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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Cyber Security (CYBER).

Modal verbs terminology

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Executive summary

Cyber threat information sharing - often described as threat intelligence sharing - is one of the most important components of an organization's cyber security program. It can be obtained internally and from external trusted sources. It is collected, analysed, shared, and leveraged. The present document provides a survey of ongoing activities and the resulting platforms that are aimed at structuring and exchanging cyber threat information. These activities range from those developed among the Computer Emergency Response Teams in the 1990s in the IETF, to cutting-edge new initiatives being advanced in OASIS. Some of the platforms are semi-open commercial product communities. It is possible that the OASIS CTI work could bring about significant interoperability if not integration in this area.

Introduction

The importance of cyber threat information sharing has been underscored recently by the European Union and North America enacting into organic law, combined with major executive level and national initiatives. These actions extend across all information, and infrastructure sectors. Some of the more prominent of these recent actions include:

- EU Network Information Security Directive, approved 18 December 2015 [i.1].
- Cybersecurity Information Sharing Act of 2015 (18 December 2015) [i.2].
- CPNI, Threat Intelligence: Collecting, Analysing, Evaluating, 23 March 2015 [i.3].
- Launch of the Canadian Cyber Threat Exchange, 11 December 2015.

Against this backdrop of initiatives that included the scaling of Financial Services Information Sharing and Analysis Center (FS-ISAC) and The Depository Trust & Clearing Corporation (DTCC) activities, the OASIS Cyber Threat Intelligence Technical Committee was formed in 2015 to bring together a broad and rapidly growing array of public and private sector organizations to advance a global set of standards for structured threat information sharing.

The present document describes the known array of existing structured threat information sharing work in diverse bodies, including the developments underway in OASIS TC CYBER which can form the basis for expanded cooperation based on existing ETSI and OASIS collaborative agreements and working relationships among Technical Committees.

1 Scope

The present document provides an overview on the means for describing and exchanging cyber threat information in a standardized and structured manner. Such information includes technical indicators of adversary activity, contextual information, exploitation targets, and courses of action. The existence and creation of organizations for the exchange of this information are out of scope the present document.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Directive of the European Parliament and of the Council concerning measures with a view to achieving for a high common level of security of network and information security systems across the Union, Brussels, 21 April 2016 (5581/16).

[i.2] Guidance to Assist Non-Federal Entities to Share Cyber Threat Indicators and Defensive Measures with Federal Entities under the Cybersecurity Information Sharing Act of 2015 (June 2016).

NOTE: Available at https://www.us-cert.gov/sites/default/files/ais_files/Non-Federal_Entity_Sharing_Guidance_%28Sec%20105%28a%29%29.pdf.

[i.3] Center for the Protection of National Infrastructure (CPNI): "Threat Intelligence: Collecting, Analysing, Evaluating".

NOTE: Available at https://www.cpni.gov.uk/Documents/Publications/2015/23-March-2015-MWR_Threat_Intelligence_whitepaper-2015.pdf.

[i.4] OASIS Specifications, STIX 1.2.1, TAXII 1.1.1, CybOX 2.1.1; draft Specifications STIX 2.0, TAXII 2.0, CybOX 3.0; draft CybOX 3.0 Roadmap, CybOX 3.0 Visualization.

NOTE 1: Available at https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=cti.

NOTE 2: See also, OASIS Cyber Threat Intelligence (CTI) TC Wiki, https://wiki.oasis-open.org/cti/; Sean Barnum, Standardizing Cyber Threat Intelligence Information with the Structured Threat Information eXpression (STIX™), MITRE (February 20, 2014).

[i.5] OASIS. Cyber Threat Intelligence (CTI) TC Meeting Notes, OASIS Cyber Threat Intelligence (CTI) TC Documents.

NOTE: Available at https://www.oasis-open.org/apps/org/workgroup/cti/documents.php?folder_id=2978.

[i.6] Internet Engineering Task Force (IETF): "Managed Incident Lightweight Exchange (mile) Working Group".

NOTE: Available at https://datatracker.ietf.org/wg/mile/documents/.

[i.7] Recommendation ITU-T X.1500-Series: "Cybersecurity information exchange".

NOTE: Available at https://www.itu.int/itu-t/recommendations/index.aspx?ser=X.

[i.8] ETSI ISG ISI (Information Security Indicators) initial Terms of Reference.

NOTE: Available at https://portal.etsi.org/ISI/ISI_ISG_ToR_Sep2011.pdf.

[i.9] ETSI GS ISI 001-1: "Information Security Indicators (ISI); Indicators (INC); Part 1: A full set of operational indicators for organizations to use to benchmark their security posture".

[i.10] ETSI GS ISI 001-2: "Information Security Indicators (ISI); Indicators (INC); Part 2: Guide to select operational indicators based on the full set given in part 1".

[i.11] ETSI GS ISI 002: "Information Security Indicators (ISI); Event Model A security event classification model and taxonomy".

