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Operational Threat Detection and Response (OTDR)

Gaining cybersecurity visibility into operational technology blind spots

Kyle Miller | Industrial Cybersecurity Engineer

September 27, 2017 | Washington, DC

Forward-Looking Statements

During the course of this presentation, we may make forward-looking statements regarding future events or the expected performance of the company. We caution you that such statements reflect our current expectations and estimates based on factors currently known to us and that actual events or results could differ materially. For important factors that may cause actual results to differ from those contained in our forward-looking statements, please review our filings with the SEC.

The forward-looking statements made in this presentation are being made as of the time and date of its live presentation. If reviewed after its live presentation, this presentation may not contain current or accurate information. We do not assume any obligation to update any forward looking statements we may make. In addition, any information about our roadmap outlines our general product direction and is subject to change at any time without notice. It is for informational purposes only and shall not be incorporated into any contract or other commitment. Splunk undertakes no obligation either to develop the features or functionality described or to include any such feature or functionality in a future release.

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Agenda

1. Introduction
2. Challenges in OT Environments
3. Our Solution
4. Use Cases
5. Concluding Comments

Introduction

Kyle Miller

Senior Lead Engineer
Industrial Cyber Security
Booz | Allen | Hamilton

- 10+ years of professional experience, mostly as an ICS/SCADA security consultant across the critical manufacturing, oil & gas, nuclear energy, defense, and water/wastewater critical infrastructure sectors both within the U.S. and abroad
- Specialized in Systems Security Engineering, Design Engineering, Security Test and Evaluations, Risk Assessments, and Detection/Response Design for SCADA and ICS

Certifications

- Certified Information Systems Security Professional (CISSP)
- Global Industrial Cyber Security Professional Certification (GICSP)
- Certified Ethical Hacker (CEH)
- Computer Hacking Forensic Investigator (CHFI)
- ISO 27001 Lead Auditor (BSI Group)
- Project Management Professional (PMP)

Education

- M.S., Cybersecurity
- B.S., Information Technology

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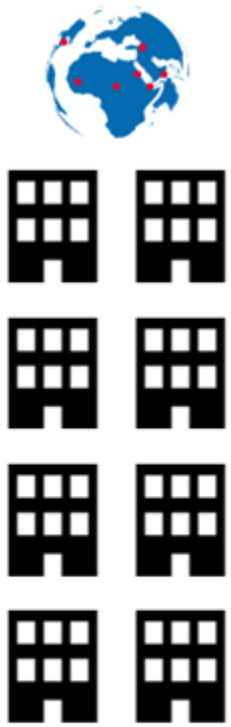
Booz | Allen | Hamilton

100 YEARS

Founded in 1914, Booz Allen is considered the world's premium international technology and strategy consulting firm, with engineering and industrial cyber domain expertise across the most challenging industries



100+
OFFICES WORLDWIDE

21,000+
TALENTED PEOPLE

INDUSTRIES SERVED

- Aerospace & Defense
- Energy & Environment
- Public Sector
- Health
- Telecom-munication
- Financial Services
- Transport

OUR CLIENTS

400+ out of Fortune 500

70 of the world's 100 largest corporations

5+ USD Billion in Revenues

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What is OT?

- Operational Technology, or OT, is a common term that describes hardware and software that *controls physical devices*
- Encompasses *multiple types of control systems* that support physical processes
- Although different, often *used interchangeably* with the terms Industrial Control Systems (ICS) and/or Supervisory Control and Data Acquisition (SCADA) systems

CONTROL SYSTEM PROCESSES

NON-EXHAUSTIVE

Oil & Gas Exploration, Production, Distribution, and Refining	
Electric Power Generation, Transmission, and Distribution	
Manufacturing	
Water, Wastewater, and Public Utilities	
Building Control Systems and Smart Cities	

OT Cybersecurity Challenges

INCREASING ATTACKS

- Recent high-profile and attacks have **increased demand**
- 1/3rd of operators indicated some form of breach; a **20% increase** in the last 18 months
- Growing **black/dark web** market for ICS or 'SCADA access-as-a-service' and other tools
- Ransomware infections on ICS to be **more frequent** and severe

COMPLEXITY

- While devices are **common**, **implementation is unique**
- Enhanced features on newer ICS devices **increases attack surface** and likelihood of vulnerabilities
- Legacy (like, really legacy) equipment and proprietary protocols require a **light touch**

BUSINESS DRIVERS

- OT relies **more and more** on cyber infrastructure and protocols for daily operations
- Business leaders want **real-time access** into the process data, leading to **increased interconnectivity**
- Finding individuals versed in **industrial engineering and cybersecurity**, is like finding a unicorn

Visibility is a Key Challenge

The Tip of the Iceberg

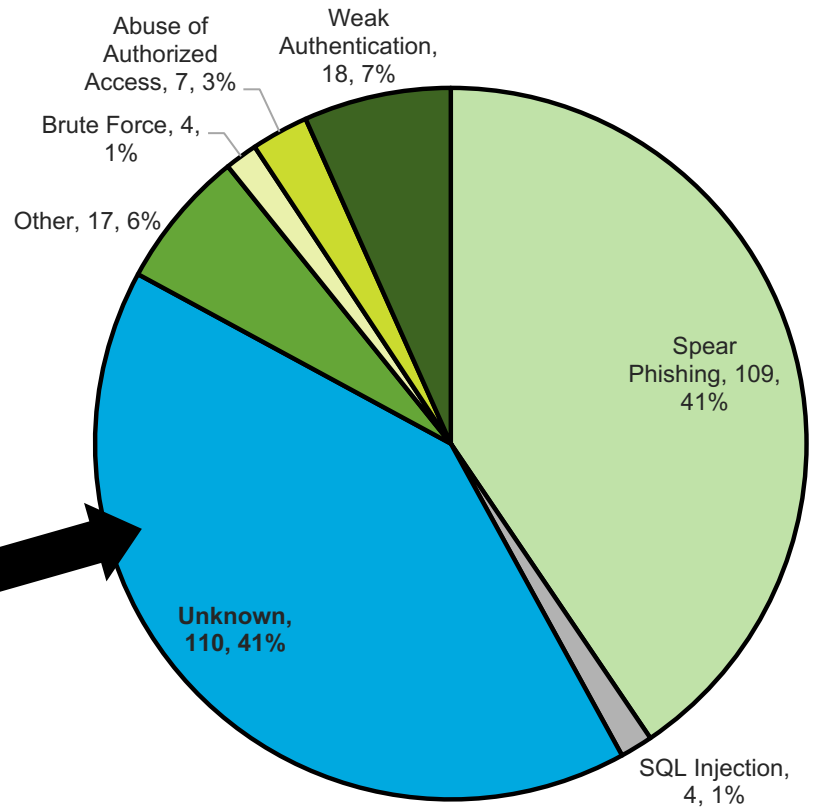
- With these increasing challenges, **traditional cyber protection** mechanisms are not always **feasible**
- Therefore, **obtaining visibility** into these environments to assist with cybersecurity efforts is critical
- Very few OT environments have any form of advanced cyber monitoring in place

Unknown, 110, 41%

"*There were **insufficient forensic artifacts** to definitively identify an initial infection vector. ICS-CERT continues to stress the importance of network security monitoring and host-based intrusion detection technologies, where the underlying systems can support it, to be deployed to better detect, respond to, and analyze incidents.*"

Source: ICS-CERT Monitor Newsletter (FY2015)

