `sha`. Defaults to `sha256`.

**createrepo\_c** = **True** (*bool*) – use `createrepo_c` (True) or legacy `createrepo` (False)

**createrepo\_deltas** = **False** (*bool*) – generate delta RPMs against an older compose. This needs to be used together with `--old-composes` command line argument.

**createrepo\_use\_xz** = **False** (*bool*) – whether to pass `--xz` to the `createrepo` command. This will cause the SQLite databases to be compressed with `xz`.

**product\_id** = **None** (*scm\_dict*) – If specified, it should point to a directory with certificates `<variant_uid>-<arch>*.pem`. This certificate will be injected into the repository.

**product\_id\_allow\_missing** = **False** (*bool*) – When `product_id` is used and a certificate for some variant is missing, an error will be reported by default. Use this option to instead ignore the missing certificate.

### 5.8.2 Example

```
createrepo_checksum = "sha"
```

## 5.9 Package Set Settings

### 5.9.1 Options

**sigkeys** (*[str or None]*) – priority list of sigkeys, *None* means unsigned

**pkgset\_source** [**mandatory**] (*str*) – “koji” (any koji instance) or “repos” (arbitrary yum repositories)

**pkgset\_koji\_tag** [**mandatory**] (*str**[str]*) – tag(s) to read package set from

**pkgset\_koji\_inherit** = **True** (*bool*) – inherit builds from parent tags; we can turn it off only if we have all builds tagged in a single tag

**pkgset\_repos** (*dict*) – A mapping of architectures to repositories with RPMs: {arch: [repo]}. Only use when pkgset\_source = “repos”.

### 5.9.2 Example

```
sigkeys = [None]
pkgset_source = "koji"
pkgset_koji_tag = "f23"
```

## 5.10 Buildinstall Settings

Script or process that creates bootable images with Anaconda installer is historically called [buildinstall](#).

### 5.10.1 Options

**bootable** (*bool*) – whether to run the buildinstall phase

**buildinstall\_method** (*str*) – “lorax” (f16+, rhel7+) or “buildinstall” (older releases)

**buildinstall\_upgrade\_image** [**deprecated**] (*bool*) – use `noupgrade` with `lorax_options` instead

**lorax\_options** (*list*) – special options passed on to *lorax*.

Format: [(variant\_uid\_regex, {arch|\*: {option: name}})].

**Recognized options are:**

- `bugurl` – *str* (default *None*)
- `nomacboot` – *bool* (default *True*)
- `noupgrade` – *bool* (default *True*)

**buildinstall\_kickstart** (*scm\_dict*) – If specified, this kickstart file will be copied into each file and pointed to in boot configuration.

### 5.10.2 Example

```
bootable = True
buildinstall_method = "lorax"

# Enables macboot on x86_64 for all variants and builds upgrade images
# everywhere.
lorax_options = [
    ("^.*$", {
        "x86_64": {
            "nomacboot": False
        }
        "*": {
            "noupgade": False
        }
    })
]
```

---

**Note:** It is advised to run buildinstall (lorax) in koji, i.e. with **runroot enabled** for clean build environments, better logging, etc.

---

**Warning:** Lorax installs RPMs into a chroot. This involves running %post scriptlets and they frequently run executables in the chroot. If we're composing for multiple architectures, we **must** use runroot for this reason.

## 5.11 Gather Settings

### 5.11.1 Options

**gather\_source** [mandatory] (*str*) – from where to read initial package list; expected values: “comps”, “none”

**gather\_method** [mandatory] (*str*) – Options are deps and nodeps. Specifies whether package dependencies should be pulled in as well.

**gather\_fulltree** = **False** (*bool*) – When set to True all RPMs built from an SRPM will always be included. Only use when gather\_method = “deps”.

**gather\_selfhosting** = **False** (*bool*) – When set to True, *Pungi* will build a self-hosting tree by following build dependencies. Only use when gather\_method = “deps”.

**greedy\_method** (*str*) – This option controls how package requirements are satisfied in case a particular Requires has multiple candidates.

- none – the best packages is selected to satisfy the dependency and only that one is pulled into the compose
- all – packages that provide the symbol are pulled in
- build – the best package is selected, and then all packages from the same build that provide the symbol are pulled in

---

**Note:** As an example let's work with this situation: a package in the compose has Requires: foo. There are three packages with Provides: foo: pkg-a, pkg-b-provider-1 and pkg-b-provider-2. The pkg-b-\* packages are build from the same source package. Best match determines pkg-b-provider-1 as best matching package.

- With greedy\_method = “none” only pkg-b-provider-1 will be pulled in.



- With `greedy_method = "all"` all three packages will be pulled in.
- With `greedy_method = "build"` `pkg-b-provider-1` and `pkg-b-provider-2` will be pulled in.

**gather\_backend = yum** (*str*) – Either `yum` or `dnf`. This changes the entire codebase doing dependency solving, so it can change the result in unpredictable ways.

Particularly the multilib work is performed differently by using `python-multilib` library. Please refer to `multilib` option to see the differences.

