

New Python versions in Fedora

- Before 3.9: New Python every 1.5 year: ~3 Fedora releases
- Now: New Python each year: ~2 Fedora releases
- Python schedule adapted to match Fedora:
 - new Python in odd releases
- Development of new Python version takes 1 year
- Fedora integrates soon, not late
 - upstream involvement
 - getting hands dirty
 - lots of breakages
 - Fedora is the driver of fixes for many upstreams



Fedora offers multiple Python versions

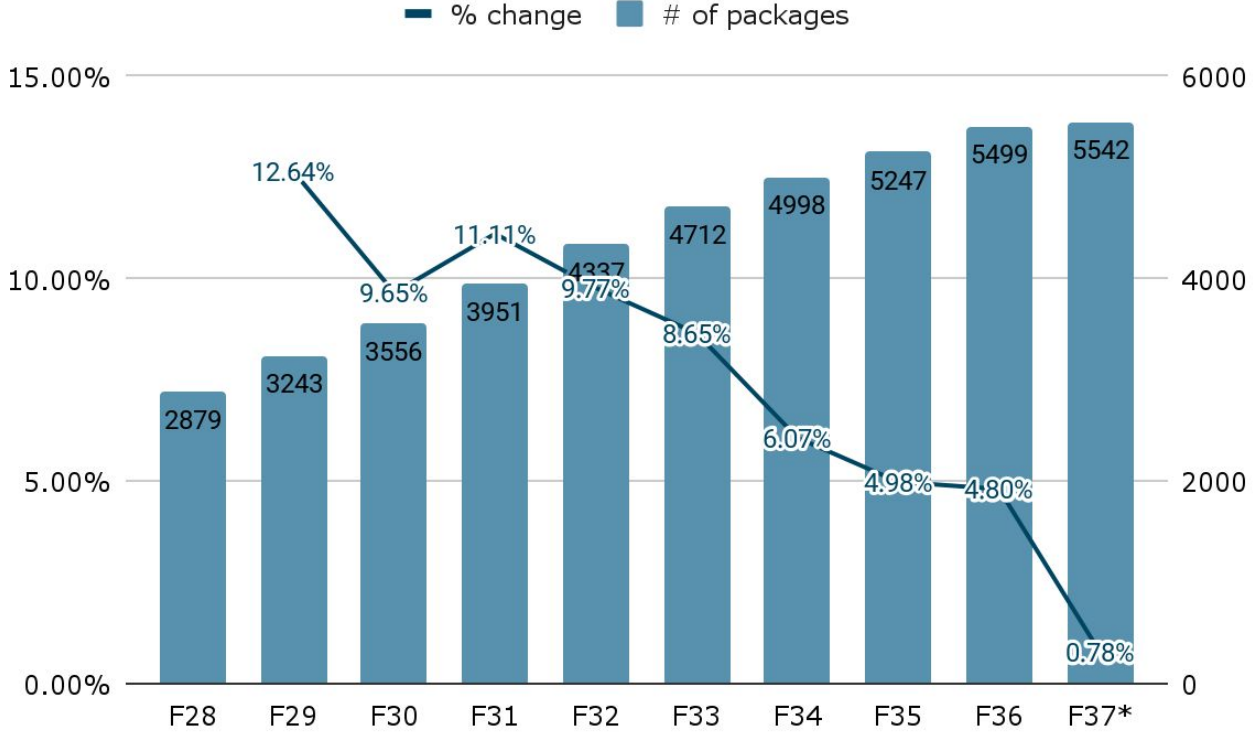
- Mostly for Python developers, our primary target audience
 - Python 2.7 (dead but not missing, RHEL 7 devs)
 - Python 3.6 (security only, RHEL 8 devs)
 - Python 3.7 (security only)
 - Python 3.8 (security only)
 - Python 3.9 (security only)
 - Python 3.10
 - Python 3.11 (development preview)
 - also PyPy, MicroPython