[i.12] ETSI GS ISI 003: "Information Security Indicators (ISI); Key Performance Security Indicators (KPSI) to evaluate the maturity of security event detection".

[i.13] ETSI GS ISI 004: "Information Security Indicators (ISI); Guidelines for event detection implementation".

[i.14] ETSI GS ISI 005: "Information Security Indicators (ISI); Guidelines for security event detection testing and assessment of detection effectiveness".

[i.15] IETF RFC 5070: "The Incident Object Description Exchange Format".

[i.16] IETF RFC 6545: "Real-time Inter-network Defense (RID)".

[i.17] IETF RFC 6546: "Transport of Real-time Inter-network Defense (RID) Messagesover HTTP/TLS".

[i.18] IETF RFC 6684: "Guidelines and Template for Defining Extensions to the Incident Object Description Exchange Format (IODEF)".

[i.19] IETF RFC 6685: "Expert Review for Incident Object Description Exchange Format (IODEF) Extensions in IANA XML Registry".

[i.20] IETF RFC 7203: "An Incident Object Description Exchange Format (IODEF) Extension for Structured Cybersecurity Information".

[i.21] IETF RFC 7495: "Enumeration Reference Format for the Incident Object Description Exchange Format (IODEF)".

[i.22] IETF RFC 6046: "Transport of Real-time Inter-network Defense (RID) Messages".

[i.23] draft-ietf-mile-implementreport-09: "MILE Implementation Report".

[i.24] draft-ietf-mile-iodef-guidance-06: "IODEF Usage Guidance".

[i.25] draft-ietf-mile-rfc5070-bis-25: "The Incident Object Description Exchange Format v2".

[i.26] draft-ietf-mile-rolie-03: "Resource-Oriented Lightweight Information Exchange".

[i.27] draft-ietf-mile-xmpp-grid-00: "XMPP Protocol Extensions for Use with IODEF".

[i.28] ISO/IEC 27001: "Information technology -- Security techniques -- Information security management systems -- Requirements".

[i.29] ISO/IEC 27002: "Information technology -- Security techniques -- Code of practice for information security controls".

[i.30] ISO/IEC 27004: "Information technology -- Security techniques -- Information security management -- Measurement".

[i.31] ETSI TR 103 305: "CYBER; Critical Security Controls for Effective Cyber Defence".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply. Reference figure 2, below.

campaign: STIX Campaign represents a set of TTPs, Incidents, or Threat Actors that together express a common intent or desired effect [i.4]

course of action: STIX Course of Action (COA) is used to convey information about courses of action that may be taken either in response to an attack or as a preventative measure prior to an attack [i.4]

exploit target: STIX Exploit Target conveys information about a vulnerability, weakness, or misconfiguration in software, systems, networks, or configurations that may be targeted for exploitation by an adversary [i.4]

incident: STIX Incident corresponds to sets of related security events affecting an organization, along with information discovered or decided during an incident response investigation [i.4]

indicators: STIX Indicator data model conveys specific Observable patterns combined with contextual information intended to represent artifacts and/or behaviors of interest within a cyber security contex [i.4]

observables: STIX Observable represents stateful properties or measurable events pertinent to the operation of computers and networks, and may consist of Observable instances and Observable Patterns [i.4]

observable instances: represent actual specific observations that took place in the cyber domain [i.4]

observable patterns: represent conditions for a potential observation that may occur in the future or may have already occurred and exists in a body of observable instances [i.4]

report: STIX Report defines a contextual wrapper for a grouping of STIX content, which could include content specified using any of the other eight top-level constructs, or even other related Reports [i.4]

Tactics, Techniques and Procedures (TTP): STIX Tactics, Techniques, and Procedures (TTP) are used to represent the behavior or modus operandi of cyber adversaries [i.4]

threat actor: STIX Threat Actor is a characterization of malicious actor (or adversary) representing a cyber attack threat including presumed intent and historically observed behavior [i.4]

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACDC	Advanced Cyber Defence Centre
AS	Autonomous System
CERT	Computer Emergency Response Team
CIF	Collection Intelligence Framework
COBIT	Control OBjectives for Information and related Technology
CPNI	Centre for the Protection of National Infrastructure
CSIRT	Computer Security Incidence Response Team
CTI	Cyber Threat Intelligence
CYBEX	Cybersecurity Information Exchange
CybOX™	Cyber Observable Expression
DHS	Department of Homeland Security
DoS	Denial of Service
DTCC	Depository Trust & Clearing Corporation
ENISA	European Union Agency for Network and Information Security
EU	European Union
FIRST	Forum of Incident Response and Security Teams
FS-ISAC	Financial Services ISAC
GS	Group Specification
HTTP	Hypertext Transfer Protocol

