Machine Learning for Systems

What is AIOps?

- Artificial Intelligence for IT Operations (AIOps): AIOps combines **big data** and **machine learning** to **automate IT operations processes**, including event correlation, anomaly detection and causality determination.
- The demands of today's digital economy—coupled with the **increasing complexity** of modern application architectures—have made the role of IT operations more challenging.
- In response, AI and machine learning have emerged as a means to relieve some of the **manual intervention** required.
- In a recent survey of more than 100 IT professionals, we found that the respondents overwhelmingly believe AIOps is the future of IT operations, with **increased automation and faster remediation** among the key benefits.

Proliferation of Monitoring Tools Makes Analytics Challenging

- The use of **disparate monitoring tools** makes it extremely difficult to obtain end-to-end visibility across the entire business service or application.
- **72%** of IT organizations rely on up to **nine different IT monitoring tools** to support modern applications.
- AIOps will help "*reduce false positives, build alert correlation and help in identifying root cause without having the tech go to multiple tools*." –Arnab Mukhopadhyay, an ITSM professional at the Florida Department of Transportation

The Sheer Volume of Alerts Is Becoming Unmanageable

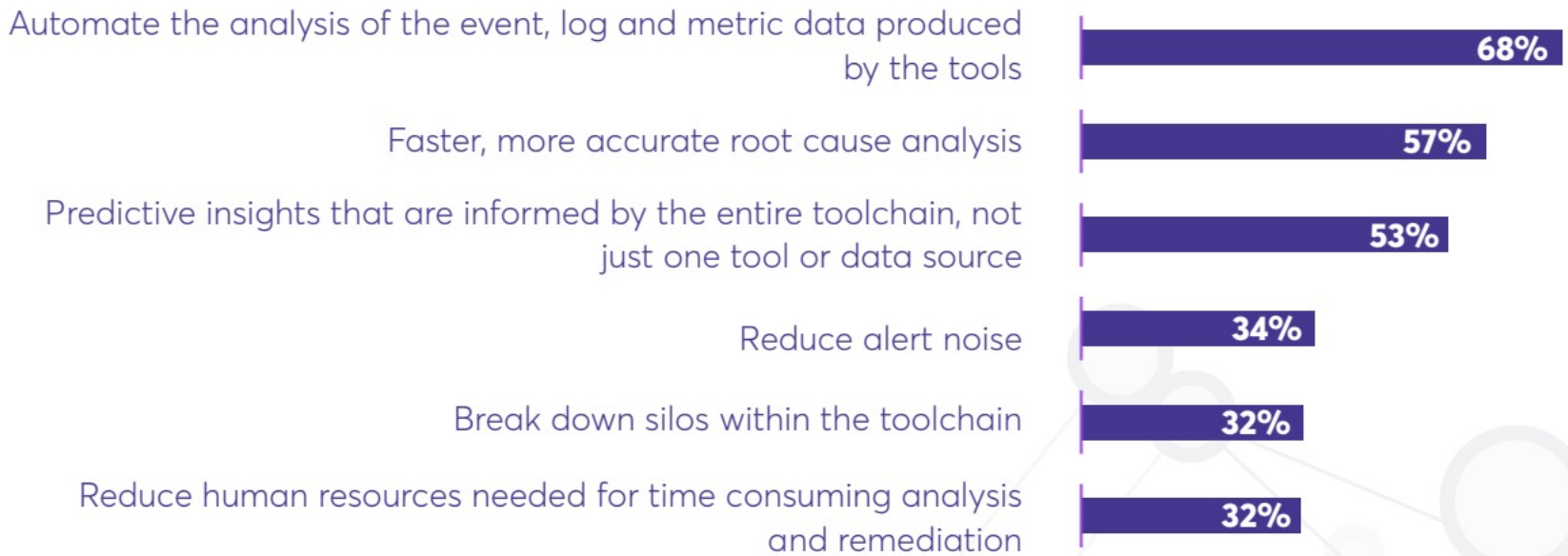
- According to the survey, **47%** IT operators experience over **50,000** alerts on average per month.
- The top cited monitoring challenges are detecting the issue proactively (71%), collaboration across teams (70%) and alert correlation across all tools (54%).

Delivering Superior User Experiences Requires Predictive Analytics

- According to the survey, delivering superior user experience with predictive analytics is among the top three most important business outcomes, and as such, predictive analytics is the most sought-after AIOps capability.

