MISP and Decaying of Indicators

Primer for indicator scoring in MISP

Team CIRCL

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September 16, 2022

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MISP
Threat Sharing

Outline of the presentation

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

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Expiring IOCs: Why and How?

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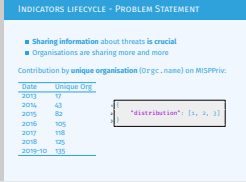
Indicators lifecycle - Problem Statement

- **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

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

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*

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- 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

Indicators lifecycle - Problem Statement
Various users and organisations can share data via MISP, multiple parties can be involved
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→ Can be partially solved with Taxonomies
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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

- 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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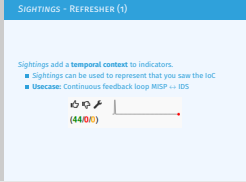
Sightings - Refresher (1)

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

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



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**

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Taxonomies - Refresher (1)

Taxonomies

« previous | 1 | 2 | next »

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)

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Taxonomies - Refresher (2)

ADMIRALTY-SCALE Taxonomy Library

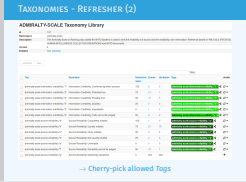
Id	127
Namespace	admiralty-scale
Description	The Admiralty Scale or Ranking (also called the NATO System) is used to rank the reliability of a source and the credibility of an information. Reference based on FM 2-22.3 (FM 34-52) HUMAN INTELLIGENCE COLLECTOR OPERATIONS and NATO documents.
Version	4
Enabled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

« previous next »

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*



Taxonomies - Refresher (3)

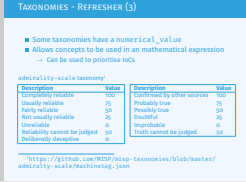
- Some taxonomies have a `numerical_value`
- Allows concepts to be used in an mathematical expression
  → Can be used to prioritise IoCs

`admirality-scale` taxonomy[1]

Description	Value
Completely reliable	100
Usually reliable	75
Fairly reliable	50
Not usually reliable	25
Unreliable	0
Reliability cannot be judged	50
Deliberatly deceptive	0

Description	Value
Confirmed by other sources	100
Probably true	75
Possibly true	50
Doubtful	25
Improbable	0
Truth cannot be judged	50

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



Taxonomies - Refresher (3)

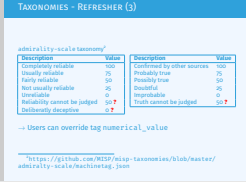
admiralty-scale taxonomy[2]

Description	Value
Completely reliable	100
Usually reliable	75
Fairly reliable	50
Not usually reliable	25
Unreliable	0
Reliability cannot be judged	50 ?
Deliberatly deceptive	0 ?

Description	Value
Confirmed by other sources	100
Probably true	75
Possibly true	50
Doubtful	25
Improbable	0
Truth cannot be judged	50 ?

