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BETTER.

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Harnessing the Law of Data Gravity: Cyber Defense and the Hybrid Cloud

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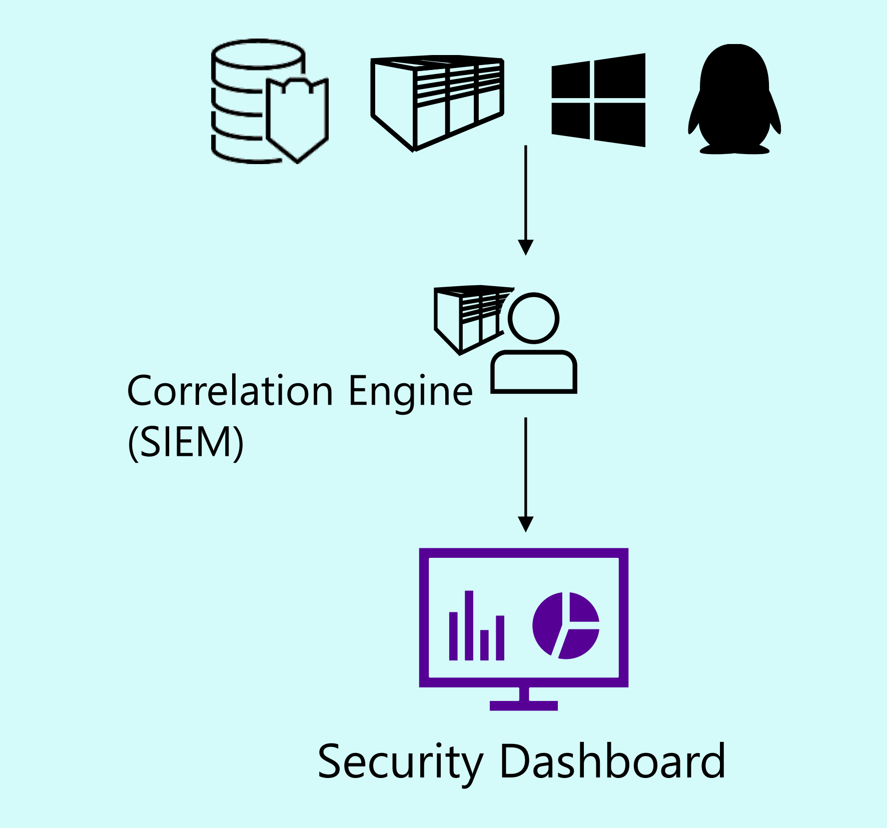
The SOC has evolved

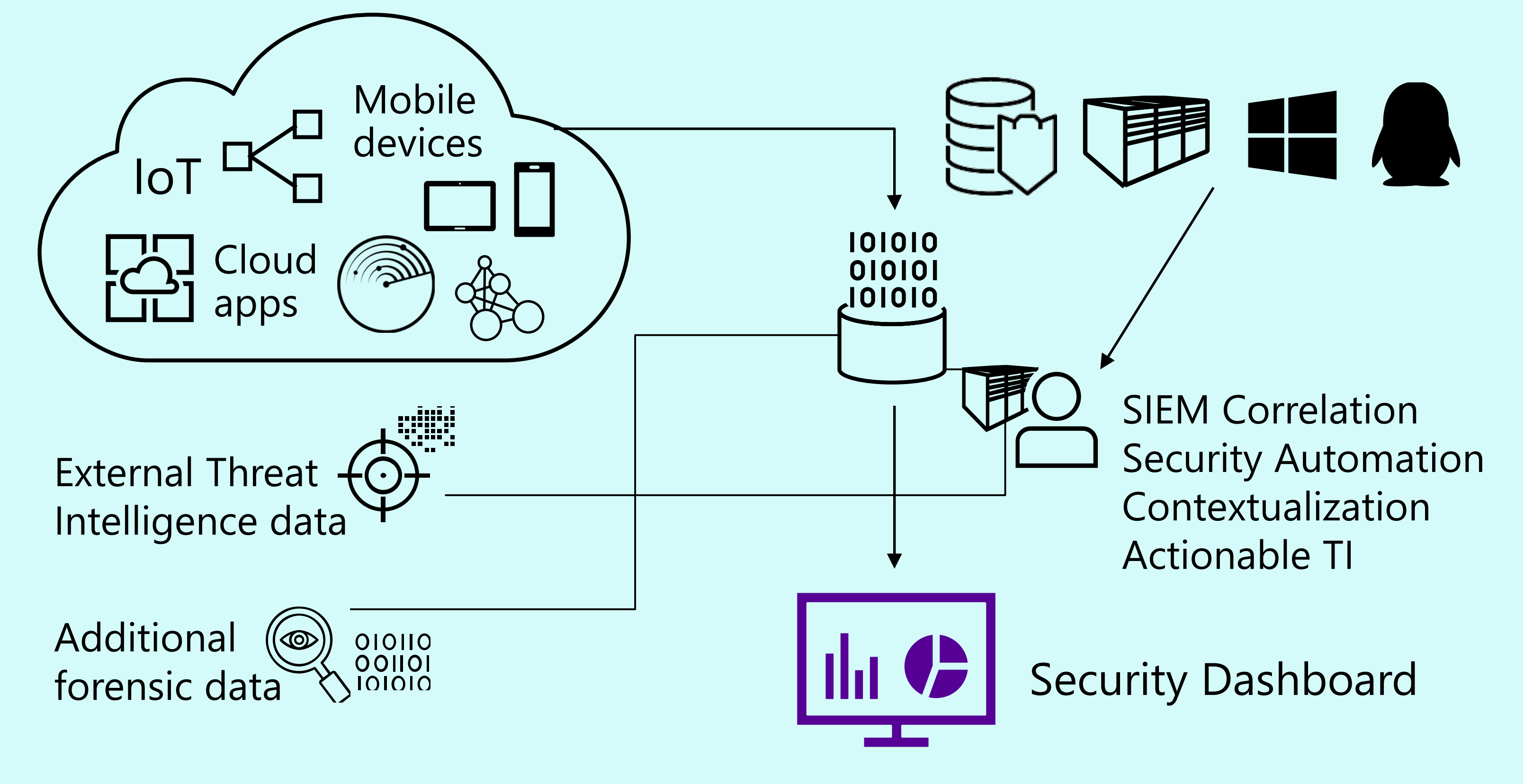
Then...



Correlation Engine (SIEM)

Security Dashboard

Now...