ICS-CERT Incidents by Attack Vector



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Our Solution

Booz | Allen | Hamilton
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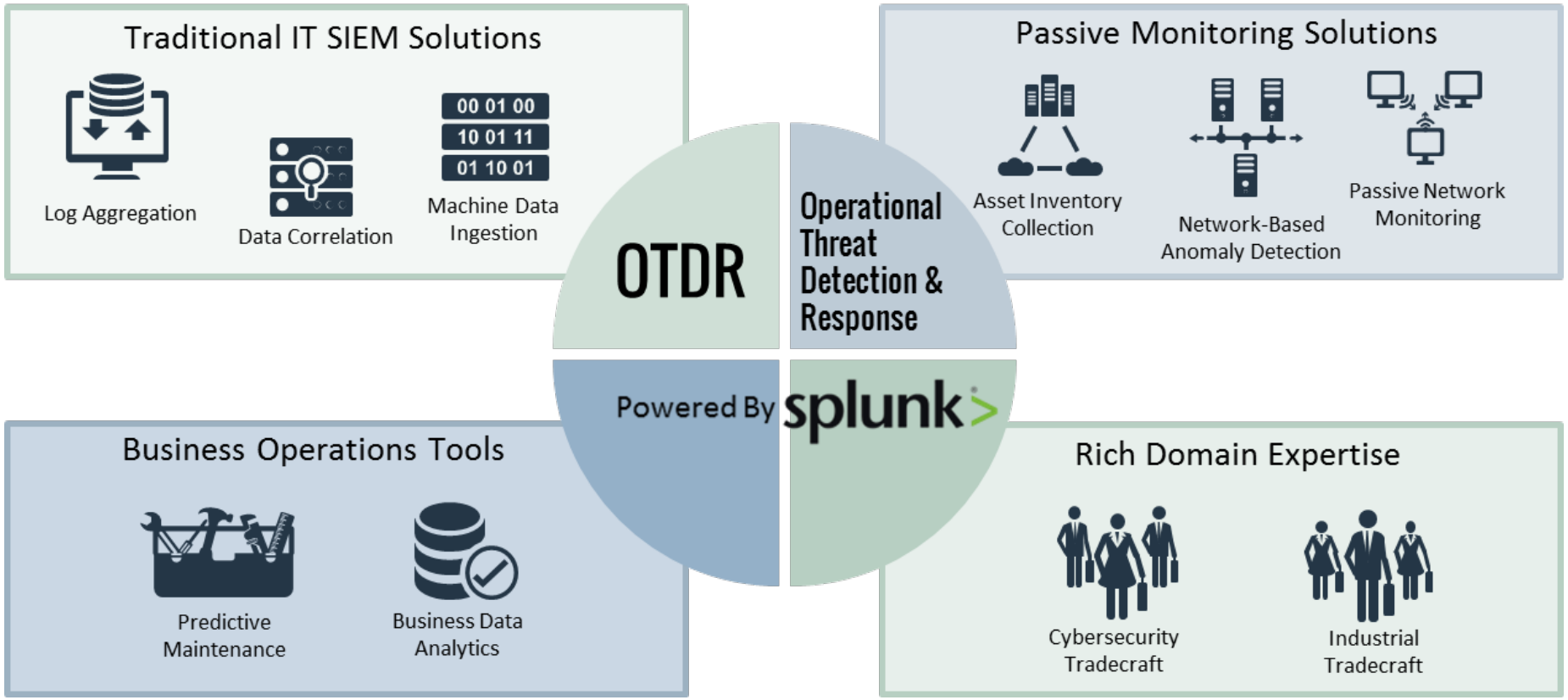
Booz Allen's OTDR solution combines capabilities from traditional SIEM providers, OT passive monitoring solutions, and business operations tools—with Booz Allen's rich domain expertise—to provide a single platform for effectively monitoring an OT environment.



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Why Splunk?

Index Untapped Data: Any Source, Type, Volume

splunk>

Ask Any Question

- Application Delivery
- IT Operations
- Security, Compliance and Fraud
- Business Analytics
- Industrial Data and the Internet of Things

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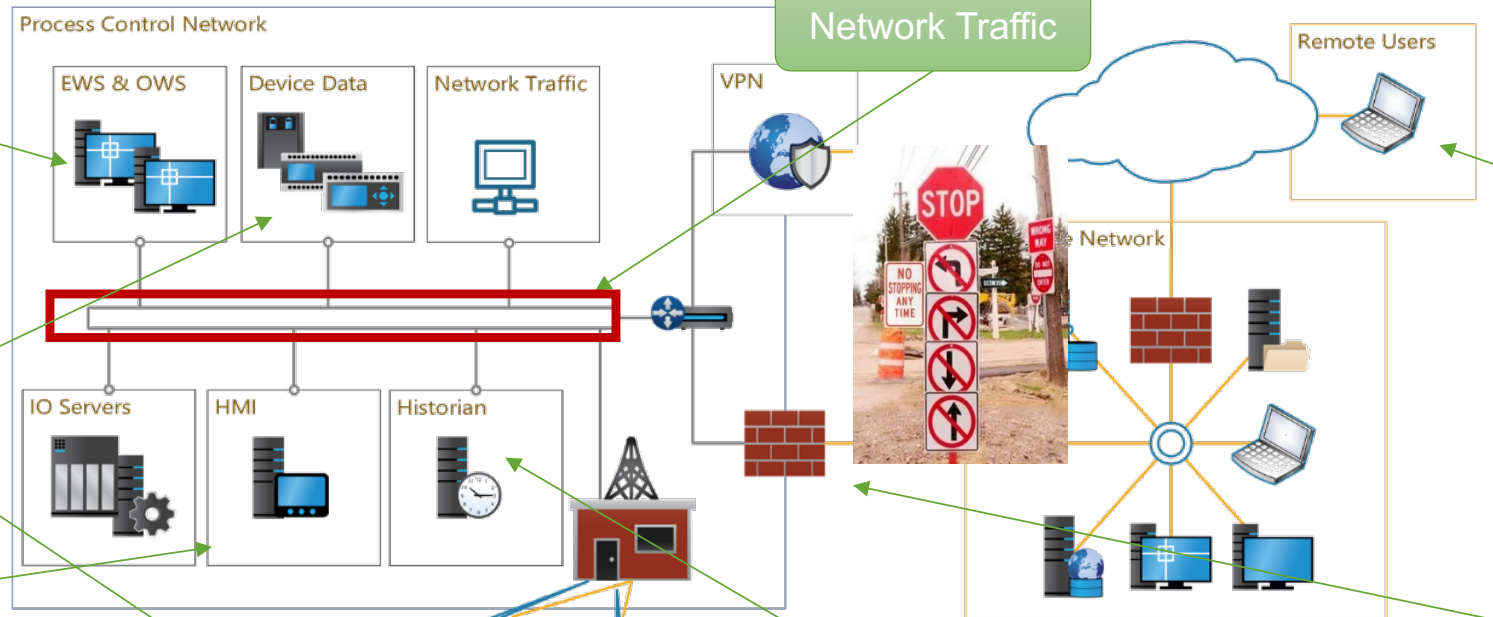
Where can you Extract Data?



Engineering Workstations (EWS)

Network Traffic

Remote Users/VPN

PLCs

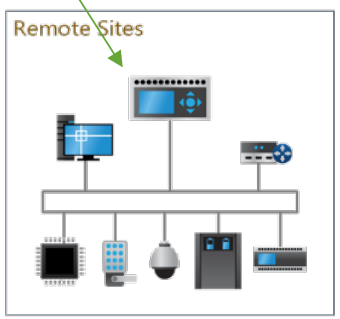
Human Machine Interface (HMI)

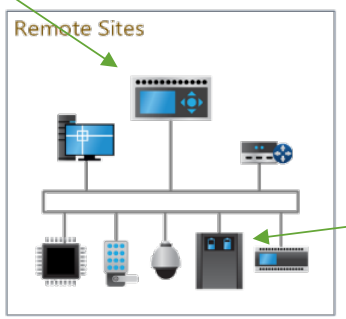
Historians

Firewalls

Network Access Points

Universal Power Supplies





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What Does OT Machine Data Look Like?

