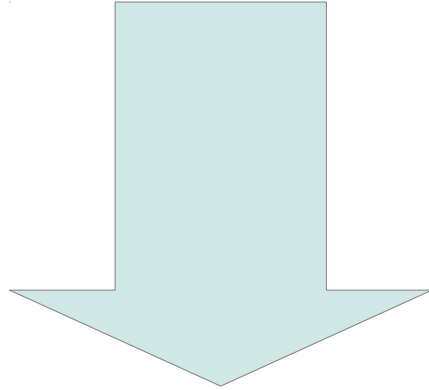


Syzix: meandering down the garden \$PATH

Kevin Pulo
Academic Consultant, NCI, ANU
kev@pulo.com.au
kevin.pulo@anu.edu.au
@_devkev_

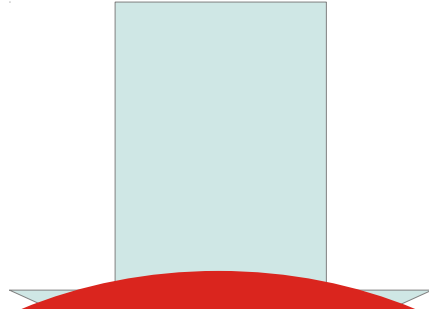


Traditional package install



<code>/bin</code>	<code>/usr/bin</code>
<code>/lib</code>	<code>/usr/lib</code>
<code>/sbin</code>	<code>/usr/sbin</code>
<code>...</code>	<code>/usr/share</code>

Traditional package install



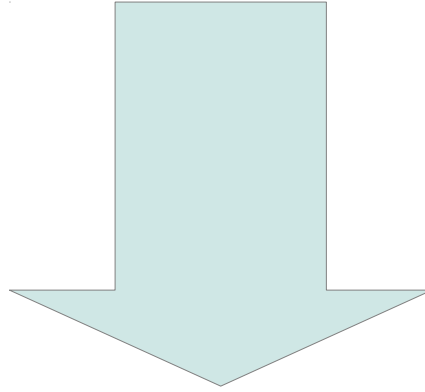
~~`/usr/bin` `/usr/bin`
`/usr/lib` `/usr/lib`
`/usr/sbin` `/usr/sbin`
`/usr/share` `/usr/share`~~

