OT Protocol Support

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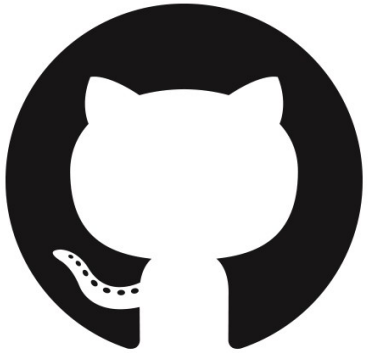
General Malcolm Information



- CISA Malcolm Documentation and Source Code
  - https://github.com/cisagov/Malcolm
  - Slides in `./Malcolm/docs/slides/`
- Malcolm Network Traffic Analysis Tool Suite YouTube channel
  - https://www.youtube.com/c/MalcolmNetworkTrafficAnalysisToolSuite
  - See “Network Traffic Analysis with Malcolm” and “Malcolm Exercises” tutorial videos
  - Videos detailing installation and configuration

Zeek OT Protocol Parser Sources

- ICSNPP - In-house development at INL for CISA
  - https://github.com/cisagov/icsnpp
- Amazon – Open-source plugins
  - https://github.com/amzn?q=zeek
  - Mostly replaced by ICSNPP at this point
- Zeek - Built-in support
  - Modbus and DNP3 (heavily augmented by ICSNPP)

OT Protocols in Malcolm

- Building Automation and Control (BACnet)
  - HVAC, lighting, access control, fire detection systems, etc.
- Bristol Standard Asynchronous Protocol (BSAP)
  - General use protocol, often used in water, power, chemical, oil and natural gas, communications, etc.
- Distributed Network Protocol 3 (DNP3)
  - Process automation systems mainly in power and water industries

OT Protocols in Malcolm (continued)

- EtherCAT
  - General use protocol, often seen in robotics, machine controls, power plants, wind turbines, manufacturing, etc.
- EtherNet/IP / Common Industrial Protocol (CIP)
  - General use protocol, widely used in many industries including manufacturing, pipeline, processing plants, water/wastewater treatment, etc.
- GENISYS
  - Somewhat obscure protocol used in the railway industry for control of signaling systems and interlockings

OT Protocols in Malcolm (continued)

- Modbus
  - General use protocol, de-facto standard for many industrial applications
- MQ Telemetry Transport (MQTT)
  - Publish/subscribe messaging used in IoT, automotive, logistics, manufacturing, smart home, oil and gas, transportation, etc.
- Open Platform Communications Unified Architecture (OPC UA) Binary
  - Used in industrial automation for data exchange between sensors and cloud applications

OT Protocols in Malcolm (continued)

- Process Field Net (PROFINET)
  - General use protocol seen in many industrial applications
- S7comm / Connection Oriented Transport Protocol (COTP)
  - Proprietary protocol used by Siemens PLCs, widely used in power, pipeline, water/wastewater, and more
- Tabular Data Stream (TDS)
  - Protocol used by Microsoft SQL servers and many data historians

OT Protocols in Malcolm – Coming Soon

- S7comm Plus (nearing release)
  - Next generation of Siemens' proprietary protocol
- PROFINET/IO Context Manager (in development)
  - Manages communication between programmable controllers and IO-supervisors

"Best Guess" Fingerprinting for ICS Protocols

- Uses simple transport protocol, port and MAC address matching to identify potential ICS traffic for protocols without parser support
- Categorized in the ICS Best Guess dashboard
- Use as a pivot point to identify devices or investigate packet payloads in Arkime or Wireshark
- Higher potential for false positives

