Improving Enterprise Security:

Cyber Threat Sharing with STIX and TAXII

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MITRE projects:

- Python STIX 2 API
- STIX Validator
- Malware Analysis Framework

Domains: Cyber security, Software/web development

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MITRE projects:

- Python STIX 2 API
- MAEC standard
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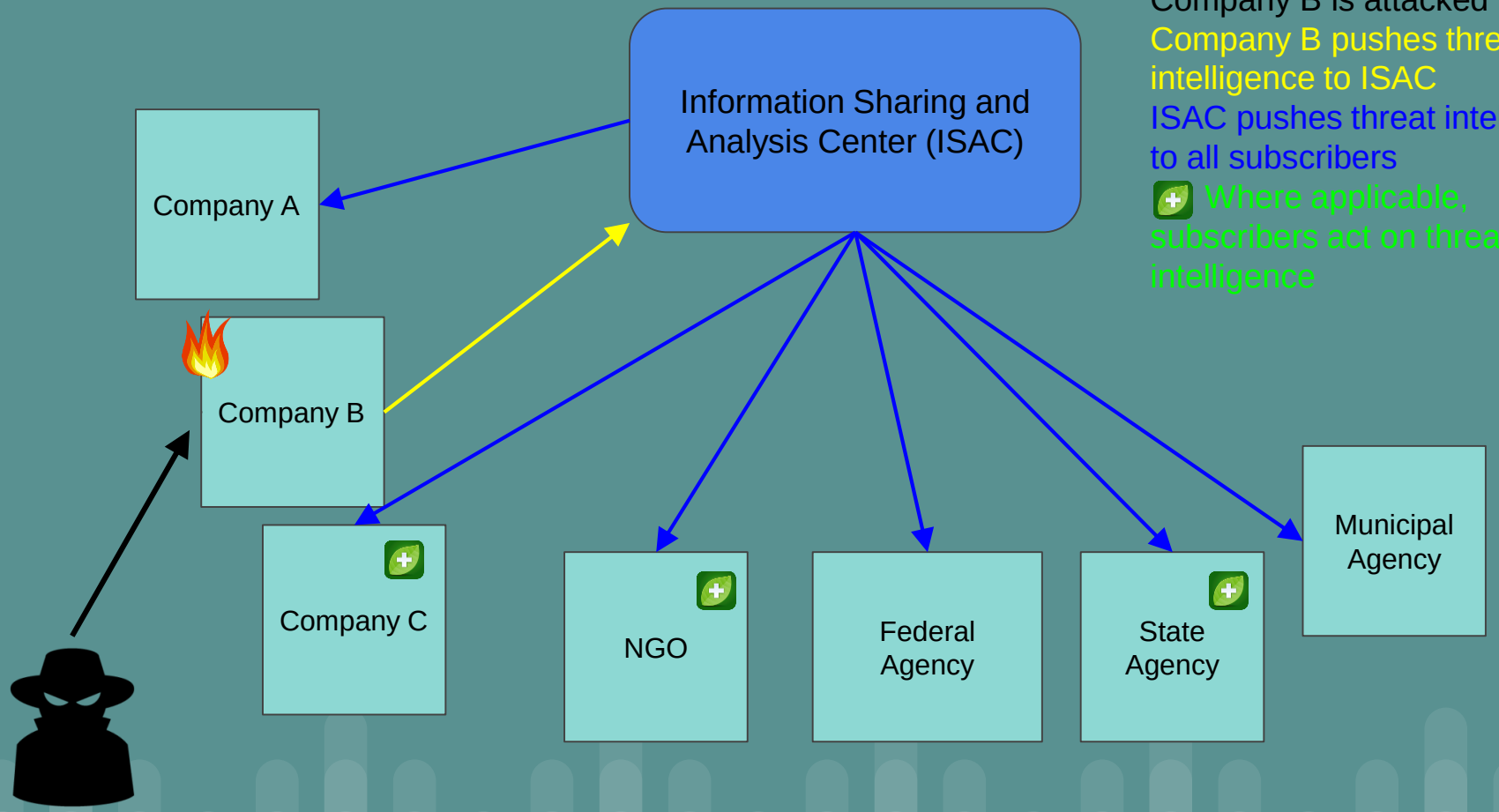
Agenda

