MISP: Introduction, Concepts and Guide

This eLearning module is a prerequisite or refreshing module to read before the actual training sessions. This helps to ensure that all participants are inline with the basic knowledge of MISP. In the training modules, the various elements mentioned in this introduction will be completed in details (e.101-104, e.205-e.206 and e.302-e.304).

Structure of this document

1. **MISP Introduction**: The what, why and how about MISP
2. **MISP Basics**: A concise introduction to MISP data model
3. **How-to**: A user guide with screenshots on how to use MISP to encode and share data

MISP Introduction

What is MISP

MISP is an open-source threat-intelligence and sharing platform meant to store, correlate, enrich, analyse and share information. It enables the various type of analysts to collaborate on investigations and incidents, perform intelligence as well as helping operators to automatically feed their protective tools.

Why is MISP relevant

Information sharing is becoming more essential than ever to oppose threats. MISP strive to be the enabler and interface for real cross-sectoral sharing and support the organisations facing hybrid threats. To achieve these goals, MISP uses a practical information sharing format expressed in JSON which is built from a practical use-cases. It is flexible and can be easily extended by users to model their own data-structure.

The MISP core format as well as the common set of vocabularies provided by the various libraries supported by the tool allows users from all around the world to understand each others and rely on normalized data, making MISP a central place to collaborate.

MISP offers different alternatives to share analysis, case and report enabling users to review data produced by partners or third-parties and propose changes if need be. This happens in a decentralized way where analyst can evaluate correlation against other existing evidences and perform enrichment on the data.

These functionnalities provide the means to fulfill the ultimate goal of MISP: Bridging communities together. By fostering communication and sharing accross multiple sectors, people are able to share and collaborate seemlessly making the connection between law enforcement with CSIRTs possible.

MISP philosophy

Sharing being the principal functionnality, it is essential that everyone is able to send and receive data. As such, everyone is considered to be a producer (also called contributor) and/or a consumer at the same time. There are stricly no obligation to contribute which in turns makes the system to have a low barrier of access for users to get acquainted to the system.

MISP Basics

A cheat-sheet describing the core concepts and data-models in MISP is available here.

1.1 Data Layer

First and foremost, it's important to understand how MISP is organised. Similar to all applications, some predefined data structure exists and are used to represent and save the actual data on the disk. Such structure in MISP could be for example *Attributes* or *MISP Objects*.

MISP Attributes *Attributes* are individual block containing the very information to be used or to be shared. Thanks to their characteristic called `type`, *Attributes* can represent concept such as an IP address, a domain name or cryptographic hash. In addition to having a `type` and a `value`, they can express if they are Indicators of Compromise (IoC) or supporting data where for example, the former could be a hash of a malicious binary and the later could be Observed behaviour or links toward documentation. The differentiation between IoC and observable can be done by flipping the *Attribute*'s `to_ids` flag.

☐	2021-11-25	Payload delivery	ip-src	118.217.182.3
☐	2021-11-25	Payload delivery	url	https://evilprovider.com/this-is-not-malicious.exe

Figure 1: attributes

MISP Objects In most of the case, these individual blocks of information can be combined together into a more elaborated concept. When multiple *Attributes* are grouped, they form another entity that is called a *MISP Object*. For example, a *File Object* contains multiple *Attributes* such as the filename, its size, its name and so on.

By their very nature, *MISP Objects* organise and facilitate the reading of data in the application. But their efficiency can be improved even more when you add the capability to link them together with relationships to create directed graph allowing to represent stories, processes or behaviours. In MISP, creating such connections is called "create an *Object Reference*". Viewing these relationships as a connected graph can be done by looking at the widget called *Event Graph*.

	2021-12-09	**Object name:** file **References:** 1 **Referenced by:** 1		
☐	2021-12-09	Payload delivery	**malware-sample:** malware-sample	malicious.exe f1a3e62de12faecee82bf4599cc1fdcd
☐	2021-12-09	Payload delivery	**filename:** filename	malicious.exe
☐	2021-12-09	Payload delivery	**md5:** md5	f1a3e62de12faecee82bf4599cc1fdcd
☐	2021-12-09	Payload delivery	**sha1:** sha1	d836f2ee449b74913d1efc615eeb459b65e4f791
☐	2021-12-09	Payload delivery	**sha256:** sha256	d90401420908dbb4b3488a306467e8fffc57577ce9d5eee016578ff6a3ada12e
☐	2021-12-09	Other	**size-in-bytes:** size-in-bytes	751328

Figure 2: objects

MISP Events Now that we have the structures to encode information, we need another structure to be able to group them together in order to avoid dealing with a soup of *Attributes* and *MISP Objects*. *MISP Events* or commonly called *Events* are envelopes allowing to assemble *Attributes* and *Objects* contextually linked. Typically, *Events* are used to encode incidents, events or reports.

Threat Intelligence Tools: Event Graph, Event Timeline and Event Reports

MISP Event Graph The MISP *Event Graph* feature is a widget accessible when viewing an *Event*. It allows analysts to visualise or create relationships between different entities in order to describe in a concise manner complex scenarios such as events performed in parallel or multiple-step attacks.

MISP Event Timeline In some situation, temporality is crucial to understand the order of events, actions or processes. To help analysts visualise and adjust the time component of *Attributes* or *Objects*, a complete timline viewer and editor is available allowing users to describe complex time-based information.

