Defensive Security Project

Virtual Space Industries (VSI)

Security Operations Center

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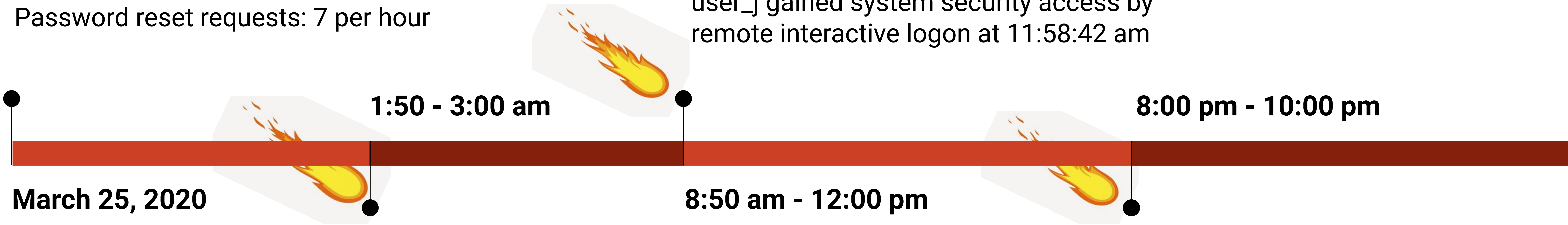
Scenario - Security Operations Center (SOC) Overview

- Why Are We Here?
  - March 25, 2020 attack
- Current Environment
  - Increased risk for cyber-attacks (e.g., rumors about JobeCorp)
  - Monitoring Tool, Reports, and Alerts
- Attack Analysis
- Attack Summary
- Remediation Recommendations

Why Are We Here?

March 25, 2020 Attack Timeline

Pre-Attack Baseline
HTTP Posts: 30
Deleted accounts: 4,726
Password reset requests: 7 per hour



March 25, 2020

1:50 - 3:00 am

8:50 am - 12:00 pm

8:00 pm - 10:00 pm

Attack 1: DDoS
User accounts locked out from
1 am to 2 am (high of 896),
mostly with user_a
Drop in deleted accounts at 2 am
HTTP POST = high of 785

Attack 2: Brute Force and Access Gain

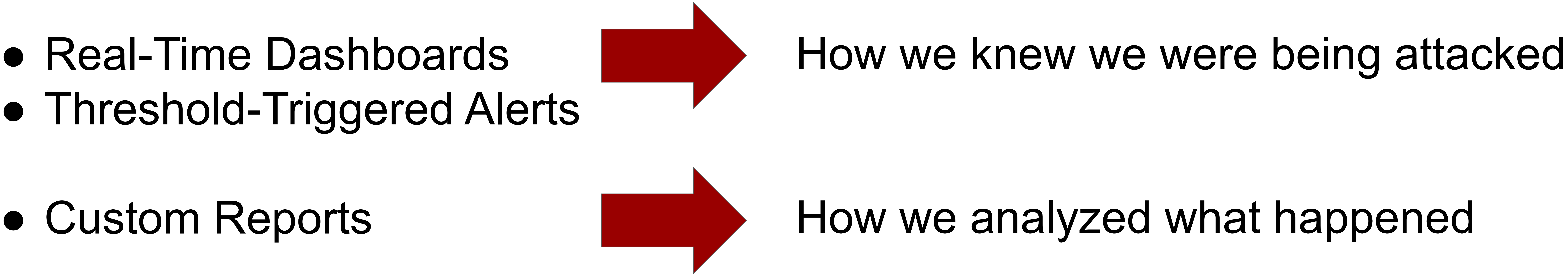
Password reset requests from NY IP: 1,296
High level of 1,256 logins by user_k at 9am
Password reset attempts: 1,258
Spike in successful logins: 196
user_j removed User_e from system security access at 11:55:50
user_j gained system security access by remote interactive logon at 11:58:42 am

Attack 3: Possible File Injection
Ukrainian IPs in Kyiv and Kharkiv
POSTing to /VSIAccount_logon.php
POST activity = high of 864
URI hits = high of 1,323

Current Environment

Splunk Enterprise Security

Application used to analyze large data sets, detect malicious network activity, and respond to threats quickly and accurately



- Real-Time Dashboards
- Threshold-Triggered Alerts

How we knew we were being attacked

- Custom Reports

How we analyzed what happened

Website Monitoring (Splunk Add-on)

- Monitors websites to detect downtime and performance problems
- Uses a modular input that can be set up easily (in five minutes or less)
- Provides excellent presets for the dashboard
  - Uptime Calculation
  - Status Monitoring
  - Email Outage Alerting
  - Change History
- Monitors real-time network activity and alerts to potential DDoS attacks such as occurred on March 25, 2020 at 08:59:00 pm
  - Greater than 3,000 HTTP response codes were generated by the Apache web server in a one-minute time span (indicative of a DDoS attack).

Built by Luke Murphey

Logs Analyzed

1 Windows Logs

The Windows Server holds the intellectual property of the VSI next-gen program.

Operating system activity is recorded in the Security Log to track activity and keep a record of Server events.

This helps to identify unwanted actions (e.g., unauthorized access to privileged files).

Windows Server

2 Apache Logs

The Apache Log server contains the modules that deliver VSI web content through our webpages.

The modules include security measures such as password authentication and other features.

APACHE HTTP SERVER PROJECT

Monitoring Reports & Alerts

Reports — Windows

Designed the following Windows Server Reports:

Report Name	Report Description
Windows Activities	Tracks the success and failure of activities in Windows
Severity Count & Percentage	Displays the count and percentage of severity in Windows
Signatures & Signature IDs	Provides all signatures used and gives associated signature IDs

Windows Server

Alerts — Windows

Designed Failed Windows Activity Alert:

Alert Name	Alert Description	Alert Baseline	Alert Threshold
Failed Windows Activity Alert	More than 10 failed Windows logins	7	When the number of failed logins is > 10

Failed Windows Activity Alert

Our threshold was set at the max number of failures in the baseline data. The minimum number of failed logins was 2, the average was 7, and the maximum was 10. The historical data did not exceed 10.

Alerts — Windows

Designed Successful Logon Alert:

Alert Name	Alert Description	Alert Baseline	Alert Threshold
Successful Logon Alert	Successful logins greater than 15	10	> 15 successful logins per hour

JUSTIFICATION:

Our threshold was set our tolerance level below the max number in the baseline data. The minimum number of failed logins was 8, the average was 13, and the maximum was 21 (which was an outlier).

Alerts — Windows

Designed User Account Deletion Alert:

Alert Name	Alert Description	Alert Baseline	Alert Threshold
User Account Deletion Alert	Deleted user accounts exceed max threshold	11	User account deletion exceeds 20

JUSTIFICATION:

The threshold was set our tolerance level due to the wide range in the baseline data. The minimum number of deleted user accounts was 5, the average was 11-12, and the maximum was 22.

Reports — Apache

Designed the following Apache Server Reports:

Report Name	Report Description
Count of HTTP Methods	Counts the HTTP Methods during time frame
Count of HTTP Response codes	Number of completed HTTP requests by response code
Hourly International Activity (excluding USA)	Activity from countries other than the United States
Top 10 Referrer Domains	Top domains from which visitors came to our website

Alerts — Apache

Designed the following Apache Alerts:

Alert Name	Alert Description	Alert Baseline	Alert Threshold
Hourly International Activity	Number of attempts per country per hour	14 - 110	> 110

JUSTIFICATION: In pre-attack data, baseline = min of 14 and max of 110. The threshold was set at the max.

Alerts — Apache

Designed the following Apache Alerts:

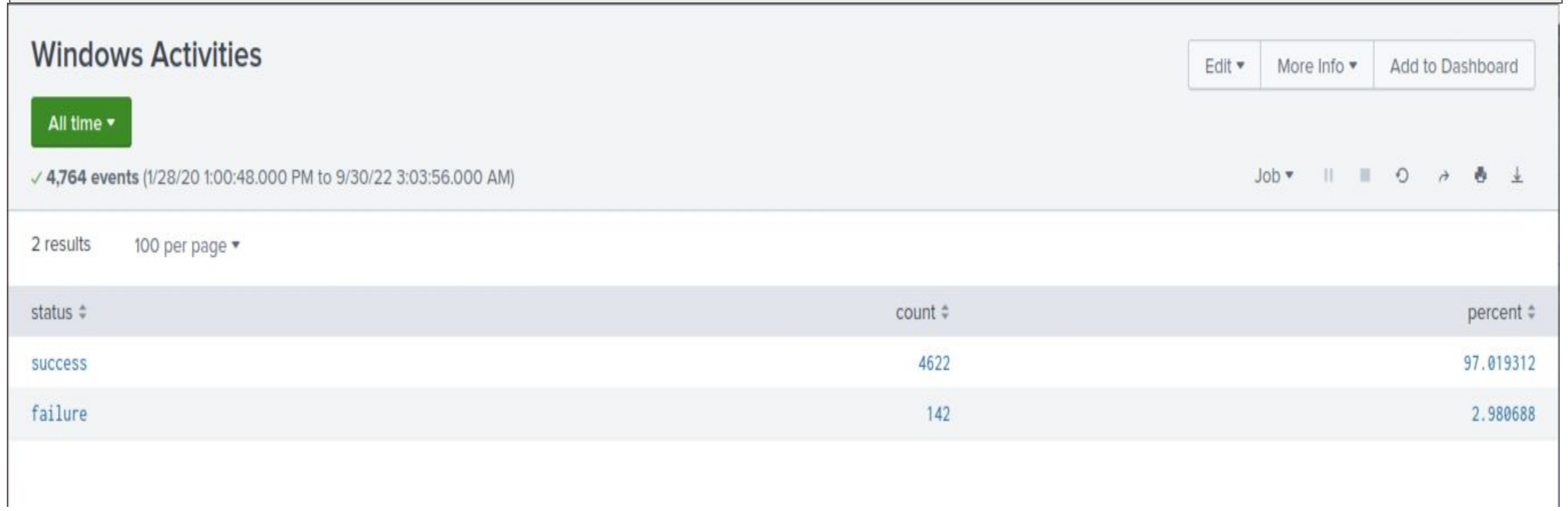
Alert Name	Alert Description	Alert Baseline	Alert Threshold
Hourly HTTP POST Method	Number of POST processes above threshold	< 6	> 6

JUSTIFICATION: The baseline ranged from 0 to a max of 7. The threshold was set greater than 6.