- What is Cyber Threat Sharing?
  - Purpose of Cyber Threat Sharing
  - Example Use Cases
- How can my organization share cyber threat intelligence?
  - Sharing models
  - Sharing levels
  - Types of data
  - Sharing technologies
- STIX, an awesome way to structure threat data!
  - Overview
  - Data Markings
  - Example Use Cases
  - Resources
- TAXII, the vehicle to share STIX data
- Takeaways

Cyber Threat Sharing

- The practice of sharing cyber threat intelligence, vulnerabilities, configurations, best practices, knowledge and tips to a larger external community.
- **Goal:** To enhance the cyber security of an individual organization as well as that of the entire sharing community.
- Enterprise/Organization:
  - Obtains a vast stream of cyber security information that can be highly tailored to its infrastructure, network/host systems, software etc...
- Community:
  - The pooled intelligence, knowledge and experience allows for a much more formidable cyber defense than any single organization could produce.
  - A survey of the Advanced Cyber Security Center (ACSC) sharing partners concluded that 87% of the partners were receiving actionable threat intelligence and 50% of the partners noted demonstrable improvement to their cyber security (Bakis, 2015)

Cyber Threat Sharing



Company B is attacked
Company B pushes threat intelligence to ISAC
ISAC pushes threat intelligence to all subscribers
Where applicable, subscribers act on threat intelligence

How to share: Sharing Models

Decision Factors

Information goals

Sharing model and mechanisms

Availability

Centralized/Hub & Spoke/Subscriber

Advantages:

- Data enhancement, added analysis
- Macro trend analysis
- Rule/agreement enforcement, organization
- Anonymization/data cleansing
- Low technical costs for new consumers

Requirements: Wide-scale trust, capitalization

Direct/Peer-to-Peer

Advantages:

- Tailored for efficiency and speed
- Lower trust requirements

Requirements: Often requires participants to have more sophisticated and matured cyber threat sharing operations

How to share: Sharing Models

Centralized/Hub & Spoke/Subscriber (examples)

- Department of Homeland Security's (DHS) Automated Indicator Sharing (AIS), Cyber Information Sharing and Collaboration Program (CISCP)
- Advanced Cyber Security Center (ACSC)
- National Council of ISAC's
  - Automotive ISAC
  - Aviation ISAC
  - Defense Industrial Base (DIB) ISAC
  - .
  - .
  - .
  - Water ISAC
- Indiana-ISAC, Michigan-ISAC

Direct/Peer-to-Peer (examples)

- Exist between all size organizations
- From handshake agreements to formal contracts
- May be for highly esoteric information or for the entire cyber threat production capabilities of the participants

(Mature cyber threat sharing organizations are highly inclined to personalized, private partnerships; especially when in the same industrial domains)

How to share: Sharing Levels

- Consuming vs. Producing
- Implement cyber threat sharing capability incrementally
  - Basic consumption -> advanced consumption -> basic production -> advanced production
- Human relationships still play pivotal role regardless of technological sophistication and capability
- Section 4, NIST Special Publication 800-150: Guide to Cyber Threat Information Sharing (Johnson et al., 2014)

How to share: Types of Data

- Internal factors
  - Capability
  - Restrictions
  - Useful

- NIST SP 800-50 - Indicators should be:
  - Timely
  - Relevant
  - Accurate
  - Specific
  - Actionable

