Viewing the nodes in the noise: Leveraging Data Science to Discover Persistent Threats

…Sharing Threats with US Based Commercial Critical Infrastructure

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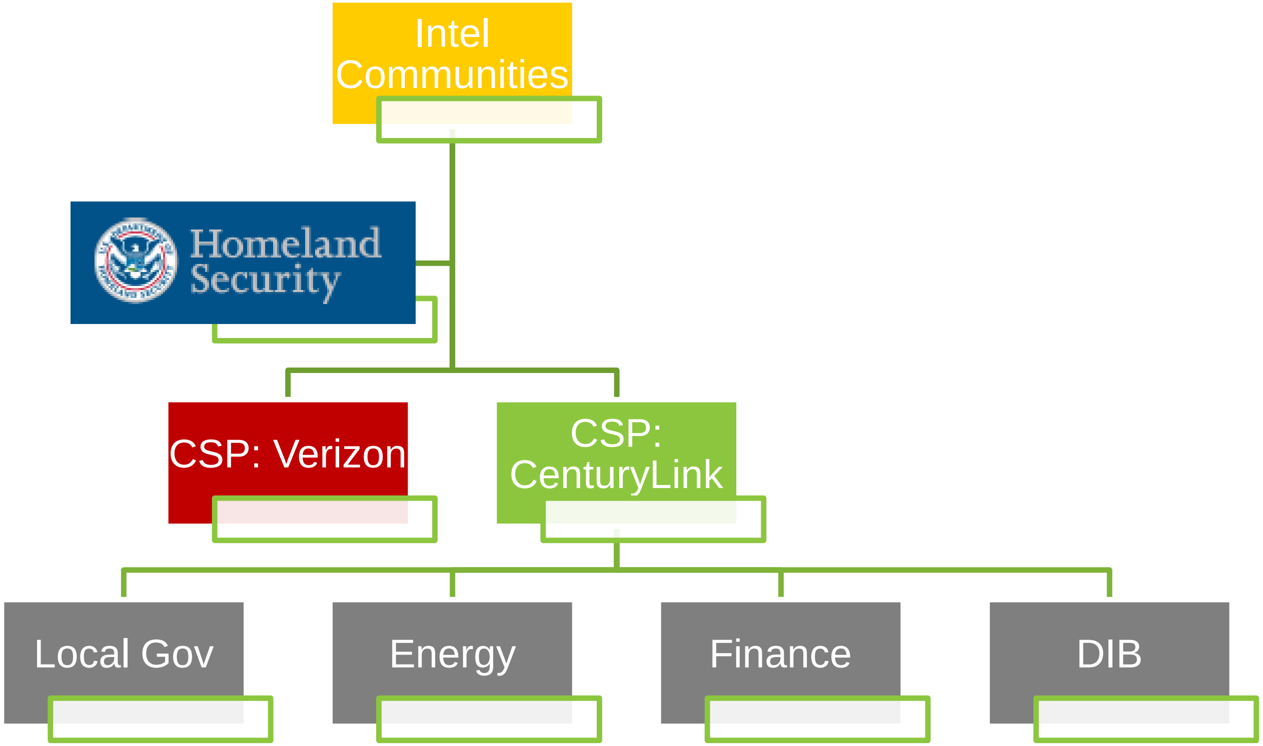
Agenda

- Intelligence Collection & Redistribution
- Lessons Learned
- Automating the Work
  - QuarterMaster
    - Exposure
    - DGA
    - Patter
- Questions

Intelligence Collection & Redistribution

1. Interested parties get cleared
2. Intel comes in from federal intel communities
3. DHS collects and redistributes intel to interested && cleared parties
4. Cleared parties identify vehicles to leverage intel in commercial spaces

Intelligence Collection & Redistribution



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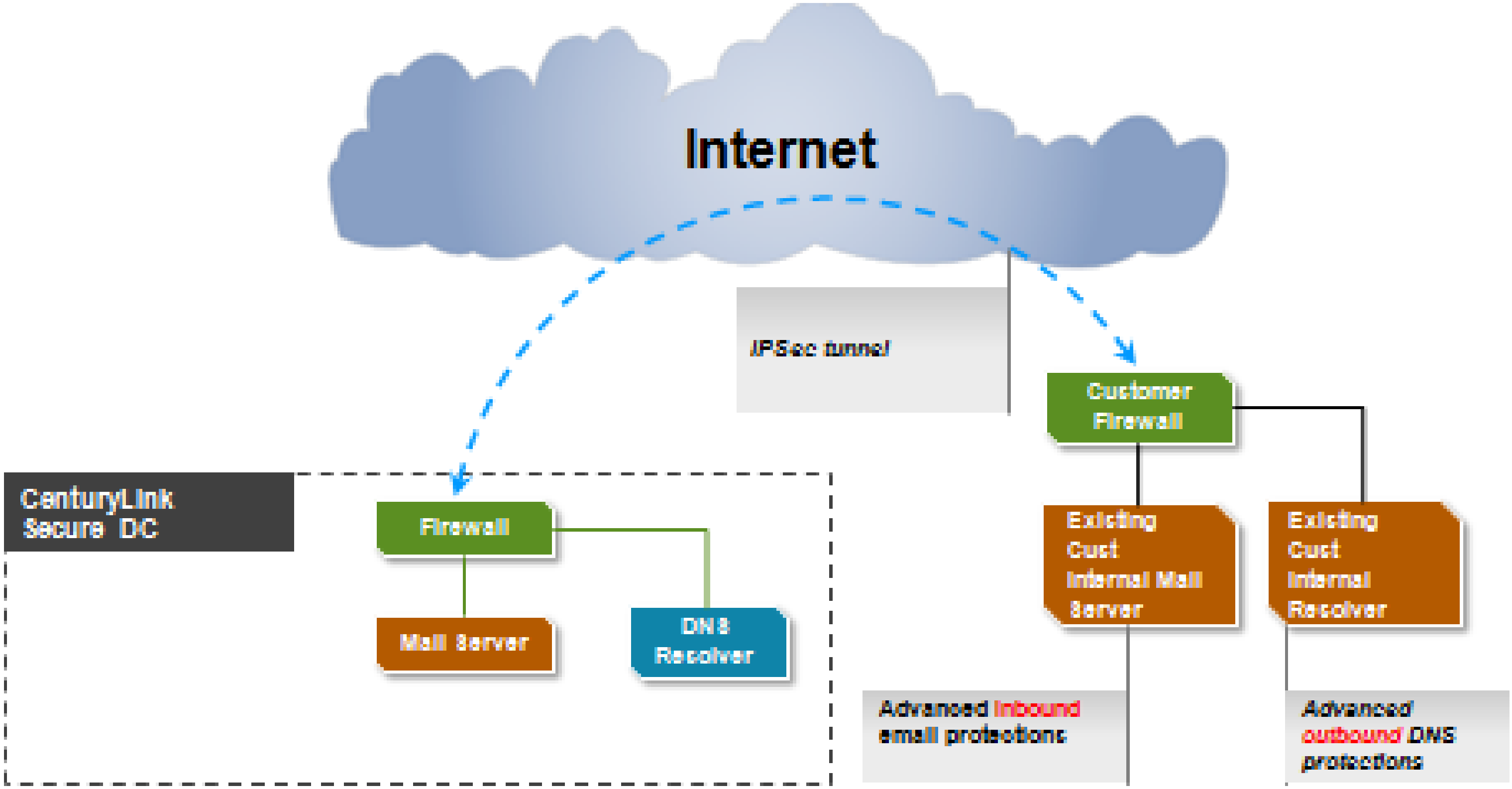
Standard Configuration