The “main” Python

- One Python version is more important than others
 - Fedora 29, 30 & 31: Python 3.7
 - Fedora 32: Python 3.8 (originally planned for 31)
 - Fedora 33 & 34: Python 3.9
 - Fedora 35 & 36: Python 3.10
 - Fedora 37 & 38: Python 3.11
- Stack of packages (thousands)
- Fedora runs on this Python (DNF, Anaconda, packaging tools...)
- Critical component
- `/usr/bin/python3` (and `/usr/bin/python`)
- Many users only use this Python

How many Python 3 packages are in Fedora



Packages require a specific Python version

- Majority of Python packages require Python X.Y specifically
 - Python libraries installed to `/usr/lib(64)/pythonX.Y/`
 - Applications embedding Python linking to `libpythonX.Y.so`
 - The bytecode cache (`.pyc` files) is compiled for Python X.Y

- Upgrading “main” Python == rebuilding ~4-5 thousands packages
 - in proper order 🤖
 - packages don't always build 💔
 - new Python is not backwards compatible 🦆
 - 3.10 to 3.11 is a “major” upgrade (not semver)

October 2021: Python 3.11.0a1

- Package as new Python version for testing
- Fork the Python 3.10 package and adapt macros (variables)
- Rebase Fedora patches
- Remove cruft
 - old Provides/Obsoletes
 - patches that have been merged upstream
- Change proposal
 - usually the first one for that Fedora
- Package can be built `--with main_python`
- Since Fedora 33, there is no “python3” source package
 - “python3” is built from “python3.11”

^
2 @python / **python3.11**Project ID: 49698
v[Overview](#) [Packages](#) [Builds](#) [Modules](#) [Monitor](#) [Settings](#)










Build Monitor

Warning! This is a large project with many packages and/or builds - we can not hold all the requested data on one page (as we usually do), please use the pagination buttons below the table.

[Simple](#) [Detailed](#)

	Fedora rawhide
Package	x86_64
2ping	✔ succeeded
389-ds-base	✔ succeeded
abiword	✔ succeeded
abrt	✔ succeeded
abrt-server-info-page	✔ succeeded
academic-admin	✔ succeeded
accerciser	✔ succeeded
adapt	✔ succeeded
adb-enhanced	✔ succeeded
afflib	✔ succeeded

Copr repo: @python/python3.11

- “Bootstrap” the very initial package set  x86_64 only
- Rebuild everything in dependency order 
- Triage hundreds of build failures:
 - (few) missing dependencies 
 - Python 3.11 incompatibilities 
 - Python 3.11 regressions 
 - fails to build for unrelated reason  
 - sometimes in copr only  
- Mass rebuild ~4k packages with every new Python version
- Keep up with Rawhide
 - automation

Past: Bootstrapping the initial package set



- GitHub: sclorg/rpm-list-builder ❤️
 - YAML with build order and RPM conditionals (%bconds)
 - Initially created from Python 3.8 data, adapting (rewriting)
 - Automated with human operator



- ~500 critical packages
 - setuptools, pip, pytest, sphinx, cython
 - rpm, dnf, anaconda, abrt, freeipa
 - koji, bodhi, fedpkg, pungi
 - boost, numpy, scipy, matplotlib, notebook
 - clang, gdb

Past: Bootstrapping the initial package set



```
python39:
  packages:
    - python3.9:
      macros:
        _with_bootstrap: 1
        _without_rpmwheels: 1
        _without_tests: 1
        _without_optimizations: 1
    - gdb # not blocking
    - python-setuptools:
      macros:
        _with_bootstrap: 1
        _without_tests: 1
    - python-wheel:
      macros:
        _with_bootstrap: 1
    - python-pip:
      macros:
        _without_tests: 1
        _without_doc: 1
    - python-setuptools:
      macros:
        _without_tests: 1
    - pyparsing:
      macros:
        _without_doc: 1
    - python3.9 # wait for gdb, skip test_io in copr
```

