Interactive Visualization Dashboard for Common Attack Pattern Enumeration Classification

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OUTLINE

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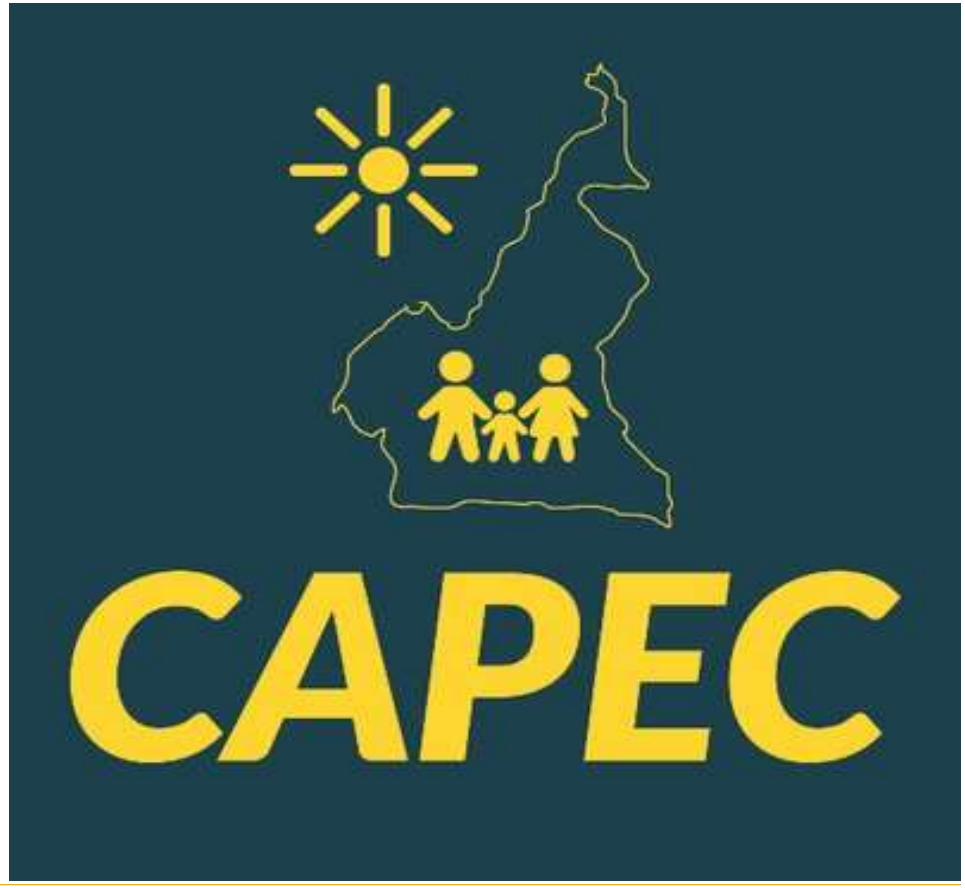
Introduction

- The current CAPEC release includes a list of 572 specific attack patterns.
- The goal of this research is to improve usability and provide a range of new capabilities for understanding and interacting with the rich content and relationships in CAPEC.
- Navigation of CAPEC web content relies on following parent-child hyperlinks in textual content.

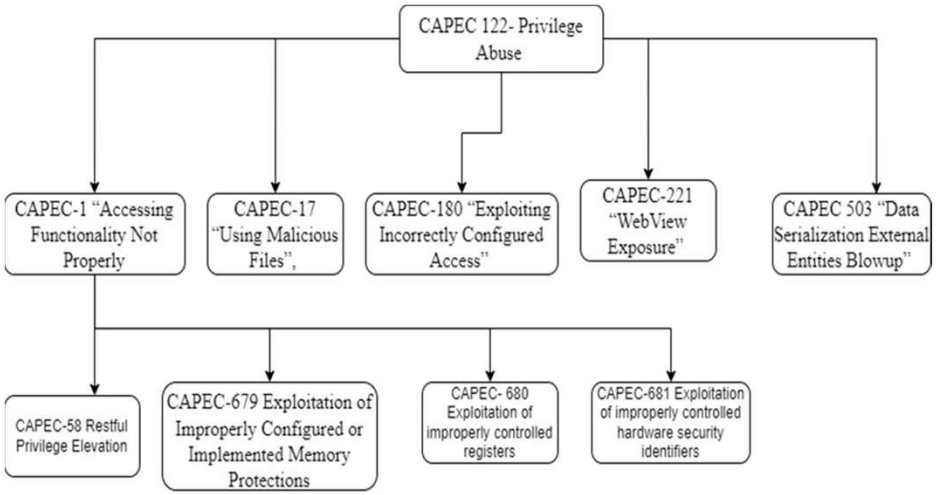


Background

CAPEC

- CAPEC attack patterns
- CAPEC attack are organized with parent and child hierarchy.