Single
package
version



Single
package
version

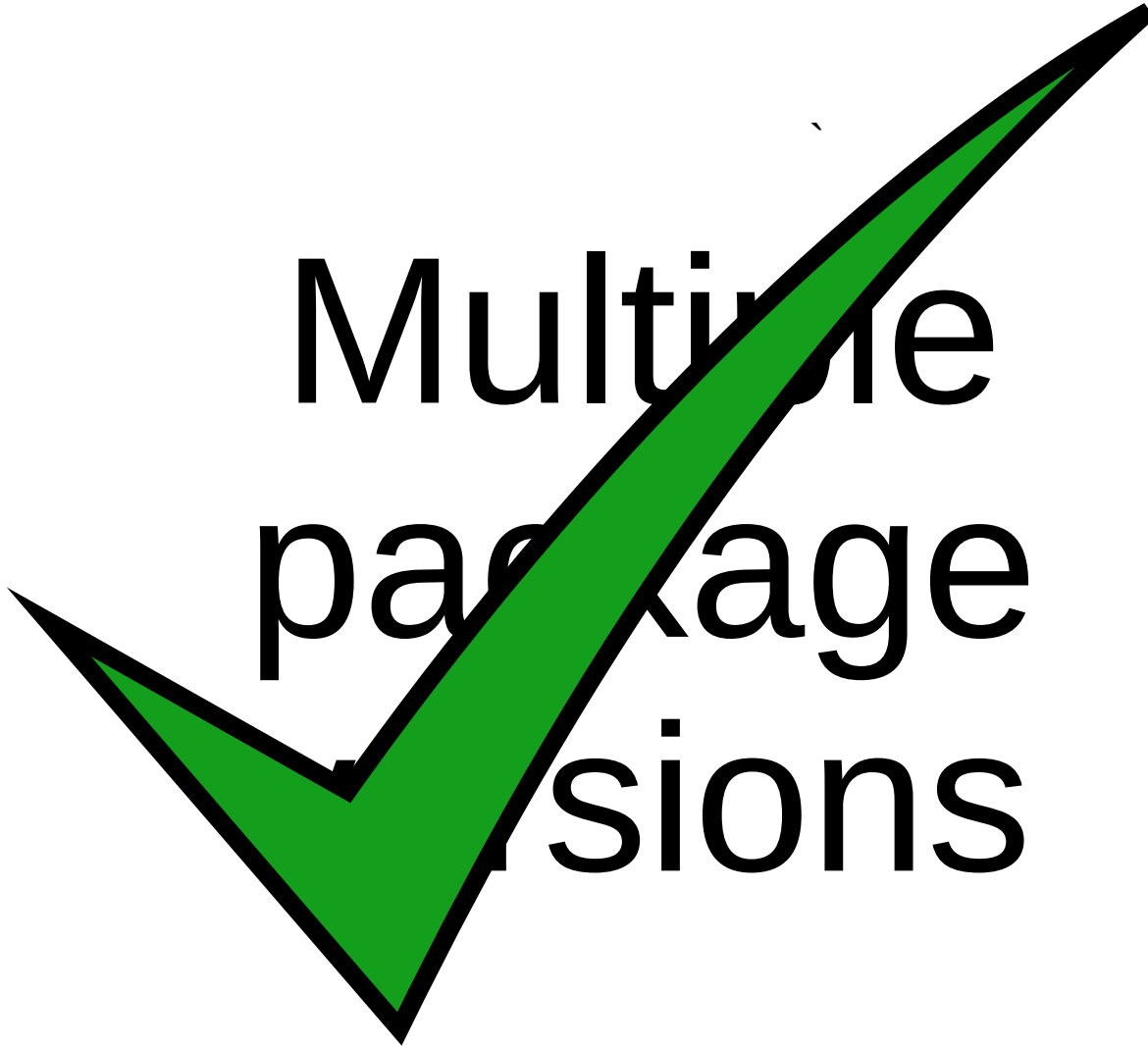
Syzix package install



/sw/\$repo/\$arch/\$pkgname/\$version

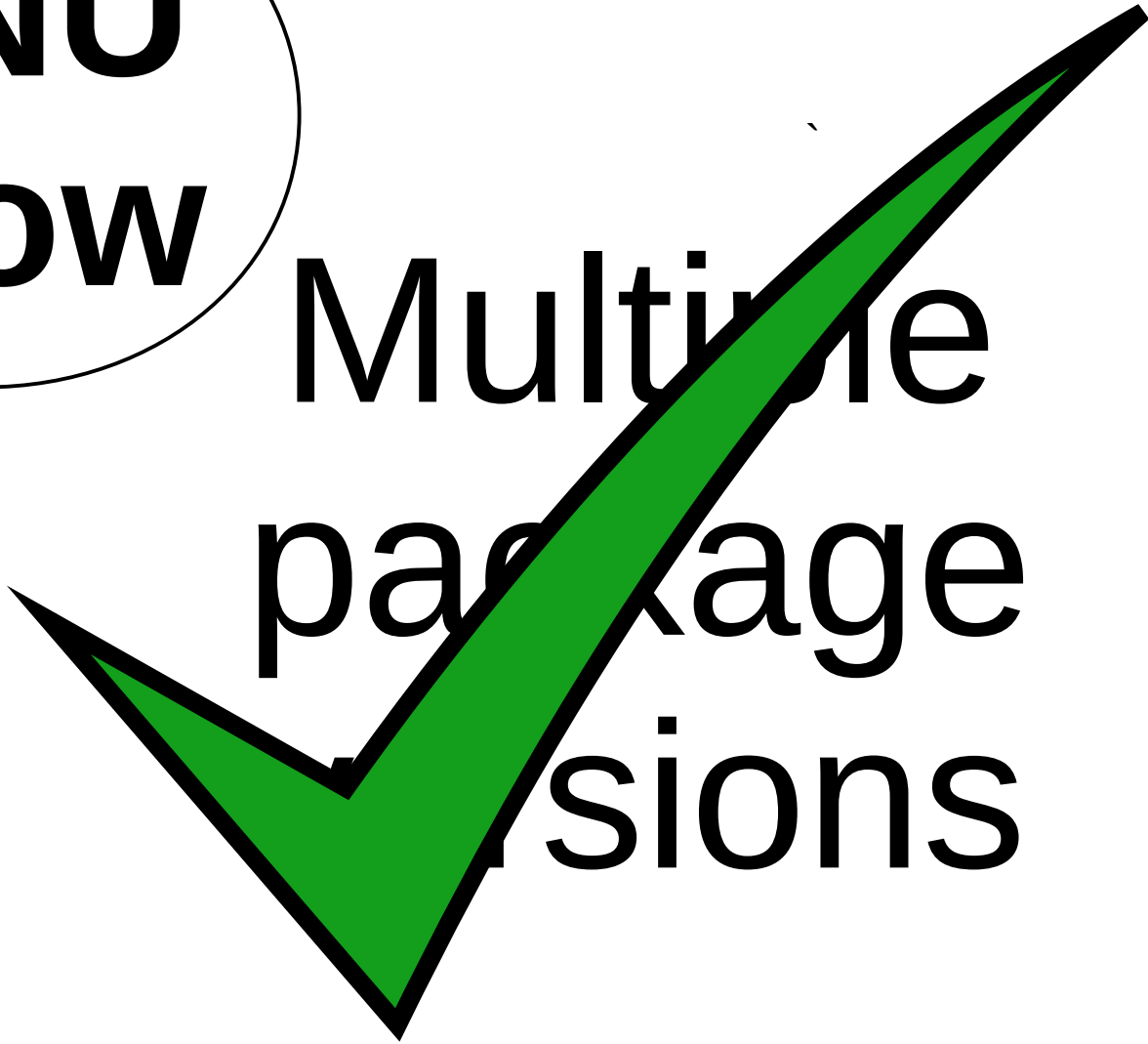
Multiple
package
versions

Multiple
package
versions





Multiple
package
versions



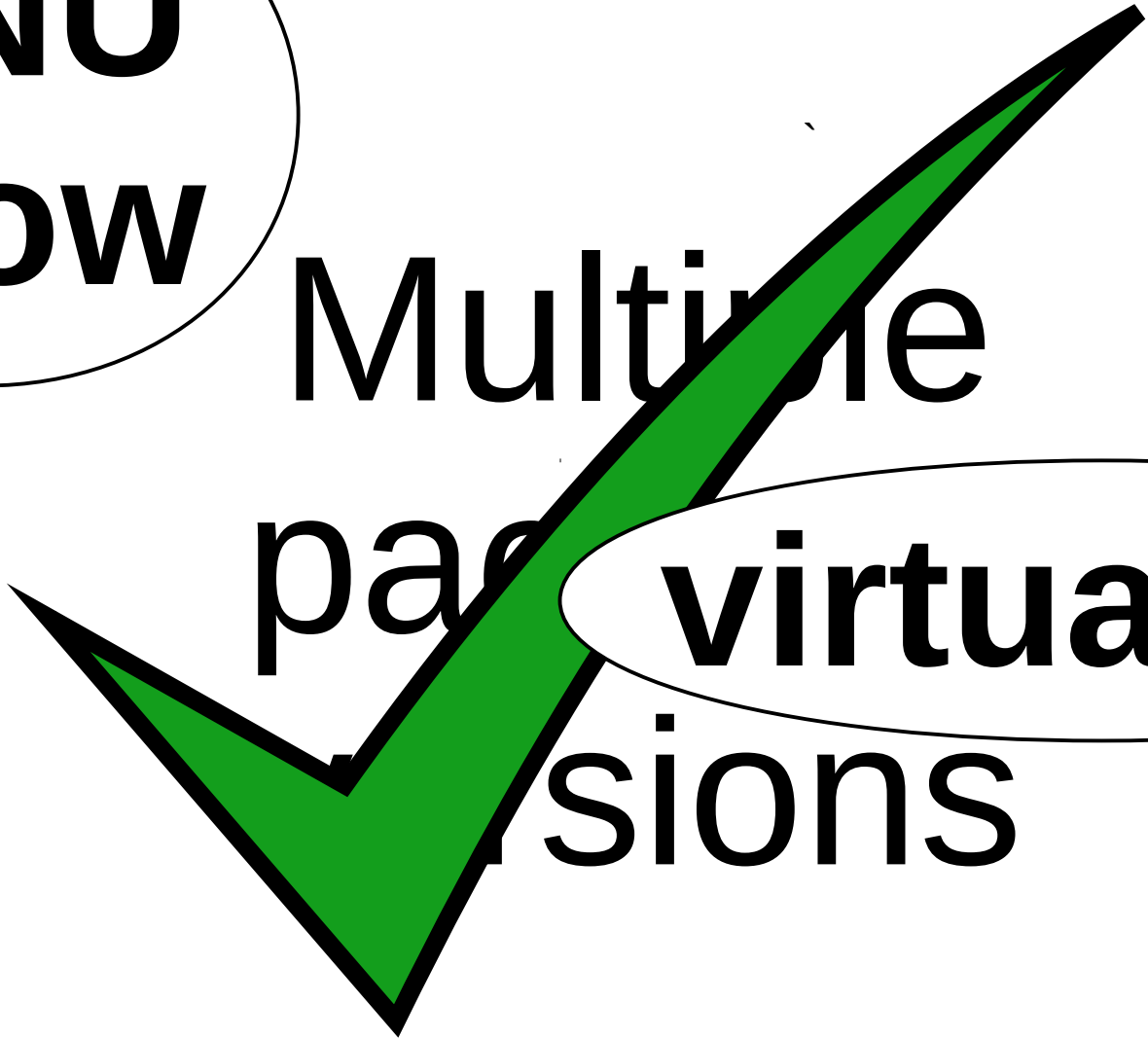
**GNU
Stow**

Multiple

packages

virtualenv

versions



**GNU
Stow**



e

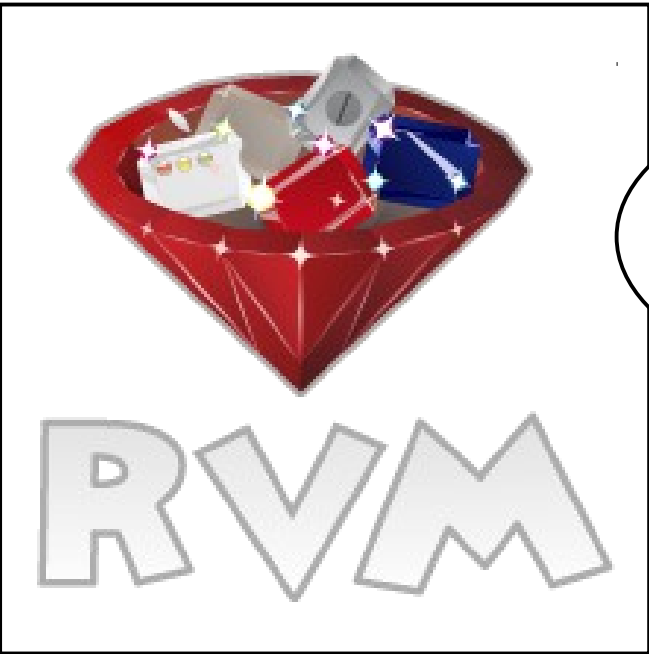
pa

virtualenv

sions



**GNU
Stow**



OSTree

virtualenv

sions



**GNU
Stow**



OSTree

pa

virtualenv

GlobalLinux

**GNU
Stow**



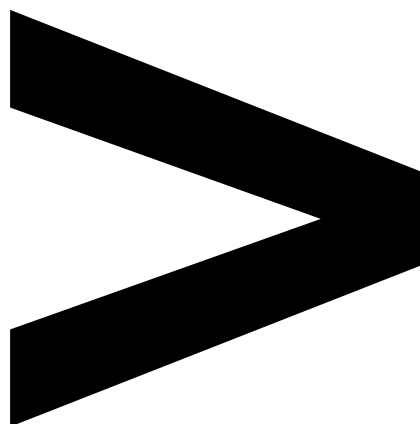
OSTree



NixOS

actualenv

Gobolinux







\$PATH

Dynamic
runtime
version
selection

