Factors for Differentiating Human from Automated Attacks

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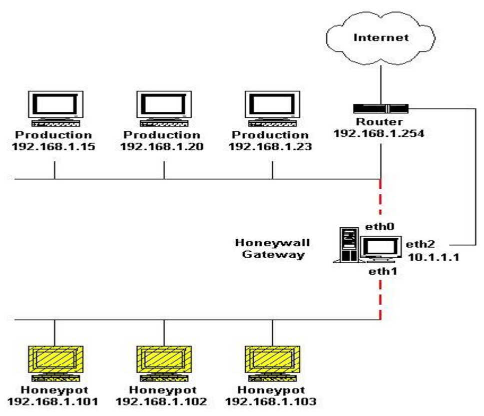
Background

- Recent cyber-crime costs are at an all-time high and still skyrocketing.
- Many Intrusion Detection Systems and Intrusion Protection Systems utilize behavior-based methodology, which seeks to identify a baseline for normal users that is then used to compare against *real-time* and *non-real-time* events in an effort to locate malicious activity
- The rise of automated attacks has created a great deal of noise for security personnel to wade through to identify malicious behavior and even with IDS systems, a human actor is still required to go through the logs to note is unusual activity is actually a threat.
- If a human based attack is significantly different than an automated attack it would be extremely useful for security personnel to have a way to separate the behavior of an automated cyberattack tool from that of a human actor, as this would allow them to create separate tools to deal with each.

Research Goals

- **Long-term Project Goals**
  - Evaluate the viability of event time-difference and event pattern-occurrence as factors in behavior-based Intrusion Detection Systems for differentiating between human and automated program behavior.
  - In the future, determine how these factors can be added into Intrusion Detection Systems to help identify attackers swiftly.
- **Short-term Goals**
  - Develop and finalize protocol for capture and analysis of honeypot machine-log data administered over by the National Center for Supercomputing Applications
    - Honeypots are a type of security architecture set up to gather information on malicious activity



  - Identify any trends or regular activity in the data

Methods

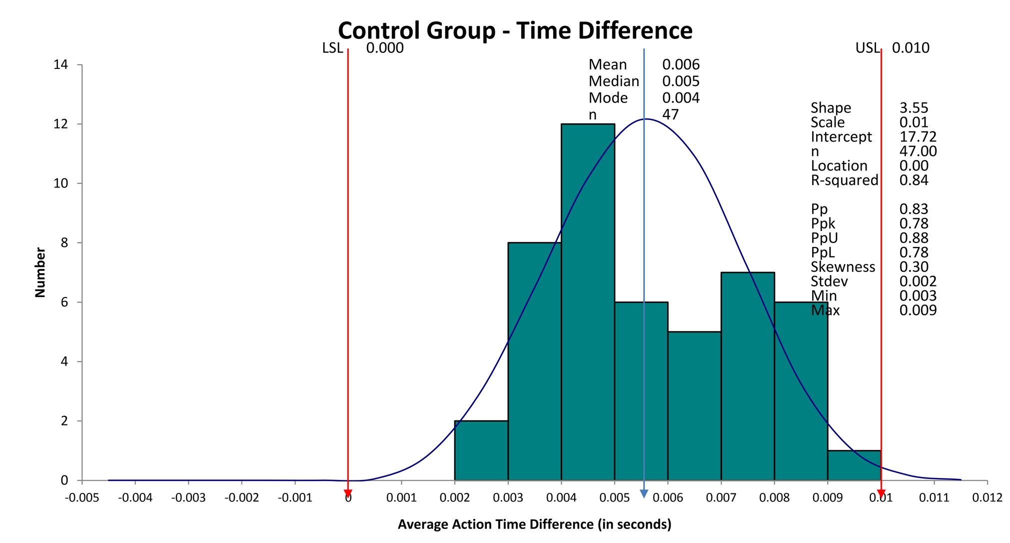
1. Organized honeypot log files by time/event/datatype

