Technical Leverage in The Python Ecosystem: Lessons Learned

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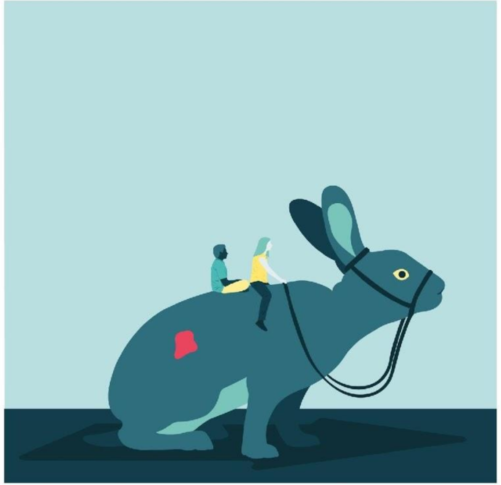
Software, then and now



Software, what we think it is

Software, then and now

Software, what we think it is

how it really is

and the risks it brings

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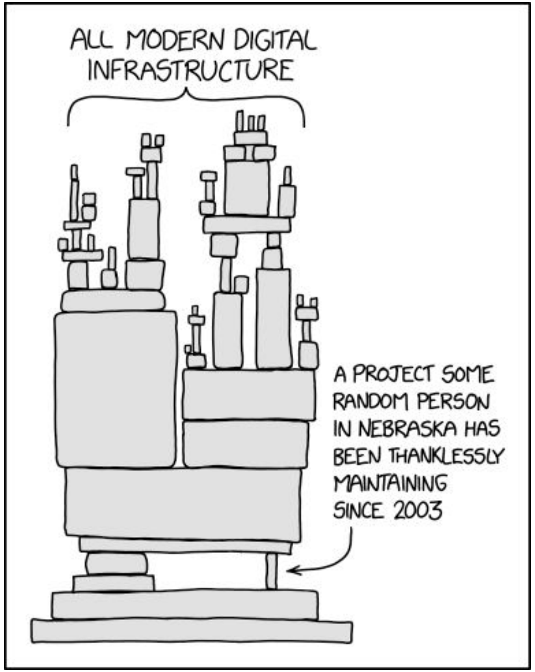
Nowadays:

- Developers use FOSS (Free Open source software) as building blocks
- **Fraction of homegrown code as low as 5%** for industry software (Source SAP)
- **Dependency code = 4x own code** as industry average (Source BlackDuck)

Technical leverage: learning from finance, now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A PROJECT SOME RANDOM PERSON IN NEBRASKA HAS BEEN THANKLESSLY MAINTAINING SINCE 2003

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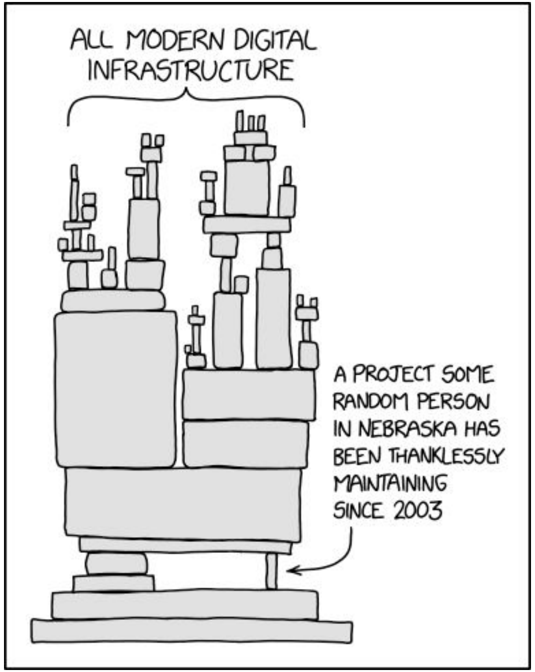
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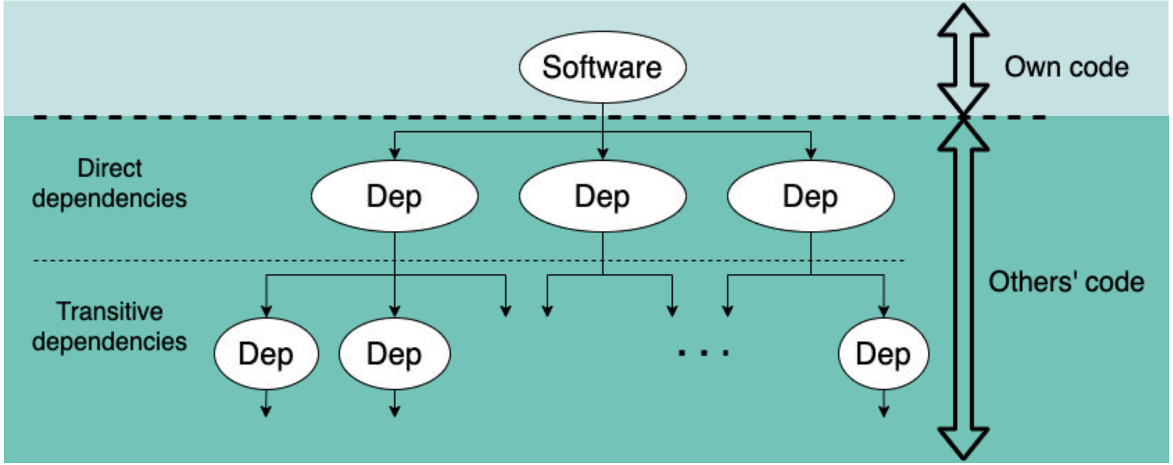

