Shining Light on the Open Source Supply Chain: The Risk in Community Health

Ubuntu Summit, Den Haag, Netherlands, Oct. 25, 2024

Georg Link, PhD

Abstract

Organizations are increasingly reliant on open-source software (OSS) to accelerate development and reduce costs. However, the **health of the communities** behind these projects is often overlooked, posing significant risks to the overall supply chain. This talk introduces the **open source tool GrimoireLab** that can shine lights onto those dark corners of your **open source supply chain**. We will also show how GrimoireLab was used in a novel **Risk Assessment Model** for the Maturity and Sustainability of open source dependencies, designed to address this critical challenge.

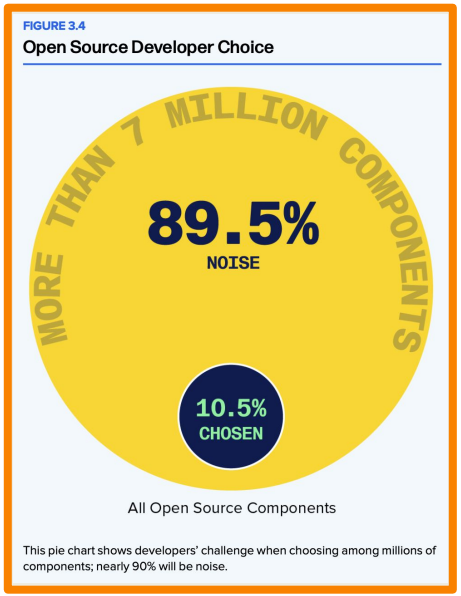
By using the GrimoireLab tool, combining concepts from the CHAOSS project and cloud-native deployment maturity models, our approach goes beyond traditional **Software Bill of Materials (SBOM)** analysis to evaluate the **ongoing maintenance activity and community health** of OSS projects.

This talk will delve into the model's design and implementation with GrimoireLab, using Kubernetes as a case study. By adopting this approach, organizations can build a more resilient and sustainable software foundation, ensuring the long-term health of their open source supply chain.

This enables organizations to:

- Assess the long-term viability of their open source dependencies.
- Make informed decisions about library selection and integration.
- Proactively mitigate risks associated with unhealthy or unsustainable communities.

Dilemma: Choice and Maintenance

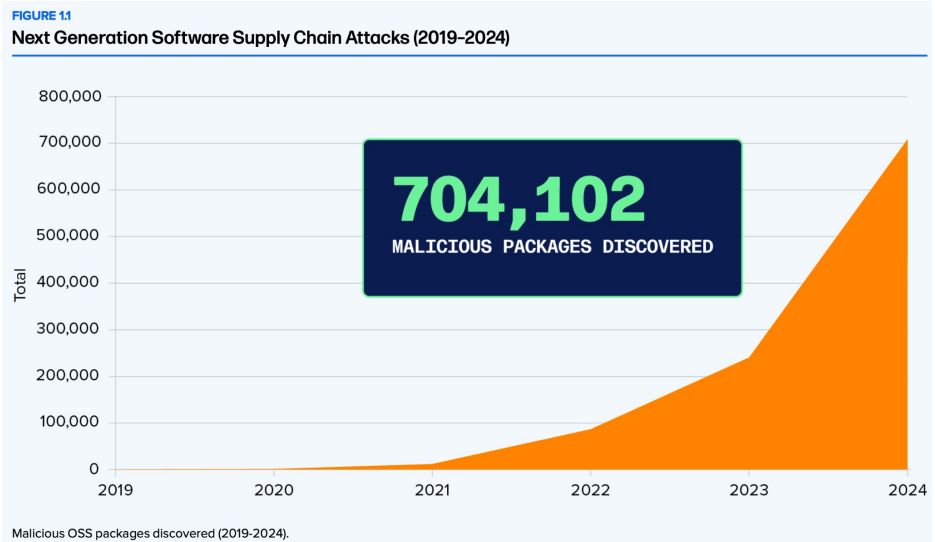


https://www.sonatype.com/state-of-the-software-supply-chain

Sonatype 9th State of Software Supply Chain report:

"Consider this: last year, we revealed that a staggering **85% of projects in Maven Central** — the largest public repository for Java open source components — **are inactive.** In other words, developers are faced with a perplexing array of choices, with only a fraction of them leading to active, well-maintained projects."

Software Supply Chain Attacks are on the Rise



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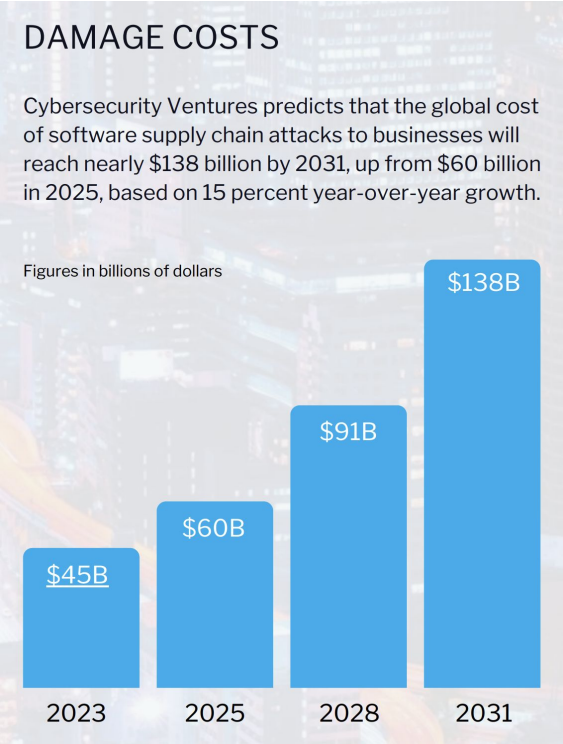
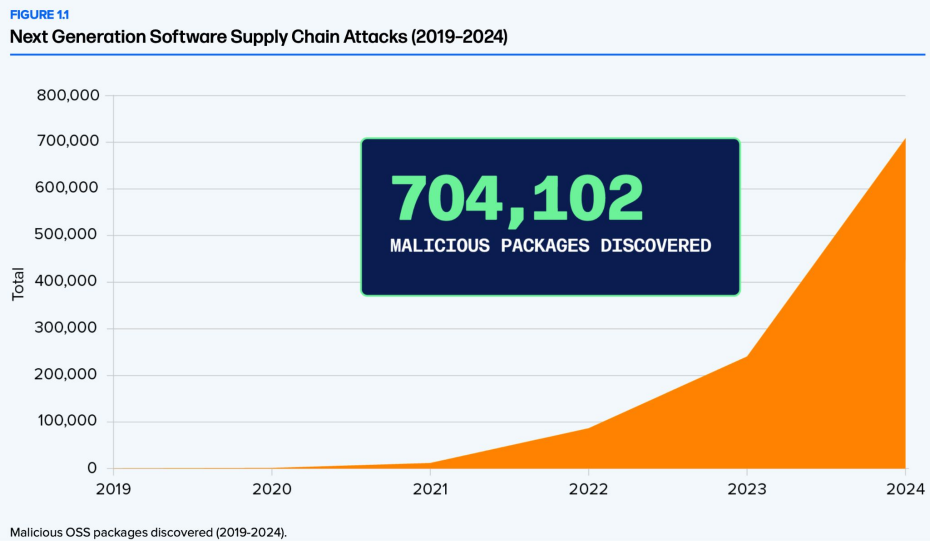
Software Supply Chain Attacks are on the Rise



https://go.snyk.io/2023-supply-chain-attacks-report.html



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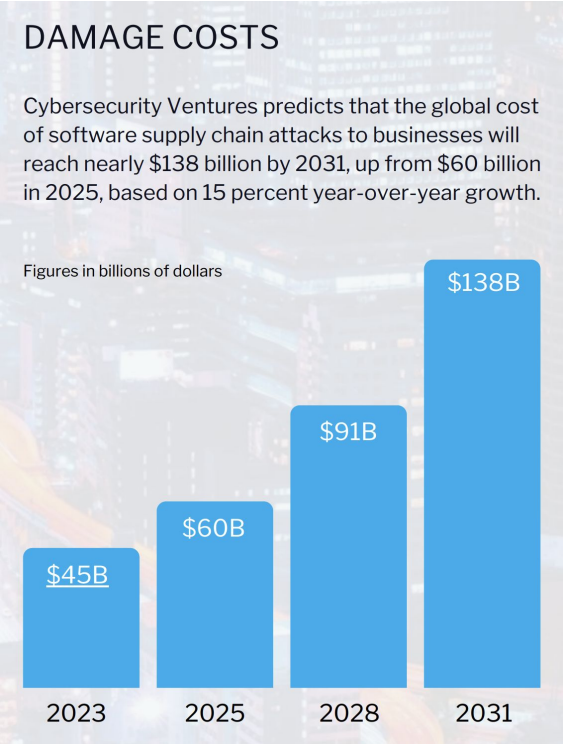