IoT

Mobile devices

Cloud apps

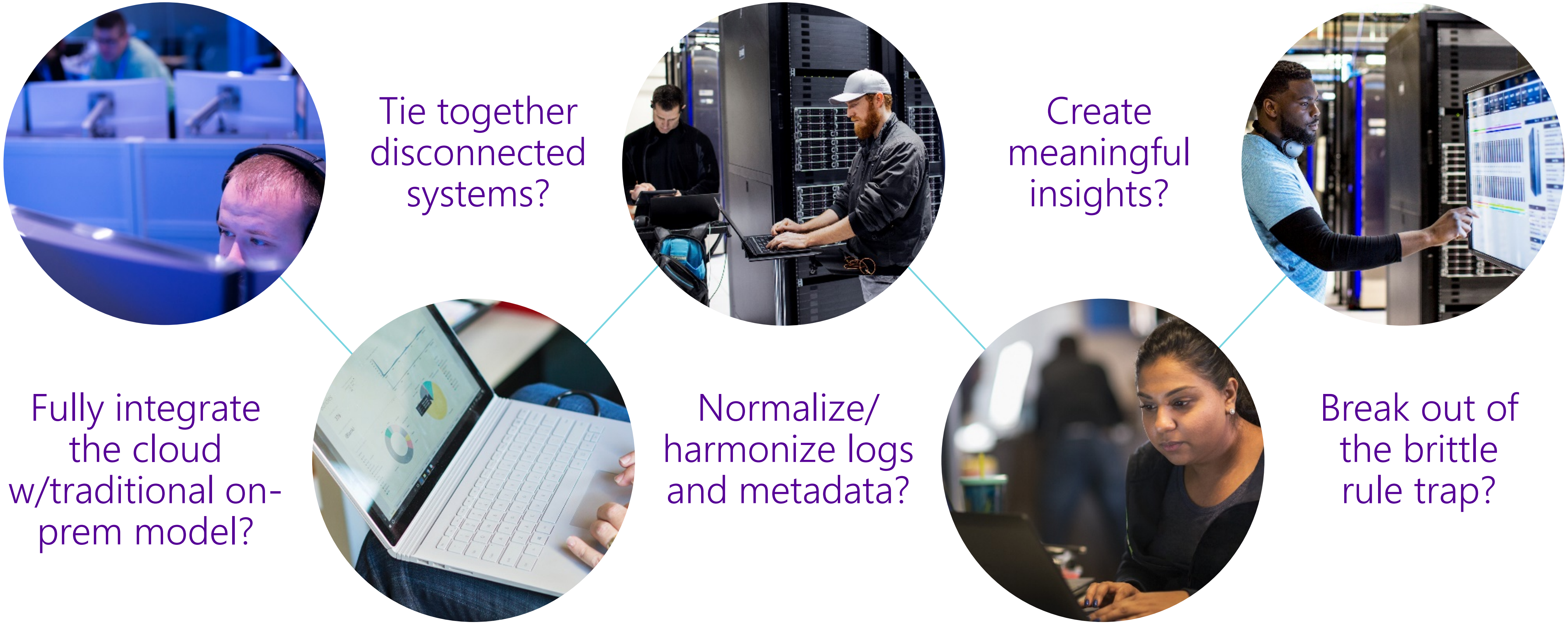
External Threat Intelligence data

Additional forensic data

SIEM Correlation
Security Automation
Contextualization
Actionable TI

Security Dashboard

How can we find the signal in the noise?



Fully integrate the cloud w/traditional on-prem model?

Tie together disconnected systems?

Normalize/ harmonize logs and metadata?

Create meaningful insights?

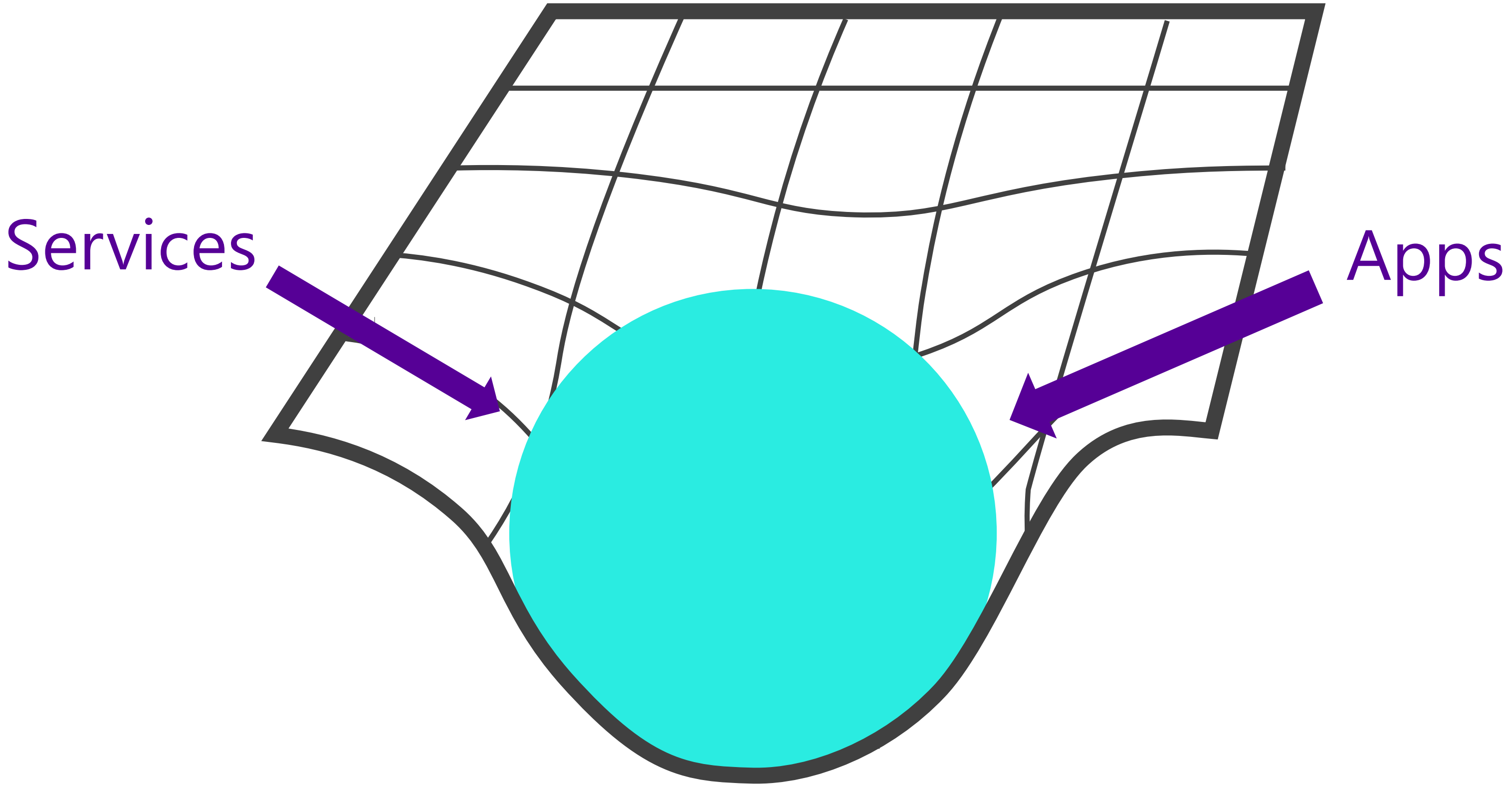
Break out of the brittle rule trap?

