From evidences to actionable information

E.206

CIRCL Computer Incident Response Center Luxembourg

MISP Project
https://www.misp-project.org/

April 8, 2022 - v0.7

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Objectives of this module

- How evidences can be useful for defense
- Why is contextualisation important
- What options do we have in MISP
- Best practises to encode and contextualise
- How can context be leveraged
- How to structure non-technical information
  - Practical case: Conti analysis

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The most common recommendations to protect people and assets from cyber attacks are usually:

1. Maintaining softwares up to date
2. Staff awareness
3. Reliable Backups
4. Endpoints protection tools (IDS or SIEM)

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2. Staff awareness
3. Reliable Backups
4. Endpoints protection tools (IDS or SIEM)

1. An Intrusion Detection System (IDS) is a tool that aims at detecting vulnerability exploits or suspicious activity against a server or a service.
2. A Security Information and Event Management (SIEM) allows centralise security alerts and events generated by endpoints and network devices.

How evidences can be useful for defense

- We can only help endpoints protection tools
- With the proper knowledge and methods, it is possible the maximize their accuracy and performance

These systems can rely on information extracted from

- Log files
- Network captures
- Disk forensic
- ...

However, from a MISP user perspective the hardest part in not to encode the raw evidences, it is to encode them so that they become **actionable**

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Why is contextualisation important

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- Allow the distinction between information of interest and raw data
- provide guidance on how to use this information can be used for for protection
- Filter out noise from information unrelated from the use-case or activity
- Enable risk assessment based on attack type, TTP and threat actor
- Allow triage in large volume of data
- Allow false-positive management

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1. Tactics, Techniques and Procedures (TTP) describe the context and a detailed description of the behavior taken by an actor

Expectations of the recipients

Most common expectations of recipients when receiving information

- Being able to **consume** the data
- Find information is **relevant** for them and their partners
- Being able to **understand** the data and its classification
- Assess the **credibility**, likelyhood and origin of the data

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What do recipient hope to do with the data

Most common expectations of recipients for handling the data

- Being able to **filter** data efficiently for different use-cases
- Obtain as much **knowledge** out of the data as possible
- Know how this data was produced and where its **origin**
- Deduce why is the data **relevant** for them and how **critical** it is

What do recipient hope to do with the data
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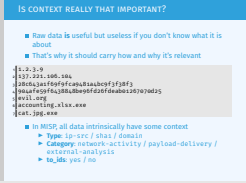
Obtain as much knowledge out of the data as possible
Know how this data was produced and where its origin
Deduce why is the data relevant for them and how critical it is

Is context really that important?

- Raw data **is** useful but useless if you don't know what it is about
- That's why it should carry how and why it's relevant

```
1.2.3.9
137.221.106.104
28c643a1f69f9fca9481a4bc9f3f38f3
904afe59f6438848be96fd26fdeab0126707 0d25
evil.org
accounting.xlsx.exe
cat.jpg.exe
```

- In MISP, all data intrinsically have some context
  - **Type**: `ip-src` / `sha1` / `domain`
  - **Category**: `network-activity` / `payload-delivery` / `external-analysis`
  - **to_ids**: `yes` / `no`



1. The 'to_ids' flag is used to differentiate between indicators and supporting data. If the flag is set, it means the attribute is an indicator and is meant for protective tools.

Is context really that important?

- Sometime, more contextual information is not needed as data inherently convey its context:
  - Tor exit nodes
  - Botnet / C2 trackers
  - Ransomwares' bitcoin addresses
  - ...
- But most of the time, **context is essential**

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What sort of context is pertinent

- To what kind of user this data is for
- What type of action can be performed with it
- Estimation on accuracy, reliability and likelyhood
- What are the impacts
- For threat actors:
  - Who is it? What tools were used?
  - What are their motivations? Who are their targets?
- How can we prevent/detect/block/remediate the attack

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What options do we have in MISP

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MISP offers mutliples means to contextualise

- Taxonomies
- Galaxies and Galaxy Clusters
- MITRE ATT&CK
- MISP Objects and relationships
- Sightings and `first_seen` / `last_seen`

Let's have an overview of each of them

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Taxonomies

- Simple labels **standardised** on vocabularies
- Taxonomy tags often **self-explanatory**
  - `workflow:state="draft"`
  - doesn't need more explanation
- Triple tag system: `namespace:predicate="value"`
- Different organisational/community cultures require different nomenclatures
  - JSON libraries that can easily be defined without the involment of the MISP-project team