Attack Analysis

Pre-Attack Images of Reports – Windows

Pre-Attack Windows Activities

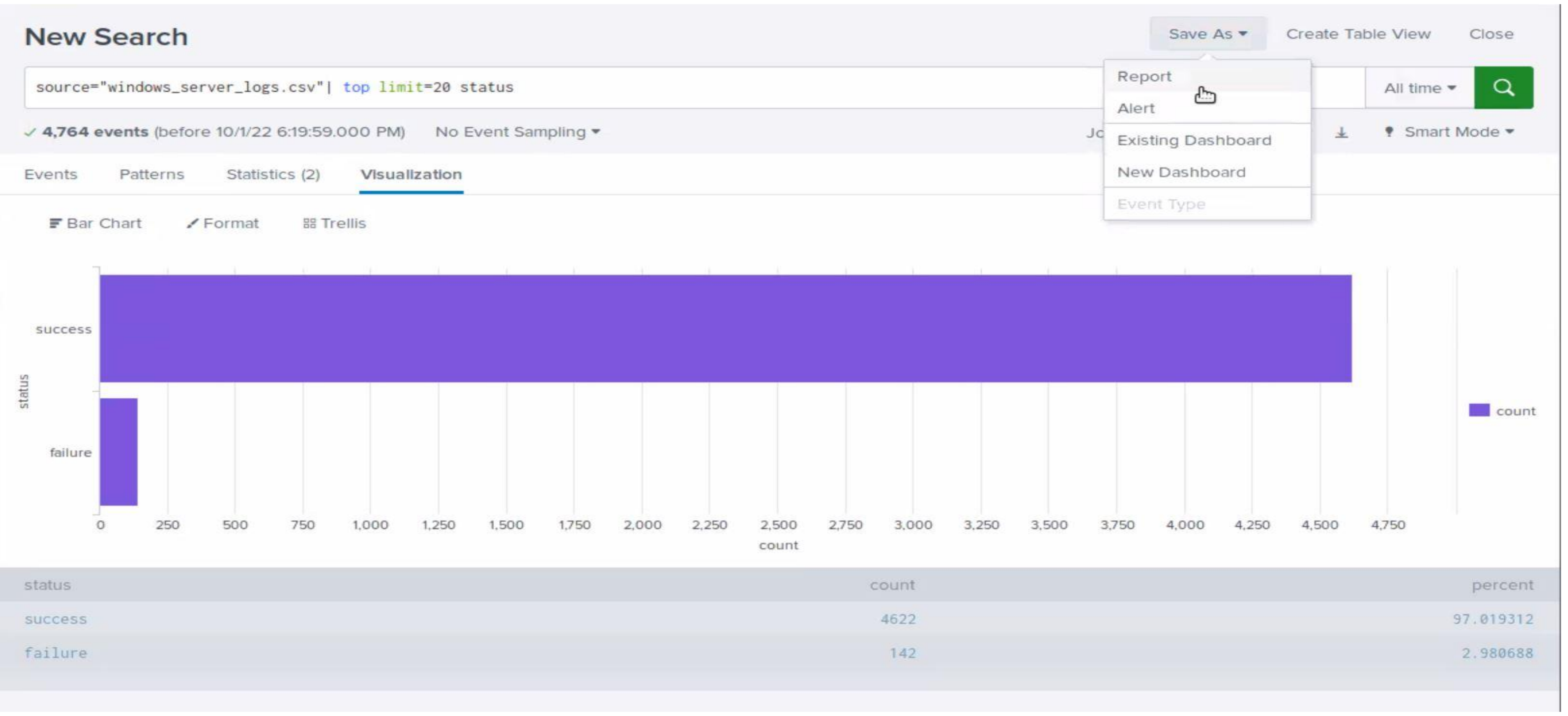


Windows Activities

✓ 4,764 events (1/28/20 1:00:48.000 PM to 9/30/22 3:03:56.000 AM)

2 results

status	count	percent
success	4622	97.019312
failure	142	2.980688



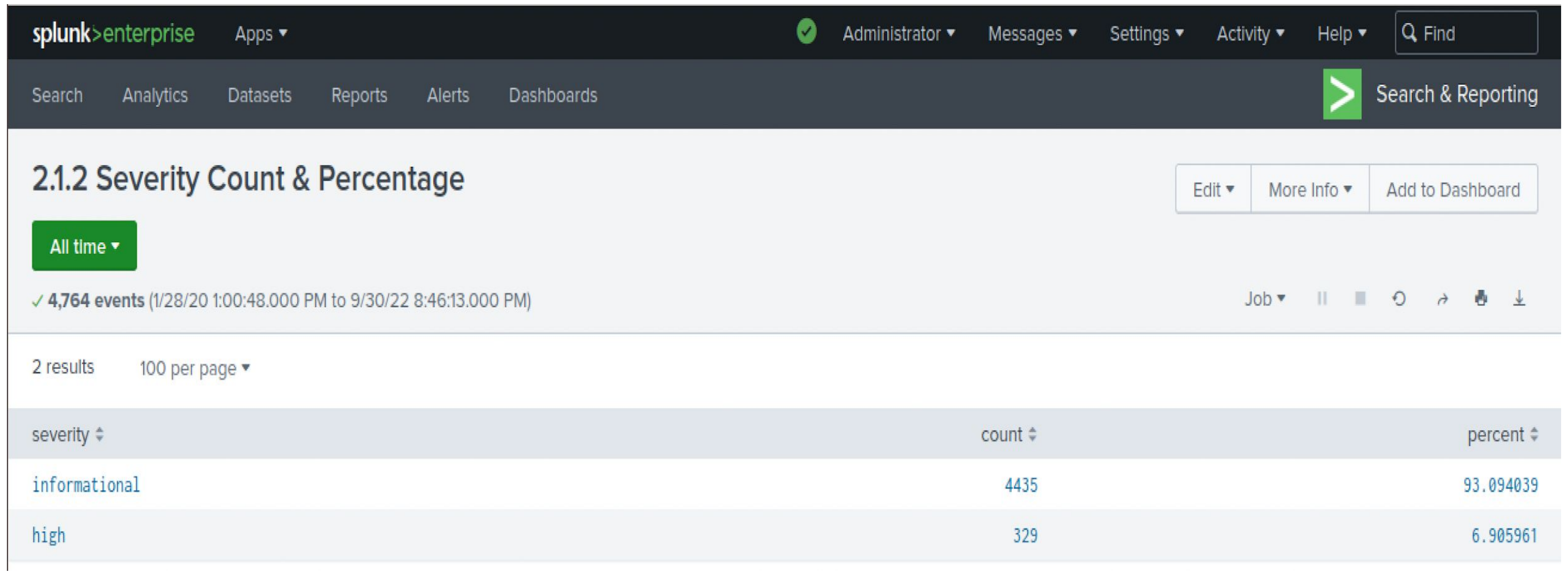
New Search

```
source="windows_server_logs.csv"| top limit=20 status
```

✓ 4,764 events (before 10/1/22 6:19:59.000 PM)

status	count	percent
success	4622	97.019312
failure	142	2.980688

Pre-Attack Severity Count & Percentage

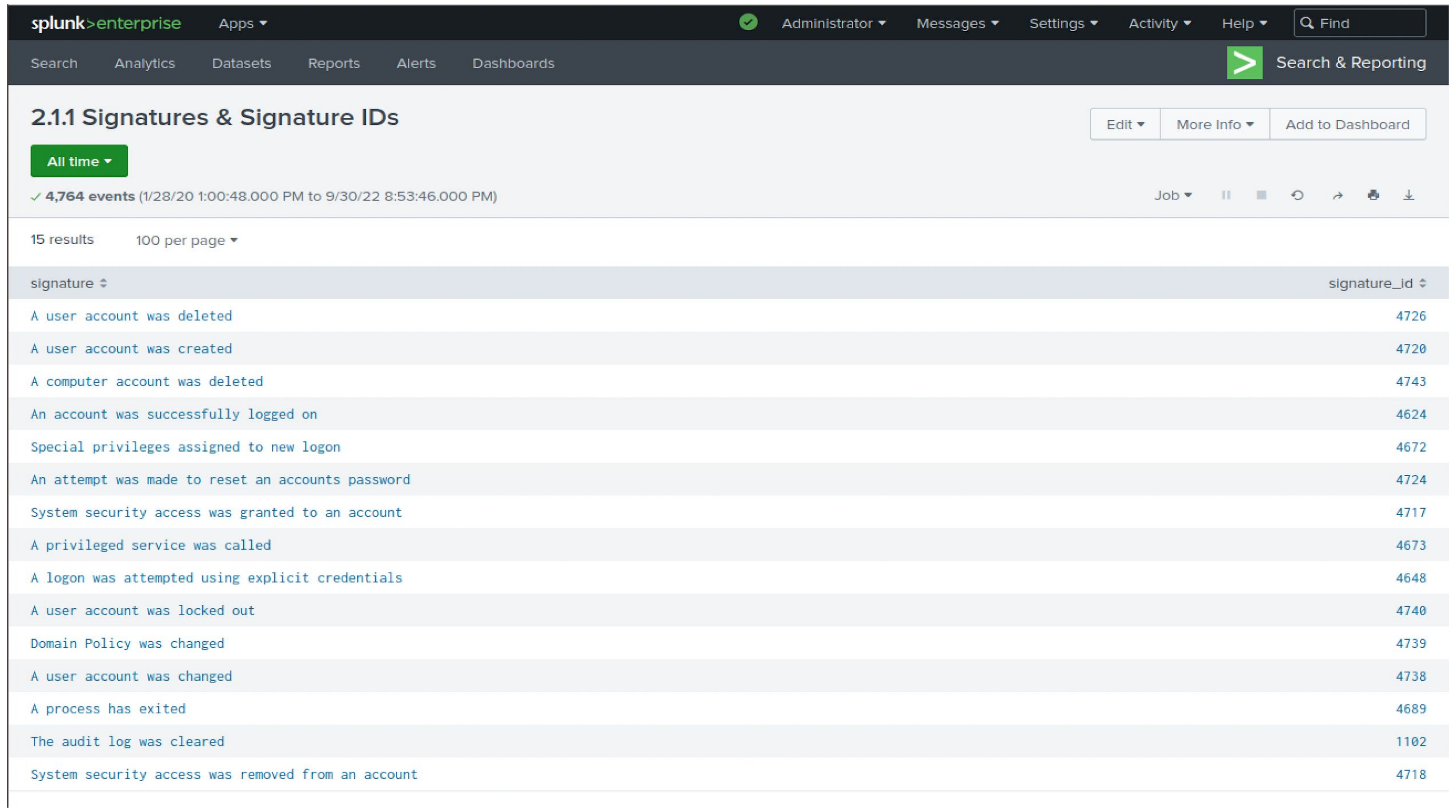


2.1.2 Severity Count & Percentage

✓ 4,764 events (1/28/20 1:00:48.000 PM to 9/30/22 8:46:13.000 PM)