Dynamic
runtime
version
selection



Environment Modules

modules.sourceforge.net

```
$ syz list
```

```
Currently Loaded Syzfiles:
```

- 1) modules/3.2.6
- 2) shwrapnel/devel
- 3) modext/devel
- 4) syz/devel

```
$ python
```

```
-bash: python: command not found
```

```
$ syz avail python
```

```
----- /sw/nix/x86_64-linux/.sf -----  
python/2.6.7                python/2.7.3-wrapper  
python/2.7.3(default)      python3/3.2.3
```

```
$ syz load python/2.6.7
```

```
$ python
```

```
Python 2.6.7 (r267:88850, Jul 20 2012, 19:59:23)
```

```
[GCC 4.6.3] on linux2
```

```
Type "help", "copyright", "credits" or "license" for  
more information.
```

```
>>>
```

```
$
```

```
$ syz list
```

```
Currently Loaded Syzfiles:
```

- | | |
|------------------------------|--------------------|
| 1) modules/3.2.6 | 8) zlib/1.2.7 |
| 2) shwrapnel/devel | 9) gcc/4.6.3 |
| 3) modext/devel | 10) bzip2/1.0.6 |
| 4) syz/devel | 11) attr/2.4.46 |
| 5) linux-headers/2.6.35.14-2 | 12) acl/2.2.51 |
| 6) glibc/2.13 | 13) coreutils/8.15 |
| 7) bash/4.2-p24 | 14) python/2.6.7 |

```
$ syz swap python/2.7.3
```

```
$ python
```

```
Python 2.7.3 (default, Jul 20 2012, 19:54:40)
```

```
[GCC 4.6.3] on linux2
```

```
Type "help", "copyright", "credits" or "license" for  
more information.
```

```
>>>
```

```
$ syz unload python
```

```
$ python
```

```
-bash: python: command not found
```

```
$
```

A hand is shown in the foreground, pointing towards the Leaning Tower of Pisa. The tower is leaning to the right. The text 'Stable + Unstable' is overlaid in the center of the image. The background shows a cloudy sky and some buildings in the distance.

Stable
+
Unstable



Rollback package updates



Safely test
new versions

Rolling release + Standard release



Binary packages

+

Source builds



Marcel van Schooten, CC-BY

<http://www.flickr.com/photos/mvs/3405603248/>



Victor Gregorio, PD

<http://hacktux.com/linux/wallpaper/apache/compile>



Builds parametrised
by \$version

Standalone install*



Flickr user ausemade, CC-BY-NC-SA
<http://www.flickr.com/photos/ausemade/63735279/>

