Teamcenter Security Monitoring through SAS Analytics

Siemens - SAS joint user behavioral analytics project

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Overview

- Requirements
- Solution overview
- Development process
- Analytics methods
- Example anomalies
- Conclusion

Requirements


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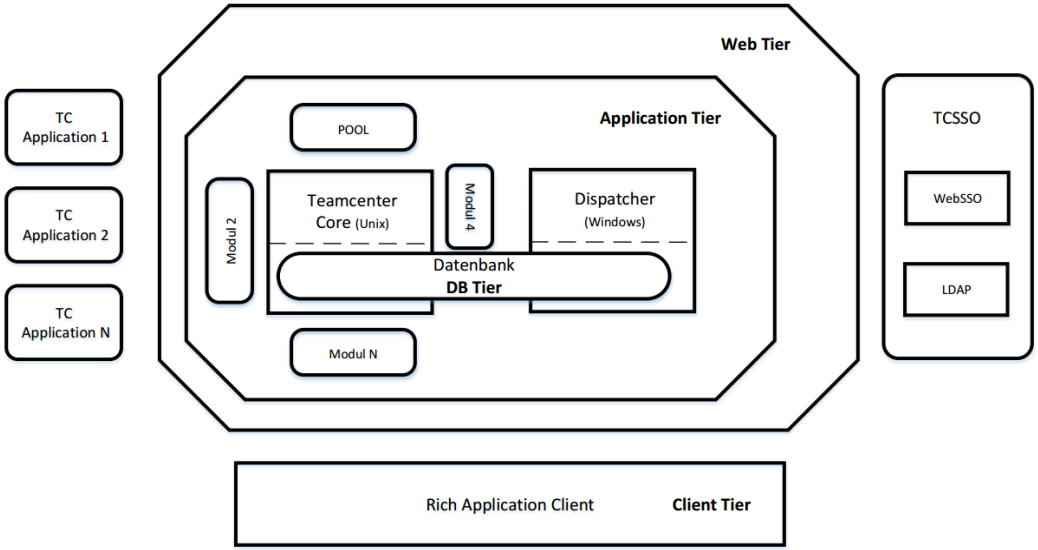
Teamcenter Security Requirements

- **Teamcenter PLM** = managing product lifecycles, contains sesitive intellectual property
- Multi-tiered web services, browser based application with array of add-on modules

High-level requirements - PoC

- Key use case = protecting intellectual property / preventing improper use and exfiltration
- Non-invasive, automated, asyncronous
- Minimize administrative overhead
- Strict user privacy (anonymization)
- Identify highly unusual anomolous user behaviors
- Minimize false alerts through embedded contextual understanding of typical / atypical behavior



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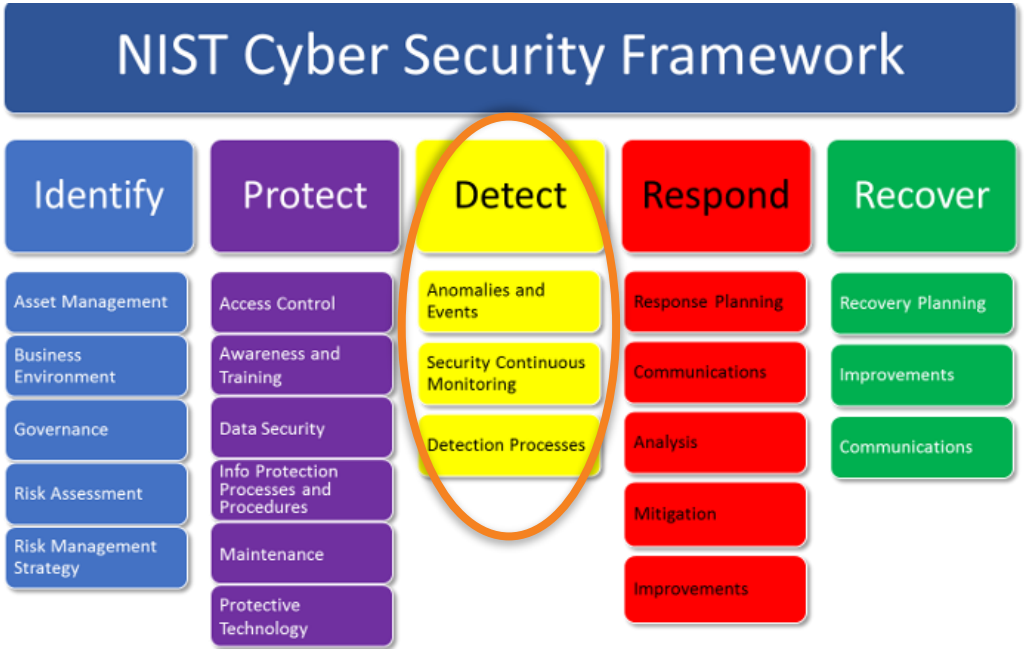
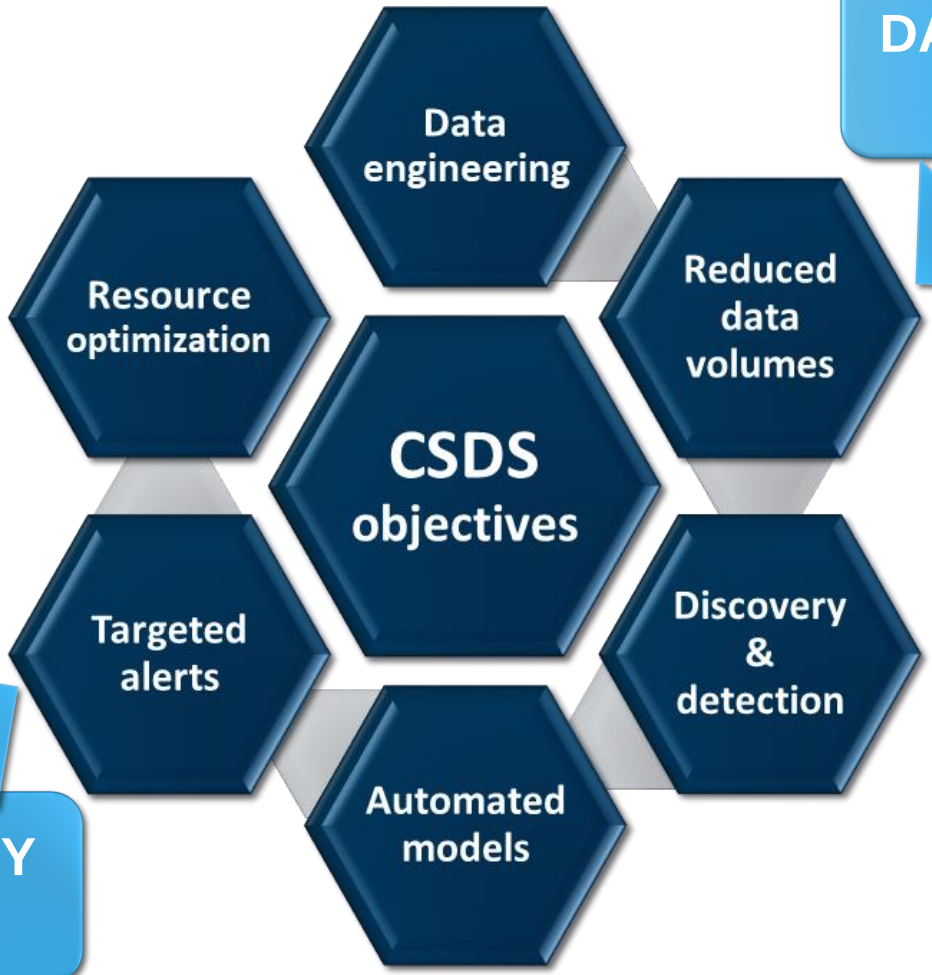