2 results

severity	count	percent
informational	4435	93.094039
high	329	6.905961



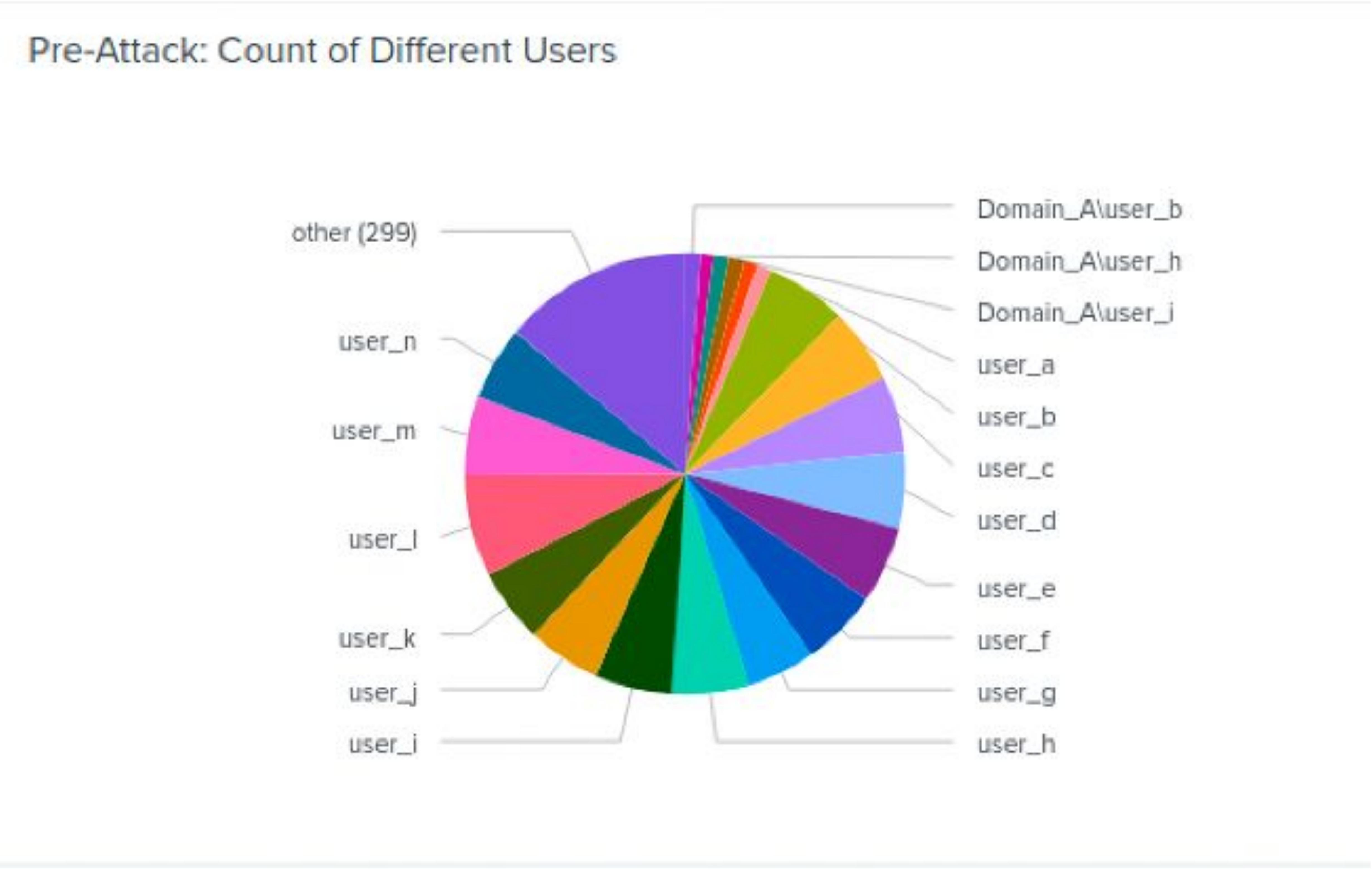
2.1.1 Signatures & Signature IDs

✓ 4,764 events (1/28/20 1:00:48.000 PM to 9/30/22 8:53:46.000 PM)

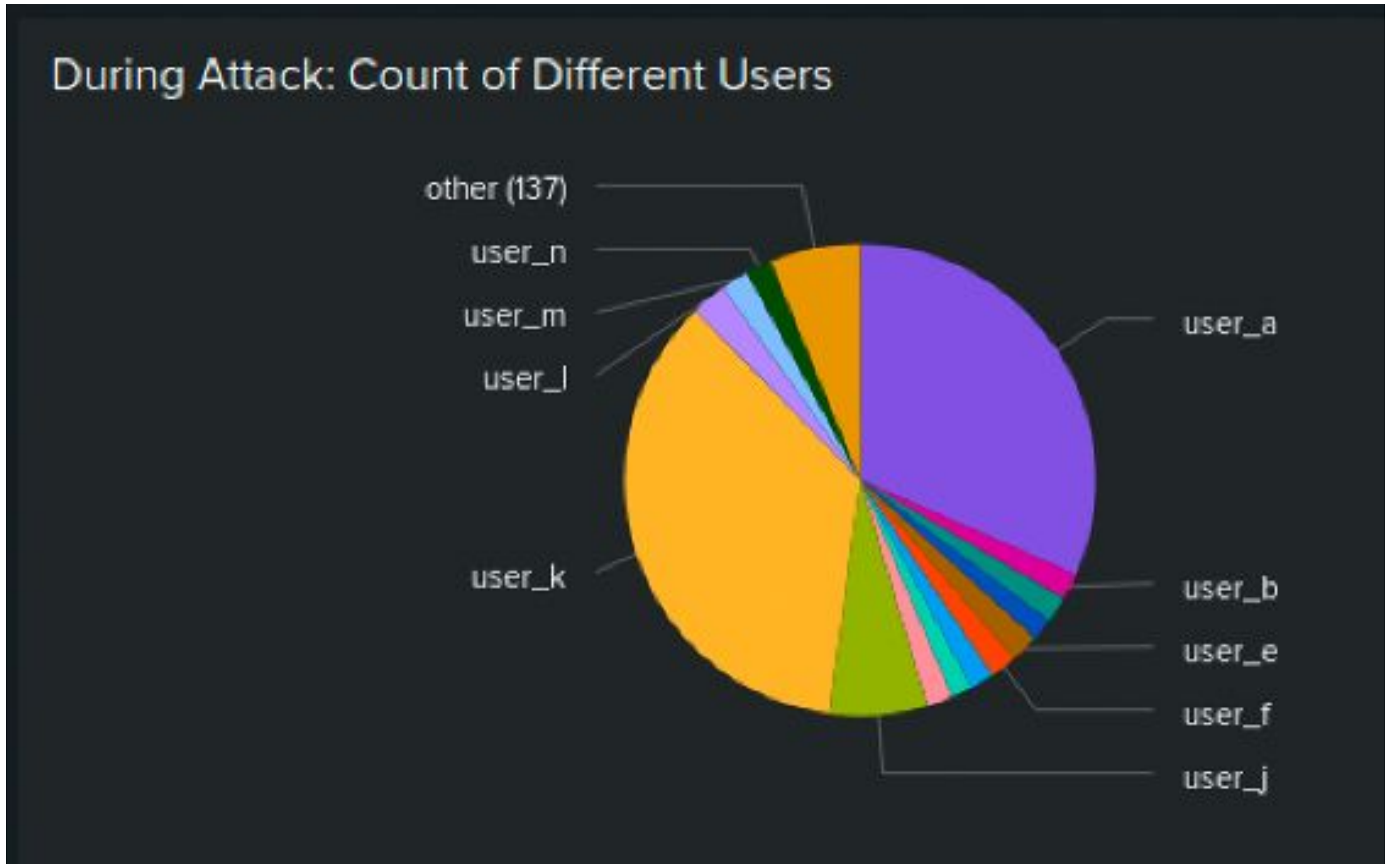
15 results

signature	signature_id
A user account was deleted	4726
A user account was created	4720
A computer account was deleted	4743
An account was successfully logged on	4624
Special privileges assigned to new logon	4672
An attempt was made to reset an accounts password	4724
System security access was granted to an account	4717
A privileged service was called	4673
A logon was attempted using explicit credentials	4648
A user account was locked out	4740
Domain Policy was changed	4739
A user account was changed	4738
A process has exited	4689
The audit log was cleared	1102
System security access was removed from an account	4718