Tag	Events	Attributes	Tags
workflow:state="complete"	11	0	workflow:state="complete"
workflow:state="draft"	0	0	workflow:state="draft"
workflow:state="incomplete"	55	10	workflow:state="incomplete"
workflow:state="ongoing"	0	0	workflow:state="ongoing"

Galaxies and Galaxy Clusters

- `Galaxy`: Container to group galaxy clusters of the same type
- `Galaxy Cluster`: knowledge-base item with complex meta-data aimed for human consumption

- Community driven **knowledge-base libraries used as tags**
- Including descriptions, links, synonyms, meta information, etc.
- **Flexible** and **reusable**
- Works the exact same way as taxonomies but with more **meta-data**
  - `misp-galaxy:ransomware="CryptoLocker"`
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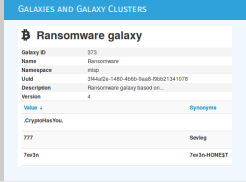
Ransomware galaxy

Galaxy ID	373
Name	Ransomware
Namespace	misp
Uuid	3f44af2e-1480-4b6b-9aa8-f9bb21341078
Description	Ransomware galaxy based on...
Version	4

Value ↓	Synonyms
.CryptoHasYou.	
777	Sevleg
7ev3n	7ev3n-HONE$T



MITRE ATT&CK and Galaxy Matrices

- MITRE ATT&CK is one of the best knowledge base of **adversary TTPs**
- **Widely used** and supported by a lot of tools
- The catalogue includes a **matrix-like** interface
- Offers clear visualisation for the kill chain

- MISP Fully support ATT&CK and embraced it's matrix structure
- Multiples matrices for other concerns are available:
  - `Badhra`: Similar to ATT&CK but for telecom operators
  - `attck4fraud`: Regrouped clusters related to fraud actions

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1. The kill chain are the sequential steps that adversaries can perform in order to achieve an attack

MITRE ATT&CK and Galaxy Matrices

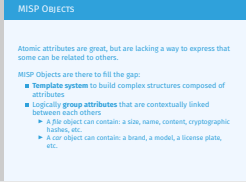
MITRE ATT&CK and Galaxy Matrices

MISP Objects

Atomic attributes are great, but are lacking a way to express that some can be related to others.

MISP Objects are there to fill the gap:

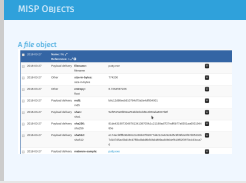
- **Template system** to build complex structures composed of attributes
- Logically **group attributes** that are contextually linked between each others
  - A *file* object can contain: a size, name, content, cryptographic hashes, etc.
  - A *car* object can contain: a brand, a model, a license plate, etc.



MISP Objects

A *file* object

☐	2018-03-27	**Name:** file ⤢ **References:** 1 ⤢ ⊞		
☐	2018-03-27	Payload delivery	**filename:** filename	putty.exe ⊕
☐	2018-03-27	Other	**size-in-bytes:** size-in-bytes	774200 ⊕
☐	2018-03-27	Other	**entropy:** float	6.7264597226 ⊕
☐	2018-03-27	Payload delivery	**md5:** md5	b6c12d88eeb910784d75a5e4df954001 ⊕
☐	2018-03-27	Payload delivery	**sha1:** sha1	5ef9515e8fd92a254dd2dcdd9c4b50afa8007b8f ⊕
☐	2018-03-27	Payload delivery	**sha256:** sha256	81de4319873046761341387 05fc1c21188ad7f27edf6b77a6551aa693194485e ⊕
☐	2018-03-27	Payload delivery	**sha512:** sha512	e174ecf4fffb36d30c2cc66b37f82877d421244c924d5c9f39f2e0f37d85332b7d107d5ac5bd19cb7ffdcdbdd8b506d488faa30664ef610f62f3970c163cca76 ⊕
☐	2018-03-27	Payload delivery	**malware-sample:**	putty.exe ⊕



Relationships

- Analysts want more than a table of atrtibute, they want to see how each of them **interact** with the others
- Relationships are essentials to describe scenarios or stories with the data
- MISP allow these relationship to be built between objects