DATA SOURCES

Firewall/VPN

10.119.1.1 VPN: 10/04/2016 16:55:14 - VPN-2 - [175.45.177.7] acme\srtabrunaevans(acme AD Authentication)[Users] - Network Connect: User with IP 10.11.36.20 connected with ESP transport mode

Human Machine Interface (HMI)

20161004171221.000000Caption=ACME-2975EB\srtabrunaevans Domain=ACME-2975EB InstallDate=NULL LocalAccount = IP: 10.11.36.20 TrueName=acme\srtabrunaevans SID =S-1-5-21-1715567821-926492609-725345543 500SIDType=1 Status=Degradedwmi_ type=UserAccounts

Programmable Logic Controller (PLC)

2016-08-18 12:40:16.311 +0000 Tag=""AB-ML.ML1100.OS FRN"" Value="527" Quality=""good"" description=""Firmware Version""","2016-08-18T05:40:16.311-0700",,12,18,40,august,16,thursday,2016,0,,"172.16.50.32",kepware,1

2016-10-04 18:40:16.311 +0000 Tag=""AB-ML.ML1100.OS FRN"" Value="729" Quality=""good"" description=""Firmware Version""","2016-10-04T05:40:16.311 0700",,12,18,40,august,16,thursday,2016,0,,"10.11.36.20",kepware,1

Equipment

10/04/2016 19:02:49 System: FTP user 'apc' logged in from 10.11.36.20. 0x0016
10/04/2016 19:07:32 System: Update successful. 0x004A
10/04/2016 19:13:40 UPS: The battery power is too low to support the load; if power fails, the UPS will be shut down immediately

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Suspicious IP

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Source IP

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Firmware Modification

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Firmware Modification

Source IP

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Firmware Modification

Source IP

Suspicious Event

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Suspicious IP

Source IP

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Source IP

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Suspicious Event

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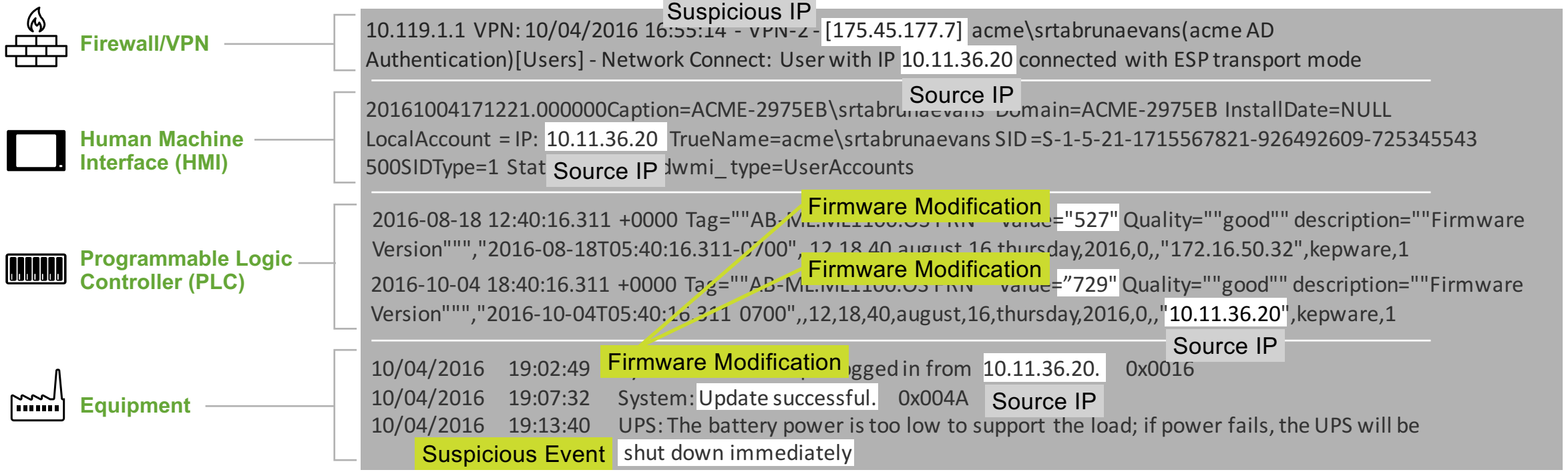

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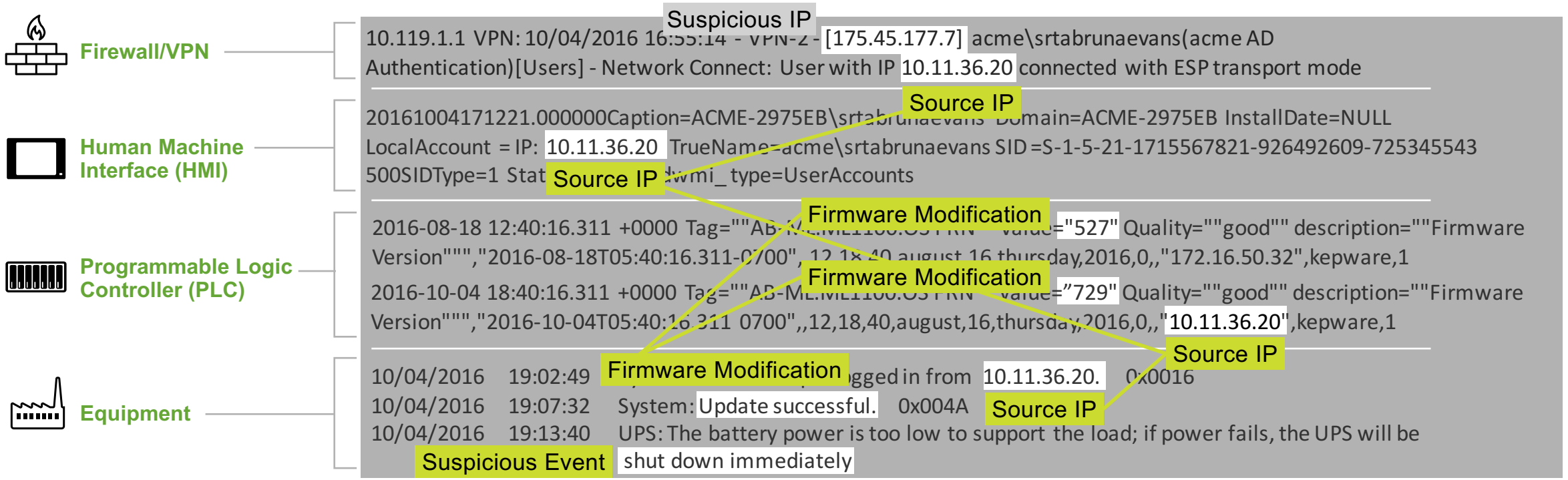
What Does OT Machine Data Look Like?