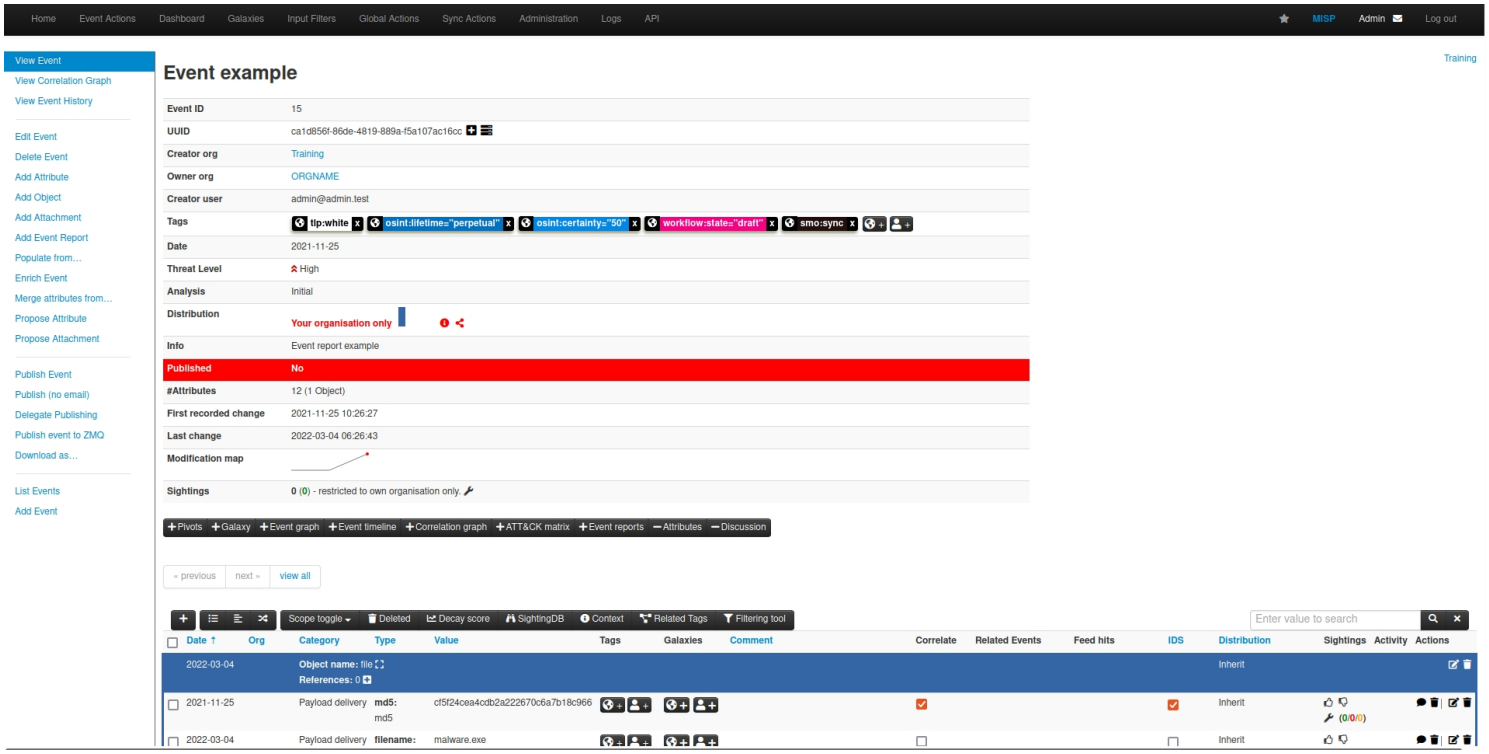


Figure 3: event

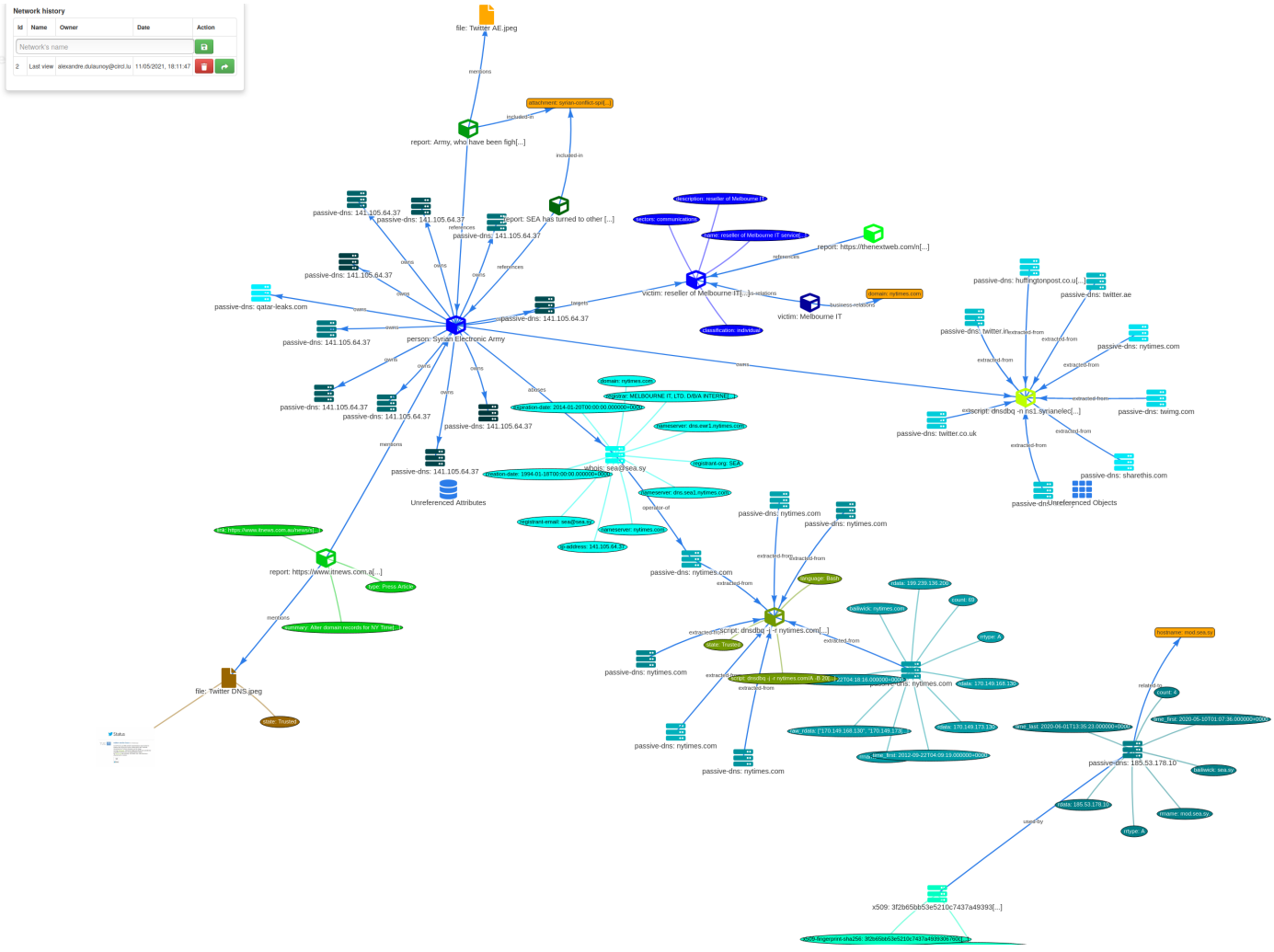


Figure 4: event-graph

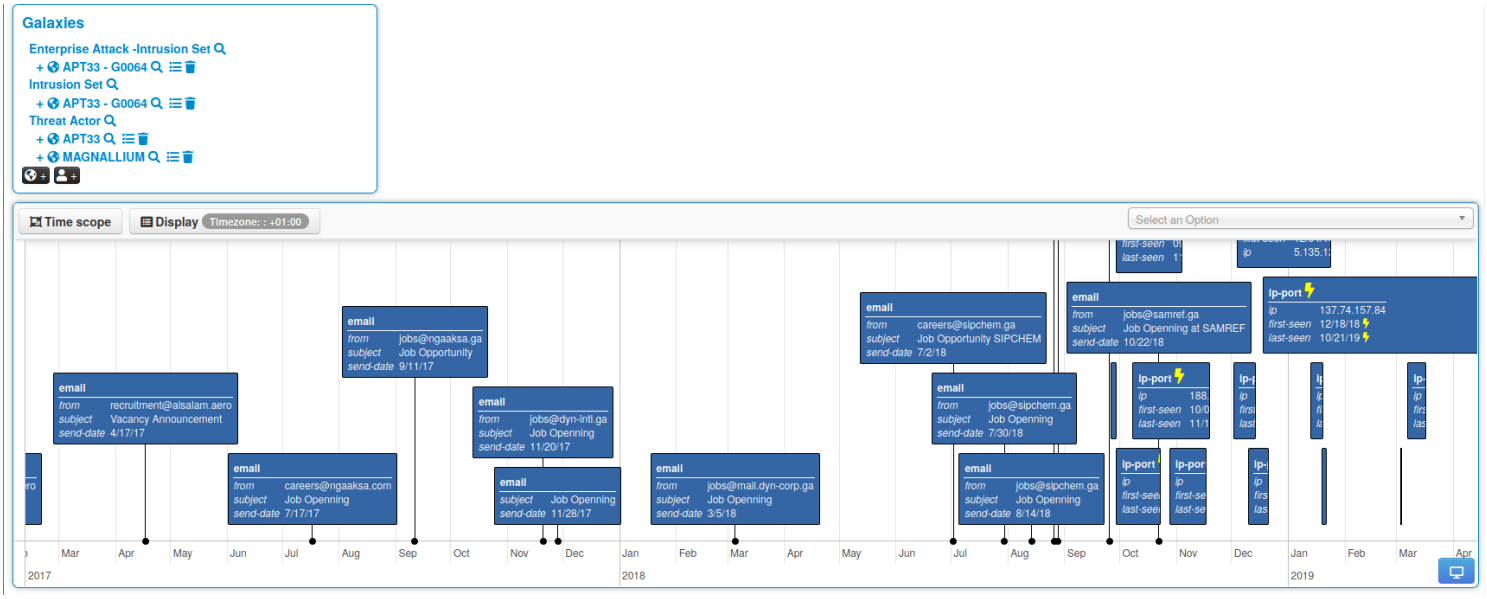


Figure 5: event-timeline

MISP Event Reports In addition to encode data into pre-formatted structure, MISP offers a tool to write report. Such report are called *Events reports* and are contained in an *Event* where they use the markdown syntax to write formatted text. They also provide directives specific to MISP allowing writers to reference other entities contained in the *Event*. This extended syntax supports referencing *Attributes*, *Objects*, *Tags* and *Galaxy Clusters*.

1.2 Context Layer

One of the most critical aspects often left aside is contextualisation. If done properly, it allows the reader to know more about where this data comes from, what it is about, how relevant it is for the user and finally, what can be done with it.

In MISP, contextualising data is as simple as attaching a label to the relevant entity. However, choosing the right labels is the difficult part. We can distinguish two types of labels: *Tags* and *Galaxy Clusters*.

Tags *Tags* are simple labels coming from a curated list of vocabulary (Also called *Taxonomy*). They are mainly used to classify data in order to ease data consumption and automation. For example, the following *Tags* can be used to quickly classify information: - `tlp`: Allow a favorable classification scheme for sharing sensitive information while keeping the control over its distribution at the same time. - `adversary`: An overview and description of the adversary infrastructure and allowed actions - `collaborative-intelligence`: Common language to support analysts to perform their analysis. The objective of this language is to advance collaborative analysis and to share earlier than later. - `estimative-language`: Estimative language to describe quality and credibility of underlying sources, data, and methodologies

Galaxy Clusters *Galaxy Clusters* are knowledge base items having descriptions, links, synonyms and any other meta-information. *Clusters* are regrouped into a higher-level structure called *Galaxy*. *Clusters* enable analysts to assign complex high-level contextual information to data-structures. Example of *Galaxy Clusters*:

- `threat-actor="Sofacy"` having information such as suspected-state-sponsor, victims, links-to-documentation, target-category and synonyms.
- `country="Luxembourg"` having information such as country-code, languages, TLD, Capital and so on.

MITRE's ATT&CK Another advantage that *Galaxy Clusters* have compared to simple labels is the fact that the list of *Clusters* belonging to the same *Galaxy* can be arranged as a matrix to have improved readability and aggregation. One of the biggest success of this kind of matrices is definitely the MITRE ATT&CK framework. It describes tacticts, techniques and procedures of adversaries. ATT&CK is very popular and its usage is highly recommanded as it offers very precise classification and is globally understood and supported by other tools.

1.3 Anatomy of a complete Event

1.4 Distribution Levels

Distribution level is the term used in MISP to determine who can read which data and how it should be shared. The distribution can be set on entities such as *Event* or *Attributes*, where the most restrictive priority will always take priority.