The concept of data gravity

Data Gravity

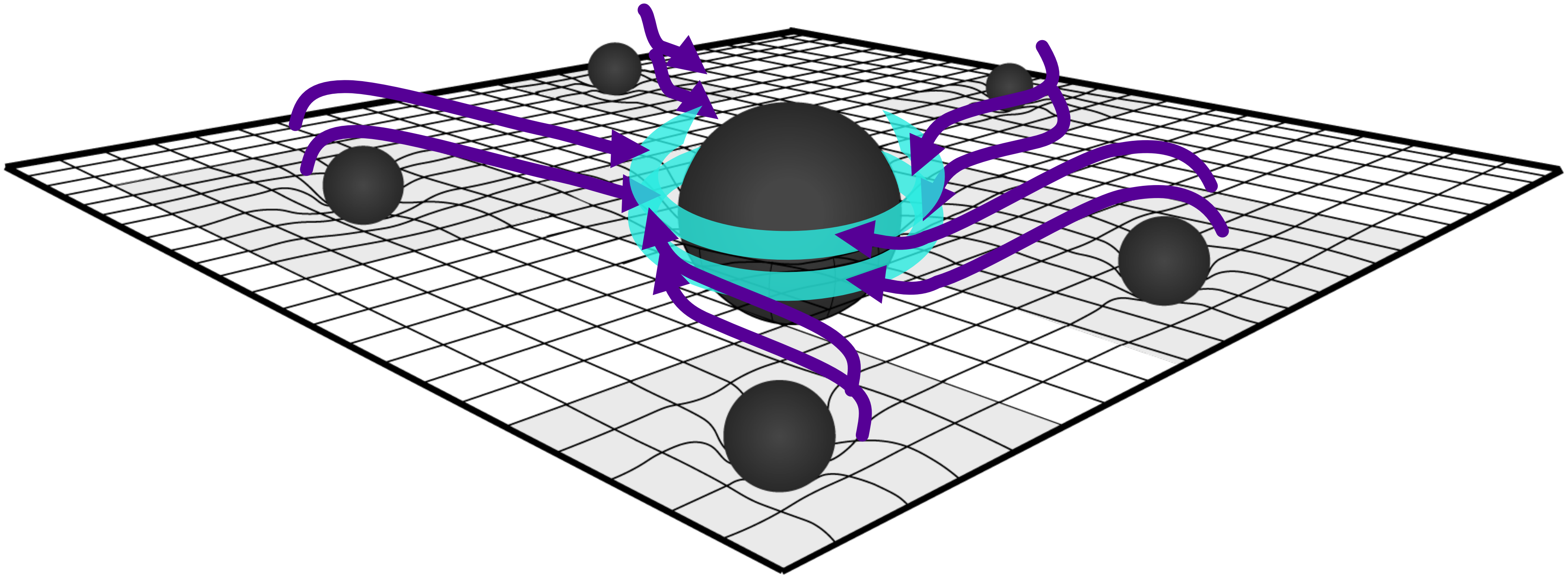
$$\frac{\left(\text{Data Mass} \times \text{Application Mass}\right) \times \text{Number of Requests per second}}{\left(\text{Latency in seconds} + \left(\text{Average Request Size in MBs} \,/\, \text{Bandwidth in MBs per second}\right)\right)^{2}}$$