**multilib\_methods [deprecated]** (*[str]*) – use `multilib` instead to configure this per-variant

**multilib\_arches [deprecated]** (*[str]* or `None`) – use `multilib` to implicitly configure this: if a variant on any arch has non-empty multilib methods, it is automatically eligible

**multilib** (*list*) – mapping of variant regexes and arches to list of multilib methods

Available methods are:

- `none` – no package matches this method
- `all` – all packages match this method
- `runtime` – packages that install some shared object file (`*.so.*`) will match.
- `devel` – packages whose name ends with `-devel` or `--static` suffix will be matched. When `dnf` is used, this method automatically enables `runtime` method as well. With `yum` backend this method also uses a hardcoded blacklist and whitelist.
- `kernel` – packages providing `kernel` or `kernel-devel` match this method (only in `yum` backend)
- `yaboot` – only `yaboot` package on `ppc` arch matches this (only in `yum` backend)

**additional\_packages** (*list*) – additional packages to be included in a variant and architecture; format: `[(variant_uid_regex, {arch|*: [package_globs]})]`

**filter\_packages** (*list*) – packages to be excluded from a variant and architecture; format: `[(variant_uid_regex, {arch|*: [package_globs]})]`

**filter\_system\_release\_packages** (*bool*) – for each variant, figure out the best system release package and filter out all others. This will not work if a variant needs more than one system release package. In such case, set this option to `False`.

**gather\_prepopulate = None** (*scm\_dict*) – If specified, you can use this to add additional packages. The format of the file pointed to by this option is a JSON mapping `{variant_uid: {arch: {build: [package]}}}`. Packages added through this option can not be removed by `filter_packages`.

**multilib\_blacklist** (*dict*) – multilib blacklist; format: `{arch|*: [package_globs]}`. The patterns are tested with `fnmatch`, so shell globbing is used (not regular expression).

**multilib\_whitelist** (*dict*) – multilib blacklist; format: `{arch|*: [package_names]}`. The whitelist must contain exact package names; there are no wildcards or pattern matching.

**gather\_lookaside\_repos = []** (*list*) – lookaside repositories used for package gathering; format: `[(variant_uid_regex, {arch|*: [repo_urls]})]`

**hashed\_directories = False** (*bool*) – put packages into “hashed” directories, for example `Packages/k/kernel-4.0.4-301.fc22.x86_64.rpm`

**check\_deps = True** (*bool*) – Set to `False` if you don’t want the compose to abort when some package has broken dependencies.

**gather\_source\_mapping** (*str*) – Only use when `gather_source = "json"`. The value should be a path to JSON file with following mapping: `{variant: {arch: {rpm_name: [rpm_arch|None]}}}`.

### 5.11.2 Example

```
gather_source = "comps"
gather_method = "deps"
greedy_method = "build"
check_deps = False
hashed_directories = True

additional_packages = [
    # bz#123456
    ('^(Workstation|Server)$', {
        '*': [
            'grub2',
            'kernel',
        ],
    }),
]

filter_packages = [
    # bz#111222
    ('^.*$', {
        '*': [
            'kernel-doc',
        ],
    }),
]

multilib = [
    ('^Server$', {
        'x86_64': ['devel', 'runtime']
    })
]

multilib_blacklist = {
    "*": [
        "gcc",
    ],
}

multilib_whitelist = {
    "*": [
        "alsa-plugins-*",
    ],
}

# gather_lookaside_repos = [
#     ('^.*$', {
#         'x86_64': [
#             "https://dl.fedoraproject.org/pub/fedora/linux/releases/22/Everything/
#             ↪x86_64/os/",
#             "https://dl.fedoraproject.org/pub/fedora/linux/releases/22/Everything/
#             ↪source/SRPMS/",
#         ]
#     }),
# ]
```

```
# ]
```

---

**Note:** It is a good practice to attach bug/ticket numbers to `additional_packages`, `filter_packages`, `multilib_blacklist` and `multilib_whitelist` to track decisions.

---

## 5.12 Koji Settings

### 5.12.1 Options

**koji\_profile** (*str*) – koji profile name

**runroot** [**mandatory**] (*bool*) – run some tasks such as `buildinstall` or `createiso` in koji build root (True) or locally (False)

**runroot\_channel** (*str*) – name of koji channel

**runroot\_tag** (*str*) – name of koji **build** tag used for runroot

**runroot\_weights** (*dict*) – customize task weights for various runroot tasks. The values in the mapping should be integers, the keys can be selected from the following list. By default no weight is assigned and Koji picks the default one according to policy.