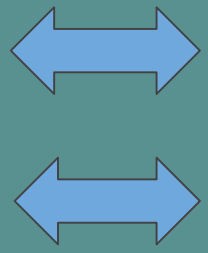
How to share: Types of Data

- Cyber Threat Information sources
  - Logs, flagged events, emails, network packets
  - Incidents, attack attempt descriptions
  - Vulnerabilities, secure configurations, firewall/IDS/IPS rules and policies
  - Malware signatures: host (files, registry keys, strings, processes), network (IP, domains, protocol, content), hashes
  - Analysis of: malware, attack pattern, exploit, network activity, host activity

How to share: Sharing Technologies

Cyber Threat Information Languages
(how data is stored)

- Structured Threat Information Expression (STIX)
- Incident Object Description Exchange Format (IODEF)
- OpenIOC



Cyber Threat Sharing Protocols
(how data is transmitted)

- Trusted Automated eXchange of Indicator Information (TAXII)
- Real-time Inter-network Defense (RID)

→ A language standard and a sharing protocol are the primary technical requirements for cyber threat sharing but they are not the *only* requirements. In practice, additional tools such as format converters, tool plugins, and APIs are essential to efficient use and adoption of cyber threat sharing.

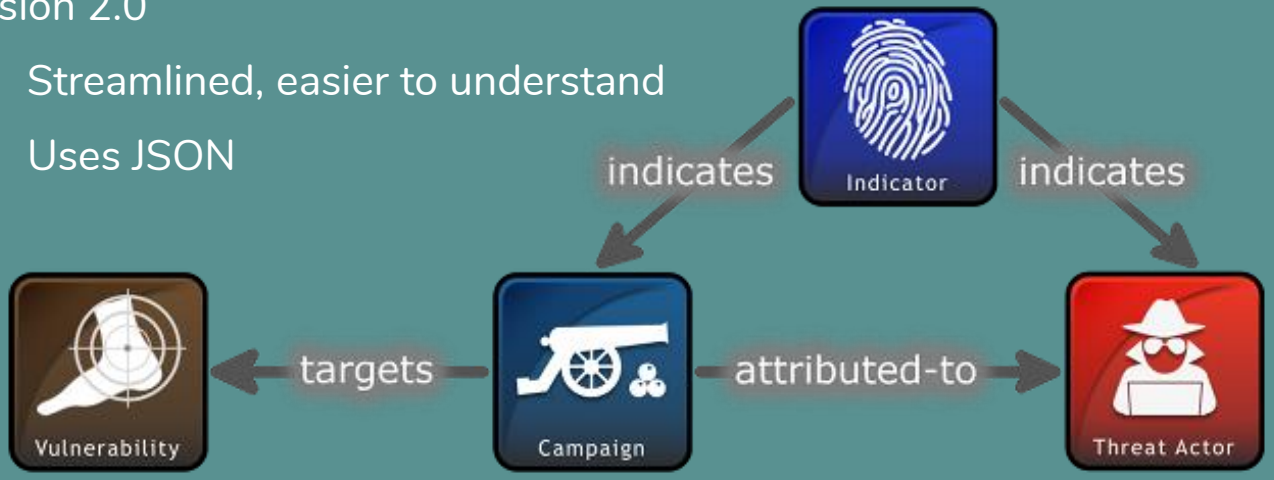
STIX: Overview

- Example of a language for sharing Cyber Threat Intelligence
  - Easy to use
  - Commonly-used
  - Well-known
  - Machine-readable (supports automation)

- Community-driven: OASIS
  - Vendors, Users
  - Government, Private Sector, Academia
  - Open Source

STIX: Overview

- Graph-based model: STIX domain objects, and relationship objects between them
  - Easier to add information
- Tool-agnostic
- Version 2.0
  - Streamlined, easier to understand
  - Uses JSON