CSDS

Cyber Security Data Science



DATA SCIENCE METHODS

CYBERSECURITY GOALS

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Solution Overview

TeamCenter Log Analytics

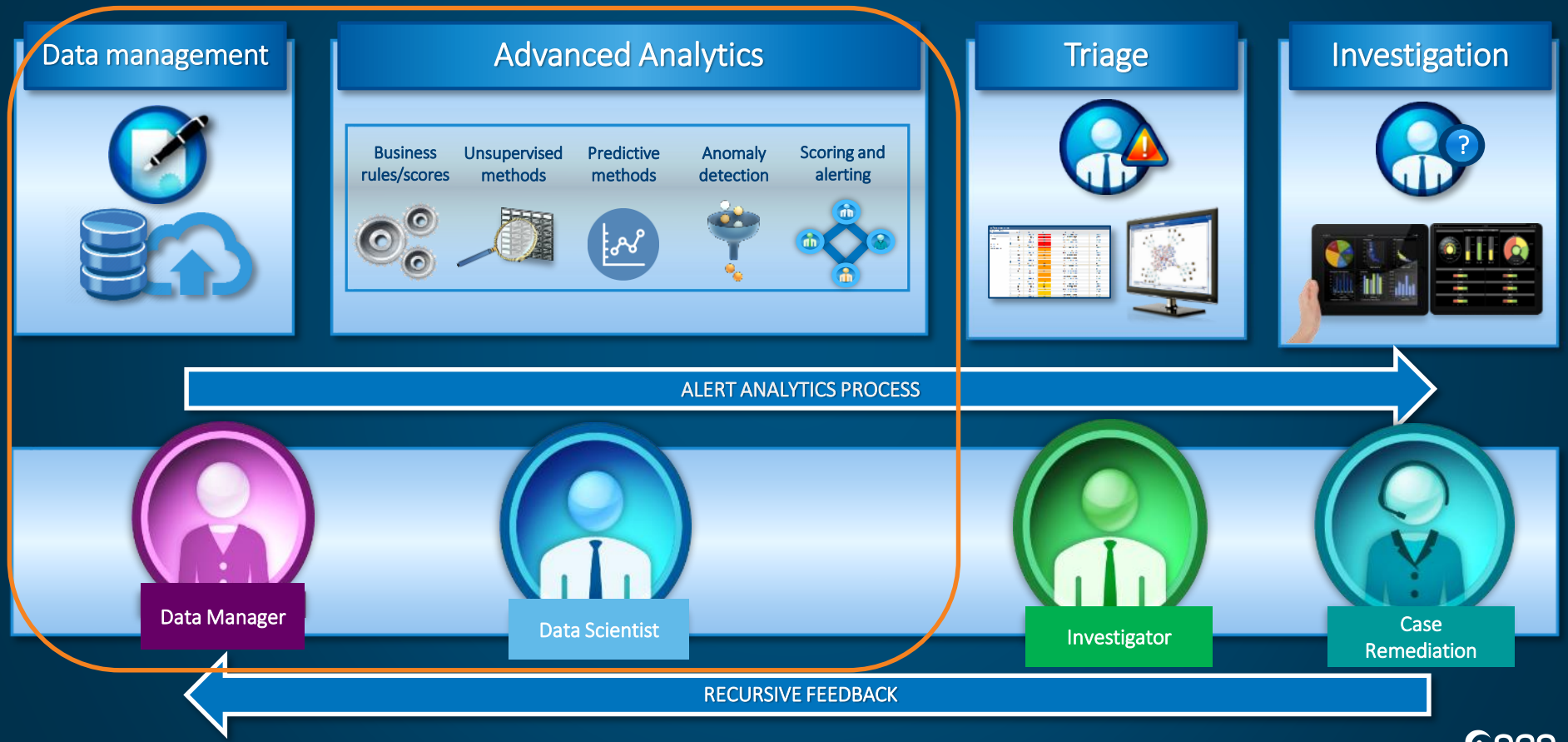
Ingest raw log data in **batch**

Refine data and apply **advanced analytics**

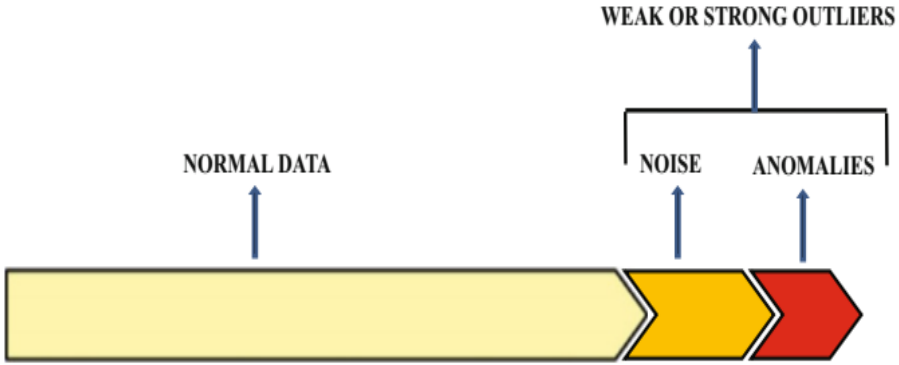
Deliver **focused anomaly alerts**

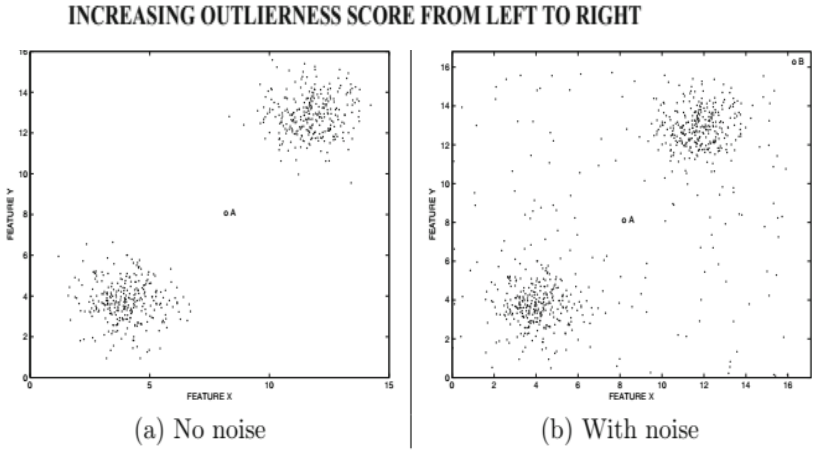
Internal follow-up

High-Level Functional Process

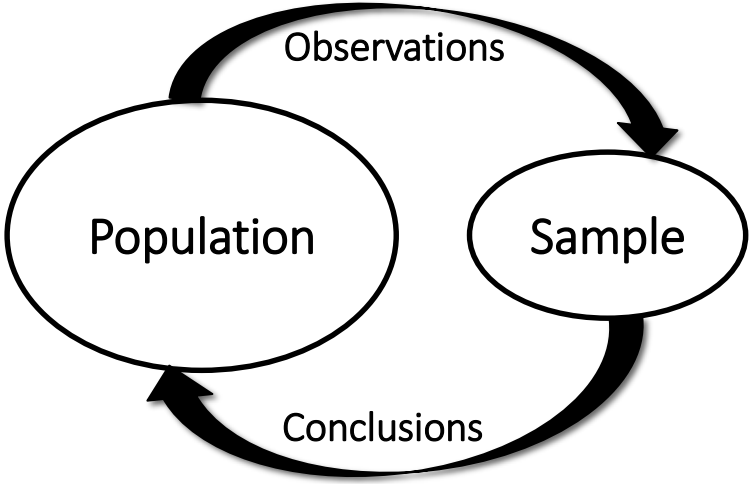


Anomaly Detection: Simply Complex



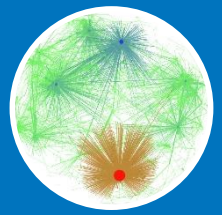


Inferential Statistics



SOURCE Aggarwal, Charu C. (2017). "Outlier Analysis: Second Edition". Springer International Publishing AG.