- `buildinstall`
- `createiso`
- `ostree`
- `ostree_installer`

### 5.12.2 Example

```
koji_profile = "koji"
runroot = True
runroot_channel = "runroot"
runroot_tag = "f23-build"
```

## 5.13 Extra Files Settings

### 5.13.1 Options

**extra\_files** (*list*) – references to external files to be placed in `os/` directory and media; format: `[(variant_uid_regex, {arch*: [scm_dicts]})]`

### 5.13.2 Example

```
extra_files = [
    ('^.*$', {
        '*': [
            # GPG keys
            {
                "scm": "rpm",
                "repo": "fedora-repos",
                "branch": None,
                "file": [
                    "/etc/pki/rpm-gpg/RPM-GPG-KEY-22-fedora",
                ],
                "target": "",
            },
            # GPL
            {
                "scm": "git",
                "repo": "https://pagure.io/pungi-fedora",
                "branch": None,
                "file": [
                    "GPL",
                ],
                "target": "",
            },
        ],
    }),
]
```

### 5.13.3 Extra Files Metadata

If extra files are specified a metadata file, `extra_files.json`, is placed in the `os/` directory and media. The checksums generated are determined by `media_checksums` option. This metadata file is in the format:

```
{
  "header": {"version": "1.0"},
  "data": [
    {
      "file": "GPL",
      "checksums": {
        "sha256": "8177f97513213526df2cf6184d8ff986c675afb514d4e68a404010521b880643"
      },
      "size": 18092
    },
    {
      "file": "release-notes/notes.html",
      "checksums": {
        "sha256": "82b1ba8db522aadf101dca6404235fba179e559b95ea24ff39ee1e5d9a53bdcb"
      },
      "size": 1120
    }
  ]
}
```

## 5.14 Productimg Settings

Product images are placed on installation media and provide additional branding and Anaconda changes specific to product variants.

### 5.14.1 Options

**productimg = False** (*bool*) – create product images; requires `bootable=True`

**productimg\_install\_class** (*scm\_dict, str*) – reference to install class **file**

**productimg\_po\_files** (*scm\_dict, str*) – reference to a **directory** with po files for install class translations

### 5.14.2 Example

```
productimg = True
productimg_install_class = {
    "scm": "git",
    "repo": "http://git.example.com/productimg.git",
    "branch": None,
    "file": "fedora23/%(variant_id)s.py",
}
productimg_po_files = {
    "scm": "git",
    "repo": "http://git.example.com/productimg.git",
    "branch": None,
    "dir": "po",
}
```

## 5.15 CreateISO Settings

### 5.15.1 Options

**createiso\_skip = False** (*list*) – mapping that defines which variants and arches to skip during createiso; format: [(variant\_uid\_regex, {archl\*: True})]

**create\_jigdo = True** (*bool*) – controls the creation of jigdo from ISO

**create\_optional\_isos = False** (*bool*) – when set to `True`, ISOs will be created even for optional variants. By default only variants with type `variant` or `layered-product` will get ISOs.

**iso\_size = 4700000000** (*int|str*) – size of ISO image. The value should either be an integer meaning size in bytes, or it can be a string with k, M, G suffix (using multiples of 1024).

**split\_iso\_reserve = 10MiB** (*int|str*) – how much free space should be left on each disk. The format is the same as for `iso_size` option.

---

**Note:** Source architecture needs to be listed explicitly. Excluding `*` applies only on binary arches. Jigdo causes significant increase of time to ISO creation.

---

### 5.15.2 Example

```
createiso_skip = [
    ('^Workstation$', {
        '*': True,
        'src': True
    }),
]
```

## 5.16 Automatic generation of version and release

Version and release values for certain artifacts can be generated automatically based on release version, compose label, date, type and respin. This can be used to shorten the config and keep it the same for multiple uses.

Compose ID	Label	Version	Release
F-Rawhide-20170406.n.0	-	Rawhide	20170406.n.0
F-26-20170329.1	Alpha-1.6	26_Alpha	1.6
F-Atomic-25-20170407.0	RC-20170407.0	25	20170407.0
F-Atomic-25-20170407.0	-	25	20170407.0

All non-RC milestones from label get appended to the version. For release either label is used or date, type and respin.

## 5.17 Common options for Live Images, Live Media and Image Build

All images can have `ksurl`, `version`, `release` and `target` specified. Since this can create a lot of duplication, there are global options that can be used instead.

For each of the phases, if the option is not specified for a particular deliverable, an option named `<PHASE_NAME>_<OPTION>` is checked. If that is not specified either, the last fallback is `global_<OPTION>`. If even that is unset, the value is considered to not be specified.

The kickstart URL is configured by these options.

- `global_ksurl` – global fallback setting
- `live_media_ksurl`
- `image_build_ksurl`
- `live_images_ksurl`

Target is specified by these settings. For live images refer to `live_target`.

- `global_target` – global fallback setting
- `live_media_target`
- `image_build_target`

Version is specified by these options. If no version is set, a default value will be provided according to [automatic versioning](#).

- `global_version` – global fallback setting
- `live_media_version`
- `image_build_version`
- `live_images_version`

Release is specified by these options. If set to a magic value to `!RELEASE_FROM_LABEL_DATE_TYPE_RESPIN`, a value will be generated according to *automatic versioning*.