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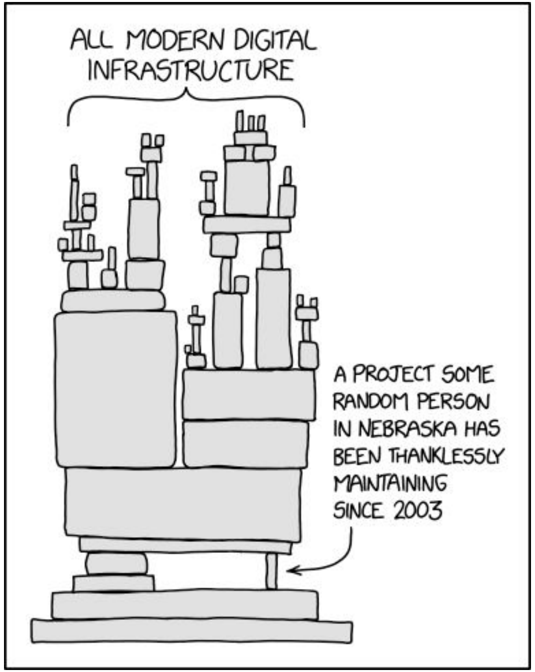
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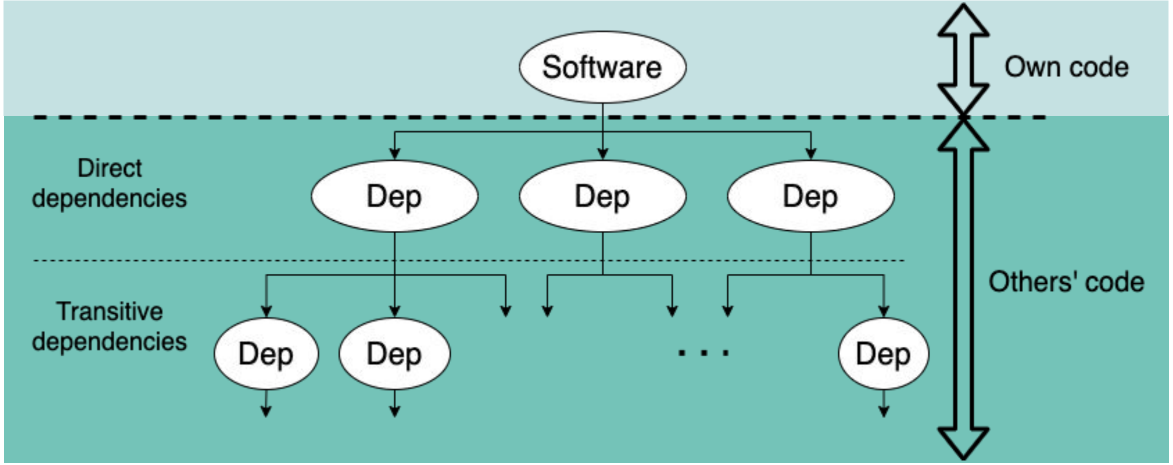
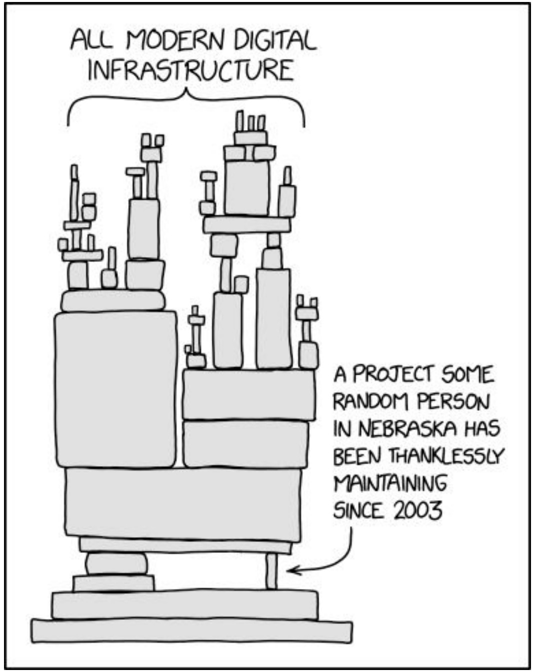


Finance

$$Leverage = \frac{Debt}{Equity}$$

Technical leverage: learning from finance, now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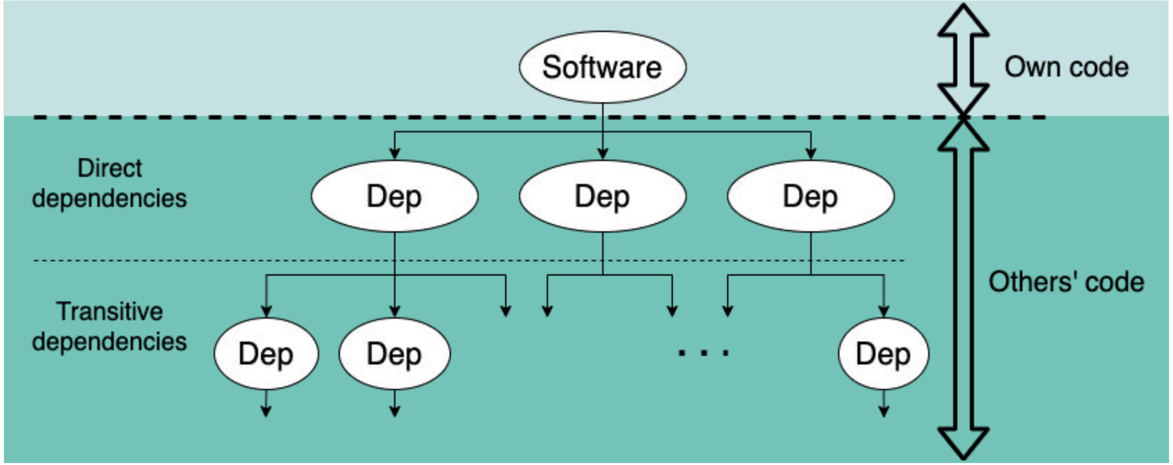