+

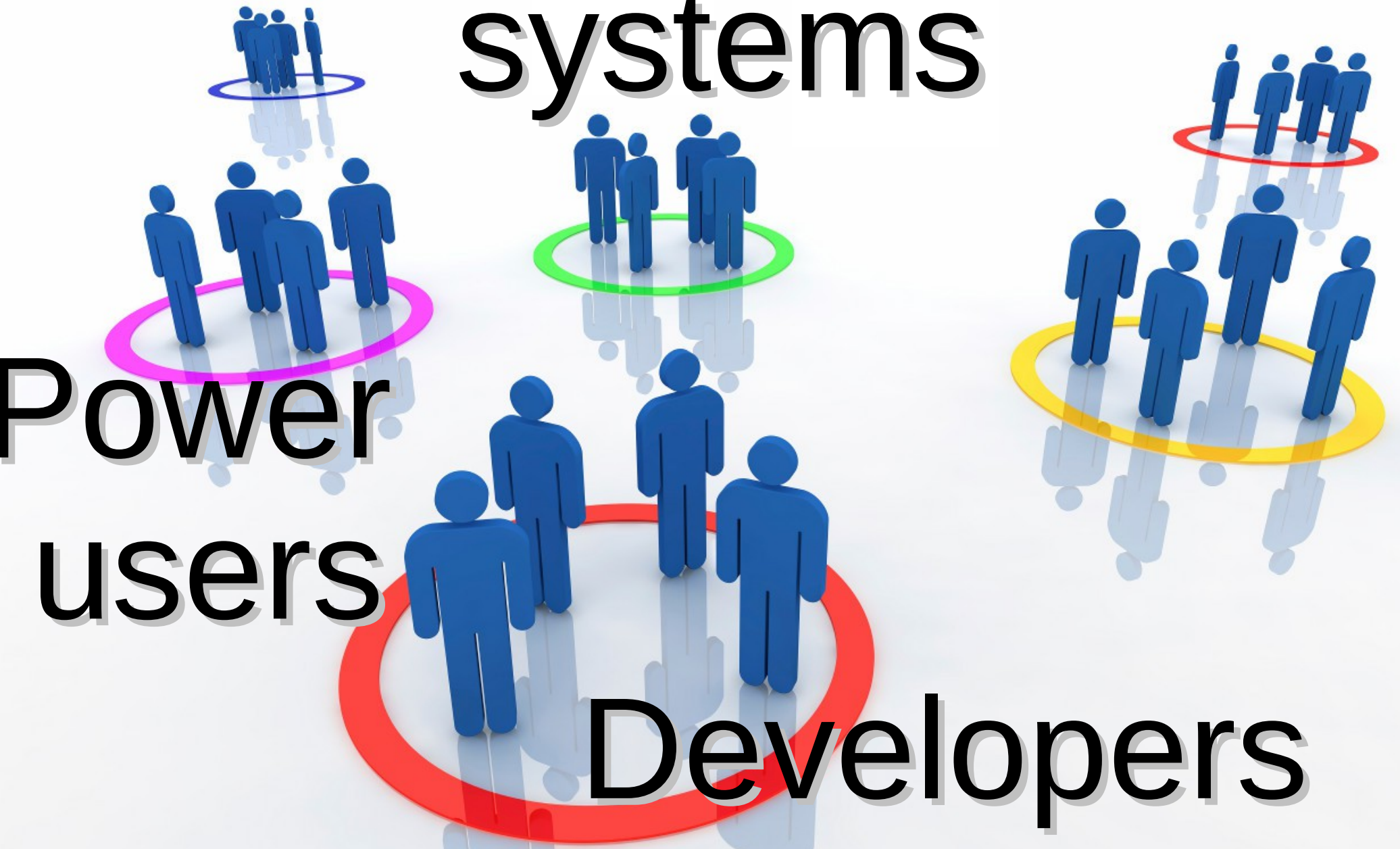


Flickr user Mrs Logic, CC-BY
http://www.flickr.com/photos/mrs_logic/3556644715/

* Not yet

Hosted install

Multi-user systems



\$ syz list

Currently Loaded Syzfiles:

- 1) modules/3.2.6
- 2) shwrapnel/devel
- 3) modext/devel
- 4) syz/devel

\$ python

-bash: python: command not found

\$ syz avail python

```
----- /sw/nix/x86_64-linux/.sf -----  
python/2.6.7                python/2.7.3-wrapper  
python/2.7.3(default)      python3/3.2.3
```

\$ syz load python/2.6.7

\$ syz avail python

```
----- /sw/nix/x86_64-linux/python/2.6.7/sw/.sf -----  
python-boto/2.6.0          python-setuptools-site/0.6c11  
python-m2crypto/0.21.1    python-ssl/2.6.7
```

```
----- /sw/nix/x86_64-linux/.sf -----  
python/2.6.7                python/2.7.3-wrapper  
python/2.7.3(default)      python3/3.2.3
```