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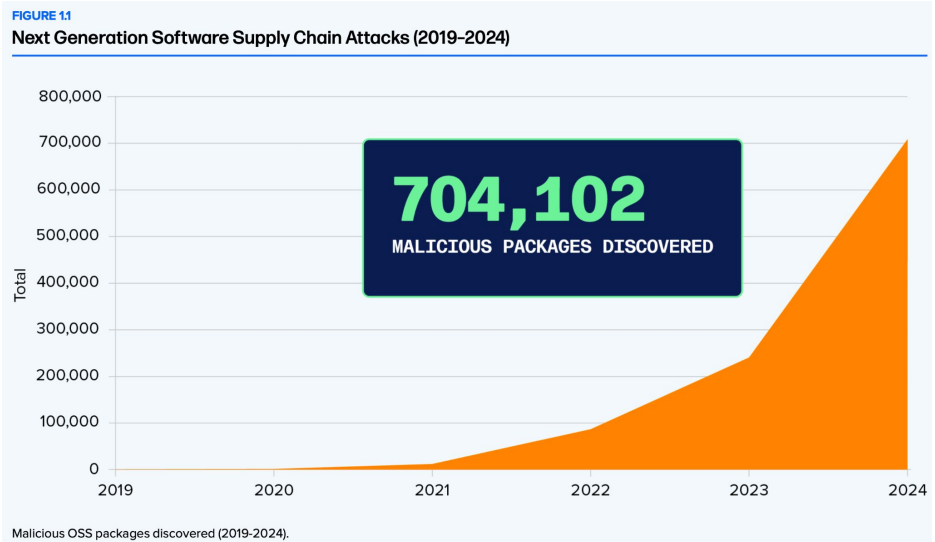
Gartner predicts that by 2025, **45 percent** of organizations worldwide will have experienced attacks on their software supply chains, a three-fold increase from 2021.
(Gartner, Mar 7, 2022)



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Research Found the SolarWinds Cyber Attack Cost Affected Companies in Key Sectors 11% of Total Annual Revenue on Average

Results indicate cyber-related information sharing is increasing, signaling a positive response to national-and industry-level calls to action

By Business Wire

Jun 28, 2021

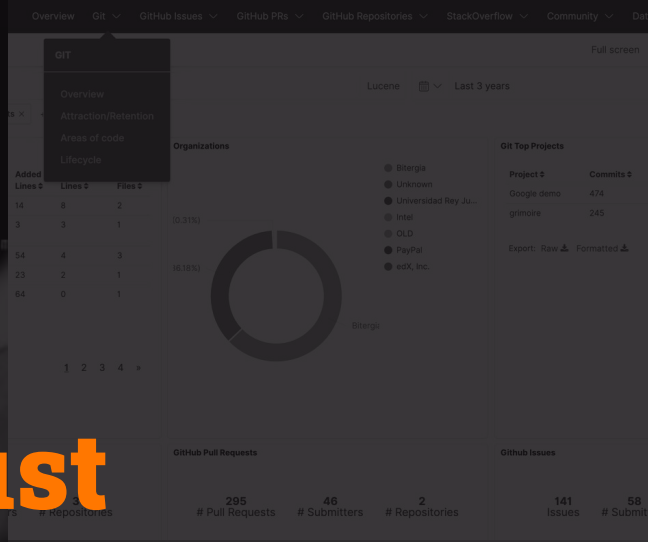
Meet Georg Link

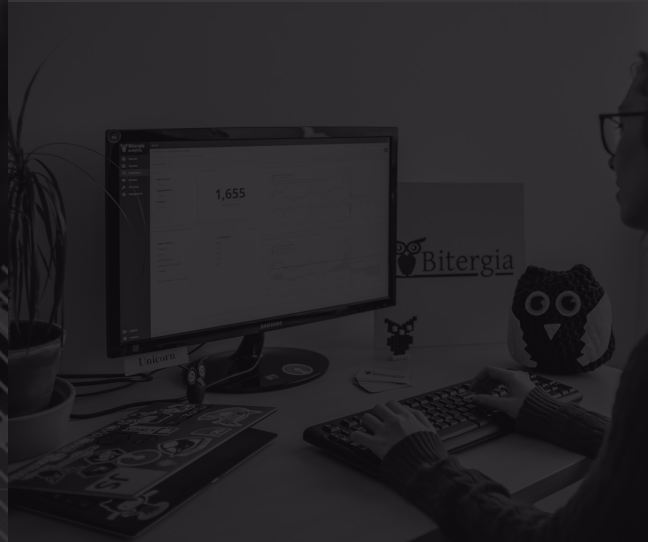
Open Source Strategist

- Business focus
- 20+ years in open source
- Co-Founder of CHAOSS
- Community Builder

“My mission is to improve the health and sustainability of open source.”

SBOMs and Trust



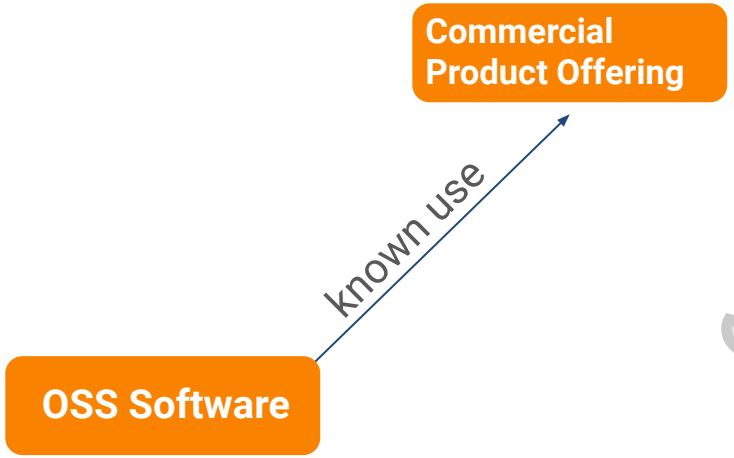


Software ages like Milk, not Wine

Trust: Expiration Label and Source Information

Context: Unmanaged OSS Use → Unknown Risk

- Developers use open source software
- 70% - 95% of software includes open source