The Expected Benefits of AIOps are Enormous

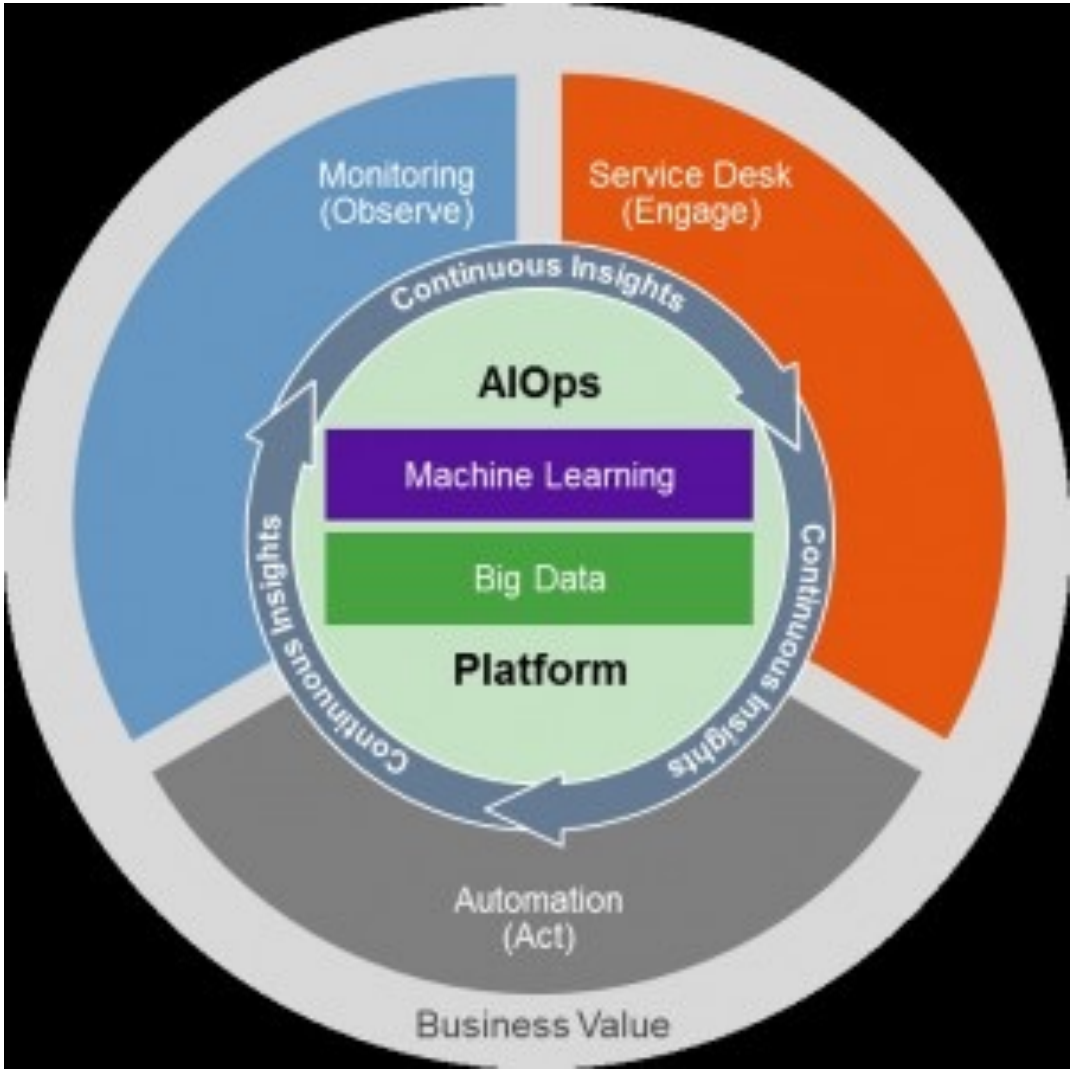
- 97% of IT professionals believe that AIOps will deliver actionable insights to help automate and enhance overall IT operations functions.



The Future of IT Operations Is AIOps

- According to Gartner, by 2023, 30% large enterprises will be using artificial intelligence for IT operations (AIOps) platforms and digital experience monitoring technology exclusively to monitor the nonlegacy segments of their IT estates, up from 2% in 2018.
- "*With machine learning to analyze our data, we can proactively be alerted of potential issues, giving us time to react and resolve a larger issue before it happens*." –Joe Scremba, system administrator, Gordon Food Service

AIOps


Monitoring
(Observe)
Service Desk
(Engage)
Continuous Insights
AIOps
Machine Learning
Big Data
Platform
Continuous Insights
Continuous Insights
Automation
(Act)
Business Value

