ZAGREB Graph Data

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Detecting GitHub Repository Vulnerabilities with Graph Databases

Inspiration

Due to the meteoric rise of supply chain attacks, especially through the NPM and PyPI package repositories, it seems that more scrutiny and mitigations should be added

Why we wouldn't be able to visualize our software structure as graph of dependencies and analyze which components are exposed to CVE security issues

Dependencies to other repositories, libraries and projects increase complexity of the problem, but can be easy represented and visualized using graph technology

Public Security Information

Common Vulnerability Exposure

The mission of the CVE® Program is to identify, define, and catalog publicly disclosed cybersecurity vulnerabilities
Currently, there are 173,267+ CVE Records accessible

National Vulnerability Database

The NVD performs analysis on CVEs that have been published

Common Platform Enumeration – CPE

Common Vulnerability Scoring System - CVSS

TOTAL CVE Records: 173267

NOTICE: Transition to the all-new CVE website at WWW.CVE.ORG is underway and will last up to one year. (details)

NOTICE: Changes coming to CVE Record Format JSON and CVE List Content Downloads in 2022.

CVE-ID

CVE-2021-45046

Learn more at National Vulnerability Database (NVD)
• CVSS Severity Rating • Fix Information • Vulnerable Software Versions • SCAP Mappings • CPE Information

Description

It was found that the fix to address CVE-2021-44228 in Apache Log4j 2.15.0 was incomplete in certain non-default configurations. This could allows attackers with control over Thread Context Map (MDC) input data
either a Context Lookup (for example, $${ctx:loginId}) or a Thread Context Map pattern (%X, %mdc, or %MDC) to craft malicious input data using a JNDI Lookup pattern resulting in an information leak and remote c
environments. Log4j 2.16.0 (Java 8) and 2.12.2 (Java 7) fix this issue by removing support for message lookup patterns and disabling JNDI functionality by default.

References

Note: References are provided for the convenience of the reader to help distinguish between vulnerabilities. The list is not intended to be complete.

- CERT-VN:VU#930724
- URL:https://www.kb.cert.org/vuls/id/930724
- CISCO:20211210 Vulnerabilities in Apache Log4j Library Affecting Cisco Products: December 2021
- URL:https://tools.cisco.com/security/center/content/CiscoSecurityAdvisory/cisco-sa-apache-log4j-qRuKNEbd
- CONFIRM:https://cert-portal.siemens.com/productcert/pdf/ssa-397453.pdf
- URL:https://cert-portal.siemens.com/productcert/pdf/ssa-397453.pdf
- CONFIRM:https://cert-portal.siemens.com/productcert/pdf/ssa-479842.pdf
- URL:https://cert-portal.siemens.com/productcert/pdf/ssa-479842.pdf
- CONFIRM:https://cert-portal.siemens.com/productcert/pdf/ssa-661247.pdf
- URL:https://cert-portal.siemens.com/productcert/pdf/ssa-661247.pdf
- CONFIRM:https://cert-portal.siemens.com/productcert/pdf/ssa-714170.pdf
- URL:https://cert-portal.siemens.com/productcert/pdf/ssa-714170.pdf
- CONFIRM:https://logging.apache.org/log4j/2.x/security.html

CVE-2021-45046 Detail

Current Description

It was found that the fix to address CVE-2021-44228 in Apache Log4j 2.15.0 was incomplete in certain non-default configurations. This could allows attackers with control over Thread Context Map (MDC) input data when the logging configuration uses a non-default Pattern Layout with either a Context Lookup (for example, $${ctx:loginId}) or a Thread Context Map pattern (%X, %mdc, or %MDC) to craft malicious input data using a JNDI Lookup pattern resulting in an information leak and remote code execution in some environments and local code execution in all environments. Log4j 2.16.0 (Java 8) and 2.12.2 (Java 7) fix this issue by removing support for message lookup patterns and disabling JNDI functionality by default.