McCrory's Original Equation



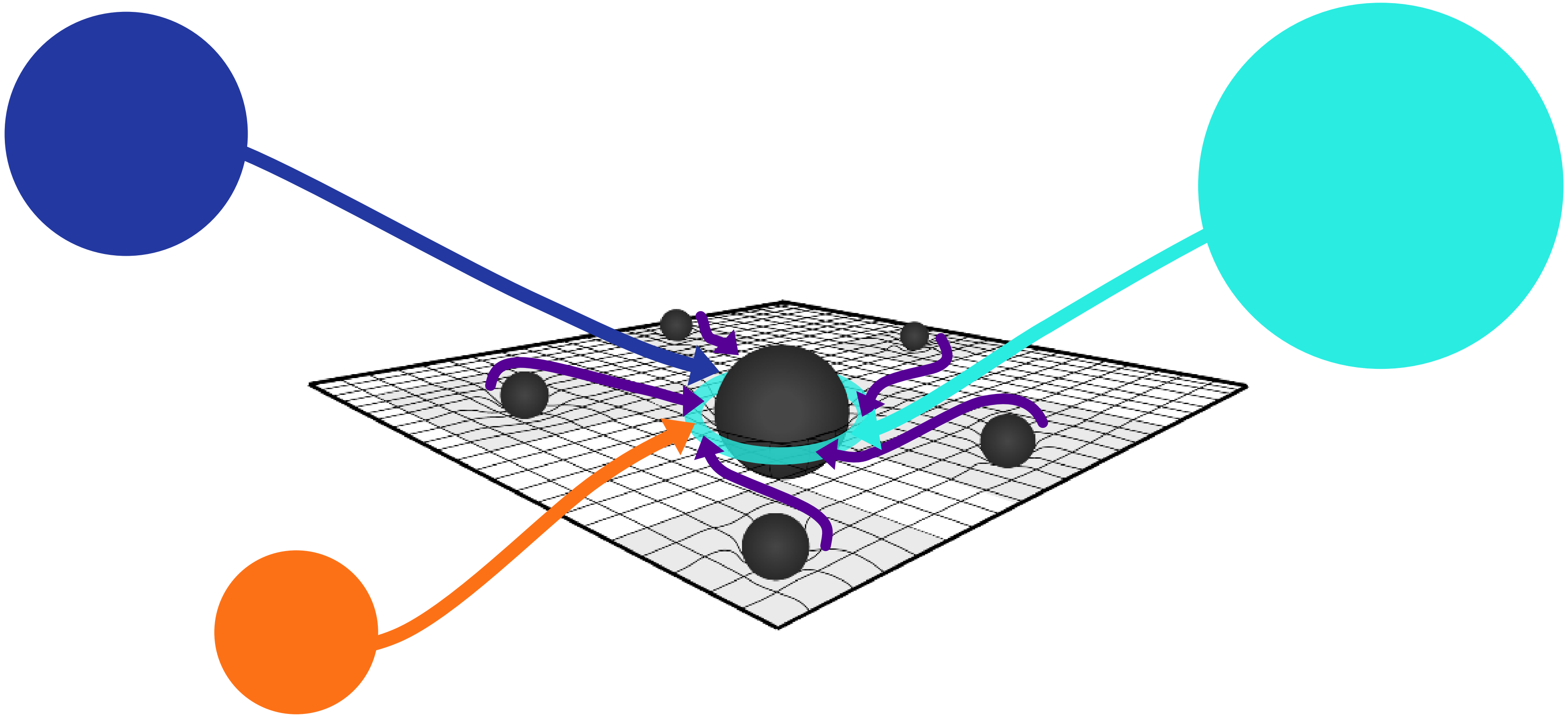
Data gravity in security

Analytics and monitoring gravitates towards the data



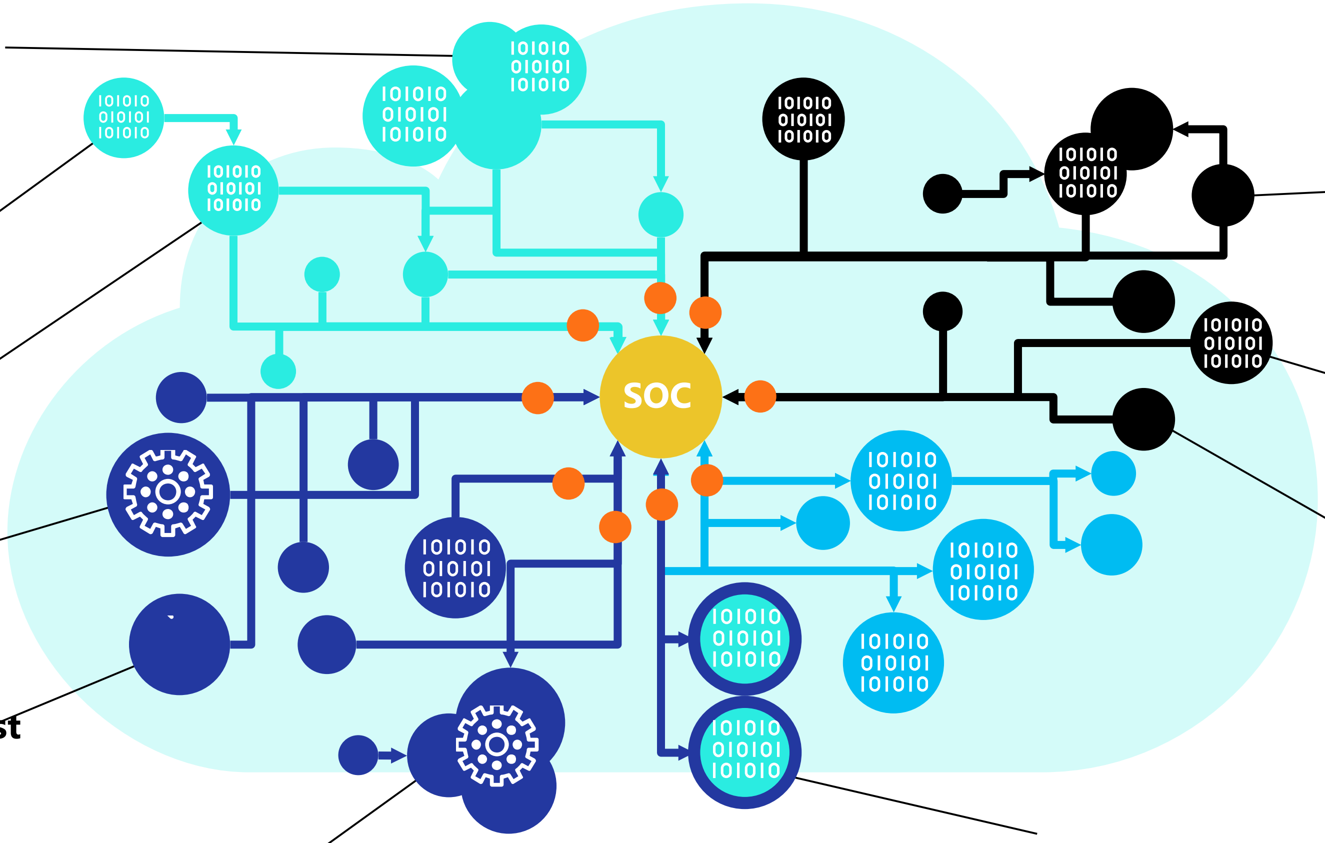
Enabling SIEM transformation

Allows analysts to get insights and context across local and cloud hosted data gravity wells



Future SOC
Data gravity + machine learning

Strong governance across all layers of operations



Advanced **contextualization** based analytics on wide range of security **data and telemetry**

Matrix driven approach for **operations performance measurement**

Capability to process **threat intelligence** data into **actionable** content, reduce noise