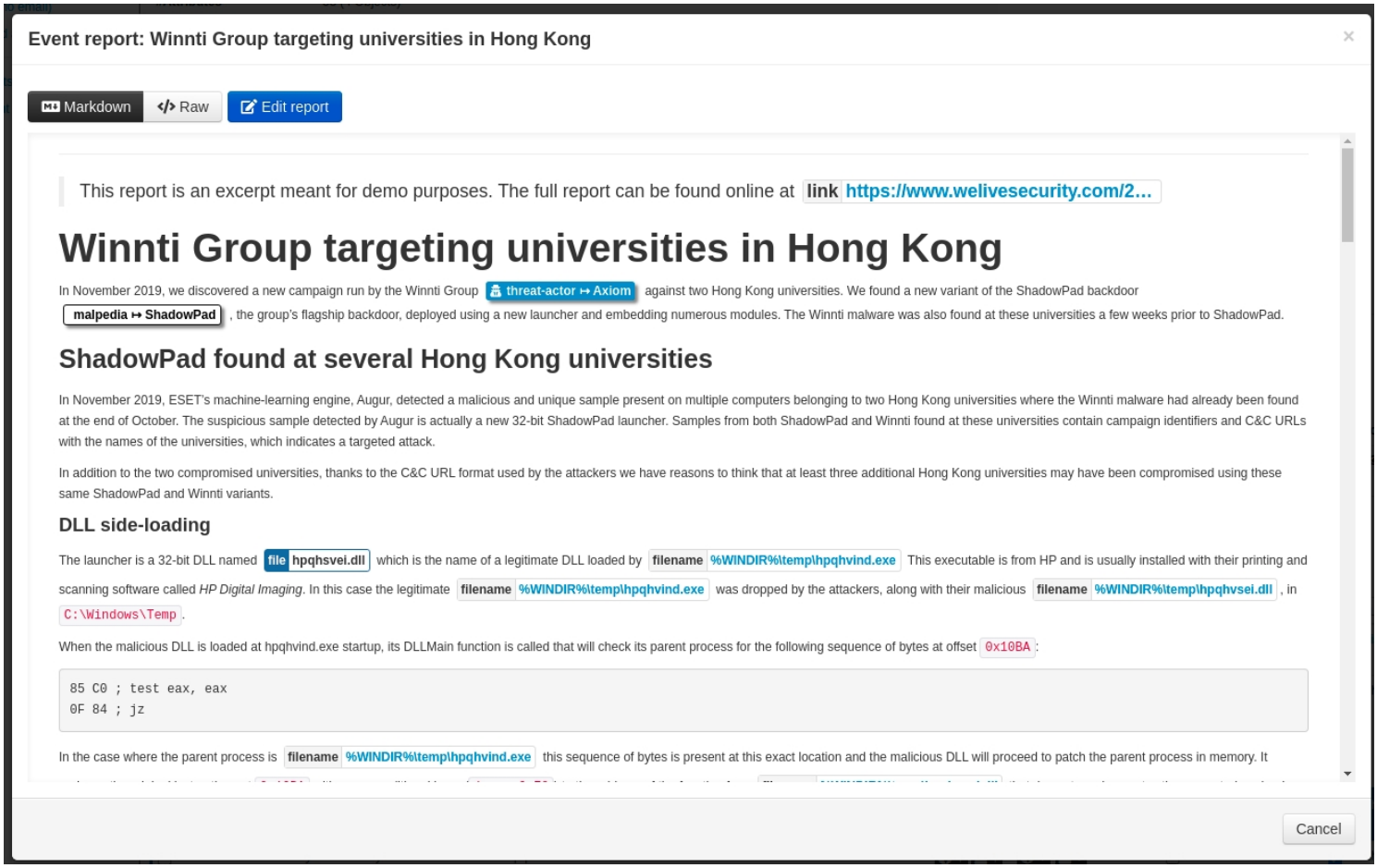


Figure 6: event-report

Name	Expanded	Numerical Value	# Events	# Attributes	Tag	Enabled	Actions
estimative-language:confidence-in-analytic-judgment="high"	Confidence in analytic judgment: High	95	15	4	estimative-language:confidence-in-analytic-judgment="high"	✔	
estimative-language:confidence-in-analytic-judgment="low"	Confidence in analytic judgment: Low	0	9	0	estimative-language:confidence-in-analytic-judgment="low"	✔	
estimative-language:confidence-in-analytic-judgment="moderate"	Confidence in analytic judgment: Moderate	55	26	4	estimative-language:confidence-in-analytic-judgment="moderate"	✔	
estimative-language:likelihood-probability="almost-certain"	Likelihood or probability: Almost certain(ly) - nearly certain - 95-99%	95	21	8	estimative-language:likelihood-probability="almost-certain"	✔	
estimative-language:likelihood-probability="almost-no-chance"	Likelihood or probability: Almost no chance - remote - 01-05%	0	0	0	estimative-language:likelihood-probability="almost-no-chance"	✔	
estimative-language:likelihood-probability="likely"	Likelihood or probability: Likely - probable (probably) - 55-80%	55	4	5	estimative-language:likelihood-probability="likely"	✔	
estimative-language:likelihood-probability="roughly-even-chance"	Likelihood or probability: Roughly even change - roughly even odds - 45-55%	45	4	2	estimative-language:likelihood-probability="roughly-even-chance"	✔	
estimative-language:likelihood-probability="unlikely"	Likelihood or probability: Unlikely - improbable (improbably) - 20-45%	20	0	1	estimative-language:likelihood-probability="unlikely"	✔	
estimative-language:likelihood-probability="very-likely"	Likelihood or probability: Very likely - highly probable - 80-95%	80	23	18	estimative-language:likelihood-probability="very-likely"	✔	
estimative-language:likelihood-probability="very-unlikely"	Likelihood or probability: Very unlikely - highly improbable - 05-20%	5	0	1	estimative-language:likelihood-probability="very-unlikely"	✔	

Figure 7: taxonomy

Country :: luxembourg

Name	luxembourg
Parent Galaxy	Country
Description	Luxembourg
Version	1
UUID	84668357-5a8c-4bdd-9f0f-6b50b24c5558
Source	MISP Project
Authors	geonames.org
Distribution	**All communities**
Creator Organisation	MISP
Connector tag	misp-galaxy:country="luxembourg"
Events	11 events

« previous | next »

Tabular view | JSON view

Key ↓	Value	Actions
Capital	Luxembourg	
Continent	EU	
CurrencyCode	EUR	
CurrencyName	Euro	
ISO	LU	
ISO3	LUX	
Languages	lb,de-LU,fr-LU	
Population	497538	
tld	.lu	

Figure 8: cluster-country

Pre Attack - Attack Pattern | **Enterprise Attack - Attack Pattern** | Mobile Attack - Attack Pattern

0 11 Show all

Initial access	Execution	Persistence	Privilege escalation	Defense evasion	Credential access	Discovery	Lateral movement	Collection	Exfiltration	Command and control
Spearphishing Attachment	Scripting	Screensaver	File System Permissions Weakness	Process Hollowing	Securityd Memory	Password Policy Discovery	AppleScript	Data from Information Repositories	Exfiltration Over Alternative Protocol	Standard Application Layer Protocol
Spearphishing via Service	Command-Line Interface	Login Item	AppCert DLLs	Code Signing	Input Capture	System Network Configuration Discovery	Distributed Component Object Model	Data from Removable Media	Exfiltration Over Command and Control Channel	Communication Through Removable Media
Trusted Relationship	User Execution	Trap	Application Shimming	Rootkit	Bash History	Process Discovery	Pass the Hash	Man in the Browser	Data Compressed	Custom Command and Control Protocol
Replication Through Removable Media	Regsvcs/Regasm	System Firmware	Scheduled Task	NTFS File Attributes	Exploitation for Credential Access	Network Share Discovery	Exploitation of Remote Services	Data Staged	Automated Exfiltration	Multi-Stage Channels
Exploit Public-Facing Application	Trusted Developer Utilities	Registry Run Keys / Start Folder	Startup Items	Exploitation for Defense Evasion	Private Keys	Peripheral Device Discovery	Remote Desktop Protocol	Screen Capture	Scheduled Transfer	Remote Access Tools
Spearphishing Link	Windows Management Instrumentation	LC_LOAD_DYLIB Addition	New Service	Network Share Connection Removal	Brute Force	Account Discovery	Pass the Ticket	Email Collection	Data Encrypted	Uncommonly Used Port
Valid Accounts	Service Execution	LSASS Driver	Sudo Caching	Process Doppelgänging	Password Filter DLL	System Information Discovery	Windows Remote Management	Clipboard Data	Exfiltration Over Other Network Medium	Multilayer Encryption
Supply Chain Compromise	CMSTP	Rc.common	Process Injection	Disabling Security Tools	Two-Factor Authentication Interception	System Network Connections Discovery	Windows Admin Shares	Video Capture	Exfiltration Over Physical Medium	Domain Fronting
Drive-by Compromise	Control Panel Items	Authentication Package	Bypass User Account Control	Timestomp	LLMNR/NBT-NS Poisoning	Network Service Scanning	Remote Services	Audio Capture	Data Transfer Size Limits	Data Obfuscation
Hardware Additions	Dynamic Data Exchange	Component Firmware	Extra Window Memory Injection	Modify Registry	Credentials in Files	File and Directory Discovery	Taint Shared Content	Data from Network Shared Drive		Connection Proxy
	Source	Windows Management Instrumentation Event Subscription	Setuid and Setgid	Indicator Removal from Tools	Forced Authentication	Security Software Discovery	Application Deployment Software	Data from Local System		Commonly Used Port
	Space after Filename	Change Default File	Launch Daemon	Hidden Window	Keychain	System Service Discovery	Third-party Software	Automated Collection		Data Encoding

Figure 9: cluster-country

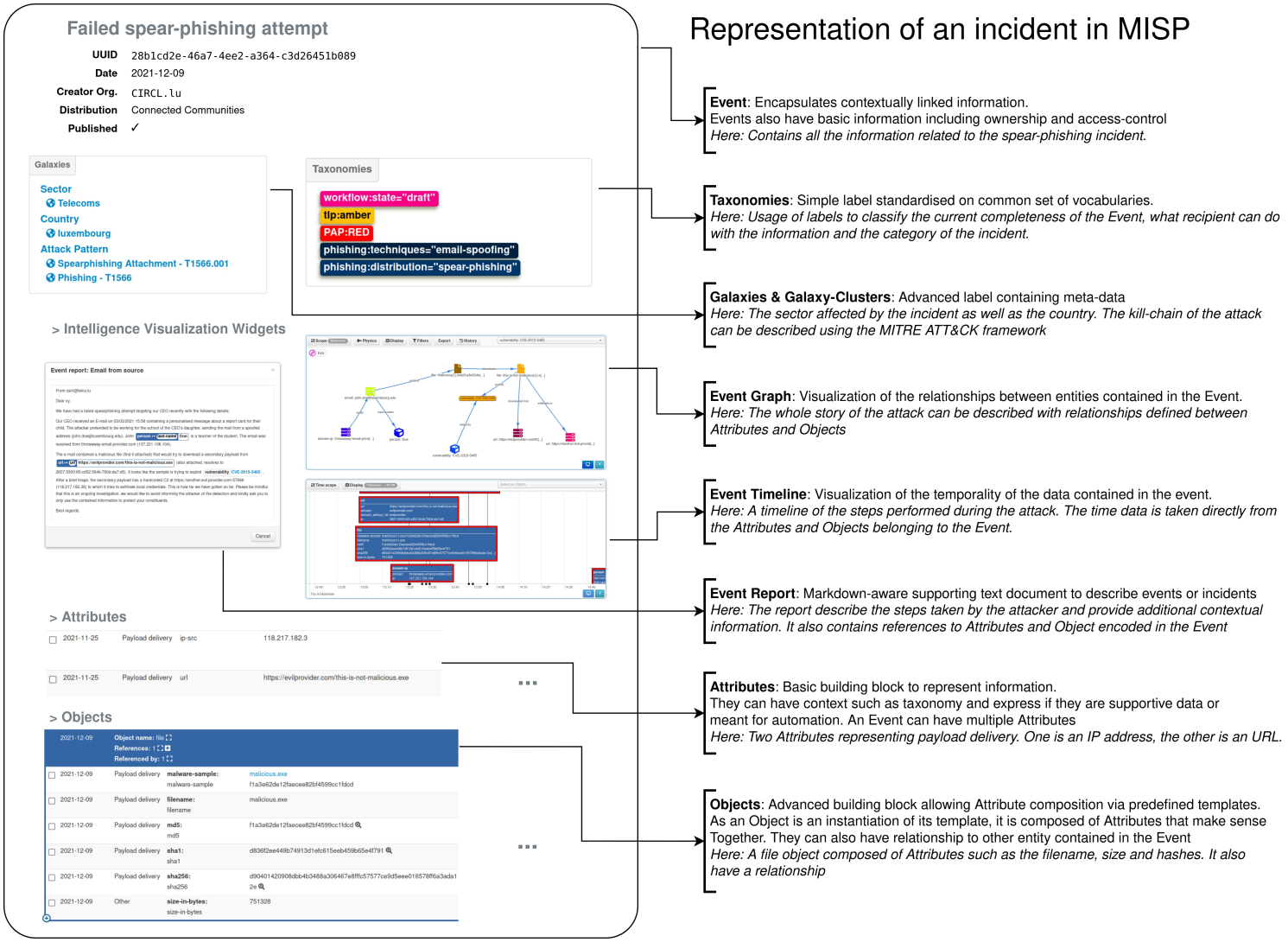
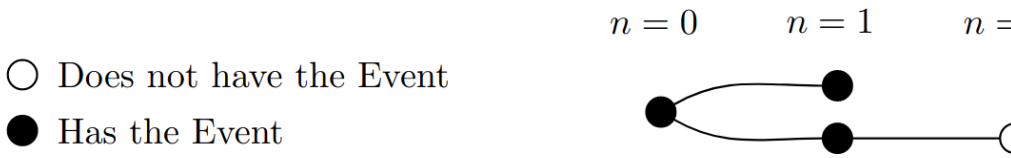