Timestamp (date)	Timestamp (time)	Event Time Difference (in seconds)	SSHD Number	Event
2015-11-12	11:42:24.172574		19698	Accepted password for … from … port … ssh2
2015-11-12	11:42:24.174622	0.002	19698	pam_unix(sshd:session): session opened for user … by (uid=0)
2015-11-12	11:42:24.981013	0.806	19698	Received disconnect from …: 11: disconnected by user
2015-11-12	11:42:24.981024	0	19698	pam_unix(sshd:session): session closed for user …

2. Employed Syntactic Pattern Recognition of events in order to establish patterns

Timestamp (date)	Timestamp (time)	Event Time Difference (in seconds)	SSHD	SSHD Pattern
2015-11-12	11:42:24.172574		19698	
2015-11-12	11:42:24.174622	0.002	19698	
2015-11-12	11:42:24.981013	0.806	19698	
2015-11-12	11:42:24.981024	0	19698	7 8 5 9

3. Pulled CRON (known program) patterns/times/frequency to form control



Preliminary Results

- Protocol creation complete
- **Trends and Regular Activity**
- The entire network test group (n=63) averaged 4.67 ± 1.88.
- The combined keystroke test group (n=190) averaged .26 ± .04 seconds.
- The keystroke data revealed four unknown *Pattern Groups*, two of which were individual events.
- While the network group had a total of seven unknown *Pattern_Groups,* two of which were individual event occurrences.
- In both the keystroke and network test groups there were several *Pattern_Groups* that occurred very quickly within a small duration of time. (see Figure 1
- There were also groups that took significantly longer to occur and were rarer. (see Figure 2)

Figure 1:

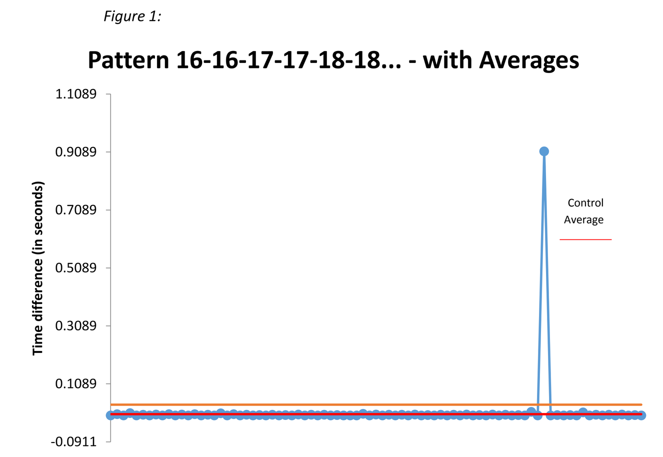
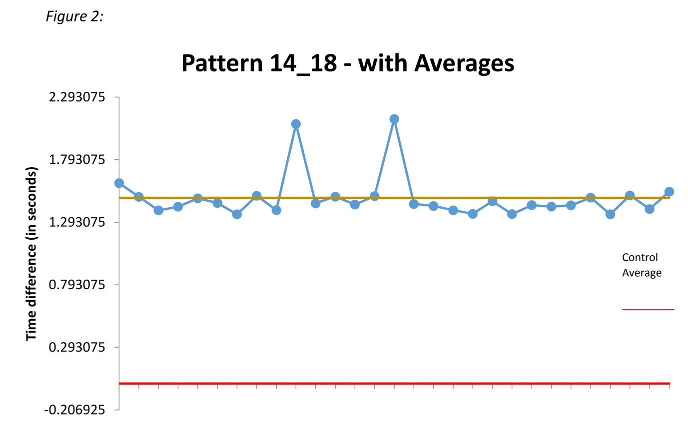


Figure 2:



Conclusions

- Some groups complete events within a rapid period of time, and repeat the same pattern of events over and over with little to no deviation.
- Other groups take a longer period of time to complete events and fall outside the standard deviation.
- This initial research has shown that *Pattern_Occurrence* and *Time_Difference* are indeed likely viable factors to separate human behavior from automated program behavior in an IDS and need further study

Future Research

- Obtain larger sample size to replicate preliminary results and improve statistical signifigance
- Establishing a way to add normalized human behavior data (as honeypots servers, by design, do not have regular users)
- Designing an experiment to control for issues like distance-from-server lag, IP bounce, etc.

Acknowledgments

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