Assessing Key Features to Produce Focused Anomalies



Network context

Session summaries

Functional calls

Exception indicators

Composite for User Baselines

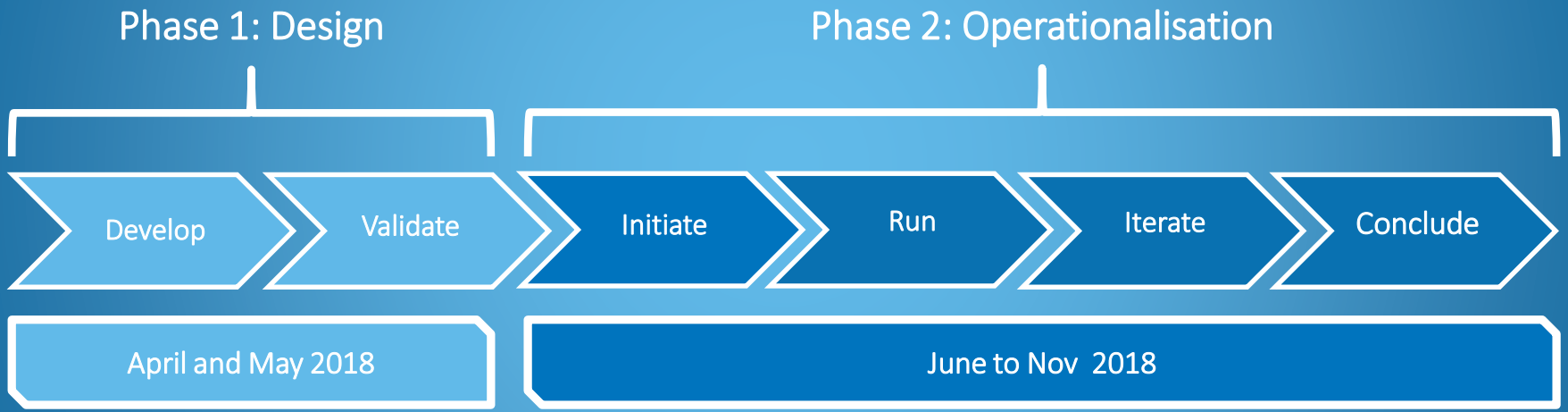
1. FLAG - many high measures

2. CHANGE - changes in behavior

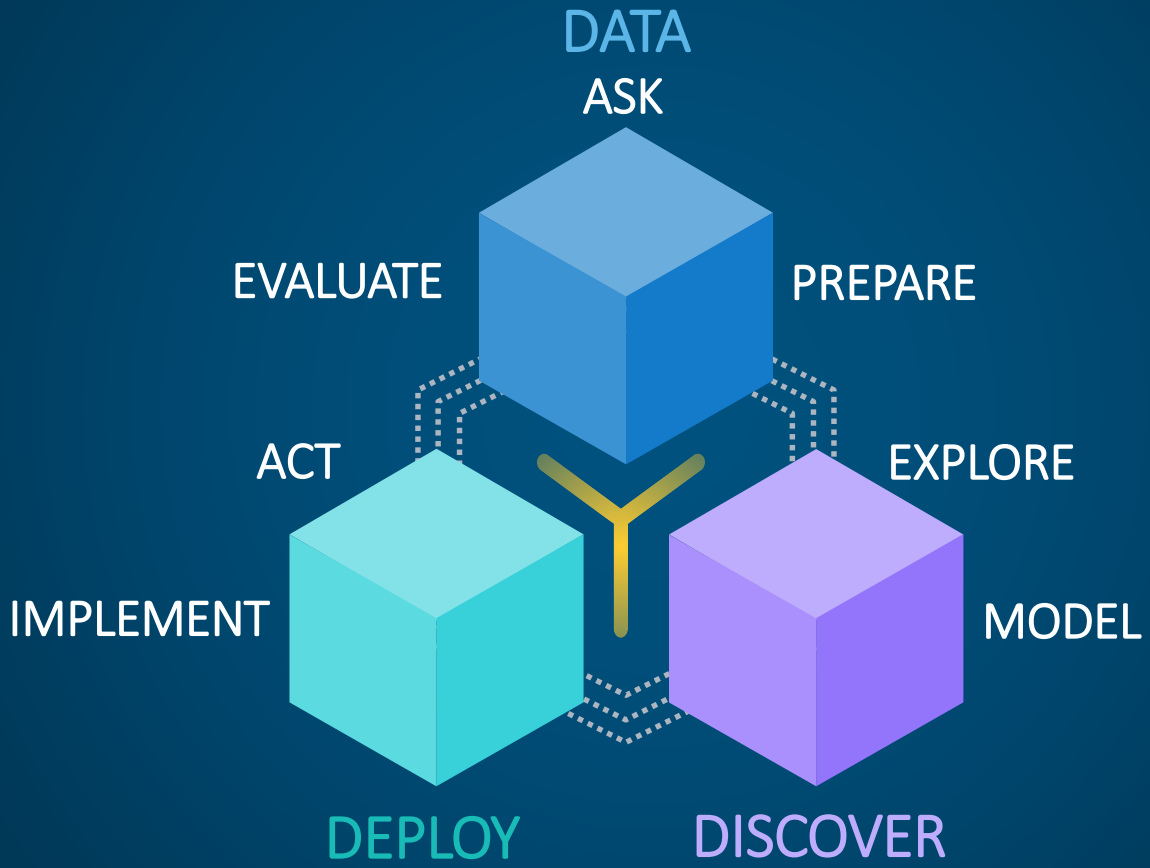
3. UNUSUAL - outliers

Development Process

Cybersecurity Analytics for TeamCenter PLM

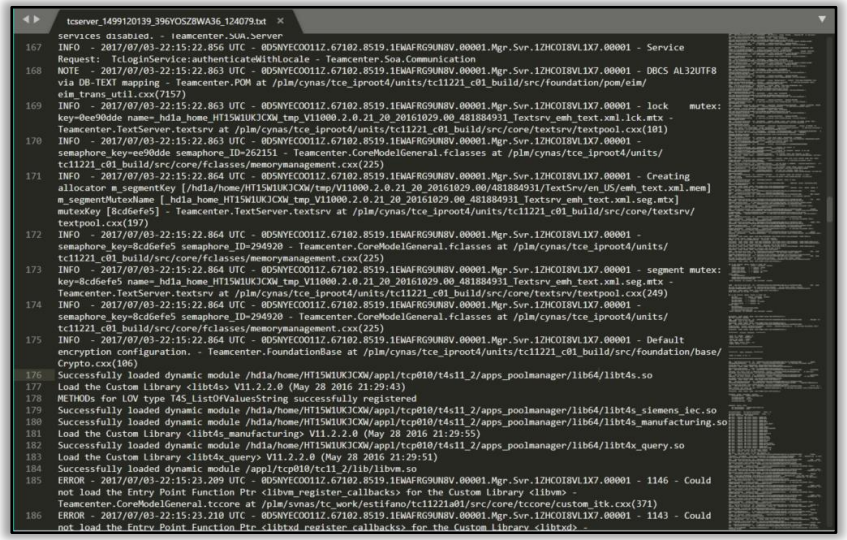


SAS Analytics Process



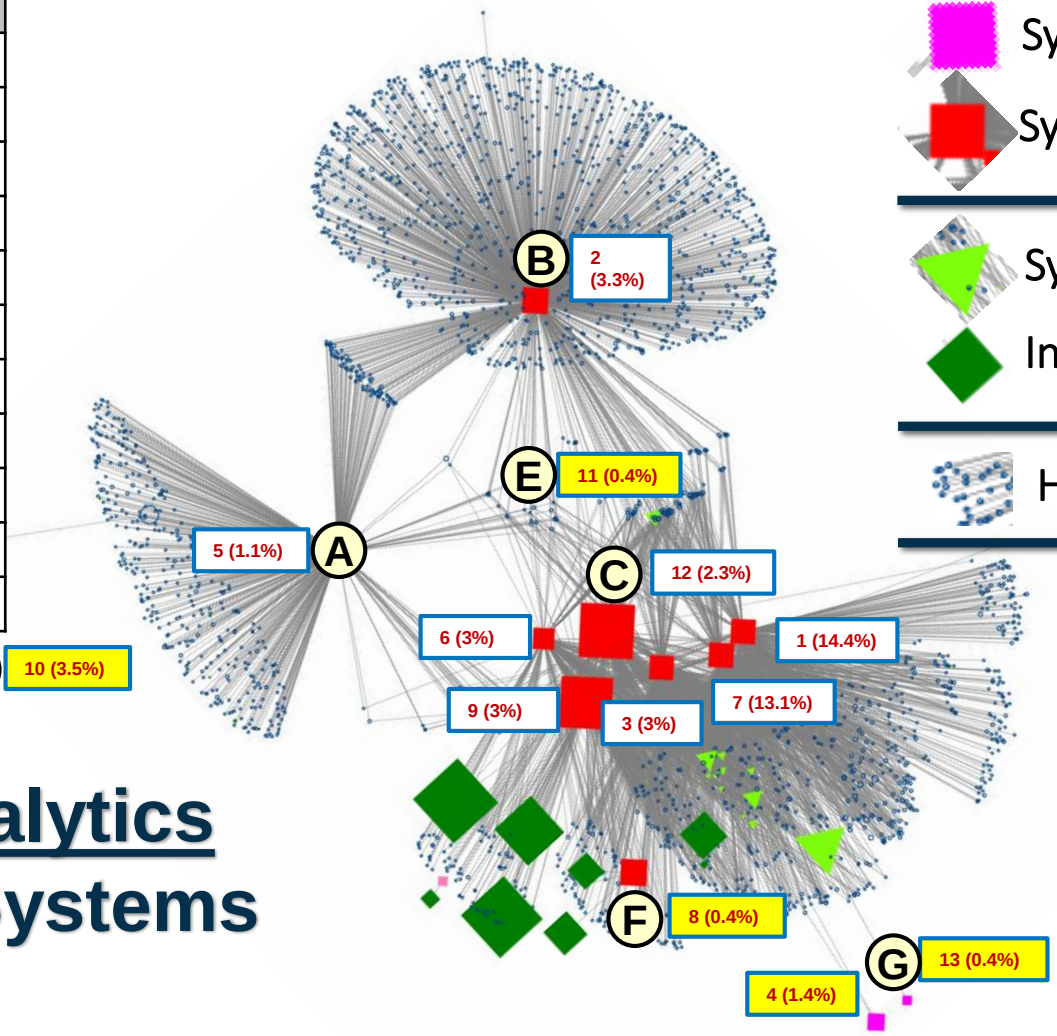
Inferential Exploration

- Exploratory analytics
- Initial sample = 2 weeks TC syslog sessions
- Initial challenges
  - Unstructured
  - Little documentation
  - Little known concerning structure/context (codes, functional relevance)
  - Verbose (many codes, commands, etc.)
- Initial investment in data selection and feature engineering