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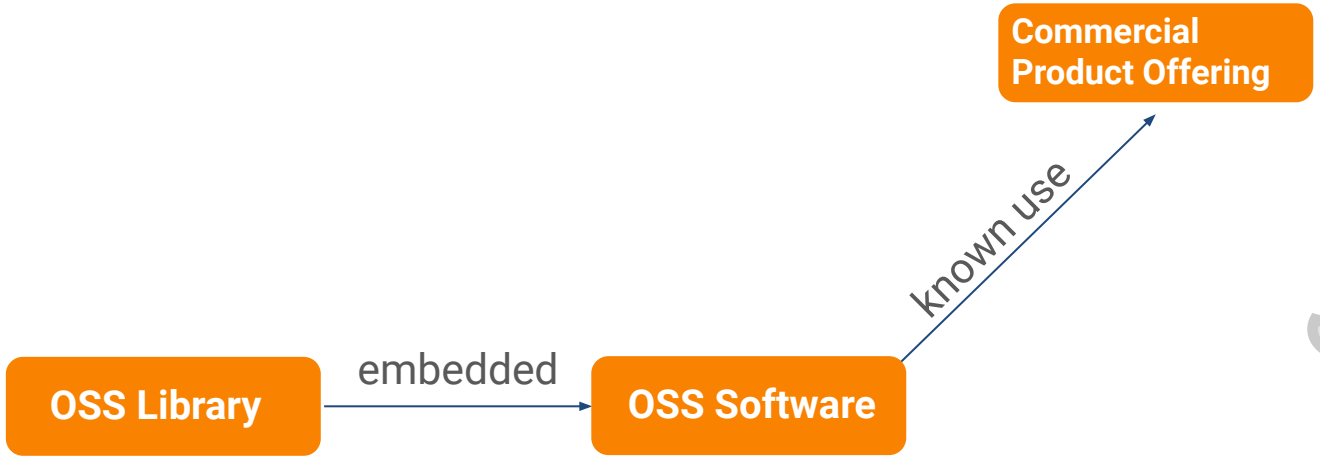

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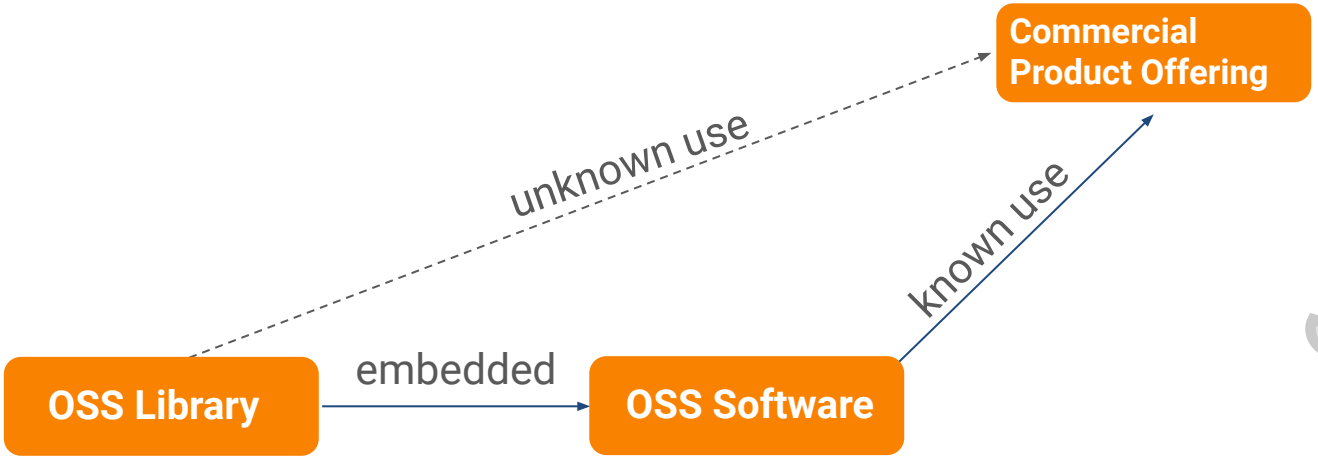
- Unmanaged OSS use → unknown dependencies → **unknown risk**



Problem: Trust in OSS Libraries to Manage Risk

https://www.sonatype.com/state-of-the-software-supply-chain

Problem: Trust in OSS Libraries to Manage Risk

- Licenses
- Vulnerabilities
- Under-maintained projects

https://www.sonatype.com/state-of-the-software-supply-chain

Problem: Trust in OSS Libraries to Manage Risk

Licenses

- License scanners

Vulnerabilities

- Software Composition Analysis (SCA)
- Vulnerability Databases

Under-maintained projects

- Community Health Metrics (CHAOSS)
- Pay for support

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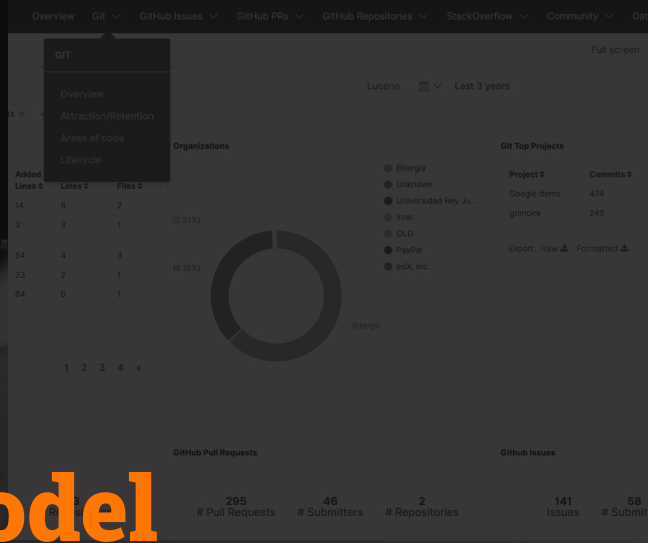
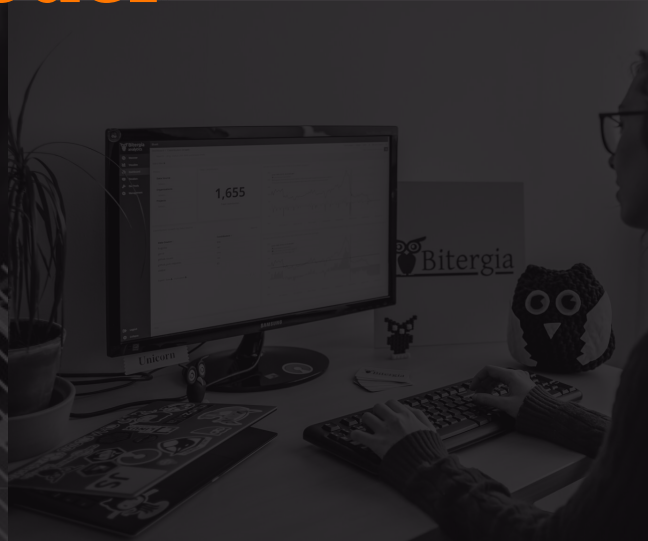
Missing: Forward looking risk

Risk Assessment Model





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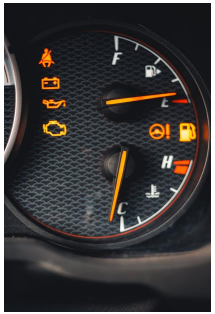
Imagine a Car

State Today:

- Flat Tires
- No Gas
- Warning Symbols
- Error Codes

→ You know how to fix today's situation



Risk - future support:

- Availability of Replacement Parts
- Skilled Workers to Repair
- Network of Repair shops
- Life Expectancy of Car

→ Unsupported Oldtimer vs. Supported Modern Car

Imagine a Car

State Today:

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- Err

→ You k uation

Licenses

Vulnerabilities

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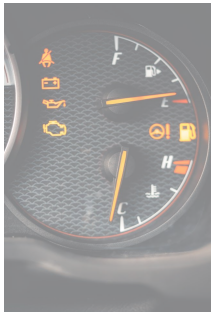
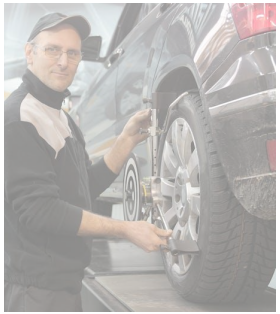



Imagine a Car

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- Wa
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Licenses

Vulnerabilities

Risk - future support:

