The balance
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Dependencies (direct)
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Discussion
Summary

Technical lag for software deployments

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"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

Technical lag

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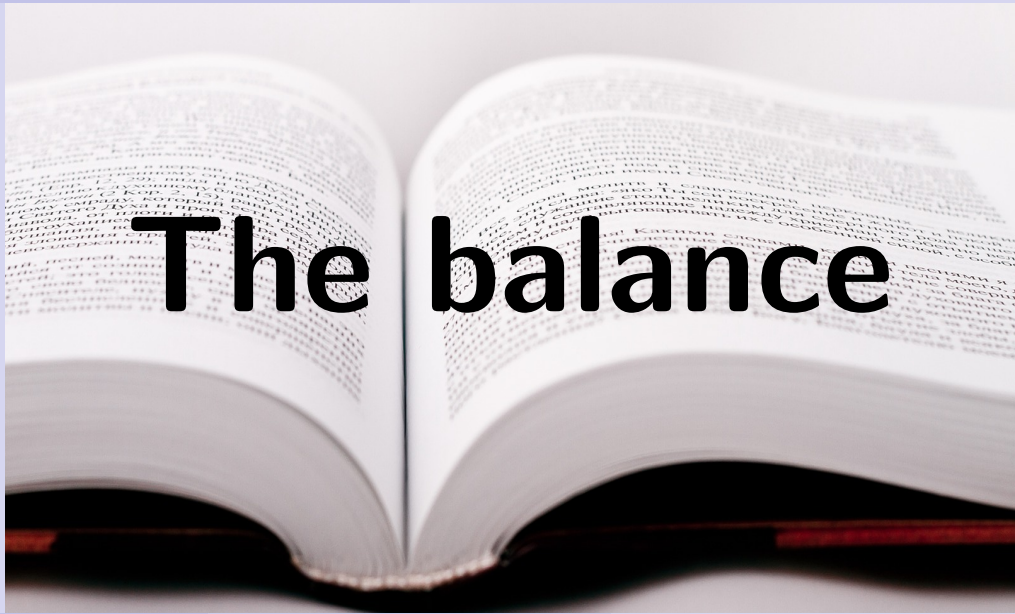

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Deployments

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

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Deployments: the balance

"If it works, don't touch it"

vs.

"The quest for the ideal"

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Deployments: example

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

Should you update?

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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

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Dependencies

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

Should dependencies be updated?

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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 / coffescript

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Technical lag

For a release:

"difference between the deployed release and the ideal release"

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

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Ideal release (examples)

Most recent

Most recent in the stable line

Less open bugs

Less unfixed vulnerabilities

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Difference (examples)

Difference in release time
Difference in version number
Number of commits
Difference in number of open bugs
Estimated effort

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- 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: $R \times Repos \rightarrow L$
  $\forall repo \in Repos, \forall r \in repo$:
  $techlag(r, repo) = diff(r, ideal(r, repo), repo)$

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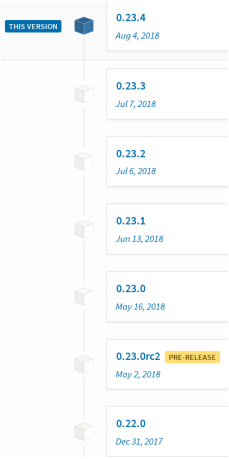
Example

Package: Pandas
Deployed: 0.22.0
Ideal: 0.23.4

Lag (releases): 6 releases
Lag (reltime): 8 months, 4 days



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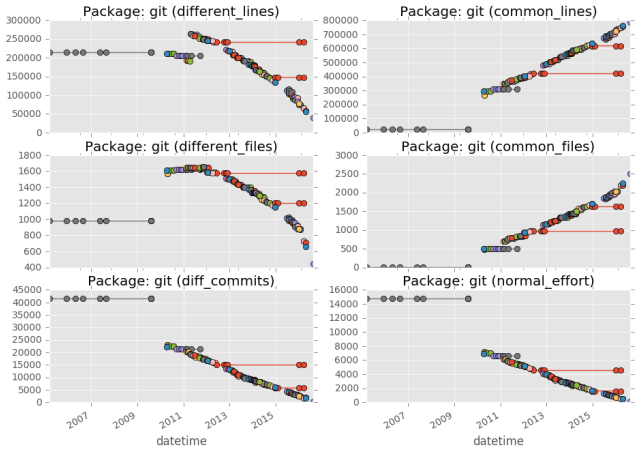
Example

Debian releases for git

(source code & commits diffs)



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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