Ability to investigate **every single** alert generated

Ability to **detect most** of the attacks in the cyber kill chain

Leverage security automation and security orchestration

Optimized operational capability by **continuous automation** and improvement

Proactive collection of **forensic evidence**, provide context to the alerts

Security **alert optimization** to reduce alert fatigue

Automated and **intelligent workflow** to minimize human errors

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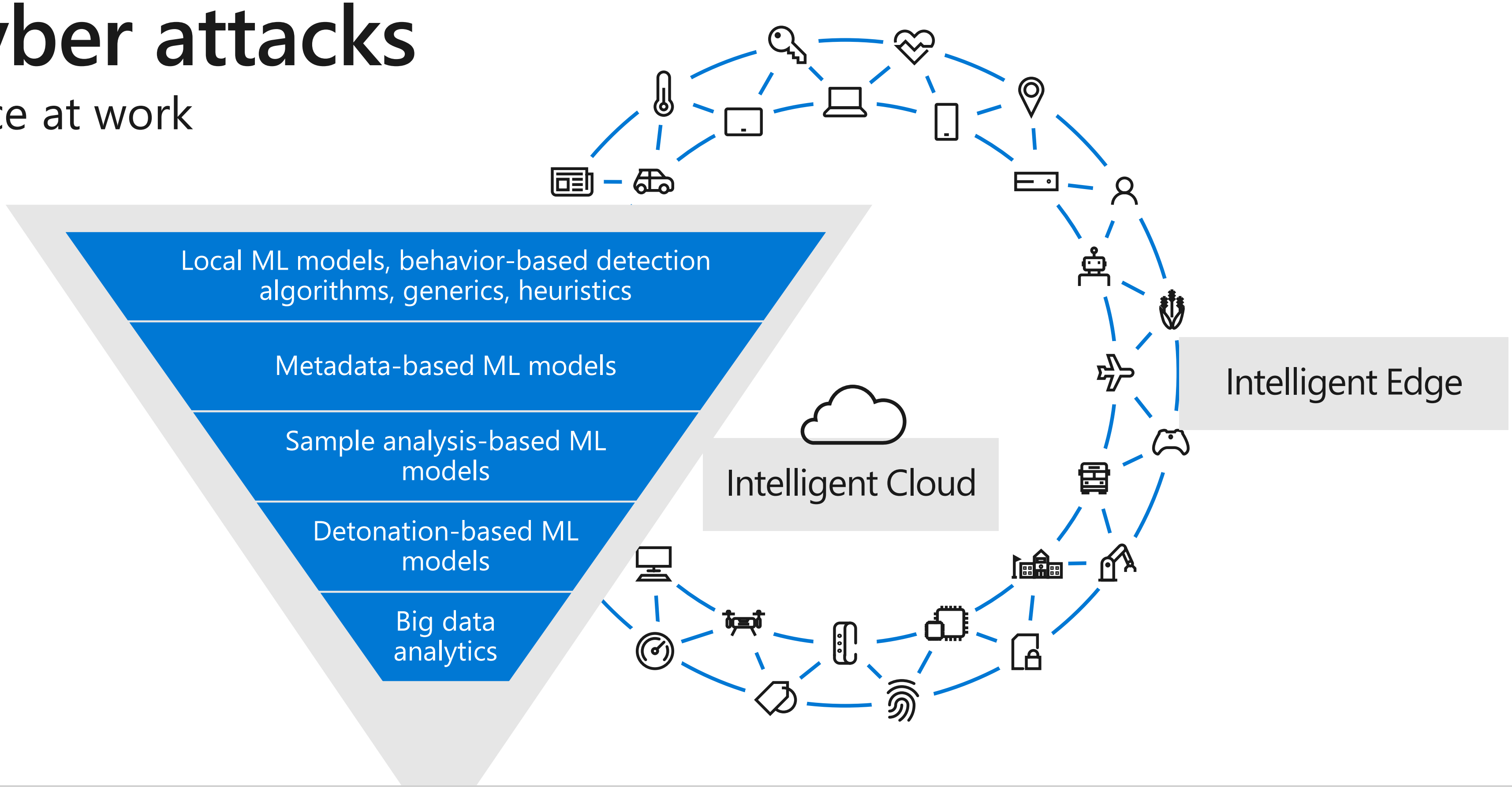
Stopping cyber attacks

Real-world intelligence at work



Local ML models, behavior-based detection algorithms, generics, heuristics

Metadata-based ML models

Sample analysis-based ML models

Detonation-based ML models

Big data analytics

Intelligent Cloud

Intelligent Edge

2017

October 2017 – Cloud-based detonation ML models identified Bad Rabbit, protecting users 14 minutes after the first encounter.

February 3 – Client machine learning algorithms automatically stopped the malware attack Emotet in real time.

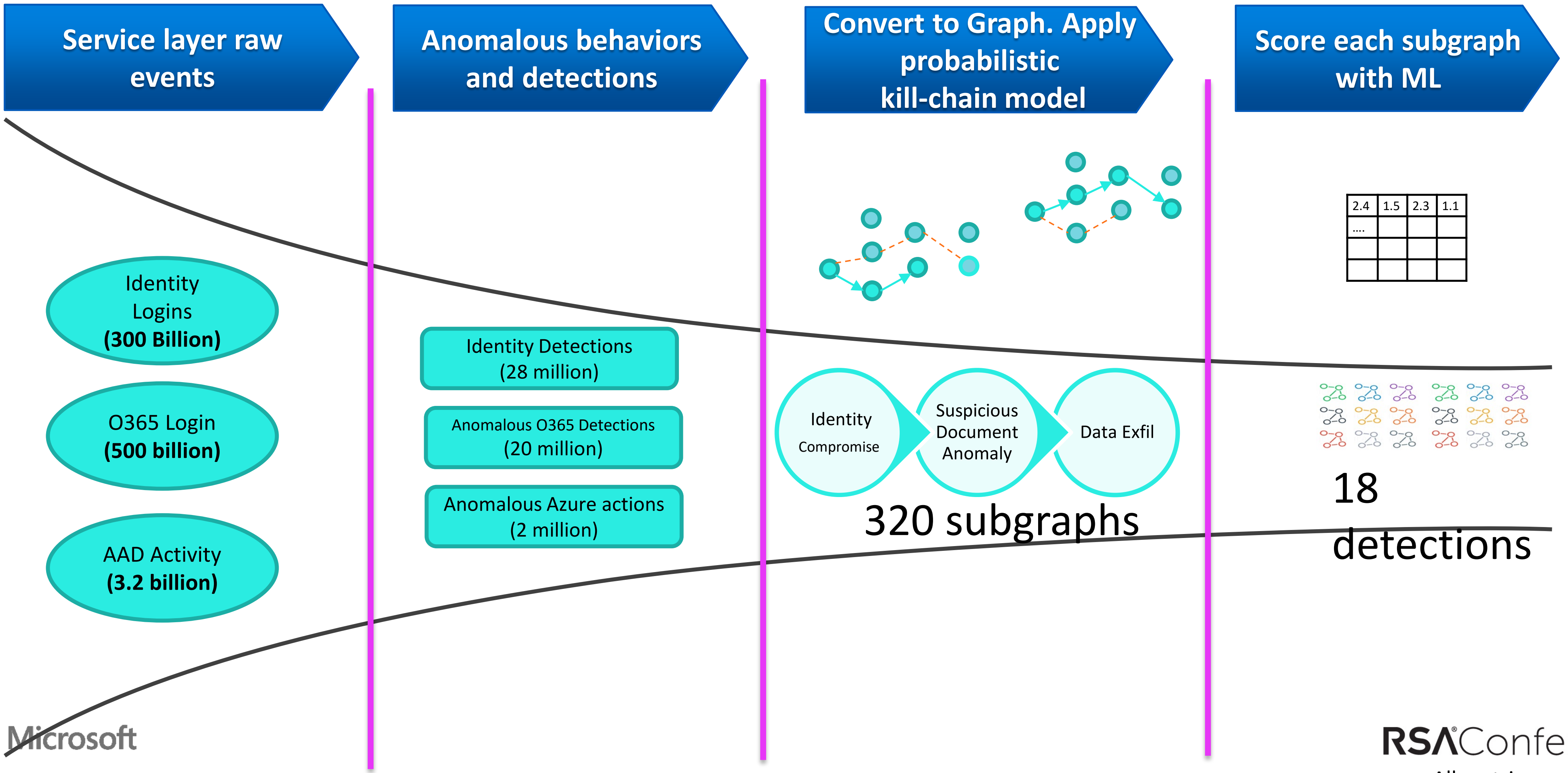
March 6 – Behavior-based detection algorithms blocked more than 400,000 instances of the Dofoil trojan.