Windows Server Dashboard – Pre- and During Attack

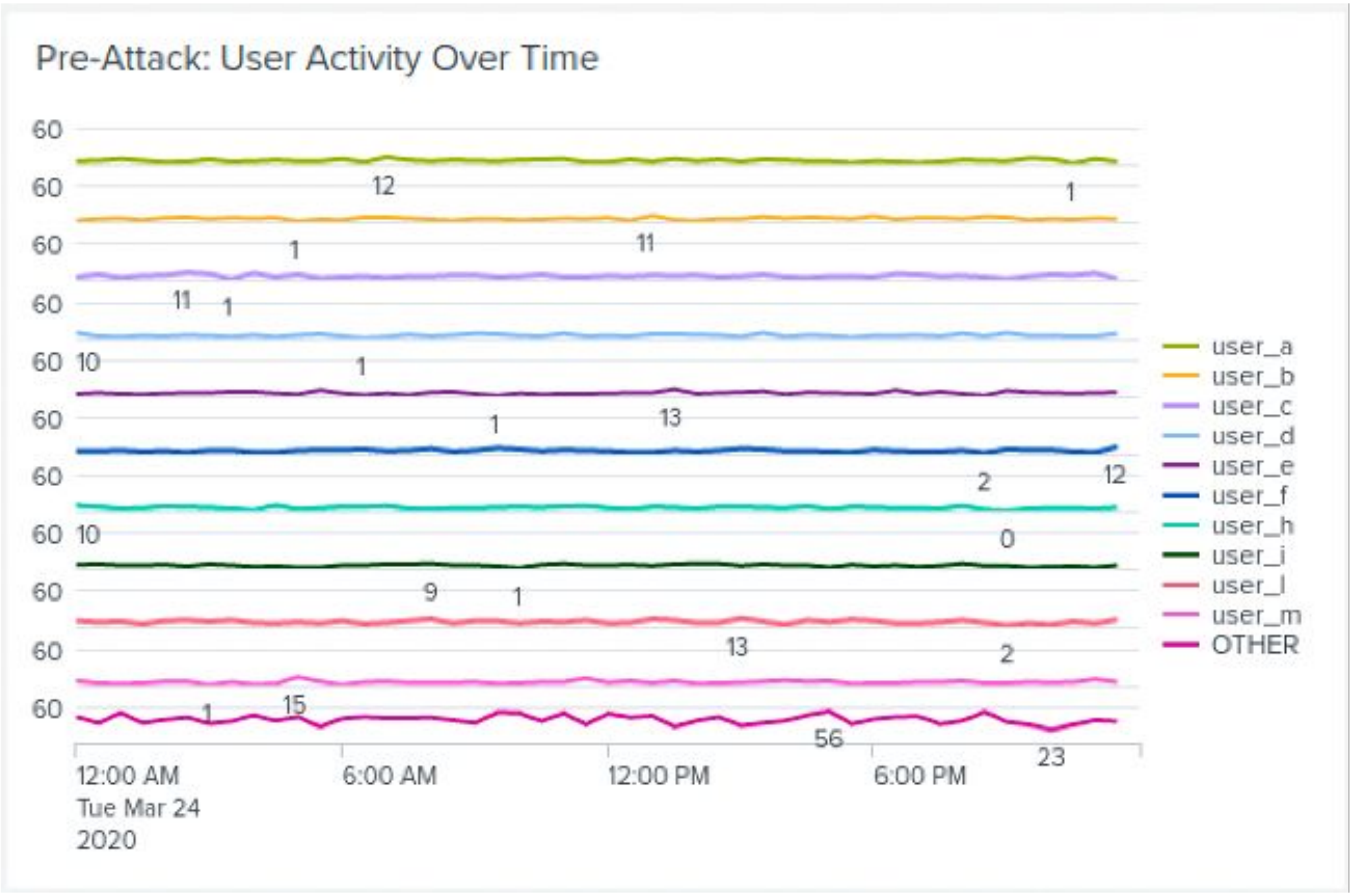


Pre-Attack: Count of Different Users

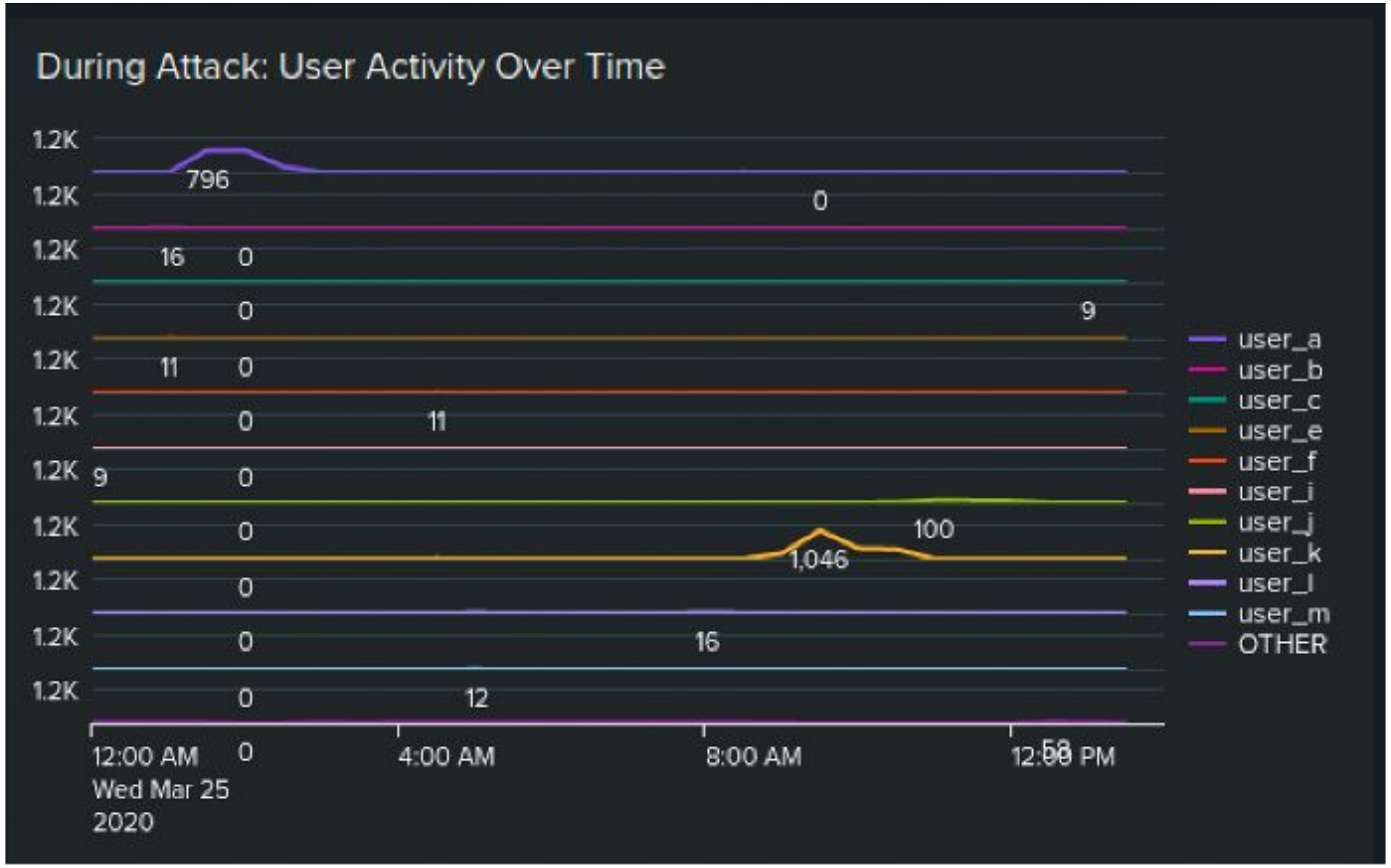


During Attack: Count of Different Users

Windows Server Dashboard – Pre- and During Attack

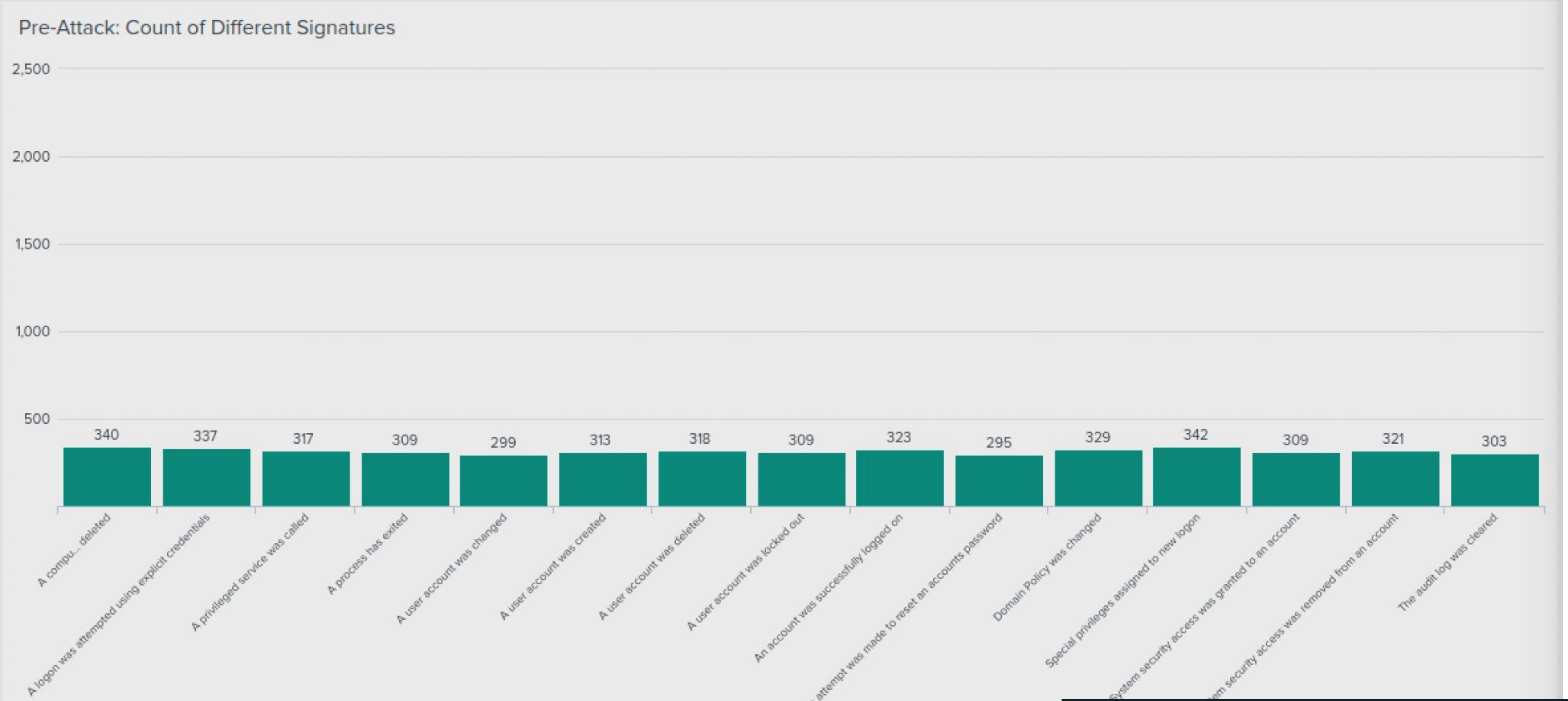


Pre-Attack: User Activity Over Time

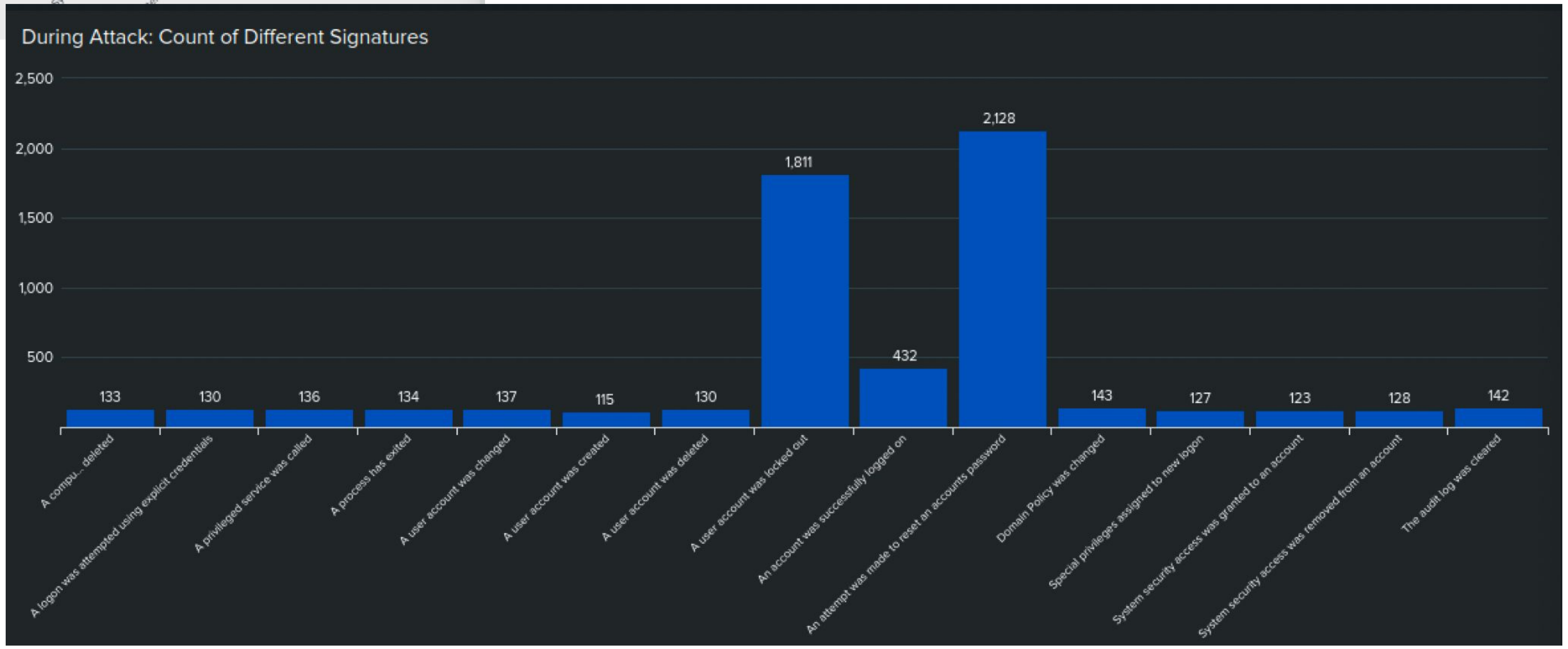