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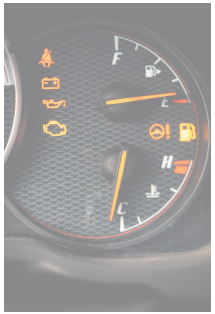
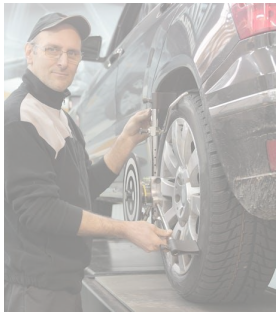
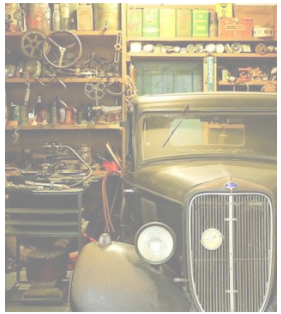
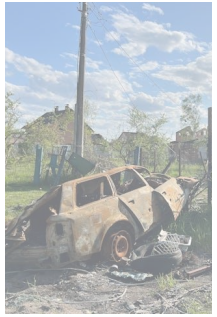
- Life

Under-maintained projects

→ Unsup orted Modern Car

Indicators for Risk: “Under-maintained Projects”

“Community Smells” include 7 metrics:

Community cannot handle workload
- Backlog Management Index
- Review Efficiency Index

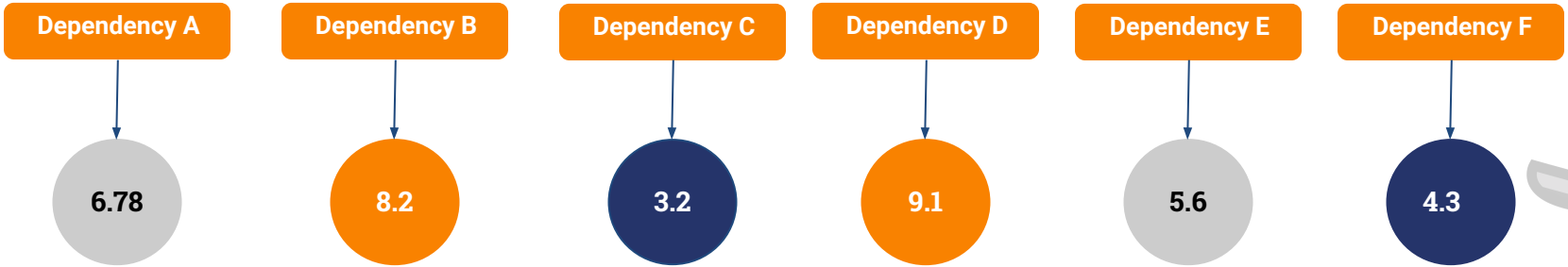
Community does not address work quickly
- Median Lead Time for Issues
- Median Lead Time for Pull Requests

Community lacks sufficient talent
- Retention Rate
- Growth of Active Contributors
- Contributor Absence Factor (aka Bus or Pony Factor)

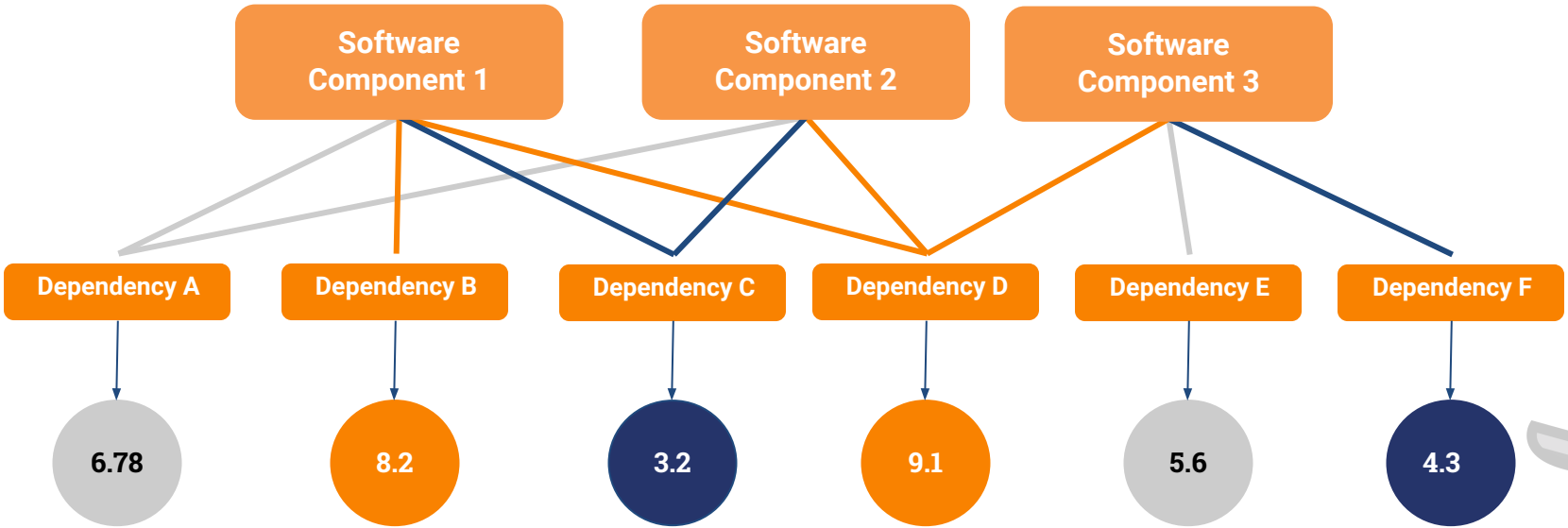
A single Risk Score per OSS library

7 metrics, normalized, and

combined into one score for each dependency



Risk Model - Aggregate By Component



Example of Kubernetes' Go Dependencies

project: Kubernetes - Golang Deps × | Add filter

Risk Model Overview Dashboard

Check the Risk Model Help Dashboard for more information about this analysis.

For more details, pin a filter by origin and visit the Risk Model Dashboard for Individual Projects.

Filters

Team

Select...

Project Category

Kubernetes - Golang Deps ×

Overview

347
Dependencies analyzed

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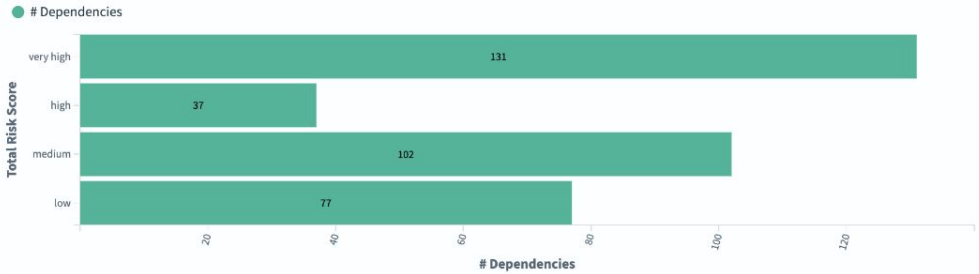
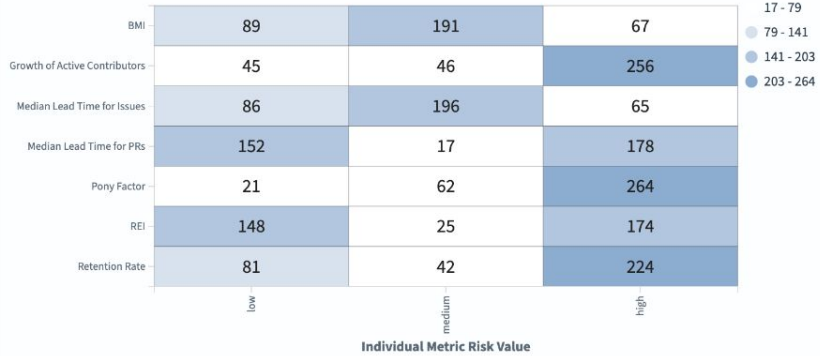
Team

Dependencies by Risk value



Risk Value per Metric, by number of Dependencies



Overall results by dependency repository

Filter...

