pip internals

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Polyconseil

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Disclaimer

Disclaimer about this talk

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- corresponds to pip 7.1.0 code

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Outline for section 1

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pip.req_set.RequirementSet

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- `-r/--requirement` requirements.txt

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- `-c/--constraint` constraints.txt (since 7.1)

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- direct args (my_package, https://foo.com/bar-1.0.0.tar.gz, ./my_package)
- `-e/--editable` editable_package
- `-r/--requirement` requirements.txt
- `-c/--constraint` constraints.txt (since 7.1)

Or a combination

```
pip install -e ./pkg1 django -e ./pkg2 -r reqs.txt -c constraint.txt
```

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RequirementCommand.populate_requirement_set

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Examples

- `extras_require={':python_version=="3.3"': ['asyncio']}`

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Environment markers

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- allows to specify required dependencies on specific environment

Examples

- `extras_require={':python_version=="3.3"': ['asyncio']}`
- `extras_require={ 'signatures': ['keyring'], 'signatures:sys_platform!="win32"': ['pyxdg'], }`

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Constraint

```
$ echo "django==1.8.3" > constraint.txt
$ pip install django==1.4.3 -c constraint.txt
Successfully installed django-1.8.3
```

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- if already there and comes from dependency, ignore

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Conflict between user and dependency

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- `add_requirement('simple')` and `add_requirement(pep8==1.3)`

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- `pip install simple pep8==1.3`
- `add_requirement('simple')` and `add_requirement(pep8==1.3)`
- `add_requirement(pep8==1.2)` ignored

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- download/update/unpack source files
- compute metadata: `setup.py egg_info` or directly from wheel
- compute dependencies (with extras)

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- 4 directories, one for each dependency

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Optional Wheel caching (pip 7+)

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Wheel caching

- on success, update link to point on new wheel file and unpack the wheel in the build_location

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- other special cases

Wheel caching

- on success, update link to point on new wheel file and unpack the wheel in the build_location
- else, no issue

Outline for section 2

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2 - How does pip perform an installation ?

Wheels

- already unpacked in prepare_files

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Note

No setuptools needed

2 - How does pip perform an installation ?

setup.py install

- `req_install.InstallRequirement.install`

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Avoid python setup.py install

- with setuptools: easy_install invocation

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- with distutils: no installed-files.txt

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Avoid python setup.py install

- with setuptools: easy_install invocation
- with distutils: no installed-files.txt
- prefer `pip install .`

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2 - How does pip perform an installation ?

editable

- `req_install.InstallRequirement.install_editable`

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editable

- `req_install.InstallRequirement.install_editable`
- `import setuptools; exec(compile(open('setup.py'))`

2 - How does pip perform an installation ?

editable

- `req_install.InstallRequirement.install_editable`
- `import setuptools; exec(compile(open('setup.py'))`
- python setup.py develop `--no-deps`

2 - How does pip perform an installation ?

Rollbacks

- uninstalls old version first

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Only one rollback

- rollbacks concerns the last uninstall

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Only one rollback

- rollbacks concerns the last uninstall
- not the whole install call

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- A==1.0 requires B==1.0 and A==2.0 requires B==2.0

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- `pip install A==2.0`

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- A==1.0 requires B==1.0 and A==2.0 requires B==2.0
- A1 and B1 in your venv
- `pip install A==2.0`
- it might: uninstall B1 and install B2 successfully

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- but then might uninstall A1 and crash on A2 install

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- A1 will be restored

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- A1 and B1 in your venv
- `pip install A==2.0`
- it might: uninstall B1 and install B2 successfully
- but then might uninstall A1 and crash on A2 install
- A1 will be restored
- but you end up with A1 and B2

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2 - How does pip perform an installation ?

Installation order

- tries to respect the provided (from args) order

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setup_requires

- currently "owned" by setuptools
- might call easy_install
- hopefully, pip might take control of this feature

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Outline for section 3

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3 - How does pip select the packages ?

Context

```
pip install foo_bar
```

3 - How does pip select the packages ?

Context

```
pip install foo_bar
```

- https://some_pypi.com/simple/foo_bar/foo_bar-1.2.tar.gz
- https://some_pypi.com/simple/foo_bar/foo_bar-1.0-py3-none-any.whl
- /home/user/wheelhouse/foo_bar-3.0-py3-none-any.whl
- dozens of others...

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3 - How does pip select the packages ?

Context

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pip install foo_bar
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What file should pip use ?

- different versions

3 - How does pip select the packages ?

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What file should pip use ?

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- different formats

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What file should pip use ?

- different versions
- different formats
- different locations

3 - How does pip select the packages ?

Where the magic happens: pip/index.py

- `PackageFinder.find_requirement(req, upgrade)`

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Where the magic happens: pip/index.py

- `PackageFinder.find_requirement(req, upgrade)`
- req is an `InstallRequirement`: `django`, `django==1.8.3`, `Django<1.8`

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3 - How does pip select the packages ?

Where the magic happens: pip/index.py

- `PackageFinder.find_requirement(req, upgrade)`
- req is an `InstallRequirement`: `django`, `django==1.8.3`, `Django<1.8`
- upgrade is a boolean (`--upgrade` option)

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3 - How does pip select the packages ?