DATA SOURCES



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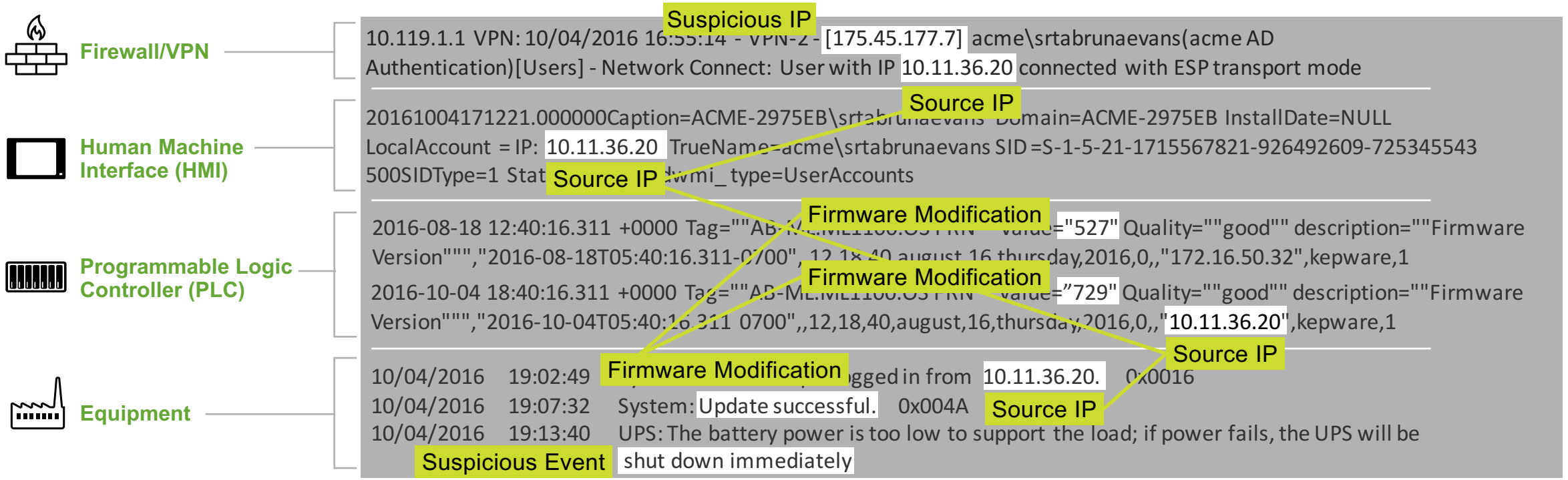

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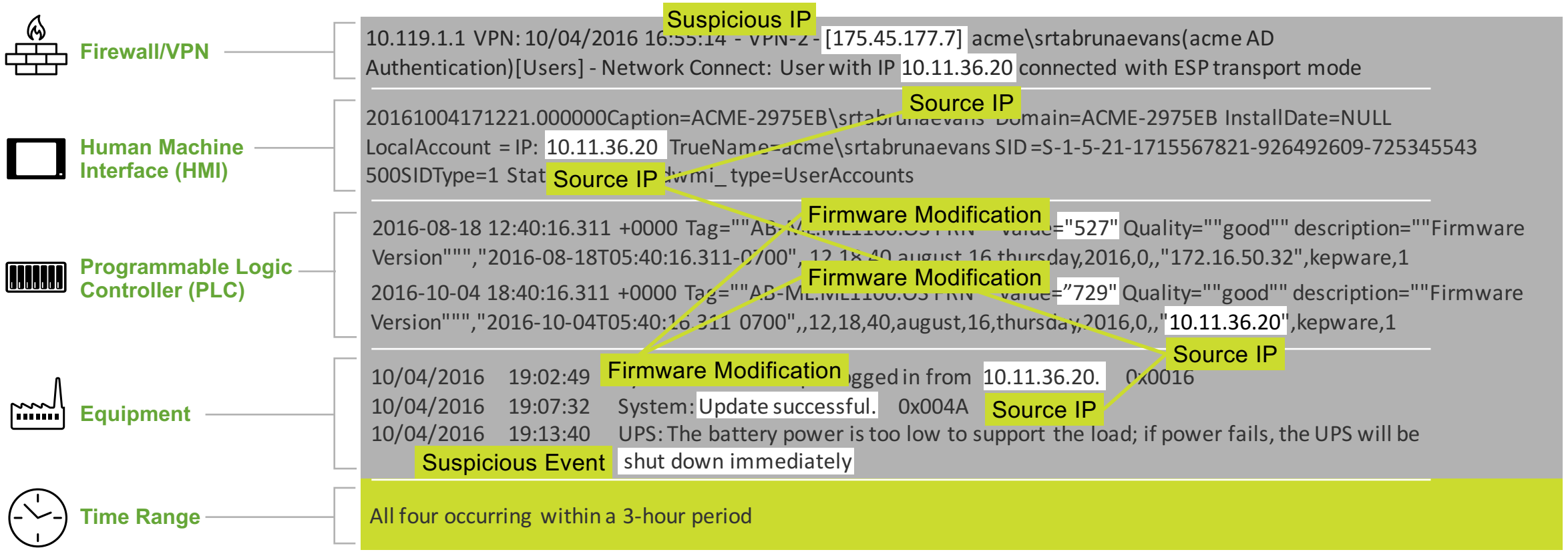

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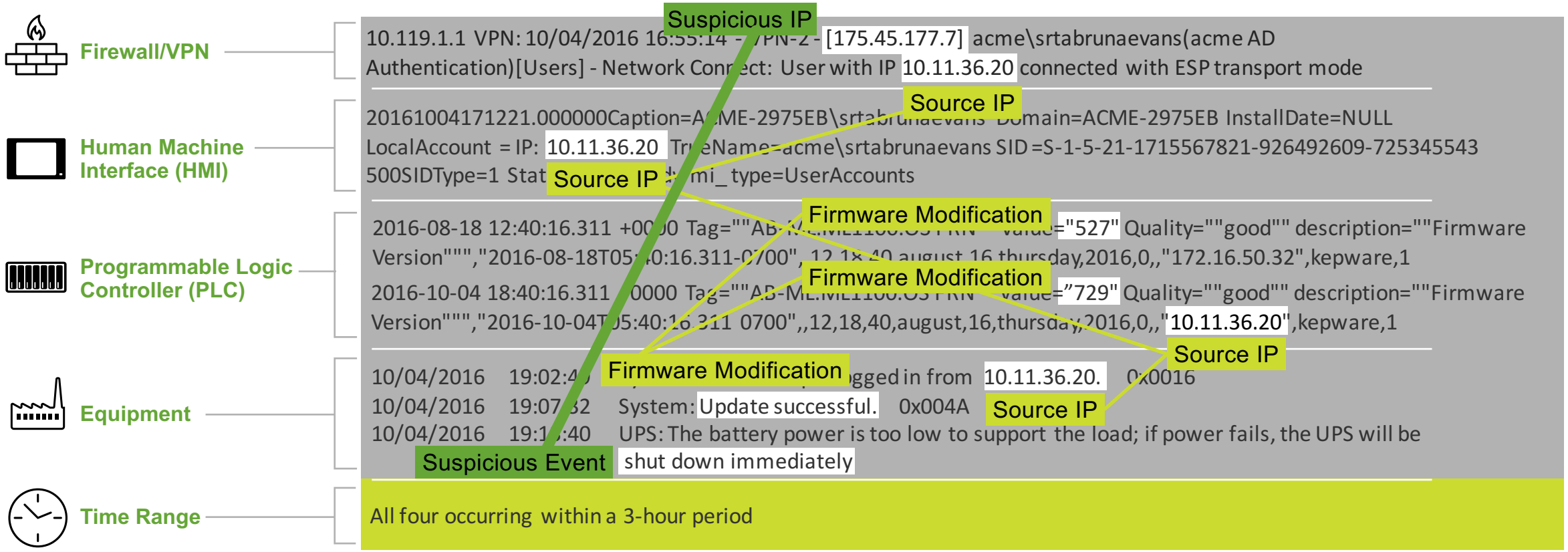

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Bringing it All Together

External Data Sources

Existing Splunk Data From Corporate Network

Threat Intel Data
- ThreatBase API
- Open Source
- Blacklists

Vulnerability Data
- CVE/NVD JSON API
- ICS-CERT

Asset Inventory
- Detailed Asset Info
- Maintenance Records

Risk Assessment Data
- Criticality Classification
- Relative Risk Ratings

splunk> Business Owner Dashboards

splunk> Oper/Eng Dashboards/Alerts

splunk> Security Analyst Dashboards/Alerts

splunk>enterprise | splunk>cloud

Sensor Data
- Output Data
- Status Tags

Servers/Historians
- Tag Data
- Historical Trending Data

Controllers
- Process Data
- Status Tags

Oper/Eng Workstations
- Windows Logs
- Application Data

Firewalls/IDSs
- Firewall Logs
- VPN Data

HMIs
- Process Data
- Status Tags

Ethernet Switches
- Network Logs
- Passive Network Traffic

OT Environment Data Sources

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Targeted Use Cases

External Boundary Activity

Unauthorized Protocol Usage
VPN Failed Login Attempts
VPN Suspicious User Login
VPN Suspicious Login Time
VPN Suspicious Geographical Login
Anomalous Stateful Connections
Attempts for Unauthorized Stateful Connections
Blacklisted IP Access Attempt (e.g. Facebook)
Firewall Rule Changes/Integrity Check
External IP Exposure

