

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Technical lag for software deployments

Jesus M. Gonzalez-Barahona

Universidad Rey Juan Carlos

@jgbarah

<http://github.com/jgbarah/presentations>

Seminar at IMDEA Software
Madrid (Spain), October 2nd 2018

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

*“If I go there will be trouble
And if I stay it will be double
So come on and let me know”*

*Should I Stay Or Should I Go?
The Clash*

<https://www.youtube.com/watch?v=BN1WwnEDWAM>

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

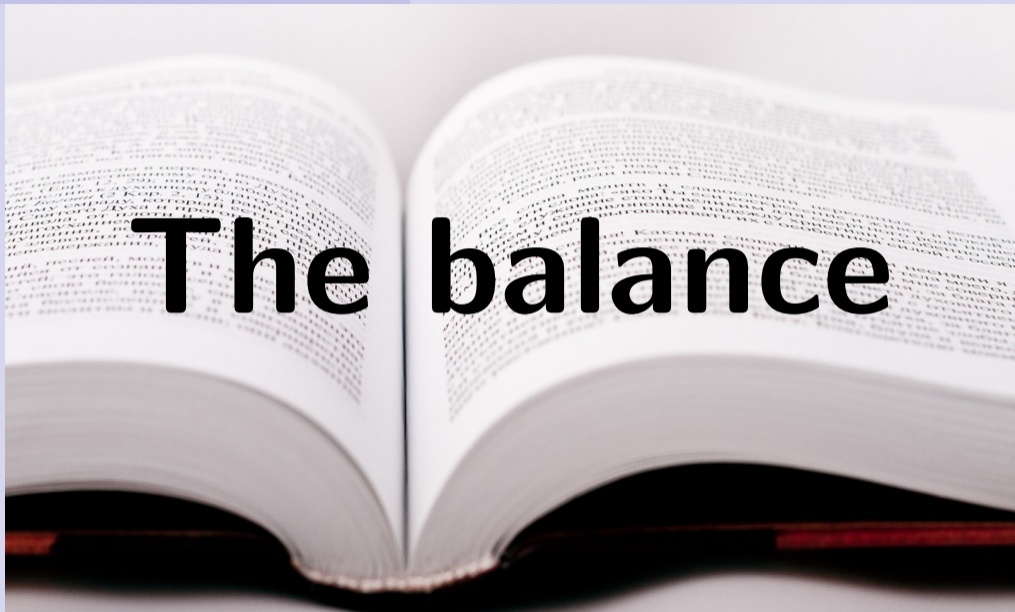
Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary



Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Deployments

Any deployment
is the real world instance
of an “ideal” target

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Deployments: the balance

“If it works, don't touch it”
vs.
“The quest for the ideal”

[Technical lag](#)Jesus M.
Gonzalez-Barahona[The balance](#)[Releases](#)[Collections](#)[Dependencies
\(direct\)](#)[Dependencies \(all\)](#)[Discussion](#)[Summary](#)

Deployments: example

You want the latest functionality
so you deploy it
but the day after
it is no longer the latest

Should you update?

Living the risky life

```
$ sudo apt-get dist-upgrade
Reading package lists... Done
Building dependency tree
Reading state information... Done
Calculating upgrade... Done
1249 upgraded, 206 newly installed, 8 to remove and 3 not upgraded.
Need to get 2,856 MB of archives.
After this operation, 340 MB of additional disk space will be used.
Do you want to continue? [Y/n]
```

Upgrading in Debian/testing

[Technical lag](#)

Jesus M.
Gonzalez-Barahona

[The balance](#)[Releases](#)[Collections](#)[Dependencies
\(direct\)](#)[Dependencies \(all\)](#)[Discussion](#)[Summary](#)

Dependencies

You want the latest functionality
so you deploy it
but dependencies may prevent you
from having the latest

Should dependencies be updated?

