04 - Package Management

CS 2043: Unix Tools and Scripting, Spring 2017 [1]

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Package Management

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- In general, these are "pre-compiled binaries": no compilation necessary. It's already packaged nice and neat just for you!

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  - Don't user others (e.g. `port`), they are outdated / EOSL.

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  [*] See next slide for a potential `update` pitfalls.

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- If your program needs a specific version of the linux kernel, you need to be very careful!
- In the end, it actually has less to do with the type of package manager, but more to do with who is packaging things.

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- This concept has no meaning for `brew`, since it compiles everything.

System Specific Package Managers

- Installing and uninstalling:

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    `apt-get install <pkg1> <pkg2> ... <pkgN>`

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Debian / Ubuntu Package Management

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    - "Group" packages are available, but still the same command.

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Debian / Ubuntu Package Management

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    - Sad face, I know. Just the way of the world.

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  5. VERY IMPORTANT: READ WHAT THE OUTPUT IS!!!! It will tell you to do things, and you *have* to do them.
     Specifically:
     "You should run 'brew doctor' *before* you install anything."

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    - `brew tap caskroom/cask`
      Install `.app` applications! Safe: installs in the "Cellar", symlinks to `~/Applications`, but *now these update with brew all on their own*!
      E.g. `brew cask install vlc`

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- Of course, there is a whole lot more that `brew` does, just like the other package managers.

OSX: One of These Kids is Not Like the Others (Part III)

- You REALLY need to pay attention to **brew** and what it says. Seriously.
- Example: after installing **opencv**, it tells me:

```
==> Caveats
Python modules have been installed and Homebrew's site-packages is not
in your Python sys.path. So you will not be able to import the modules
this formula installed. If you plan to develop with these modules,
please run:
  mkdir -p /Users/sven/.local/lib/python2.7/site-packages
  echo 'import site; site.addsitedir("/usr/local/lib/python2.7/site-packages")' >> \
    /Users/sven/.local/lib/python2.7/site-packages/homebrew.pth
# (continued onto newline so you can read, it gives you copy-paste format!)
```

- Obviously I want to use **opencv** with Python, so I am going to follow what **brew** tells me to do.
- If it may cause problems, it will tell you what the problems might be.

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Other Managers

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- Checkout the GitHub page in [2]

References I

[1] B. Abrahao, H. Abu-Libdeh, N. Savva, D. Slater, and others over the years.
Previous cornell cs 2043 course slides.

[2] V. Iakovlev.
Magnificent app which corrects your previous console command.
https://github.com/nvbn/thefuck.

[3] Linux.com.
What you need to know about fedora's switch from yum to dnf.
https://www.linux.com/learn/tutorials/
838176-what-you-need-to-know-about-fedoras-switc

[4] Reddit.com.
Dnf remove package, keep dependencies??
https:
//www.reddit.com/r/Fedora/comments/3pqrv9/
dnf_remove_package_keep_dependencies/.