

# The Software Package Dependency Networks of some Linux Distributions

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- ▶ mainly source packages with compilation rules: Arch, Slackware, Gentoo

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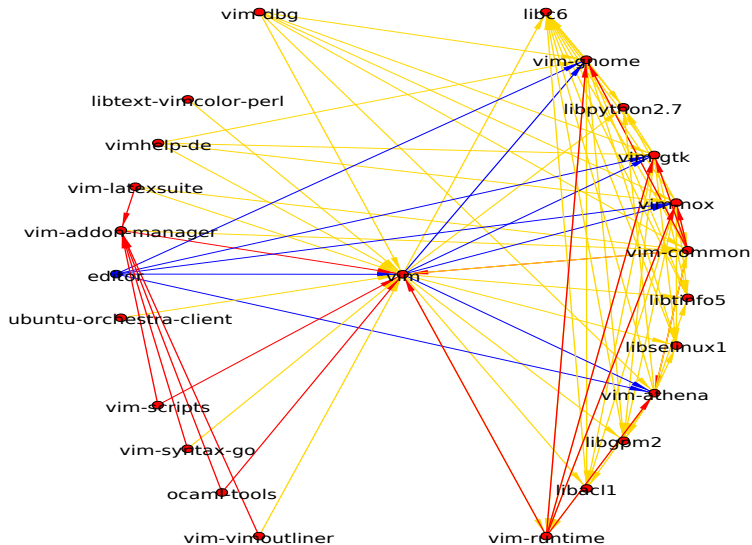
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- ▶ <http://django.arek.uni-obuda.hu/cxnet>
- ▶ We use it to teach complex networks.

# Part of the Software Package Dependency Network of Ubuntu



# Package and connection types stored in cxnet

## Package types

- ▶ vim is a real package
- ▶ editor is virtual package  
if package depends on editor, it is enough to have vim (or emacs or nano or ...)

## Connection types

- ▶ vim **depends** on libc6
- ▶ vim **recommends** vim-nox
- ▶ vim **provides** editor
- ▶ (deb format uses some other connections not stored by cxnet)

# Softw. Pack. Dep. Net. of Ubuntu 11.10

June 15, 2012

41371 packages

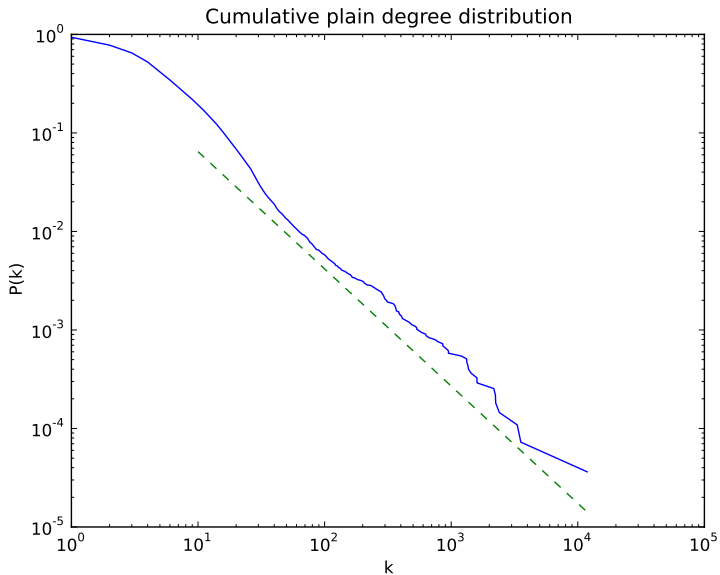
- ▶ 88.7% real packages
- ▶ 11.3% virtual packages

170185 stored connections

- ▶ 88.3% **dependences**
- ▶ 7.7% **recommendations**
- ▶ 4.0% **provisions**

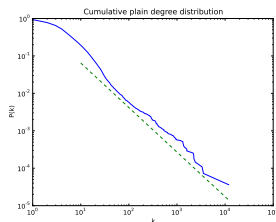
# Cumulative degree distribution of Ubuntu 9.04

November 3, 2009



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- ▶ log scales + straight line = power-law function
- ▶ (true for cumulative deg. dist. as well)
- ▶  $p(k) \sim k^{-\gamma}$
- ▶  $P(k) \sim k^{-(\gamma-1)}$
- ▶  $\gamma$  from max. likelihood estimate
- ▶  $\gamma = 2.19 \pm 0.14^{+0.1}_{-0.12} \quad k > 200$



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▶  $k_{out,max} = 133$

$> 20 \times \langle k_{out} \rangle$

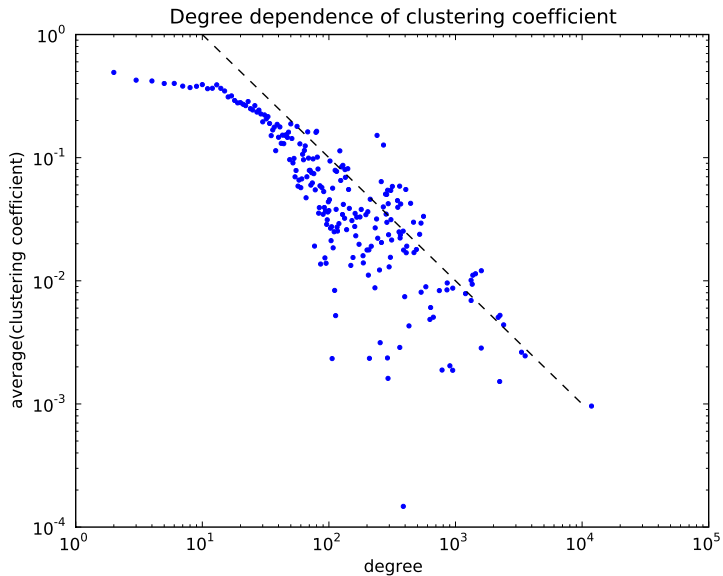
## Largest in-degrees, Ubuntu, 2012, 2009', 2008''