Internet
IPSec tunnel
Customer Firewall
CenturyLink Secure DC
Firewall
Existing Cust Internal Mail Server
Existing Cust Internal Resolver
Mail Server
DNS Resolver
Advanced Inbound email protections
Advanced outbound DNS protections

Lessons Learned

What works, What hasn’t

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Mature Organizations

Saying “*Because it’s Bad*” doesn’t work

Non-Mature Organizations

Identifying discovered threats

For non-mature organizations advanced methods are required to aid in the endeavors of identifying the exact source of discovered & blocked threats.

- *Advanced HoneyPot Tactics*
  - Issuing fake files to retrieve (HII) host identifiable information
- *WebRTC*
  - Leveraging existing JS code to retrieve (HII) host identifiable information
- *Netflow Traffic*
  - The integration and collection of netflow traffic allows for the identification of the source

Findings

- If you are providing IOC’s to clients, maintain an Intel database and send them enriched data

- If you are a client that receives IOCs, maintain your own intel database.

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Sourcing your DB

- https://attack.mitre.org/wiki/Groups
- https://www.fireeye.com/current-threats/apt-groups.html
- https://apt.securelist.com/#!/threats/
- https://github.com/CyberMonitor/APT_CyberCriminal_Campagin_Collections
  - https://github.com/kbandla/APTnotes
  - https://github.com/fdiskyou/threat-INTel

Automating the hard work

Advanced analytics - Cultivating a better Cyber World

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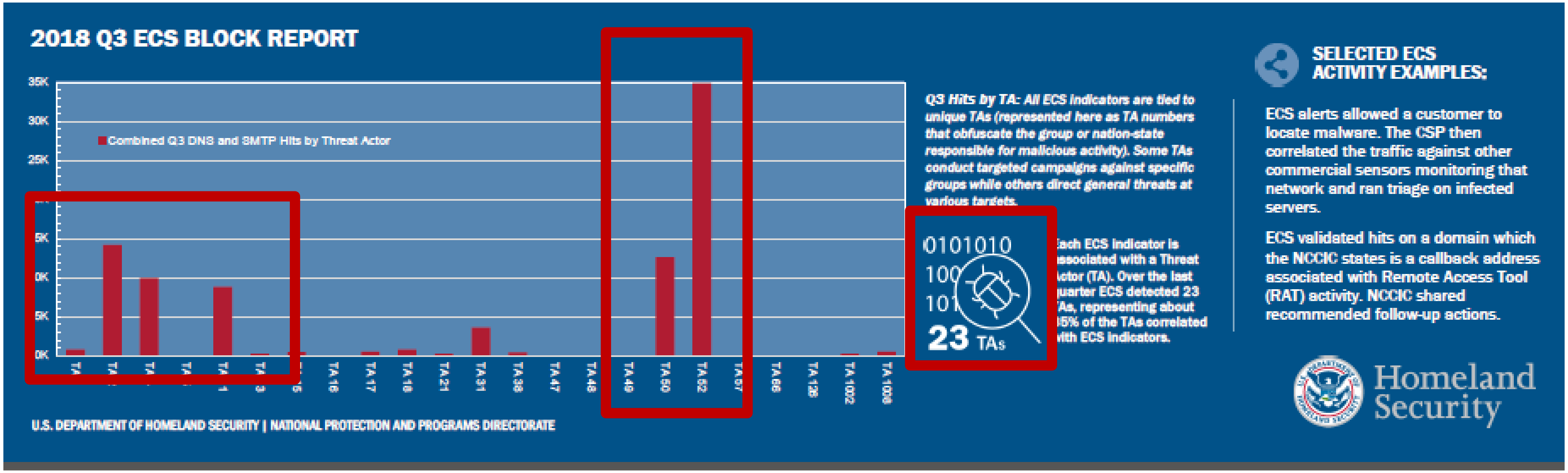
Intelligence Collection & Redistribution



2018 Q3 ECS BLOCK REPORT

Q3 Hits by TA: All ECS indicators are tied to unique TAs (represented here as TA numbers that obfuscate the group or nation-state responsible for malicious activity). Some TAs conduct targeted campaigns against specific groups while others direct general threats at various targets.

ach ECS Indicator is ssociated with a Threat ctor (TA). Over the last uarter ECS detected 23 As, representing about 5% of the TAs correlated ith ECS indicators.