- `global_release` – global fallback setting
- `live_media_release`
- `image_build_release`
- `live_images_release`

Each configuration block can also optionally specify a `failable` key. For live images it should have a boolean value. For live media and image build it should be a list of strings containing architectures that are optional. If any deliverable fails on an optional architecture, it will not abort the whole compose. If the list contains only `"*"`, all arches will be substituted.

## 5.18 Live Images Settings

**live\_target** (*str*) – Koji build target for which to build the images. This gets passed to `koji spin-livectd`.

**live\_images** (*list*) – Configuration for the particular image. The elements of the list should be tuples (`variant_uid_regex, {arch|*: config}`). The config should be a dict with these keys:

- `kickstart` (*str*)
- `ksurl` (*str*) [optional] – where to get the kickstart from
- `name` (*str*)
- `version` (*str*)
- `repo` (*str*[*str*]) – repos specified by URL or variant UID
- `specfile` (*str*) – for images wrapped in RPM
- `scratch` (*bool*) – only RPM-wrapped images can use scratch builds, but by default this is turned off
- `type` (*str*) – what kind of task to start in Koji. Defaults to `live` meaning `koji spin-livectd` will be used. Alternative option is `appliance` corresponding to `koji spin-appliance`.
- `sign` (*bool*) – only RPM-wrapped images can be signed

Deprecated options:

- `additional_repos` – deprecated, use `repo` instead
- `repo_from` – deprecated, use `repo` instead

**live\_images\_no\_rename** (*bool*) – When set to `True`, filenames generated by Koji will be used. When `False`, filenames will be generated based on `image_name_format` configuration option.

## 5.19 Live Media Settings

**live\_media** (*dict*) – configuration for `koji spin-livemedia`; format: `{variant_uid_regex: [{opt:value}]}`

Required options:

- `name` (*str*)

- `version (str)`
- `target (str)`
- `arches ([str])` – what architectures to build the media for; by default uses all arches for the variant.
- `kickstart (str)` – name of the kickstart file

Available options:

- `ksurl (str)`
- `ksversion (str)`
- `scratch (bool)`
- `release (str)` – a string with the release, or `!RELEASE_FROM_LABEL_DATE_TYPE_RESPIN` to automatically generate a suitable value. See [automatic versioning](#) for details.
- `skip_tag (bool)`
- `repo (str/[str])` – repos specified by URL or variant UID
- `title (str)`
- `install_tree_from (str)` – variant to take install tree from

Deprecated options:

- `repo_from` – deprecated, use `repo` instead

## 5.20 Image Build Settings

**image\_build** (*dict*) – config for `koji image-build`; format: `{variant_uid_regex: [{opt: value}]}`

By default, images will be built for each binary arch valid for the variant. The config can specify a list of arches to narrow this down.

---

**Note:** Config can contain anything what is accepted by `koji image-build --config configfile.ini`

Repo can be specified either as a string or a list of strings. It will be automatically transformed into format suitable for `koji`. A repo for the currently built variant will be added as well.

If you explicitly set `release` to `!RELEASE_FROM_LABEL_DATE_TYPE_RESPIN`, it will be replaced with a value generated as described in [automatic versioning](#).

Please don't set `install_tree`. This gets automatically set by *pungi* based on current variant. You can use `install_tree_from` key to use install tree from another variant.

The `format` attr is `[('image_type', 'image_suffix'), ...]`. See `productmd` documentation for list of supported types and suffixes.

If `ksurl` ends with `#HEAD`, Pungi will figure out the SHA1 hash of current HEAD and use that instead.

Setting `scratch` to `True` will run the `koji` tasks as scratch builds.

---

### 5.20.1 Example



```

image_build = {
    '^Server$': [
        {
            'image-build': {
                'format': [('docker', 'tar.gz'), ('qcow2', 'qcow2')]
                'name': 'fedora-qcow-and-docker-base',
                'target': 'koji-target-name',
                'ksversion': 'F23',          # value from pykickstart
                'version': '23',
                # correct SHA1 hash will be put into the URL below automatically
                'ksurl': 'https://git.fedorahosted.org/git/spin-kickstarts.git?
↪somedirectoryifany#HEAD',
                'kickstart': "fedora-docker-base.ks",
                'repo': ["http://someextrarepos.org/repo", "ftp://rekcod.oi/repo"],
                'distro': 'Fedora-20',
                'disk_size': 3,

                # this is set automatically by pungi to os_dir for given variant
                # 'install_tree': 'http://somepath',
            },
            'factory-parameters': {
                'docker_cmd': "[ '/bin/bash' ]",
                'docker_env': "[ 'PATH=/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/
↪bin:/sbin:/bin' ]",
                'docker_labels': '{"Name': 'fedora-docker-base', 'License': 'u'GPLv2',
↪'RUN': 'docker run -it --rm ${OPT1} --privileged -v \`pwd\`:./atomicapp -v /run:/run_
↪-v /:/host --net=host --name ${NAME} -e NAME=${NAME} -e IMAGE=${IMAGE} ${IMAGE} -v $
↪${OPT2} run ${OPT3} /atomicapp', 'Vendor': 'Fedora Project', 'Version': '23',
↪'Architecture': 'x86_64' }",
            }
        },
        {
            'image-build': {
                'format': [('docker', 'tar.gz'), ('qcow2', 'qcow2')]
                'name': 'fedora-qcow-and-docker-base',
                'target': 'koji-target-name',
                'ksversion': 'F23',          # value from pykickstart
                'version': '23',
                # correct SHA1 hash will be put into the URL below automatically
                'ksurl': 'https://git.fedorahosted.org/git/spin-kickstarts.git?
↪somedirectoryifany#HEAD',
                'kickstart': "fedora-docker-base.ks",
                'repo': ["http://someextrarepos.org/repo", "ftp://rekcod.oi/repo"],
                'distro': 'Fedora-20',
                'disk_size': 3,

                # this is set automatically by pungi to os_dir for given variant
                # 'install_tree': 'http://somepath',
            }
        },
        {
            'image-build': {
                'format': [('qcow2', 'qcow2')]
                'name': 'fedora-qcow-base',
                'target': 'koji-target-name',
                'ksversion': 'F23',          # value from pykickstart
                'version': '23',
                'ksurl': 'https://git.fedorahosted.org/git/spin-kickstarts.git?
↪somedirectoryifany#HEAD',