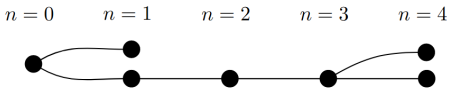
Figure 10: event-anatomy

There are 5 distribution levels controlling who can see and how it should be shared: - **Organisation only**: Only members of your organisation - **This Community**: Organisations on one MISP instance - **Connected Community**: Organisations on one MISP instance and those on MISP instances synchronising with this one. Upon receiving data, the distribution will be downgraded to



This community to avoid further propagation

- **All Community**: Anyone having access. Data will be freely propagated in the network of connected MISP instances



- **Sharing Groups**: Distribution list that exhaustively keeps track of which organisations can access the data and to which server it should be synchronised

Sharing Group configuration	
Organisations	Org. α Org. ω Org. γ
Instances*	MISP 1 MISP 2 MISP 3

*Or enable roaming mode instead

1.5 Synchronisation

In MISP, a synchronisation is the act of sharing data from one MISP to another. It can be done with two mechanisms, namely *push* and *pull*. The fact of an instance sending data to another is called *pushing*. If one instance retrieve data from another, it is called *pulling*.

The diagram below shows a one-way synchronisation link between two MISP instances. The Organisation α created a *sync_user* (denoted with a +) on MISP 2. A synchronisation link can be created on MISP 1 using the API Key and the orgasation of the *sync_user*. At that point, MISP 1 can *pull* data from MISP 2 and can *push* data to MISP 2.

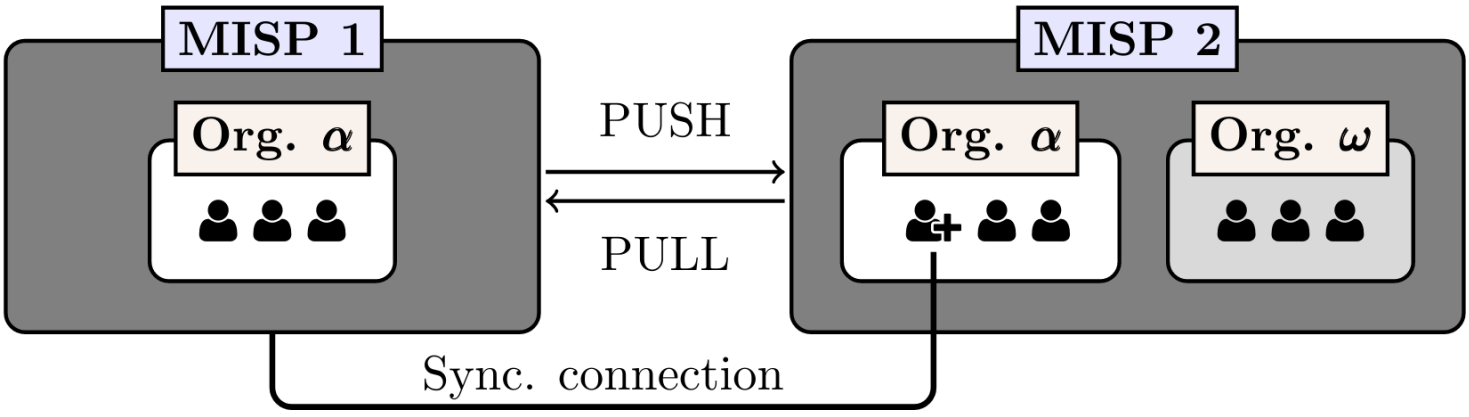


Figure 11: synchronisation

Once a synchronisation link exists *Events* can flow through that connection if and only if the distribution level of the *Event* allows it and if the *Event* is published.

1.6 Correlation

A *correlation* is a link between two *Attributes* that are created automatically. They allow interconnection between *Events* based on the correlation *Attribute*'s value. The sytem responsible to create these links is called the correlation engine and support not only strict string comparison but also more clever data type such as CIDR blocks and Fuzzy hashing like SSDEEP.

The correlation system is a tool meant for analysts to corroborate findings and gauge the trustiness of the data. It allows to confirm certain aspect of a report or to find new or unknown threats.

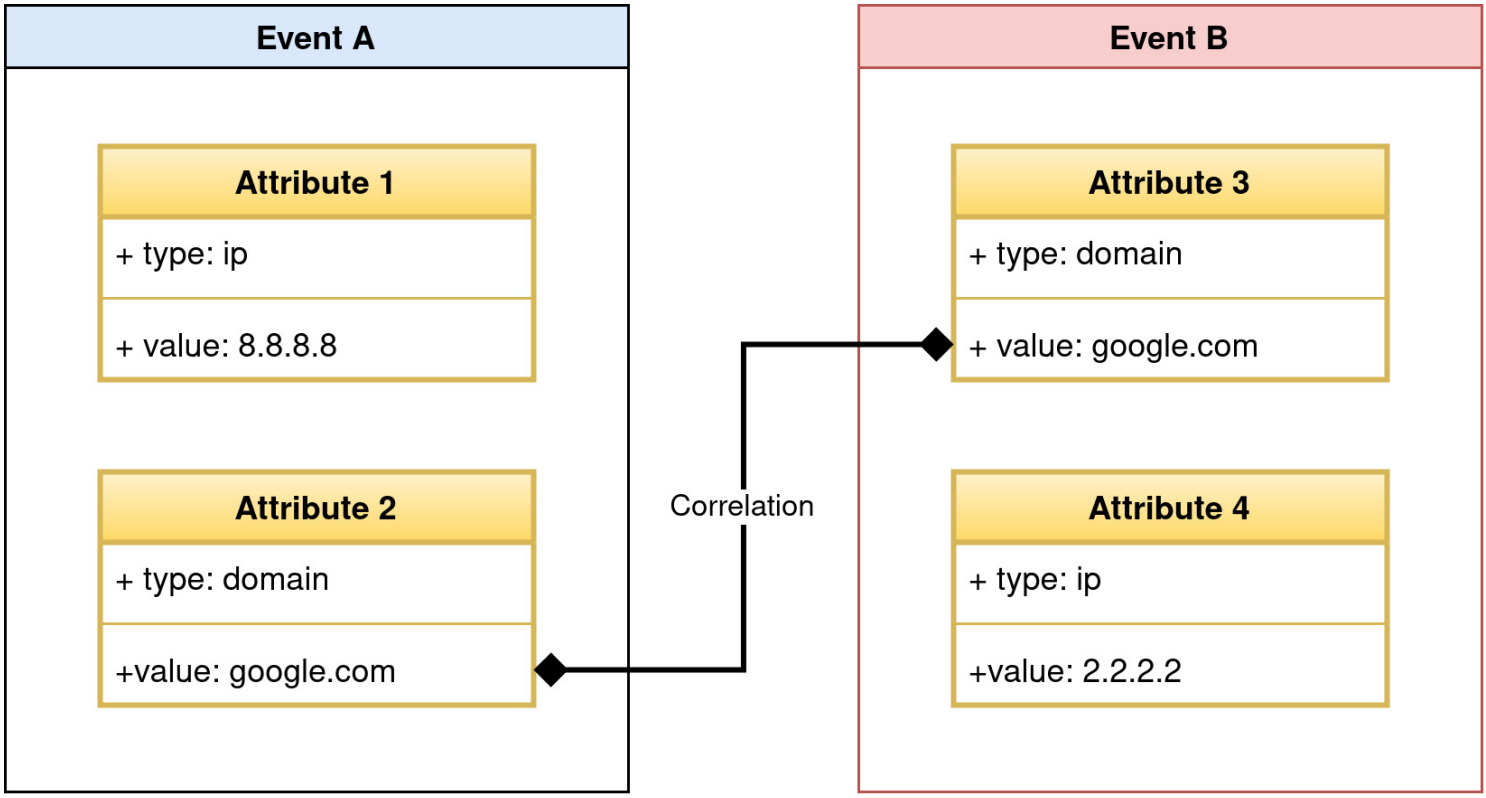
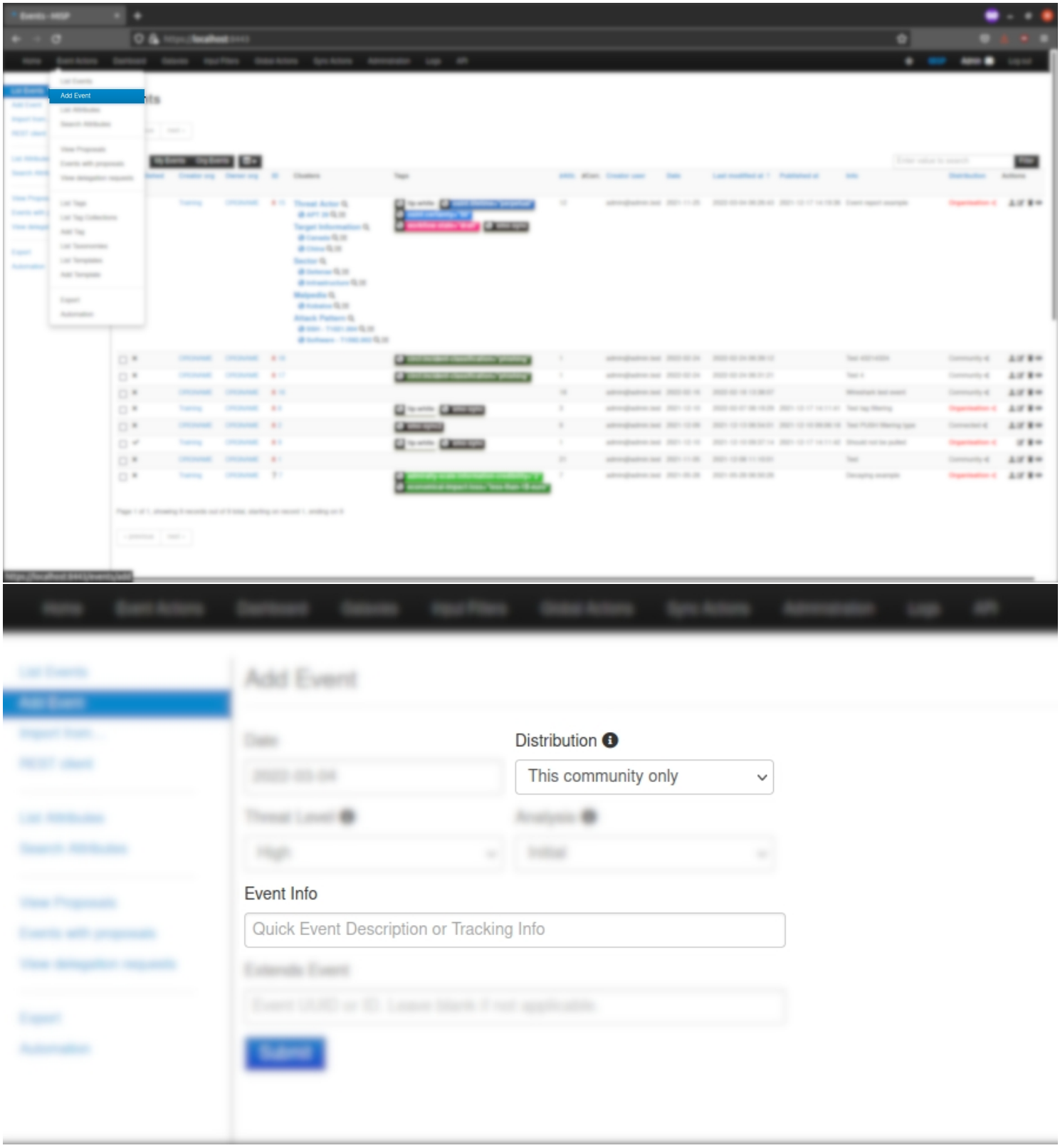