During Attack: User Activity Over Time

Windows Server Dashboard – Pre- and During Attack

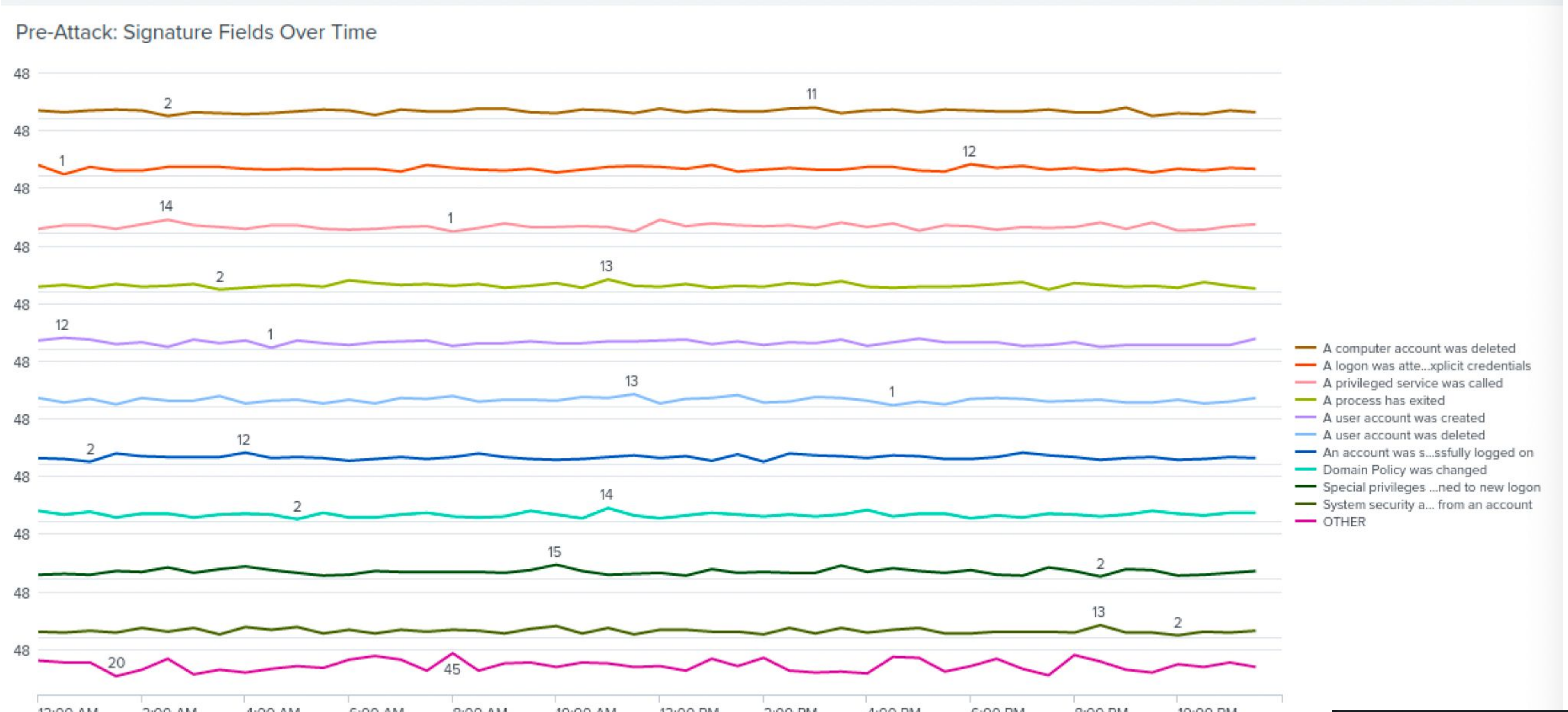


Pre-Attack Signature IDs
Baseline amount of user actions (e.g., requesting password resets, account lockouts, account logins)



During Attack Signature IDs
Spike in user actions (account lock-outs and password reset requests)