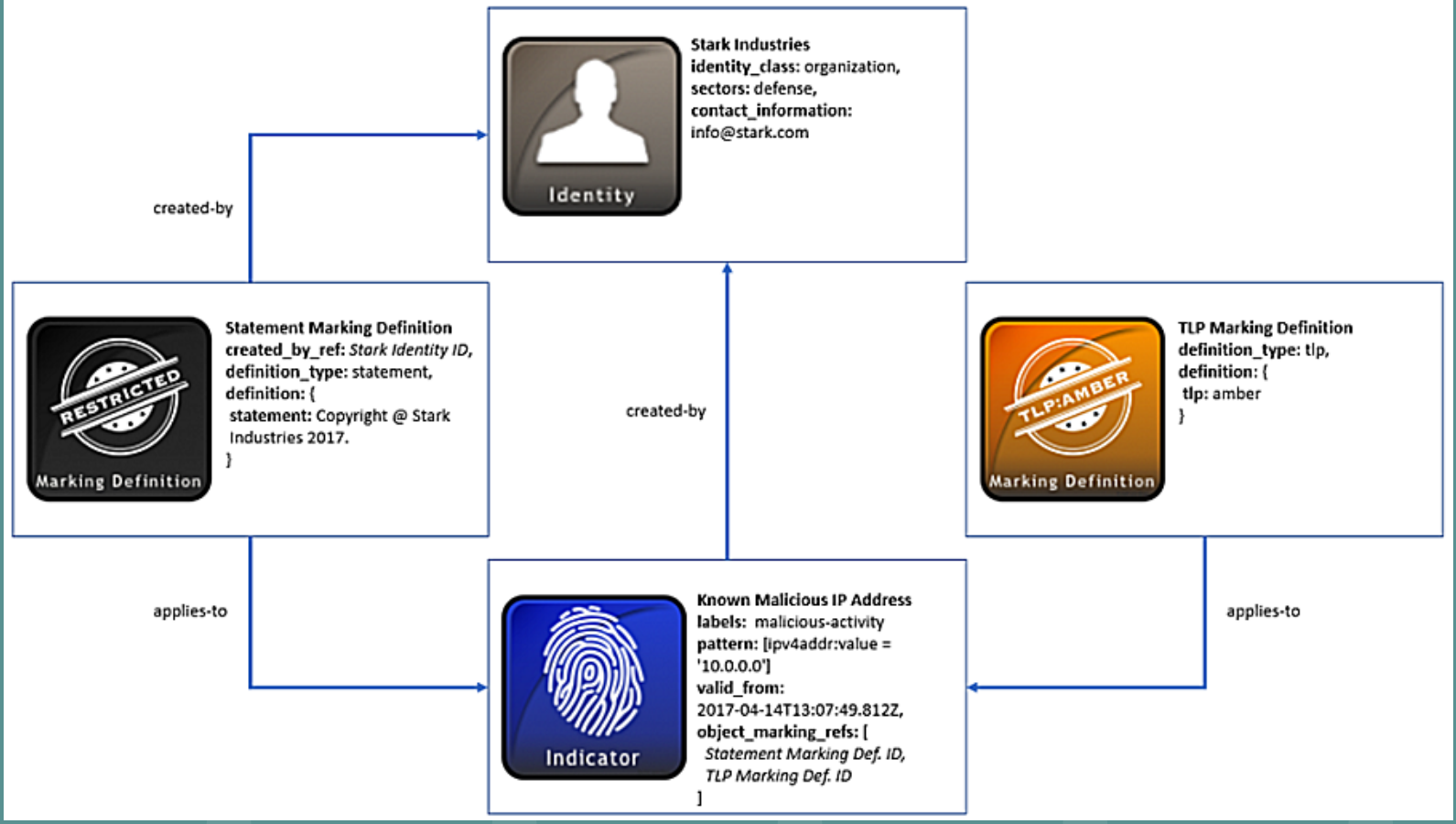
STIX: Overview

- What types of objects are included in model?
  - Threat Actors
  - Indicators of suspicious activity
  - Vulnerabilities
  - Malware
  - Reports
  - Courses of action
  - And more...