USER TYPE	# SESSIONS
System-User	10331
System-User	9497
Interface-User	7559
System-User	6936
System-User	3287
System-User	2769
System-User	1998
Interface-User	1382
Interface-User	1156
*User **	*934*
Interface-User	793

** User XXXXXXXX*



Graph Analytics
Multiuser Systems

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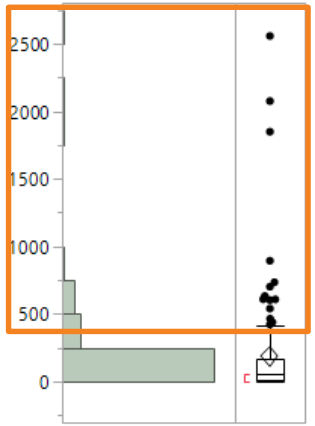
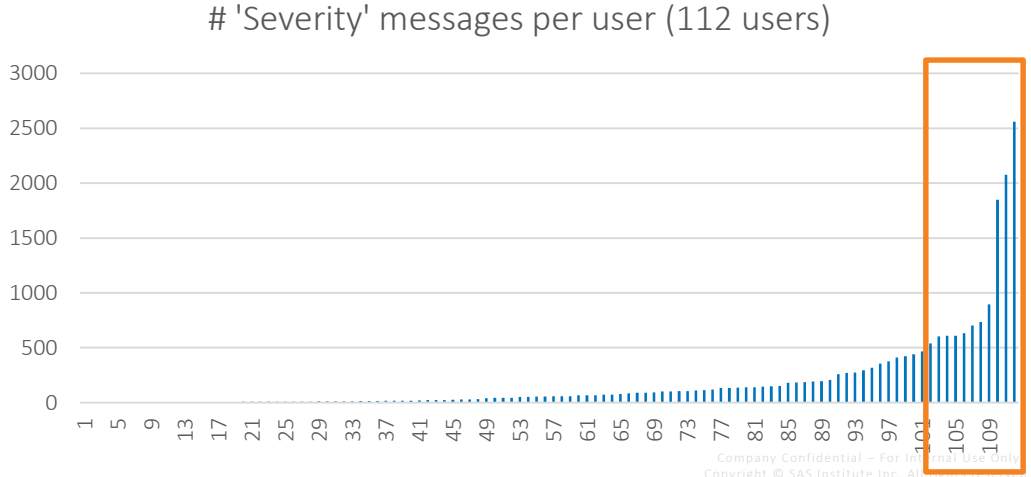
States Indicative of Exceptions

Example: 'SEVERITY'

- Determine how many users and sessions with term
- Aggregate total for each user and make record
  - Expand details for frequent terms (e.g. mean, st dev, total)
- Profile and determine outliers
- Record flag for outliers
- *Validate with systems experts to determine significance*





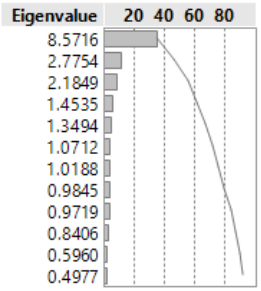
Quantiles

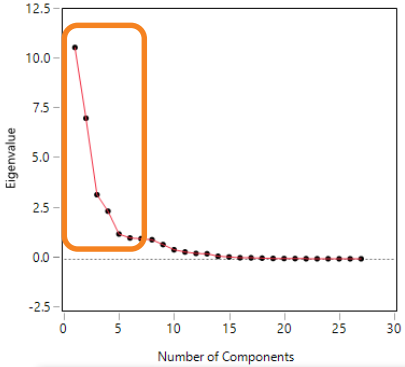
100.0%	maximum	2559
99.5%		2559
97.5%		1889.725
90.0%		517.5
75.0%	quartile	172.75
50.0%	median	55.5
25.0%	quartile	9.75
10.0%		3.3
2.5%		1.825
0.5%		1
0.0%	minimum	1

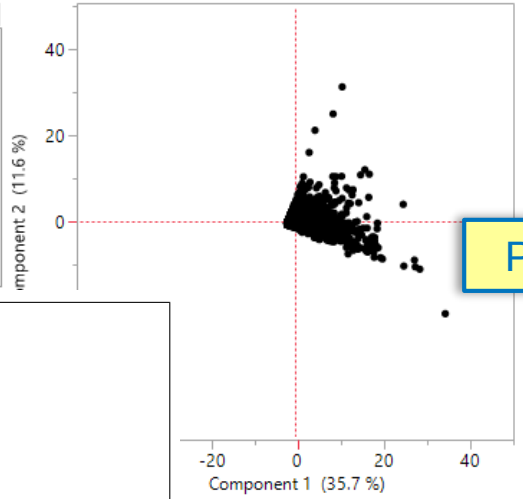
Summary Statistics

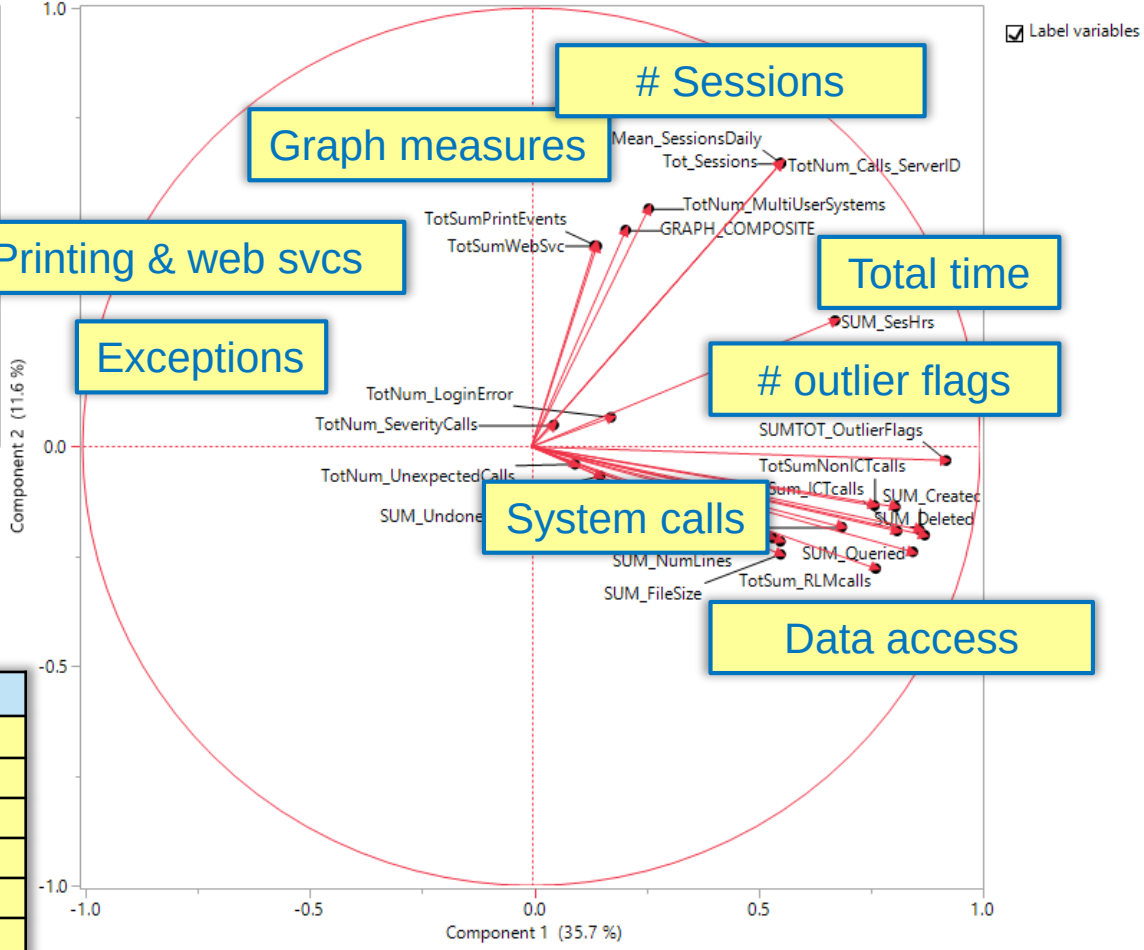
Mean	184.01786
Std Dev	380.96684
Std Err Mean	35.997982
Upper 95% Mean	255.35026
Lower 95% Mean	112.68545
N	112