Where the magic happens: pip/index.py

- `PackageFinder.find_requirement(req, upgrade)`
- req is an `InstallRequirement`: `django`, `django==1.8.3`, `Django<1.8`
- upgrade is a boolean (`--upgrade` option)
- returns an `InstallationCandidate` (a file/location)

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find_requirement(req, upgrade)

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- for django on PyPI, 112 InstallationCandidate
- on my setup (with private mirror and wheelhouse), 249

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- filter on version requirements (==1.8.3) and `--pre` option

Polyconseil

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Polyconseil

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- on my setup (with private mirror and wheelhouse), 249
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- (stable) sort by version
- returns most recent/currently installed version (`--upgrade` option)

Polyconseil

3 - How does pip select the packages ?

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Polyconseil

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- find_links: `--find-links` options
- dependency_links: provided by some setup.py if `--process-dependency-links`

Polyconseil

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Polyconseil

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Polyconseil

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Polyconseil

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With modern indexes - PyPI

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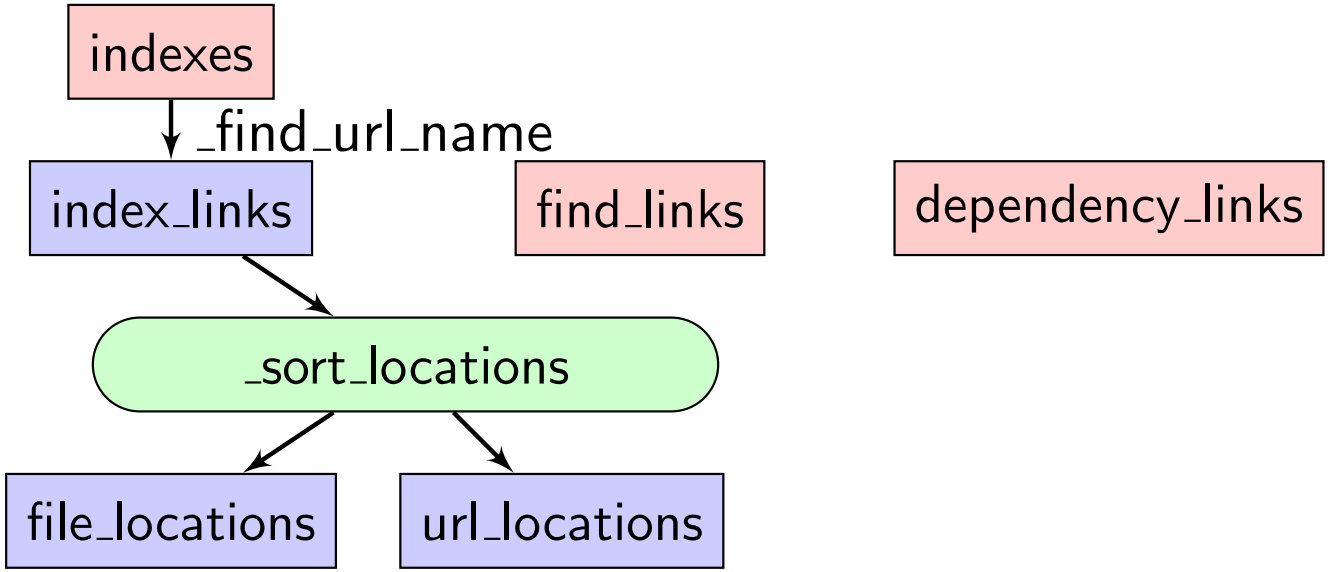

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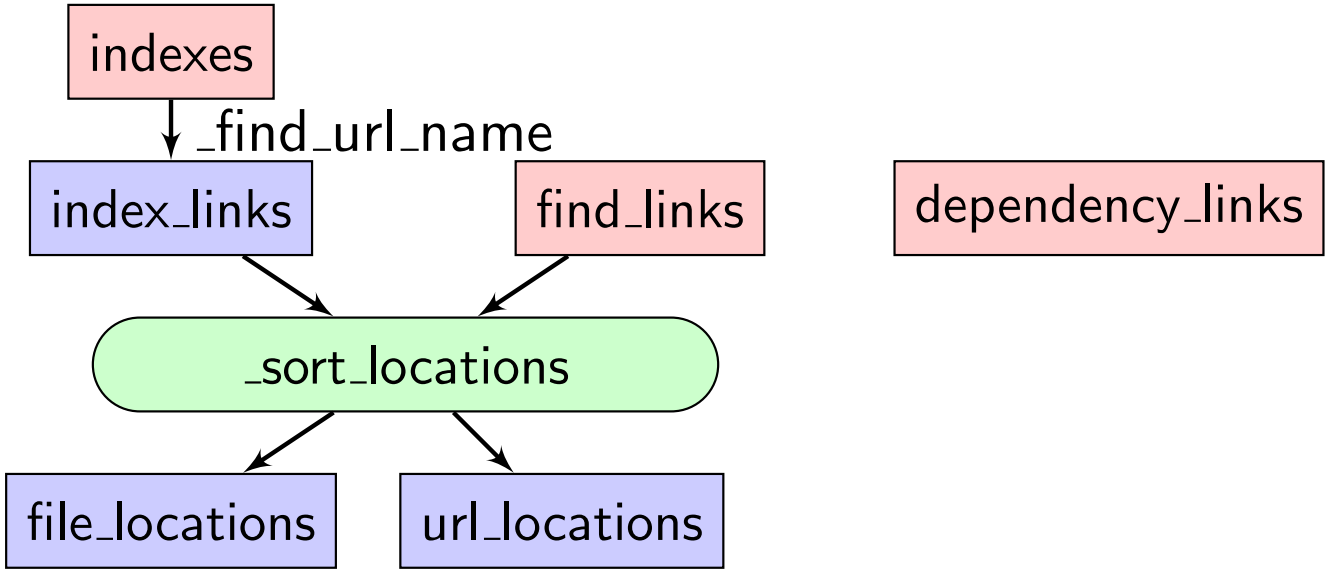