Machine Learning Prime

- Artificial Intelligence: computers perform tasks that normally require human intelligence
- Machine learning: using patterns in data to ”learn” intelligence behaviors without being explicitly programmed.
  - One approach to AI
- AI vs. ML vs. AIOps:
  - ML is one approach to AI
  - AIOps refers to IP Operation tools that use ML

Supervised vs. Unsupervised Learning

- Supervised learning
  - Inputs: raw data + training labels
  - Examples: Is this image a dog or a cat?
- Unsupervised learning
  - Inputs: raw data only
  - Example: Group news articles by topics

Black-box vs. Open-box Machine learning

- Black-box machine learning: don't know the decision making process
- Open-box machine learning
  - Explainable: the logic is expressed in a format which can be understood
  - Editable: The logic can be edited so that you can incorporate human knowledge and experience
  - Previewable: you can preview the result against a historical dataset

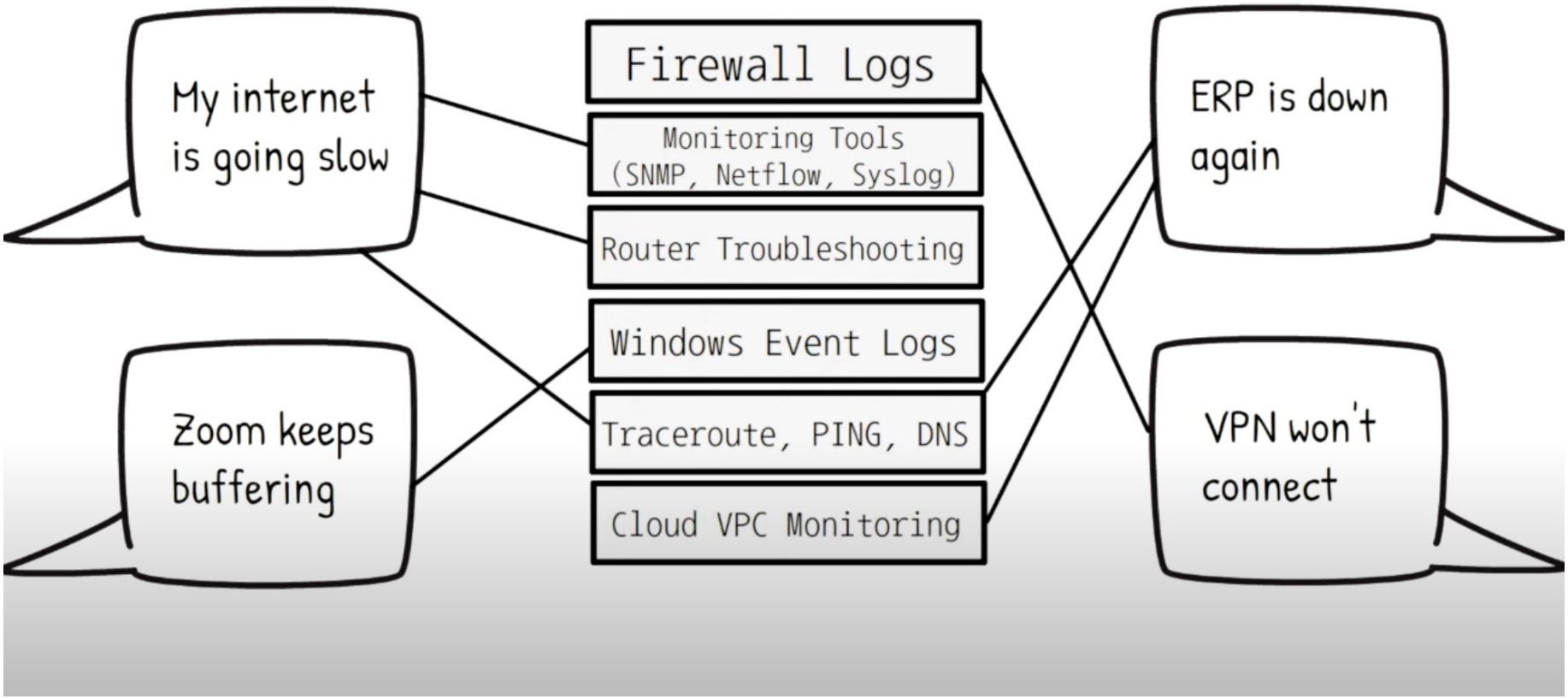
Types of Data

- Log data
- Wire data
- Metric data
- Alert data
- API data
- Ticket data
- …

What's the Data Analyzed for?