SELECTED ECS ACTIVITY EXAMPLES:

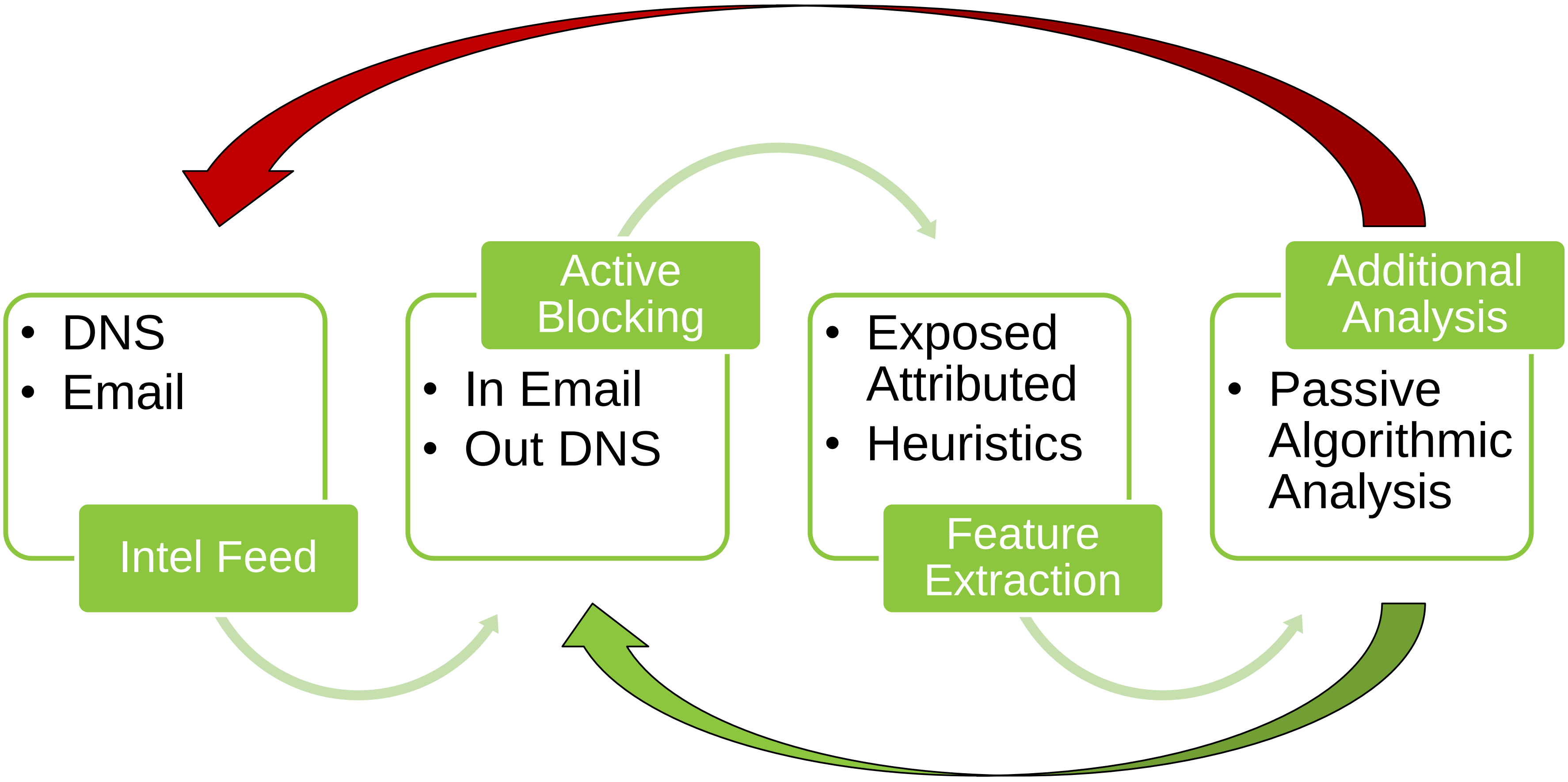
ECS alerts allowed a customer to locate malware. The CSP then correlated the traffic against other commercial sensors monitoring that network and ran triage on infected servers.

ECS validated hits on a domain which the NCCIC states is a callback address associated with Remote Access Tool (RAT) activity. NCCIC shared recommended follow-up actions.

Homeland Security

U.S. DEPARTMENT OF HOMELAND SECURITY | NATIONAL PROTECTION AND PROGRAMS DIRECTORATE

Lifecycle



Intel Feed

- DNS
- Email

Active Blocking

- In Email
- Out DNS

Feature Extraction

- Exposed Attributed
- Heuristics

Additional Analysis

- Passive Algorithmic Analysis

Algorithms

Algorithms designed to identify malicious DNS Names

- DGA Algorithm
  - Identifies Dynamically Generated Domain Names
- Exposure Algorithm
  - Uses Exposed DNS Attributes to identify potentially malicious domains
- Pattern Algorithm
  - Uses callback intervals to identify potentially malicious domains

Operationalizing Models

- DGA models:
  - Model only needs to be trained once
  - Only uses domain name for classifying

- Exposure Model:
  - Need historical data to train the model
  - Needs to be re-trained every few months
  - Classifying domains requires historical features

- Training utilizes batch-processing using a week's worth of data

- Scoring requires semi-real time stream processing with different codebase

Leveraging Attributes

This allows us to identify new C2 domains in an unclassified way: using the unclassified attributes of classified indicators sourced from the Intel Community.

DGA

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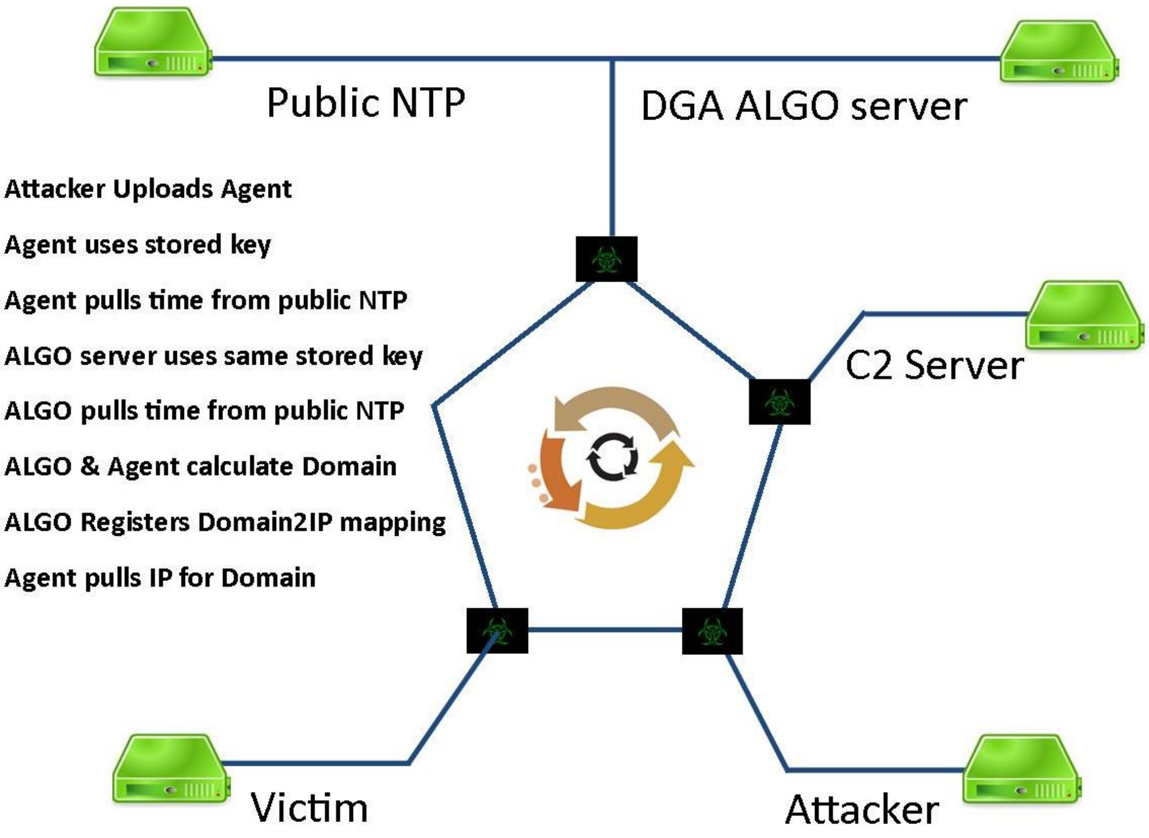
DGA Algorithm: Lifecycle