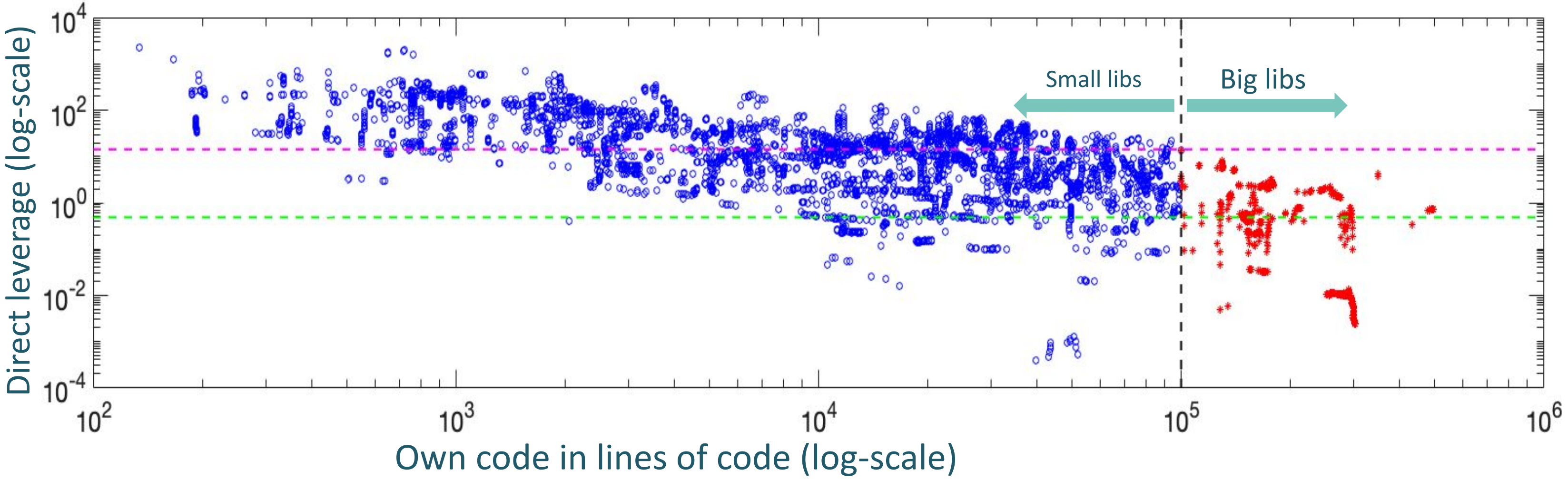
Finance

$$Leverage = \frac{Debt}{Equity}$$

Software

$$Tech\ leverage = \frac{Others'\ code}{Own\ code}$$

Previous work in Java (Massacci & Pashchenko, ICSE’21)



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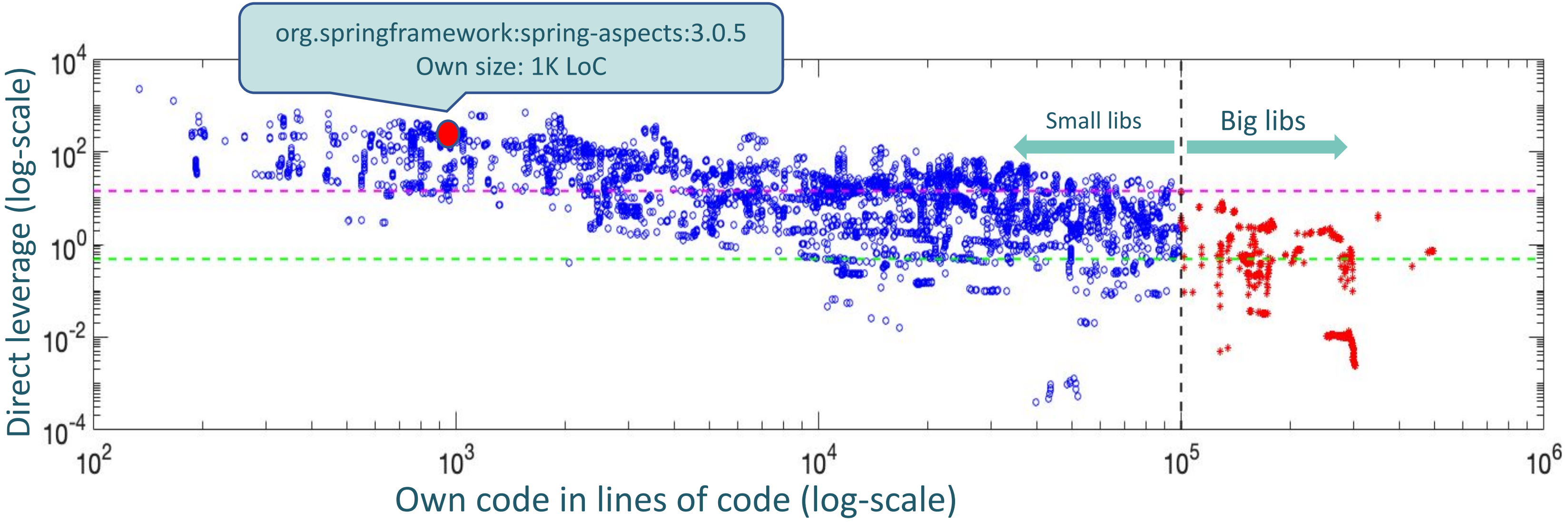

org.springframework:spring-aspects:3.0.5
Own size: 1K LoC

Small libs

Big libs

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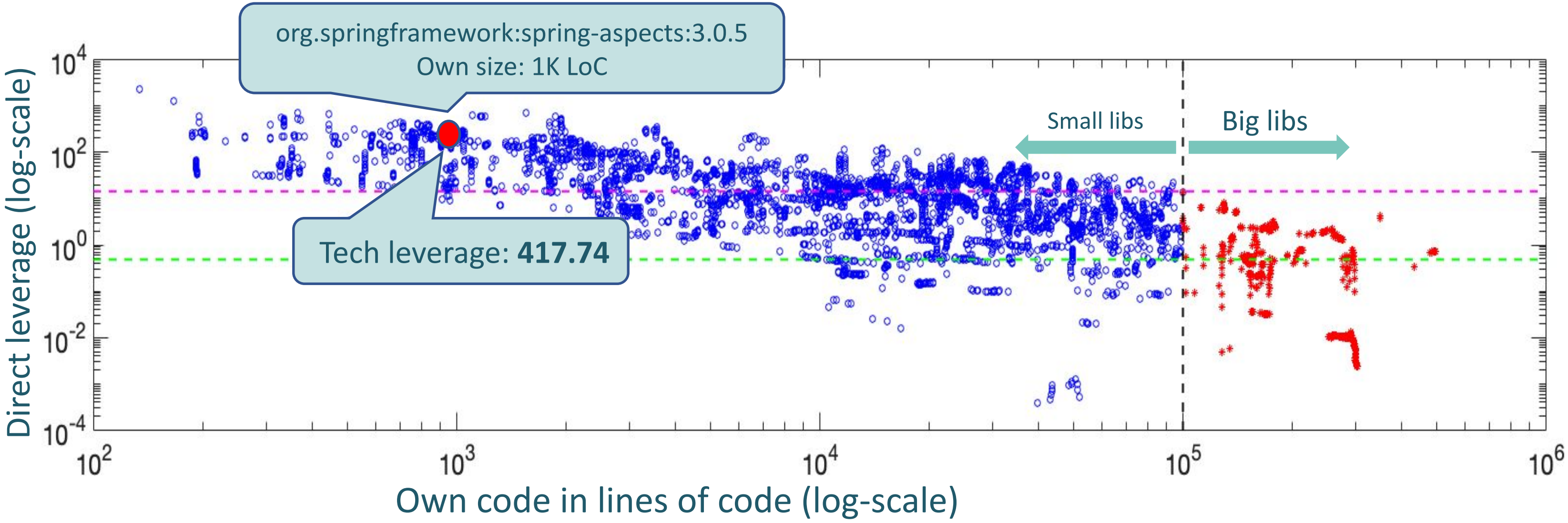

