

Segurança em Redes de Comunicações

Security in Communications Networks

Second Report

Professors:

Paulo Salvador salvador@ua.pt;
António Nogueira nogueira@ua.pt;

Objective: Define SIEM rules to detect anomalous network behaviors and possibly compromised devices. Test the defined rules on a data log of IP traffic flows, identifying the compromised devices.

Description:

A corporate network has a SIEM system with the historic data of traffic flows on the network. To implement a reliable Cybersecurity system it requires the implementation of alert rules, of possible attacks, based on anomalous behaviors.

Consider the dataset (datasetX.zip file) with files dataX.parquet, testX.parquet and serversX.parquet, where X is the remainder of the division of the sum of the student numbers by 10: in python:

$X = (\text{num_mec1} + \text{num_mec2}) \% 10$

Using data from one full day (file dataX.parquet) define the typical behavior of the network devices. This data was already fully analyzed and no illicit behavior was detected. You may assume that the IPv4 private address of each device does not change over time and is assigned to the same end-user.

The file testX.parquet contains data from a fully day and may contain anomalous behaviors resulting from illicit activities within the network, such as internal botnet activities, data exfiltration, and remote C&C of devices. The file serversX.parquet contains data from a fully day of external accesses to the corporation servers (in network 200.0.0.0/24) from a small set of client in the same network, and may contain external users interacting with the corporation servers in an anomalous way (tip: it is not the amount of traffic or flows).

Each *.parquet data files contain the list of all observed IPv4 data flows with the following information about each flow (columns):

- timestamp: time of observation of the first packet of the flow, in 1/100 of seconds from 0h of the day;
- src_ip: IPv4 source address (for dataX and testX files identifies the internal device, for the serversX file identifies the external client);
- dst_ip: IPv4 destination address (identifies the external or internal server);
- proto: transport protocol used (tcp or udp);
- port: destination port;qq
- up_bytes: total of uploaded bytes;
- down_bytes: total of downloaded bytes.

IMPORTANT NOTE: all public IPv4 addresses represent real networks, but (besides the flow statistics) only the owner and location are relevant. The real purpose/services of the same are not relevant! **DO NOT PERFORM SERVICE/VULNERABILITY SCANS ON THE IPv4 ADDRESSES!**

Data is structured using pandas, and stored in parquet format. See: <https://pandas.pydata.org/> and <https://parquet.apache.org/> . Check the provided python script (sampleScript.py) with basic examples on how to read and process the data file. Geo-localization based on the IPv4 address must rely on external databases (GeoIP_DBs.zip). Check also the provided python script with with basic examples on how to perform IP Geo-localization and DNS queries.

- Present a report with the proposed SIEM rules and rule tests (anomalous device detection). Submit via e-learning, in format PDF, until June 11th. Should be done by a group of 2 students. Exceptionally, can be done individually.

▪ Tasks:

- Analysis of the non-anomalous behaviors; identify internal server/services, describe and quantify traffic exchanges from internal users with internal and external servers, and describe and quantify traffic exchanges from external users with the corporation public servers (4 points).
- Definition of the SIEM rules and respective justification for detection of internal BotNet activities, data exfiltration using HTTPS and or DNS, C&C activities using DNS, and external users using the corporate public services in an anomalous way. (6 points).
- Test of the SIEM rules and identification of the devices with anomalous behaviors (6 points).
- Written report; structure and content (4 points).