Evaluating the Observability of Network Security Monitoring Strategies With TOMATO

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INTRODUCTION

- In order to deal with an attack on a network, the attack must first be detected. Therefore, we need to place sensors around our network to collect data that could signal a potential attack.
- However, how do we know where to place the sensors to maximize detection? Additionally, is the data we are collecting even relevant and accurate? If we collect all data, the chance for false positives increases.
- The measurement of how a network's monitoring strategies effectively address the above issues is called **observability.** In order to calculate observability, James Halvorsen, Jesse Waite, and Adam Hahn developed a tool called TOMATO.
- They already conducted research into the effectiveness of TOMATO, so our project is an extension of their previous work.
- We use a new SIEM/data aggregation tool called Wazuh which aggregates data from Suricata, Sysmon, and Windows Event Channels.
- The previous experiment used the ELK Stack (Elasticsearch, Logstash, and Kibana) to aggregate data from Sysmon, Windows Logs, and Netflows.
- As a result, our project seeks to test TOMATO on measuring the observability of more SIEM/data aggregation tools.
- We are also looking into the possibility of expanding the previous experiment by using new tactics.

MITRE ATT&CK FRAMEWORK

- A database of tactics and techniques that adversaries use against computer systems. It's based on real-world observations.
- It was developed by the MITRE corporation.

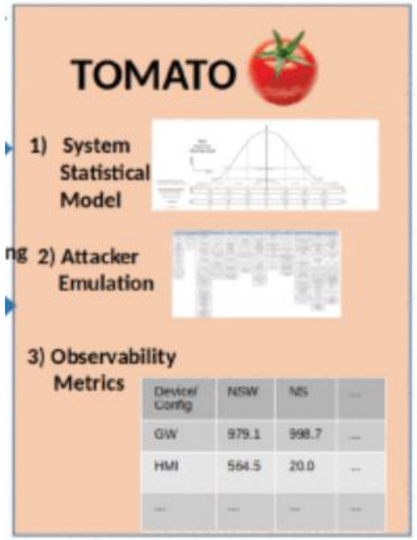

Figure 1: Graphic from "Evaluating the Observability of Network Security Monitoring Strategies With TOMATO". Depicts the general flow of the TOMATO tool.

TOMATO

- A tool made by James Halvorsen to measure the observability of a network's security monitoring strategies.
- Requires a graphical model of a network, a set of known attack tactics and techniques, and a real-time dataset.
- Using the real-time data, a conditional probability distribution is generated with respect to the techniques of the tactics we are observing. This distribution is used to get the local probability of observing features associated with the technique on a host and connection between hosts.
- Furthermore, a frequency matrix of the tactics used on the system is produced by generating sequences of attacks and simulating them on the graphical representation of our network.
- By combining the matrix of local probabilities of observing tactics with the frequency matrix of the tactics, TOMATO outputs a metric for each host in the network to help understand the effectiveness of sensor placement and quality of the overall data.

Network Graph of my setup

Name in Graph	agent.name in Wazuh
CMP1	DESKTOP-9LO9B7Q
CMP2	DESKTOP-D403BQC
CMP3	DESKTOP-0H8GJPO
CMP4	DESKTOP-CKP652S
Server	zachary-VirtualBox

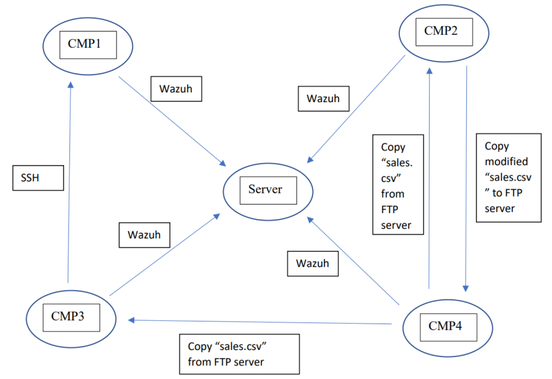

Figure 2: Graphic depicting our experimental setup.

EXPERIMENTAL SETUP

- Our experiment consists of five computers. Four are Windows 10 machines that generate network traffic between each other. The fifth is an Ubuntu Linux machine that hosts the Wazuh server.
- On all of the Windows 10 Machines, we use Wazuh agents to collect data from Sysmon, Windows Event Channels, and Suricata.
- This information gets stored in the Wazuh server and can be processed using the ELK Stack.
- **Sysmon**: A Windows system service that collects system information and logs it in the Windows Event log. We use it to log process creation events.
- **Windows Event Channels**: These channels store information on events that correspond to applications, security, and the system of a windows machine.
- **Suricata**: A network intrusion detection system that stores information on network events into and out of a host.

TACTICS

- **Discovery** - Discovery is when an attacker has gained access to an environment, which they then use to gain knowledge about the system and internal network. This process allows the adversary to examine the environment and determine their next course of action. Discovery is often a precursor to other attacks.
- **Execution** - Execution is often a remote attack where the attacker tries to run malicious code on a system. Execution is often paired with other techniques to achieve broader goals.
- **Lateral Movement** - Lateral movement is when an attacker gains control of one part of a network, which is then used to move further within the system. The adversary moves through the environment using different tactics, compromising systems and accounts in the process.

REFERENCES

J. Halvorsen, J. Waite and A. Hahn, "Evaluating the Observability of Network Security Monitoring Strategies With TOMATO," in *IEEE Access*, vol. 7, pp. 108304-108315, 2019, doi: 10.1109/ACCESS.2019.2933415.

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