- Automatic pattern discovery
- Root cause analysis
- Predictive Analysis
- Anomaly detection

Correlation with Issues and Data



Rule-based Technologies

- Select a a specific subset of your data to focus on
- Experts help determine how to process that data
- Translate expert process to rules
- Machine follow the rules
- Observe & refine rules to deal with exceptions, outliers, etc.

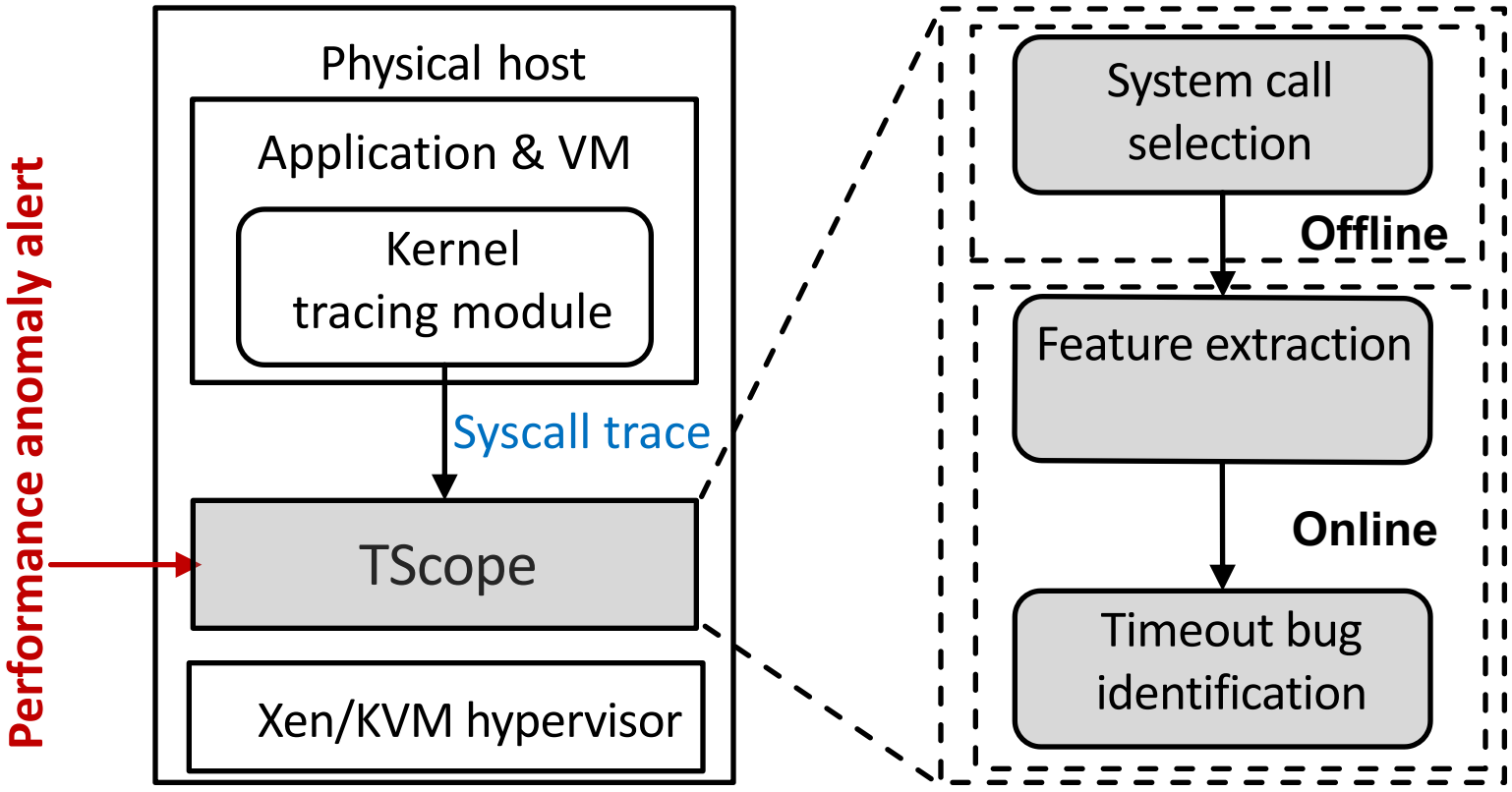
Machine Learning can Help

- Learns about your environment
- Handles the “known knowns” and the “unknown unknowns”
- Cost-effective and scale in real-time
- Autonomously respond 24*7*365
- When you use open-box machine learning, you are always in control

Whether AIOps can play well with you?