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

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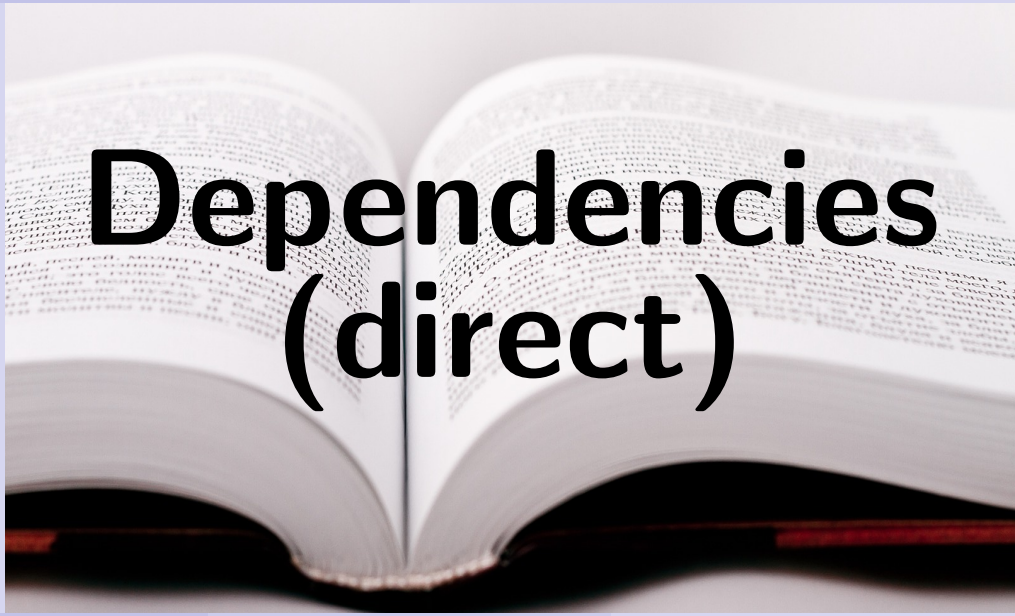

Dependencies (direct)

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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

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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 $repo \in Repos, r \in repo$,
  $deploy(r, repo) =$
  $\{selectver(allowed(r, p_i, repo)), \forall p_i \in dep(r)\}$
- $deplag : R \times Repos \rightarrow L$:
  $deplag(r, repo) = techlag(deploy(r, repo))$

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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

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

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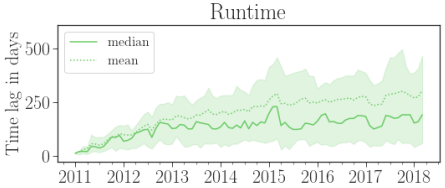
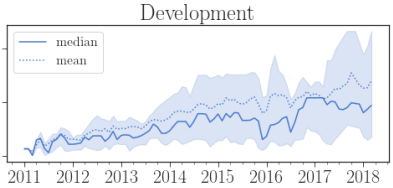
Example





npm releases

release time lag, direct dependencies

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Uses

Technical lag of:

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

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Uses

Who can control technical lag:

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

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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

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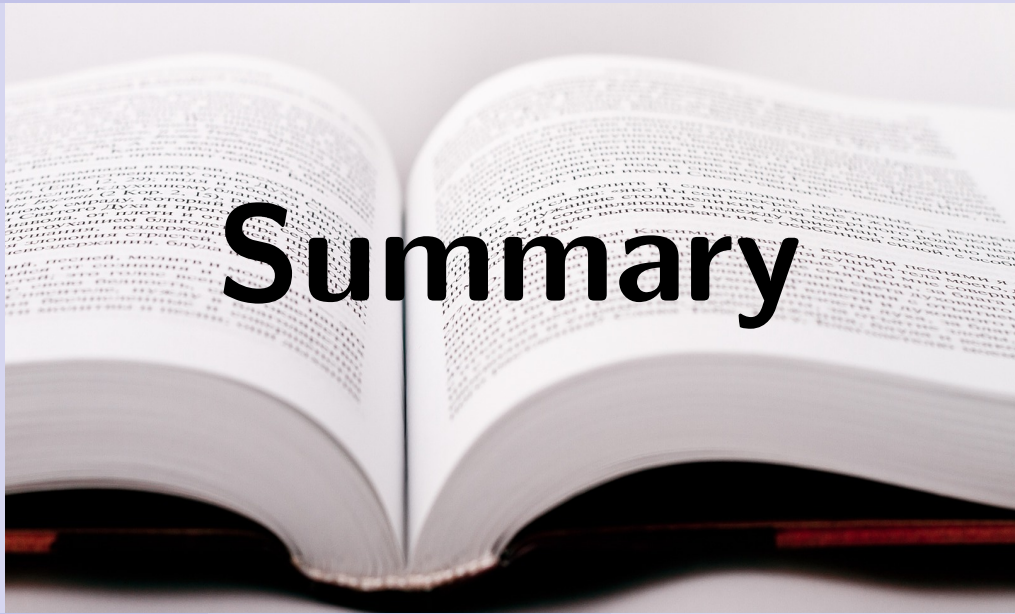

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Difference between real and ideal

What am I missing if I upgrade?

Dependencies impact on lag

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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

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