Figure 12: correlation

How-to

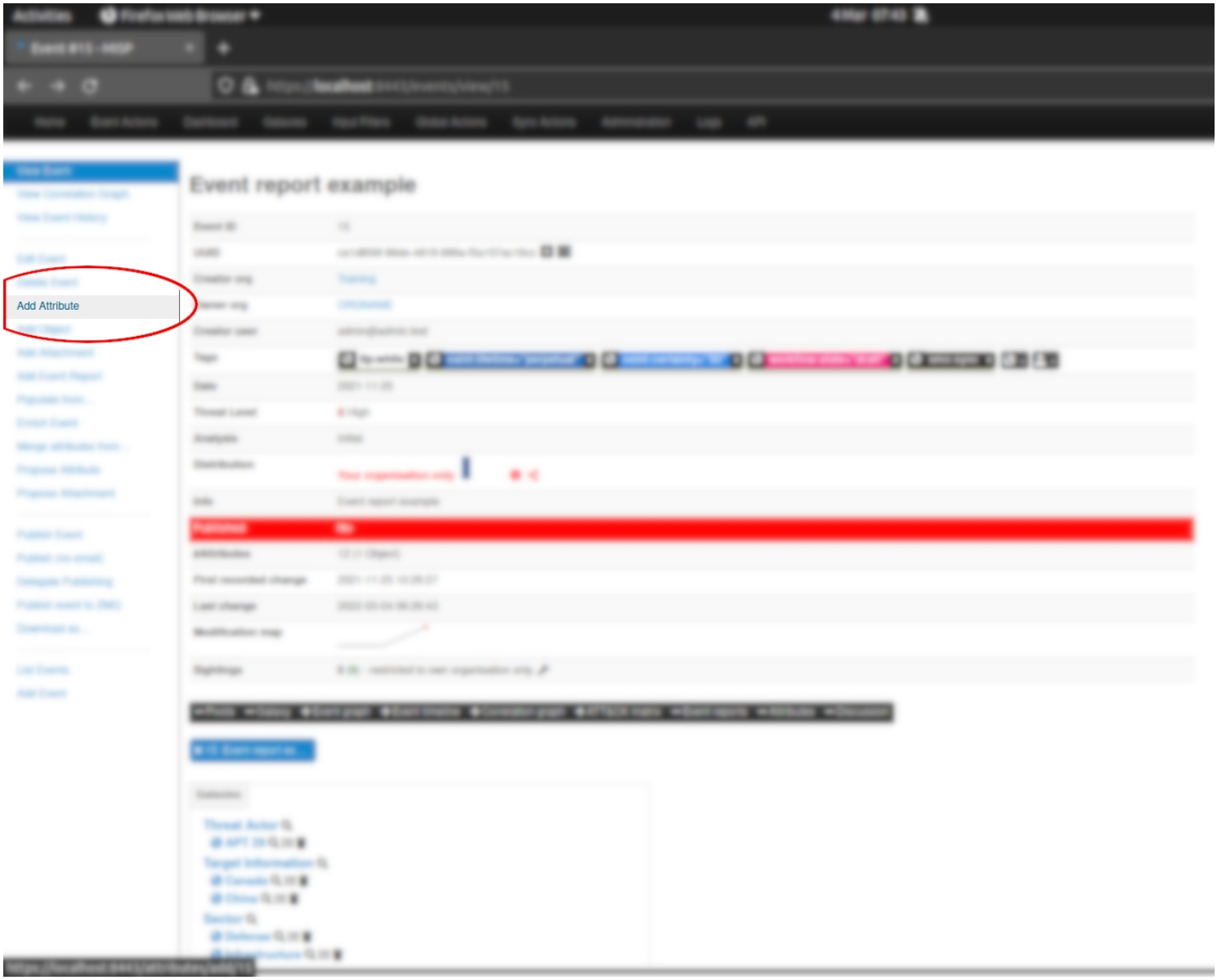
Create an Event

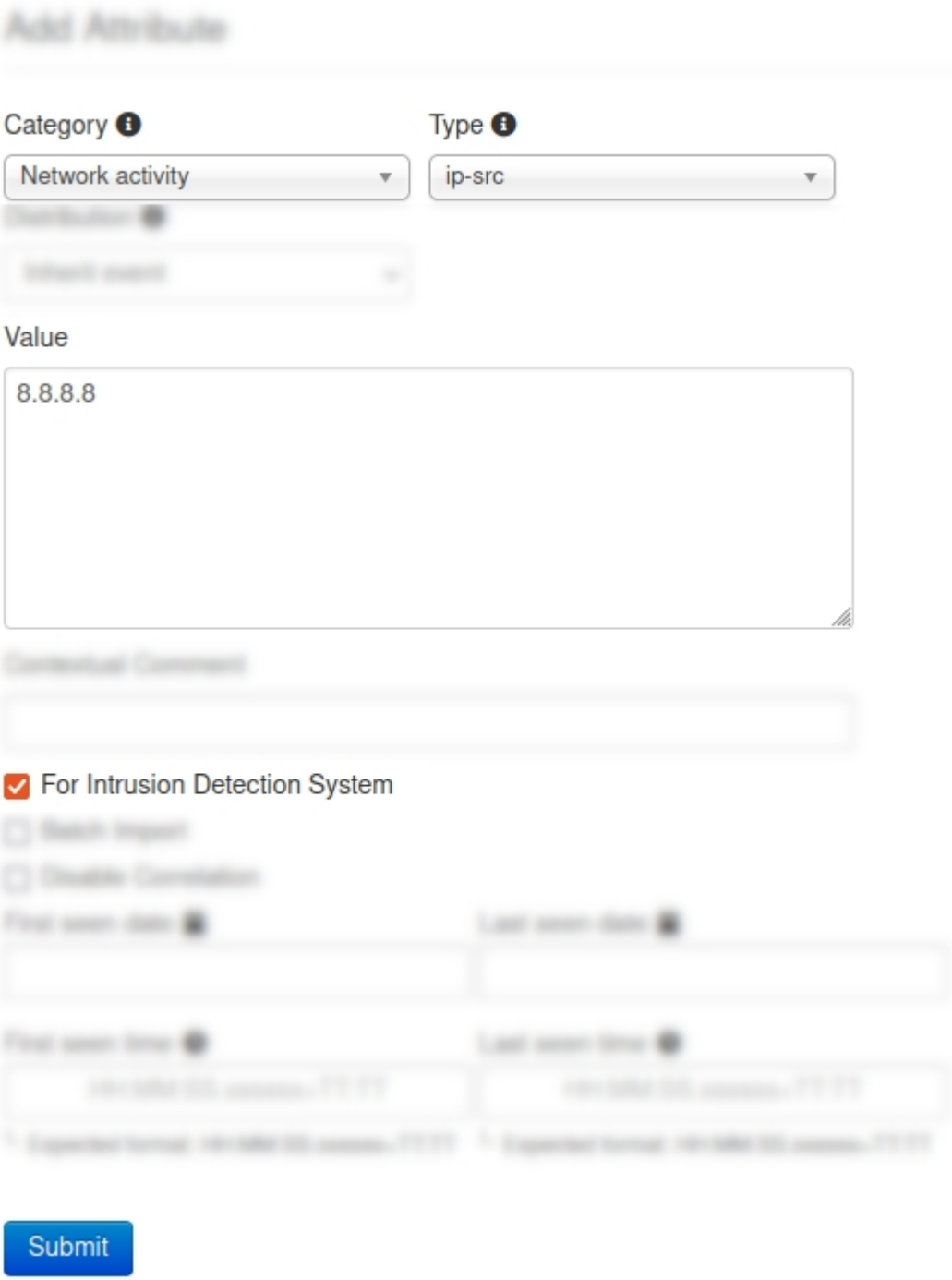
1. On the top-bar, click on `Event Action` then `Add Event`
2. Choose the correct distribution
3. Fill the `Event info` field with a concise summary of what this *Event* is about
4. Fill the remaining optional fields
5. Click on `Submit`