Internal Network Activity

Packet Payload Size Increase
Suspicious Network Scanning Activity
Unauthorized Bridged Networks
Rogue Network Device Detection
Use of External Device/Media (e.g. USB, serial)
Physical Changes to PLC/RTU (e.g. IO card)
Anomalous Network Time Protocol Traffic
Substantial Increase in Network Traffic
Suspicious PLC/RTU Comm Port Access
Port Security Violations

Status & Trend Information

OS Patch Status (e.g. up to date)
Application Patch Status
PLC Firmware Patch Status
HMI Firmware Patch Status
Anti-Malware Status
Anti-Virus Status
HIDS Status
Device Uptime Trend Analysis Over Time
Device Inbound Traffic (Host Volume) Trend Analysis Over Time
Device Outbound Traffic (Host Volume) Trend Analysis Over Time
Device Protocol Trend Analysis Over Time
Default Credential Use on Devices
Default Credential Use on ICS App
Default Credential Use on Workstation
Web Interface Activated on Device (e.g. PLC)
Unauthorized Remote Tools on Host (e.g. RDP, VNC)
OS Configuration Change Activated Wireless Drivers
Near Capacity Log Storage
Win 911 Stats

OT Device Monitoring

PLC Firmware Changes
HMI Firmware Changes
PLC Status Mode Changes
PLC Response Times/Latency
PLC Scan Rate Frequency
PLC/RTU Log Mods Stats

Account Information

OS Account Creation
ICS Application Account Creation
PLC/RTU Account Modification HMI Account Creation
AD/LDAP Account Creation
OS Group Assignment
Workstation Account Lockout
PLC Account Lockout
HMI Account Lockout
Server Account Lockout
Infrastructure Account Lockout
HMI Failed Login
Infrastructure Failed Login
PLC Failed Login Attempts
Workstation Failed Login Attempts
Server Failed Login Attempts

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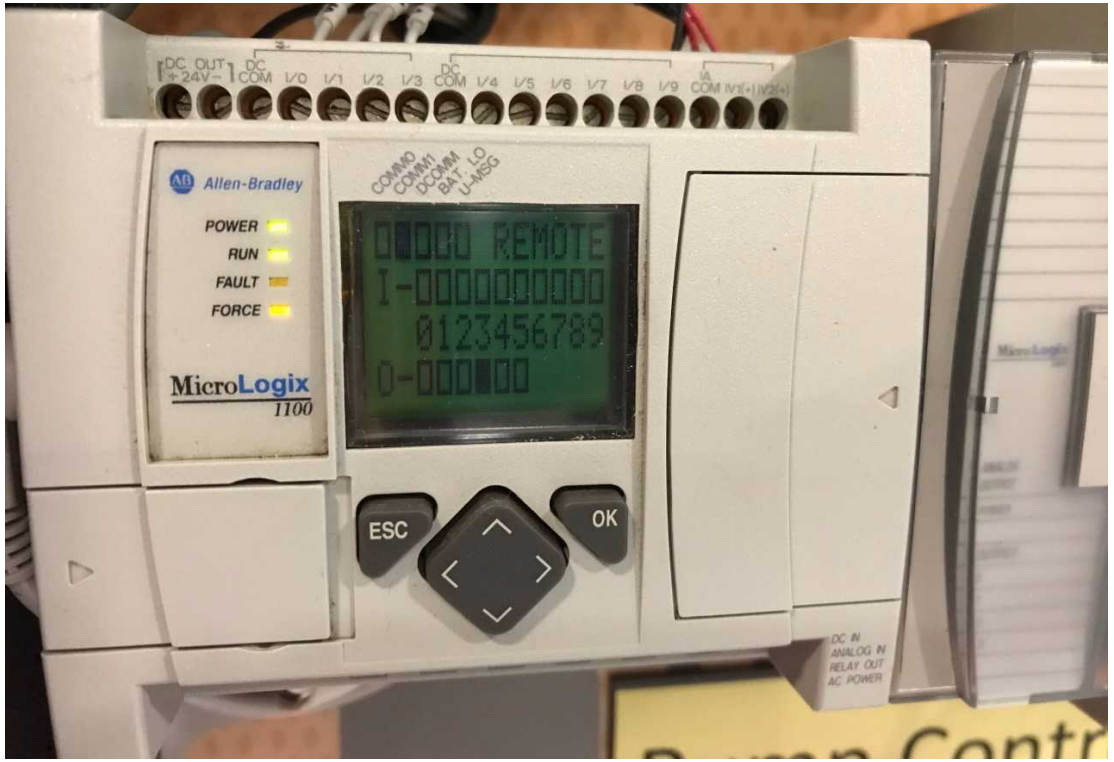
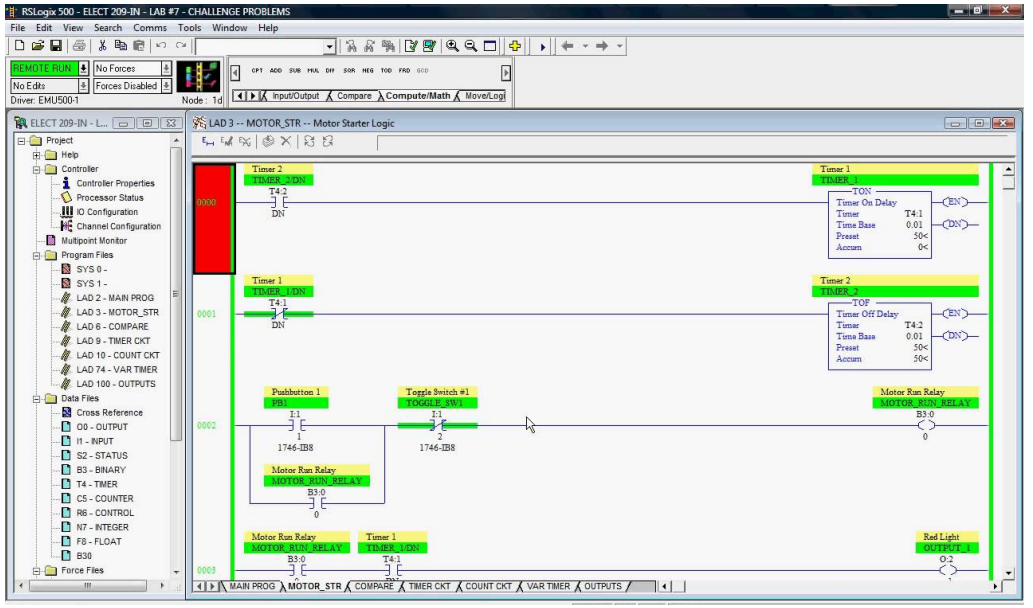
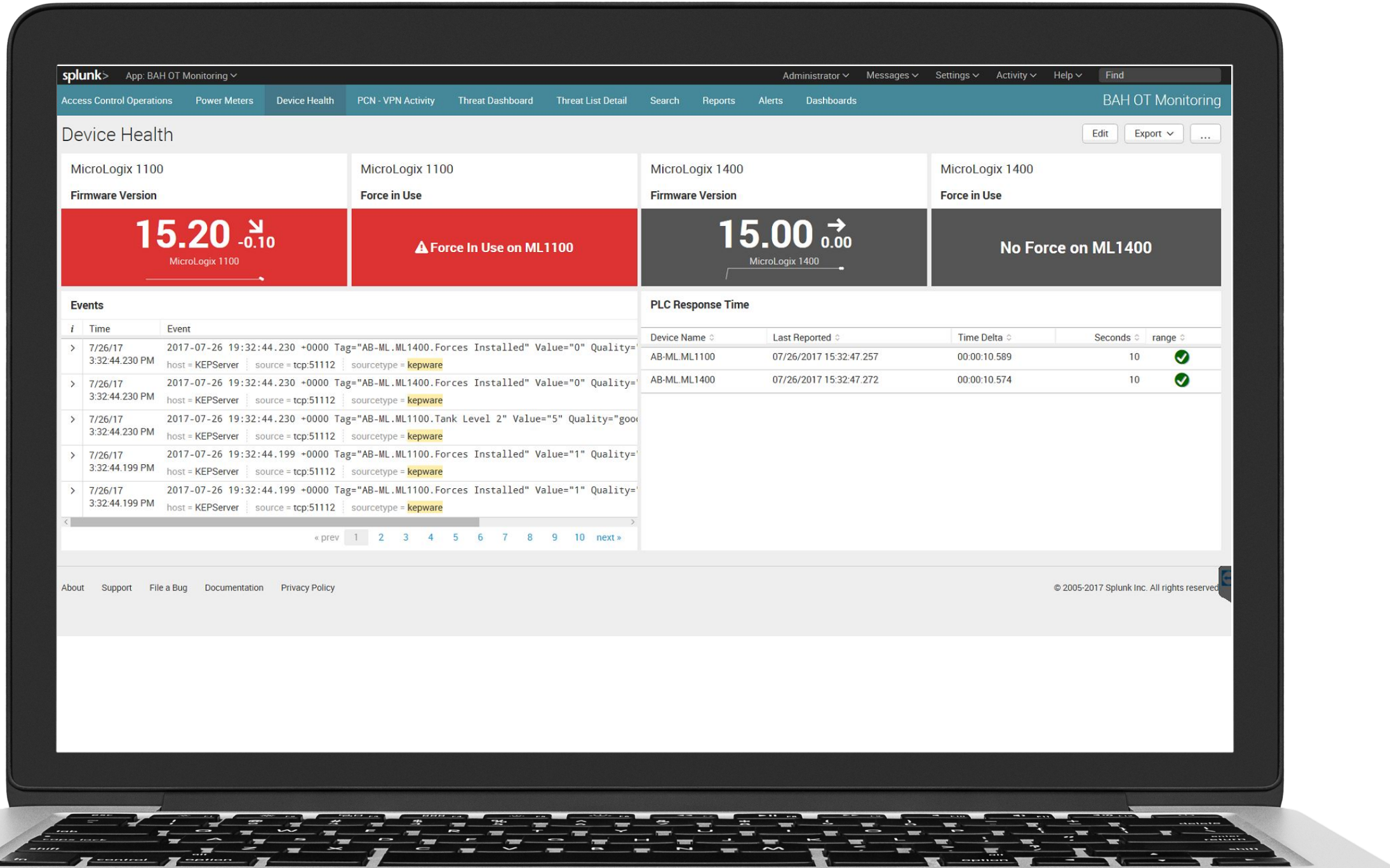
Example Use Case #1 - Controller Manipulation