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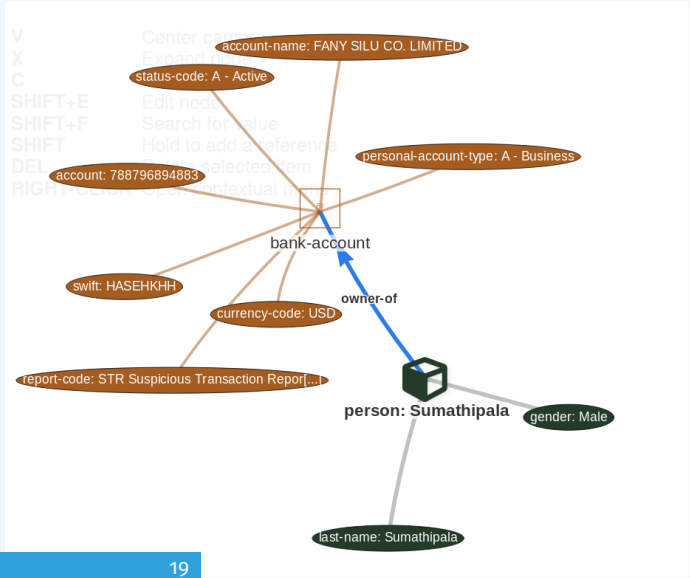
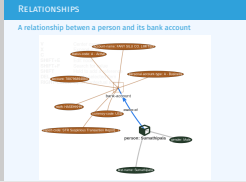
Relationships

A relationship betwen a person and its bank account





Timeliness with Sightings and `first_seen` / `last_seen`

Adding **Temporality** os a good way to avoid having the data frozen in time

- Sightings
  - Allows to signal the fact that an indicator was **sighted**
  - They can record the time and where they were the sighting was seen
  - E.g.: Sight C2 servers or phishing websites
- `first_seen` / `last_seen`
  - These two data-points allow to set when the specified item was first and last seen
  - Enables the visualisation of data timeframe with a timeline
  - *e.g: Track the duration of a campaign or duration for which something was online*

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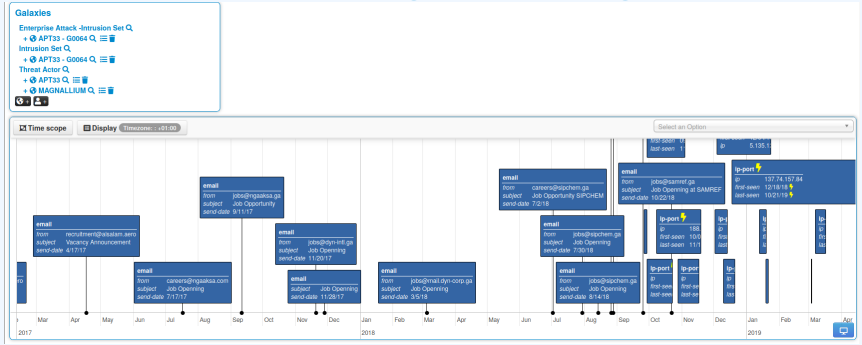
Screenshot of the timeline widget when viewing a MISP event



Timeliness with Sightings and first_seen / last_seen
Screenshot of the timeline widget when viewing a MISP event

Best practises to encode and contextualise

Encoding: Event

Always keep in mind that the recipient is a human:

- Include a self-explanatory title
- Make it concise
- Include a report along with the machine parsable data
  - It can either be included as an attribute or as an event-report

It will make the live of the analyst easier: That analyst might end up being you!

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Encoding: Attributes and objects

Prefer the use of object rather than attributes for attributes intrinsically linked together.

Atomic data by themselve rarely exists: They are often related to something else

- Interactions between between elements are frequent
  - They can often be described by using verbs: `connects-to`, `contain-within`, ...
- A story can be inferred without the need to put it into words
  - *"`file` was attached to `email` which when extracted contained a `malware` connecting to `ip-address` which was used `C2`"*
- Properly encoding these relationships turns flat data into a **connected graph**

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Contextualisation: Distributions and permissible actions

Adding context on **what** actions can be done on the data and **who** can it be shared with

- Permissible actions taxonomies:
  - *PAP*: Permissible Actions Protocol
  - *IEPF*: Information Exchange Policy (IEP) Framework
  - `pap:white` No restrictions in using this information
- Sharing level taxonomies:
  - *TLP*: Traffic Light Protocol
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Contextualisation: Attributes and their context

- Each data point has a meaning and tells a part of the story
- One should try to capture the answer to these question when contextualising:
  - In what context was this IoC seen?
  - Is it related to compromision? Does it tell us anything about the adversary infrastructure?
  - Was it used to exfiltrate data? Did it acted as a C2?
  - Did it perform subsequent actions?
  - ATT&CK can procure even more knowledge

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Contextualisation: Attributes and their context

However, think twice before tagging:

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Contextualisation: Origin, likelyhood and reliability

- The source of information has an impact on how people evaluates its trust
  - Data without a source / origin might be considered unreliable
  - *i.e: A research paper without citing its sources is useless*
- MISP bridges people and and communities
  - The more one is connected, the greater the quantity and diversity of data
  - Not everything you read on the internet is true!

