Review of Package Managers for Bioinformatics Software Distribution

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Abstract

Introduction

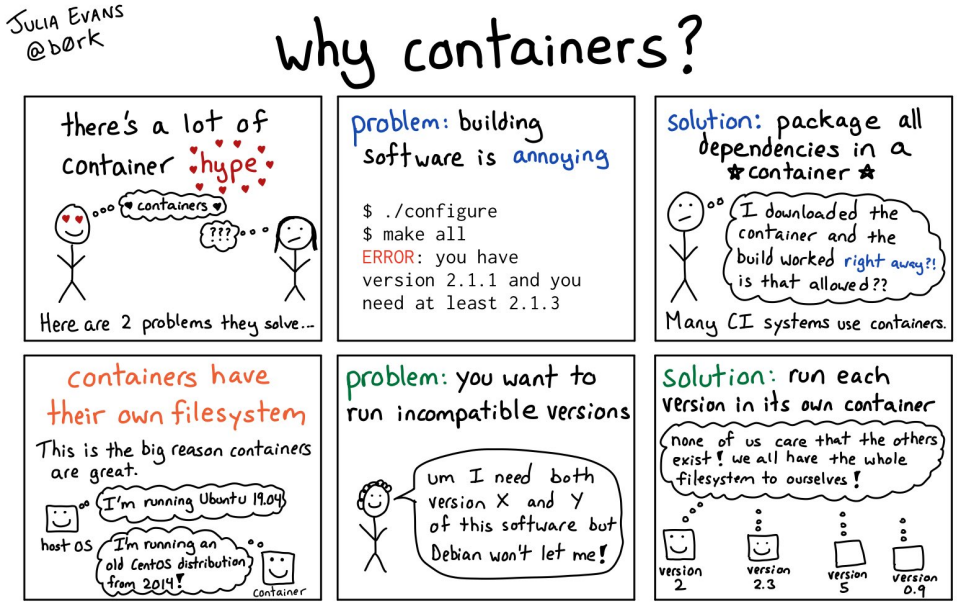
Discussion

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



  - 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

Acknowledgements

Author Contributions

References

Tables

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

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

{#tbl:features}

Distribution System Name	First Release	Latest Release	Age	Number of Releases	Number of Tools	Number of Bio Tools
AppImage	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	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		
Snap						
Spack	2014-07-09	2020-04-15	5	27		
Vagrant						
yum (CHECK RED HAT)	2002-06-08	2011-06-28	18	221		
Zero Install	2005-02-04	2020-05-04	15	145		

{#tbl:popularity}

Distribution System Name	Official Repository Name	Store URL	Pricing	Restrictions
AppImage	AppImageHub	https://appimage.github.io/apps/		
APT				
Bioconda				
Bioconductor				
conda				
CRAN				

Distribution System Name	Official Repository Name	Store URL	Pricing	Restrictions
Docker				
Easybuild				
Flatpak	Flathub	https://flathub.org/		
GNU Guix				
Homebrew				
pip				
Singularity				
Snap				
Spack				
Vagrant				
yum				
Zero Install				

{#tbl:official-repositories}