STIX: Data Markings

- Supports marking data with different restrictions
- Examples
  - Classified data
  - Data that cannot be re-shared
- Can apply to an entire object or just certain properties of the object

STIX: Data Markings



STIX: Data Markings


```
{
   "type": "marking-definition",
   "id": "marking-definition--d771aceb-3148-4315-b4b4-130b888533d0",
   "created": "2017-04-14T13:07:49.812Z",
   "created_by_ref": "identity--611d9d41-dba5-4e13-9b29-e22488058ffc",
   "definition_type": "statement",
   "definition": {
     "statement": "Copyright © Stark Industries 2017."
   }
 },
 {
   "type": "indicator",
   "id": "indicator--33fe3b22-0201-47cf-85d0-97c02164528d",
   "created": "2017-04-14T13:07:49.812Z",
   "modified": "2017-04-14T13:07:49.812Z",
   "created_by_ref": "identity--611d9d41-dba5-4e13-9b29-e22488058ffc",
   "name": "Known malicious IP Address",
   "labels": [
     "malicious-activity"
   ],
   "pattern": "[ipv4addr:value = '10.0.0.0']",
   "valid_from": "2017-04-14T13:07:49.812Z",
   "object_marking_refs": [
     "marking-definition--f88d31f6-486f-44da-b317-01333bde0b82",
     "marking-definition--d771aceb-3148-4315-b4b4-130b888533d0"
   ]
 }
```

STIX: Use Cases

- Use case examples
  - Share information about a threat actor
    - Aliases
    - Goals
    - Motivations
    - Attack patterns
  - Share indicators of compromise
    - Malicious file hashes
    - Malicious url
    - C2 IP addresses
- These are simple examples, but work is being done to include more sophisticated forms of intelligence in future versions

STIX: Use Cases


```
   {
      "type": "indicator",
      "id": "indicator--a932fcc6-e032-176c-126f-cb970a5a1ade",
      "created": "2014-02-20T09:16:08.989000Z",
      "modified": "2014-02-20T09:16:08.989000Z",
      "name": "File hash for Poison Ivy variant",
      "description": "This file hash indicates that a sample of
Poison Ivy is present.",
      "labels": [
        "malicious-activity"
      ],
      "pattern": "[file:hashes.'SHA-256' =
'ef537f25c895bfa782526529a9b63d97aa631564d5d789c2b765448c8635fb6c']
",
      "valid_from": "2014-02-20T09:00:00.000000Z"
    }
```

STIX: Resources

- STIX website: http://cti-tc.github.io
- STIX JSON schemas: https://github.com/oasis-open/cti-stix2-json-schemas
- Tools:
  - Python API https://github.com/oasis-open/cti-python-stix2
  - Validator https://github.com/oasis-open/cti-stix-validator
  - Converter/Elevator https://github.com/oasis-open/cti-stix-elevator

TAXII

- Protocol for sharing Cyber Threat Intelligence
- Defines a standard REST API
- Easy to deploy
- Specifically designed for sharing STIX
  - (can work with other standards too)
- Version 2.0
  - Uses HTTPS for security
  - Uses JSON for interoperability and ease of use

Takeaways

- Cyber Threat Sharing strengthens the security of your organization as well as the whole community.
  - No one organization knows everything!
- Key Considerations:
  - Centralized or Peer-to-Peer? Hybrid?
  - Implement sharing gradually, moving from consuming to also producing
  - What types of data to share?
- STIX and TAXII are easy-to-use examples of standards and technologies for sharing Cyber Threat Intelligence.

References

NIST Special Publication 800-150 Guide to Cyber Threat Information Sharing (Johnson et al., 2016)

Bakis, B. (2015). Cyber Threat Information Sharing - Lessons Learned and Challenges. MITRE Corporation. Retrieved from http://www.mitre.org/capabilities/cybersecurity/overview/cybersecurity-blog/blueprint-for-cyber-threat-sharing-lessons

Cyber Threat Intelligence Technical Committee. https://oasis-open.github.io/cti-documentation/