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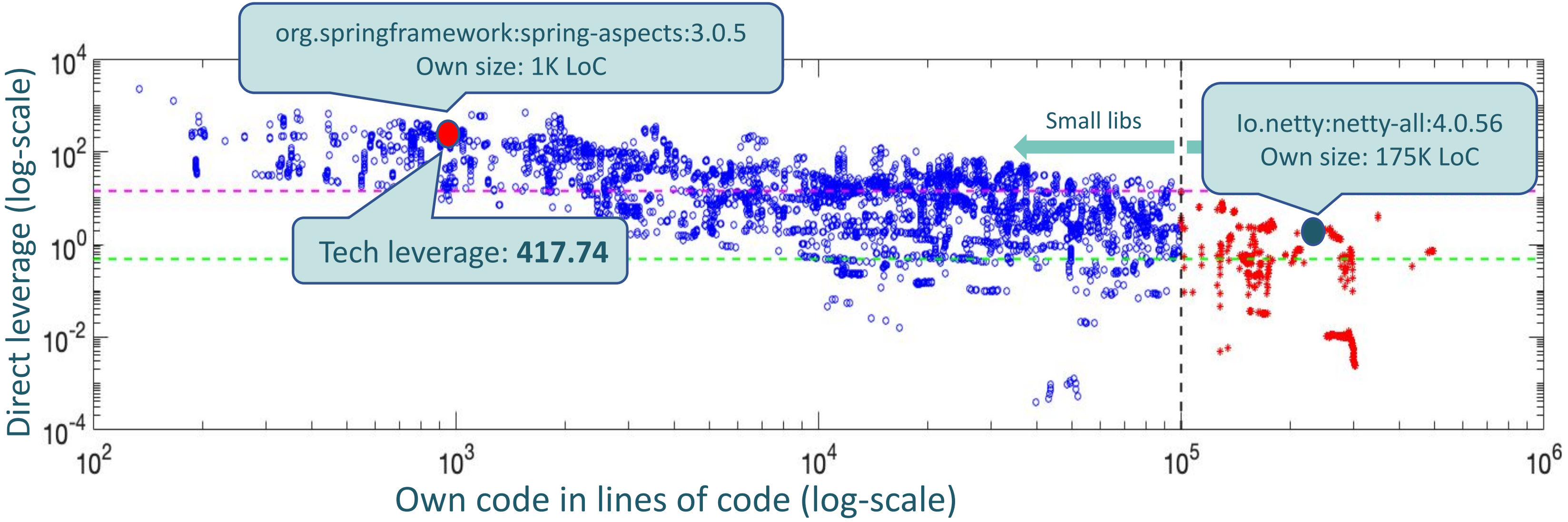

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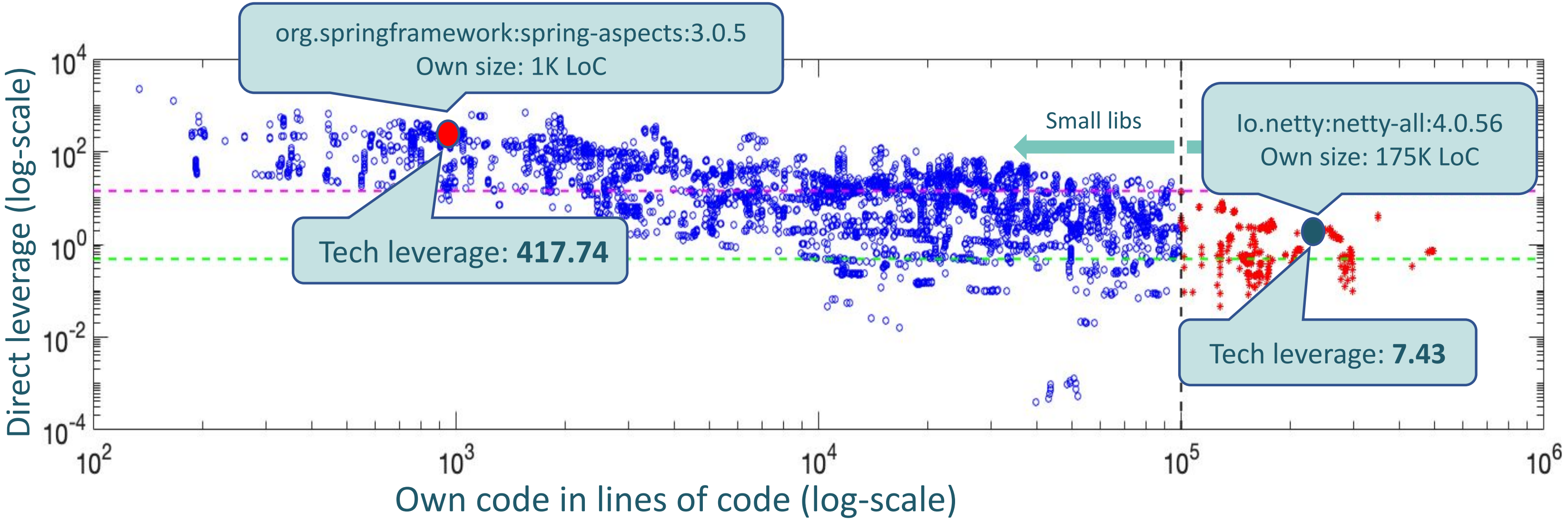