```

```
        'kickstart': "fedora-docker-base.ks",
        'distro': 'Fedora-23',

        # only build this type of image on x86_64
        'arches': ['x86_64']

        # Use install tree and repo from Everything variant.
        'install_tree_from': 'Everything',
        'repo': ['Everything'],

        # Set release automatically.
        'release': '!RELEASE_FROM_LABEL_DATE_TYPE_RESPIN',
    }
}
]
```

## 5.21 OSTree Settings

The `ostree` phase of *Pungi* can create ostree repositories. This is done by running `rpm-ostree compose` in a Koji runroot environment. The ostree repository itself is not part of the compose and should be located in another directory. Any new packages in the compose will be added to the repository with a new commit.

**ostree** (*dict*) – a variant/arch mapping of configuration. The format should be [(variant\_uid\_regex, {arch|\*: config\_dict})].

The configuration dict for each variant arch pair must have these keys:

- `treefile` – (*str*) Filename of configuration for rpm-ostree.
- `config_url` – (*str*) URL for Git repository with the `treefile`.
- `repo` – (*str|dict|list|dict*) repos specified by URL or variant UID or a dict of repo options, `baseurl` is required in the dict.
- `ostree_repo` – (*str*) Where to put the ostree repository

These keys are optional:

- `keep_original_sources` – (*bool*) Keep the existing source repos in the tree config file. If not enabled, all the original source repos will be removed from the tree config file.
- `config_branch` – (*str*) Git branch of the repo to use. Defaults to `master`.
- `failable` – (*list*) List of architectures for which this deliverable is not release blocking.
- `update_summary` – (*bool*) Update summary metadata after tree composing. Defaults to `False`.
- `version` – (*str*) Version string to be added as versioning metadata. If this option is set to `!OSTREE_VERSION_FROM_LABEL_DATE_TYPE_RESPIN`, a value will be generated automatically as `$VERSION.$RELEASE`. *See how those values are created.*
- `tag_ref` – (*bool*, default `True`) If set to `False`, a git reference will not be created.

Deprecated options:

- `repo_from` – Deprecated, use `repo` instead.
- `source_repo_from` – Deprecated, use `repo` instead.
- `extra_source_repos` – Deprecated, use `repo` instead.

### 5.21.1 Example config

```
ostree = [
    ("^Atomic$", {
        "x86_64": {
            "treefile": "fedora-atomic-docker-host.json",
            "config_url": "https://git.fedorahosted.org/git/fedora-atomic.git",
            "repo": [
                "Server",
                "http://example.com/repo/x86_64/os",
                {"baseurl": "Everything"},
                {"baseurl": "http://example.com/linux/repo", "exclude": "systemd-
↪container"},
            ],
            "keep_original_sources": True,
            "ostree_repo": "/mnt/koji/compose/atomic/Rawhide/",
            "update_summary": True,
            # Automatically generate a reasonable version
            "version": "!OSTREE_VERSION_FROM_LABEL_DATE_TYPE_RESPIN",
        }
    })
]
```

## 5.22 Ostree Installer Settings

The `ostree_installer` phase of *Pungi* can produce installer image bundling an OSTree repository. This always runs in Koji as a runroot task.

**ostree\_installer** (*dict*) – a variant/arch mapping of configuration. The format should be `[(variant_uid_regex, {arch|*: config_dict})]`.

The configuration dict for each variant arch pair must have this key:

These keys are optional:

- `repo` – (*str*/*str*) repos specified by URL or variant UID
- `release` – (*str*) Release value to set for the installer image. Set to `!RELEASE_FROM_LABEL_DATE_TYPE_RESPIN` to generate the value *automatically*.
- `failable` – (*str*) List of architectures for which this deliverable is not release blocking.