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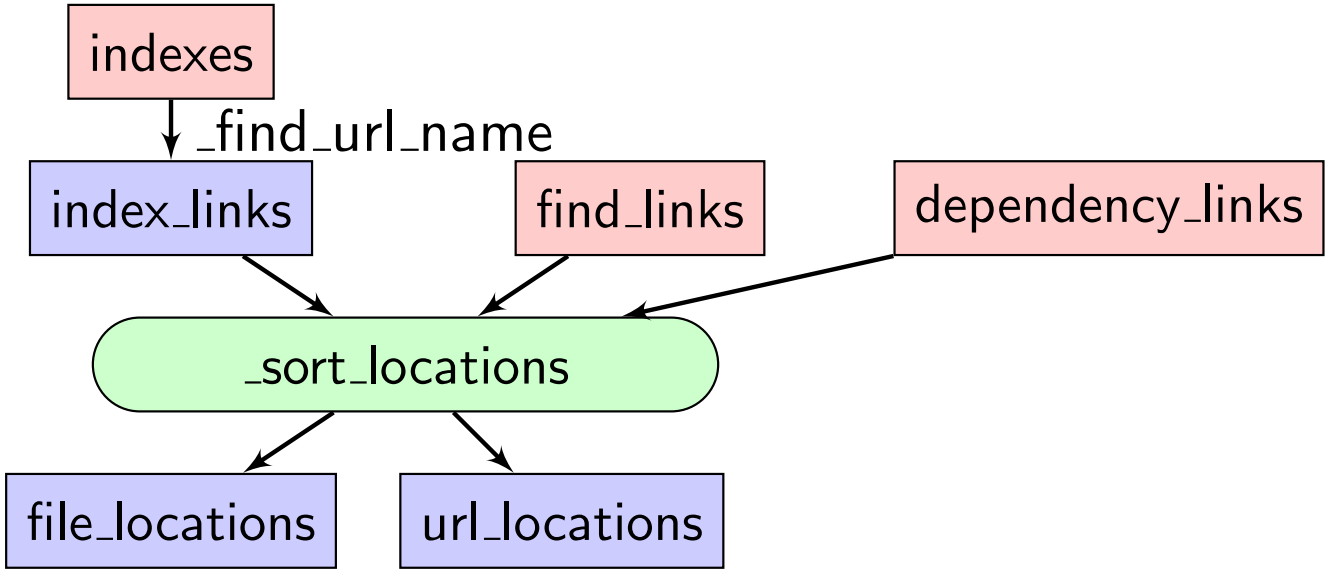

3 - How does pip select the packages ?

_sort_locations

```
if the scheme == file or if the path exists:
    if is a file:
        if html: -> urls
        else: -> files
    elif is a directory:
        if dealing with find_links:
            for all files:
                if html: -> urls
                else: -> files
        else: -> urls
else: -> urls
```

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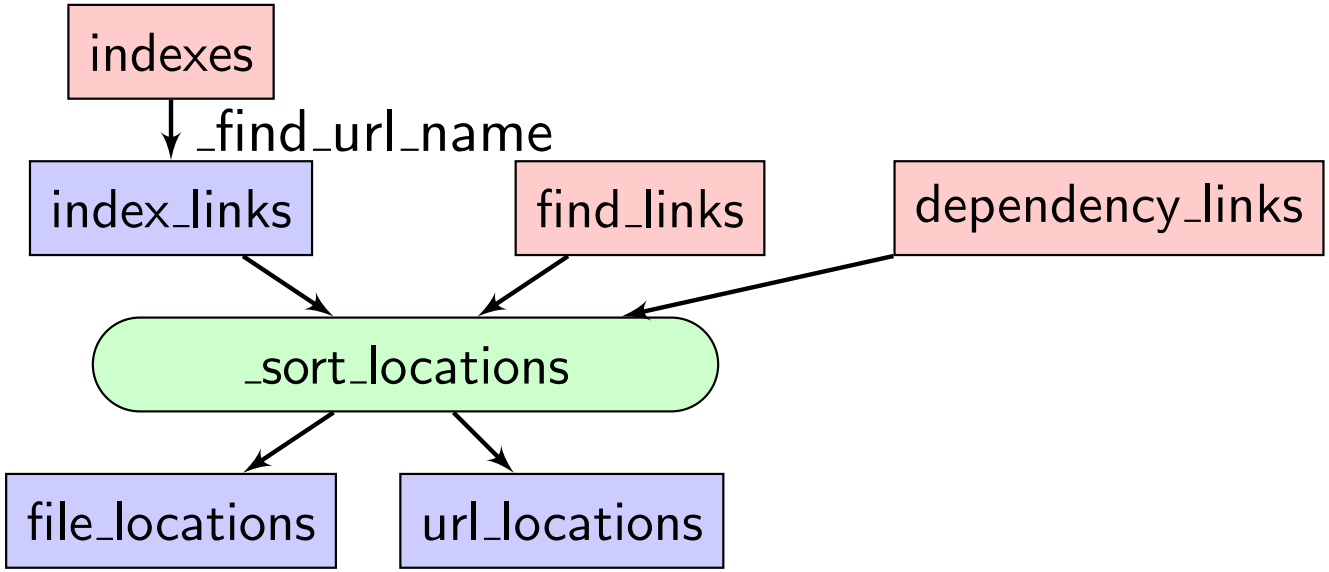