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Living in the past

```
"dependencies": {  
  "coffeescript": "~1.10.0",  
  "dateformat": "~1.0.12",  
  "eventemitter2": "~0.4.13",  
  "exit": "~0.1.1",  
  "findup-sync": "~0.3.0",  
  ...  
},
```

Oct. 2018: Grunt master / coffeescript

install

```
> npm i coffeescript
```

↓ weekly downloads

168,282

version

2.3.2

[Technical lag](#)[Jesus M. Gonzalez-Barahona](#)[The balance](#)[Releases](#)[Collections](#)[Dependencies \(direct\)](#)[Dependencies \(all\)](#)[Discussion](#)[Summary](#)

Releases

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Technical lag

For a release:

“difference between the deployed release
and the ideal release”

- What is “ideal release”?
- How we measure difference between releases?

Technical lag

Jesus M.
Gonzalez-Barahona

Ideal release (examples)

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Most recent

Most recent in the stable line

Less open bugs

Less unfixed vulnerabilities

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Difference (examples)

Difference in release time

Difference in version number

Number of commits

Difference in number of open bugs

Estimated effort

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

- $ideal: P \times Repos \rightarrow R$
Given $p \in P$, $repo \in Repos$, $ideal(p, repo)$
- $diff: R \times R \times Repos \rightarrow L$
Given $repo \in Repos$ and $r, s \in repo$,
 $diff(r, s, repo)$, if $package(r) = package(s)$
- $techlag: R \times Repos \rightarrow L$
 $\forall repo \in Repos, \forall r \in repo$:
 $techlag(r, repo) = diff(r, ideal(r, repo), repo)$

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Package: Pandas

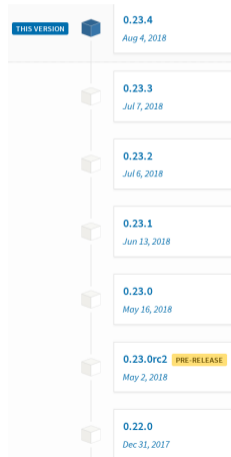
Deployed: 0.22.0

Ideal: 0.23.4

Lag (releases): 6 releases

Lag (reltime): 8 months, 4 days

Example



Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

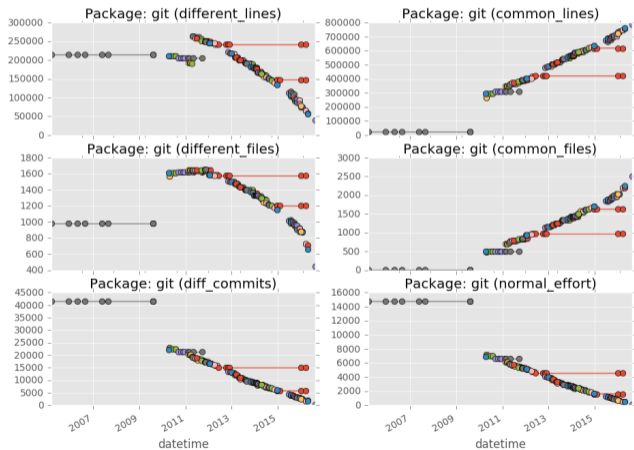
Dependencies (all)

Discussion

Summary

Debian releases
for git(source code &
commits
diffs)

Example



[Technical lag](#)[Jesus M. Gonzalez-Barahona](#)[The balance](#)[Releases](#)[Collections](#)[Dependencies \(direct\)](#)[Dependencies \(all\)](#)[Discussion](#)[Summary](#)

Collections

Technical lag

For a collection of releases:

“aggregation of the lag
for each release in the collection”

- How do we aggregate?
- Examples: maximum, summation, mean

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

- $\text{techlag}: \mathcal{P}(R) \times \text{Repos} \rightarrow L$
- Given $rcoll \in \mathcal{P}(R)$, $repo \in \text{Repos}$,
 $\text{techlag}_{\max}(rcoll, repo) = \max_{r \in rcoll}(\text{techlag}(r, repo))$
- Given $rcoll \in \mathcal{P}(R)$, $repo \in \text{Repos}$,
 $\text{techlag}_{\text{add}}(rcoll, repo) = \sum_{r \in rcoll} \text{techlag}(r, repo)$

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Dependencies (direct)

An open book with white pages and a dark cover is shown from a top-down perspective. The pages are slightly curved, and the text on them is blurred. Overlaid on the center of the book is the title 'Dependencies (direct)' in a large, bold, black sans-serif font.