Repository	Category	Risk Value	Risk Score (over 10)	# "Low risk" metrics	# "Medium risk" metrics	# "High risk" metrics	Last analyzed on
https://github.com/json-iterator/go	Kubernetes - Golang Deps	very high	10	0	0	7	Jun 27, 2024 @ 12:35
https://github.com/spf13/afero	Kubernetes - Golang Deps	very high	10	0	0	7	Jun 27, 2024 @ 12:35
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https://github.com/davecgh/go-spew	Kubernetes - Golang Deps	very high	9.29	0	1	6	Jun 27, 2024 @ 12:35

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Risk Model Overview Dashboard

Check the Risk Model Help Dashboard for more information about this analysis.

For more details, pin a filter by origin and visit the Pi

Filters

Team

Select...

Project Category

Kubernetes - Golang Deps ×

Project Category

Kubernetes - Golang Deps ×

Dependencies by Risk value

Dependencies

very high 131

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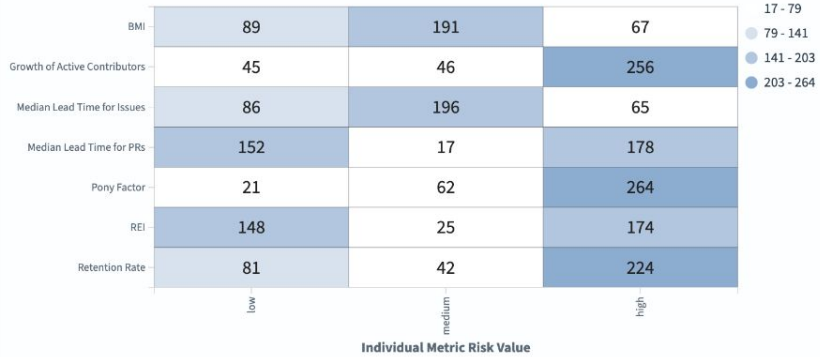
Team

Risk Value per Metric, by number of Dependencies



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Dashboards | Demo - Risk Model Overview Dashboard

Full screen | Share | Clone | Edit

project: Kubernetes - Golang Deps × Add filter

Risk Model Overview Dashboard

Check the Risk Model Help Dashboard for more information about this analysis.

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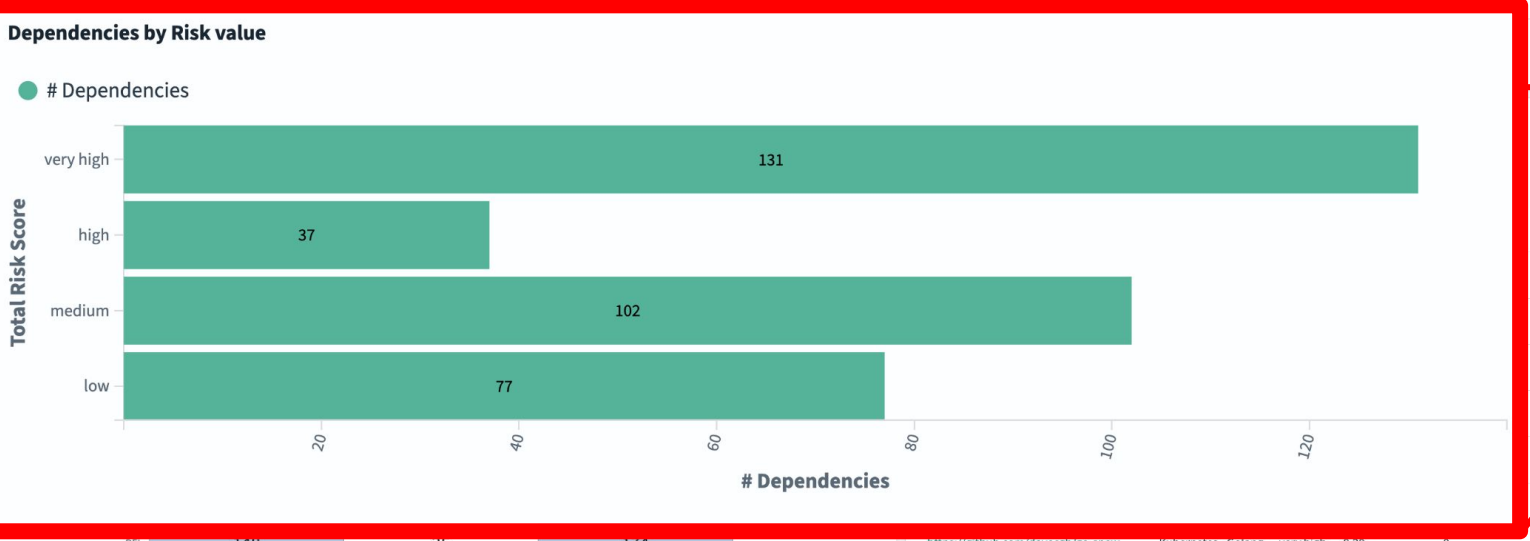
Filters

Overview

Dependencies by Risk value



	low	medium	high
REI	148	25	174
Retention Rate	81	42	224

Individual Metric Risk Value

# "Medium risk" metrics	# "High risk" metrics	Last analyzed on
0	7	Jun 27, 2024 @ 12:35
0	7	Jun 27, 2024 @ 12:35
1	6	Jun 27, 2024 @ 12:35
1	6	Jun 27, 2024 @ 12:35
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	6	Jun 27, 2024 @ 12:35
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https://github.com/davecgh/go-spew | Kubernetes - Golang Deps | very high | 9.29 | 0