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Contextualisation: Origin, likelyhood and reliability

If you can't share the source, provide the trust in the source

- Include the reliability and the credibility of the information
  - Taxonomy: `admiralty-scale`
  - *i.e:* *`admiralty-scale:source-reliability="Usually reliable"`*
- Include the quality and likelyhood
  - Taxonomy: `estimative-language`
  - *i.e:* *`estimative-language:likelihood-probability="very likely"`*

Contextualisation: Make the attribution

- The purpose is not to blame but to identify the attacker's **intent**
- Knowing the intent greatly help to:
  - Know the objectives
  - Understand what are the targeted assets
  - Deduce the treat level
- It allows to identity behaviors
  - Might speed up the next investigation
  - Might boostrap the analysis procdess

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Contextualise: Provide advices on how to protect themselves

To help recipients to better protect themselve, additional information can be provided.

- Indicate what can be done with the data
  - Use it to feed an IDS
  - Perform historical search with a SIEM to find a potential compromision
  - Inform your peers against a new type of threat
- Provide additional supporting materials
  - The original report form which the data is coming from
  - Home-brew scripts
  - Sigma rules for SIEM searches
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How can context be leveraged

Leveraging the context

Let's make use of this well-structured, context-rich data

- Incorporate all contextualisation options into API filters

```
{
    "AND": [
        "admiralty-scale:source-reliability=\"Reliable\""
    ],
    "OR": [
        "threat-actor=\"Sofacy\"",
        "sector=\"Chemical\"",
        "country=\"Luxembourg\"",
    ]
}
```


Leveraging the context
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Incorporate all contextualisation options into API filters

Leveraging the context

- On-demande potential false positive exclusion
- Warninglist system helps to exclude known false-positives reducing alert-fatigue

LIST OF KNOWN IPV4 PUBLIC DNS RESOLVERS

Id	89
Name	List of known IPv4 public DNS resolvers
Description	Event contains one or more public IPv4 DNS resolvers as attribute with an IDS flag set
Version	20181114
Type	string
Accepted attribute types	ip-src, ip-dst, domain|ip
Enabled	**Yes** (disable)

Values

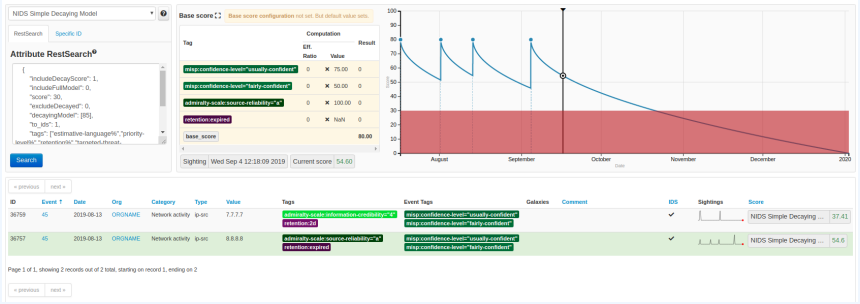
1.0.0.1
1.1.1.1
1.11.71.4

Warning: Potential false positives

List of known IPv4 public DNS resolvers
Top 1000 website from Alexa
List of known google domains

Leveraging the context

- IoC prioritization and lifecycle management
- Integrate decay models to filter out expired/unrelevant data



Leveraging the context
IoC prioritization and lifecycle management
Integrate decay models to filter out expired/unrelevant data

Leveraging the context

- Allow users to build their own export module

HTTP headers

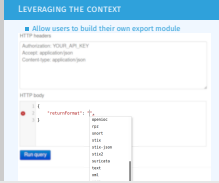
```
Authorization: YOUR_API_KEY
Accept: application/json
Content-type: application/json
```