DGA Lifecycle



Attacker Uploads Agent

Agent uses stored key

Agent pulls time from public NTP

ALGO server uses same stored key

ALGO pulls time from public NTP

ALGO & Agent calculate Domain

ALGO Registers Domain2IP mapping

Agent pulls IP for Domain

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DGA Detection Models

- **Analyzing statistical features (randomly-generated)**
  - 60680ad5728991c31277cd43f733903d[.]net
  - mns34m1qifzti4q7h9qlpik[.]com
  - rxjthjm1pofte[.]com

- **Pre-defined word lists** (**Dictionary-DGA**)
  - Using NLP techniques, determine when words “don’t make sense” together:
    - hypophyseal-relativity[.]com
    - machinelike-hypocellularity[.]com
    - imperative-carborundum[.]com

- **words and random characters** (**Hybrid-DGA**)
  - yawqthdpanxious[.]download
  - msxvkcijreactivity[.]download

Exposure

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Exposure Model

- Using these features and probabilities from DGA models, we train a model using whitelisted and blacklisted domains:

- WhiteListed:
  - TrendMicro
  - Symantec
  - Verizon

- Blacklisted:
  - bambenekconsulting.com/feeds/
  - OTX
  - AIS

Exposure Model

~30 Attributes

TTL

Registration

IP Variations

Responses

Daily Trends

Cost per Query

Pattern

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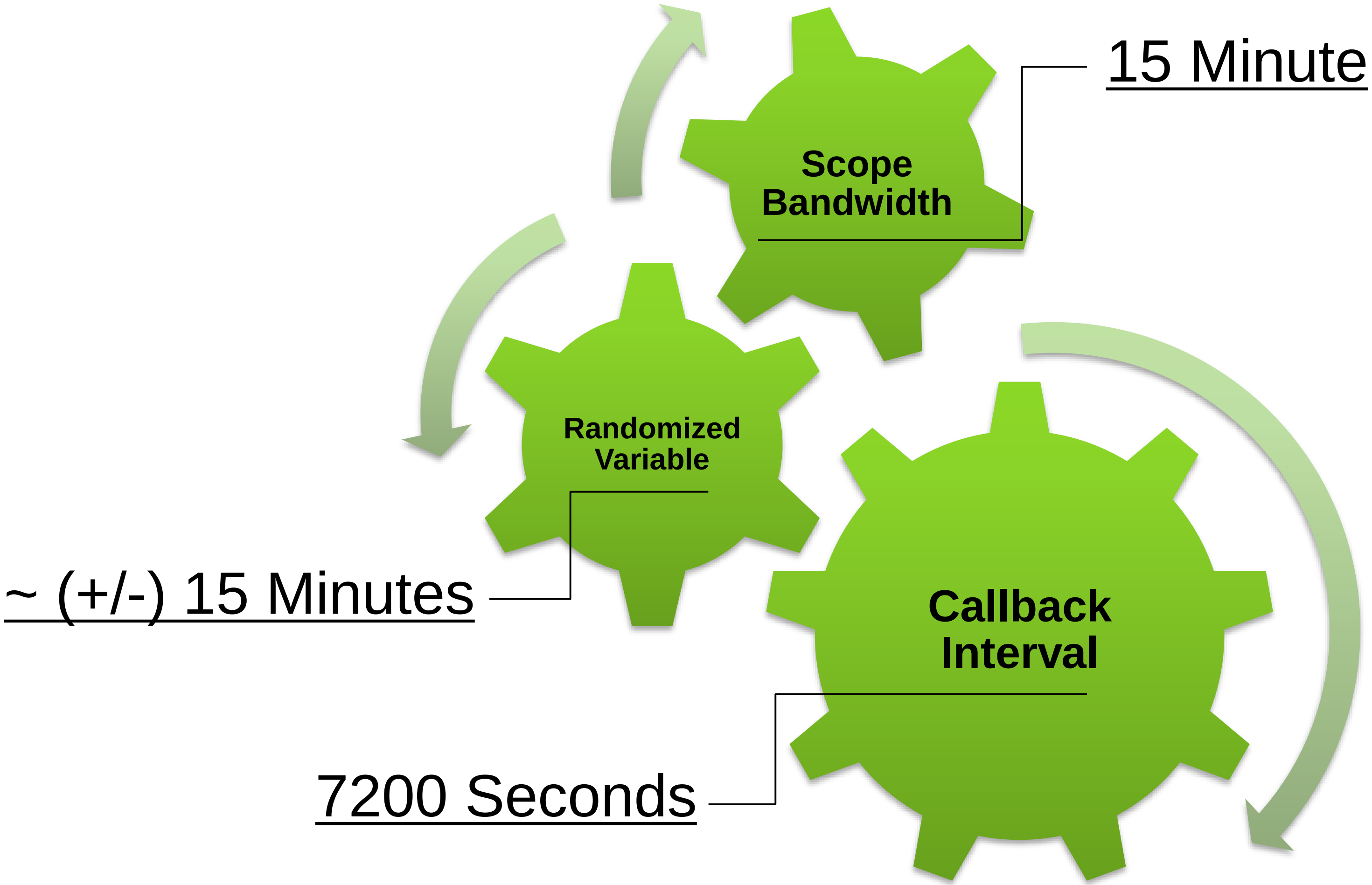
Pattern Algo



