Multi-layer Filtering for the Management of Alerts in Intrusion Detection Systems

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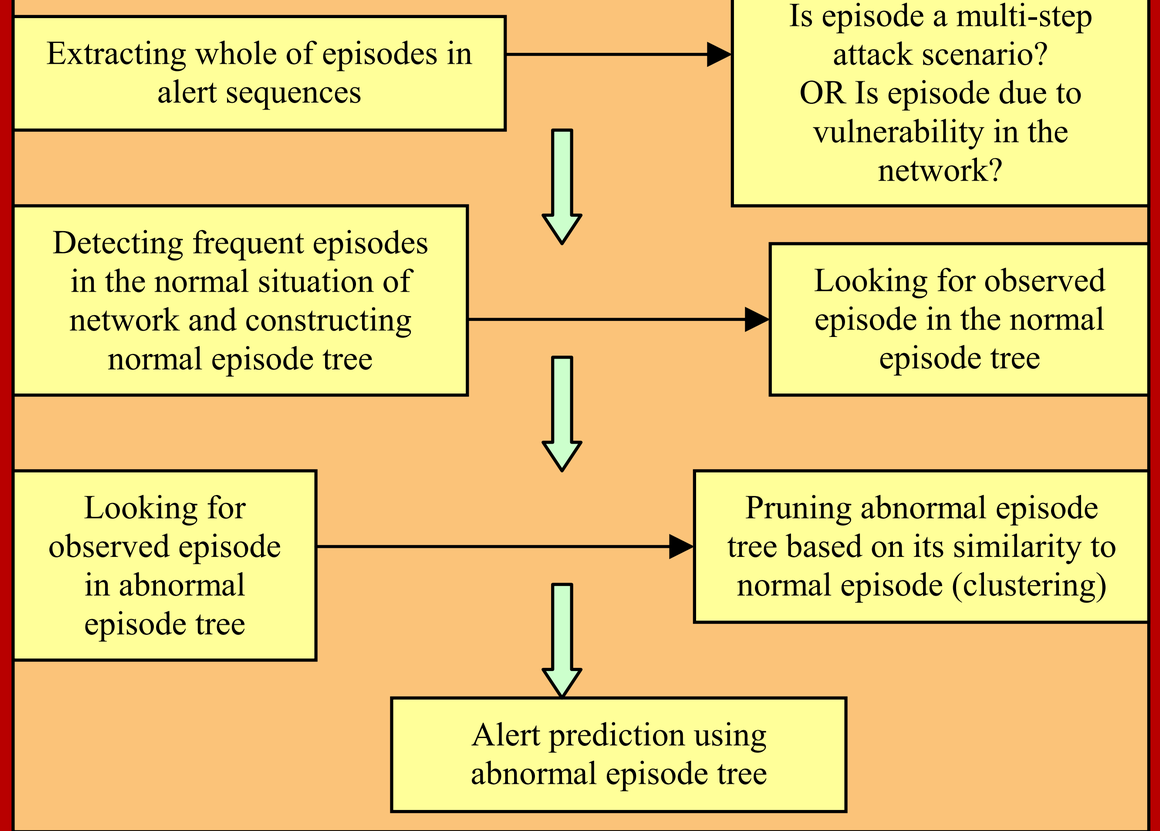
Motivation

Often Intrusion Detection Systems (IDSs) generate too many alerts in a typical network. Managing this huge amount of alerts and finding the important ones are the main goals of this research.