HTTP body

```
1 {
2     "returnFormat": "",
3 }
```

openioc
rpz
snort
stix
stix-json
stix2
suricata
text

Run query



Enabling common user profiles to better perform their tasks

How does different user profiles benefits to most of well-structured, context-rich data

- **incident responder**: Self-explanatory data relieves pressure and reduces the change of misunderstanding it
- **SOC operator**: Reduce alert-fatigue and energy to filter unwanted data
- **ISP**: Ease the task to decide if the data is fit for blocking based on trust and context the data was seen in
- **threat analyst**: Provide insight on the modus operandi and goals of attacker
- **risk analyst**: Help highlighting potential security gaps and formulate advices on preventive actions
- **decision maker**: Guide resources allocation based on current/emerging threats for their region and sector

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How to structure non-technical information

Objectives

- Identify non-technical data that can be useful for an investigation,
- Illustrate how non-technical and technical data can interact to produce meaninful insights,
- Model these interactions,
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1. A note for the slide handout

We live in Socio-Technical Systems

Computer and their security is linked to human activities:

- Technical traces show human activities,
- Technical traces can convey human intent,
- Human interactions can explain and give context to Technical traces,
- CyberCrime requires infrastructures and logistics that are discussed between humans,
- TTPS are discussed and exchanged,
- Human interaction can help attributing attacks to threat actors,
- Human interaction can help deciphering intent and motives, and discriminate human error from sabotage.

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Plan

Use OSINT and data leaks to:

- bring context to other ransomware cases,
- better understand the gang day to day operations,
- get insights on events' timeline,
- confirm or invalidat previous hypotheses,
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1. A note for the slide handout

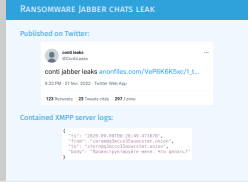
Conti ransomware group leak analysis

Ransomware Jabber chats leak

Published on Twitter:

Contained XMPP server logs:


```
{
  "ts": "2020-09-08T00:28:49.471678",
  "from": "ceram@q3mcco35auwcstmt.onion",
  "to": "stern@q3mcco35auwcstmt.onion",
  "body": "Проинструктируйте меня. Что делать?"
}
```

Ransomware Jabber chats leak in AIL

We use AIL[1] to dig into the data:

- AIL processes the data and search for relevant information
  - PGP keys,
  - Bitcoin addresses, maybe others,
  - onion hidden services,
  - IP addresses.
- Once we find relevant information we push it into MISP,
- we use MISP correlation engine to find relevant past cases.

[1] https://ail-project.org/

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1. It is important to understand what we search for before digging into the data with AIL.
2. Gang may discuss payments, so we are interested in crypto currencies
3. Gang may discuss IP addresses and infrastructure, etc.
4. For the training, we use a dedicated AIL container that contains RAW translated jabber chats.

Ransomware Jabber chats leak in AIL

We use pyail to feed conti ransomware logs into AIL

```
from pyail import PyAIL
#... imports
#...  setup code
for content in sys.stdin:
    elm = json.loads(content)
    tmp = elm['body']
    tmpmt = {}
    tmpmt['jabber:to'] = elm['to']
    tmpmt['jabber:from'] = elm['from']
    tmpmt['jabber:ts'] = elm['ts']
    tmpmt['jabber:id'] = "{}".format(uuid.uuid4())
    pyail.feed_json_item(tmp, tmpmt, ailfeedertype,
        source_uuid)
```

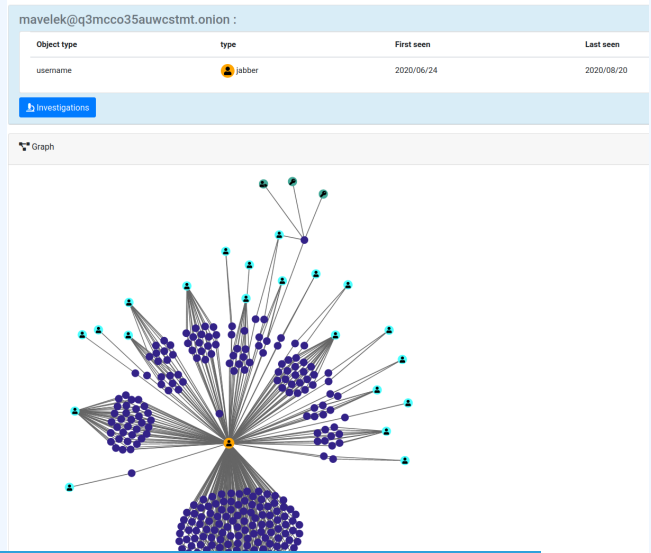
```
        $ cat ~/conti/* | jq . -c | python ./feeder.py
```