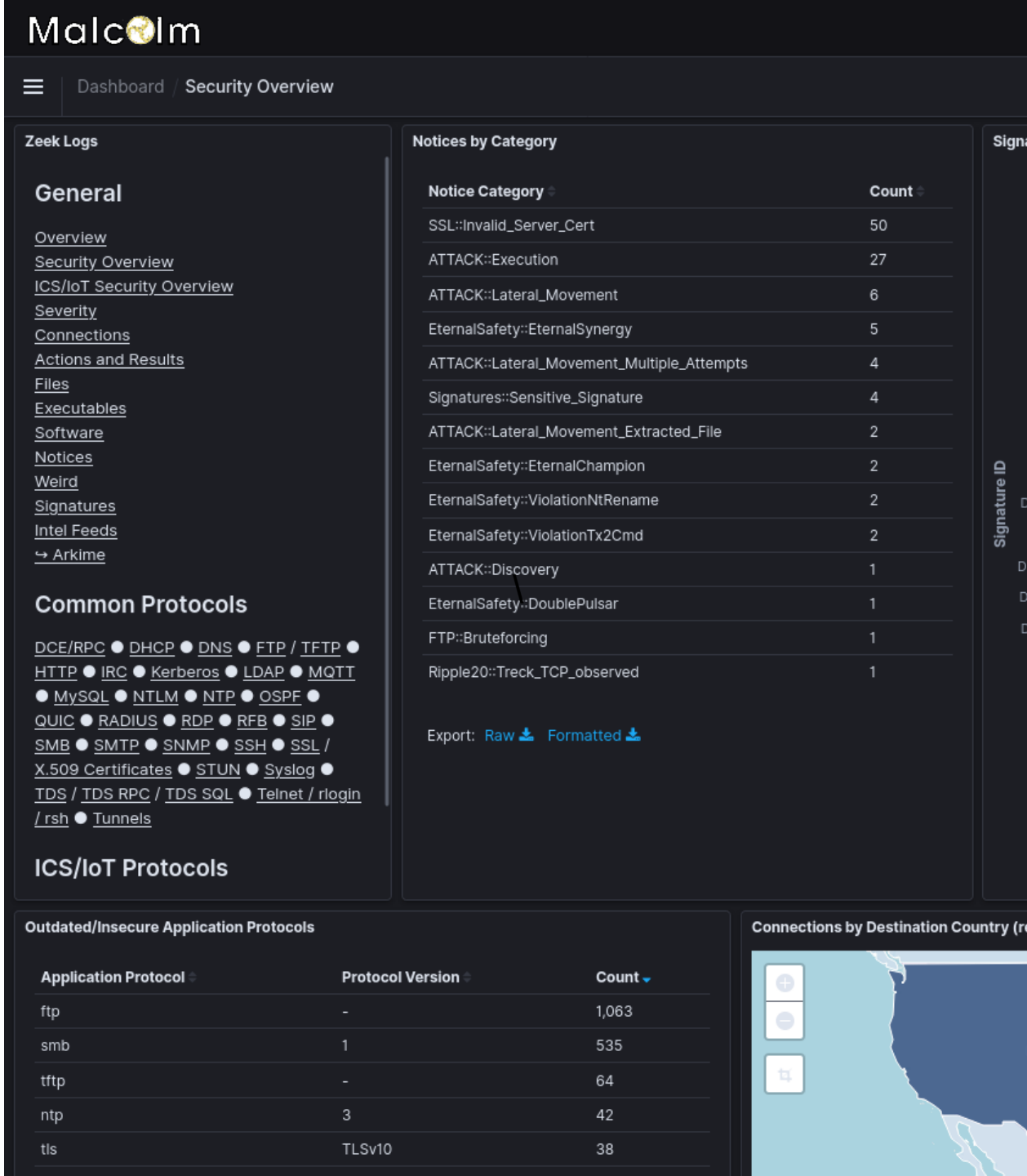
Data Tagging and Enrichment

- Logstash enriches Zeek log data
  - MAC addresses to hardware vendor/manufacturer
  - GeoIP and ASN lookups
  - Internal/external traffic based on IP ranges
  - Reverse DNS lookups
  - DNS query and hostname entropy analysis
  - Connection fingerprinting (JA3 for TLS, HASSH for SSH, Community ID for flows)

- `tags` field
  - Populated for both Arkime sessions and Zeek logs with tags provided on upload and words extracted from PCAP filenames
  - `internal_source`, `internal_destination`, `external_source`, `external_destination`, `cross_segment`

OpenSearch Dashboards

- Front end for Zeek logs
- Prebuilt visualizations for all Malcolm-supported protocols
  - General dashboards for high-level views and beginning investigation
  - Protocol-specific dashboards for IT and OT protocols
- Drill down from high-level trends to specific items of interest



Arkime

- Front end for **both** enriched Zeek logs and Arkime sessions
  - Malcolm's custom Arkime Zeek data source adds full support for Zeek logs to Arkime, including ICS protocols
- Filter by Zeek logs or Arkime sessions; or, view both together
- "Wireshark at scale": full PCAP availability for
  - viewing packet payload
  - exporting filtered and joined PCAP sessions
  - running deep-packet searches ("packet grep")
- Connections view
  - Visualize connections between network hosts

File Analysis

- Zeek can “carve” file transfers in common protocols
- Malcolm examines carved files and flags hits
  - ClamAV – open source antivirus engine
  - YARA – pattern matching swiss army knife
  - Capa – portable executable capabilities analyzer
  - VirusTotal – online database of file hashes
    - requires API token and internet connection
- Triggering files can be automatically saved for future investigation

Suricata IDS – Coming Soon

- Integration of Suricata into Malcolm is the focus of a capstone project for a team of undergraduate researchers at BYU
- Several Suricata rulesets for industrial control systems are publicly available and will be usable by Malcolm
- Project is nearing completion; expect Malcolm release early Q2 2022

Q&A

Malcolm

Thank you!

Visit Malcolm on GitHub
support!

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