These optional keys are passed to `lorax` to customize the build.

- `installpkgs` – (*str*)
- `add_template` – (*str*)
- `add_arch_template` – (*str*)
- `add_template_var` – (*str*)
- `add_arch_template_var` – (*str*)
- `rootfs_size` – (*str*)
- `template_repo` – (*str*) Git repository with extra templates.
- `template_branch` – (*str*) Branch to use from `template_repo`.

The templates can either be absolute paths, in which case they will be used as configured; or they can be relative paths, in which case `template_repo` needs to point to a Git repository from which to take the templates.

Deprecated options:

- `repo_from` – Deprecated, use `repo` instead.
- `source_repo_from` – Deprecated, use `repo` instead.

### 5.22.1 Example config

```
ostree_installer = [
    ("^Atomic$", {
        "x86_64": {
            "repo": [
                "Everything",
                "https://example.com/extra-repo1.repo",
                "https://example.com/extra-repo2.repo",
            ],
            "release": "!RELEASE_FROM_LABEL_DATE_TYPE_RESPIN",
            "installpkgs": ["fedora-productimg-atomic"],
            "add_template": ["atomic-installer/lorax-configure-repo.tpl"],
            "add_template_var": [
                "ostree_osname=fedora-atomic",
                "ostree_ref=fedora-atomic/Rawhide/x86_64/docker-host",
            ],
            "add_arch_template": ["atomic-installer/lorax-embed-repo.tpl"],
            "add_arch_template_var": [
                "ostree_repo=https://kojipkgs.fedoraproject.org/compose/atomic/
↪Rawhide/",
                "ostree_osname=fedora-atomic",
                "ostree_ref=fedora-atomic/Rawhide/x86_64/docker-host",
            ]
            'template_repo': 'https://git.fedorahosted.org/git/spin-kickstarts.git',
            'template_branch': 'f24',
        }
    })
]
```

## 5.23 OSBS Settings

*Pungi* can build docker images in OSBS. The build is initiated through Koji `container-build` plugin. The base image will be using RPMs from the current compose and a `Dockerfile` from specified Git repository.

Please note that the image is uploaded to a Docker v2 registry and not exported into compose directory. There will be a metadata file in `compose/metadata/osbs.json` with details about the built images (assuming they are not scratch builds).

**osbs** (*dict*) – a mapping from variant regexes to configuration blocks. The format should be `{variant_uid_regex: [config_dict]}`.

The configuration for each image must have at least these keys:

- `url` – (*str*) URL pointing to a Git repository with `Dockerfile`. Please see [Git URLs](#) section for more details.
- `target` – (*str*) A Koji target to build the image for.

- `git_branch` – (*str*) A branch in SCM for the `Dockerfile`. This is required by OSBS to avoid race conditions when multiple builds from the same repo are submitted at the same time. Please note that `url` should contain the branch or tag name as well, so that it can be resolved to a particular commit hash.

Optionally you can specify `failable`. If it has a truthy value, failure to create the image will not abort the whole compose.

---

**Note:** Once OSBS gains support for multiple architectures, the usage of this option will most likely change to list architectures that are allowed to fail.

---

The configuration will pass other attributes directly to the Koji task. This includes `name`, `version`, `scratch` and `priority`.

A value for `yum_repourls` will be created automatically and point at a repository in the current compose. You can add extra repositories with `repo` key having a list of urls pointing to `.repo` files or just variant uid, Pungi will create the `.repo` file for that variant. `gpgkey` can be specified to enable `gpgcheck` in repo files for variants.

### 5.23.1 Example config

```
osbs = {
    "^Server$": {
        # required
        "url": "git://example.com/dockerfiles.git?#HEAD",
        "target": "f24-docker-candidate",
        "git_branch": "f24-docker",

        # optional
        "name": "fedora-docker-base",
        "version": "24",
        "repo": ["Everything", "https://example.com/extra-repo.repo"],
        # This will result in three repo urls being passed to the task.
        # They will be in this order: Server, Everything, example.com/
        "gpgkey": 'file:///etc/pki/rpm-gpg/RPM-GPG-KEY-redhat-release',
    }
}
```

## 5.24 Media Checksums Settings

**media\_checksums** (*list*) – list of checksum types to compute, allowed values are anything supported by Python's `hashlib` module (see [documentation for details](#)).

**media\_checksum\_one\_file** (*bool*) – when `True`, only one `CHECKSUM` file will be created per directory; this option requires `media_checksums` to only specify one type

**media\_checksum\_base\_filename** (*str*) – when not set, all checksums will be save to a file named either `CHECKSUM` or based on the digest type; this option allows adding any prefix to that name

It is possible to use format strings that will be replace by actual values. The allowed keys are:

- `arch`
- `compose_id`
- `date`

- label
- label\_major\_version
- release\_short
- respin
- type
- type\_suffix
- version
- version

For example, for Fedora the prefix should be `%(release_short)s-%(variant)s-%(version)s-%(date)s%(type_`  
`%(respin)s`.