Windows Server Dashboard – Pre- and During Attack

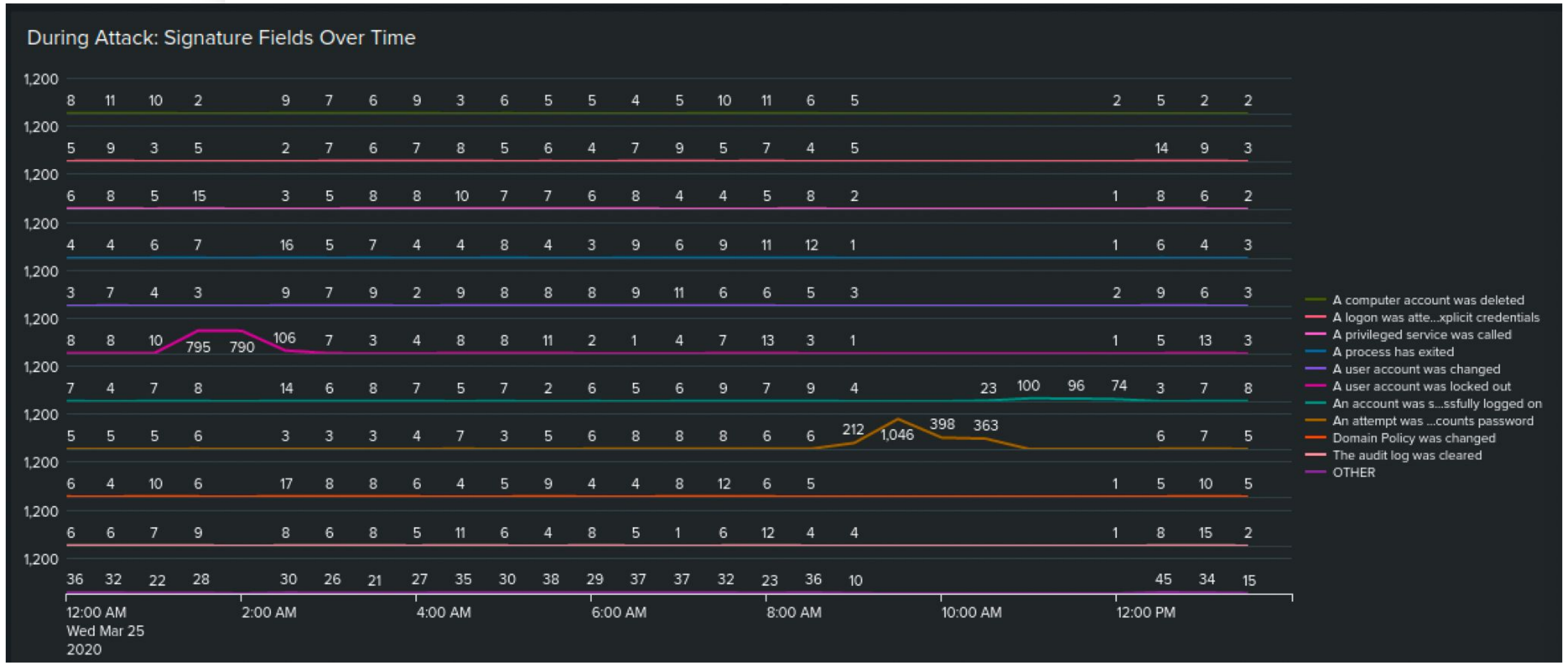


Pre-Attack Signature Fields Over Time

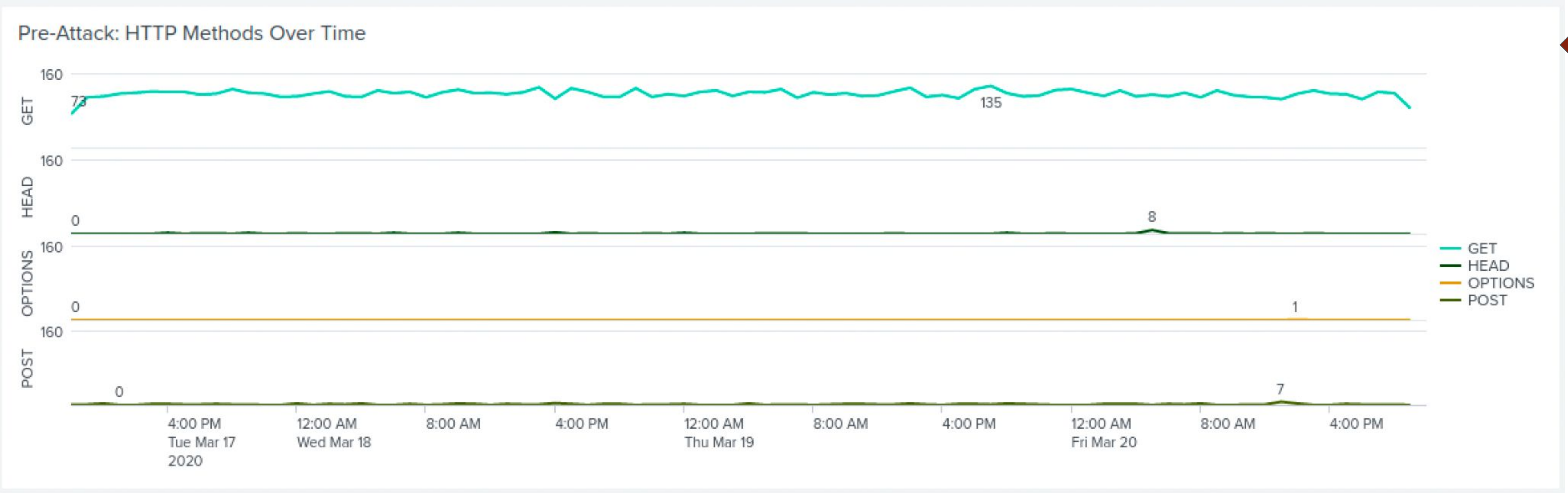
Baseline of exact time of actions requested

During Attack Signature fields

Spike in account lockouts from 1:30am to 2:30am and the password reset requests from 9:30am to 10:30am



Apache Server Dashboard – Pre- and During Attack

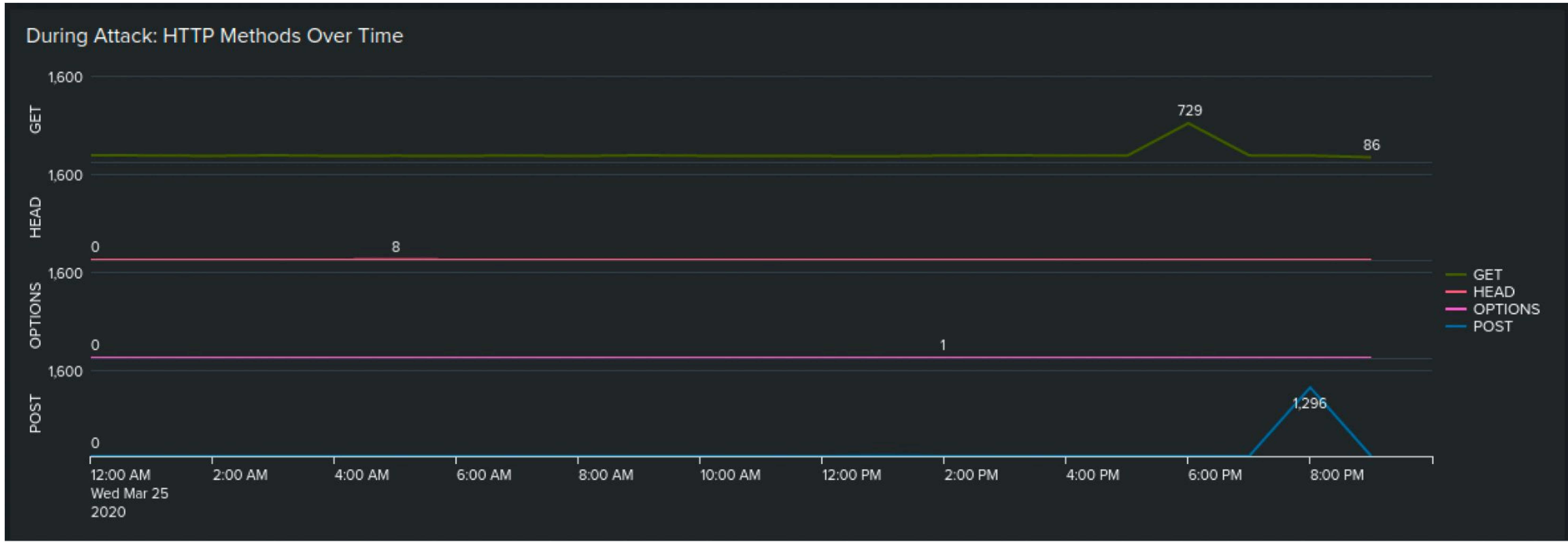


Pre-attack HTTP Methods

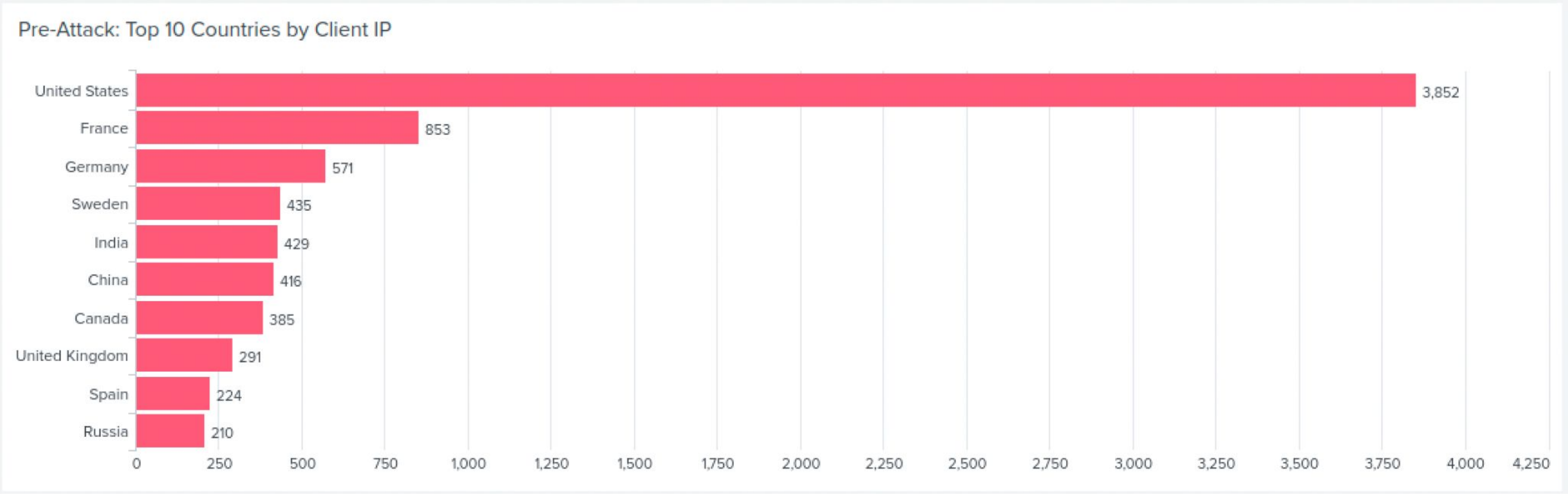
Baseline HTTP method activity over time. The data is relatively consistent with very few spikes in data

During Attack HTTP Methods

Spike from 5:30pm to 6:30pm in GET posts and spike from 7:00 pm to 8:30pm in POST reponses