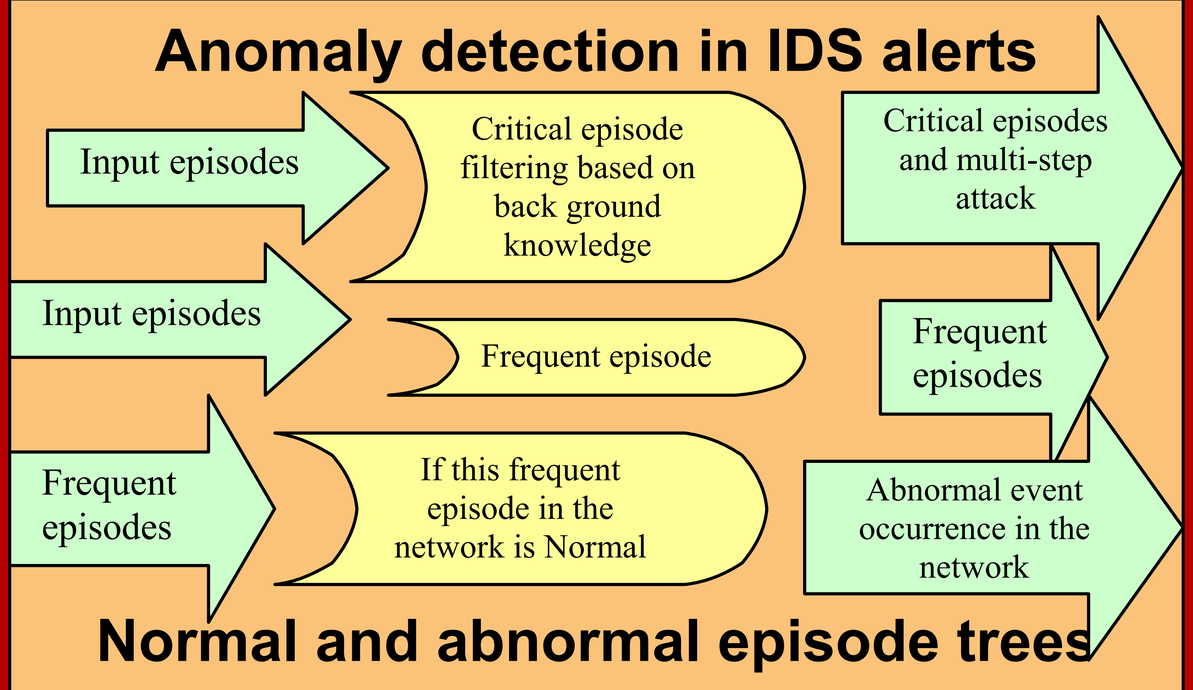
Methodology

- Multi-filtering approach for identifying critical alerts in a network, based on expert knowledge and machine learning methods.
- Determining normal behaviour of security devices and consequently normal alerts that are triggered frequently by an IDS in a particular network.
- Comparing normal behaviour with current frequent alerts that are generated by an IDS in the network to identify those alerts in the network which are more interesting for administrator.
- Using a combination of signature based IDS and an anomaly-based framework in our framework.
- Applying “Discovery of frequent episodes in event Sequences” algorithm for alert mining.

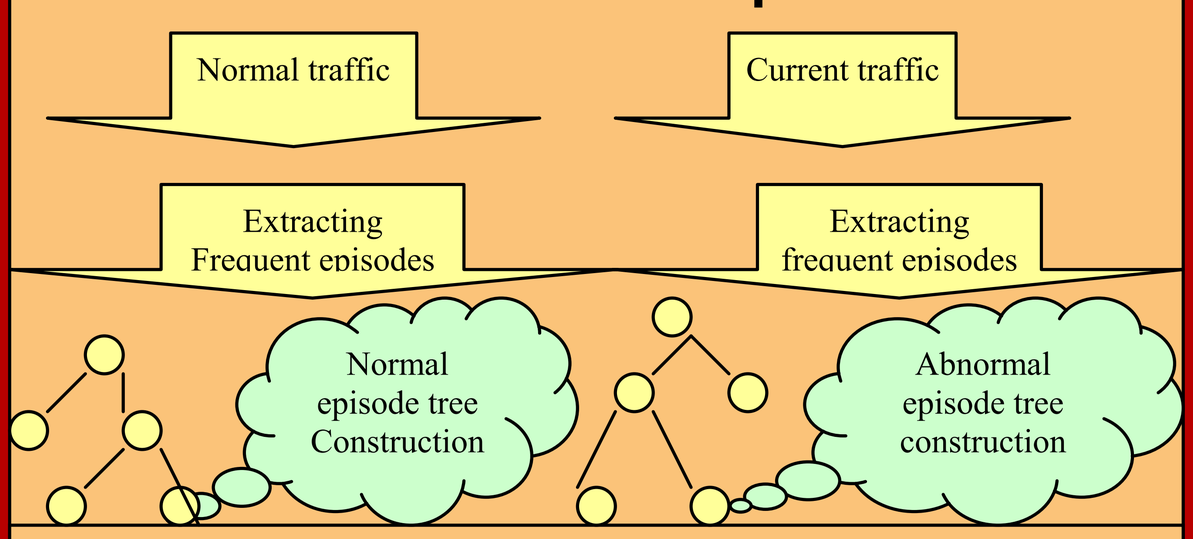
Multi-step filtering for alert reduction