$k_{in}$	$k_{in}'$	$k_{in}''$	package	description
14565	11866	10748	libc6	C shared libraries
4056	3319	2803	libstdc++6	Standard C++ library
3779	3548	2970	libgcc1	Libraries of C compiler
3397	2229	1842	perl	Perl language
2827	1595	1122	python	Python language
2684	2243	1818	libglib2.0-0	The GLib library
1571	2170	3172	libx11-6	X11 client-side library
1457	947	945	dpkg	deb package management
1435	1571	1275	libgtk2.0-0	The GTK+ graphical user interface library
1217	553	108	libqtcore4 <sup>1</sup>	Qt 4 core module

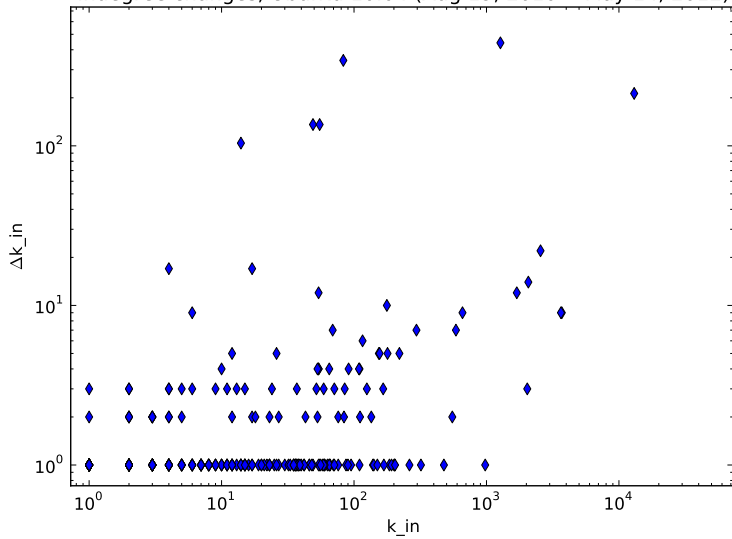
## Largest out-degrees, Ubuntu, 2012, 2009'

$k_{\text{out}}$	$k_{\text{out}}'$	package	description
210	–	ubuntu-sugar-remix	Programs for education
200	113	ubuntu-desktop	Ubuntu with GNOME desktop environment
199	74	xubuntu-desktop	Ubuntu with XFCE desktop environment
176	111	ubuntustudio-desktop	Multimedia creation flavor of Ubuntu
176	66	kubuntu-desktop	Ubuntu with KDE desktop environment
144	133	ichthux-desktop	Desktop for Christians
130	–	libmono-cil-dev	Development files for Mono
119	–	kubuntu-full	The Kubuntu with additional packages.
106	103	texlive-full	Meta package pulling in all components of TeX Live

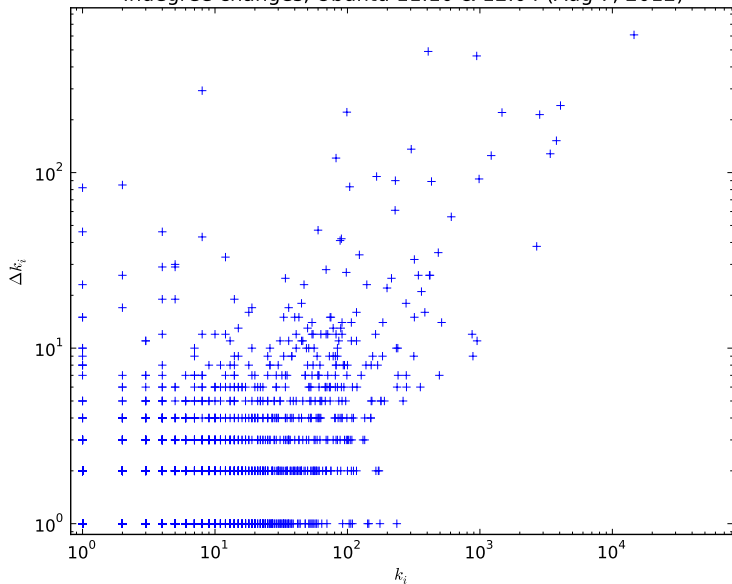
# Average clustering coefficient as a function of degree



Indegree changes, Ubuntu 10.04 (Aug 19, 2010 -- May 14, 2012)



Indegree changes, Ubuntu 11.10 & 12.04 (Aug 7, 2012)





Thank you for your attention!

<http://django.erek.uni-obuda.hu/cxnet>

Questions?