IANA	Internet Assigned Numbers Authority
IDS	Identification Detection System
IETF	Internet Engineering Task Force
INC	INdiCators
INCH	INCident Handling
IODEF	Incident Object Description Exchange Format
IP	Internet Protocol
ISAC	Information Sharing and Analysis Center
ISACA	Information Systems Audit and Control Association
ISG	Industry Specification Group
ISI	Information Security Indicators
IT	Information Technology
ITU-T	International Telecommunication Union Telecommunication Standardization
JSON	JavaScript Object Notation
KPSI	Key Performance Security Indicators
MAEC™	Malware attribute enumeration and characterization
MILE	Managed Incident Lightweight Exchange
NIS	Network and Information Security
NREN	National Research and Education Network
OASIS	Organization for the Advancement of Structured Information Standards
OMG	Object Management Group
OSSIM	Open Source Security Information Management
OTX	Open Threat eXchange
RID	Real-time Inter-network Defense
STIX™	Structured Threat Information Expression
TAXII™	Trusted Automated Exchange of Indicator Information
TTP	Tactics, Techniques and Procedures
US	United States
VERIS	Vocabulary for Event Recording and Incident Sharing
XML	Extensible Markup Language
XMPP	Extensible Messaging and Presence Protocol

NOTE: CybOX™, MAEC™, STIX™ and TAXII™ are trademarks of The MITRE Corporation operating as a non-profit Federally Funded Research and Development Center (FFRDC) of the U.S. Department of Homeland Security. See http://stixproject.github.io/legal/. This information is given for the convenience of users of the present document and does not constitute an endorsement by ETSI of the product named. Equivalent products may be used if they can be shown to lead to the same results.

4 Means for exchanging structured cyber threat intelligence

4.1 Introduction

The need for the exchange of structured cyber threat intelligence grew in the 1990s in conjunction with increasing numbers of discovered exploits of network vulnerabilities and attacks. This led to a diverse array of initiatives and projects to develop structured expressions and associated protocols for the trusted exchange of information concerning those vulnerabilities and attacks, and remediation steps - which are described in the following clauses. These efforts and the resulting platforms have moved forward (or not) at significantly different scales, and involve specialized and sometimes vendor-oriented communities. The Financial Services Information Sharing and Analysis Center (FS-ISAC) and The Depository Trust & Clearing Corporation (DTCC) communities are especially significant and one of the EU NIS essential services sectors. The largest related standards activity - now consists of OASIS Technical Committee on Cyber Threat Intelligence (TC CTI) - and is still rapidly growing and evolving.

4.2 OASIS Cyber Threat Intelligence Technical Committee (TC CTI)

4.2.1 Introduction

The OASIS Cyber Threat Intelligence (CTI) TC was chartered to define a set of information representations and protocols to address the need to model, analyze, and share cyber threat intelligence. In the initial phase of TC work, three specifications were transitioned from the US Department of Homeland Security (DHS) for development and standardization under the OASIS open standards process: STIX™ (Structured Threat Information Expression), TAXII™ (Trusted Automated Exchange of Indicator Information), and CybOX™ (Cyber Observable Expression). The OASIS CTI Technical Committee remit includes:

- define composable information sharing services for peer-to-peer, hub-and-spoke, and source subscriber threat intelligence sharing models;
- develop standardized representations for campaigns, threat actors, incidents, tactics techniques and procedures (TTPs), indicators, exploit targets, observables, and courses of action;
- develop formal models that allow organizations to develop their own standards-based sharing architectures to meet specific needs.

TC CTI consists of a significant number of companies, government agencies, and institutes from around the world. New OASIS versions of the three initial platforms (STIX™, TAXII™, and CybOX™) were produced and next generation versions being produced. Rather considerable material including running code is hosted on multiple design GitHubs. (https://github.com/STIXProject, https://github.com/TAXIIProject, https://github.com/CybOXProject, https://github.com/MAECProject/. It is expected that MAEC™ will be conflated into the TAXII™. As of June 2016, the deliverables consist of:

- STIX™ 1.2.1 Specification, August 2016.
- STIX™ 2.0 Specification [target Q1 2017].
- TAXII™ 1.1.1 Specification, August 2016.
- TAXII™ 2.0 Specification [target Q1 2017].
- CybOX™ 2.1.1 Specification, [September 2016].
- CybOX™ 3.0 Specification [target Q1 2017].
- CybOX™ 3.0 Roadmap.
- CybOX™ 3.0 Visualisation.
- Interoperability Guidelines.
- Interoperability Demonstration Policy.

The platforms have significant potential use within Network Functions Virtualization environments. The degree of activity and importance of this work merits more detailed treatment of the principal CTI subcommittees and their work. It presently has four active subcommittees dedicated to specific deliverables that are described below. There is an additional Marketing Group within the TC as well as several informal ad hoc "mini working groups".

4.2.2 CTI STIX Subcommittee

The objective of the Structured Threat Information Expression (STIX™) effort is to specify, characterize, and capture cyber threat information. STIX addresses a full range of cyber threat use cases - including threat analysis, capture and specification of indicators, management of response activities, and information sharing - to improve consistency, efficiency, interoperability, and overall situational awareness.