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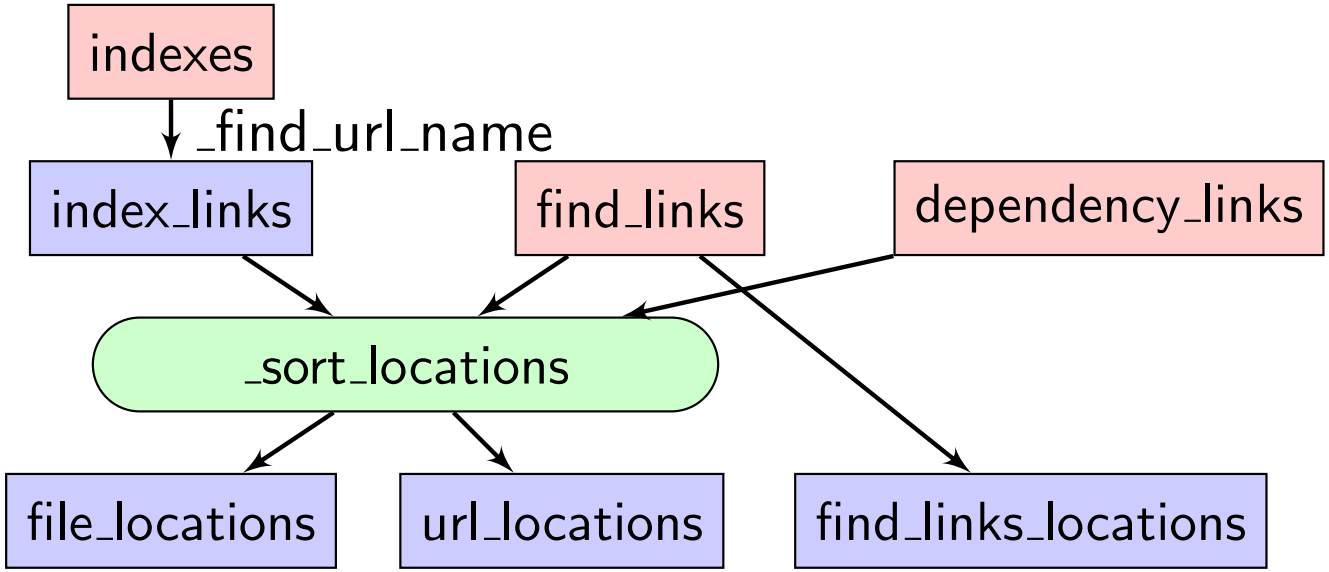

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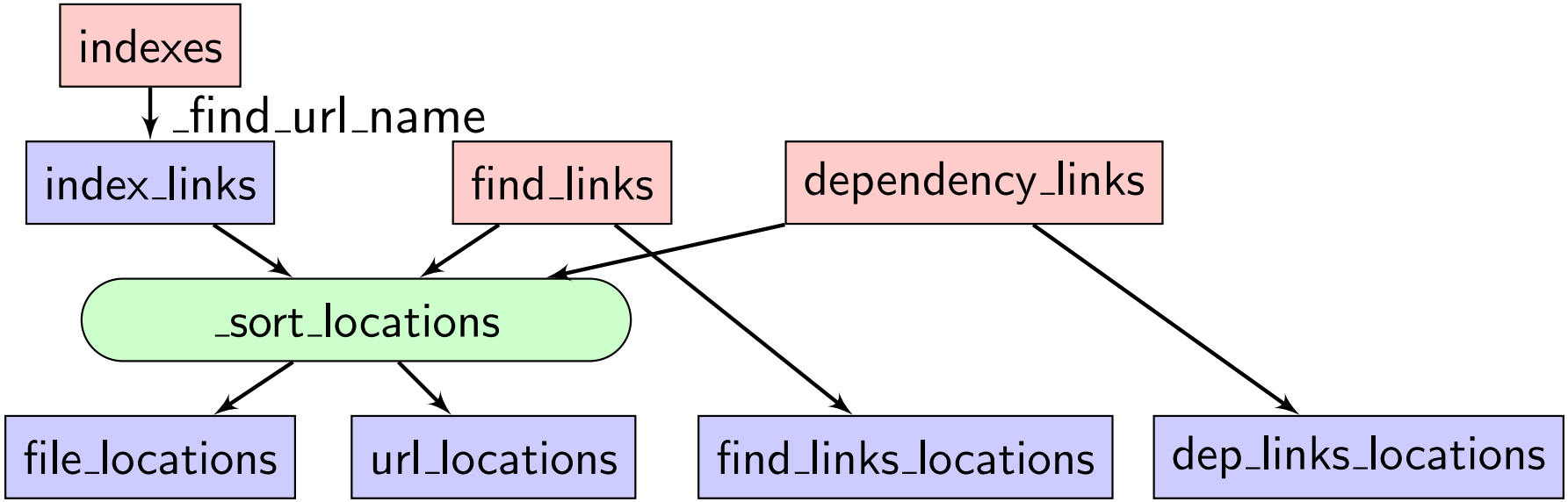