August 2018 – Cloud machine learning algorithms blocked a highly targeted campaign to deliver Ursnif malware to under 200 targets

2018

For a given scenario…

Compromise identity → Suspicious document → Exfiltrate data



Service layer raw events

Anomalous behaviors and detections

Convert to Graph. Apply probabilistic kill-chain model

Score each subgraph with ML

Identity Logins **(300 Billion)**

O365 Login **(500 billion)**

AAD Activity **(3.2 billion)**

Identity Detections (28 million)

Anomalous O365 Detections (20 million)

Anomalous Azure actions (2 million)

Identity Compromise

Suspicious Document Anomaly

Data Exfil

320 subgraphs

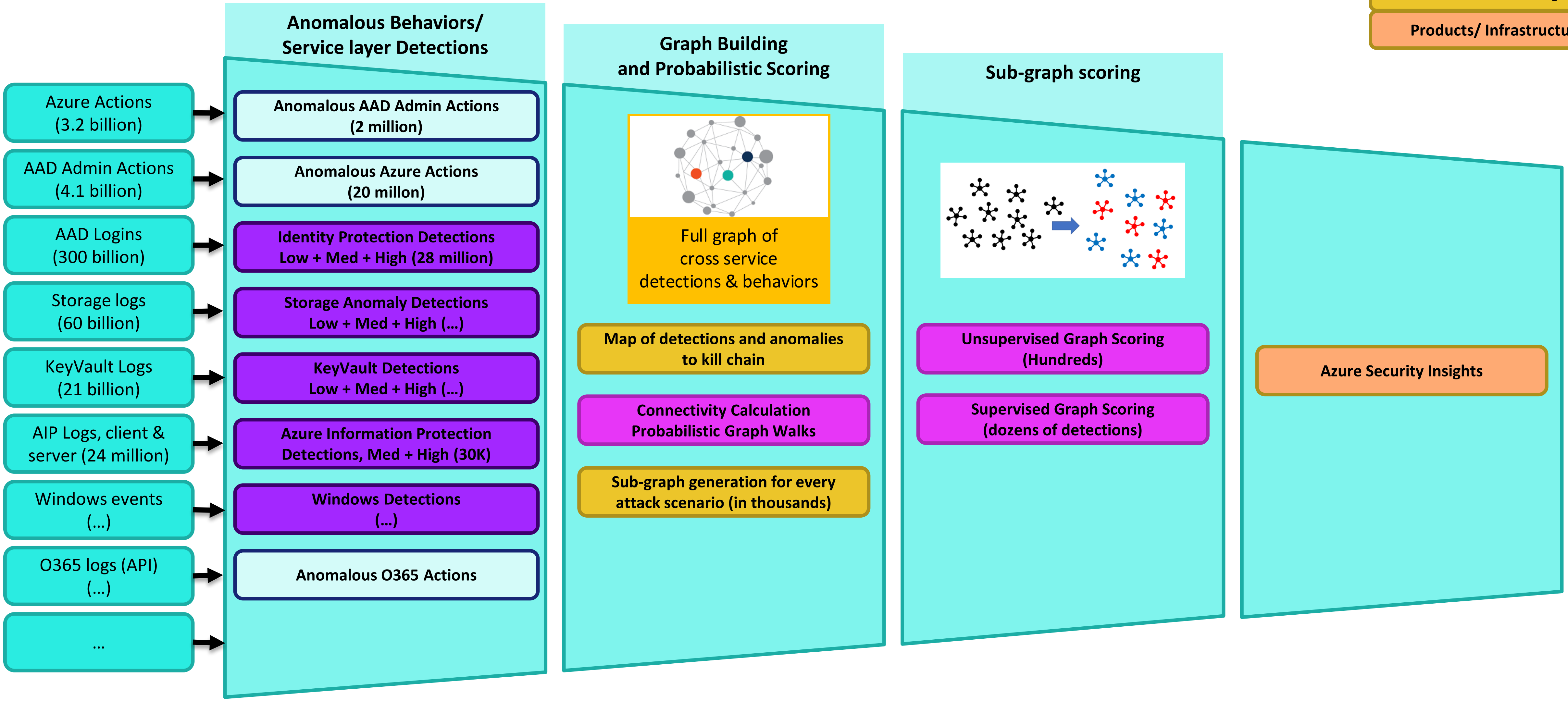
2.4	1.5	2.3	1.1
….			

18 detections

All metrics are for a month

Compound Detection

- Service/Component Detections
- Generic Anomaly Detection
- ML Algorithm
- Domain Knowledge
- Products/ Infrastructure



Azure Actions (3.2 billion)

AAD Admin Actions (4.1 billion)

AAD Logins (300 billion)

Storage logs (60 billion)

KeyVault Logs (21 billion)

AIP Logs, client & server (24 million)

Windows events (…)

O365 logs (API) (…)

…

Anomalous Behaviors/ Service layer Detections

- Anomalous AAD Admin Actions (2 million)
- Anomalous Azure Actions (20 millon)
- Identity Protection Detections Low + Med + High (28 million)
- Storage Anomaly Detections Low + Med + High (…)
- KeyVault Detections Low + Med + High (…)
- Azure Information Protection Detections, Med + High (30K)
- Windows Detections (…)
- Anomalous O365 Actions

Graph Building and Probabilistic Scoring

Full graph of cross service detections & behaviors

- Map of detections and anomalies to kill chain
- Connectivity Calculation Probabilistic Graph Walks
- Sub-graph generation for every attack scenario (in thousands)

Sub-graph scoring

- Unsupervised Graph Scoring (Hundreds)
- Supervised Graph Scoring (dozens of detections)