Past: Rebuilding everything else until it does

- Determine the full list of packages (dnf repoquery)
- Replace rpm-list-builder with copr automation
- Define packages in copr to build from Fedora sources (dist-git)
- Set up build automation (hooks)
 - every git push to Fedora Rawhide triggers a build
 - even Pull Requests trigger builds (isolated) 
 - manual builds possible as well
- Build packages in waves
 - every successful build may be another failed build's remedy
- Triaging and reporting failures 
- Keep the package list up to date

Present: Resolve the dependency order

- github.com/hroncok/whatdoibuild
- for each package, resolve its buildroot in current Rawhide
- repoquery too high-level, uses dnf Python API
- reports package readiness wrt. deps
- detects (some) loops
- bconds data hardcoded, resolved from scratchbuilds
- reports most significant blockers
- chokes on unresolvable packages
 - dist-git vs source repo
 - the “random architecture” BuildRequires problem (e.g. scipy and pythran)

Present: Resolve the dependency order

- Resolving 31 requirements... to 369 installs.
 - module-build-service: 98 packages / 95 components relevant to our problem
 - python-kombu
 - ✓ python3-kombu
 - python-alembic
 - ✓ python3-alembic
 - python-constantly
 - ✓ python3-constantly
 - python-stevedore
 - ✓ python3-stevedore
 - ...
 - m2crypto
 - X python3-m2crypto
 - python-requests-gssapi
 - ✓ python3-requests-gssapi
 - ...






The 50 most commonly needed components are:

```
4 m2crypto
2 python-spnego
1 ...
```

The 20 most commonly last-blocking components are:

```
4 m2crypto
2 python-spnego
1 ...
```

Triaging and reporting failures

- Triaging build logs with regexes 
- Build failed:
 - automatically check root.log for dependency issues
 - automatically check build.log for common errors
 - investigate the rest
- Reporting 
 - unrelated fails to build from source (very often, policies to the rescue)
 - block F36FTBFS, later F37FTBFS
 - Python 3.11 incompatibility
 - figure out why, offer help
 - block PYTHON3.11
 - fixes not possible without actual maintainers, thanks!
 - build failures often caused by dependencies without %check

Depends On:	2019068	2021804	2021897	2021938	2021972	2022284	2022529	2025576	2026257	2026348	2026781	2026935	2026936	2026945	2028098	2032607	2033213	2041090	2044961	2044963	2045001	2045255	2046260	2047011	2047046
	2047047	2049619	2049621	2049626	2049675	2049682	2049705	2051204	2068733	2074531	2078518	2080856	2083977	2084083	2090763	2093177	2093934	2093963	2093977	2093985	2094372	2096365	2098660	2098691	2098692
	2098693	2098694	2098895	2098702	2098722	2098732	2098742	2098746	2098747	2098750	2098751	2098752	2098753	2098768	2098772	2098775	2098781	2098787	2098800	2098818	2098823	2098826	2098829	2098850	2098856
	2098875	2098884	2098886	2098888	2098892	2098904	2098905	2098906	2098908	2098917	2098967	2098977	2098978	2098999	2099034	2099071	2099080	2099090	2099110	2099111	2099112	2099129	2099148	2099152	2100813
	2100815	2100819	2101963	2102133	2103637	2103640	2107826	2113238	2113441	2113555	1987993	1999445	2048972	2049006	2049007	2049014	2049017	2049019	2049041	2049051	2049056	2049057	2049058	2049059	2049060
	2049062	2049069	2049070	2049072	2049074	2049075	2049076	2049077	2049078	2049079	2049080	2049081	2049082	2049083	2049084	2049085	2049086	2049087	2049088	2049089	2049090	2049091	2049092	2049093	2049094
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	2021863	2021886	2021889	2021898	2021900	2021902	2021921	2021924	2021928	2021933	2021946	2022252	2022268	2022269	2022272	2022274	2022282	2022350	2022351	2022393	2022394	2022396	2022397	2023272	2025026
	2025517	2025554	2025559	2025563	2025583	2025584	2025589	2025590	2025594	2025599	2026245	2026248	2026252	2026258	2026262	2026264	2026269	2026270	2026330	2026332	2026334	2026337	2026340	2026341	2026342
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	2099137	2099138	2099139	2099140	2099141	2099142	2099143	2099144	2099145	2099146	2099147	2099148	2099149	2099											