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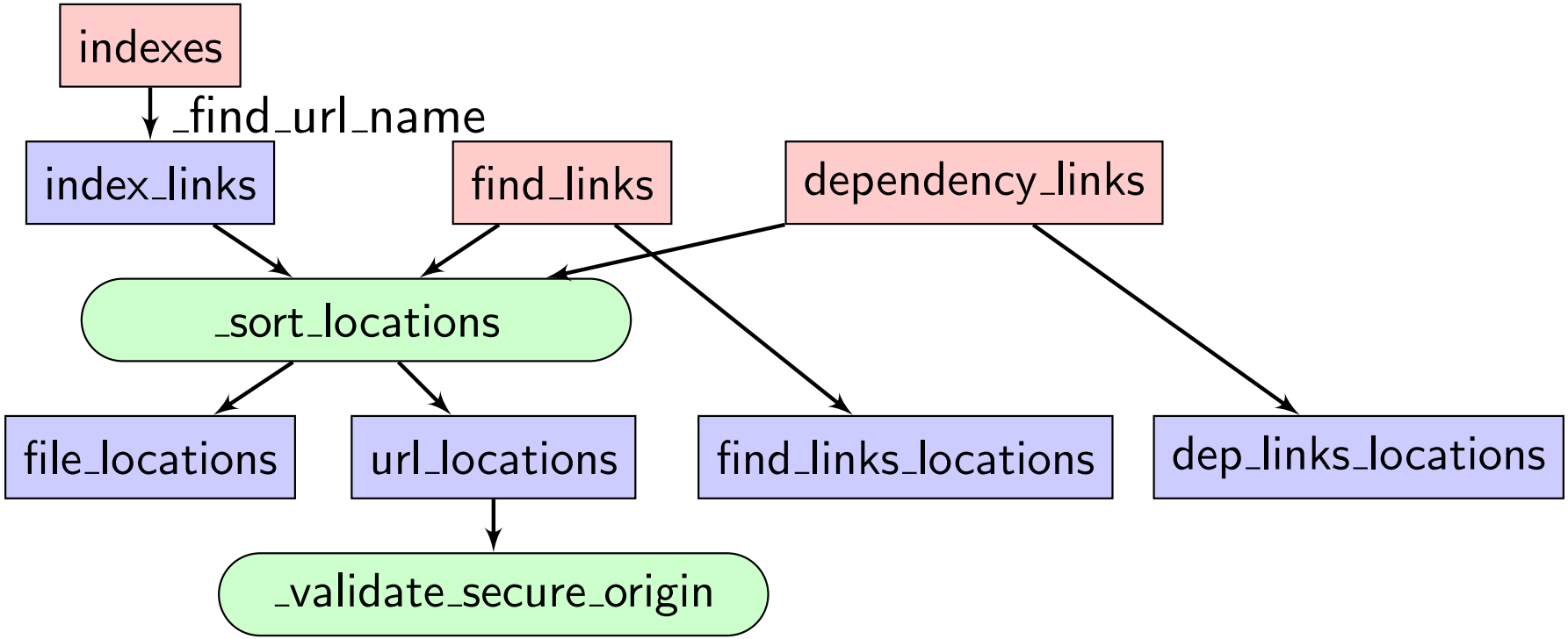

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3 - How does pip select the packages ?

_validate_secure_origin for url_locations

- protocol, hostname, port
- ("https", "*", "*"),
- ("*", "localhost", "*"),
- ("*", "127.0.0.0/8", "*"),
- ("*", "::1/128", "*"),
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Polyconseil

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- ("file", "*", None),
- ("*", host, "*"), for all hosts from `--trusted-host` option