Create an Attribute

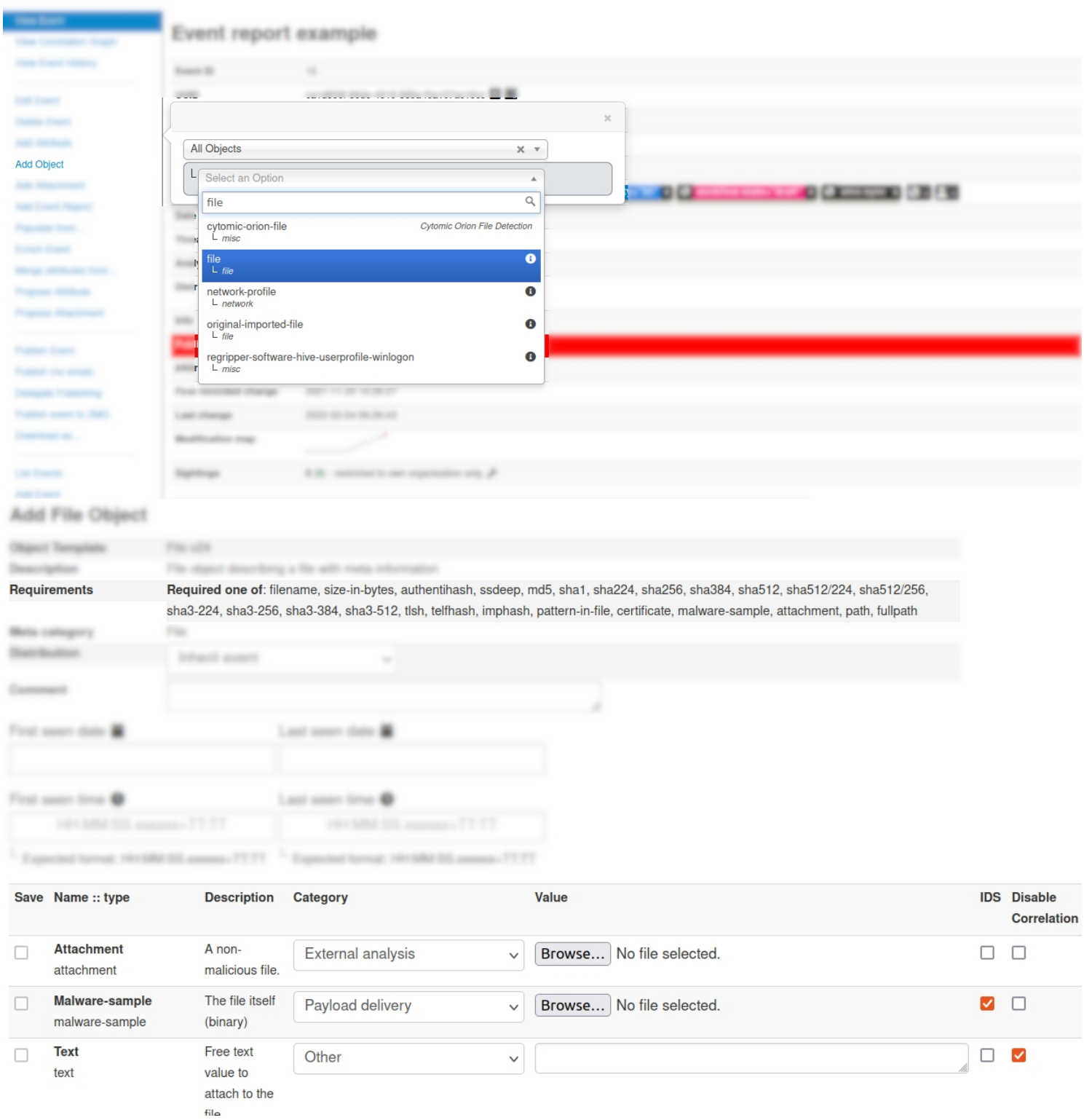
1. When viewing an *Event*, click on `Add Attribute`
2. Fill the required `Category`, `Type` and `Value` field
3. Check `For Intrusion Detection System` checkbox if you consider this *Attribute* to be an indicator
4. Fill the remaining optional fields
5. Click on `Submit`