CAPEC-1, CAPEC 122, CAPEC-17, CAPEC-180, CAPEC-221.CAPEC-58,CAPEC-679,CAPEC-680,CAPEC-681



Background

Tree Map

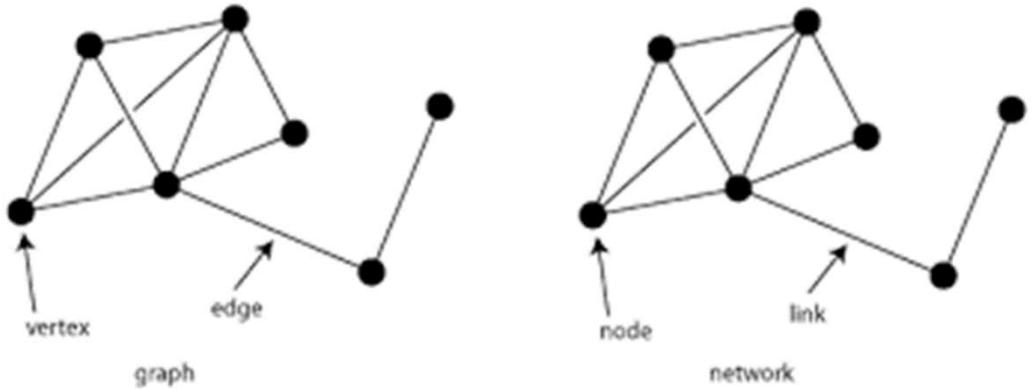
- Tree maps use rectangular space-filling layout.
- Rectangular and radial layout
- Basic tree map

Background

Network Graph

- Node-link diagram is the most common representation.
- visualize tree or hierarchical relationship.
- Not all of the nodes and links are created equally

Example of network graph



Background

Dash

- Plotly's dash library
- Dash-html components
- Interactivity is implemented with callbacks.

The CAPEC Visualization Dashboard

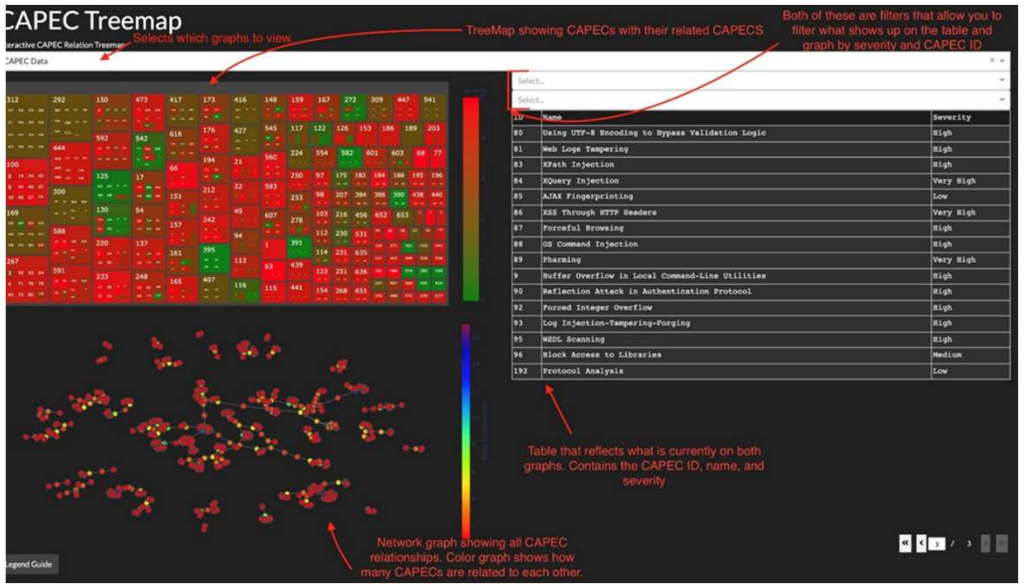
CAPEC attack Patterns

- Presents unique visualizations techniques for navigating the CAPEC taxonomy.
- Tree maps and network graphs are implemented using Dash, Plotly, Heroku, and MongoDB.
- The data obtained from MITRE'S CAPEC website in the form of a CSV is hosted on a MongoDB database.