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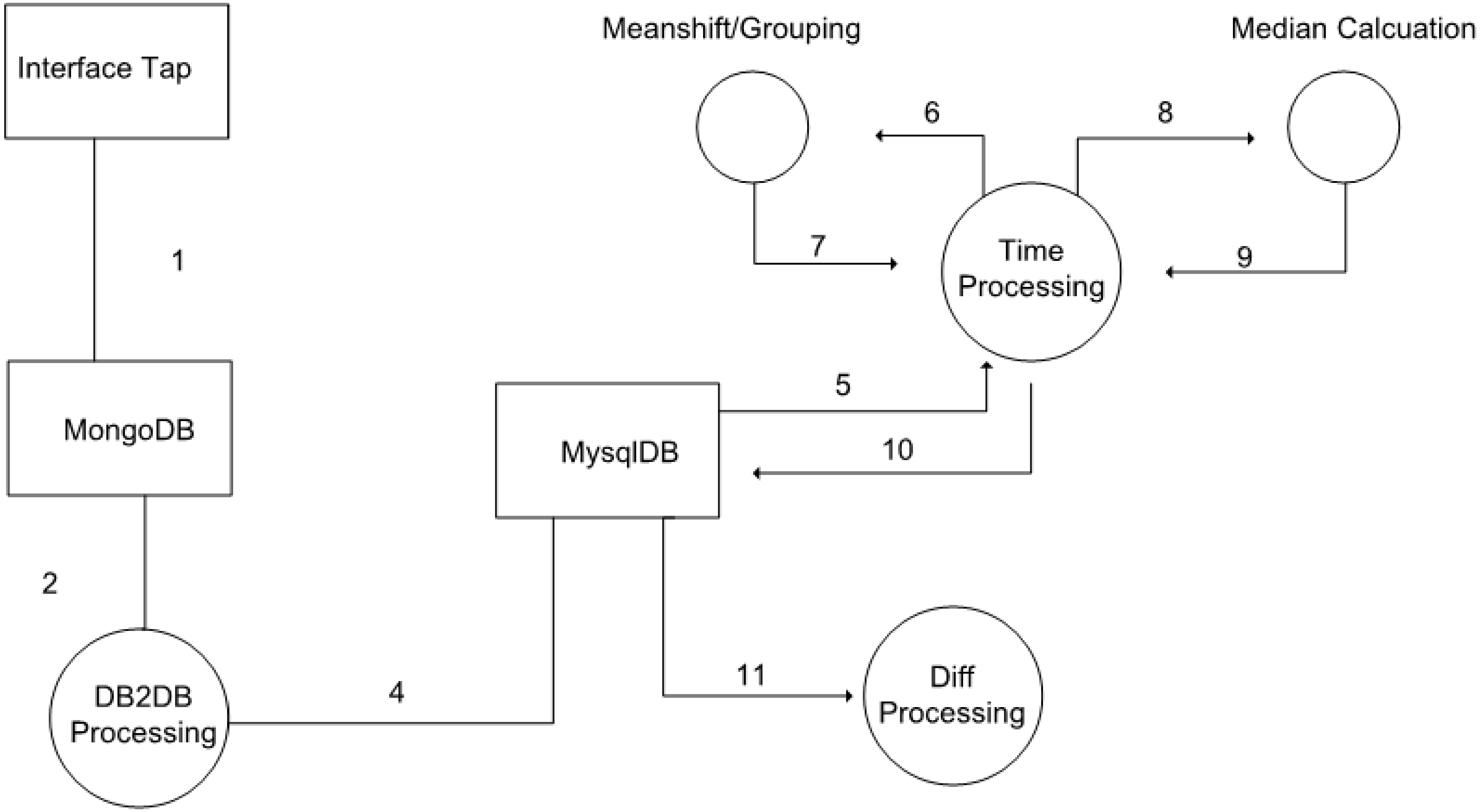
Viewing the Noise