## 5.25 Translate Paths Settings

**translate\_paths** (*list*) – list of paths to translate; format: `[(path, translated_path)]`

---

**Note:** This feature becomes useful when you need to transform compose location into e.g. a HTTP repo which is can be passed to `koji image-build`. The path part is normalized via `os.path.normpath()`.

---

### 5.25.1 Example config

```
translate_paths = [  
    ("/mnt/a", "http://b/dir"),  
]
```

### 5.25.2 Example usage

```
>>> from pungi.util import translate_paths  
>>> print translate_paths(compose_object_with_mapping, "/mnt/a/c/somefile")  
http://b/dir/c/somefile
```

## 5.26 Miscelanous Settings

**paths\_module** (*str*) – Name of Python module implementing the same interface as `pungi.paths`. This module can be used to override where things are placed.

**link\_type = hardlink-or-copy** (*str*) – Method of putting packages into compose directory.

Available options:

- hardlink-or-copy
- hardlink
- copy

- `symlink`
- `abspath-symlink`

**skip\_phases** (*list*) – List of phase names that should be skipped. The same functionality is available via a command line option.

**release\_discinfo\_description** (*str*) – Override description in `.discinfo` files. The value is a format string accepting `%(variant_name)s` and `%(arch)s` placeholders.

**symlink\_isos\_to** (*str*) – If set, the ISO files from `buildinstall`, `createiso` and `live_images` phases will be put into this destination, and a symlink pointing to this location will be created in actual compose directory.





## PROGRESS NOTIFICATION

*Pungi* has the ability to emit notification messages about progress and general status of the compose. These can be used to e.g. send messages to *fedmsg*. This is implemented by actually calling a separate script.

The script will be called with one argument describing action that just happened. A JSON-encoded object will be passed to standard input to provide more information about the event. At the very least, the object will contain a `compose_id` key.

The script is invoked in compose directory and can read other information there.

Currently these messages are sent:

- `status-change` – when composing starts, finishes or fails; a `status` key is provided to indicate details
- `phase-start` – on start of a phase
- `phase-stop` – when phase is finished
- `createiso-targets` – with a list of images to be created
- `createiso-imagedone` – when any single image is finished
- `createiso-imagefail` – when any single image fails to create
- `fail-to-start` – when there are incorrect CLI options or errors in configuration file; this message does not contain `compose_id` nor is it started in the compose directory (which does not exist yet)
- `ostree` – when a new commit is created, this message will announce its hash and the name of ref it is meant for.

For phase related messages `phase_name` key is provided as well.

A `pungi-fedmsg-notification` script is provided and understands this interface.

### 6.1 Setting it up

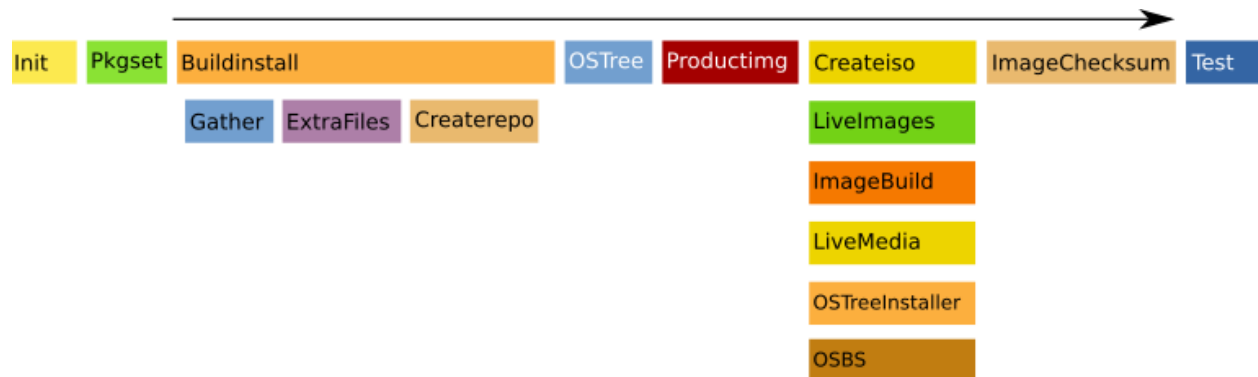
The script should be provided as a command line argument `--notification-script`.

```
--notification-script=pungi-fedmsg-notification
```



## PHASES

Each invocation of `punji-koji` consists of a set of phases.



Most of the phases run sequentially (left-to-right in the diagram), but there are use cases where multiple phases run in parallel. This happens for phases whose main point is to wait for a Koji task to finish.

### 7.1 Init

The first phase to ever run. Can not be skipped. It prepares the comps files for variants (by filtering out groups and packages that should not be there).

### 7.2 Pkgset

This phase loads a set of packages that should be composed. It has two separate results: it prepares repos with packages in `work/` directory (one per arch) for further processing, and it returns a data structure with mapping of packages to architectures.