+View Analysis Description

Severity

CVSS Version 3.x | CVSS Version 2.0

CVSS 3.x Severity and Metrics:

NIST: NVD **Base Score:** 9.0 CRITICAL **Vector:** CVSS:3.1/AV:N/AC:H/PR:N/UI:N/S:C/C:H/I:H/A:H

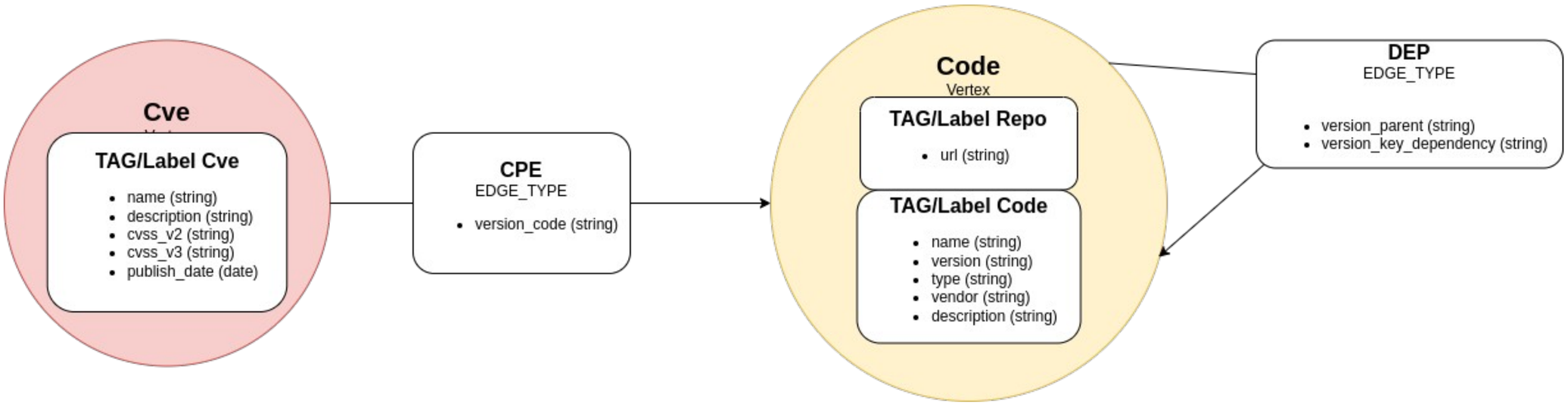
NVD Analysts use publicly available information to associate vector strings and CVSS scores. We also display any CVSS information provided within the CVE List from the CNA.

QUICK INFO

CVE Dictionary Entry:
CVE-2021-45046
NVD Published Date:
12/14/2021
NVD Last Modified:
02/18/2022
Source:
Apache Software Foundation

Using Graph Models

- Easy
  to model data
- Easy
  to maintain and synchronize data
- Powerful & Fast
  to handle large dataset



