MISP AND DECAYING OF INDICATORS

PRIMER FOR INDICATOR SCORING IN MISP

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Outline of the presentation

- Present the components used in MISP to expire IOCs
- Present the current state of Indicators life-cycle management in MISP

MISP and Decaying of Indicators
└─Expiring IOCs: Why and How?

2024-04-15

Expiring IOCs: Why and How?

Expiring IOCs: Why and How?

INDICATORS LIFECYCLE - PROBLEM STATEMENT

- **Sharing information** about threats **is crucial**
- Organisations are sharing more and more

Contribution by **unique organisation** (`Orgc.name`) on MISPPriv:

Date	Unique Org
2013	17
2014	43
2015	82
2016	105
2017	118
2018	125
2019-10	135

```
1 {
2     "distribution": [1, 2, 3]
3 }
```

MISP and Decaying of Indicators
└─Expiring IOCs: Why and How?

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        └─Indicators lifecycle - Problem Statement

- Various users and organisations can share data via MISP, multiple parties can be involved
  - ▶ **Trust**, **data quality** and **relevance** issues
  - ▶ Each user/organisation have **different use-cases** and interests
    - ■ Conflicting interests: Operational security VS attribution
- → Can be partially solved with *Taxonomies*

MISP and Decaying of Indicators
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└─Indicators lifecycle - Problem Statement

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Indicators lifecycle - Problem Statement

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- → Can be partially solved with *Taxonomies*

- Attributes can be shared in large quantities (more than 12M on MISPPRIV - Sept. 2020)
  - ▶ Partial info about their **freshness** (*Sightings*)
  - ▶ Partial info about their **validity** (*last_seen*)
- → Can be partially solved with our *Data model*

  MISP's *Decaying model* combines the two

Requirements to enjoy the decaying feature in MISP

MISP and Decaying of Indicators
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└─Requirements to enjoy the decaying feature in MISP

- Starting from **MISP 2.4.116,** the decaying feature is available
- **Update** decay models and **enable** some
- MISP Decaying strongly relies on *Taxonomies* and *Sightings*, don't forget to review their configuration

Note: The decaying feature has no impact on the information stored in MISP, it's just an **overlay** to be used in the user-interface and API

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MISP and Decaying of Indicators
└─Expiring IOCs: Why and How?

└─*Sightings* - Refresher (1)

Sightings add a **temporal context** to indicators.

- *Sightings* can be used to represent that you saw the IoC
- **Usecase:** Continuous feedback loop MISP ↔ IDS

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MISP and Decaying of Indicators
└─Expiring IOCs: Why and How?

└─*Sightings* - Refresher (2)
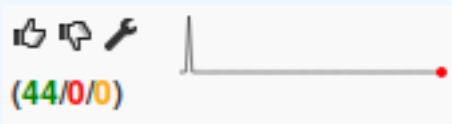
Sightings add a **temporal context** to indicators.

- *Sightings* give more credibility/visibility to indicators
- This information can be used to **prioritise and decay indicators**

Taxonomies

Id ↑	Namespace	Description	Version	Enabled	Required	Active Tags	Actions
181	workflow	Workflow support language is a common language to support intelligence analysts to perform their analysis on data and information.	9	Yes	☐	27 / 26 (enable all)	➖ 👁 🗑
180	vocabulaire-des-probabilites-estimatives	Ce vocabulaire attribue des valeurs en pourcentage à certains énoncés de probabilité	2	Yes	☐	5 / 5	➖ 👁 🗑
179	threats-to-dns	An overview of some of the known attacks related to DNS as described by Torabi, S., Boukhtouta, A., Assi, C., & Debbabi, M. (2018) in Detecting Internet Abuse by Analyzing Passive DNS Traffic: A Survey of Implemented Systems. IEEE Communications Surveys & Tutorials, 1–1. doi:10.1109/comst.2018.2849614	1	No	☐	0 / 18	➕ 👁 🗑
178	targeted-threat-index	The Targeted Threat Index is a metric for assigning an overall threat ranking score to email messages that deliver malware to a victim's computer. The TTI metric was first introduced at SecTor 2013 by Seth Hardy as part of the talk "RATastrophe: Monitoring a Malware Menagerie" along with Katie Kleemola and Greg Wiseman.	2	Yes	☐	11 / 11	➖ 👁 🗑

- *Taxonomies* are a simple way to attach a classification to an *Event* or an *Attribute*
- Classification must be globally used to be efficient (or agreed on beforehand)

MISP and Decaying of Indicators
└─ Expiring IOCs: Why and How?