Principal Component Analysis (PCA)









# Var	Suggested Variable Components
9	Key events (created, deleted, queried)
10	# sessions, server ID calls, # outlier flags
6	File sizes and # lines
6	Non-ICT calls, unexpected calls
3	Data access calls
3	Multi-user systems / graph measures

Log File Measures Extracted

Session summaries

Session events

Exception indicators

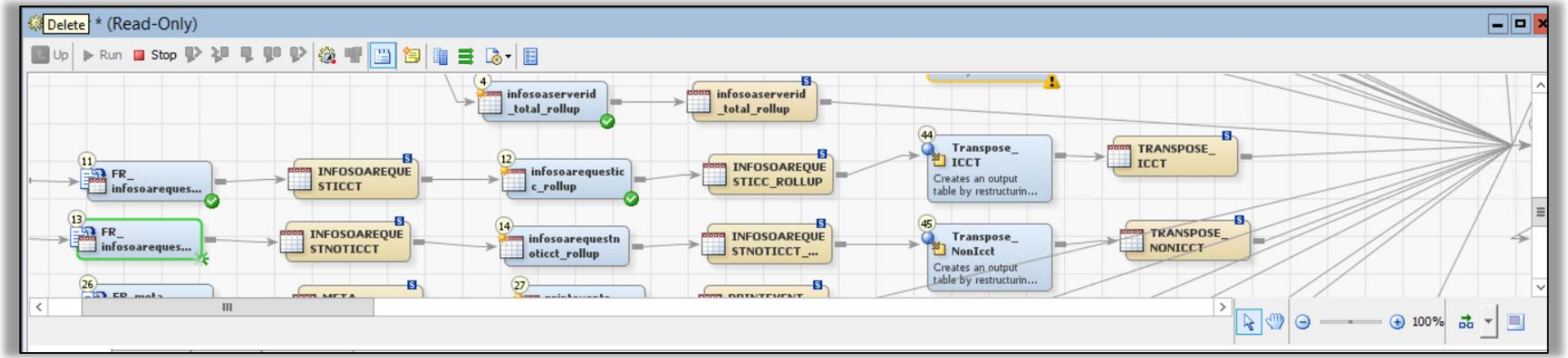
Functional calls

Network context

1 week & 6 week roll-ups
- Total sum ∑
- Standard deviation σ
- 110 total measures

Resulting ETL Process

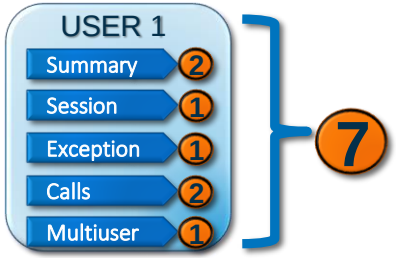
- SAS extract-transform-load (ETL) to process data and orchestrate analytics
- Specialized data handing: *i.e. time zone adjustment, segmentation of specialized users & subcommand handling*
- Regularized and reliable – *flat data goes in and focused anomalies are produced*