Apache Server Dashboard – Pre- and During Attack

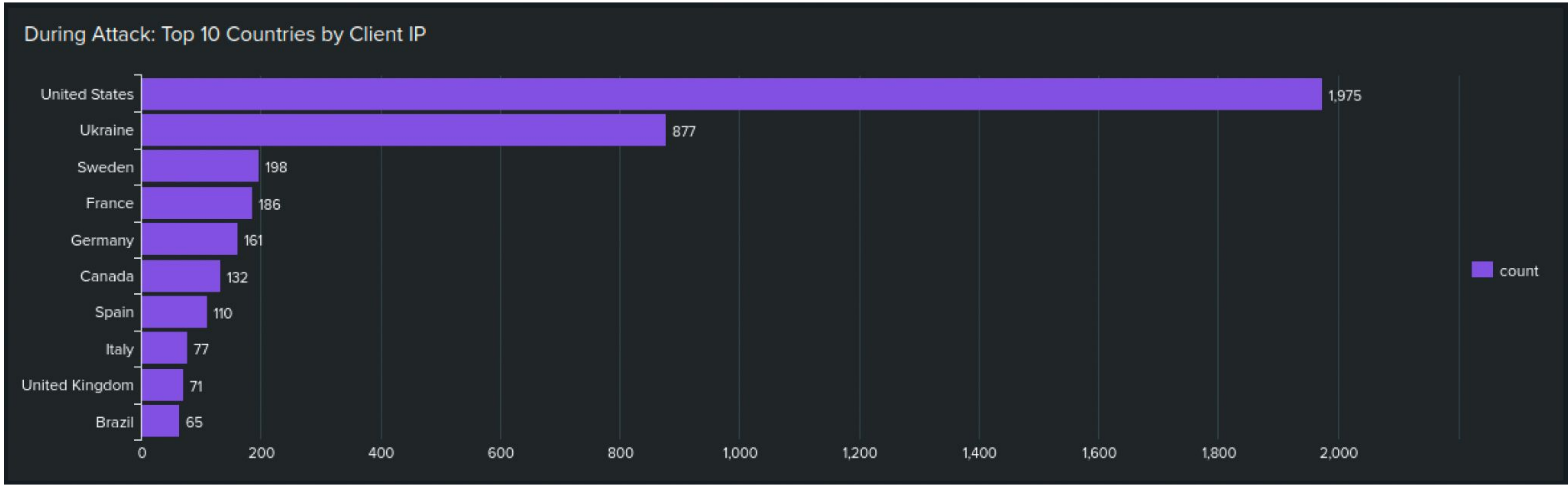


Pre-Attack Site visits by Top 10 Countries

United States, France and Germany had most visits (Ukraine not in Top 10)

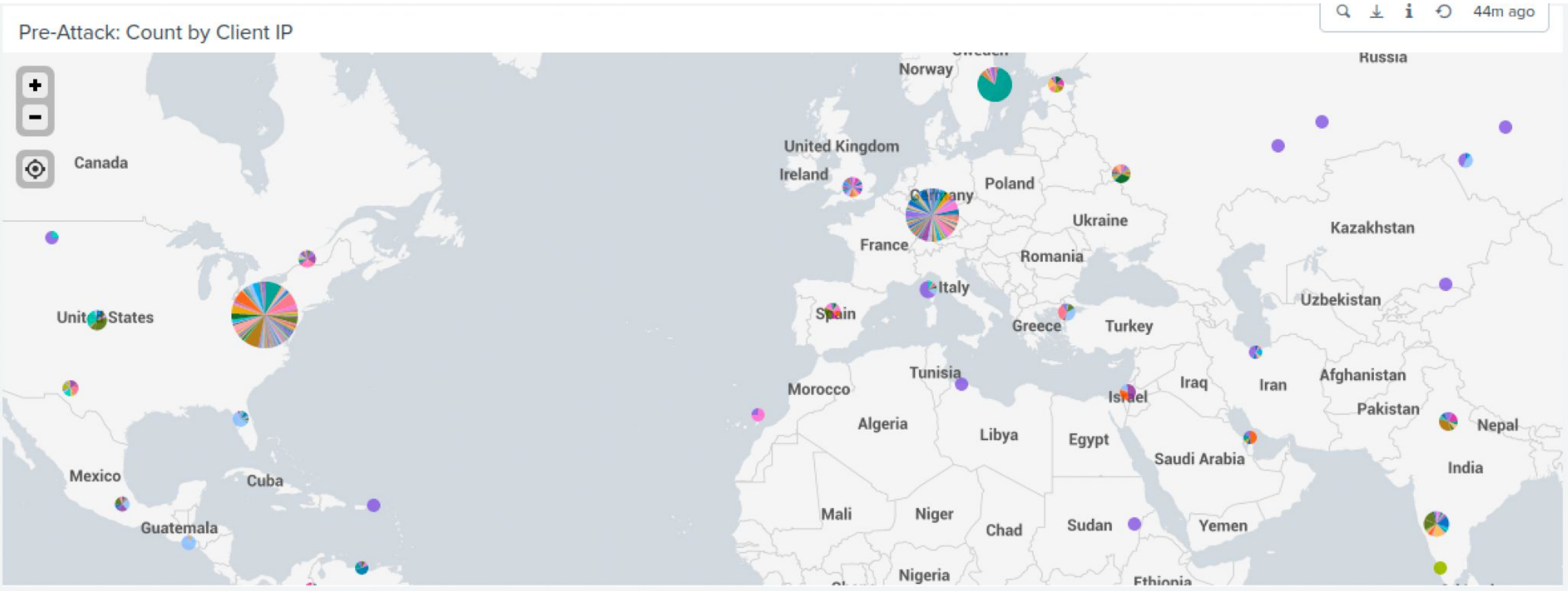
During Attack Top Countries

Massive spike in activity from Ukraine



As we can see in charts A and B, there was an abnormal increase in traffic coming from Ukraine during the attack (210> to 877).

Apache Server Dashboard – Pre- and During Attack



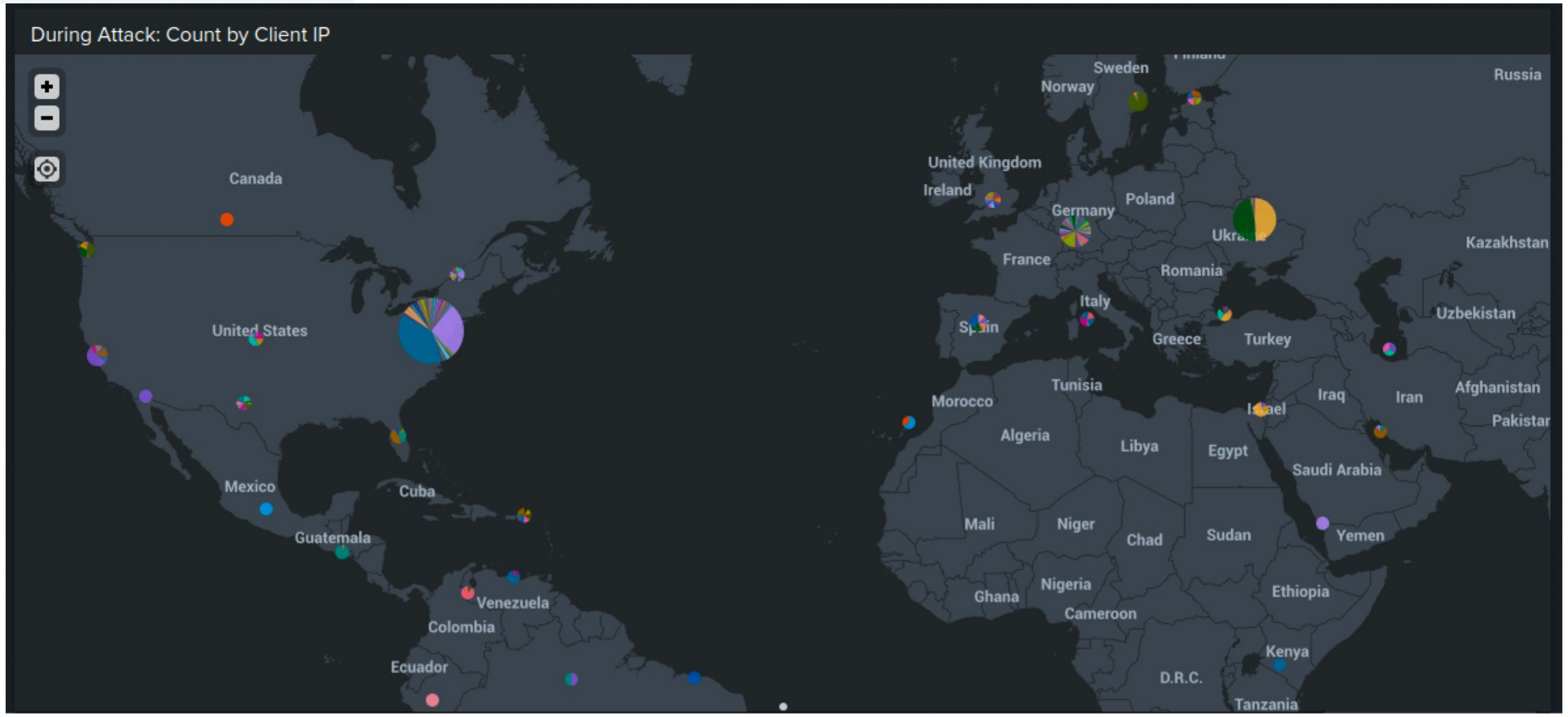
Pre-Attack: Count by Client IP

Pre-Attack

Top 3 Client IP origins located in the US (3,852 events), France (853 events) and Sweden (571). Ukraine not even in top 10.