\$

```
$ syz load python-boto
```

```
$ syz list
```

```
Currently Loaded Syzfiles:
```

- 1) modules/3.2.6
- 2) shwrapnel/devel
- 3) modext/devel
- 4) syz/devel
- 5) linux-headers/2.6.35.14-2
- 6) glibc/2.13
- 7) bash/4.2-p24
- 8) zlib/1.2.7
- 9) gcc/4.6.3
- 10) bzip2/1.0.6
- 11) attr/2.4.46
- 12) acl/2.2.51
- 13) coreutils/8.15
- 14) python/2.6.7
- 15) setuptools/0.6c11
- 16) python-setuptools-site/0.6c11-2
- 17) python-boto/2.6.0

```
$
```



```
$ python -c 'import boto'
```

```
$ echo $PYTHONPATH
```

```
...:/sw/nix/x86_64-linux/python/2.6.7/sw/python-boto/2.6.0/lib/python2.6/site-packages:...
```

```
$ syz swap python/2.7.3
```

```
$ syz list
```

```
Currently Loaded Syzfiles:
```

- 1) modules/3.2.6
- 2) shwrapnel/devel
- 3) modext/devel
- 4) syz/devel

```
...
```

- 14) python-boto/2.6.0
- 15) python-setuptools-site/0.6c11-2
- 16) setuptools/0.6c11
- 17) python/2.7.3
- 18) openssl/1.0.0i
- 19) perl/5.14.2

```
$
```

```
$ python -c 'import boto'
```

```
$ echo $PYTHONPATH
```

```
...:/sw/nix/x86_64-linux/python/2.7.3/sw/python-boto/2.6.0/lib/python2.7/site-packages:...
```

```
$ syz unload python
```

```
$ syz list
```

```
Currently Loaded Syzfiles:
```

- 1) modules/3.2.6
- 2) shwrapnel/devel
- 3) modext/devel
- 4) syz/devel

```
...
```

- 13) coreutils/8.15
- 14) openssl/1.0.0i
- 15) perl/5.14.2

```
Currently Inactive Syzfiles:
```

- 1) setuptools/0.6c11
- 2) python-setuptools-site/0.6c11
- 3) python-boto/2.6.0

```
$
```

```
$ syz show -r python
```

```
##Module
```

```
description {
```

```
    bin-dir    bin
```

```
    man-dir    share/man
```

```
    include-dir -language python lib/python2.7/site-  
                                                    packages
```

```
##syzix-dir    sw
```

```
pkgconfig-dir lib/pkgconfig
```

```
modules-dir   sw/.sf
```

```
lib-dir       lib
```

```
include-dir   -languages c,cxx,f include
```

```
soft-prereq   glibc/2.13
```

```
soft-prereq   bash/4.2-p24
```

```
soft-prereq   gcc/4.6.3
```

```
soft-prereq   openssl/1.0.0i
```

```
soft-prereq   bzip2/1.0.6
```

```
soft-prereq   zlib/1.2.7-2
```

```
soft-prereq   coreutils/8.15
```

```
}
```

```
#
```

```
$ syz show -r python/2.6.7
```

```
#%Module
```

```
description {
```

```
    bin-dir    bin
```

```
    man-dir    share/man
```

```
    include-dir -language python lib/python2.6/site-  
                                                    packages
```

```
    #syzix-dir  sw
```

```
    pkgconfig-dir lib/pkgconfig
```

```
    modules-dir sw/.sf
```

```
    lib-dir    lib
```

```
    include-dir -languages c,cxx,f include
```

```
    soft-prereq glibc/2.13
```

```
    soft-prereq bash/4.2-p24
```

```
    soft-prereq gcc/4.6.3
```

```
    soft-prereq bzip2/1.0.6
```

```
    soft-prereq zlib/1.2.7-2
```

```
    soft-prereq coreutils/8.15
```

```
}  
$
```

