

# Review of Package Managers for Bioinformatics Software Distribution

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## Authors

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- **Sharon Waymost**

 [0000-0003-1176-5386](#) ·  [sbpw](#)

CS Dept, UCLA

# Abstract

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# Introduction

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# Discussion

## Existing problems with software distribution and installation

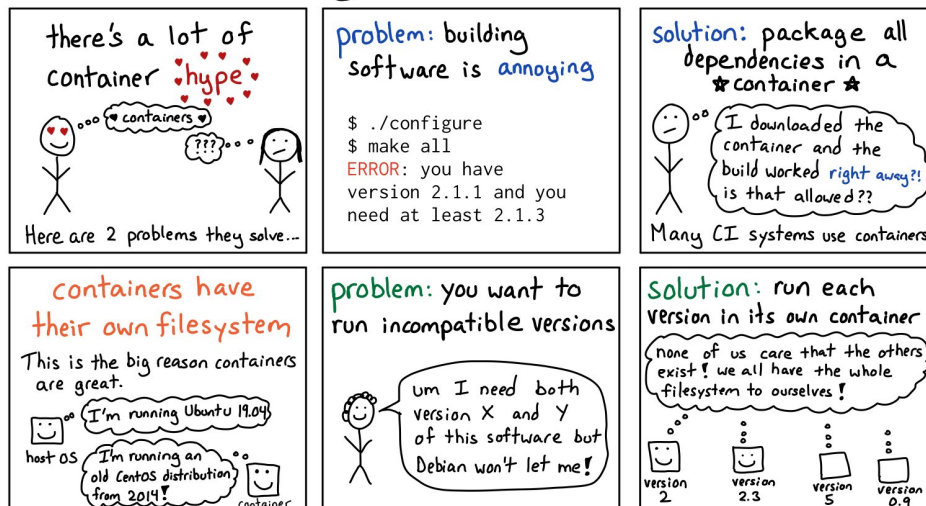
- root access limitations
- reproducibility of findings
- version conflicts
- dependency resolution

## Definitions and explanations of distribution system types

- package managers
  - definition
  - benefits for the developer
    - mature technology - higher degree of familiarity
    - allows dependency specification (including versions) - limitations for the developer
    - can't always use to install missing dependencies for end-user
  - benefits for the end-user
    - package size is minimal (dependencies aren't duplicated)
    - installs missing dependencies
  - limitations for the end-user
    - not always accessible (unless admin user)
    - can't install multiple versions of same software
- containerization

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@bork

## why containers?



- definition
- benefits for the developer
  - include specific versions of dependencies
  - known running environment
    - fewer test variables
    - reproducibility of results
- limitations for the developer
  - learn a new system instead of focusing on research
- benefits for the end-user
  - no installation (except possible runtime)
  - no dependency issues
  - sandbox provides computer system security
- limitations for the end-user

- container size
- duplication of dependencies
- root access requirement to install runtime
- configuration in cluster
- centralized repositories
  - definition
  - benefits
    - known download site
    - hosting is taken of
  - limitations
    - repo specific restrictions

## Glossary

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## Acknowledgements

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## Author Contributions

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# References

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# Tables

Distribution System Name	URL	Publication	Type	Licensing
ApplImage	<a href="https://appimage.org">https://appimage.org</a>	-	containerization	MIT
APT	<a href="https://wiki.debian.org/Apt">https://wiki.debian.org/Apt</a>	-	package manager	GNU GPL 2+
Bioconda	<a href="https://bioconda.github.io">https://bioconda.github.io</a>	Grüning et al, 2018	package manager	MIT
Bioconductor	<a href="https://www.bioconductor.org">https://www.bioconductor.org</a>	Gentleman et al, 2004	package manager	MIT
conda	<a href="https://docs.conda.io/en/latest">https://docs.conda.io/en/latest</a>	-	package manager	3-Clause BSD
CRAN	<a href="https://cran.r-project.org/index.html">https://cran.r-project.org/index.html</a>	-	package manager	GNU GPL
Docker	<a href="https://www.docker.com">https://www.docker.com</a>	-	containerization	Apache 2.0
Easybuild	<a href="https://easybuilders.github.io/easybuild">https://easybuilders.github.io/easybuild</a>	Hoste et al, 2012	package manager	GNU GPL 2
Flatpak	<a href="https://flatpak.org">https://flatpak.org</a>	-	containerization	LGPL
GNU Guix	<a href="https://www.gnu.org/software/guix">https://www.gnu.org/software/guix</a>	Courtès, 2013	package manager	GNU AGPL
Homebrew	<a href="https://brew.sh">https://brew.sh</a>	-	package manager	BSD 2-Clause Simplified
pip	<a href="https://pypi.org/project/pip">https://pypi.org/project/pip</a>	-	package manager	MIT
Singularity	<a href="https://sylabs.io">https://sylabs.io</a>	-	containerization	3-Clause BSD
Snap	<a href="https://snapcraft.io">https://snapcraft.io</a>	-	containerization	proprietary
Spack	<a href="https://spack.io">https://spack.io</a>	Gamblin et al, 2015	package manager	MIT or Apache
Vagrant	<a href="https://www.vagrantup.com">https://www.vagrantup.com</a>	-	virtual machine	MIT
yum	<a href="http://yum.baseurl.org">http://yum.baseurl.org</a>	-	package manager	
Zero Install	<a href="https://0install.net">https://0install.net</a>	-	package manager	GNU LGPL 2.1+

