SBOM Analysis

Transitive Dependencies & Supply Chain Lineage

Cybersecurity Use Cases: Full Code-to-Cloud Traceability with Neo4j

Based on: pedroleitao-neo4j/cyber-sbom

What is an SBOM?

The "Pre-packaged Meal" Analogy

Think of an application as a pre-packaged meal:

- The **label** lists the ingredients (libraries/components).
- Developers don't write everything from scratch; they use libraries.
- Those libraries use *other* libraries, creating a **hidden chain**.

The Goal: Move from guessing risk to total traceability.

The Problem: Hidden Ingredients

Traditional tools focus on top-level dependencies, missing Transitive Risks.

- **Invisible Chains:** Risks buried 4-5 layers deep in the software lineage.
- **Zero-Day Lag:** Finding affected apps manually can take weeks.
- **The Gap:** Disconnect between Development (code) and Operations (cloud servers).

The Solution: Cyber-SBOM Graph

Building on the VPEM (Vulnerability Prioritization) model, this solution provides:

1. **Transitive Traversal:** Navigating recursive `DEPENDENCY_OF` relationships.
2. **Zero-Day Resilience:** Instant impact analysis for new CVEs.
3. **Code-to-Cloud Visibility:** Linking vulnerable code directly to the **ComputeInstances** where it is running.

Core Project Architecture

1. Data Ingestion (`loader.ipynb`)

- Loads transitive dependency data into the VPEM graph.
- Simulates multi-tier software lineage.

2. SBOM Analysis (`sbom.ipynb`)

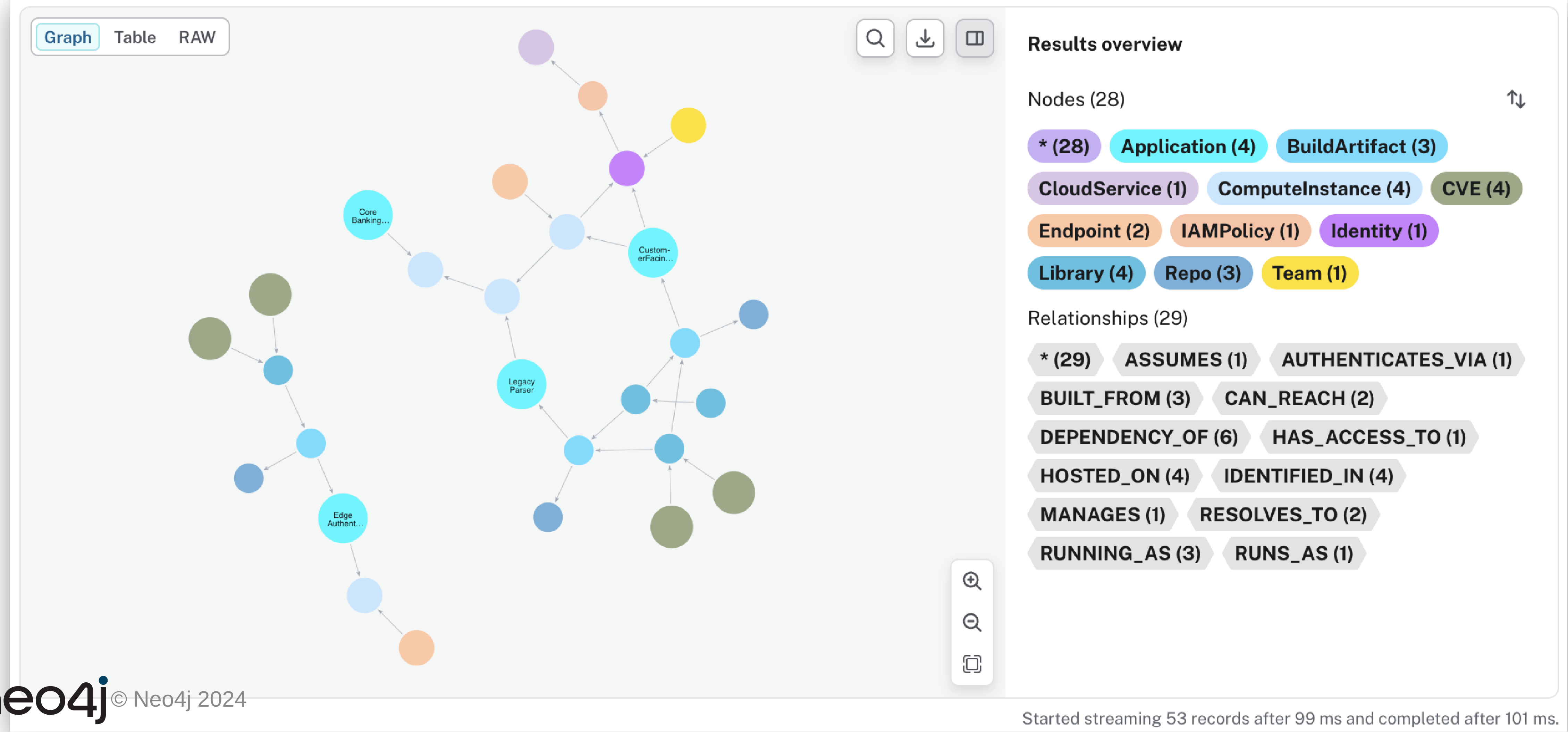
- Identifies vulnerabilities in deep dependencies.
- Maps risk to internet-facing production infrastructure.

Analysing the Blast Radius

The Application View Graph

- **Traceability:** Map the path from a poisoned 3rd-party library to a business app.
- **Exposure:** Correlate vulnerable code with infrastructure data.
- **Real-time:** See which internet-facing servers are running "at-risk" artifacts.

The Blast Radius Graph



The Resulting Graph Schema

The model uses a Security Knowledge Graph to map three distinct layers:

- **Layer 1: Threat Intel** (CVE, NVD, CISA KEV).
- **Layer 2: Software Lineage** (Recursive `DEPENDENCY_OF` relationships).
- **Layer 3: Infrastructure** (Build artifacts $\longrightarrow$ Applications $\longrightarrow$ ComputeInstances).

The Graph Advantage: Impact Analysis

Unlike flat lists, Neo4j allows for Transitive Dependency Traversal:

- **Impact Analysis:** Instantly find every server affected by a new vulnerability.
- **Chokepoint Discovery:** Find internal shared components that, if patched, resolve the highest number of reachable risks.
- **Remediation Efficiency:** Prioritize by "reachability" and "exposure."

System Integration & Output

The insights from this analysis flow into:

- **DevSecOps (CI/CD):** Automatically fail builds that introduce critical transitive risks.
- **Security Operations (SOAR):** Prioritize patching for internet-facing hosts.
- **Compliance:** Generate "Full Lineage" reports for regulatory requirements (e.g., Executive Order 14028).

Questions?

GitHub: pedroleitao-neo4j/cyber-sbom

Reference: VPEM (Vulnerability Prioritization and Exposure Management)