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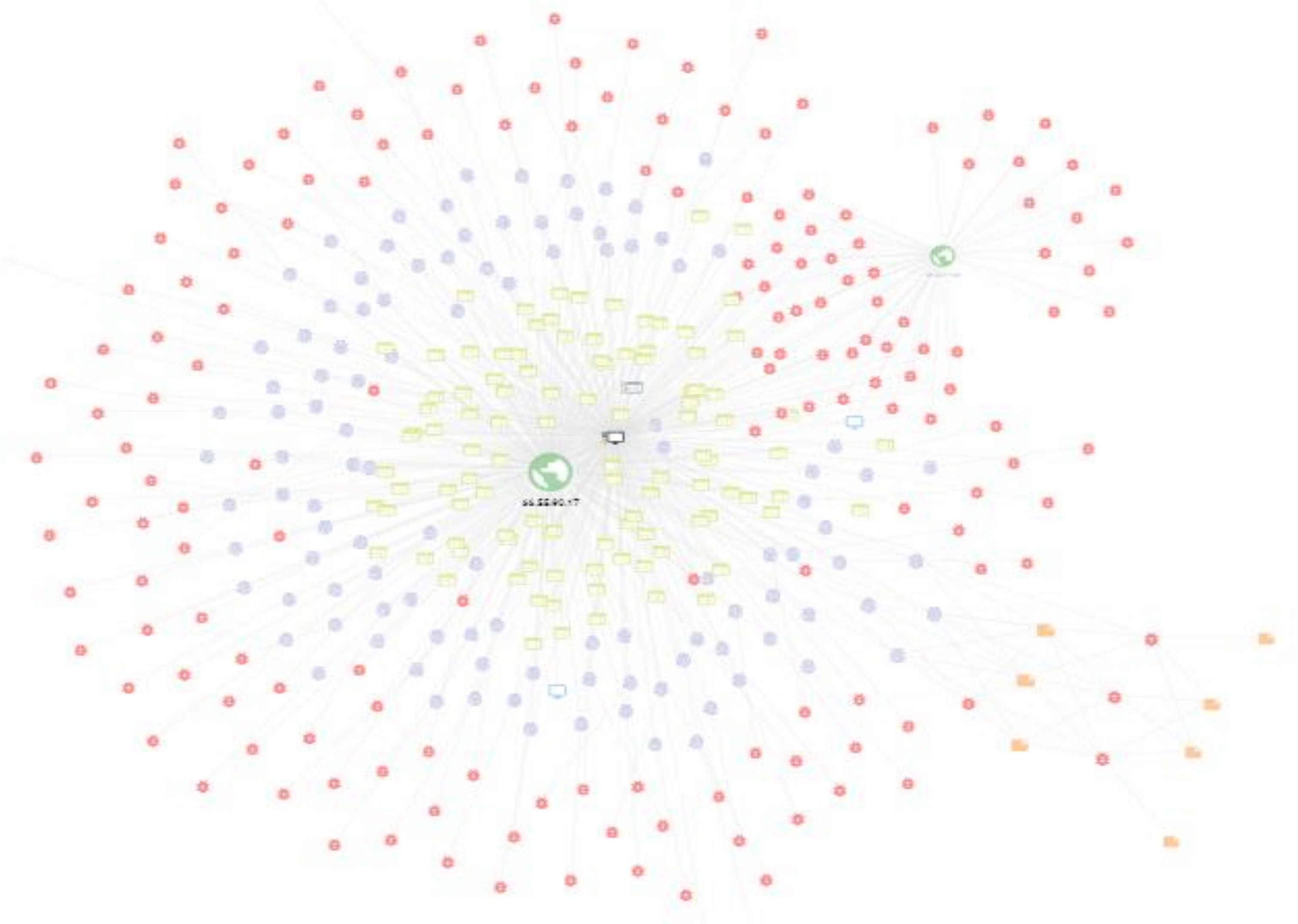
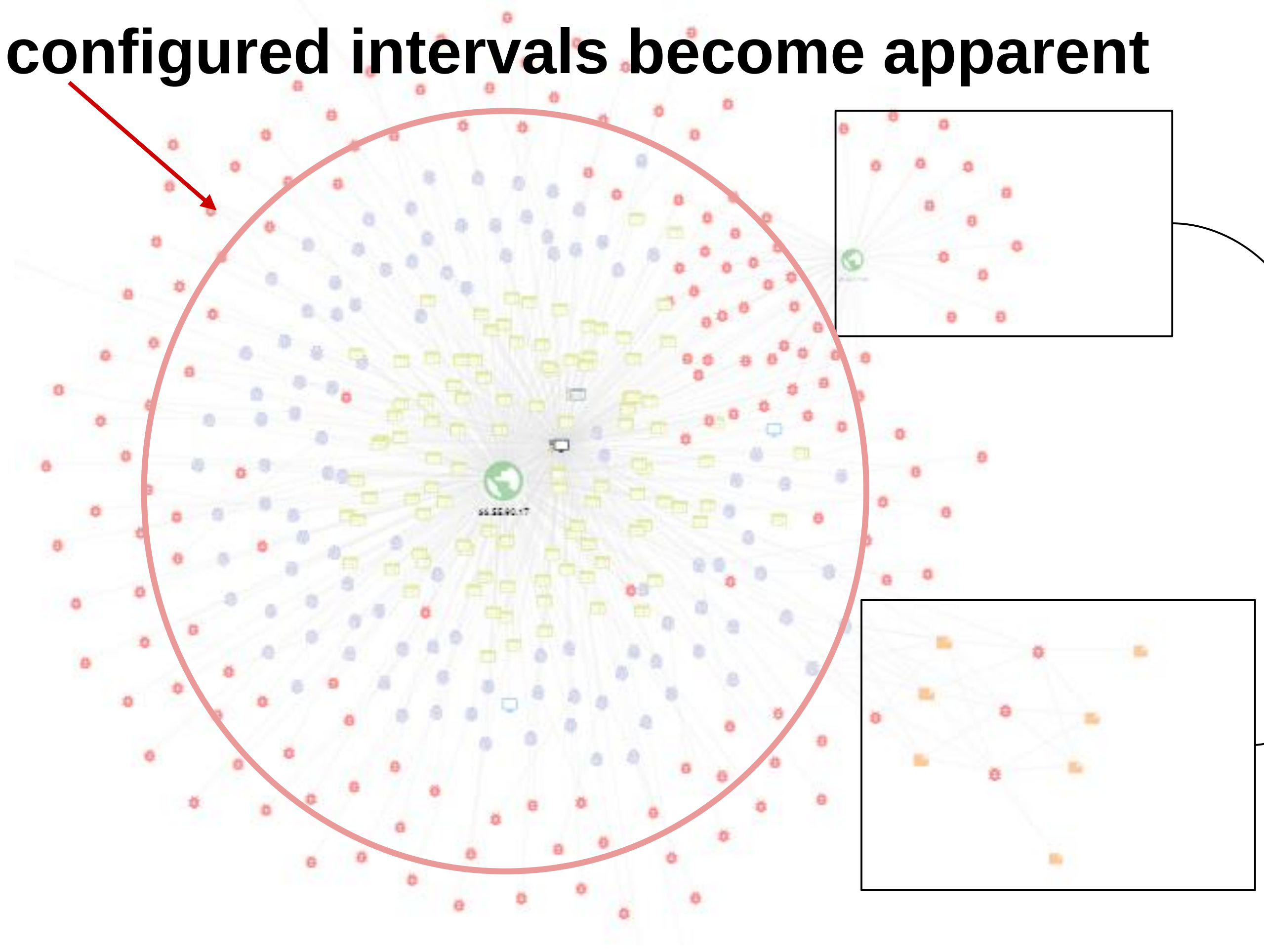
Viewing the Noise



Viewing the Noise

configured intervals become apparent



Remove outliers

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Data Organization & Alerting