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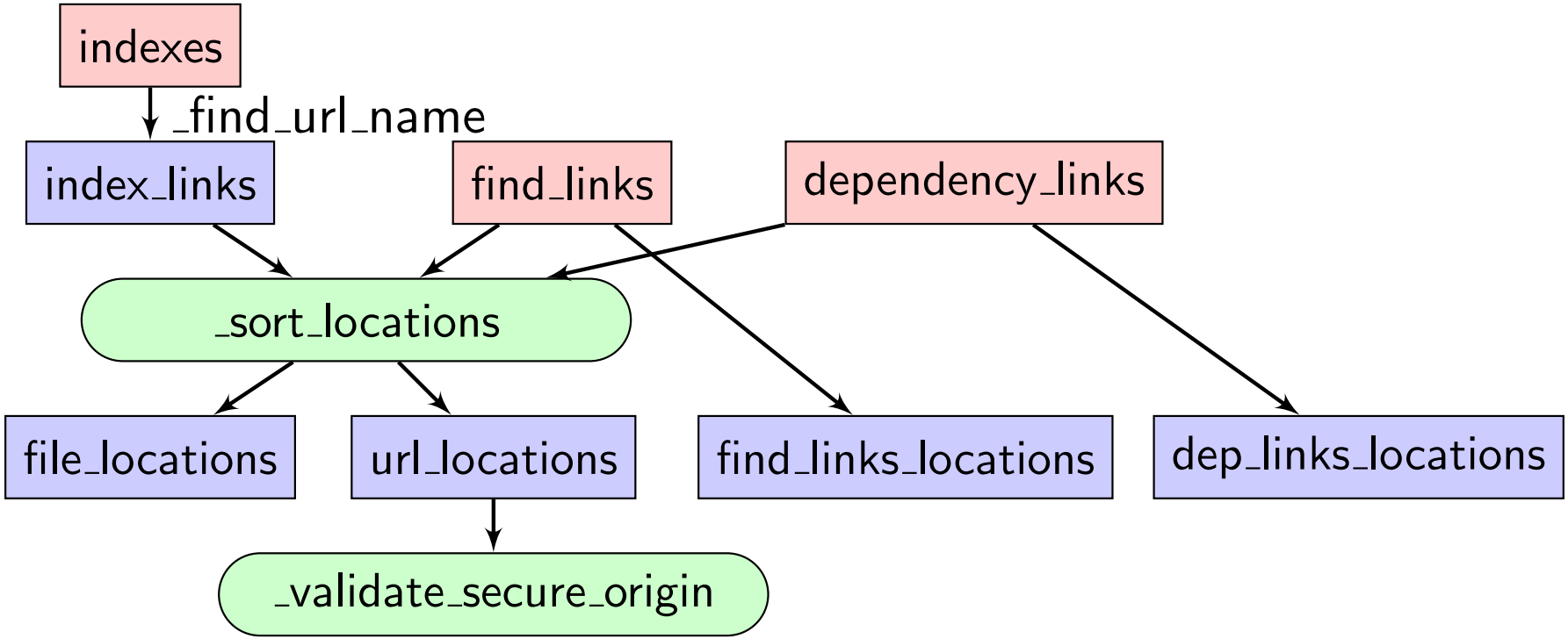

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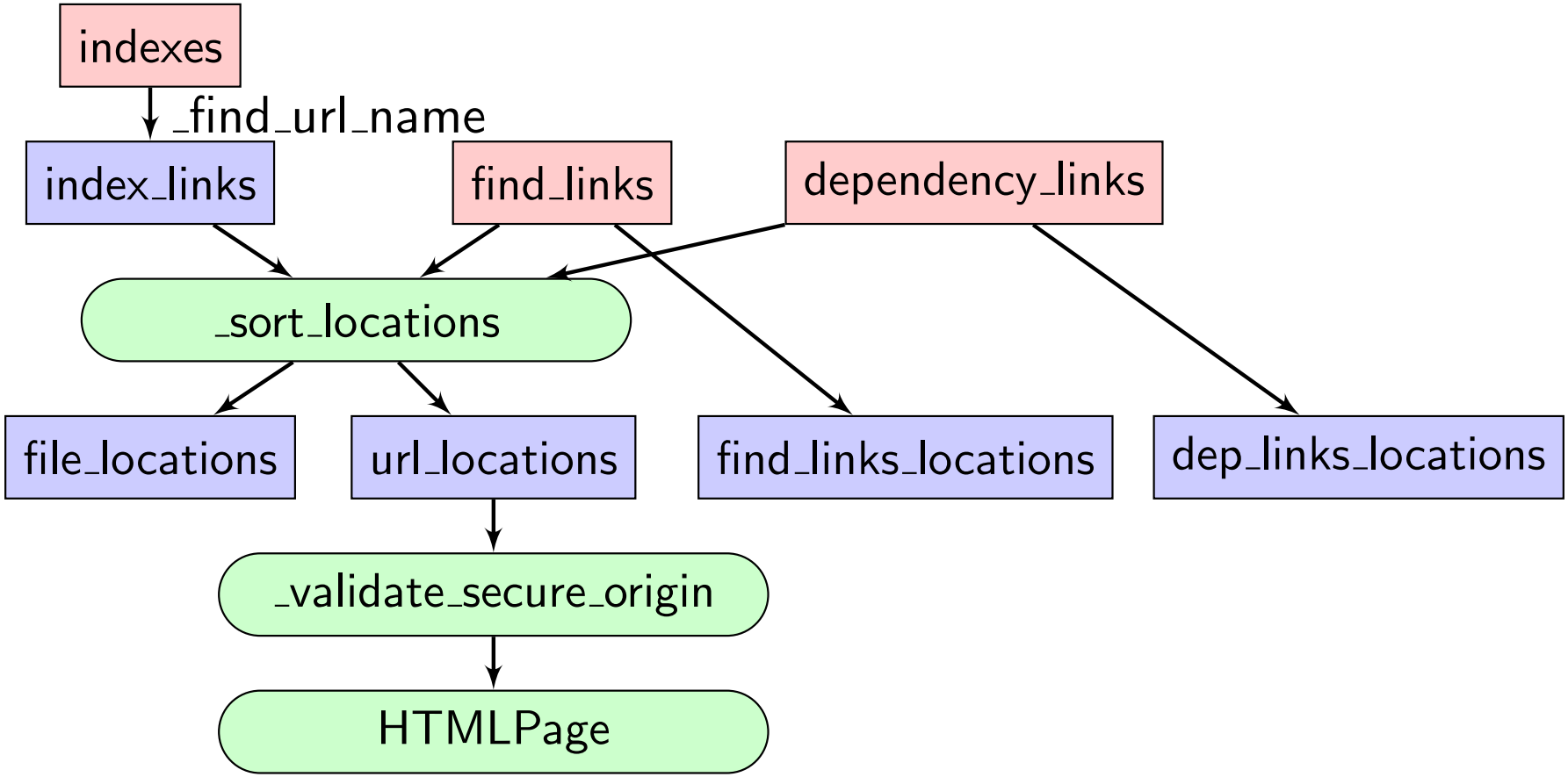

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3 - How does pip select the packages ?