Implementation

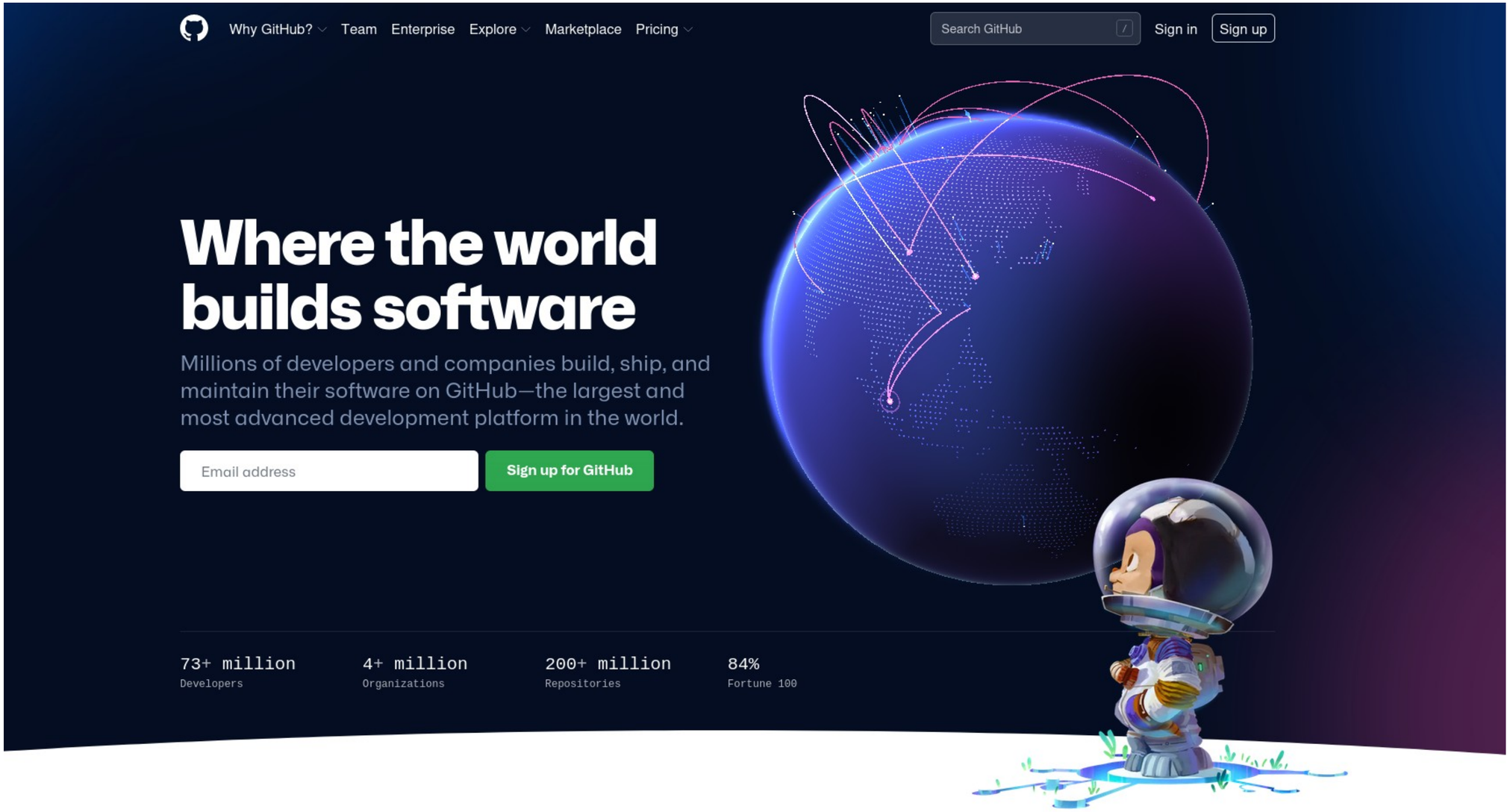
- **Python & Javascript code**
  Custom python code for web application service
  Javascript visualization library
- **Application server**
  Nginx web server
- **Graph Database**
  Memgraph