Visualization of the CAPEC Data

- Visualization of CAPEC Data
- Graph display
- CAPEC Data or External Mapping
- Visualization of a tree map created using Plotly
- CVS is created with the columns parent, child, and severity.
- A network graph showing how a CAPEC attack pattern is related to other CAPEC attack patterns.

The figure below demonstrates the tree map and network graph to visualize CAPEC data

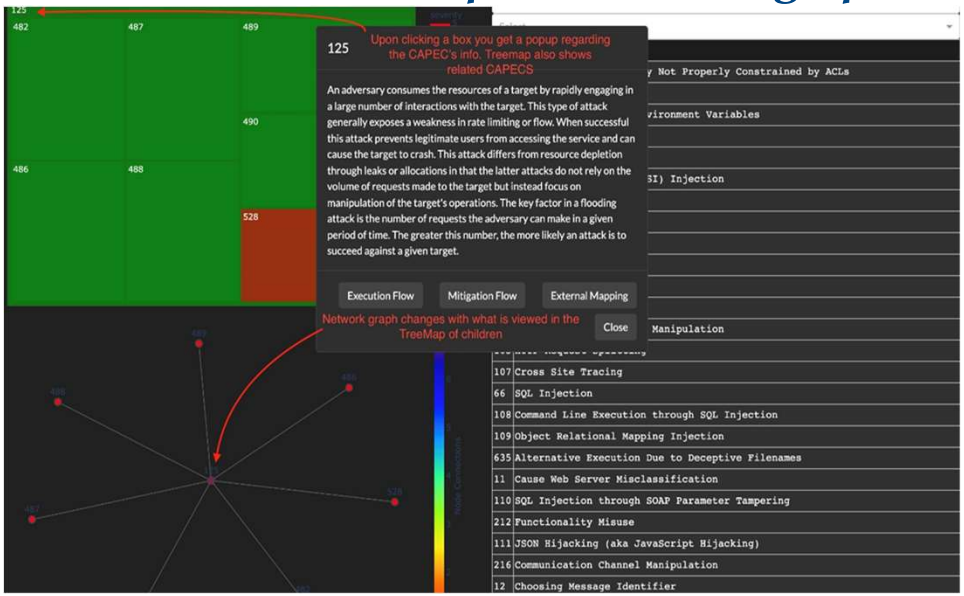


Visualization of the CAPEC Data

Continued

- Visualization dashboard allows user to select a CAPEC ID from the tree map to view detailed information of the CAPEC attack pattern.
- For example, in figure 3, if a user click on CAPEC-125 in the tree map, a window will pop up showing the description of CAPEC-125

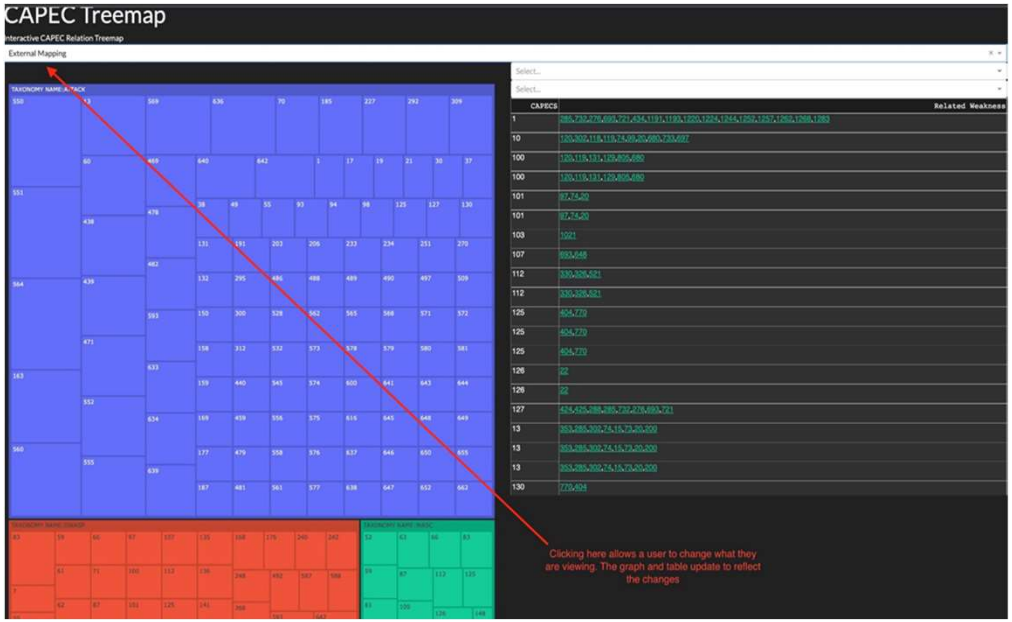
Figure 3 demonstrates the interaction between the tree map and network graph



Visualization of the CAPEC External Mapping

- The CAPEC attack patterns are mapped to ATT&K, OWASP, WASC and CWE weaknesses.
- In the figure , the left top rectangle in blue color shows the CAPEC IDs that are mapped to the ATT&K taxonomy.
- The left bottom rectangle in orange color shows the CAPEC IDs that are mapped to OWASP.
- The right bottom rectangle in green color shows the CAPEC IDs that are mapped to WASC.