\$ syz show python

/sw/nix/x86_64-linux/.sf/python/2.7.3:

prepend-path PATH /sw/.../python/2.7.3/bin

prepend-path MANPATH /sw/.../python/2.7.3/share/man

prepend-path PYTHONPATH /sw/.../python/2.7.3/lib/python2.7/site-
packages

prepend-path PKG_CONFIG_PATH /sw/.../python/2.7.3/lib/pkgconfig

prepend-path MODULEPATH /sw/.../python/2.7.3/sw/.sf

prepend-path LIBRARY_PATH /sw/.../python/2.7.3/lib

prepend-path LD_LIBRARY_PATH /sw/.../python/2.7.3/lib

prepend-path LD_RUN_PATH /sw/.../python/2.7.3/lib

prepend-path C_INCLUDE_PATH /sw/.../python/2.7.3/include

prepend-path CPLUS_INCLUDE_PATH /sw/.../python/2.7.3/include

prepend-path CPATH /sw/nix/x86_64-linux/python/2.7.3/include

prepend-path FPATH /sw/nix/x86_64-linux/python/2.7.3/include

conflict python

setenv PYTHON_BASE /sw/nix/x86_64-linux/python/2.7.3

setenv PYTHON_ROOT /sw/nix/x86_64-linux/python/2.7.3

setenv PYTHON_VERSION 2.7.3

module-what is python, version 2.7.3

\$

```
$ syzomatic - /sw/nix/x86_64-linux/bash/4.2-p24
#%Module
```

```
description {
    # Auto-generated for /sw/nix/x86_64-
    linux/bash/4.2-p24
    bin-dir bin
    soft-prereq glibc/2.13
    # End of generated description
}
$
```

```
$ type syz
syz is a function
syz ()
{
    eval `syzcmd bash "$@" ; echo local rc=$?`;
    return $rc
}
$ type syzcmd
syzcmd is
/sw/syzix/hostdep/noarch/syz/devel/bin/syzcmd
$ . /syzzyup
$ ls -la /syzzyup
lrwxrwxrwx 1 root root 48 Mar 23  2012 /syzzyup ->
/sw/syzix/hostdep/noarch/syz/default/bin/syzzyup
$
```

Comparisons

- GNU Stow: <http://www.gnu.org/s/stow/>
 - Symlink heavy
 - No dynamic runtime switching
- Python virtualenv: <http://www.virtualenv.org/>
 - Domain specific
- Ruby RVM: <http://rvm.io/>
 - Domain specific
 - Clumsy handling of `.rvmrc` and `cd`

Comparisons

- OSTree: <https://live.gnome.org/OSTree>
 - Focused on binary packages
 - Unable to compose trees
 - Heavy on chroots, reboots
- GoboLinux: <http://www.gobolinux.org/>
 - Symlink heavy
 - No dynamic runtime switching
 - Crazy abandonment of Unix FS norms

Comparisons

- Nix/NixOS: <http://nixos.org/>
 - Change fundamental lib → rebuild entire system
 - Eradicating security-flawed code is neither fast nor easy
 - Disk space & inodes scales badly
 - Extreme and overriding obsession with bit-reproducibility
 - entire source used in id hash
 - /nix/store mounted ro
 - Everything timestamped 0

Comparisons

- Nix/NixOS: <http://nixos.org/>
 - `/nix/store/043zrsanirjh8nbc5vqpjn93hhrf107f-bash-4.2-p24`
 - Deps are build-time
 - Runtime switching involves full symlink trees
 - Rollback is system-wide, not per-package
 - Hashes completely opaque
 - Hashes ahead of `$pkgname-$version` is awkward
 - So is having a flat `/nix/store` dir structure

Comparisons

- GNU Guix: <https://www.gnu.org/software/guix/>
 - Nix, but guile instead of nix-lang

#!?

- `#!/bin/bash`
- `#!/usr/bin/env bash`
- `#!/shbang bash`
- `#!/shbang -ensure bash/4.2 bash`

ELF/ld fun

- Can use RPATH to find (default) libs without needing modules loaded
- What about runtime versioning of ld-linux.so?
 - Likely to have a thin shim to resolve using \$PATH
- setuid binaries likely to be tricky