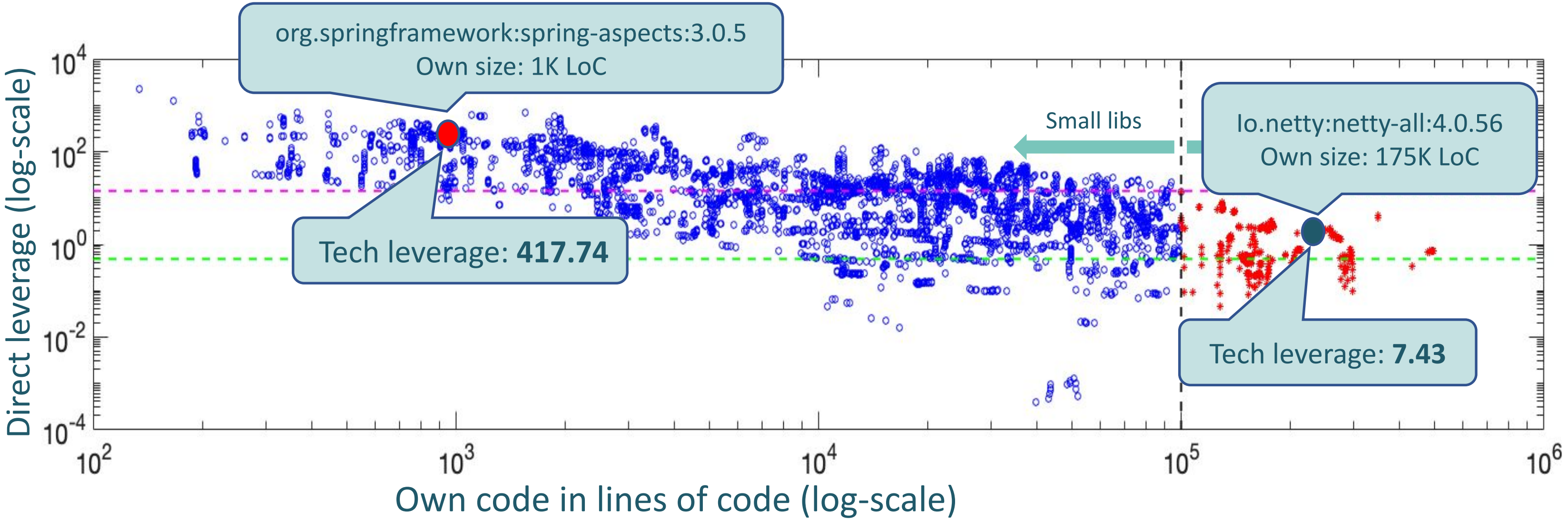
org.springframework:spring-aspects:3.0.5
Own size: 1K LoC

Tech leverage: **417.74**

Io.netty:netty-all:4.0.56
Own size: 175K LoC

Tech leverage: **7.43**

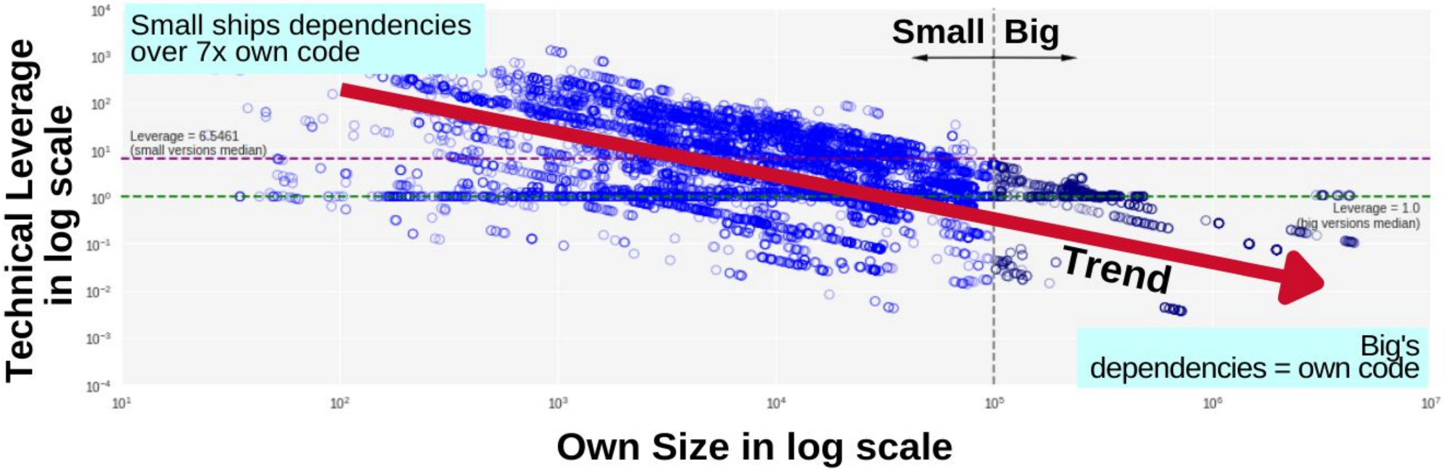
Previous work in Java (Massacci & Pashchenko, ICSE'21)



How about in another ecosystem?