Technical lag

For direct dependencies of a release:

“technical lag
for the collection formed by
direct dependencies of the release”

- Having constraints into account
- Selecting as the package manager does

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

- $dep : R \rightarrow \mathcal{P}(P)$
- $allowed : R \times P \times Repos \rightarrow \mathcal{P}(R)$
 $allowed(r, p, repo) = rcol$, where $rcol \subset repo$.
- $selectver : \mathcal{P}(R) \rightarrow R$
- $deploy : R \times Repos \rightarrow \mathcal{P}(R)$
 Given $repo \in Repos, r \in repo$,
 $deploy(r, repo) =$
 $\{selectver(allowed(r, p_i, repo)), \forall p_i \in dep(r)\}$
- $deplag : R \times Repos \rightarrow L$:
 $deplag(r, repo) = techlag(deploy(r, repo))$

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Dependencies (all)



Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Technical lag

For all dependencies of a release:

“technical lag
for the collection formed by
all (transitive) dependencies of the release”

- Having constraints into account
- Selecting as the package manager does

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

- $deploy^+ : R \times Repos \rightarrow \mathcal{P}(R)$
- Given $repo \in Repos, r \in repo$,
 $deploy^+(r, repo)$ as the minimal fix point such that:
 $deploy^+(r, repo) \supseteq deploy(r, repo)$
 $deploy^+(r, repo) \supseteq deploy(r', repo) \forall r' \in deploy^+(r, repo)$
- $deplag^+ : R \times Repos \rightarrow L$:
 $deplag^+(r, repo) = techlag(deploy^+(r, repo))$

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

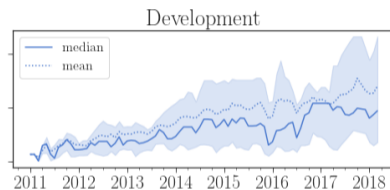
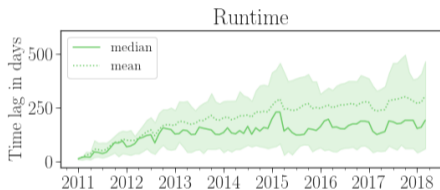
Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Example



npm releases

release time lag, direct dependencies

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Discussion



Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Uses

Technical lag of:

- deployed distributions
- container images
- deployed applications
- embedded systems

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Uses

Who can control technical lag:

- deployers: “top level” releases
- developers: direct dependencies
- ecosystems: typical dependencies

Types

Ideal: latest, most stable, more secure, less buggy...

Difference:

- Release metadata: versions, release time...
- Source code: diff lines, diff files
- SCM: commits, normalized effort
- ITS: bugs fixed, vulnerabilities fixed, feature requests closed

Aggregations: maximum, summation, mean, median

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary



Summary

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary



Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

Difference between real and ideal

What am I missing if I upgrade?

Dependencies impact on lag

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

More info...

Ahmed Zerouali, Eleni Constantinou, Tom Mens,
Gregorio Robles, Jesús M. González-Barahona:
“An Empirical Analysis of Technical Lag in npm Package
Dependencies”
ICSR 2018: 95-110

Jesús M. González-Barahona, Paul Sherwood, Gregorio
Robles, Daniel Izquierdo-Cortazar:
“Technical Lag in Software Compilations: Measuring
How Outdated a Software Deployment Is”
OSS 2017: 182-192

Technical lag

Jesus M.
Gonzalez-Barahona

The balance

Releases

Collections

Dependencies
(direct)

Dependencies (all)

Discussion

Summary

©2018 Jesus M. Gonzalez-Barahona.

Some rights reserved. This document is distributed under the terms
of the Creative Commons License “Attribution-ShareAlike 4.0”,
available in

<http://creativecommons.org/licenses/by-sa/4.0/>

This document (including source) is available from
<https://github.com/jgbarah/presentaciones>