Azure Security Insights

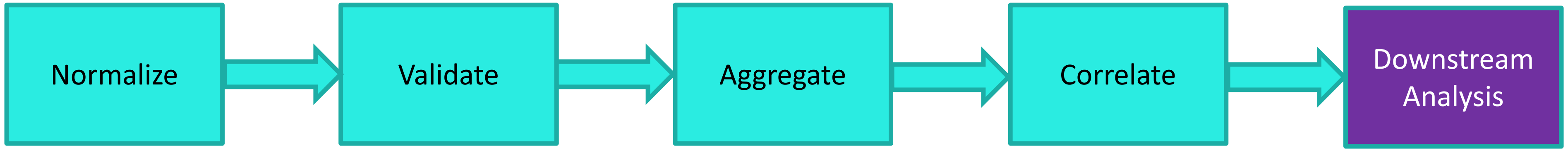
All stats are for a month

Traditional Rule Based Engines

🔴 High Risk

🟡 Medium Risk

🟢 Low Risk



Normalize → Validate → Aggregate → Correlate → Downstream Analysis

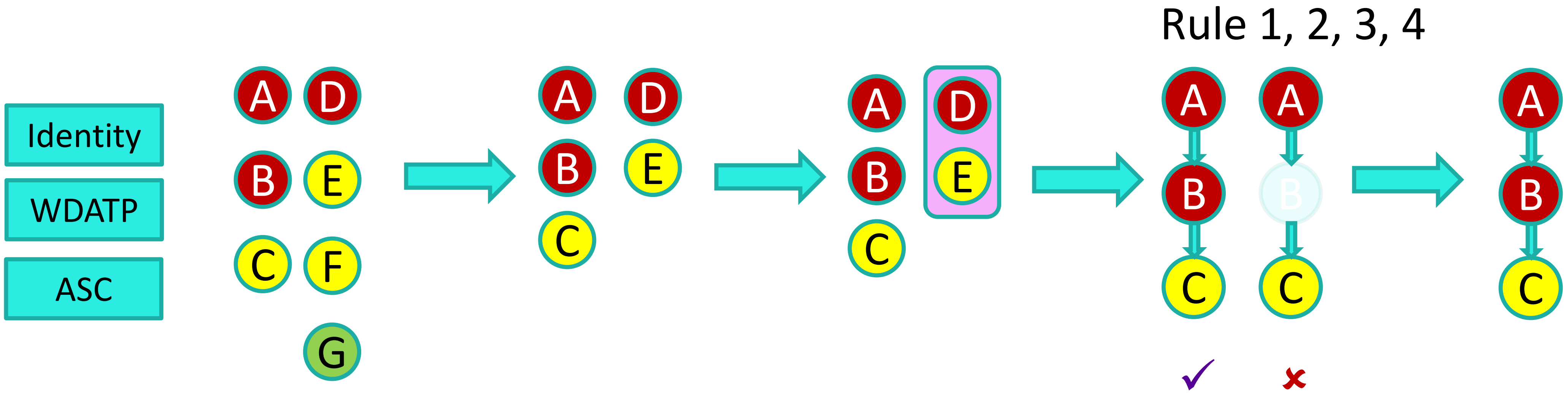
- Standardized schema

- Custom logic for handling false positives, throttling data load

- Reduce complexity of space, eliminate common events

- Rule based approach for joining known data

- Prioritize attack incidents
- Predict Known attacks
- Detect novel attack strategy
- Find missing attacks
- Find similar attacks



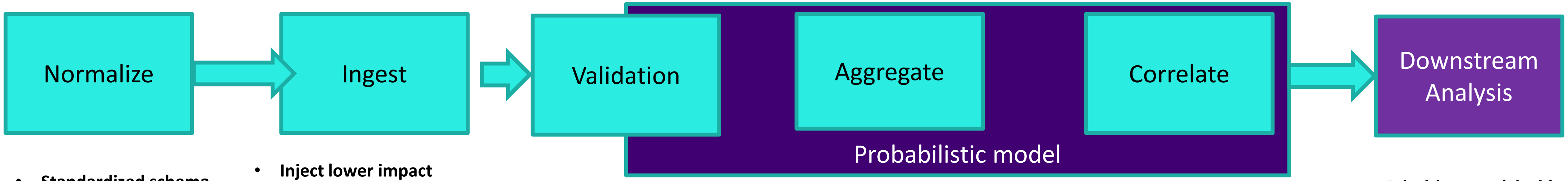
Graph based Machine Learning

🔴 High Risk

🟡 Medium Risk

🟢 Low Risk

🟣 High Impact Activities

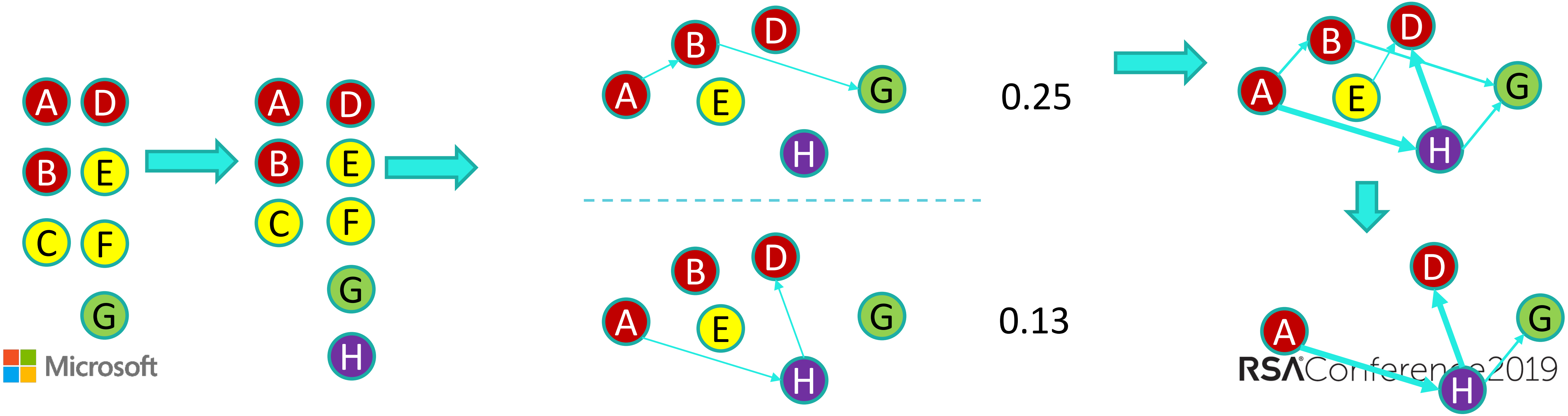


- Standardized schema

- Inject lower impact events, and other high impact activities
- Validate HIA lightly, push other validation downstream