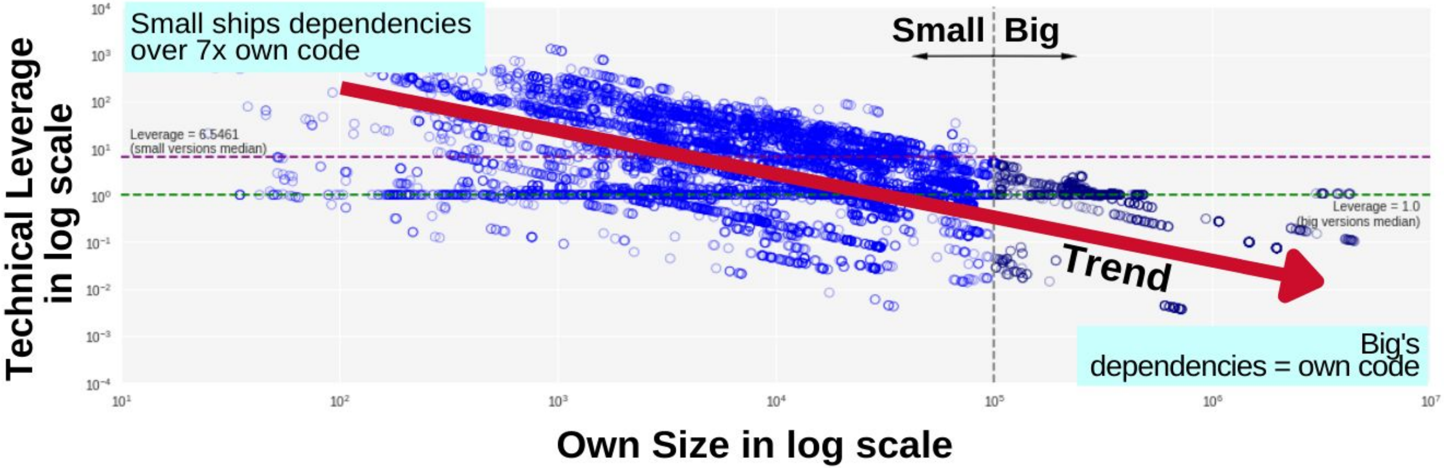
How is the evolution of technical leverage?

RQ1: How is technical leverage distribution in the Python ecosystem?



As in Java, Python developers also tend to ship a lot of other people's code (RQ1)

RQ1: How is technical leverage distribution in the Python ecosystem?

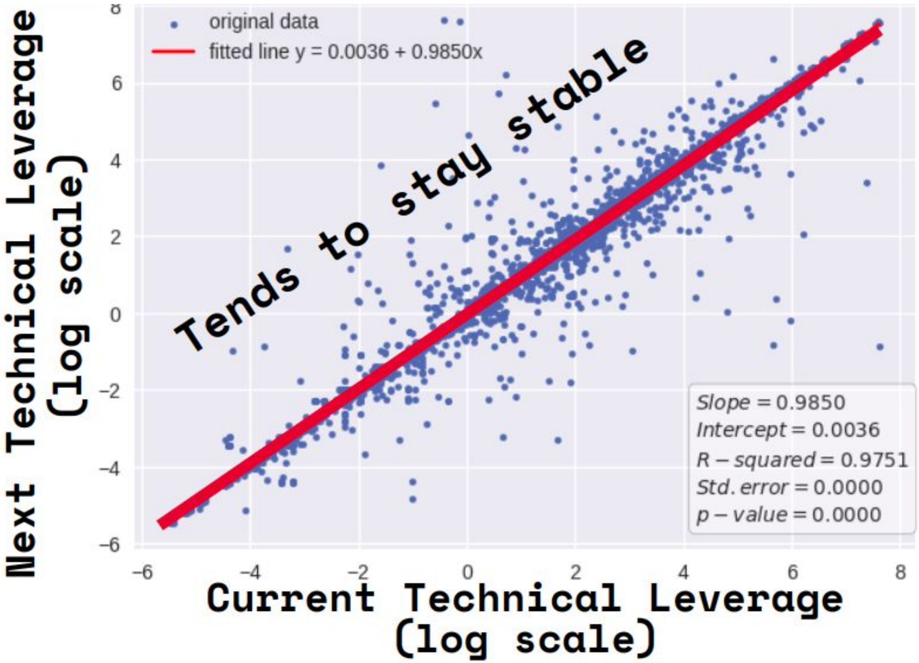


As in Java, Python developers also tend to ship a lot of other people's code (RQ1)

LESSON LEARNED

Understanding what else will come along when a package is adopted is *key* to assessing its level of uncontrollable risk.

RQ2: How does the technical leverage metric change when we move to newer versions in a package?



If you are highly leveraged, you will stay so.

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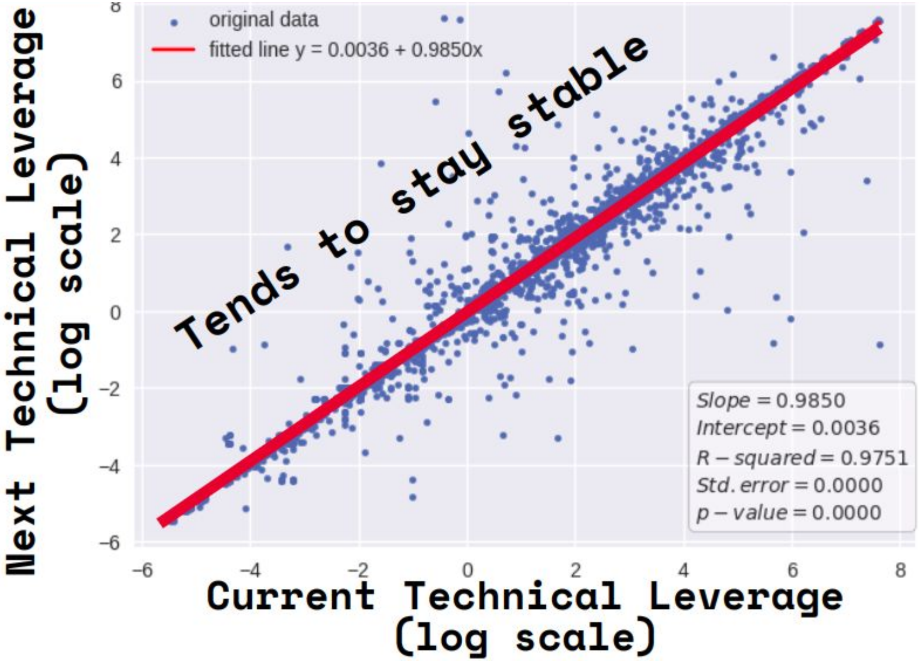

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LESSON LEARNED

Once a package has been adopted, the level of uncontrollable risk is unlikely to change over time