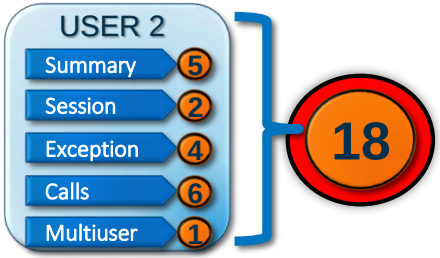


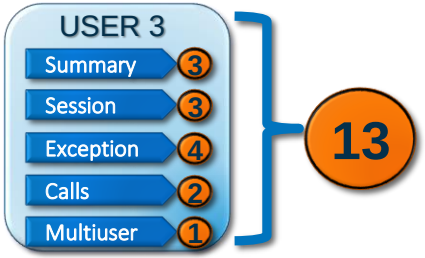
Analytics Methods

Cybersecurity Anomaly Detection

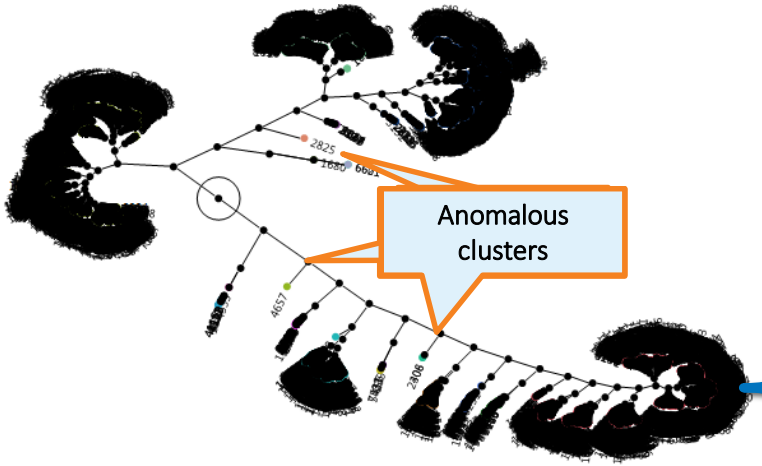
Multiple Methods to Surface Anomalies



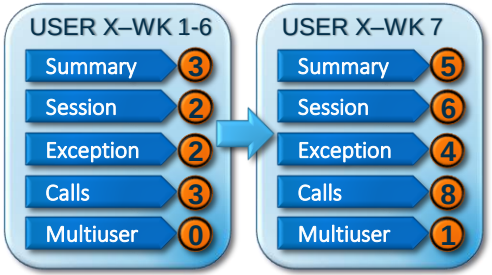


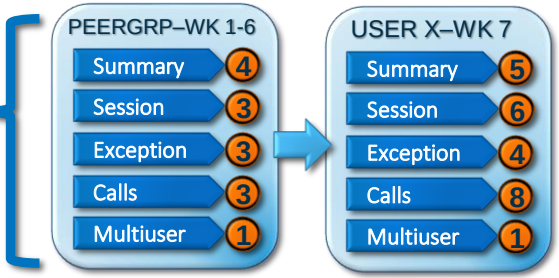


1. UNIVARIATE 'FLAGS'



2. UNSUPERVISED MACHINE LEARNING

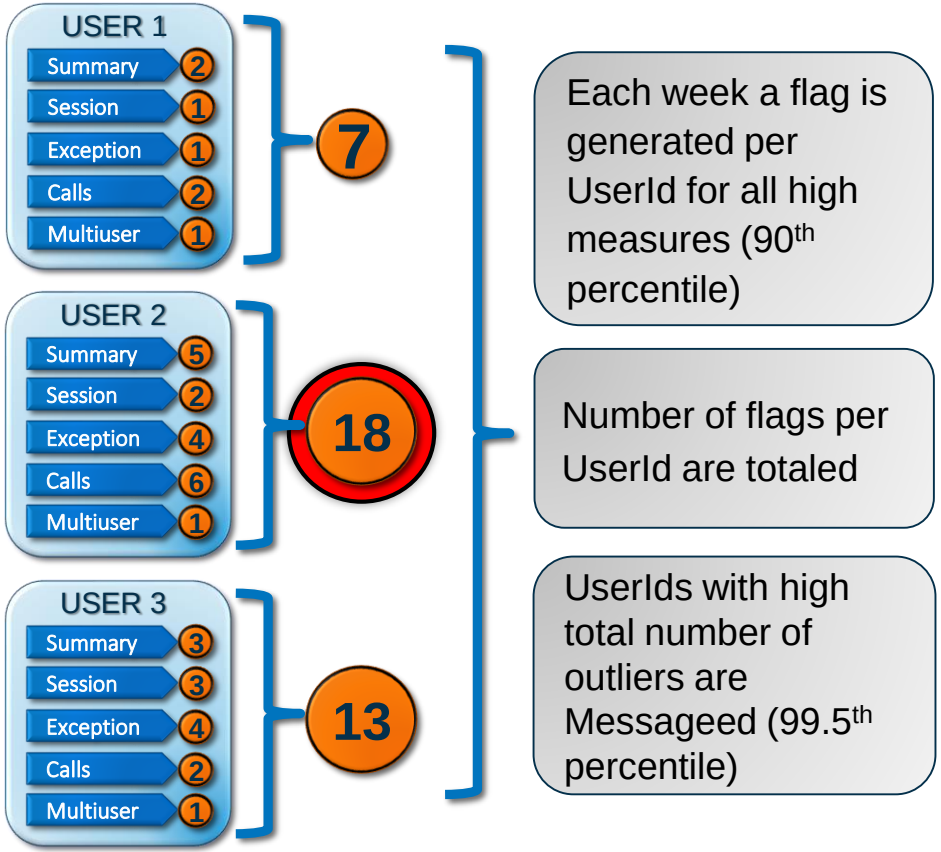




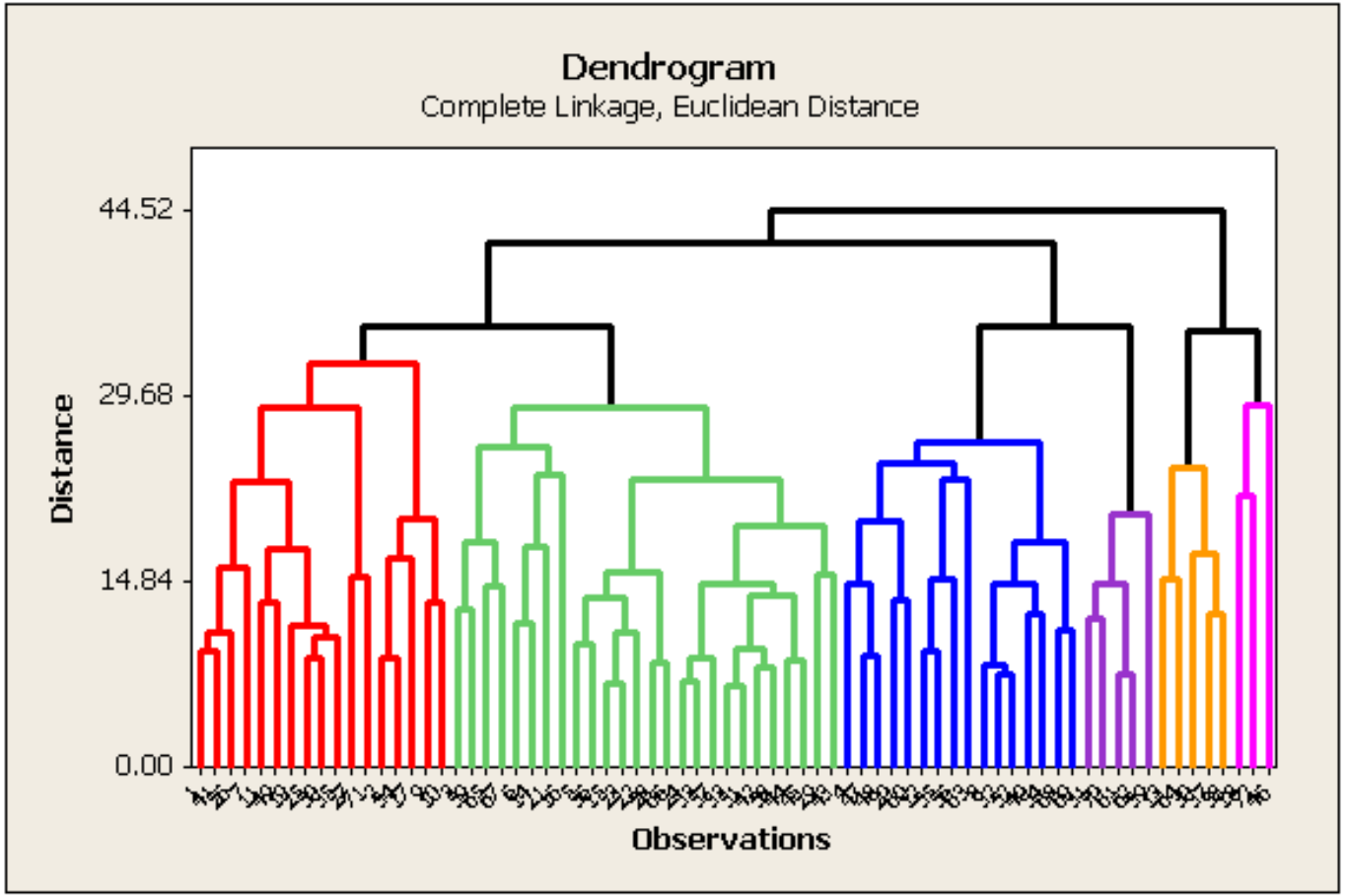
3. DEVIATION FROM OWN PATTERNS (OWN & PEER GROUP)

1. ‘FLAG’ Messages

Univariate Flag Outliers (**MSG1**) - Many Individual Outliers in 1 Week



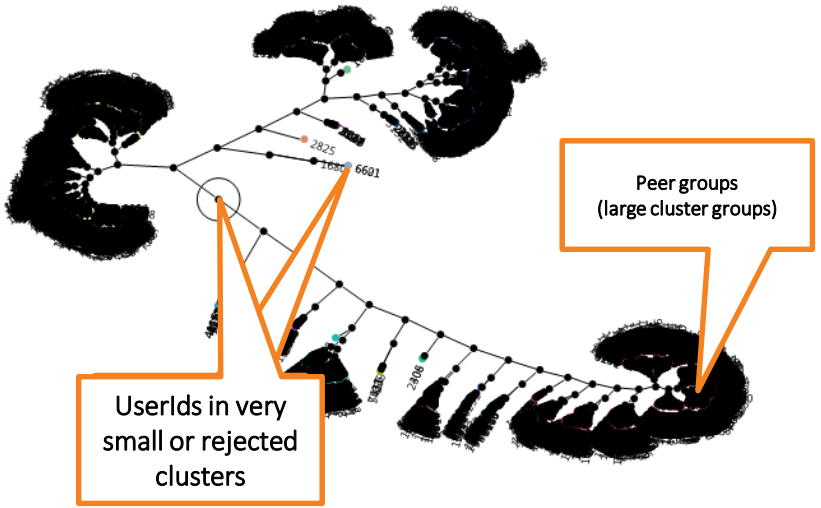
Unsupervised Machine Learning: Cluster Analysis



2. ‘UNUSUAL’ Messages

Multivariate Cluster Anomalies (**MSG 2, 3, 5 & 6**) - Small or Rejected (1 & 6 wks)

Each week all UserIds are run through cluster analysis –
both on ***1 week*** and ***6 weeks*** of aggregated data



“UNUSUAL”
Anomalies surface from cluster analysis

“NORMAL”
Large clusters indicate users behaving in similar ways

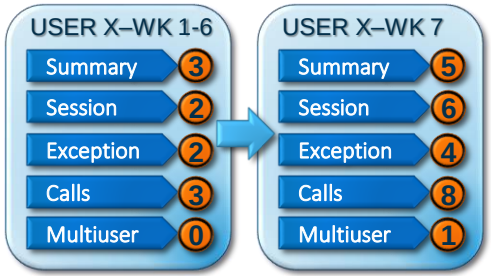
3. ‘CHANGE’ Messages

Latest week against six previous weeks **(MSG 4 & 7)**

Based on 7 consecutive weeks of data, the latest week (wk 7) for each user is compared against:
1) Own average activities in previous 6 weeks
2) Peer group of similar users in previous 6 weeks

This produces:
- Users who far exceed own 6 week averages
- Users who far exceed peer group 6 week avg