November 2021: Python 3.11.0a2
December 2021: Python 3.11.0a3
January 2022: Python 3.11.0a4

- Update the Fedora package (official and copr)
- Check if basic packages still build in Copr
 - partial rebootstrap needed for arched packages
 - copr problems
 - we don't bump releases, need to delete old builds
- Mass rebuild everything


February 2022: Fedora 36 branching

- Finally, Rawhide is Fedora 37 🎉
- Up until now, some don't consider Fedora 37 🐛s urgent
 - some still don't 😐

March to May: Repetition, repetition

- New alphas
- New mass rebuilds
- New Python incompatibilities
- New Rawhide breakages
- New dependency issues

May 2022: Python 3.11.0b1: The first beta

- No new features beyond beta 1
- Figure out whether Fedora 37 is ready (see copr, bugzilla)
 - it wasn't, some critical packages were still broken
- 2nd beta - start building in Fedora
 - announce, announce, announce!
 - koji side tag not to break everything
 - reproduce 
 - enhanced whatdoibuild with a Koji builder
 - mass build everything
 - new failures for different arches




Merging the side tag

- Ideally, when everything is built
 - That won't ever happen
 - Too soon? Too late?
 - Mind the mass rebuild
 - Point of no return, but is it?
 - The merge “breaks” whatdoibuild 😬
-
- Reality:
 - ~10 days
 - ~3700 builds merged
 - ~500 packages failed to build, nothing “important”
 - compose blocked after merge by anaconda/dracut bug, fixed in 1 day

Fails To Install bugzillas and policy

- Many maintainers don't consider Python 3.11 bugs priority
- Many maintainers don't respond to Bugzilla
- Nonresponsible maintainer policy does not scale
 - Many take it as a personal attack 🧑
- **Fails To Install** policy to the rescue
 - targets packages, not people
 - allows orphaning and retirement 💀
 - existing tooling, updated
- Still fighting the “I'll set it to ASSIGNED but wont' fix it” approach

July: Revert! Revert!

- Too many upstream blockers
- “If not fixed, we’ll delay by 2 months”
- Possible ABI incompatibility after Fedora 37 GA
- Revert immediately?
 - Rawhide would go 3.10  3.11  3.10  3.11
 - triples the work
- Revert after F37 branching?
 - Rawhide would stay at 3.11
 - complicates pre-beta testing
- Blockers actually fixed, never mind

July: New betas, checking ABI compat.

- New betas (3-5) upgraded in copr first and check ABI compat.
- No new features, but possible reverts
 - ABI changes can cause segfaults
 - bytecode cache format (SELinux), happened with Python 3.8 and 3.11
- Mini mass rebuilds possibly needed (~600 packages)
 - arched packages only

- Reality
 - the ABI stayed the same after 3.11.0b3
 - bytecode magic number was updated in 3.11.0b4

Bytecode magic number has changed

- Number encoded in headers of bytecode cache files (.pyc)
- Unique for each Python version, stable after rc
- Breaking change in 4th beta
- F37 mass rebuild took care of most packages
- ~60 packages failed during mass rebuild
- tracked in bugzilla

August: Python 3.11.0rc1, F37 Beta Freeze

- Python rc versions are pretty much the same as final
- Plan: Ship Fedora 37 Beta with at least 3.11.0rc1
- 85 packages still fail to build and hence fail to install
- Discover Python related runtime problems during beta

September/October: Finalizing

- September: Python 3.11.0rc2 (the last rc)
- early October: Fedora 37 Final Freeze
 - all packages built / retired before the freeze

- Freeze Exceptions:
 - Python 3.11.0 final (might happen after the freeze)
 - obsolete removed packages to unblock upgrade paths

- Python 3.12.0a1 released, let's start over



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