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Dashboards

project: Kubernetes - Gola

Risk Model Overvi

Check the Risk Model He

For more deta s, pin a f

Filters

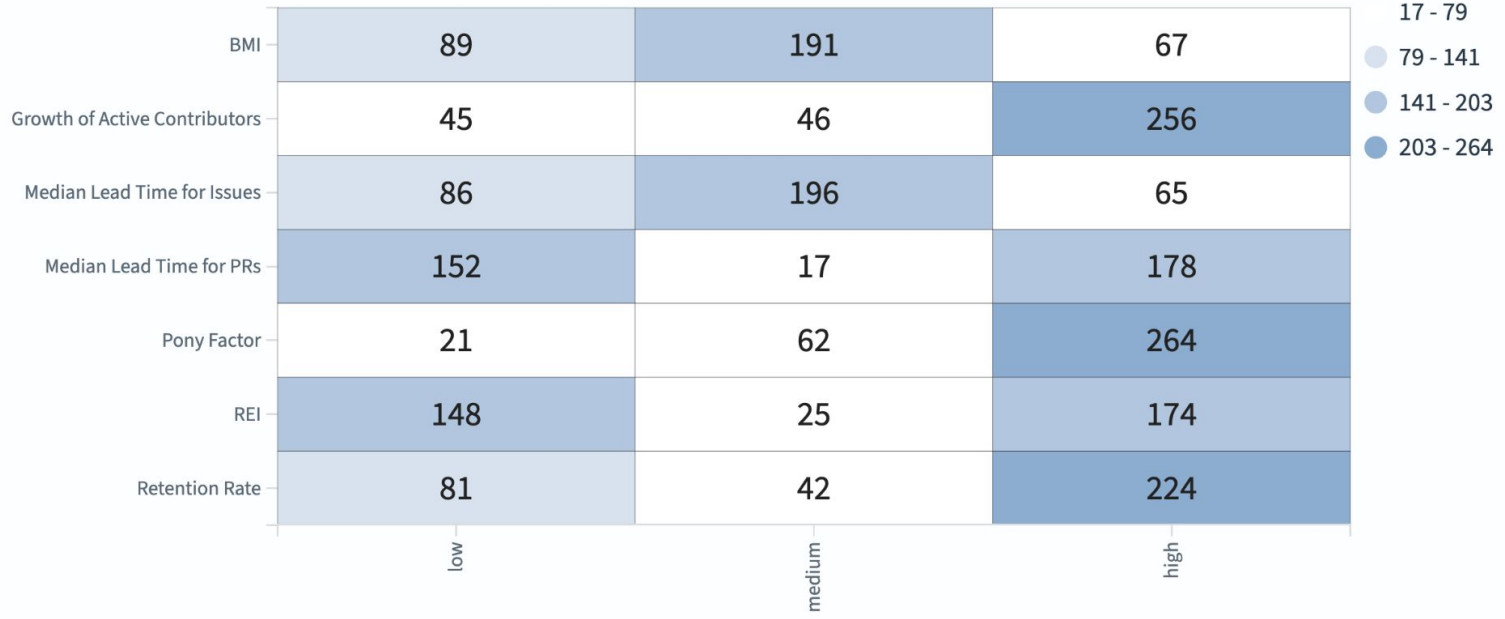
Team

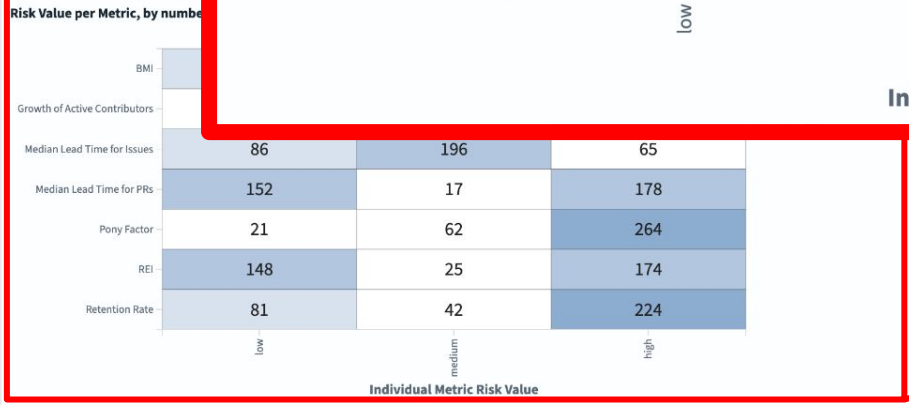
Select.

Project Category

Ku ernetes - Golang Deps ×

Risk Value per Metric, by number of Dependencies





	Deps						12:35
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Filters

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Select...

Project Category

Kubernetes - Golang Deps ×

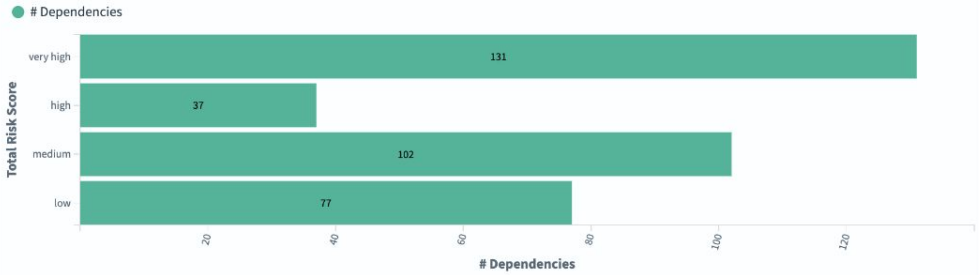
Overview

347

Dependencies analyze

Drill Down

Dependencies by Risk value



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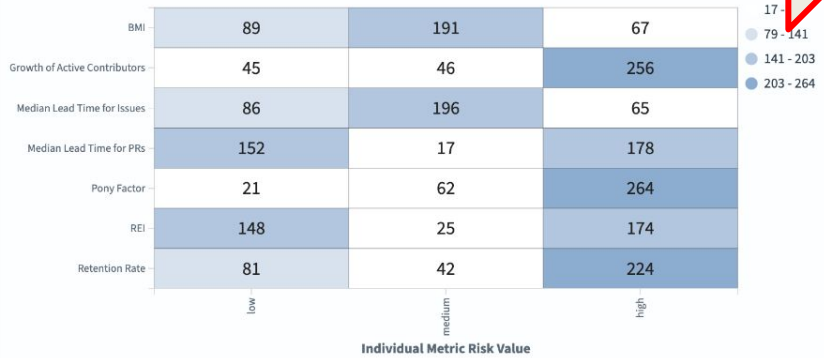

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Risk Model Dashboard for Individual Projects

Make sure to filter by a given repository before using this dashboard.

Check the Risk Model Help Dashboard for more information about this analysis.

Go back to the Risk Model Overview Dashboard.

Total Risk Score

github.com/stretchr/testify	medium	4.29	https://github.com/stretchr/t
Package Name	Total Risk	Total Risk Score (over 10)	Package Repository

Select an dependency first to check its risk

Team: Select...

Dependency Pkg Name: Select...

Dependency Repository: Select...

Project Category: Kubernetes - Golang Deps ×

Risk Model: Detailed view - dependency selector table

stre

Dependency	Package Name	Risk Level	Risk Score
https://github.com/stretchr/testify	github.com/stretchr/testify	medium	4.29

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Metric	Risk Value	Metric Value
Retention Rate	low	1.769
REI	low	1.164
Pony Factor	medium	2
Median Lead Time for PRs	high	90.285
Median Lead Time for Issues	high	221.23
Growth of Active Contributors	medium	0.833
BMI	low	1.337