Event report example
Add Attribute



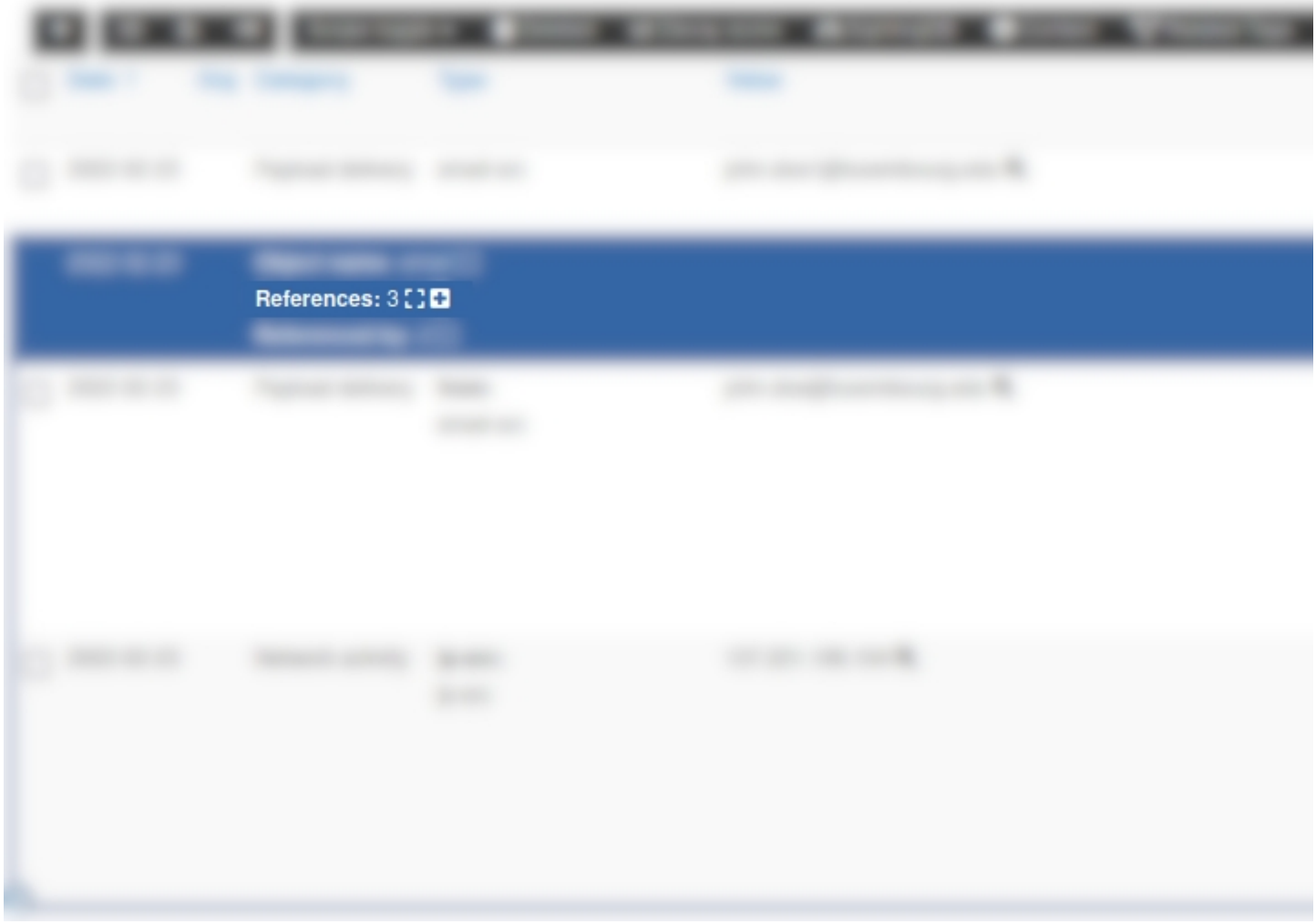
Create an Object

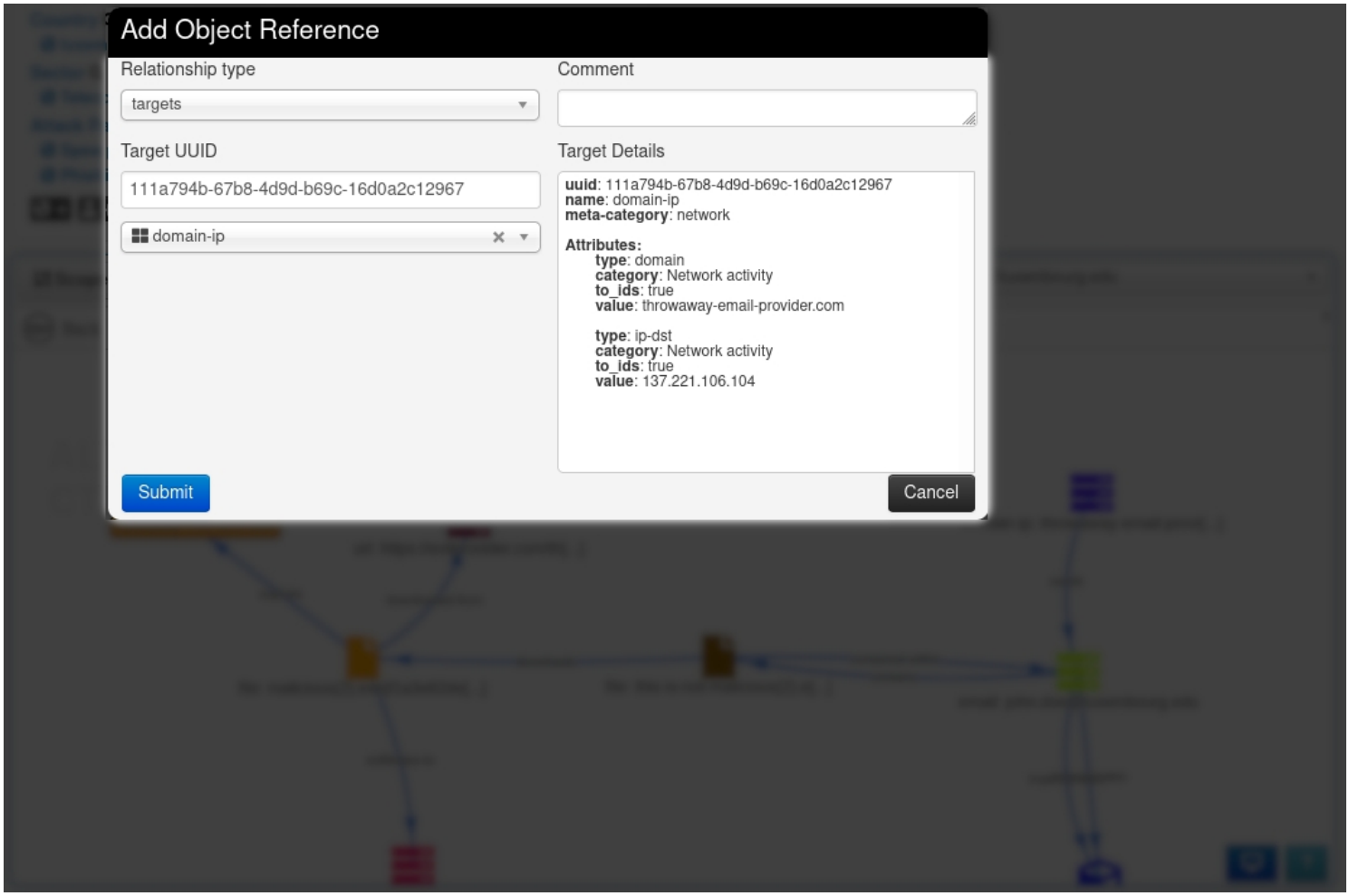
1. When viewing an *Event*, click on `Add Object`
2. If you know the category of the *Object*, select it, otherwise pick `All Objects`
3. To add a "File" *Object*, search the entry in the dropdown or start typing `file` then select the entry
4. Fill out at least the requirements for this Object and additional other *Attributes*
5. Click on `Submit`
6. Review the *Object* you are about to create then it `Create new object`



Create an Relationship

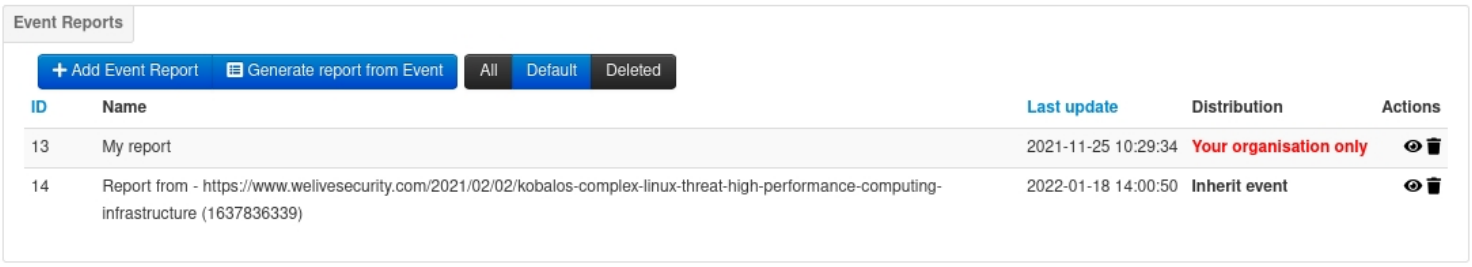
1. To create a relationship or *Reference*, a user can either click on the plus button from the *Object* table or do it directly from the *Event Graph*
2. On the *Event Graph*, click on `Edit` then drag an arrow from the first *Object* to another entity
3. On the `Add Object Reference` box, select which verb should be use to describe the relationship in the `Relationship type` input
   - Note: If you want to use a verb not present in the list, use the `custom` entry
4. Click on `Submit`

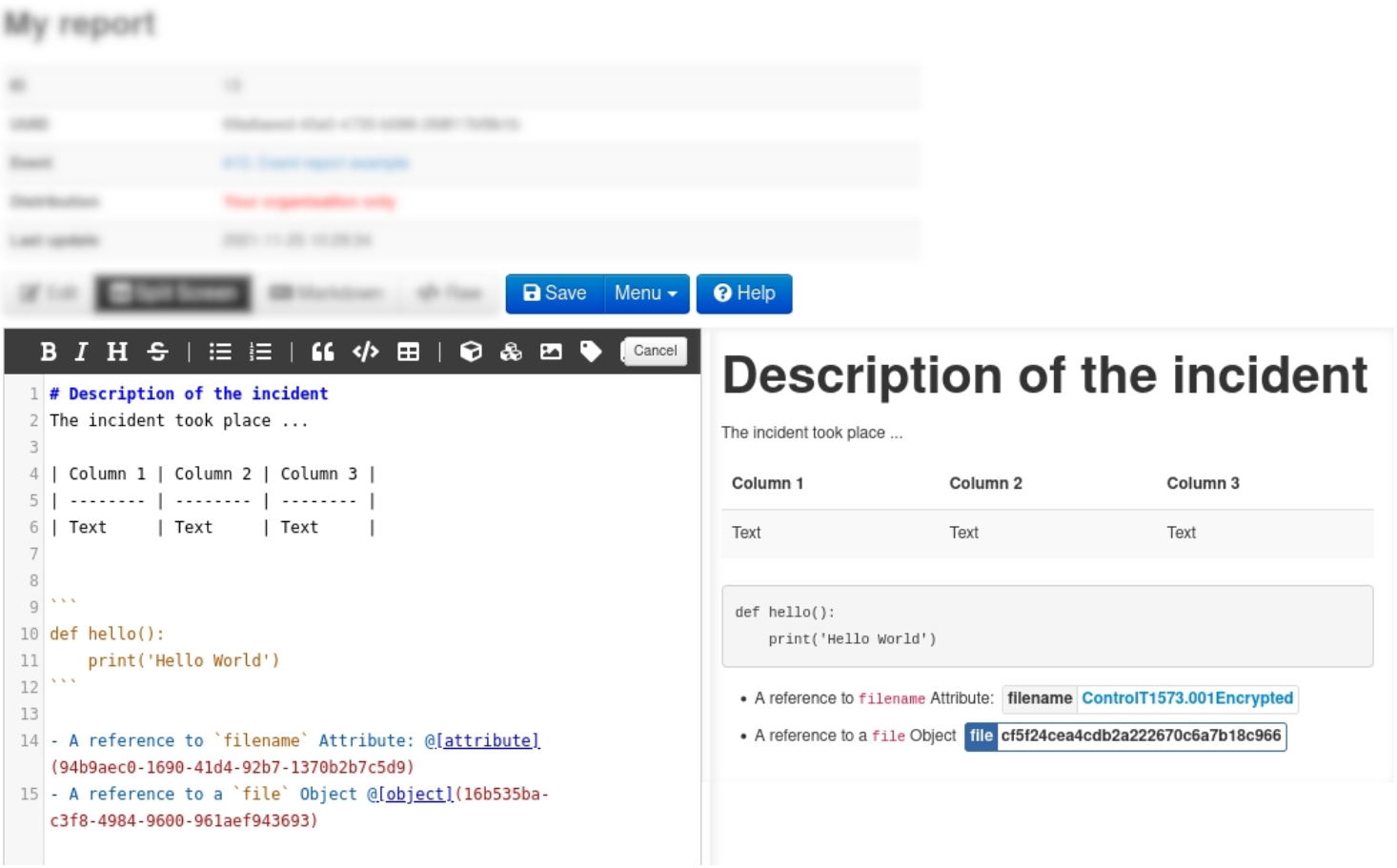

References: 3



Create an Event Report

1. When viewing an *Event*, click on the toggle button `Event reports`
2. Click on `Add Event Report` and enter the name of the report. As its content can be written with more ease in the dedicated editor, leave it empty and click on `Submit`
3. Once the list has reloaded, click on the *Event Report* that was created, then on the `Edit report` button
4. Write the report in the editor
   - Note: The `Help` button contains documentation about the supported markdown syntax and how to reference *Attributes*, *Objects* and context.
5. Once you are done, click the `Save` button





Add Tags

1. *Tags* can be attached to both *Events* and *Attributes* with the following buttons:
2. To tag the *Event* or the *Attribute* globally, click on the button with the globe icon
3. Select the *Taxonomy* in which the tag is part of or click on `All Tags`
4. Pick the tag then click on `Submit`