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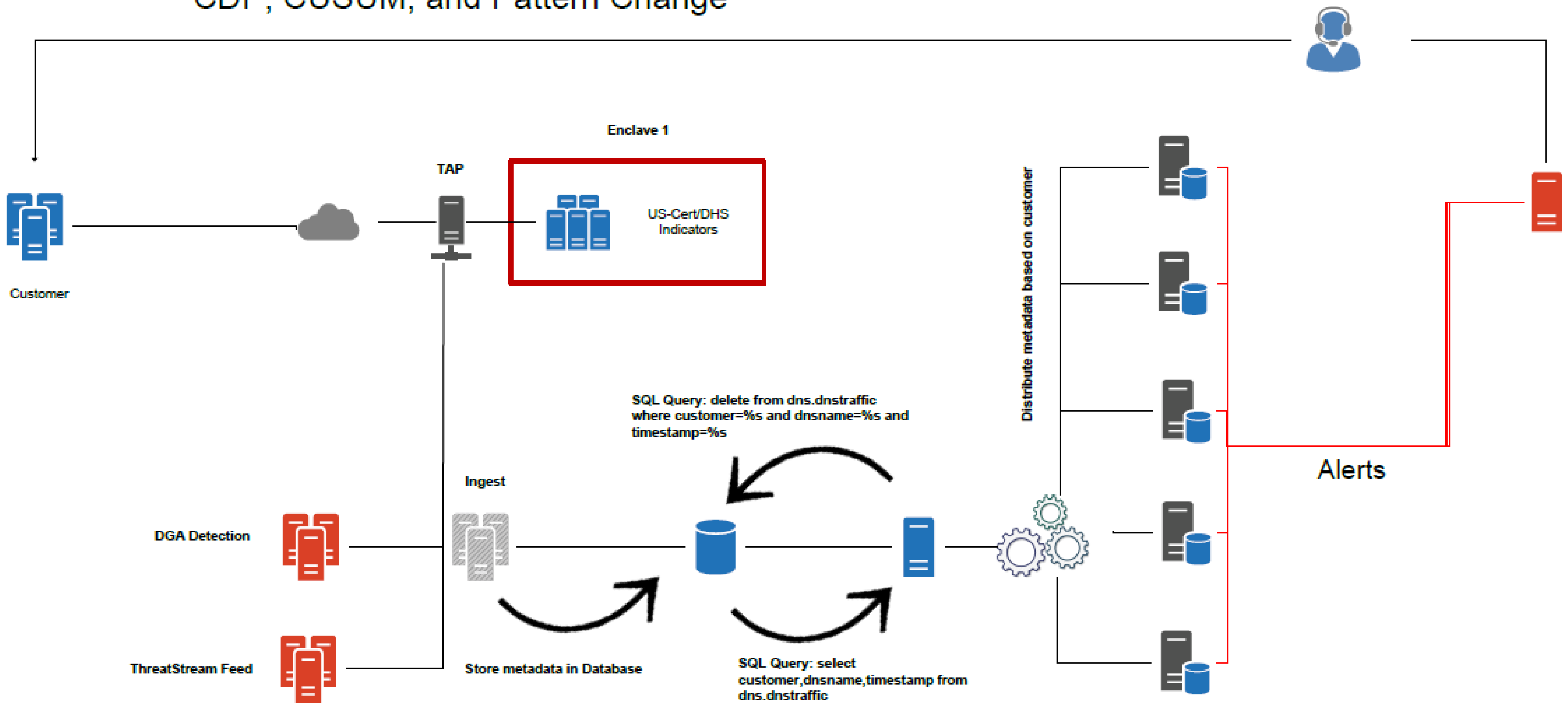
Data Organization

Extended Configuration

CDP, CUSUM, and Pattern Change



Enclave 1
TAP
US-Cert/DHS Indicators
Customer
Distribute metadata based on customer
SQL Query: delete from dns.dnstraffic where customer=%s and dnsname=%s and timestamp=%s
Alerts
Ingest
DGA Detection
ThreatStream Feed
Store metadata in Database
SQL Query: select customer,dnsname,timestamp from dns.dnstraffic

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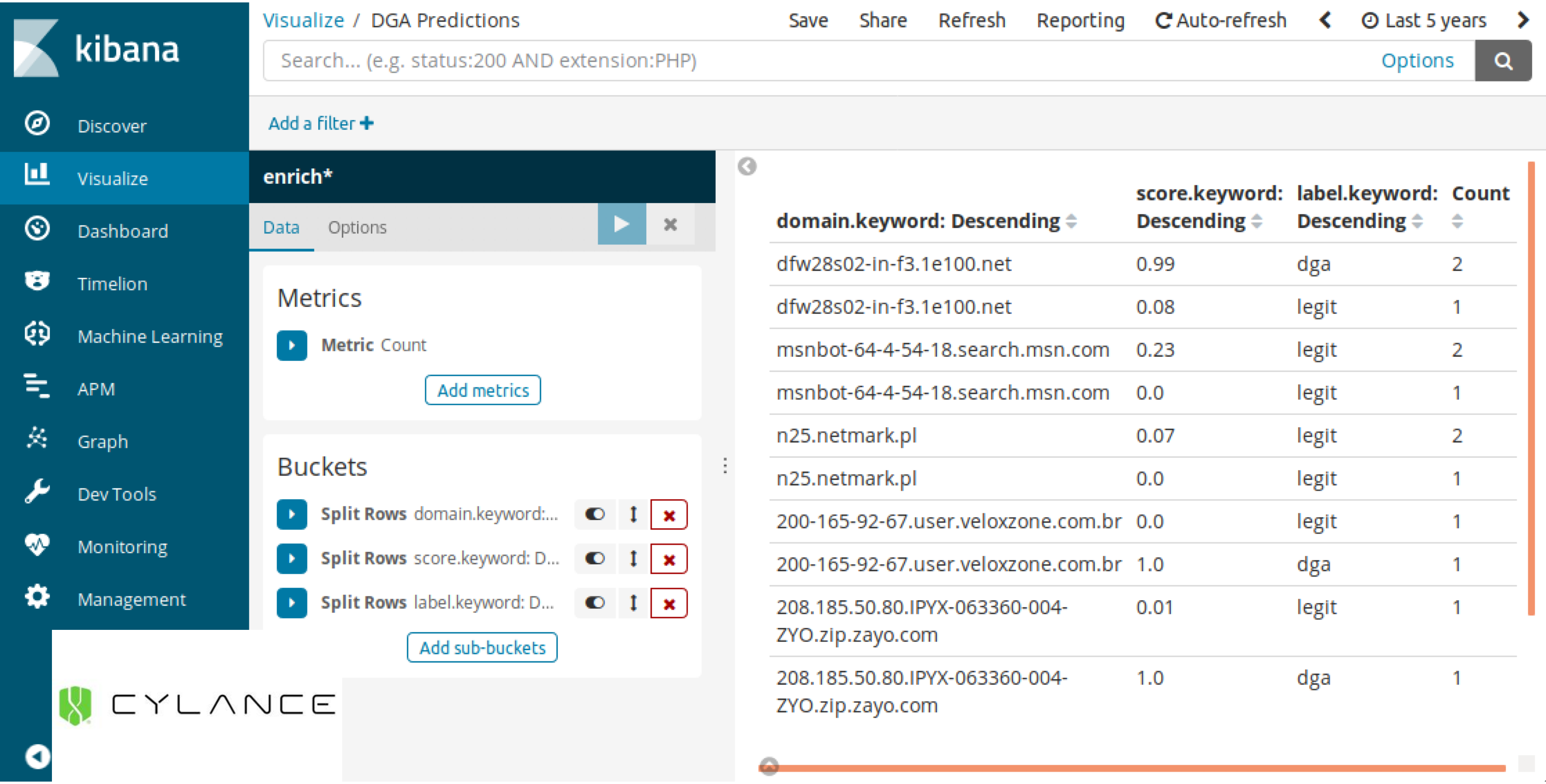
Data Tagging