→ Users can override tag numerical_value

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



Scoring Indicators: Our solution

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

- 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

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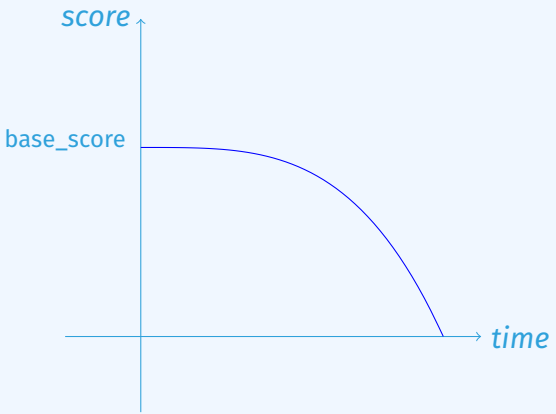
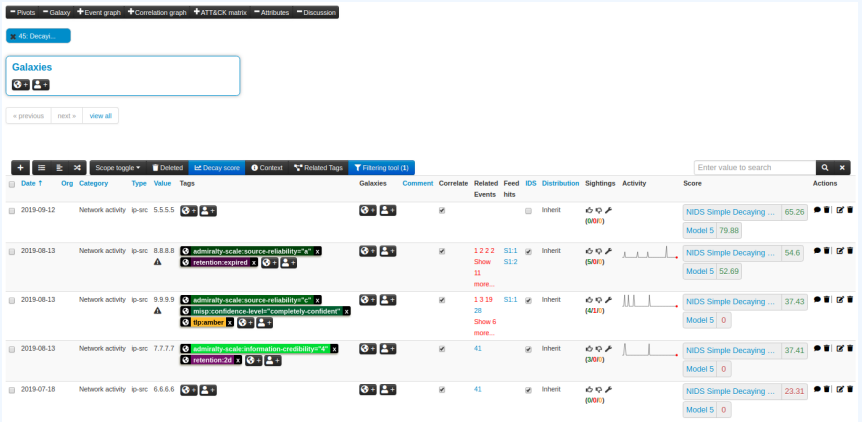


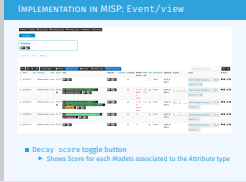
Scoring Indicators: Our solution

Current implementation in MISP

Implementation in MISP: Event/view



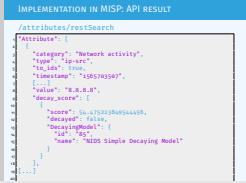
- Decay score toggle button
  - Shows Score for each *Models* associated to the *Attribute* type



Implementation in MISP: API result

/attributes/restSearch

```
"Attribute": [
  {
    "category": "Network activity",
    "type": "ip-src",
    "to_ids": true,
    "timestamp": "1565703507",
    [...]
    "value": "8.8.8.8",
    "decay_score": [
      {
        "score": 54.475223849544456,
        "decayed": false,
        "DecayingModel": {
          "id": "85",
          "name": "NIDS Simple Decaying Model"
        }
      }
    ],
[...]
```

Implementation in MISP: Objectives

- **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

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Implementation in MISP: Models definition

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

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

Implementation in MISP: Models definition
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Implementation in MISP: Models Types

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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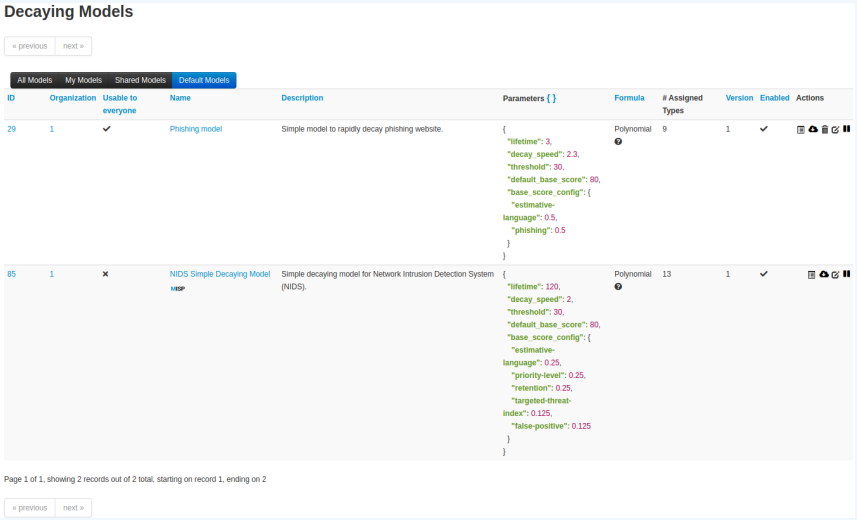
Implementation in MISP: Index



Decaying Models

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All Models | My Models | Shared Models | Default Models