Figure 4 demonstrates the attack patterns that are mapped to these taxonomies

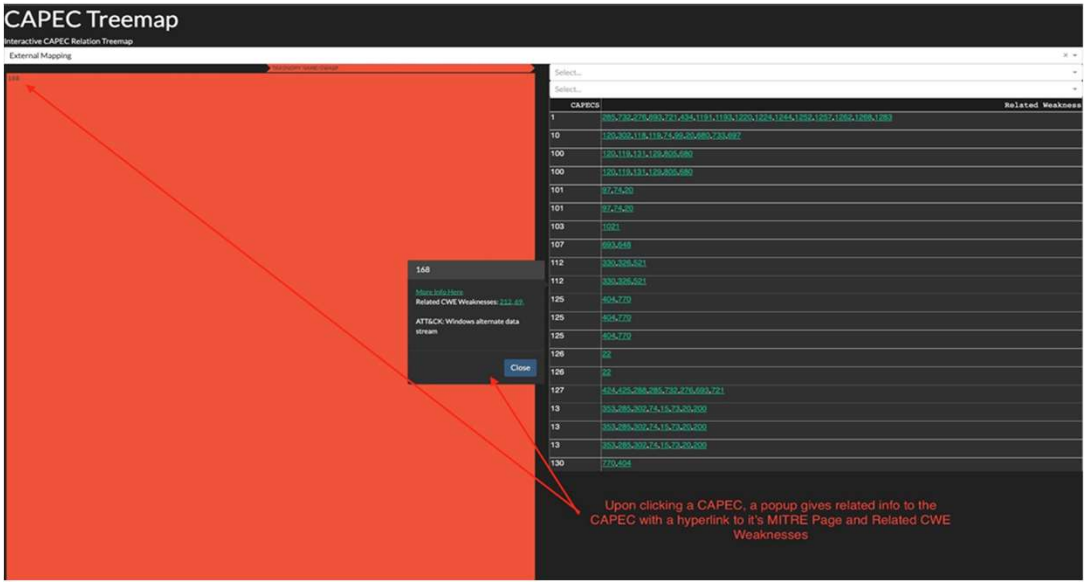


Visualization of the CAPEC External Mapping

Continues

- User can select and CAPEC ID
- Dashboard demonstrates the external mapping of any particular attack pattern.
- Figure 5 demonstrates the CAPEC-168.

Figure 5 demonstrates the pop up window to display external mapping information of CAPEC attack pattern.



CAPEC Treemap

- Website demonstrates different attacks of CAPEC through their taxonomy name.
- The interactive CAPEC relation treemap.

- https://ncat-app.88vos00tcm0k8.us-east-2.cs.amazonlightsail.com/

Related Work

- Noel visualized the overall hierarchical structure of CAPEC attack patterns using network graph, Sunburst visualization, Circular tree map, and Voronoi tree map.
- Conducted text mining and computed hierarchical clusters and grouped related attack patterns through automatic analysis.
- Used bipartite graph to visualize cross references from CAPEC attack patterns to CWE weaknesses.
- The goal of our tool is to allow users to receive such information easily.

Related Work

Continues

- Regainia and Salva proposed a methodology that takes as inputs CAPEC attack patterns, and infers relationships between attacks, weaknesses, security principles and patterns to generate the classification and Attack Defense Trees.
- Used software repositories like CVE(Common Vulnerabilities and Exposures) and CAPEC to help develop secure software.
- Developed a recommender system that recommends attack patterns relevant to the system under development based on software requirements and design documents.

Conclusion and Future Work

- Describe a web-based interactive visualization dashboard for the CAPEC attack patterns.
- Hierarchical structure of CAPEC attack pattern using tree map and network graph.
- The goal of this research
- This tool will help users to make use of CAPEC attack patterns.
- Developing secure software or conducting other security activities.
- For our future work, we want to conduct user study for the dashboard to assess the effectiveness of the tool in helping users understanding the structure of CAPEC.
- Make use of CAPEC attack patterns in their security tasks.

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Thank You