Distribution System Name	Supported Operating Systems	Supported Languages	Root to Install	Root to Run
ApplImage	Linux	any	n/a	no
APT	Debian, Ubuntu	any	yes	yes

Distribution System Name	Supported Operating Systems	Supported Languages	Root to Install	Root to Run
Bioconda	Linux, macOS, Windows	any	no	no
Bioconductor	Linux, macOS, Windows	R	no	no
conda	Linux, macOS, Windows	any	no	no
CRAN	Linux, macOS, Windows	R	no	no
Docker	Linux, macOS, Windows	any	yes	no
Easybuild	Linux	any	no	no
Flatpak	Linux	any	no	no
GNU Guix	Linux	any	no	no
Homebrew	Linux, macOS	any	no	no
pip	Linux, macOS, Windows	Python	no	no
Singularity	Linux, macOS	any	yes	no
Snap	Linux	any	yes	no
Spack	Linux, macOS	any	no	no
Vagrant	Linux, macOS, Windows	any	yes	
yum	Linux, macOS, Windows	any	no	yes
Zero Install	Linux, macOS, Windows	any	no	no

Distribution System Name	First Release	Latest Release	Age	Number of Releases	Number of Tools	Number of Bio Tools
ApplImage	2014-01-24	2020-06-01	7	121		
APT	1998-03-31	2020-05-08	22	362		
Bioconda	2014-01-24	2016-09-06	7	39		
Bioconductor	2002-05-01	2020-04-28	17	37		
conda	2014-01-24	2020-04-13	6	261		
CRAN	1997-04-23	2020-02-29	22	29		
Docker Engine	2013-03-23	2020-06-01	7	121		
Easybuild	2012-11-09	2020-04-14	7	51		
Flatpak	2015-03-23	2020-04-03	5	128		
GNU Guix	2012-07-07	2020-04-15	7	23		
Homebrew	2009-05-20	2020-05-04	10	155		
pip	2009-01-20	2020-04-28	11	81		
Singularity	2012-07-07	2020-04-15	7	23		
snapt	2014-12-09	2020-07-15	5	232		
Spack	2014-07-09	2020-04-15	5	27		

Distribution System Name	First Release	Latest Release	Age	Number of Releases	Number of Tools	Number of Bio Tools
Vagrant						
yum (CHECK RED HAT)	2002-06-08	2011-06-28	18	221		
Zero Install	2005-02-04	2020-05-04	15	145		

Distribution System Name	Official Repository Name	Repository URL
ApplImage	ApplImageHub	<a href="https://appimage.github.io/apps">https://appimage.github.io/apps</a>
APT	-	-
Bioconda	bioconda channel	<a href="https://github.com/bioconda/bioconda-recipes">https://github.com/bioconda/bioconda-recipes</a>
Bioconductor	-	<a href="https://www.bioconductor.org/packages/release/BiocViews.html#___Software">https://www.bioconductor.org/packages/release/BiocViews.html#___Software</a>
conda	-	<a href="https://repo.anaconda.com/pkgs">https://repo.anaconda.com/pkgs</a>
CRAN	-	<a href="https://cran.r-project.org/web/packages/available_packages_by_name.html">https://cran.r-project.org/web/packages/available_packages_by_name.html</a>
Docker	Docker Hub	<a href="https://hub.docker.com">https://hub.docker.com</a>
Easybuild		
Flatpak	Flathub	<a href="https://flathub.org/">https://flathub.org/</a>
GNU Guix	-	<a href="https://guix.gnu.org/packages">https://guix.gnu.org/packages</a>
Homebrew	Homebrew Formulae	<a href="https://formulae.brew.sh">https://formulae.brew.sh</a>
pip	Python Package Index (PyPI)	<a href="https://pypi.org">https://pypi.org</a>
Singularity	Singularity Hub	<a href="https://singularity-hub.org">https://singularity-hub.org</a>
Snap	Snapcraft	<a href="https://snapcraft.io/store">https://snapcraft.io/store</a>
Spack	-	-
Vagrant	Vagrant Cloud	<a href="https://app.vagrantup.com/boxes/search">https://app.vagrantup.com/boxes/search</a>
yum	-	-
Zero Install	-	<a href="https://apps.0install.net/">https://apps.0install.net/</a>