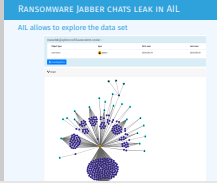

Ransomware Jabber chats leak in AIL
We use pyail to feed conti ransomware logs into AIL

1. A note for the slide handout

Ransomware Jabber chats leak in AIL

AIL allows to explore the data set





1. For this particulare account, we see inteactions with various accounts,
2. as well as the exchange of the PGP key.

Correlating with MISP's data

First we quickly extract at most 1000 bitcoin addresses without context:

```
$ . ~/AILENV/bin/activate
$ python ~/ail-framework/tools/
    extract_cryptocurrency.py -t bitcoin -n
    1000 | jq .[].nodes[].text | tr -d '"'
```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extract_cryptocurrency.py -t bitcoin -n
1000 | jq .[].nodes[].text | tr -d '"'

1. The script extracts the bitcoin addresses from AIL,
2. we use `jq` to select the right bit of data,
3. we trim the unecessary quotes with `tr`.

Correlating with MISP's data

We use MISP's free text import feature to populate a new event:

Freetext Import Results

Below you can see the attributes that are to be created. Make sure that the categories and the types are correct, often several options will be offered based on a resolution.

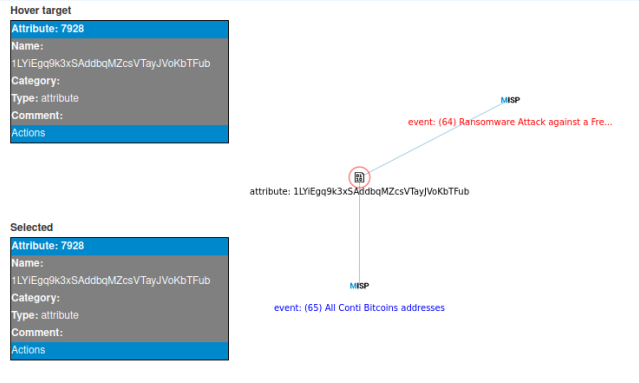
☐ Proposals instead of attributes

Value	Similar Attributes	Category	Type	IDS	Disable Correlation
12ccnkcqwzAXp58YePMVTMT3uiFpLj9DTt		Financial fraud	btc	☑	☐
12p1cEthQKc8K2ogUtJWjKfiEmnrcoULAY		Financial fraud	btc	☑	☐
15As7FpCKd6qsZa1kKpPNG6ZdomEdwhoqG		Financial fraud	btc	☑	☐
16cb7AUf64daxLmDhXzvhBeRzeuNj34Fc2		Financial fraud	btc	☑	☐
17RiMroeXvNwQDMf9FEVaFZvWj2uja99Z5		Financial fraud	btc	☑	☐
17Yq9fkbPSyCRbsn8UDywQXWG3jADf1RkQ		Financial fraud	btc	☑	☐
17g3e3fooEHD3G3UyBmTcXEkRdD6C8rsdJ		Financial fraud	btc	☑	☐
17h32zGE7gF1De1kPhDVia2ac7cVCQM3Jr		Financial fraud	btc	☑	☐
17p9YoDWHeCX6yuaX1UGVdA1AyXucJZnFa		Financial fraud	btc	☑	☐
18VHRQFAi6TvDwyvSrzJ4BKBj3ptc8v8pb		Financial fraud	btc	☑	☐
193UjvwxxvqbZJopaALERyaCXN4Ep1ZKRb		Financial fraud	btc	☑	☐
19EYKePWvc8G6QSPoN9qiCCQsidVR4Gcmb		Financial fraud	btc	☑	☐
19EtWPotqs8Tnkt1oaWBNxZJYGkfN9TVn5		Financial fraud	btc	☑	☐
1A5ypTVDUH8vJdNCs7opGT9PjG62PZyXbn		Financial fraud	btc	☑	☐

Correlating with MISP's data
We use MISP's free text import feature to populate a new event:

1. MISP allows to verify for each field is it detected the right type of attribute.

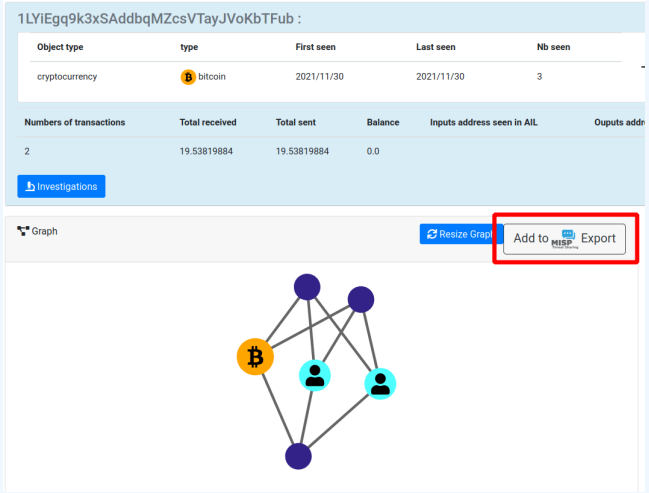
MIPS links one related event



1. MISP automaticaly match various attributes between events,
2. In this case, one bitcoin address was spotted in another event.

Correlating with MISP's data

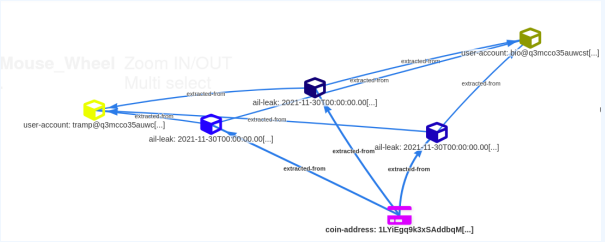
To add some contextual information about attackers' social interactions we go back to AIL:



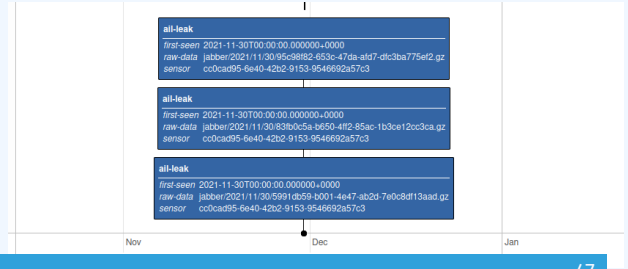
1. This bitcoin address appeared in three interactions (AIL items), between two individuals.
2. We use the "Add to MISP export" button to export this bitcoin address to MISP.
3. When prompted by AIL we choose to export the address on two levels to reach usernames:
4. Bitcoin address -> items -> usernames

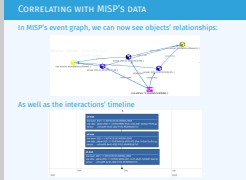
Correlating with MISP's data

In MISP's event graph, we can now see objects' relationships:



As well as the interactions' timeline





Social Contextualisation

Here the communications related to this address:

- The BTC-wallet for payment: 1LYiEgq9k3xSAddbqMZcsVTayJVoKbTFub
- and if we close the question, the wallet remains the same? The BTC-wallet for payment: 1LYiEgq9k3xSAddbqMZcsVTayJVoKbTFub
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Writing an Intelligence Report

We gathered new information:

- We confirmed that the ransomware gang is indeed Conti,
- we know the amount of money claimed by the attacker.

We will pack this information in a digestible package:

- We extend the exisintg event with the event created from AIL,
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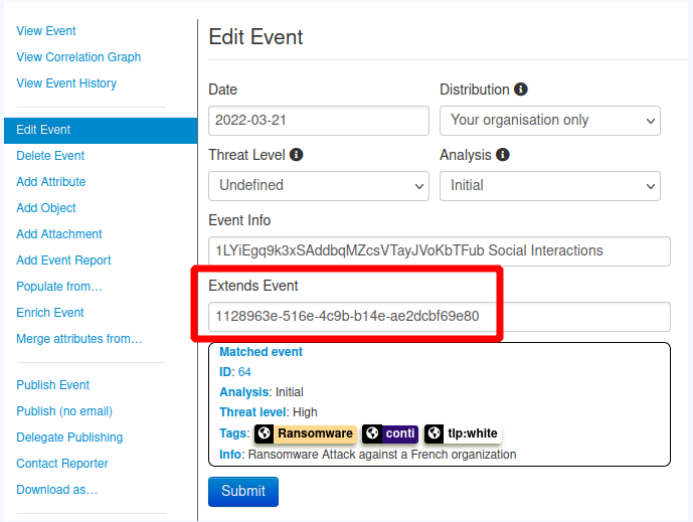
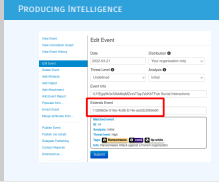
1. Exenting an event will allow us to reference information from one event to the other as if they were the same event.