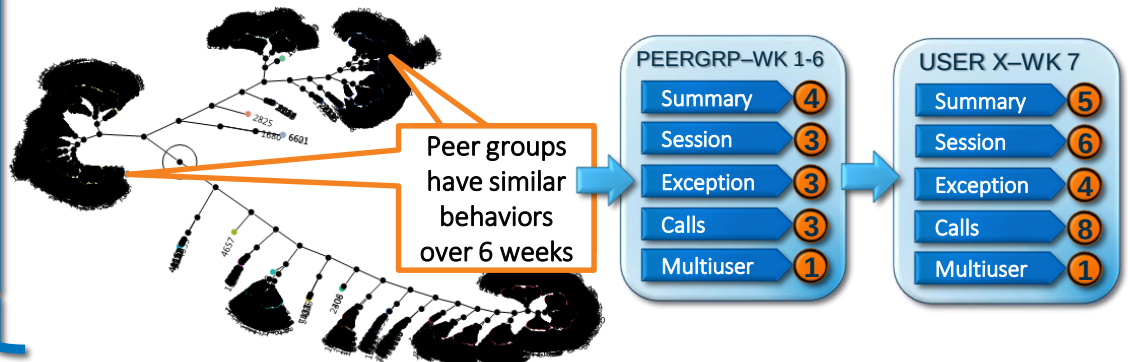
1. OWN DELTA



MSG 4

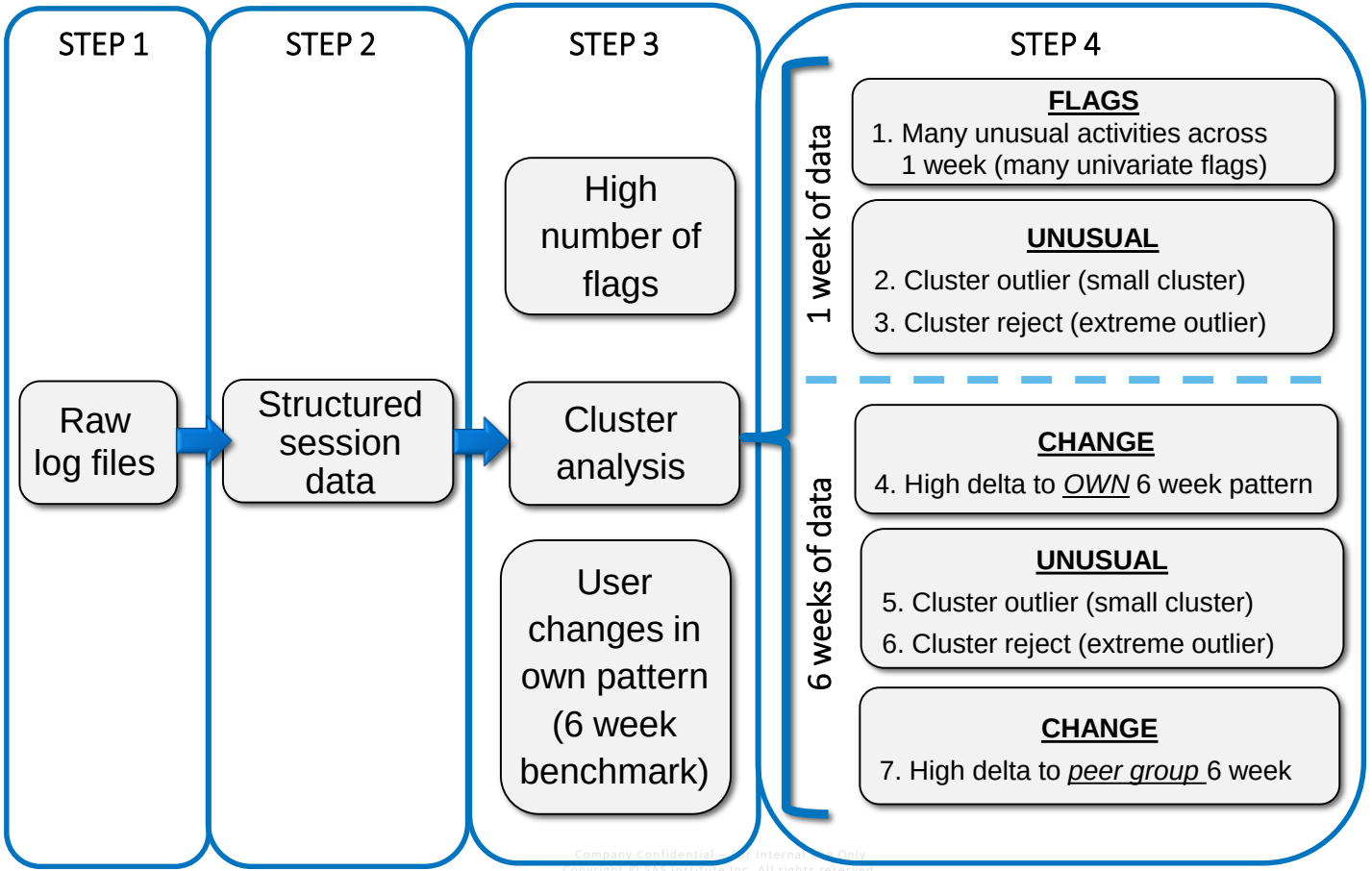
MSG 7

2. PEER GROUP DELTA



Summary Overview

Anomaly Detection Methods

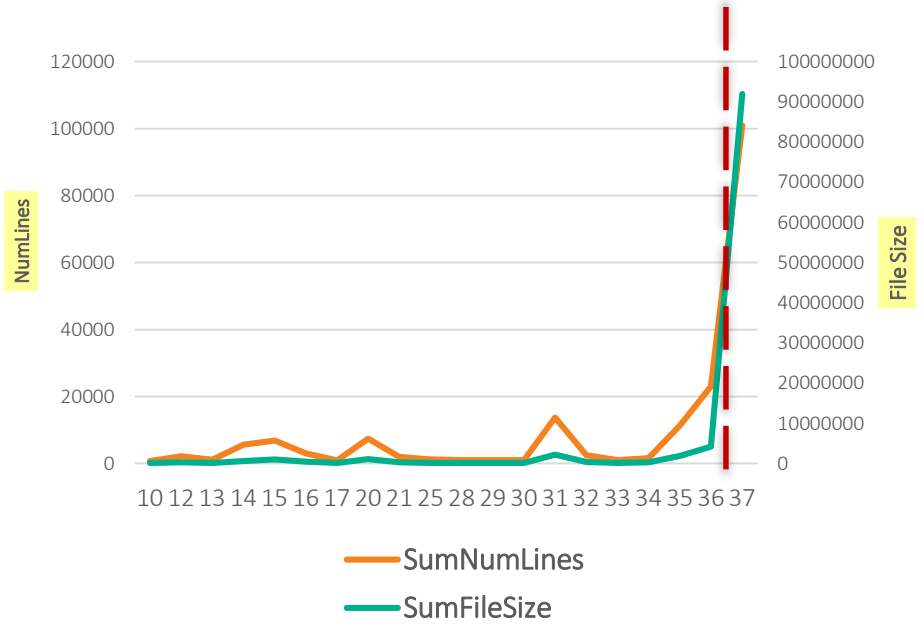


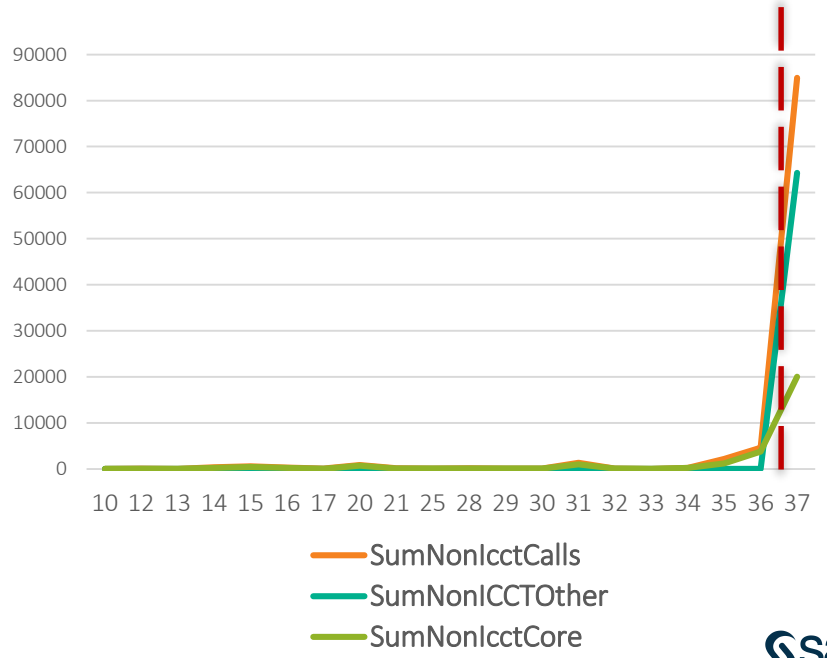

HUMAN
ORGAN
FOR TRANSPLANT

Example Anomalies

Example Anomaly: Red Teaming

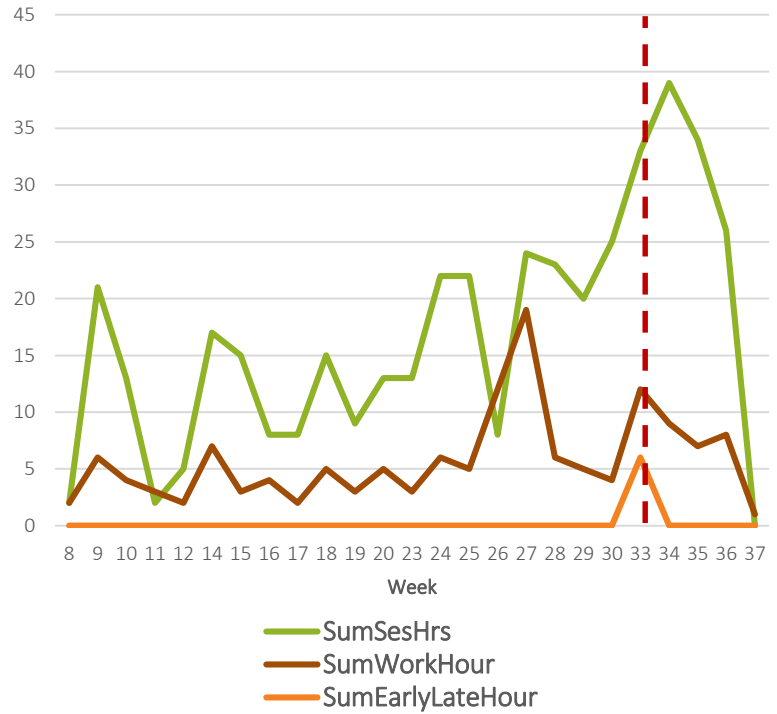
- Alert messages **UNUSUAL (3)** and **CHANGE (4&7)**
- Some of variables showing particular spike:
  Very high session activities, large number of system calls





