Review of Package Managers for Bioinformatics Software Distribution

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Abstract

Introduction

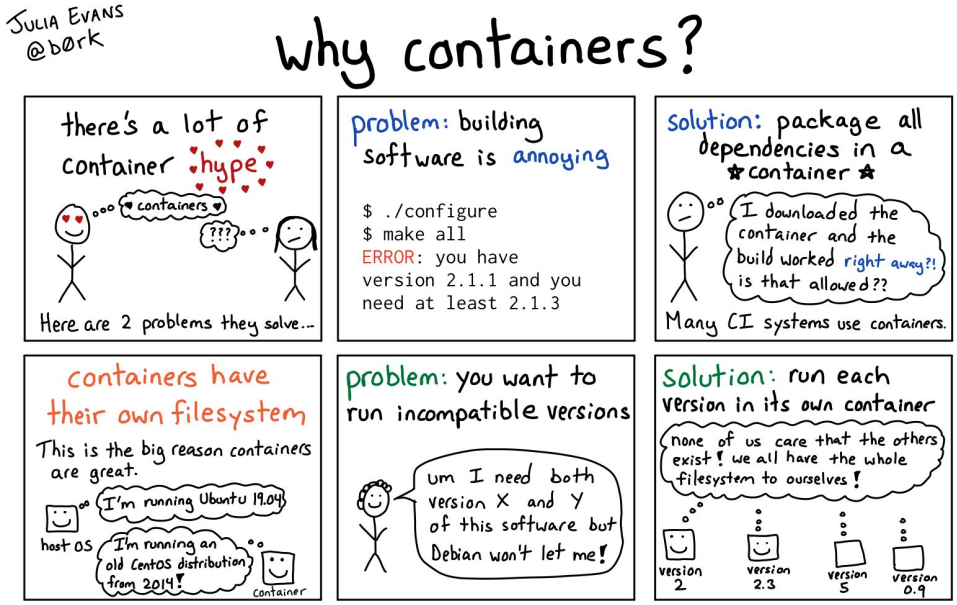
Discussion

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
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	BSD 3 Clause
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+

{#tbl:basic-info}

Distribution System Name | Supported Operating Systems | Root Access Required | Cluster User Access |
:————————– | :– | | :— | :— |
AppImage |
APT |
Bioconda |

Bioconductor |
CRAN |
Docker |
Easybuild |
FlatPak |
GNU Guix |
Homebrew |
pip |
Singularity |
Snap |
Spack |
Vagrant |
yum |
Zero Install |

{#tbl:availability}

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	215		
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

Distribution System Name	Official Repository Name	Store URL	Pricing	Restrictions
AppImage	AppImageHub	https://appimage.github.io/apps/		
APT				
Bioconda				
Bioconductor				
CRAN				
Docker				
Easybuild				
FlatPak				
GNU Guix				
Homebrew				
pip				
Singularity				
Snap				
Spack				
Vagrant				
yum				
Zero Install				

{#tbl:official-repositories}