MasonBayesian-ATTaCK-Graph

GMU CYSE 650 - Summer 2024

Overview

Software translates MITRE's ATT&CK framework into a bayesian node representation. Input files must be in .json format and conform to MITRE standards as of July 2024 (ATT&CK 15.1), Output files will be in a .net format.

Walkthrough

From GitHub Repo:

1. Install dependencies `pip install pgmpy`
2. Place .json files into the input directory
3. Run `python JSONtoNET` in main directory
4. Terminal will display whether the conversion was a success/failure
5. If successful, output .net files will be available in the output directory, with copies of the original .json files in a backup sub-directory
6. Graphical output of these .net files works best with Java-based UnBBayes applicaiton

Overall Approach

- Recursive analysis of each file in input directory
  - Read data
  - Validate fit-to-format
  - Evaluate JSON nodes
  - Convert JSONtoNET
  - Backup JSON
- Read is done using default python libraries, directory structure rigid
- Validation is done using MITRE-distributed Structured Threat Information Expression (STIX), basic formatting errors are caught if variable fields are present
- Evaluation of nodes is done using **pgmpy**, sequential approach that groups nodes by their stronger relations to one-another and their inherited/parental status
- JSON to Net conversion done in plain-text, header is created and then each node is written in a 3-line format: label, position, and state
- JSON file is then backed up to a subfolder, to prevent potential data loss due to file conversion

MITRE STIX

- MITRE STIX used to format all data into one constant format
- Presence of basic variable fields will validate and conform data, there are minimal false negatives
- False positives occur due to not rigorously validating each field, which could be done via extended catch arguments for STIX format

https://github.com/mitre/cti/tree/master?tab=readme-ov-file#stix

https://github.com/mitre/cti/tree/master/enterprise-attack

pgmpy

- Python library for Bayesian network evaluation
- Implemented discrete pgmpy to represent scores for different ATT&CK values
- Each node generated is linked to other nodes via this library, which is then used by UnBBayes for graphical rendering
- Nodes are evaluated linearly with score, some grouping would be expected if this was to be fine-tuned for specific risk profiles.
- Superseded by scores provided via JSON

https://pgmpy.org/factors/discrete.html

Scenarios

1. General system vulnerability assessment
    - Determine where to commit resources for broad value
    - Inward focus

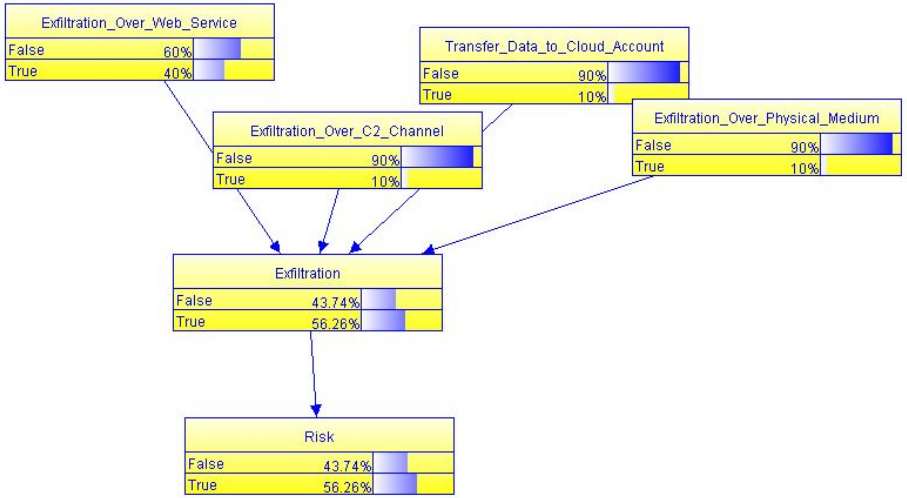
Concern has been expressed about the ability for a system to be exploited for data exfiltration should an adversary gain access to the system. All vectors of potential exfil were identified to evaluate the associated risk

2. Target adversarial assessment
    - Determine where to commit resources to minimize potential vulnerabilities or minitage damage
    - Outward focus

A comprehensive evaluation of a nation-state adversary was conducted due to taking on a high-risk client. After evaluating security shortfalls, targeted triage was conducted prior to onboarding the new customer.

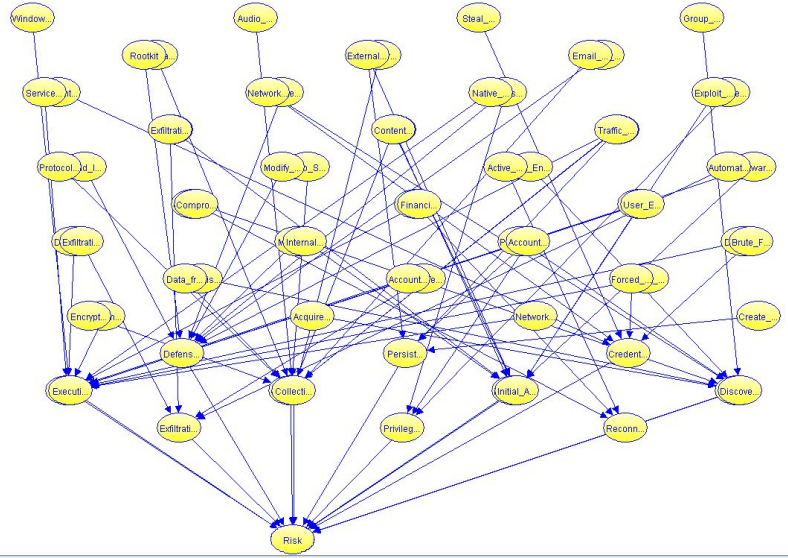
Scenario 1

- Scenario 1 provides a small focus on exfiltration risk, which is 1:1 with total system risk in this scenario.
- Risk is assessed at ~56%, as a result of 4 input risks of 10-40%



Scenario 2

- Extremely dense network graph based on target capabilities
- This scenario would benefit from an ability to evaluate risk logarithmically rather than linearly
- Overall values approach 100% due to quantity, hard to isolate particular areas of improvement
- Screenspace constrained by UnBBayes, could investigate increasing maximum window size



Questions?