- Make sure your data source align with the desired outcome
- Does the solution work with a best-of-breed tools ecosystem?
- Where does the training data come from?
- Can you get insight from both streaming and historical data?
- Are ML decisions “open-box” or “black-box”?

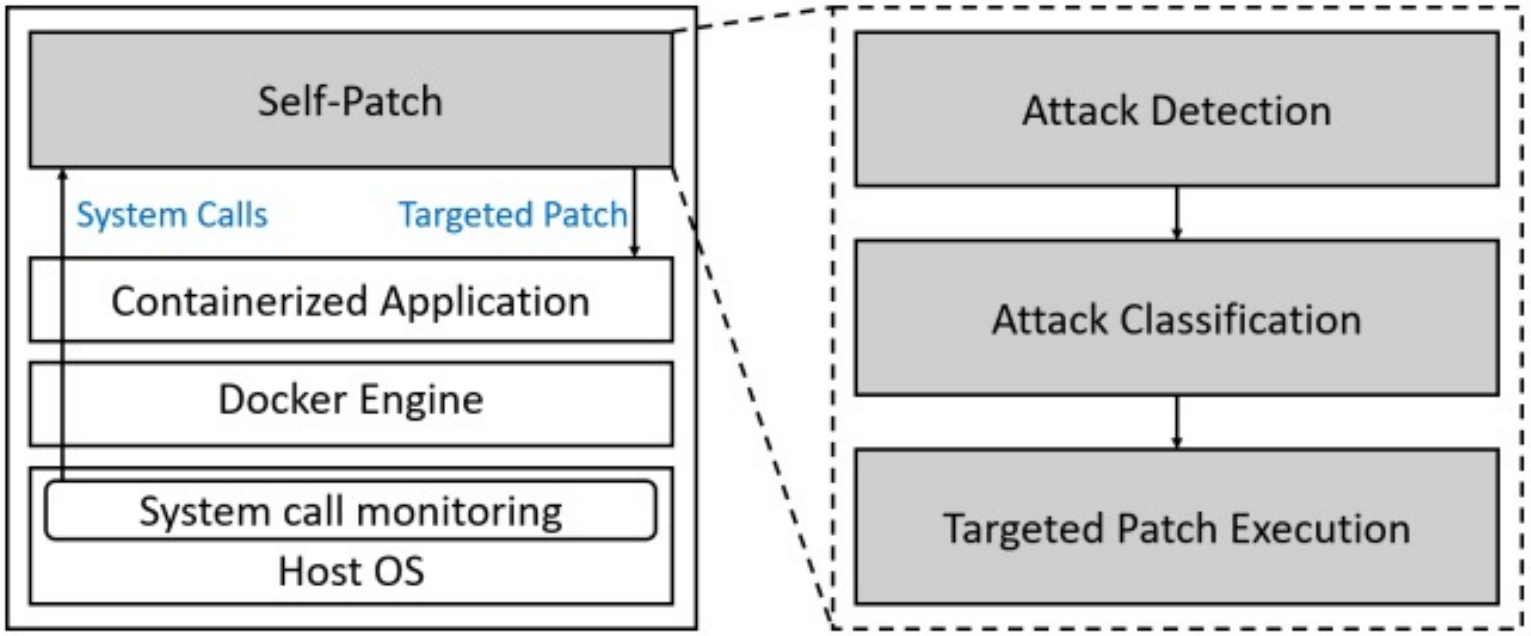
Case Study – Timeout Bug Identification



Case Study – Timeout Bug Identification

- **runtime** timeout bug identification tool.
  - Combines **timeout related feature selection** and **runtime anomaly detection** to achieve higher precision.
  - does not require any application instrumentation for bug detection.
  - Evaluates over **19** performance bugs and identifies **18** of them.

Case Study – Docker Container Vulnerability Detection



Case Study – Docker Container Vulnerability Detection

- **self-triggering** targeted patching framework.
  - The attack detection module monitors container runtime behaviors by analyzing system call traces via autoencoder neural network learning methods.
  - offline profiling to extract the vulnerability signature by extracting the top frequently used system calls after triggering the corresponding attack.
  - Evaluates over **31** CVEs and classifies **81%** of them.

Case Study -- AIOps at IBM Watson

https://www.youtube.com/watch?v=ph8p-eP9Y90

Case Study -- AIOps at MicroSoft

https://www.youtube.com/watch?v=F0qEla88cXo

Summary

- AIOps is the future of IT operations
- Supervised and unsupervised learning in AIOps
- Play with AIOps
- Comparison between rule-based technologies and AIOps
- Case studies