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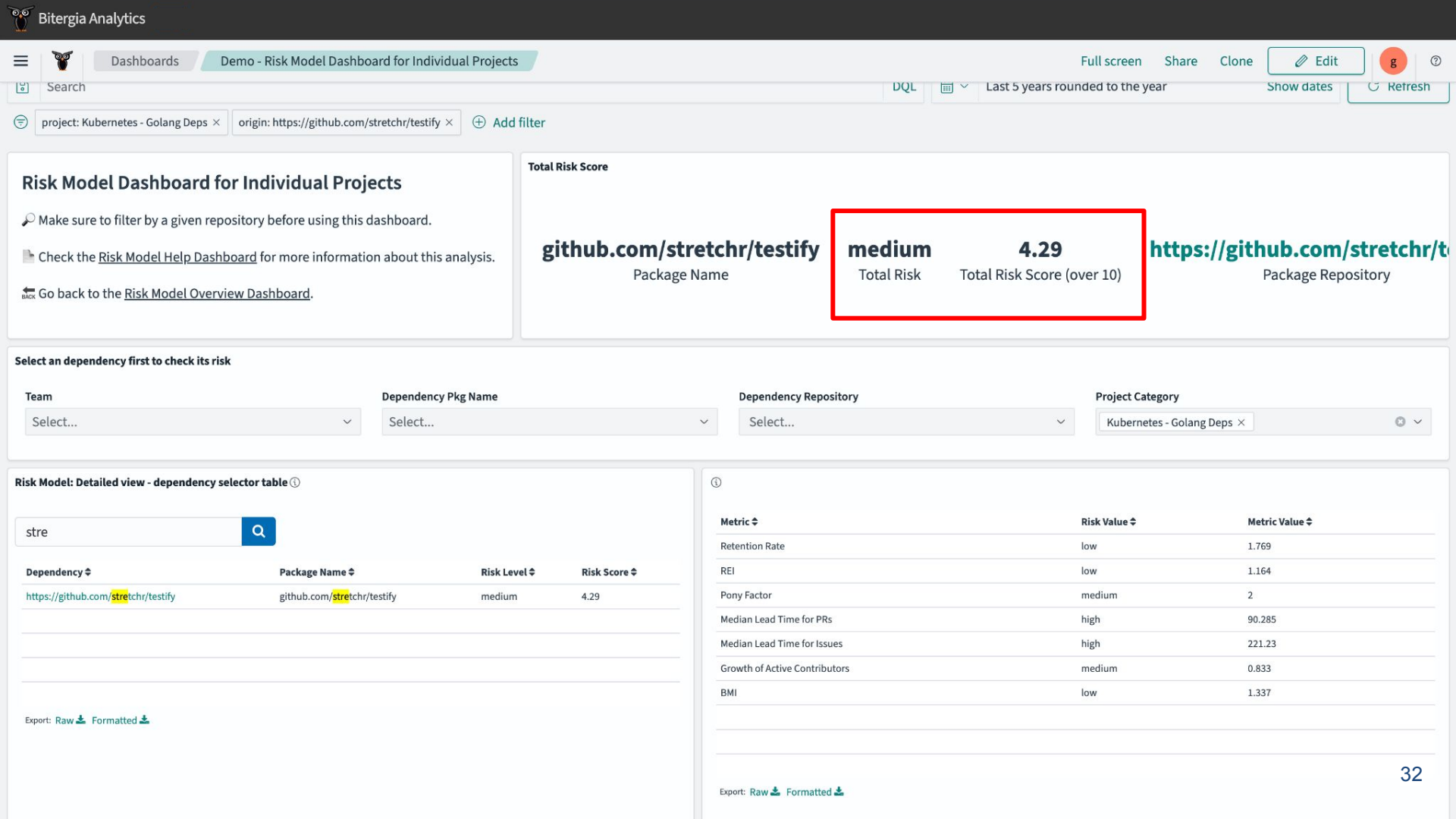
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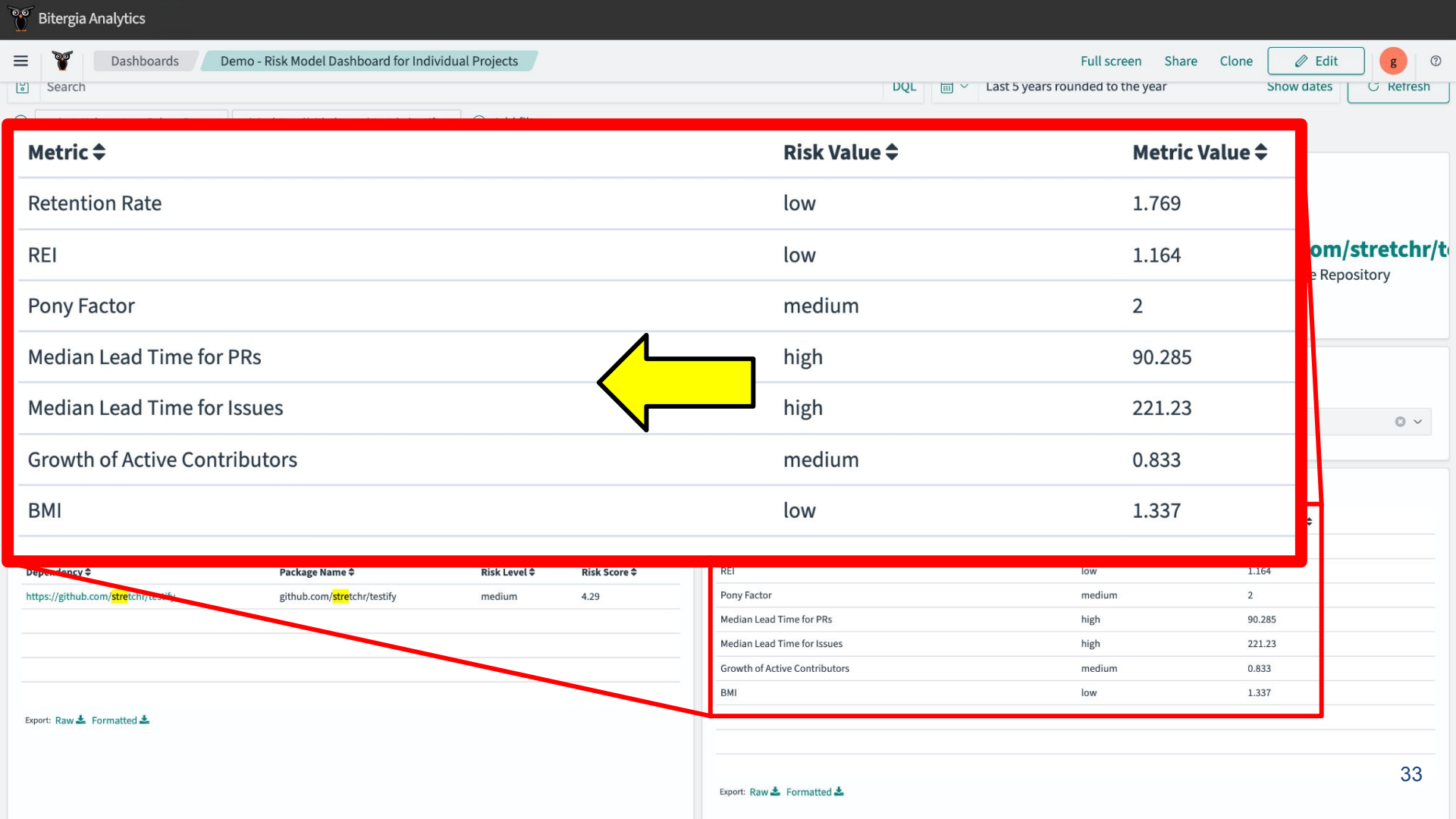
Dashboards
Demo - Risk Model Dashboard for Individual Projects
Full screen
Share
Clone
Edit
Search
DQL
Last 5 years rounded to the year
Show dates
Refresh
project: Kubernetes - Golang Deps
origin: https://github.com/stretchr/testify
Add filter
Risk Model Dashboard for Individual Projects
Make sure to filter by a given repository before using this dashboard.
Check the Risk Model Help Dashboard for more information about this analysis.
Go back to the Risk Model Overview Dashboard.
Total Risk Score
github.com/stretchr/testify
Package Name
medium
Total Risk
4.29
Total Risk Score (over 10)
https://github.com/stretchr/t
Package Repository
Select an dependency first to check its risk
Team
Select...
Dependency Pkg Name
Select...
Dependency Repository
Select...
Project Category
Kubernetes - Golang Deps
Risk Model: Detailed view - dependency selector table
stre
Dependency
Package Name
Risk Level
Risk Score
https://github.com/stretchr/testify
github.com/stretchr/testify
medium
4.29
Export: Raw Formatted
Metric
Risk Value
Metric Value
Retention Rate
low
1.769
REI
low
1.164
Pony Factor
medium
2
Median Lead Time for PRs
high
90.285
Median Lead Time for Issues
high
221.23
Growth of Active Contributors
medium
0.833
BMI
low
1.337
Export: Raw Formatted


Bitergia Analytics
Dashboards
Demo - Risk Model Dashboard for Individual Projects
Full screen
Share
Clone
Edit
Search
DQL
Last 5 years rounded to the year
Show dates
Refresh
Metric
Risk Value
Metric Value
Retention Rate
low
1.769
REI
low
1.164
Pony Factor
medium
2
Median Lead Time for PRs
high
90.285
Median Lead Time for Issues
high
221.23
Growth of Active Contributors
medium
0.833
BMI
low
1.337
Package Name
Risk Level
Risk Score
github.com/stretchr/testify
medium
4.29
Export: Raw Formatted
33

GrimoireLab: The Open Source Tool

BITERGIA | 2024

Story of GrimoireLab

- 2004 LibreSoft @ University Rey Juan Carlos in Spain
- 2012 Bitergia offers commercial services with Metrics Grimoire
- 2016 GrimoireLab starts, using ElasticSearch for Dashboarding
- 2017 Founding of CHAOSS
- 2024 version 1.0 released

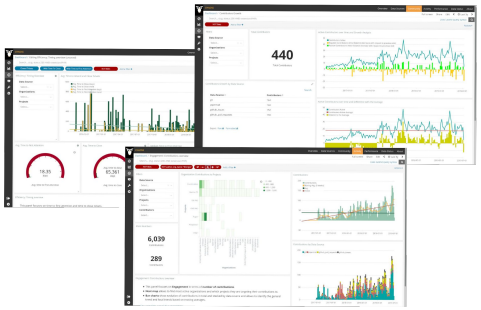
Example: Mozilla Foundation

“[...] holistic view of our contributor ecosystem’s network structure, health and impact [...]”