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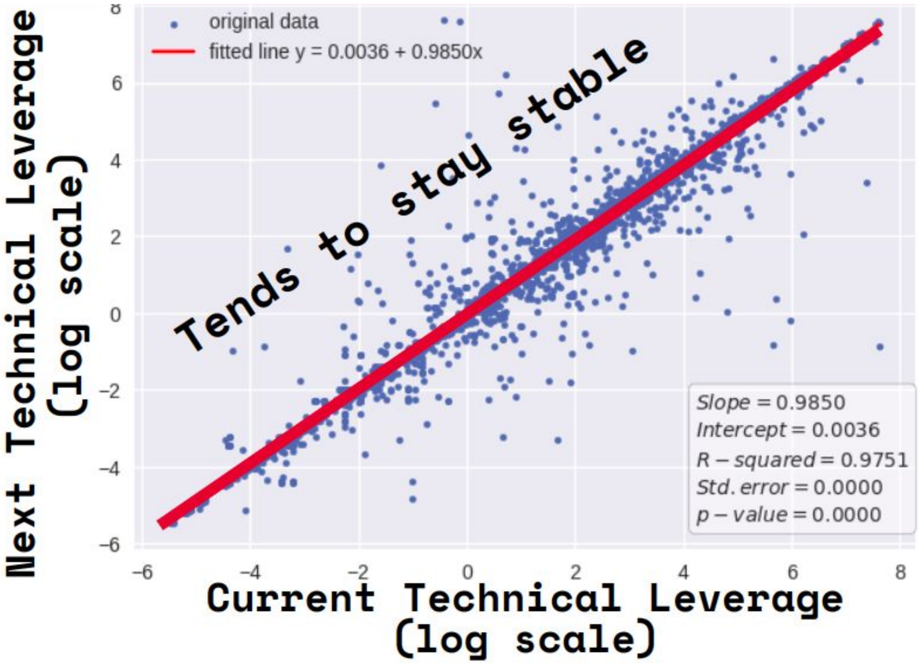

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LESSON LEARNED

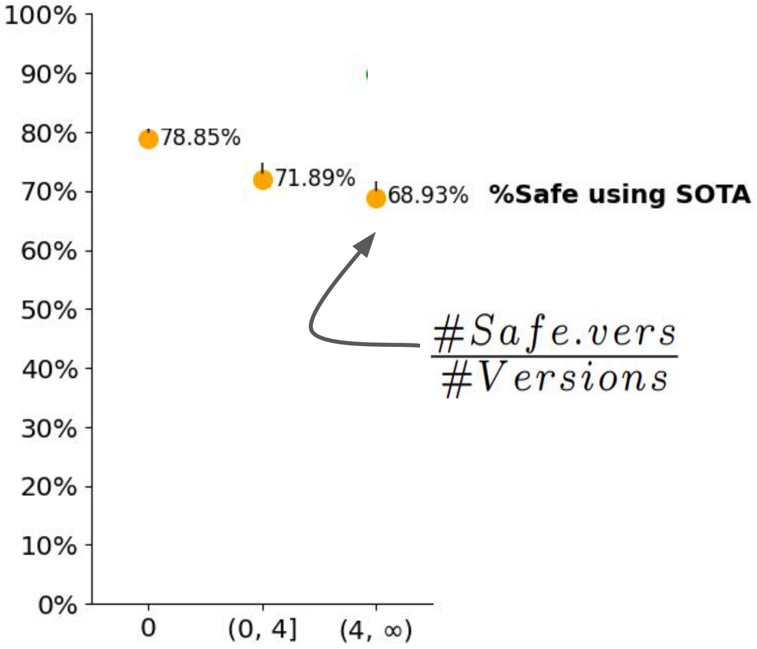
Once a package has been adopted, the level of uncontrollable risk is unlikely to change over time

Good News

If the risk was consciously accepted

Otherwise → ***Bad News***

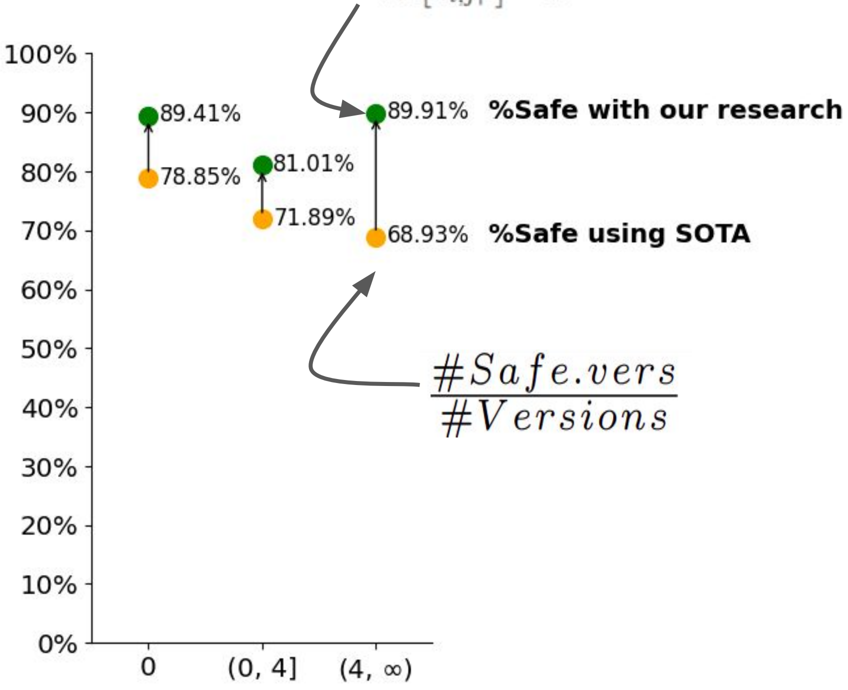
RQ3: Does technical leverage capture the risk of having vulns?



$$\frac{\#Safe.vers}{\#Versions}$$

RQ3: Does technical leverage capture the risk of having vulns?

$$Pr[safe\ vers|\lambda] = \frac{1}{N_{\Lambda=\lambda}} \sum_{\substack{\text{package } i \\ \wedge \mathbb{E}[\lambda_{i,j}|i] = \lambda}} \left(1 - \frac{v_i}{n_i}\right) \qquad (7)$$



$$\frac{\#Safe.vers}{\#Versions}$$

The probability of choosing a safe package version is higher than the proportion in the ecosystem.