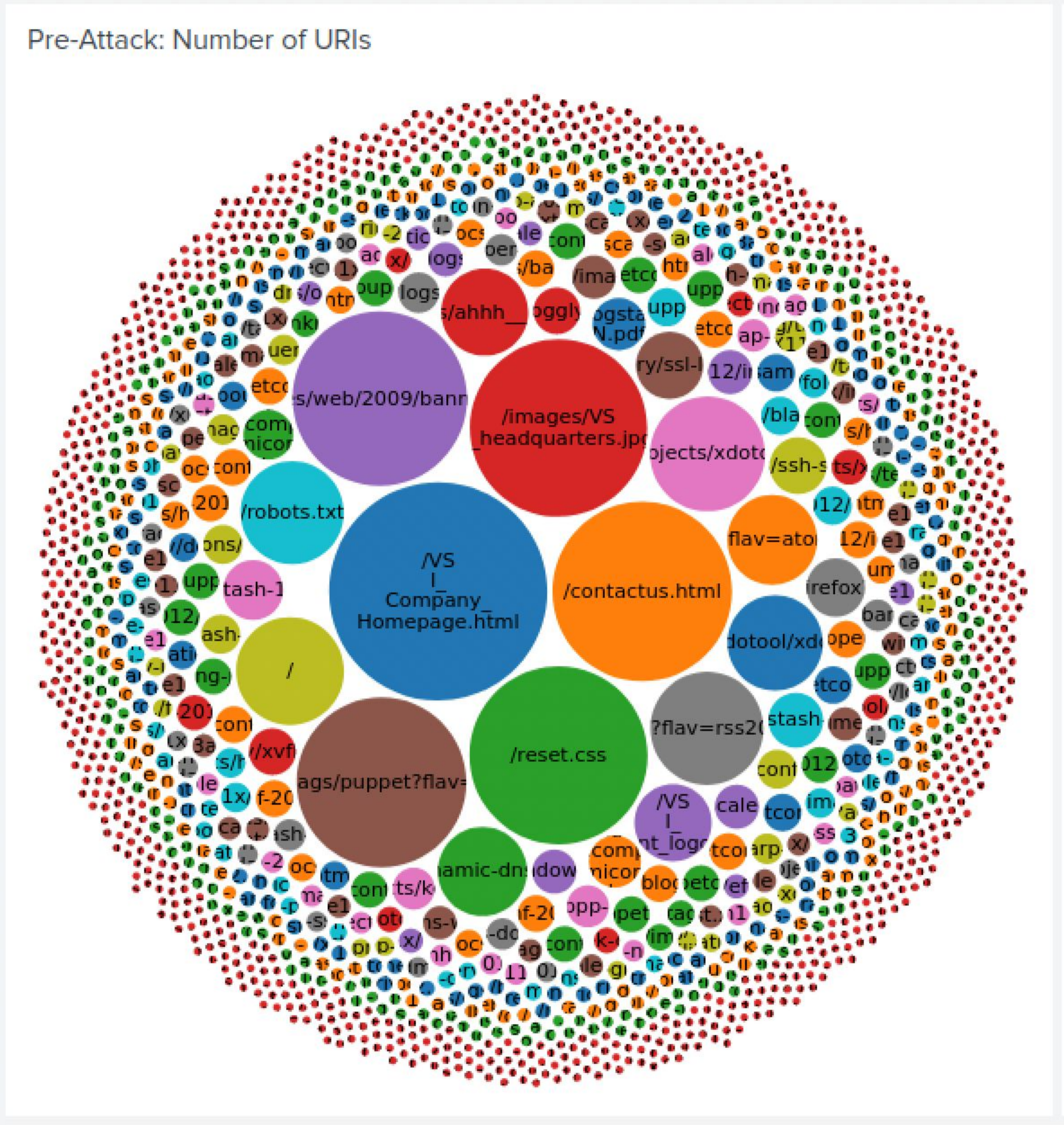
During Attack

Top 3 Client IP origins located in the US (1,975 events), Ukraine (877 events), and Sweden (199)

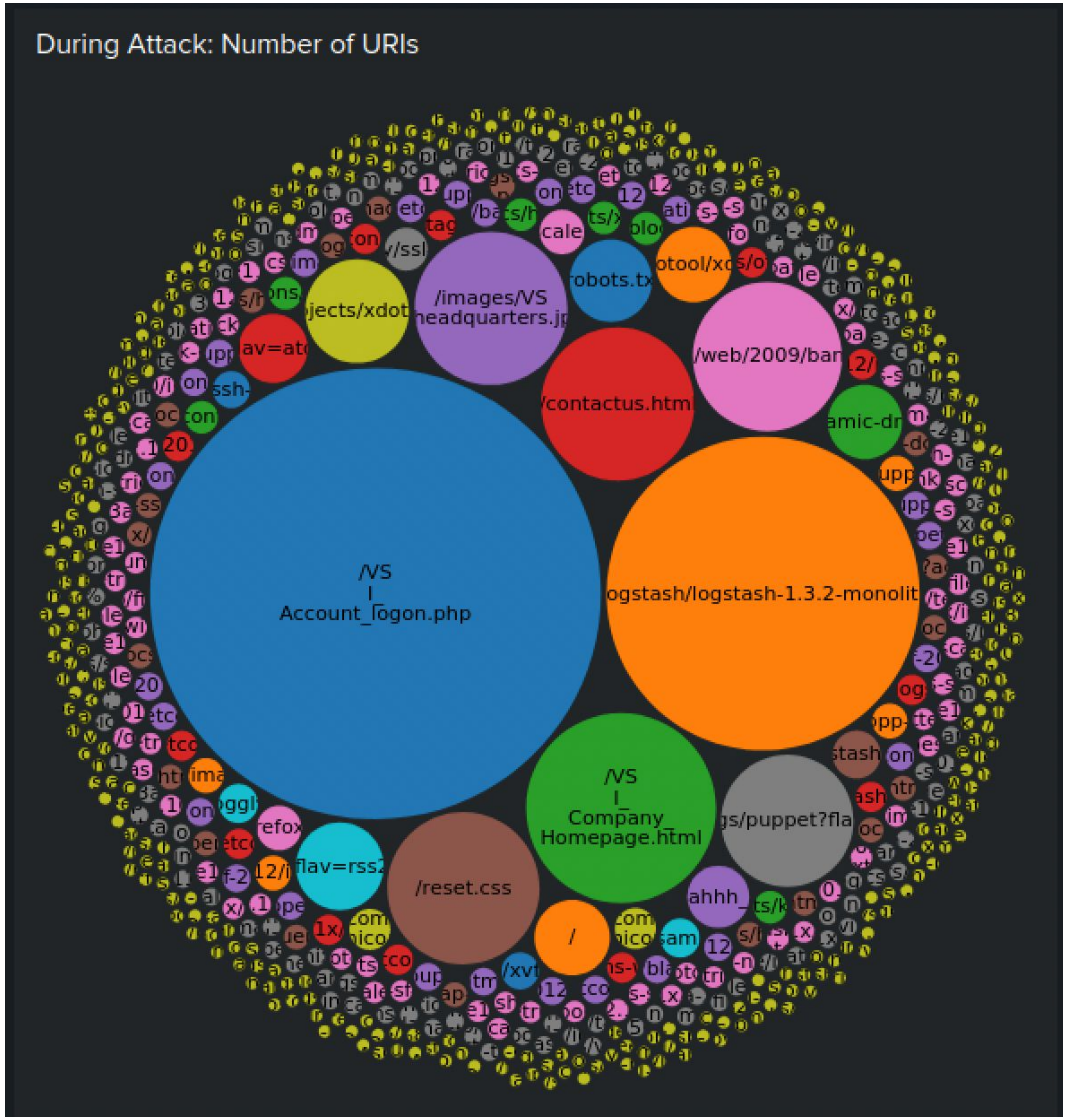


During Attack: Count by Client IP

Apache Server Dashboard – Pre- and During Attack


Pre-Attack: Number of URIs

During attack, POST requests to a .php page skyrocketed, indicating malicious code injection attempts


During Attack: Number of URIs

Attack Summary

Attack Summary

Attack 1 - Denial of Service & Compromise

- At 1:50am on March 25, 2020, VSI experienced an extreme spike in successful logins of 785 (vs a baseline of 30) at abnormal times from IP addresses 194.105.145.147, 194.146.132.138, and 79.171.127.138, indicating a Distributed Denial of Service (DDoS) Attack
- At 2 am, the attacker(s) deleted several crucial accounts, likely hiding evidence of their malicious activities

Attack 2 - Persistence & Privilege Escalation

- From 9:20 am - 11 am, a series of password resets occurred (Windows log ID_4724)
- user_j removed user_e from system security access at 11:55:50 am
- user_j gained system security access by remote interactive logon at 11:58:42 am

Attack Summary (continued)

Attack 3 (DDoS and Possible .php Injection)

- At 8:05:59 pm, 1,296 HTTP POST requests came in from three different IP addresses indicating a Slow POST attack
  - 194.105.145.147 (Kyiv, Ukraine) – 438 requests
  - 194.146.132.128 (New York, NY) – 432 requests
  - 79.171.127.34 (Kharkiv, Ukraine) – 432 requests
- At 10pm, activity spiked from baseline of 85 to 877 events (including 864 logon attempts)
- An increase in GET requests that could imply a Slow GET attack
- URI data also shows potentially suspicious behavior due to the main files changing, indicating possible .php file injection attack (via the VSI_Account_logon.php page)

Remediation Recommendations

Remediation Recommendations – Windows Server

- Upgrade authentication schemes
  - Enable lockout of user accounts after multiple failed logins
  - Implement Multi-Factor Authentication (MFA)
  - Password resets should require a special code
  - Internal users should access
  - Conditional access to trusted devices with geolocation

- Isolate targets

- Lockout offending IPs
  - Protocols such as ICMP, can be limited to allow listed internal IP addresses, ensuring functionality while potentially limiting DDoS attacks

Windows Server

Remediation Recommendations – Windows Server

- Harden Windows Server
  - Set rate limits on routers
  - Enable timeouts on unused connections
  - Block unused ports on servers and firewalls
  - Detect and drop spoofed packages
  - Maintain up-to-date security configurations
  - Patch & upgrade software promptly and conduct maintenance

- DDoS protection and response vendors
  - Example: Akamai’s DDoS security and monitoring

Windows Server

Remediation Recommendations – Apache Server

- HTTPS
  - Enable SSL on Apache Server via Mod_SSL to redirect to HTTPS
- GeoBlocking
  - Blocklist suspicious IP addresses and/or from originating countries (e.g., Ukraine) if allowed by business constraints
- Limit HTTP requests
  - Block an IP address after 5 consecutive POST requests to the logon.php page and/or logstash page (to prevent brute force attacks)
- Employ Detection/Network Management tool & Web Application Firewall
  - Mod_evasive/Mod_Security

Questions?