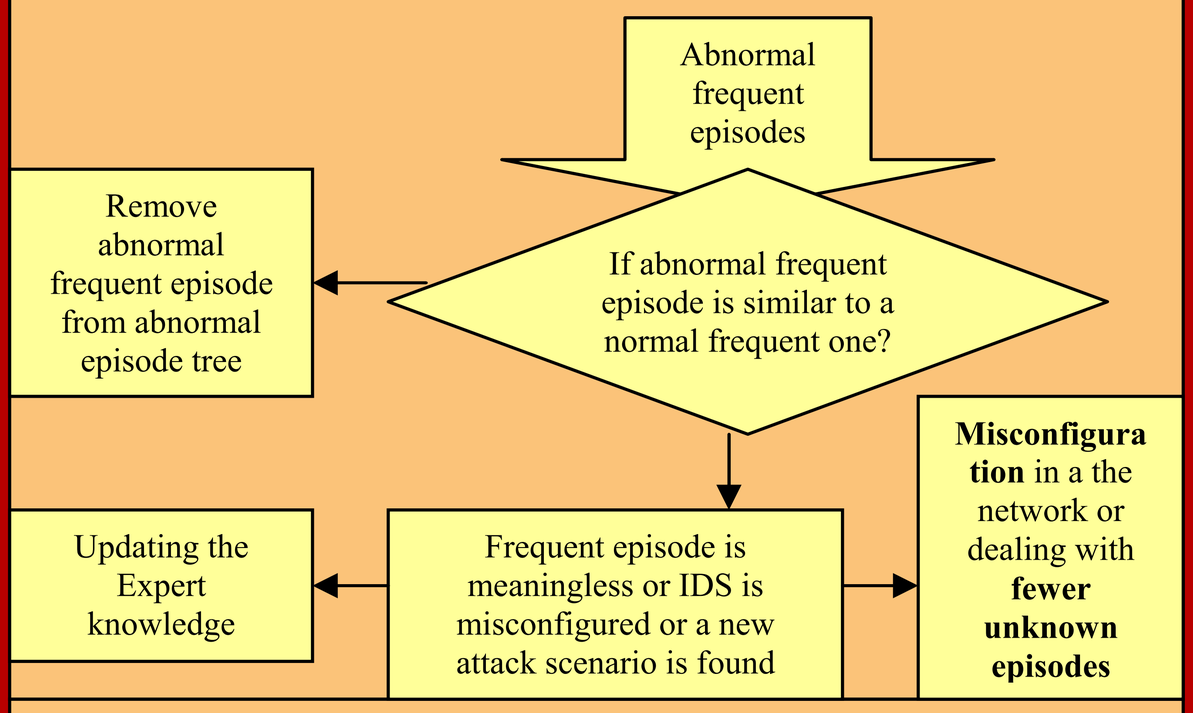
Anomaly detection in IDS alerts



Normal and abnormal episode trees



Clustering and pruning abnormal episodes tree



Episode rule extraction for attack prediction

Support (X) *= Percentage of alert sequences that contain alert X.*

Rule: X→ Y (s, c)

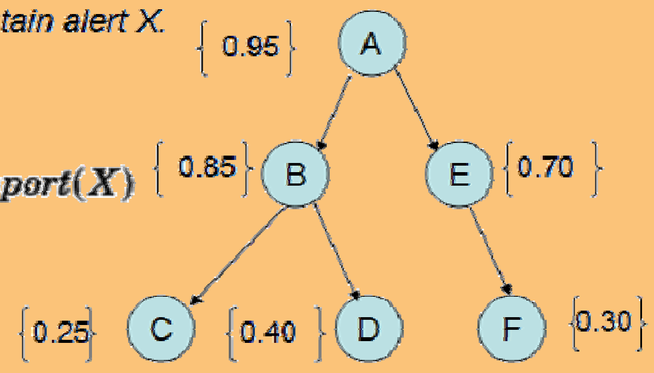
$$s = support(X \cup Y)$$

$$c = support(X \cup Y)/support(X)$$

Support , Confidence

A → B, [0.85, 0.89]

AE → F, [0.30, 0.42]



Results

Our method could extract all of critical and multi-step attacks in LL DDoS 1.0 data set while we had almost 90% reduction in number of alerts.