- Probabilistic Bayesian inference, to validate, aggregate, and correlation behavior between alerts and High Impact activity
- Iterative Reversible Jump MCMC algorithm to expand, contract graph, calculate probability between events, and aggregated events
- Output continuous probabilities between edges, and hyper

- Prioritize attack incidents (Probabilistic)
- Predict Known attacks (Probabilistic)
- Detect novel attack strategy
- Find missing attacks
- Find similar attacks

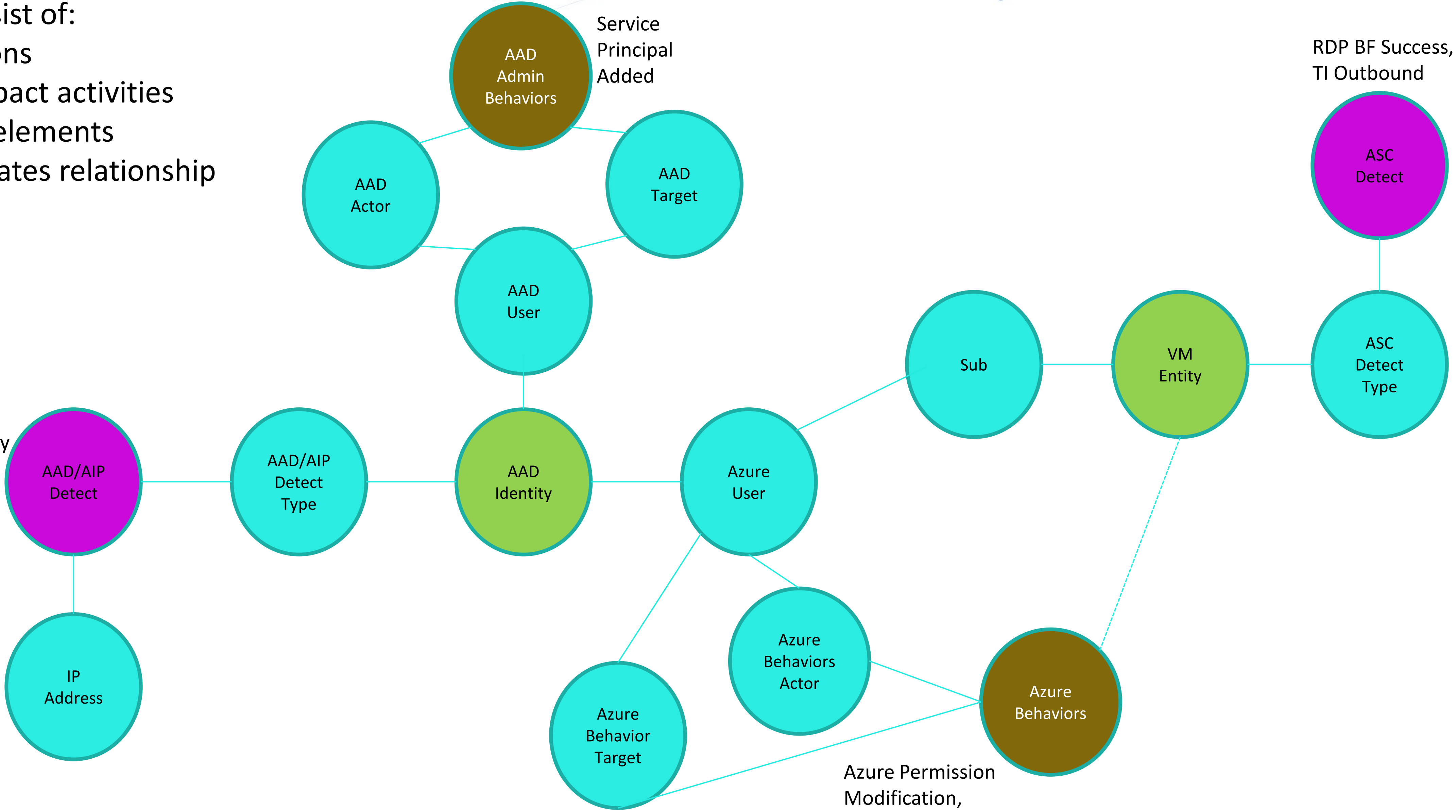


Building a Cross Service Graph of Detections and Behaviors

Nodes consist of:

- Detections
- High impact activities
- Linking elements

Edges indicates relationship



Service Principal Added

RDP BF Success, TI Outbound

Geo Login Anomaly Detection (GLAD), Familiar Location, Suspicious IP, AIP Exfiltration etc

Azure Permission Modification, RDP Enable, RDP Download, etc

Real World Proof

Noisy results

- Company proxy
- Cell phone networks
- Vacations/travel

A former rules-based Microsoft system scored

2.8% of logins as suspicious

1 billion logins per day =

280 million

"suspicious" logins

After applying **machine learning with rules,** the rate dropped to less than

0.01%

Work by Mace et. al, Microsoft

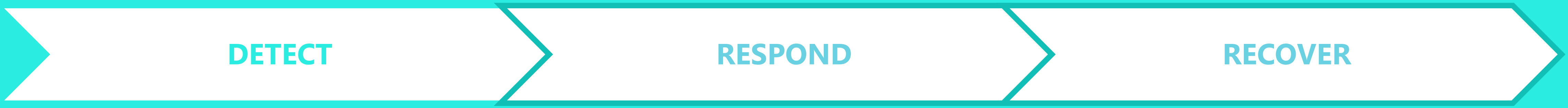
Benefits

Maximize visibility

Reduce manual steps and errors

Maximize human impact

SPEED THE MTTI/MTTC



DETECT

RESPOND

RECOVER

Observe

Orient

Decide

Act

Summary

- SIEM and traditional SOCs can't keep up
- We need to reimagine our response
- Harnessing the law of data gravity helps move us to a CDOC model
- Informed and augmented with layered ML

Apply What You Have Learned Today

- Next week you should:
  - Assess your current SOC, can it keep up?
- In the first three months following this presentation you should:
  - Determine SOC requirements for the next 1-3 years
    - Data collection, multi-cloud, multi-partner, containers & functions
    - Consider applying Data Gravity concept to evolved SOC planning
- Within six months you should:
  - Build the strategy for Future SOC
  - Deploy in functional buckets, single cloud before broader roll-out

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Thank you!