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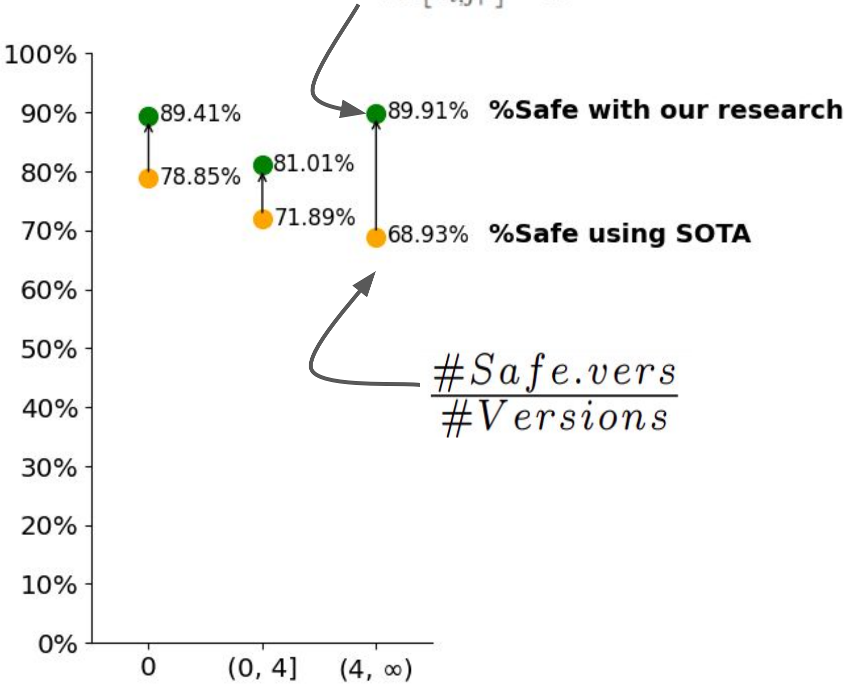

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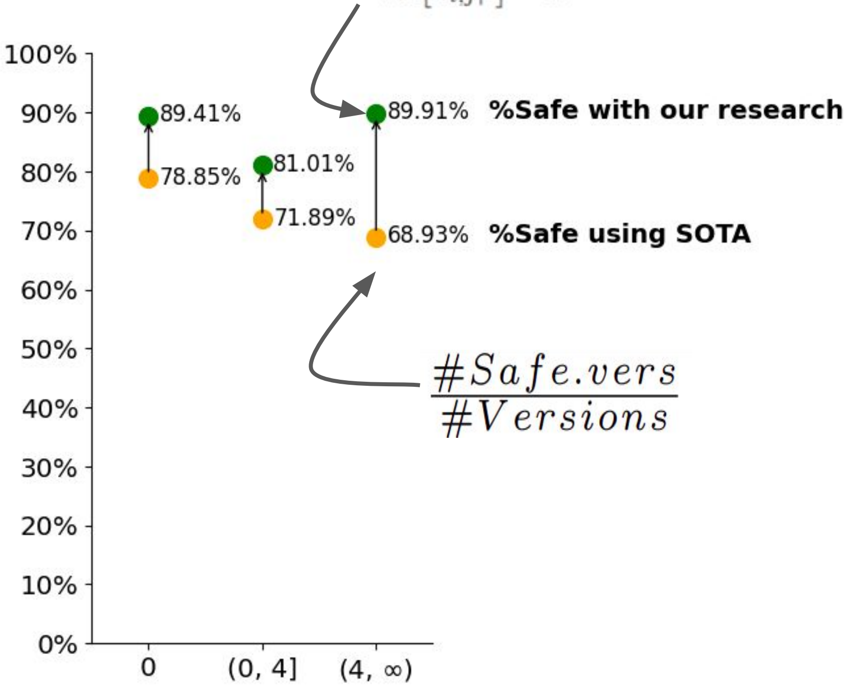

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Good News

Life can be better than researchers depict it.

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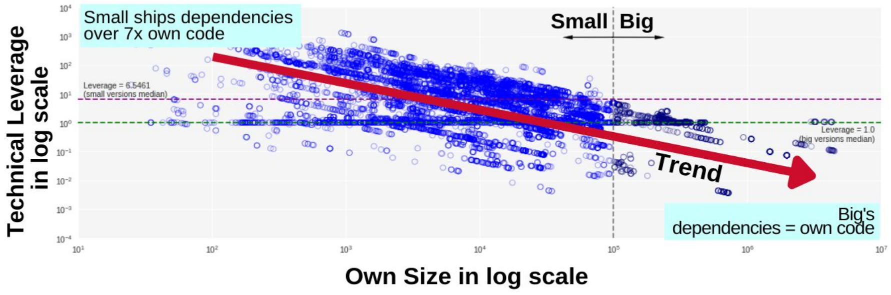

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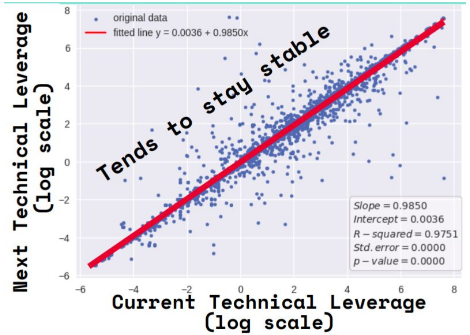
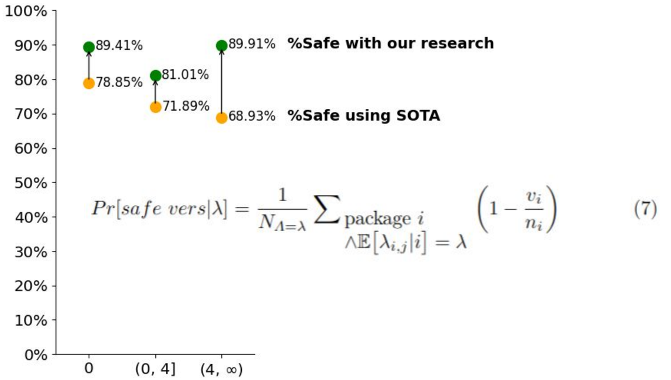


MY WEB

RQ3: Does technical leverage capture the risk of having vulns?



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PARTICIPATE IN OUR EXPERIMENT!

“Do you think it is an Ethical Decision?”

Some questions on an example from the ACM Code of Ethics and professional conduct

- Your participation is **voluntary**.
- The QR code will redirect you to an online survey.
- The **aim** of the study is to find out how people think about **ethical decisions in security.**
- The data is collected **anonymously** and will be used for research purposes.
- It will take you approximately **5-10 minutes**