Modeling & ELK Tagging Configuration

- You can easily us Python to train your models, process your data, and assign relevant tags in your Elastic dataset

Data Tagging



Metric Count

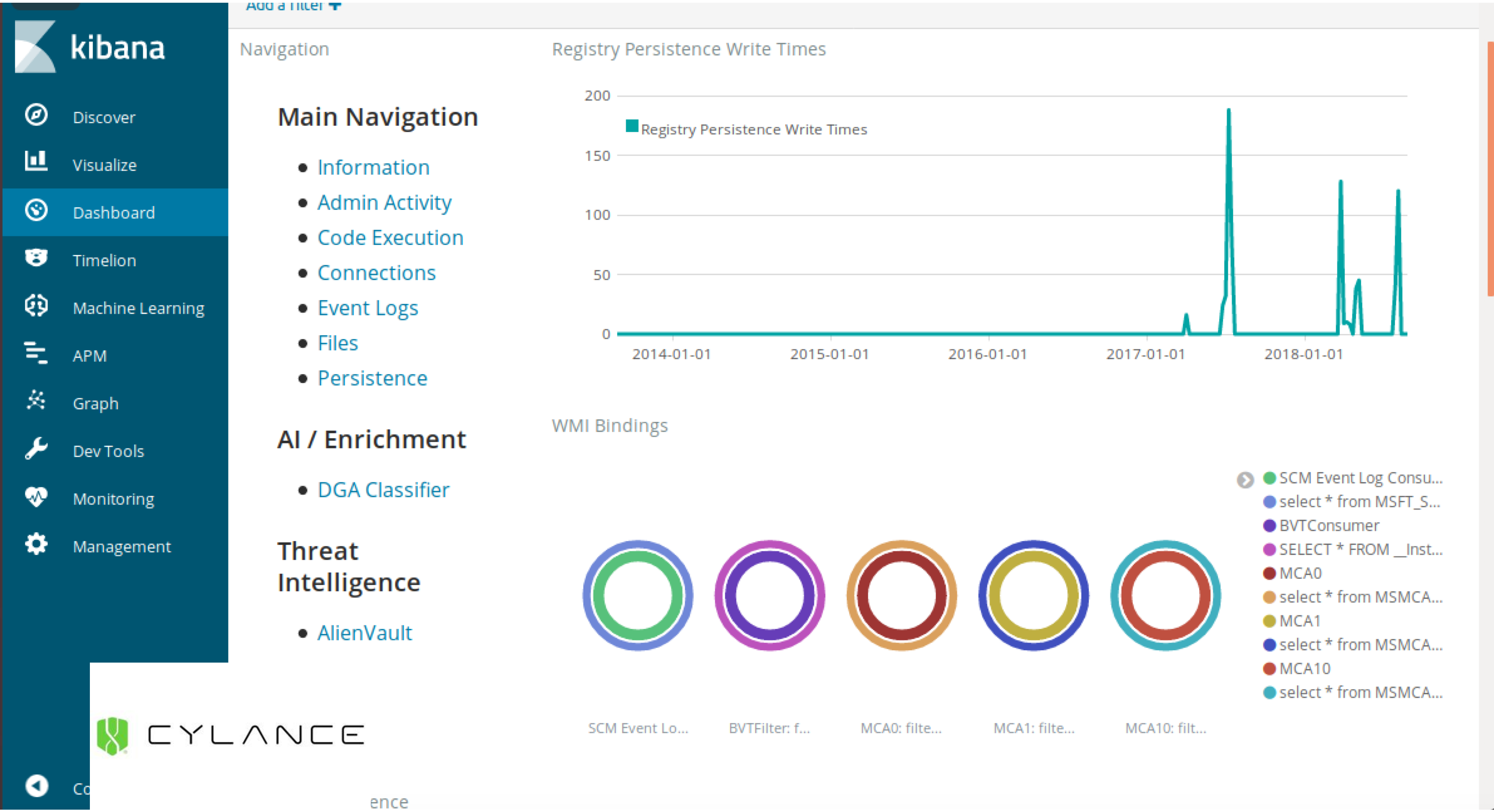
Split Rows domain.keyword:...

Split Rows score.keyword: D...

Split Rows label.keyword: D...

domain.keyword: Descending	score.keyword: Descending	label.keyword: Descending	Count
dfw28s02-in-f3.1e100.net	0.99	dga	2
dfw28s02-in-f3.1e100.net	0.08	legit	1
msnbot-64-4-54-18.search.msn.com	0.23	legit	2
msnbot-64-4-54-18.search.msn.com	0.0	legit	1
n25.netmark.pl	0.07	legit	2
n25.netmark.pl	0.0	legit	1
200-165-92-67.user.veloxzone.com.br	0.0	legit	1
200-165-92-67.user.veloxzone.com.br	1.0	dga	1
208.185.50.80.IPYX-063360-004-ZYO.zip.zayo.com	0.01	legit	1
208.185.50.80.IPYX-063360-004-ZYO.zip.zayo.com	1.0	dga	1

Active Blocking from Passive Threat Intelligence



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Active Blocking from Passive Threat Intelligence

Modeling & ELK Tagging Configuration

- You then generate alerts from your ELK platform that allow you to respond to identified threats.

- Once new threats are passively identified, add them to your active blocking platform

Thank you

Questions