### 7.3 Buildinstall

Spawns a bunch of threads, each of which runs either `lorax` or `buildinstall` command (the latter coming from `anaconda` package). The commands create `boot.iso` and other boot configuration files. The image is finally linked into the `compose/` directory as `netinstall` media.

The created images are also needed for creating live media or other images in later phases.

With `lorax` this phase runs one task per `variant.arch` combination. For `buildinstall` command there is only one task per architecture and `product.img` should be used to customize the results.

## 7.4 Gather

This phase uses data collected by `pkgset` phase and figures out what packages should be in each variant. The basic mapping can come from `comps` file, a JSON mapping or `additional_packages` config option. This inputs can then be enriched by adding all dependencies. See *Gathering packages* for details.

Once the mapping is finalized, the packages are linked to appropriate places and the `rpms.json` manifest is created.

## 7.5 ExtraFiles

This phase collects extra files from the configuration and copies them to the compose directory. The files are described by a JSON file in the compose subtree where the files are copied. This metadata is meant to be distributed with the data (on ISO images).

## 7.6 Createrepo

This phase creates RPM repositories for each `variant.arch` tree. It is actually reading the `rpms.json` manifest to figure out which packages should be included.

## 7.7 OSTree

Updates an ostree repository with a new commit with packages from the compose. The repository lives outside of the compose and is updated immediately. If the compose fails in a later stage, the commit will not be reverted.

Implementation wise, this phase runs `rpm-ostree` command in Koji runroot (to allow running on different arches).

## 7.8 Productimg

Creates `product.img` files for customizing the bootable media created in `buildinstall` phase.

## 7.9 Createiso

Generates ISO files and accumulates enough metadata to be able to create `image.json` manifest. The file is however not created in this phase, instead it is dumped in the `pungi-koji` script itself.

The files include a repository with all RPMs from the variant. There will be multiple images if the packages do not fit on a single image.

The image will be bootable if `buildinstall` phase is enabled and the packages fit on a single image.

There can also be images with source repositories. These are never bootable.

## 7.10 LiveImages, LiveMedia

Creates media in Koji with `koji spin-livecd`, `koji spin-appliance` or `koji spin-livemedia` command. When the media are finished, the images are copied into the `compose/` directory and metadata for images is updated.

## 7.11 ImageBuild

This phase wraps up `koji image-build`. It also updates the metadata ultimately responsible for `images.json` manifest.

## 7.12 OSBS

This phase builds docker base images in [OSBS](#).

The finished images are available in registry provided by OSBS, but not downloaded directly into the compose. The is metadata about the created image in `compose/metadata/osbs.json`.

## 7.13 OSTreeInstaller

Creates bootable media that carry an ostree repository as a payload. These images are created by running `lorax` with special templates. Again it runs in Koji runroot.

## 7.14 ImageChecksum

Responsible for generating checksums for the images. The checksums are stored in image manifest as well as files on disk. The list of images to be processed is obtained from the image manifest. This way all images will get the same checksums irrespective of the phase that created them.

## 7.15 Test

This phase is supposed to run some sanity checks on the finished compose.

The first test is to run `repoclosure` on each repository. However, even if it fails, the compose will still be considered a success. The actual error has to be looked up in the compose logs directory.

The other test is to check all images listed the metadata and verify that they look sane. For ISO files headers are checked to verify the format is correct, and for bootable media a check is run to verify they have properties that allow booting.



## GATHERING PACKAGES

A compose created by Pungi consists of one or more variants. A variant contains a subset of the content targeted at a particular use case.

There are different types of variants. The type affects how packages are gathered into the variant.

The inputs for gathering are defined by the `gather_source` option. It provides a list of package names, comps groups names and a list of packages that should be filtered out.

Next, `gather_method` defines how the list is processed. For `nodeps`, the results from source are used pretty much as is<sup>1</sup>. For `deps` method, a process will be launched to figure out what dependencies are needed and those will be pulled in.

### 8.1 Variant types

**Variant** is a base type that has no special behaviour.

**Addon** is built on top of a regular variant. Any packages that should go to both the addon and its parent will be removed from addon. Packages that are only in addon but pulled in because of `gather_fulltree` option will be moved to parent.

**Integrated Layered Product** works similarly to *addon*. Additionally, all packages from addons on the same parent variant are removed integrated layered products.

The main difference between an *addon* and *integrated layered product* is that *integrated layered product* has its own identity in the metadata (defined with product name and version).

---

**Note:** There's also *Layered Product* as a term, but this is not related to variants. It's used to describe a product that is not a standalone operating system and is instead meant to be used on some other base system.

---

**Optional** contains packages that complete the base variants' package set. It always has `fulltree` and `selfhosting` enabled, so it contains build dependencies and packages which were not specifically requested for base variant.

Some configuration options are overridden for particular variant types.

---

<sup>1</sup> The lists are filtered based on what packages are available in the package set, but nothing else will be pulled in.

Table 8.1: Depsolving configuration

Variant	Fulltree	Selfhosting
base	configurable	configurable
addon/ILP	enabled	disabled
optional	enabled	enabled