Producing Intelligence



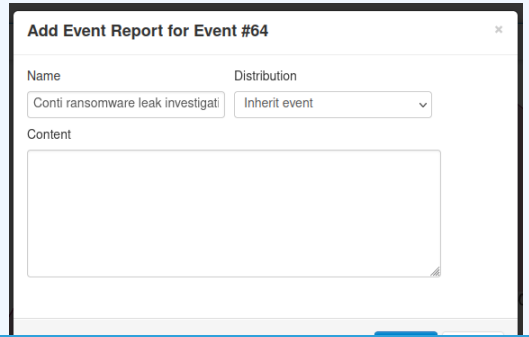


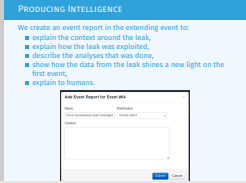
1. We extend the event that contains the ransomware case with the one we created in AIL by adding the first event's uuid in the latter "Extends Event" property.
2. Once the event is exented by another, one can switch between the "atomic view" and the "extended view" by clicking the arrows in the "Extended By" event property box.

Producing Intelligence

We create an event report in the extending event to:

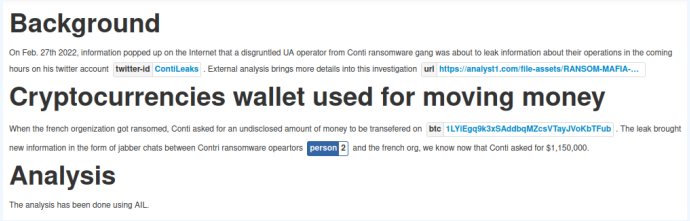
- explain the context around the leak,
- explain how the leak was exploited,
- describe the analyses that was done,
- show how the data from the leak shines a new light on the first event,
- explain to humans.





1.

Writing the story around the event fosters to addition of more contextual information:



Background

On Feb. 27th 2022, information popped up on the Internet that a disgruntled UA operator from Conti ransomware gang was about to leak information about their operations in the coming hours on his twitter account twitter-id ContiLeaks . External analysis brings more details into this investigation url https://analyst1.com/file-assets/RANSOM-MAFIA-...

Cryptocurrencies wallet used for moving money

When the french orgenization got ransomed, Conti asked for an undisclosed amount of money to be transefered on btc 1LYiEgq9k3xSAddbqMZcsVTayJVoKbTFub . The leak brought new information in the form of jabber chats between Contri ransomware opeartors person 2 and the french org, we know now that Conti asked for $1,150,000.

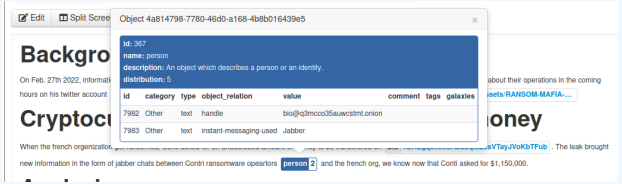
Analysis

The analysis has been done using AIL.

Producing Intelligence
Writing the story around the event fosters to addition of more contextual information:
Background
Cryptocurrencies wallet used for moving money
Analysis

1. Here we only added a twitter account, but numerous information could be added to the event to create a meaninful report.

Event reports are supported by the data contained into the event, and as such allows for getting more information on clicking on the object from the report:



1. In this view we click on a person object to get more details about it.

To sum it all up

- Given the growth and diversification and maturity of users, **contextualisation is becoming essential**
- Well-structured, context-rich data is good as it enables better **decision making**
- It will rise user capabilities and thus **improve protection**
- MISP has a format and tools designed to support contextualised data

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Acknowledgment

Provide sources along with the data!

- Turning data into actionable intelligence - advanced features in MISP supporting your analysts and tools (CIRCL.lu)
  - https://www.enisa.europa.eu/events/2019-cti-eu/2019-cti-eu-bonding-eu-cyber-threat-intelligence
- Colouring Outside the Lines (Andras Iklody & Trey Darley)
  - https://www.first.org/conference/2020/recordings
- MISP Training Materials
  - https://github.com/MISP/misp-training

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