HTMLPage

- for urls looking like archives, check content type first
  if "text/html", continue
- get content and parse
- check all links
- if rel contains 'homepage' or 'download'
  add it (untrusted to url_locations)

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Note

- with api_version 2 i.e. PyPI, <a> can be marked with `rel="internal"`
- only trust internals
- `<meta name="api-version" value="2" />` in the page head
- `--allow-external/--allow-all-external`

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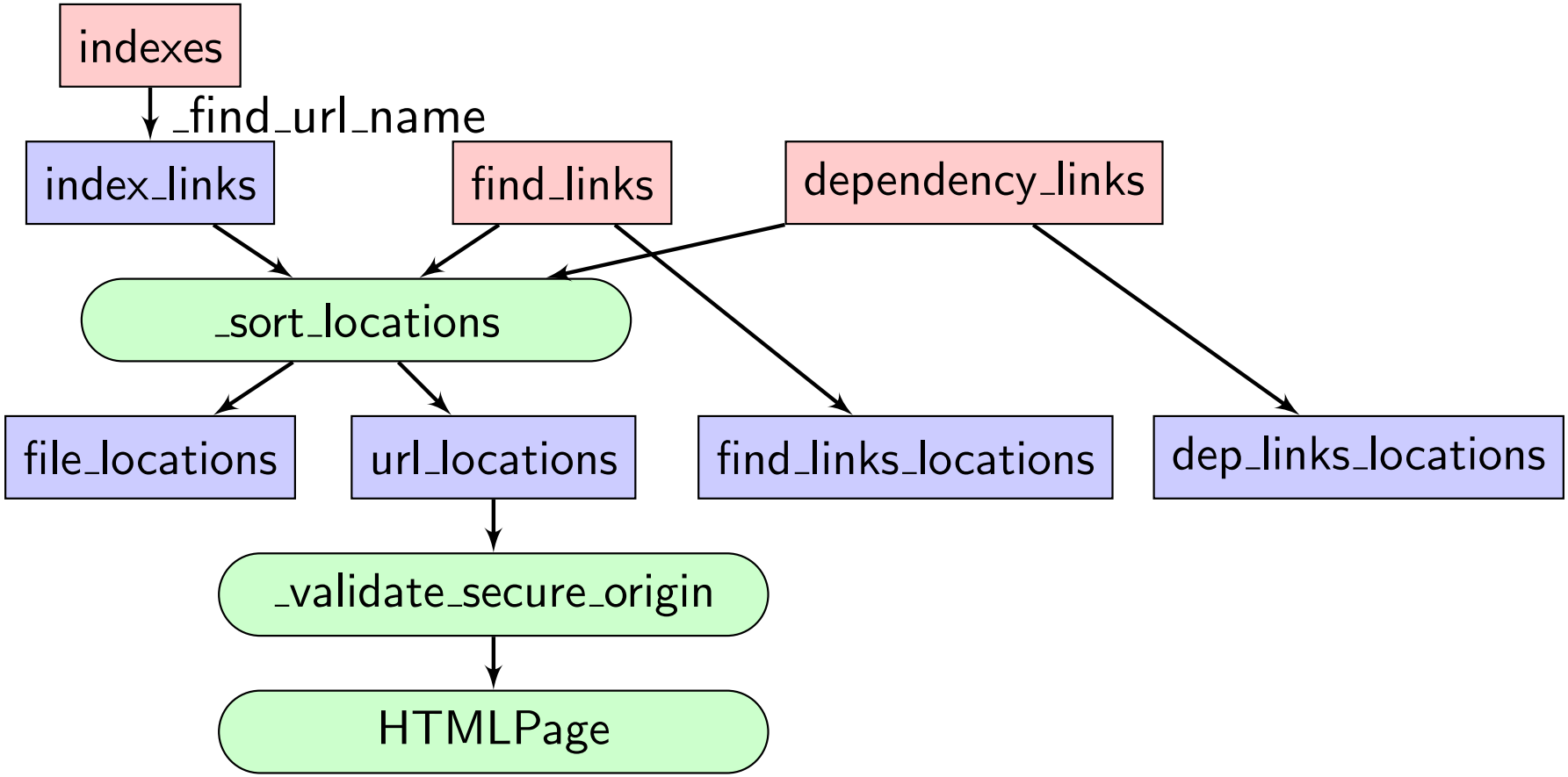