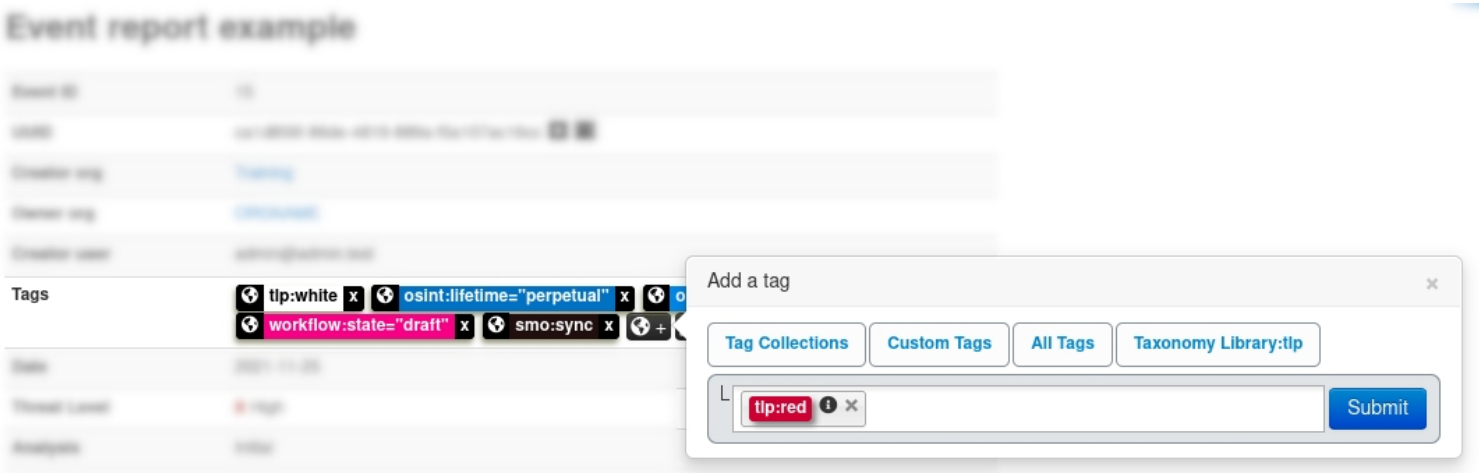


Figure 13: tag

Add Galaxy Clusters

1. Similar to tags, *Galaxy Clusters* can be attached with the button with the globe icon
2. To tag the *Event* or the *Attribute* globally, click on the button with the globe icon
3. Select the namespace in the *Galaxy* is part of or click on `All namespaces`
4. Select the *Galaxy* in which the *Cluster* is part of or click on `All Clusters`
5. Pick the *Cluster* then click on `Submit`

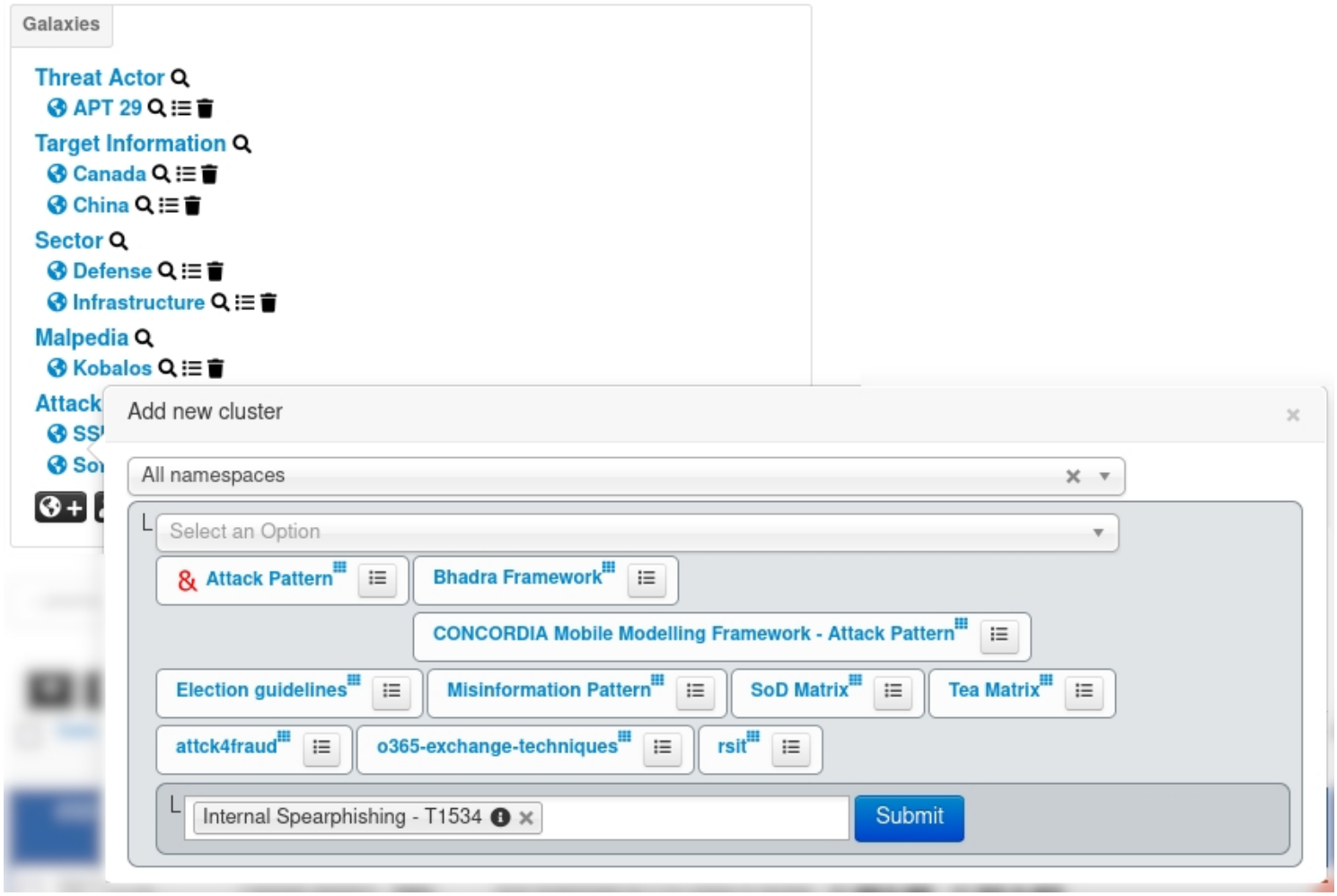


Figure 14: cluster

Publish

1. Whenever an *Event* is to be shared, it has to be be Published
2. When viewing an *Event*, click on the `Publish` button located on the sidebar

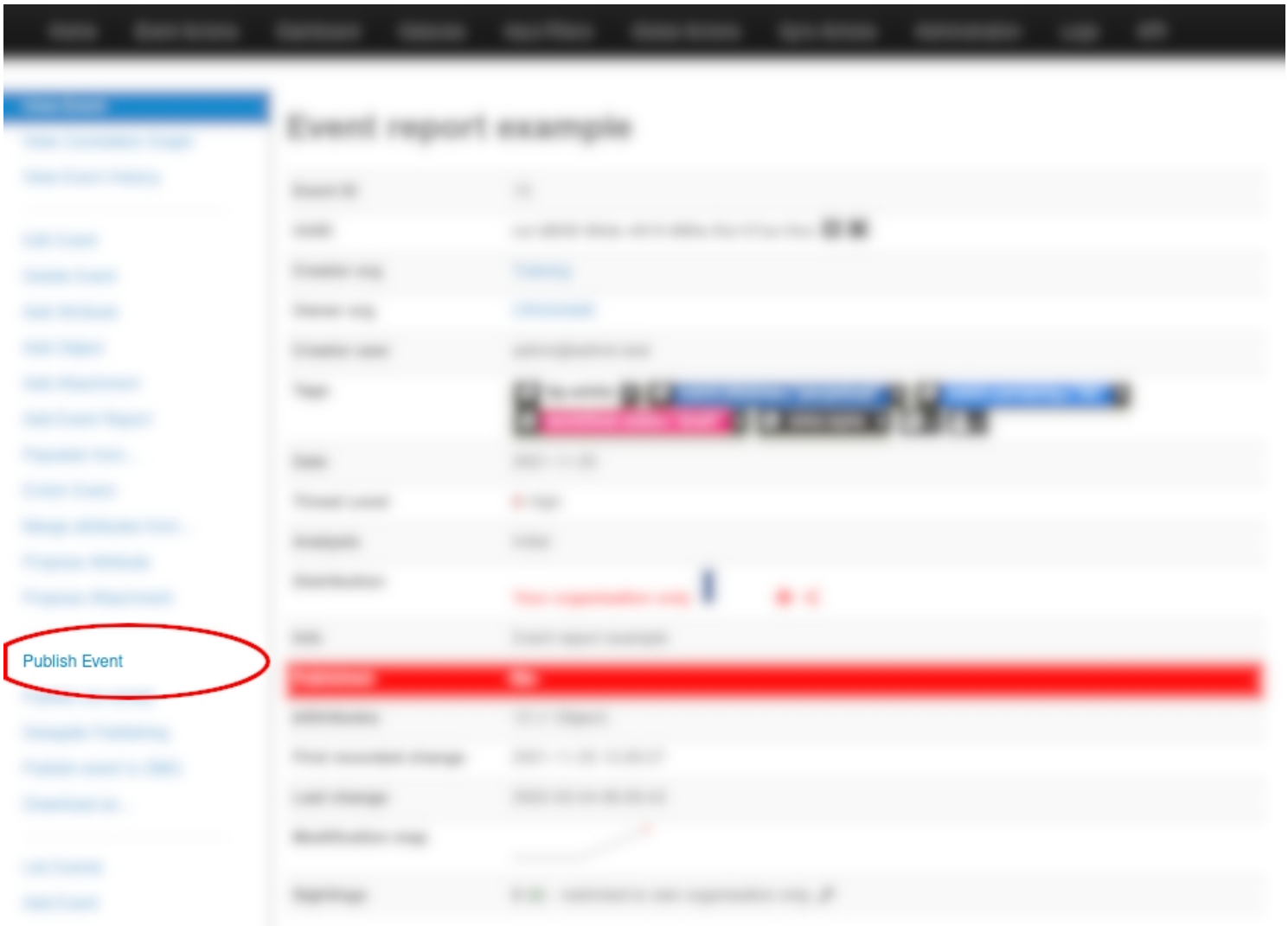


Figure 15: publish-event

Further document and reading references

The following references are not required to follow the training later. The documents and references below are provided for student willing to deep dive into MISP or have specific topic to understand.

- Neolea trainings
- Virtual machines (VirtualBox and VMWare format) if you want to explore a bit more MISP
  - https://vm.misp-project.org/
- Slide Deck (source file and compiled)
  - https://github.com/MISP/misp-training
  - https://github.com/cerebrate-project/cerebrate-training
- Cheatsheet
  - https://www.misp-project.org/misp-training/cheatsheet.pdf
- PyMISP
  - https://github.com/MISP/PyMISP/
- OpenAPI documentation
  - https://www.misp-project.org/documentation/openapi.html
- MISP Book
  - User guide for MISP PDF
- MISP data models and knowledge base available

– MISP taxonomies
– MISP object templates
– MISP galaxy