- Purpose
  - Identify changes to the logic (programming), firmware, or configuration settings on a controller

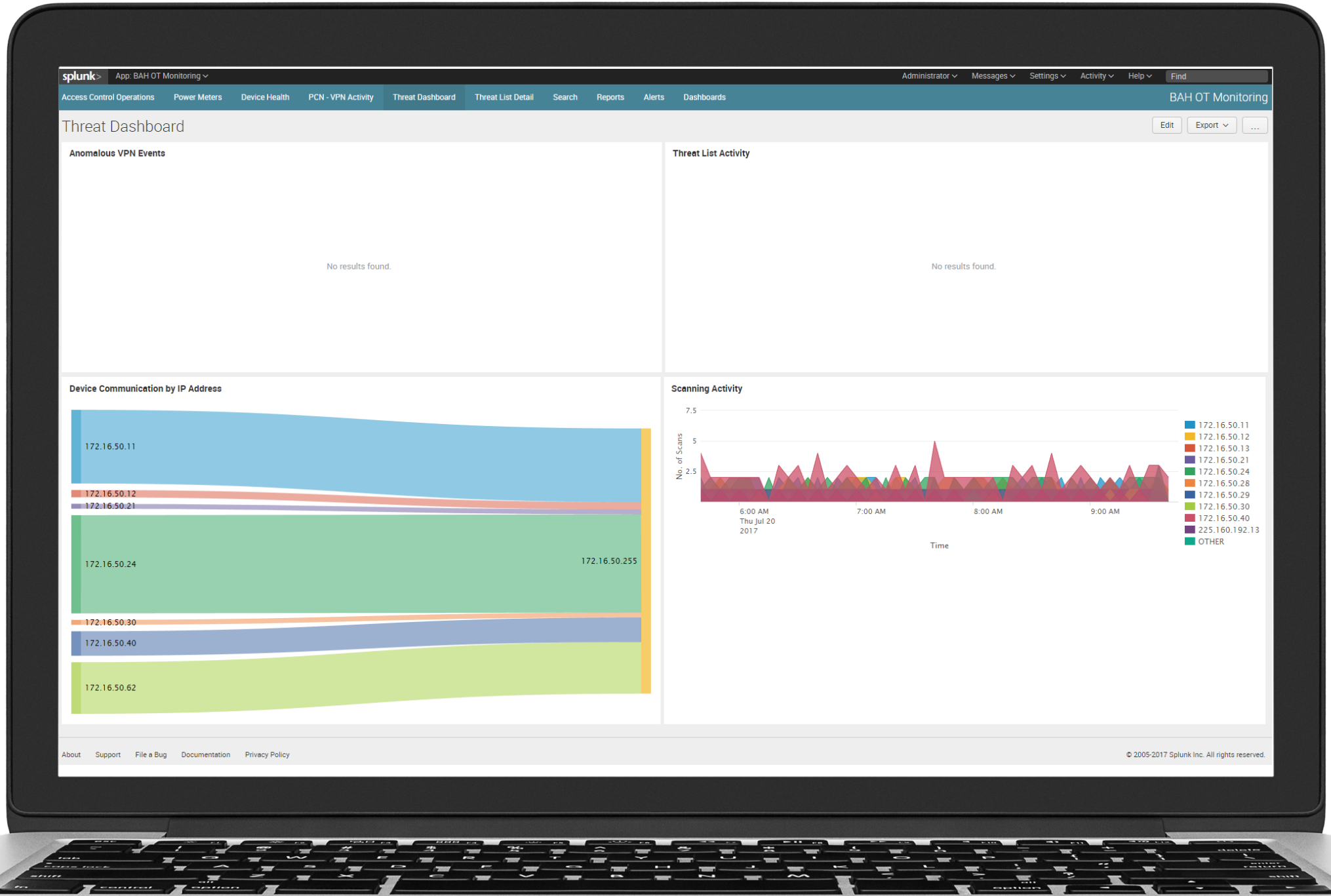


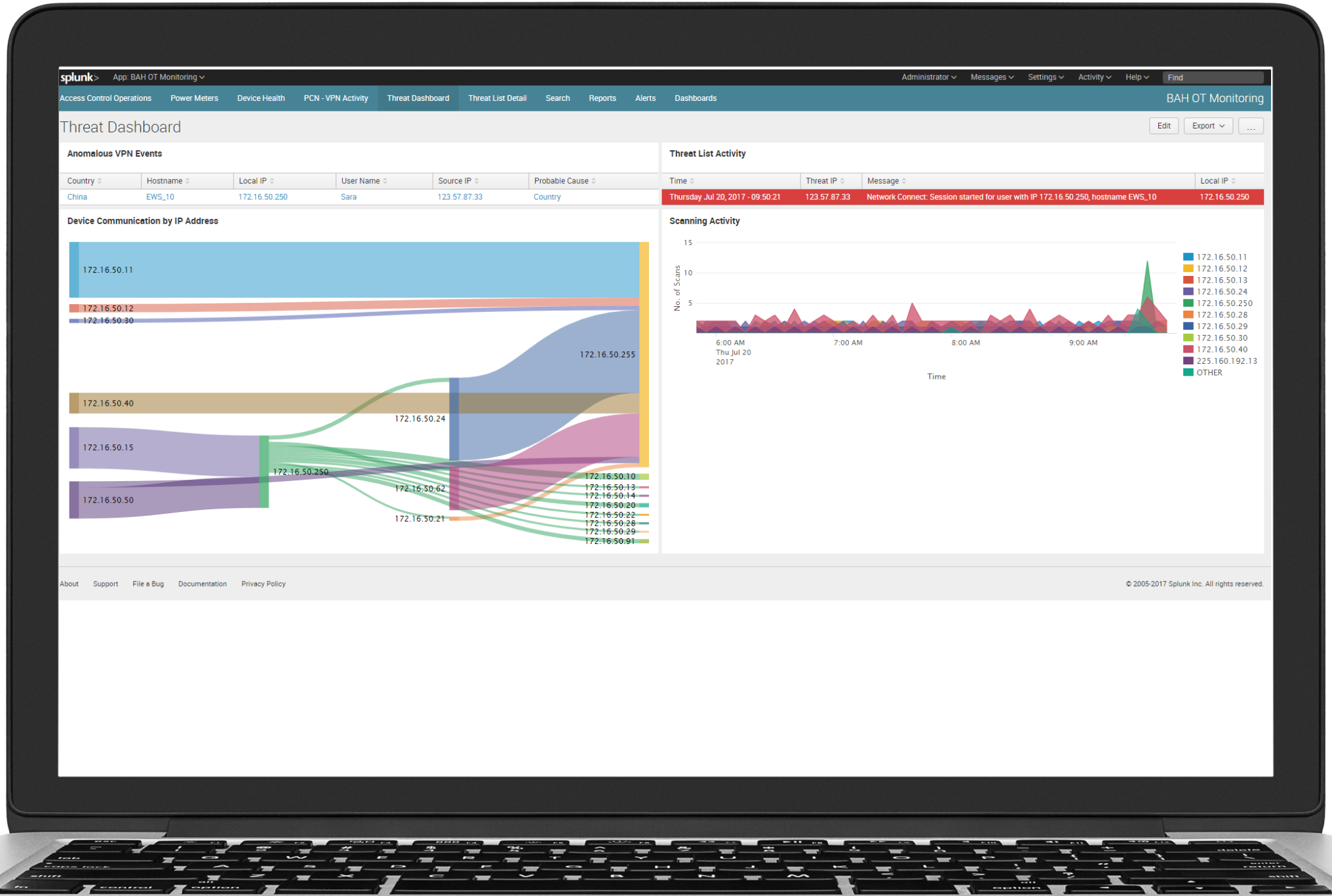




Example Use Case #2 - Anomalous Traffic

- Purpose
  - Develop a baseline of normal traffic throughout the network
  - Identify network traffic that is out of normal bounds
    - Inbound/outbound # of connections
    - Inbound/outbound # of hosts
    - Inbound/outbound # of ports
  - Tuned around the most critical assets





Example Use Case #3 - Improper Traffic Flow

- Purpose
  - Identify unanticipated or misconfigured traffic flows throughout the network