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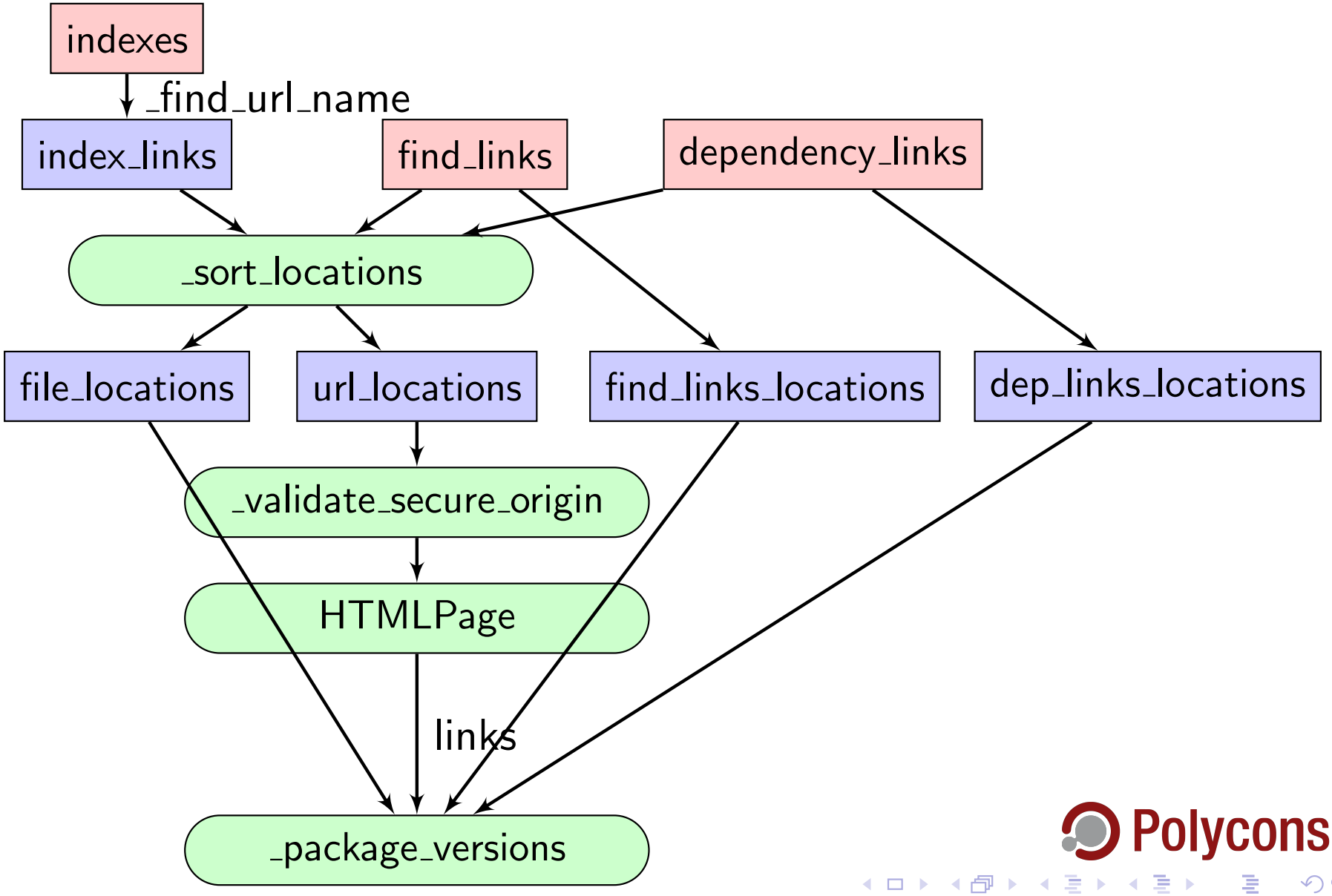

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- push egg links (containing #egg=) to the end

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- tries to extract version from filename and reject file if fails
- if version contains -py2/-py3/-py27/etc, check python version
- check internal/external hosted files and verifiable/unverifiable files `--allow-external/--allow-all-external/--allow-unverified`

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Preference Order

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Note

Wheel cache (pip 7 feature) has no impact on _find_all_versions

Polyconseil

3 - How does pip select the packages ?

_find_all_versions('pep8')

```
[<InstallationCandidate('pep8', <Version('1.5.7')>,
    <Link file:///home/user/wheelhouse/pep8-1.5.7-py2.py3-none-any.whl>)>,
 <InstallationCandidate('pep8', <Version('1.5.0')>,
    <Link file:///home/user/wheelhouse/pep8-1.5.0-py27-none-any.whl>)>,
 ...
 <InstallationCandidate('pep8', <Version('0.3.1')>,
    <Link https://private_pypi/simple/pep8/pep8-0.3.1.tar.gz>)>,
 <InstallationCandidate('pep8', <Version('0.4.1')>,
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 ...
 <InstallationCandidate('pep8', <Version('1.5.2')>,
    <Link https://pypi.python.org/packages/3.3/p/pep8/
    pep8-1.5.2-py2.py3-none-any.whl#md5=a0caba277a2f491b1634246a338a1235>)>,
 <InstallationCandidate('pep8', <Version('1.5.3')>,
    <Link https://pypi.python.org/packages/3.3/p/pep8/
    pep8-1.5.3-py2.py3-none-any.whl#md5=0654904760aa9a24062bf367f39e873e>)>]
```

Thanks!

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- Bon appétit !