https://secure.codegraph.space

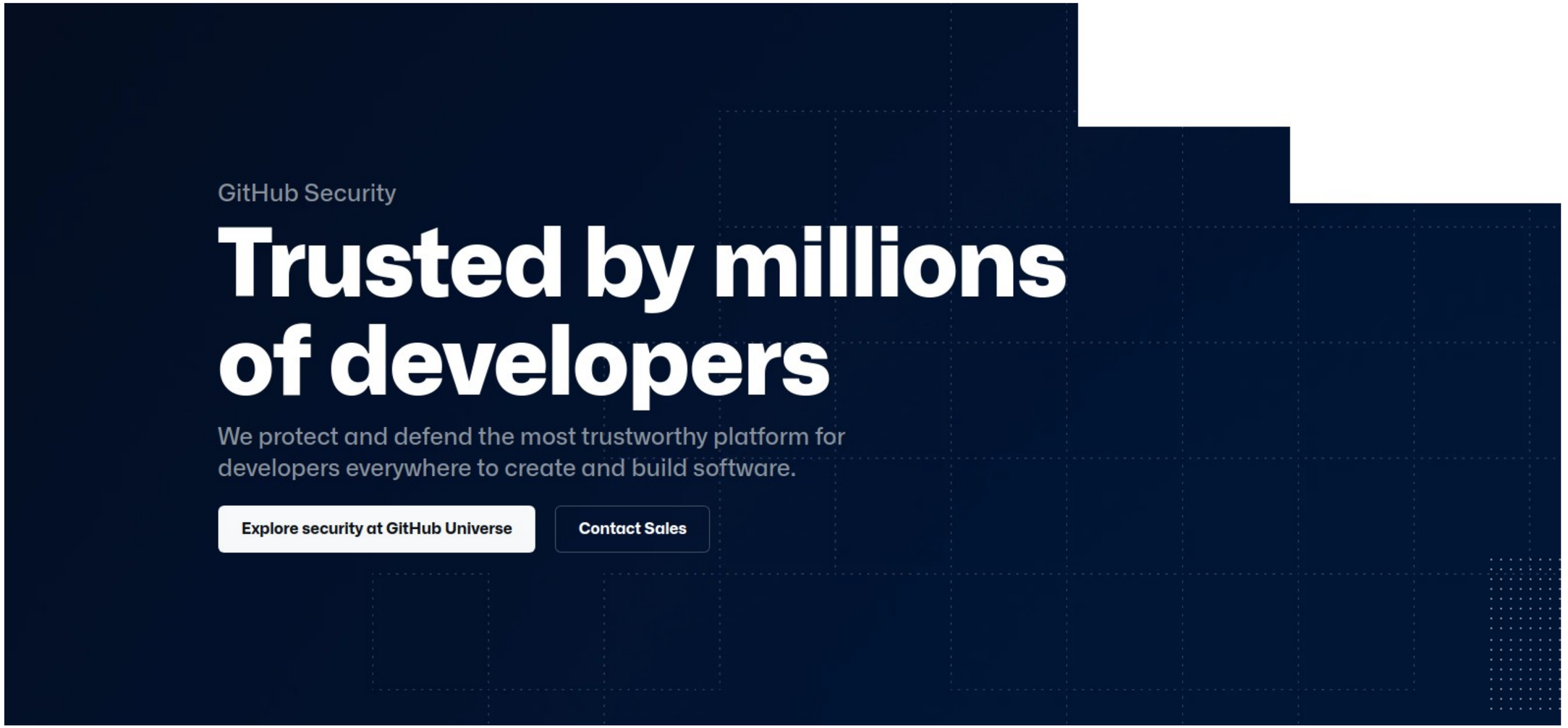
https://github.com/mirac7/codegraph

```
# install MemGraph database with docker

docker pull memgraph/memgraph-platform

docker run -it -d --name memgraph -p 7687:7687 -p 3000:3000 \
-e MEMGRAPH="--bolt-port=7687" \
-v mg_lib:/var/lib/memgraph \
-v mg_log:/var/log/memgraph \
-v mg_etc:/etc/memgraph \
memgraph/memgraph-platform


# connect to MemGraph using MemgraphLab console

http://localhost:3000/lab/overview

# execute in Query console screen

CREATE INDEX ON :Cve(name);
CREATE INDEX ON :Code(name);
```