        └─ Taxonomies – Refresher (1)

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ADMIRALTY-SCALE Taxonomy Library

Id	127
Namespace	admiralty-scale
Description	The Admiralty Scale or Ranking (also called the NATO System) is used to rank the reliability of a source and the credibility of an information. Reference based on FM 2-22.3 (FM 34-52) HUMAN INTELLIGENCE COLLECTOR OPERATIONS and NATO documents.
Version	4
Enabled	Yes (disable)

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Filter

Tag	Expanded	Numerical value	Events	Attributes	Tags	Action
admiralty-scale:information-credibility="1"	Information Credibility: Confirmed by other sources	100	6	0	admiralty-scale:information-credibility="1"	< ⟳ −
admiralty-scale:information-credibility="2"	Information Credibility: Probably true	75	21	1	admiralty-scale:information-credibility="2"	< ⟳ −
admiralty-scale:information-credibility="3"	Information Credibility: Possibly true	50	16	5	admiralty-scale:information-credibility="3"	< ⟳ −
admiralty-scale:information-credibility="4"	Information Credibility: Doubtful	25	2	0	admiralty-scale:information-credibility="4"	< ⟳ −
admiralty-scale:information-credibility="5"	Information Credibility: Improbable	0	1	0	admiralty-scale:information-credibility="5"	< ⟳ −
admiralty-scale:information-credibility="6"	Information Credibility: Truth cannot be judged	50	9	2	admiralty-scale:information-credibility="6"	< ⟳ −
admiralty-scale:source-reliability="a"	Source Reliability: Completely reliable	100	1	0	admiralty-scale:source-reliability="a"	< ⟳ −
admiralty-scale:source-reliability="b"	Source Reliability: Usually reliable	75	21	76	admiralty-scale:source-reliability="b"	< ⟳ −
admiralty-scale:source-reliability="c"	Source Reliability: Fairly reliable	50	9	8	admiralty-scale:source-reliability="c"	< ⟳ −
admiralty-scale:source-reliability="d"	Source Reliability: Not usually reliable	25	2	0	admiralty-scale:source-reliability="d"	< ⟳ −
admiralty-scale:source-reliability="e"	Source Reliability: Unreliable	0	0	0	admiralty-scale:source-reliability="e"	< ⟳ −
admiralty-scale:source-reliability="f"	Source Reliability: Reliability cannot be judged	50	10	7	admiralty-scale:source-reliability="f"	< ⟳ −
admiralty-scale:source-reliability="g"	Source Reliability: Deliberatly deceptive	0	N/A	N/A		+

→ Cherry-pick allowed *Tags*

9

26

- Some taxonomies have a `numerical_value`
- Allows concepts to be used in an mathematical expression
    $\rightarrow$ Can be used to prioritise IoCs

`admirality-scale` taxonomy[1]

Description	Value	Description	Value
Completely reliable	100	Confirmed by other sources	100
Usually reliable	75	Probably true	75
Fairly reliable	50	Possibly true	50
Not usually reliable	25	Doubtful	25
Unreliable	0	Improbable	0
Reliability cannot be judged	50	Truth cannot be judged	50
Deliberatly deceptive	0		

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[1]https://github.com/MISP/misp-taxonomies/blob/master/
admiralty-scale/machinetag.json

MISP and Decaying of Indicators
└─Expiring IOCs: Why and How?

└─Taxonomies - Refresher (3)

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Taxonomies - Refresher (3)

admirality-scale taxonomy[2]

Description	Value	Description	Value
Completely reliable	100	Confirmed by other sources	100
Usually reliable	75	Probably true	75
Fairly reliable	50	Possibly true	50
Not usually reliable	25	Doubtful	25
Unreliable	0	Improbable	0
Reliability cannot be judged	50 **?**	Truth cannot be judged	50 **?**
Deliberatly deceptive	0 **?**		

$\rightarrow$ Users can override tag `numerical_value`

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[2]https://github.com/MISP/misp-taxonomies/blob/master/
admiralty-scale/machinetag.json

MISP and Decaying of Indicators
└─Expiring IOCs: Why and How?

└─Scoring Indicators: Our solution

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Scoring Indicators: Our solution

$$score(\text{Attribute}) = base\_score(\text{Attribute, Model}) \bullet decay(\text{Model, time})$$

- **base_score**(Attribute, Model)
  - ▶ Initial score of the *Attribute* only considering the context (*Attribute's type, Tags*)

- **decay**(Model, time)
  - ▶ Function composed of the **lifetime** and **decay speed**
  - ▶ Decreases the base_score over time

SCORING INDICATORS: OUR SOLUTION
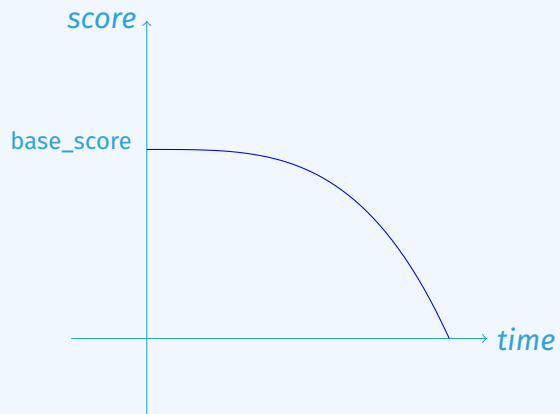
$$score(_{\text{Attribute}}) = base\_score(_{\text{Attribute, Model}}) \bullet decay(_{\text{Model, time}})$$

MISP and Decaying of Indicators
└─Expiring IOCs: Why and How?