  - Identify communications that may require specific firewall rules to be put in place

- Outcome
  - Correct misconfigurations that may impact plant operations
  - Provide administrators information necessary to implement network segmentation

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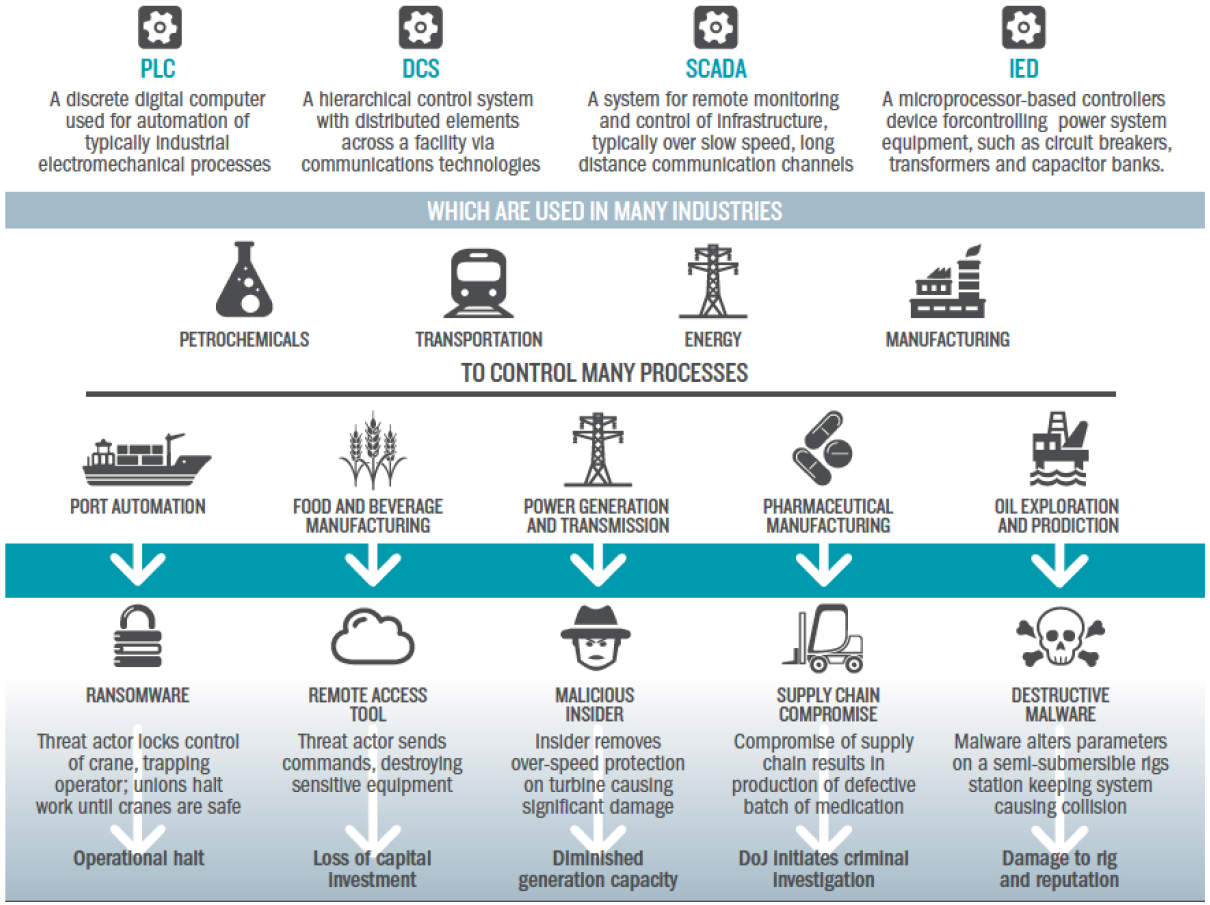
The OT Landscape

- Businesses **require a digital footprint** to support optimization, improve safety, and increase automation – but to do this successfully, it must also be secure
- Business is a set of **critical operational processes** – not just connected components
- Traditional IT protection mechanisms are not always feasible in these environments, so **visibility is paramount**