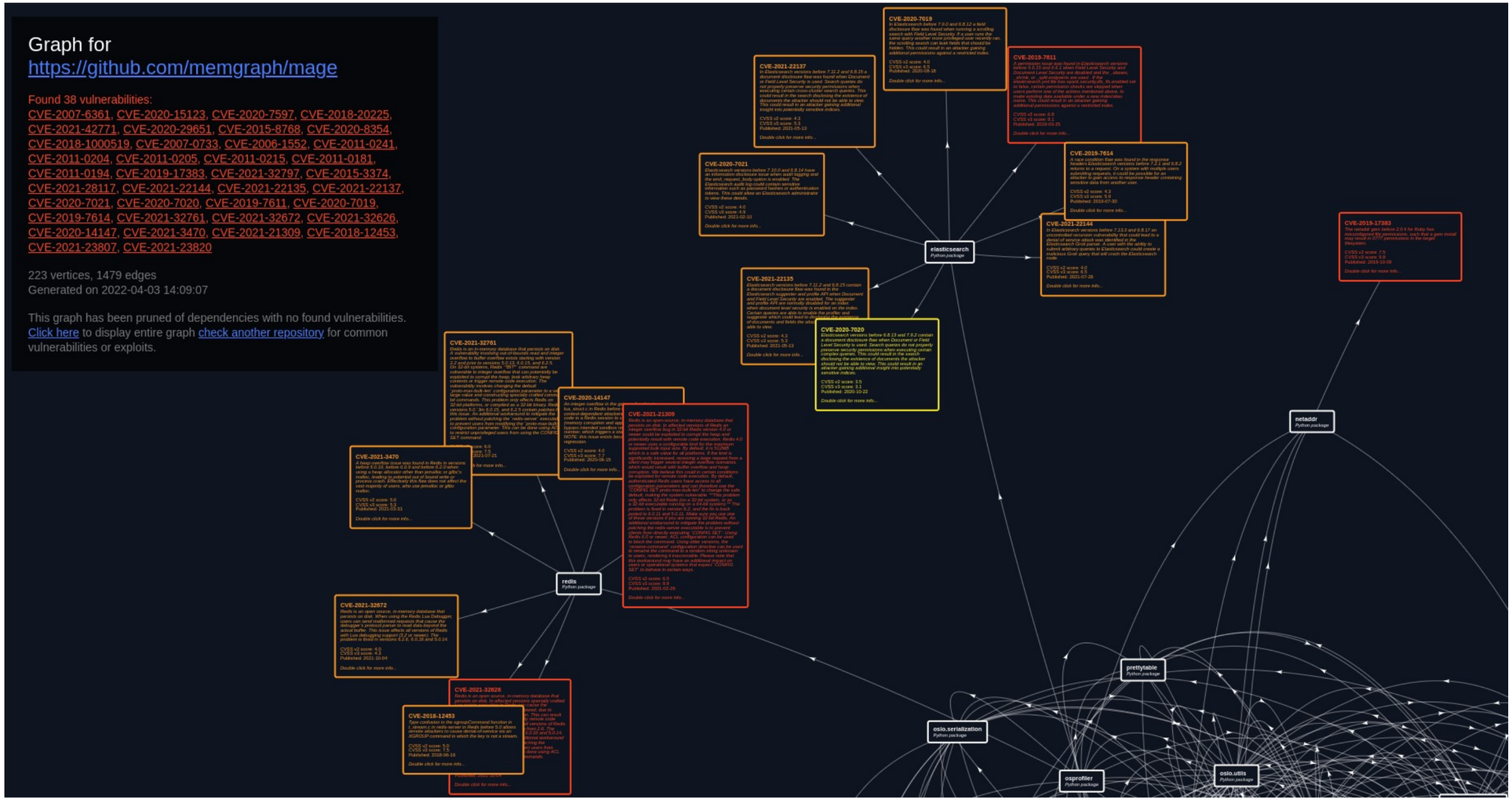
Why this is important ?



Why this is important ?