  └─Scoring Indicators: Our solution

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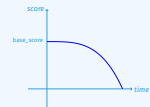
CURRENT IMPLEMENTATION IN MISP

IMPLEMENTATION IN MISP: Event/view

■ **Decay score** toggle button
  ► Shows Score for each *Models* associated to the *Attribute* type

/attributes/restSearch

```
1  "Attribute": [
2    {
3      "category": "Network activity",
4      "type": "ip-src",
5      "to_ids": true,
6      "timestamp": "1565703507",
7      [...]
8      "value": "8.8.8.8",
9      "decay_score": [
10       {
11         "score": 54.475223849544456,
12         "decayed": false,
13         "DecayingModel": {
14           "id": "85",
15           "name": "NIDS Simple Decaying Model"
16         }
17       }
18     ],
19   [...]
```

16

- **Automatic scoring** based on default values
- **User-friendly UI** to manually set *Model* configuration (lifetime, decay, etc.)
- **Simulation** tool
- Interaction through the **API**
- Opportunity to create your **own** formula or algorithm

$$score = base\_score \cdot \left(1 - \left(\frac{t}{\tau}\right)^{\frac{1}{\delta}}\right)$$

Models are an instanciation of the formula with configurable parameters:

- Parameters: `lifetime, decay_rate, threshold`
- `base_score` computation
- `default base_score`
- associate *Attribute* types
- formula
- creator organisation

Two types of model are available

- **Default Models**: Created and shared by the community. Coming from `misp-decaying-models` repository[3].
  - → Not editable

- **Organisation Models**: Created by a user on MISP
  - ▶ Can be hidden or shared to other organisation
  - → Editable

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[3]https://github.com/MISP/misp-decaying-models.git

Decaying Models

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| All Models | My Models | Shared Models | Default Models |

ID	Organization	Usable to everyone	Name	Description	Parameters { }	Formula	# Assigned Types	Version	Enabled	Actions

29	1	✓	Phishing model	Simple model to rapidly decay phishing website.	{
					  "lifetime": 3,
					  "decay_speed": 2.3,
					  "threshold": 30,
					  "default_base_score": 80,
					  "base_score_config": {
					    "estimative-language": 0.5,
					    "phishing": 0.5
					  }
					}
						Polynomial ❓	9	1	✓	▤ ☁ 🗑 ✎ ❚❚

85	1	✗	NIDS Simple Decaying Model MISP	Simple decaying model for Network Intrusion Detection System (NIDS).	{
					  "lifetime": 120,
					  "decay_speed": 2,
					  "threshold": 30,
					  "default_base_score": 80,
					  "base_score_config": {
					    "estimative-language": 0.25,
					    "priority-level": 0.25,
					    "retention": 0.25,
					    "targeted-threat-index": 0.125,
					    "false-positive": 0.125
					  }
					}
						Polynomial ❓	13	1	✓	▤ ☁ 🗑 ✎ ❚❚

Page 1 of 1, showing 2 records out of 2 total, starting on record 1, ending on 2

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Standard CRUD operations: View, update, add, create, delete, enable, export, import

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MISP and Decaying of Indicators
└─ Current implementation in MISP

└─ Implementation in MISP: Index

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IMPLEMENTATION IN MISP: FINE TUNING TOOL

Configure models: Create, modify, visualise, perform mapping

Implementation in MISP: base_score tool

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Adjust Taxonomies relative weights

Simulate decay on *Attributes* with different *Models*

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Simulate decay on *Attributes* with different *Models*

/attributes/restSearch

```
1  {
2      "includeDecayScore": 1,
3      "includeFullModel": 0,
4      "excludeDecayed": 0,
5      "decayingModel": [85],
6      "modelOverrides": {
7          "threshold": 30
8      }
9      "score": 30,
10 }
11
```

```php
<?php
include_once 'Base.php';

class Polynomial extends DecayingModelBase
{
    public const DESCRIPTION = 'The description of your new
    decaying algorithm';

    public function computeScore($model, $attribute, $base_score,
    $elapsed_time)
    {
        // algorithm returning a numerical score
    }

    public function isDecayed($model, $attribute, $score)
    {
        // algorithm returning a boolean stating
        // if the attribute is expired or not
    }
}
?>
```

- Improved support of *Sightings*
  - ▶ `False positive` *Sightings* should somehow reduce the score
  - ▶ `Expiration` *Sightings* should mark the attribute as decayed
- Potential *Model* improvements
  - ▶ Instead of resetting the score to `base_score` once a *Sighting* is set, the score should be increased additively (based on a defined coefficient); thus **prioritizing surges** rather than infrequent *Sightings*
  - ▶ Take into account related *Tags* or *Correlations* when computing score
- Increase *Taxonomy* coverage
  - ▶ Users should be able to manually override the `numerical_value` of *Tags*