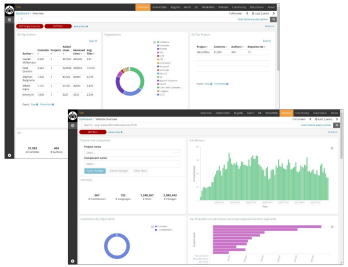
“[...] we’re able to visually describe these distinct contributor communities as well as how they are interconnected [...]”

https://report.mozilla.community/

Platforms built with GrimoireLab



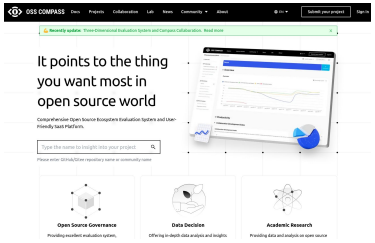
Bitergia Analytics



The Document Foundation

Mystic

Linux Foundation Insights



OSS Compass

Collecting data from OSS communities

Data Collection

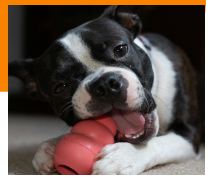
Digital footprints from data source

(biased towards activities that are logged)

Enrichment

Translate data into information

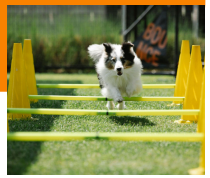
(connect and unify for consistency)



Visualization and Reporting

Gain insights and decide actions

(tell stories and convince)



SortingHat to disambiguate contributors

08/2008 - 07/2011 Bankhaus C. L. Seeliger
10/2011 - 05/2015 TU Braunschweig
08/2015 - 05/2019 University of Nebraska at Omaha
05/2019 - now Bitergia

git

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PHABRICATOR

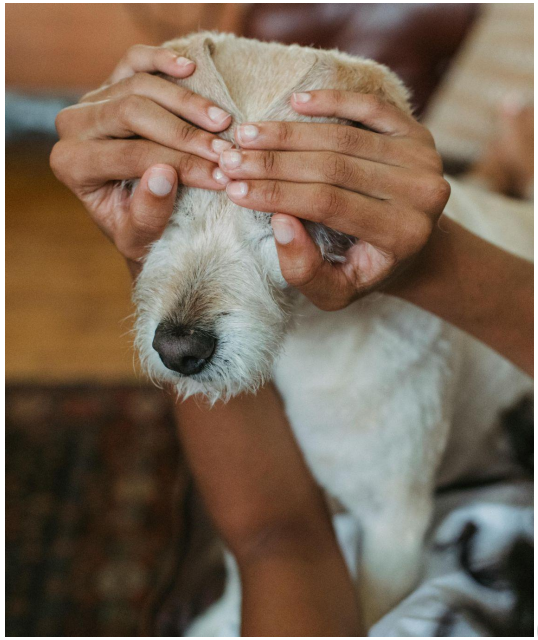
georglink@bitergia.com

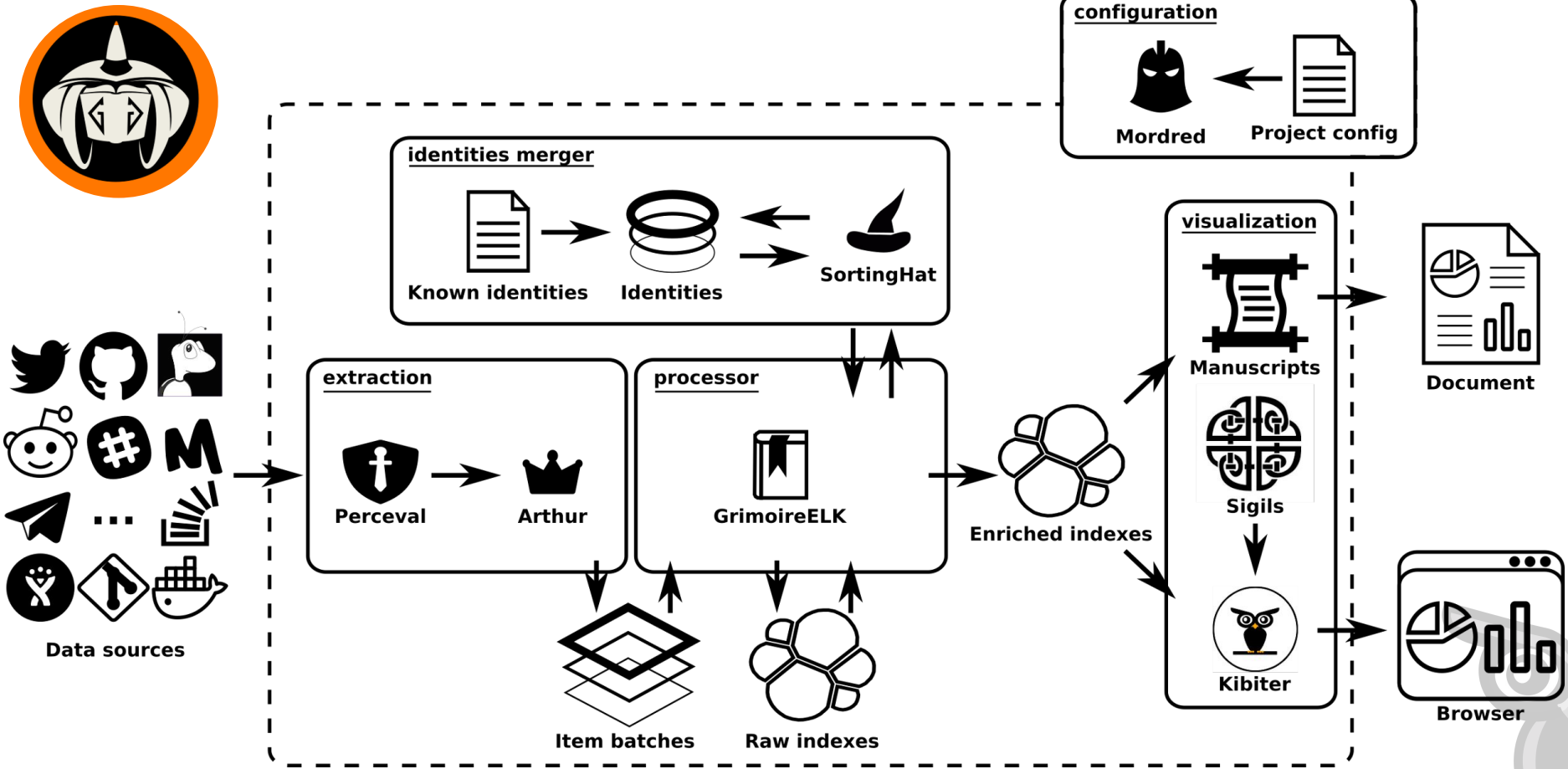
slack

GeorgLink

Excursion: Minding data privacy

- GDPR is gold standard
- Opt-in vs. Opt-out
- Enriching data from data sources
- Offering a “remove my data” feature




configuration
Mordred
Project config
identities merger
Known identities
Identities
SortingHat
visualization
Manuscripts
Document
extraction
Perceval
Arthur
processor
GrimoireELK
Enriched indexes
Sigils
Kibiter
Browser
Data sources
Item batches
Raw indexes

GrimoireLab 2.0 roadmap

- **Maintenance effort:** ⬇️
  Graphical user interface and an API for configuring data collection
- **Scalability and performance:** ⬆️
  Currently, 3,500 high-active repositories require three days of data analysis before the data is ready for the user
- **Integration with other tools:** 🔀
  Support more tools for visualizing and analyzing the data

How to Get Started?

Open Source: GrimoireLab tutorial

- https://chaoss.github.io/grimoirelab-tutorial/

Commercial Support: Bitergia Analytics

- https://bitergia.com/bitergia-analytics/

Shining Light on the Open Source Supply Chain: The Risk in Community Health

Thank you and please reach out!

Georg Link, PhD
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