It is Your Code !
Let’s make whole GitHub more secure



Data – CVE Nodes

```
// Example data in Cypher syntax

// Cve Nodes

MERGE (cve:Cve { name: "CVE-2021-28377" })
ON CREATE SET cve.description="ChronoForums 2.0.11 allows av Directory Traversal to read arbitrary files.",
cve.cvss_v2_score="5.0", cve.cvss_v3_score="5.3",
cve.publish_date="2022-01-12";

MERGE (cve:Cve { name: "CVE-2022-0159" })
ON CREATE SET cve.description="orchardcore is vulnerable to Improper Neutralization of Input During Web Page Generation ('Cross-site Scripting')",
cve.cvss_v2_score="3.5", cve.cvss_v3_score="5.4",
cve.publish_date="2022-01-12";

MERGE (cve:Cve { name: "CVE-2021-4104" })
ON CREATE SET cve.description="JMSAppender in Log4j 1.2 is vulnerable to deserialization of untrusted data when the attacker has write access to the Log4j configuration.
The attacker can provide TopicBindingName and TopicConnectionFactoryBindingName configurations causing JMSAppender to perform JNDI requests that result in remote code execution in a similar fashion to CVE-2021-44228. Note this issue only affects Log4j 1.2 when specifically configured to use JMSAppender, which is not the default.
Apache Log4j 1.2 reached end of life in August 2015. Users should upgrade to Log4j 2 as it addresses numerous other issues from the previous versions.",
cve.cvss_v2_score="6.0", cve.cvss_v3_score="7.5",
cve.publish_date="2021-12-14";
```

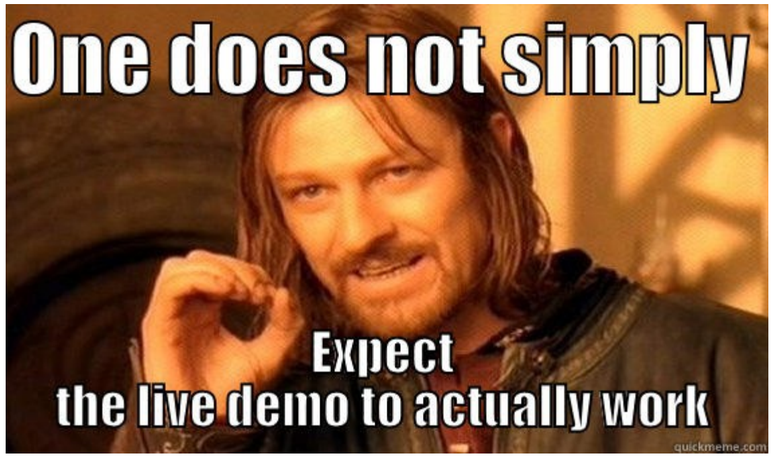
Data – Code Nodes and Edges to Vulnerabilities

```
// Code Nodes and CPE Edges

MERGE (code:Code:Repo { name: "easy_forms_for_mailchimp" });
MATCH (cve:Cve {name: "CVE-2021-24985" }),(code:Code { name: "easy_forms_for_mailchimp" }) MERGE (cve)-[:CPE { version_code: "<:6.8.6" }]->(code);
MATCH (cve:Cve {name: "CVE-2019-15318" }),(code:Code { name: "easy_forms_for_mailchimp" }) MERGE (cve)-[:CPE { version_code: "<:6.5.3" }]->(code);

MERGE (code:Code:Repo { name: "log4sh" });
MATCH (cve:Cve {name: "CVE-2005-1915" }),(code:Code { name: "log4sh" }) MERGE (cve)-[:CPE { version_code: "==:1.2.5" }]->(code);
MATCH (cve:Cve {name: "CVE-2005-1915" }),(code:Code { name: "log4sh" }) MERGE (cve)-[:CPE { version_code: "==:1.2.3" }]->(code);
MATCH (cve:Cve {name: "CVE-2005-1915" }),(code:Code { name: "log4sh" }) MERGE (cve)-[:CPE { version_code: "==:1.2.4" }]->(code);

MERGE (code:Code:Repo { name: "dolphin_browser" });
MATCH (cve:Cve {name: "CVE-2010-1730" }),(code:Code { name: "dolphin_browser" }) MERGE (cve)-[:CPE { version_code: "==:2.5.0" }]->(code);

MERGE (code:Code:Repo { name: "zipwrangler" });
MATCH (cve:Cve {name: "CVE-2010-1685" }),(code:Code { name: "zipwrangler" }) MERGE (cve)-[:CPE { version_code: "==:1.20" }]->(code);
```


PRESENTATION OVER S.
DEMO TIME!
memegenerator.net


Demo time


DEMO TIME


One does not simply
Expect
the live demo to actually work
quickmeme.com

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Thank you


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We're hiring!