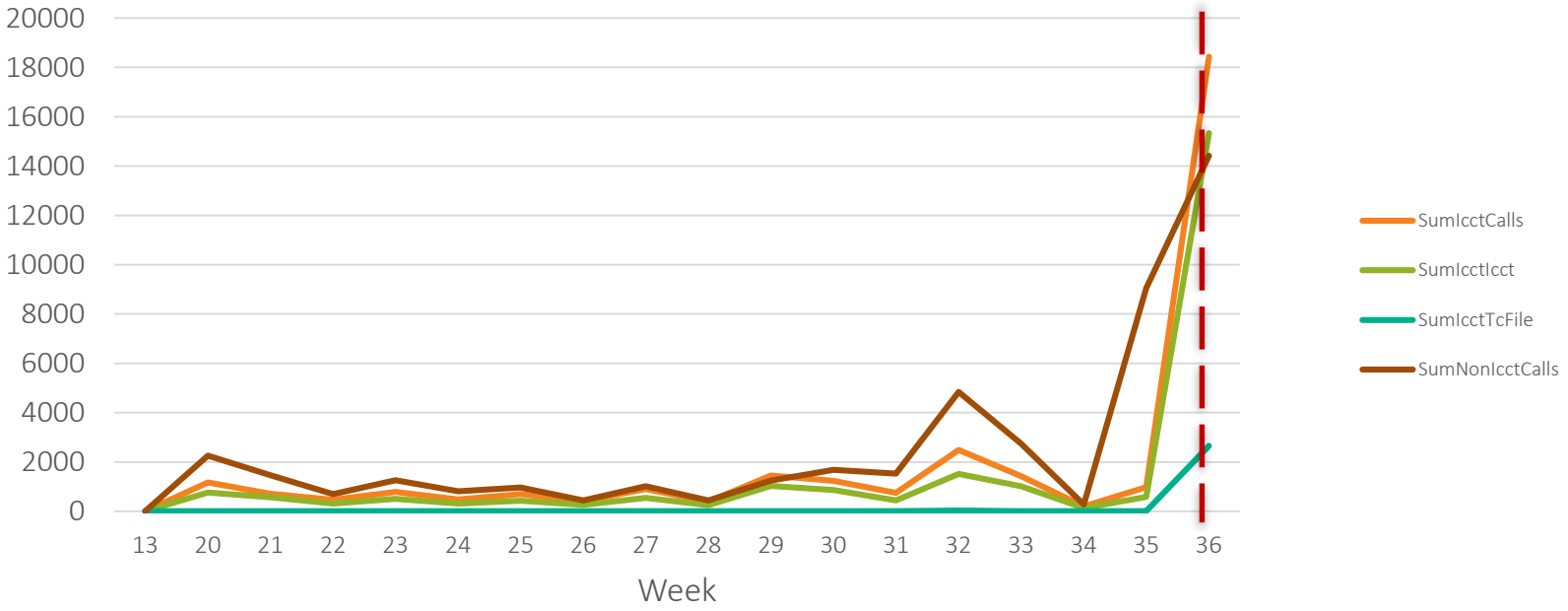
Example Anomaly: Team Leader in Performance Incident

Alerted – **CHANGE** (MSGs 4 & 7)



Example Anomaly: Unusual Behaviour

- System calls spike during week 36
- Received alert **UNUSUAL** (MSG 2) on week 36



Conclusion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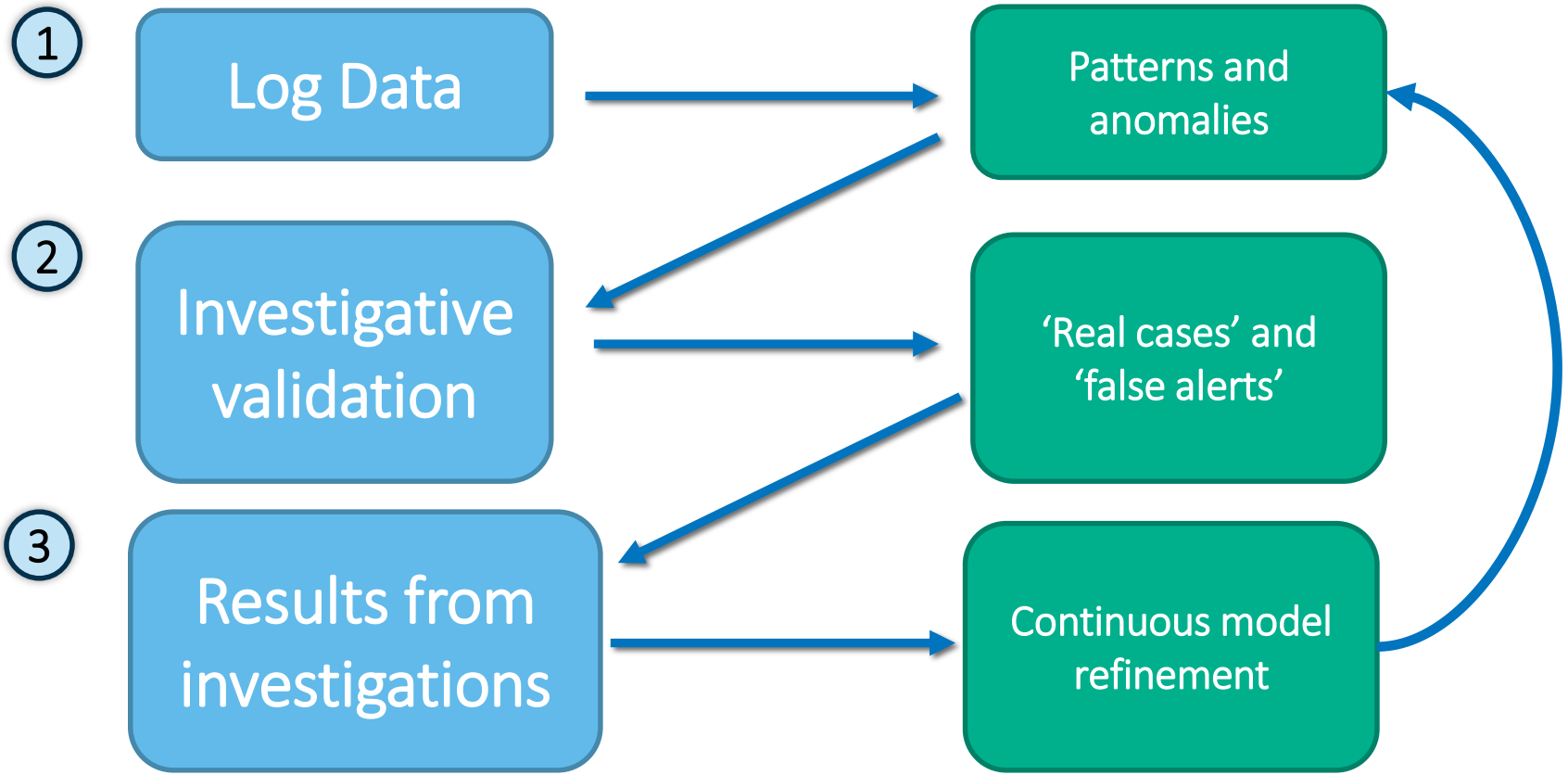
Continuous Detection Improvement Process



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SARK7

QUESTIONS?

APPENDIX

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