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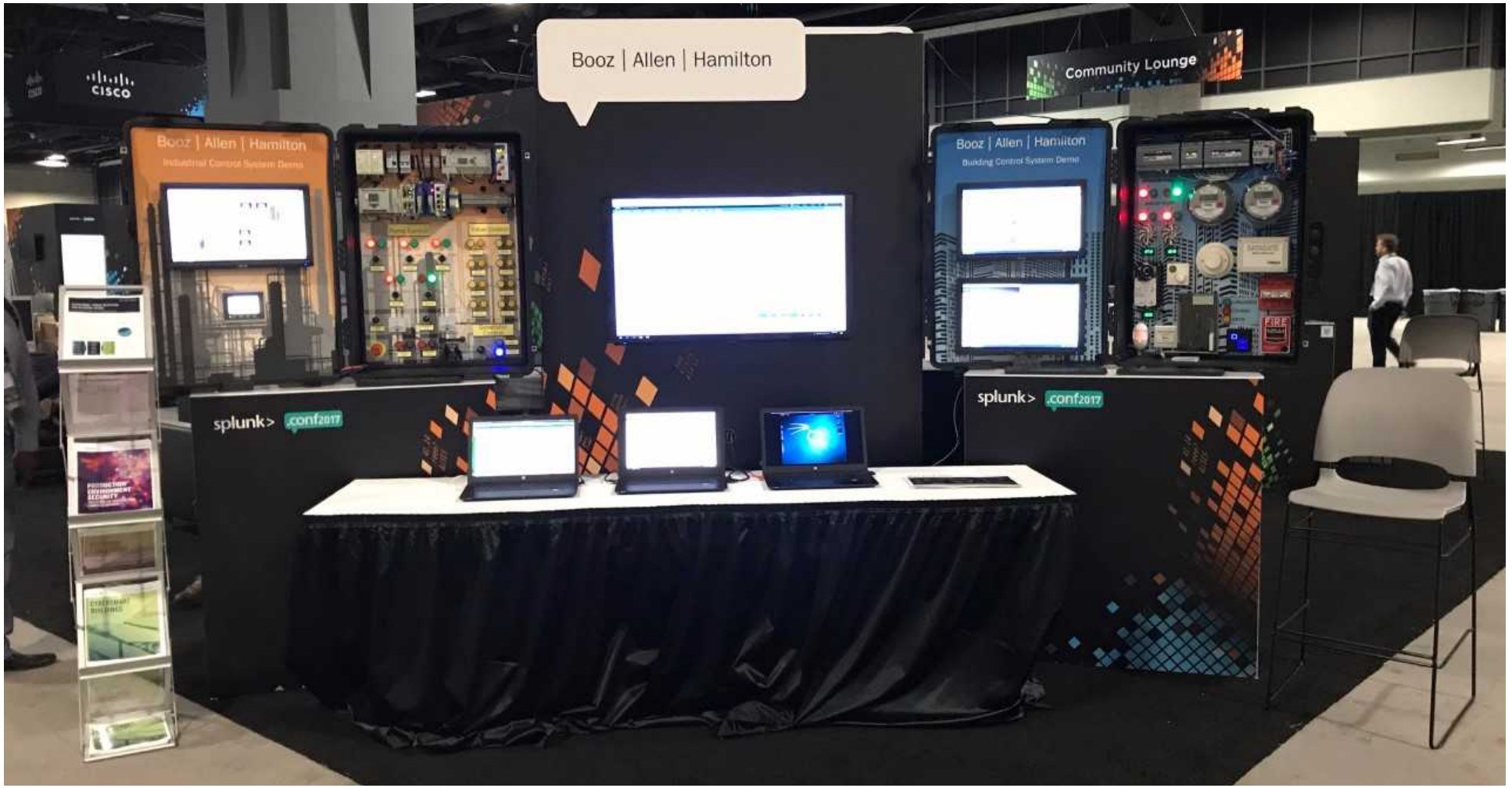
Our Demo Lab

Come check out our booth!



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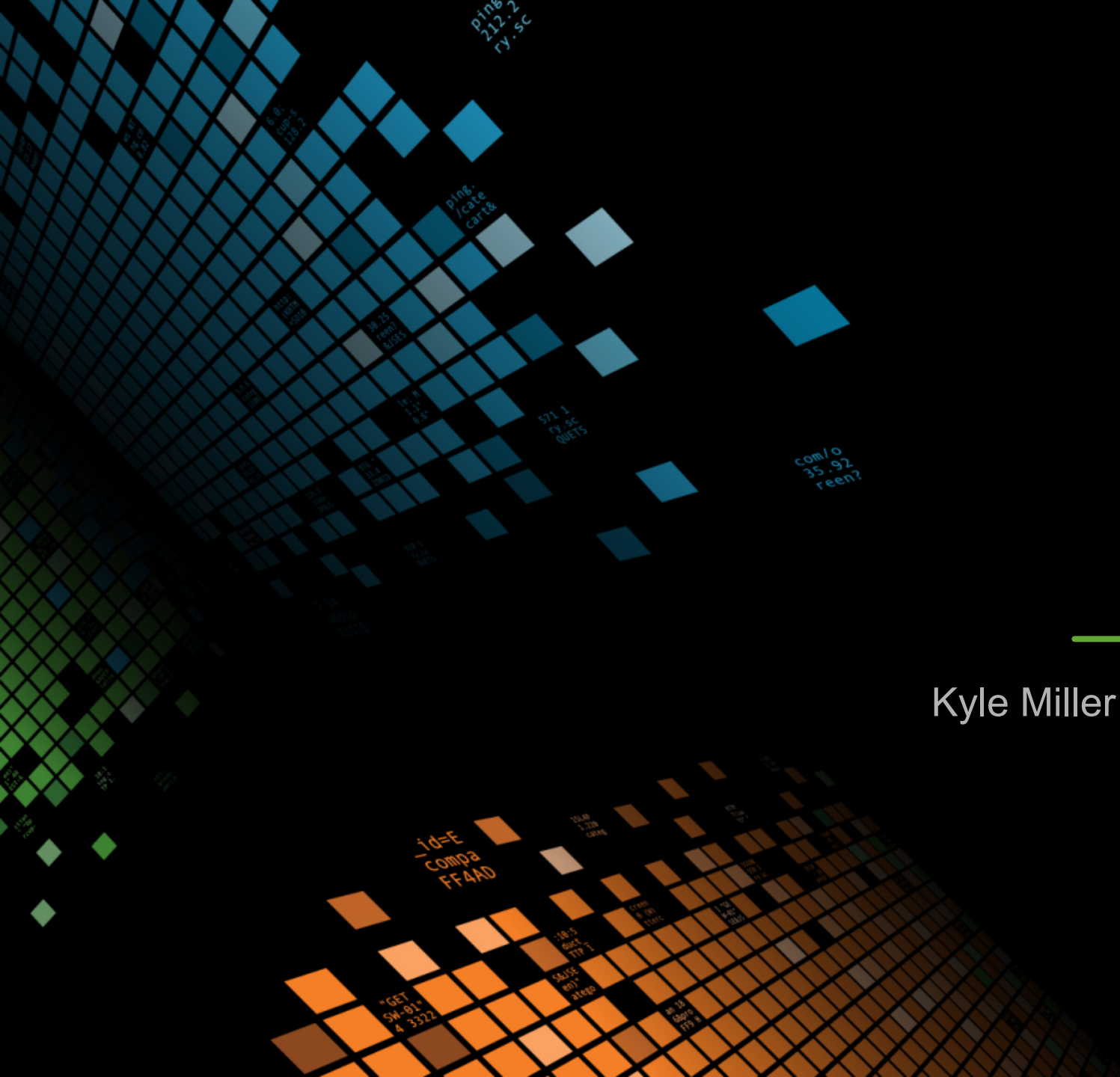

Q&A

Kyle Miller | Industrial Cyber Security Engineer

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Thank You

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