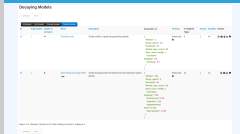
ID	Organization	Usable to everyone	Name	Description	Parameters { }	Formula	# Assigned Types	Version	Enabled	Actions
29	1	✔	Phishing model	Simple model to rapidly decay phishing website.	{ "lifetime": 3, "decay_speed": 2.3, "threshold": 30, "default_base_score": 80, "base_score_config": { "estimative-language": 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

« previous | next »

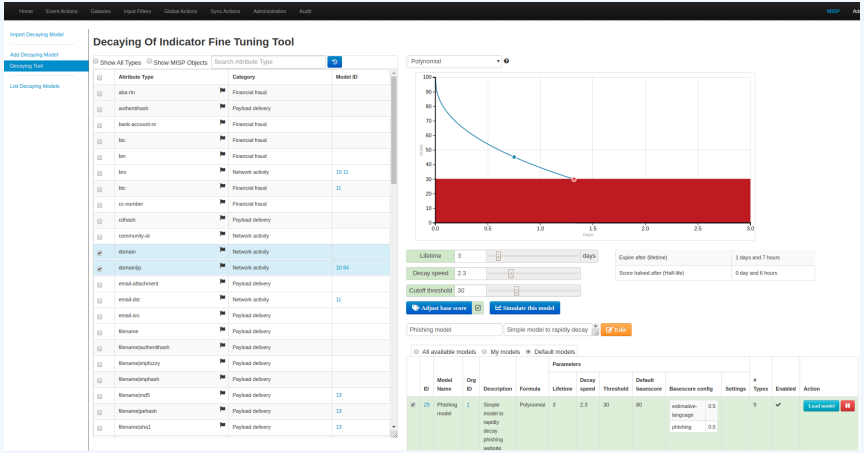
Standard CRUD operations: View, update, add, create, delete, enable, export, import

Implementation in MISP: Index



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

Implementation in MISP: Fine tuning tool

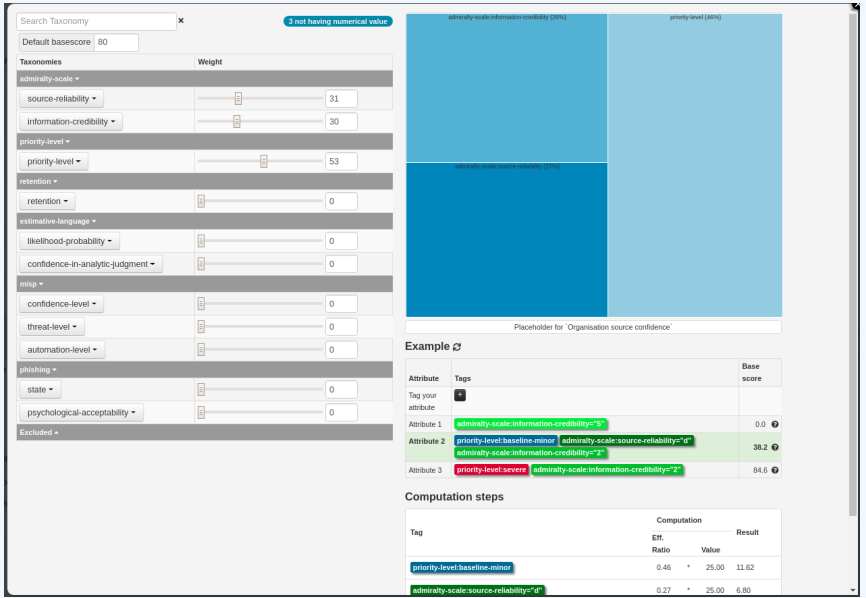


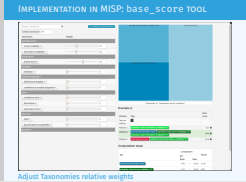
Configure models: Create, modify, visualise, perform mapping

Implementation in MISP: Fine tuning tool

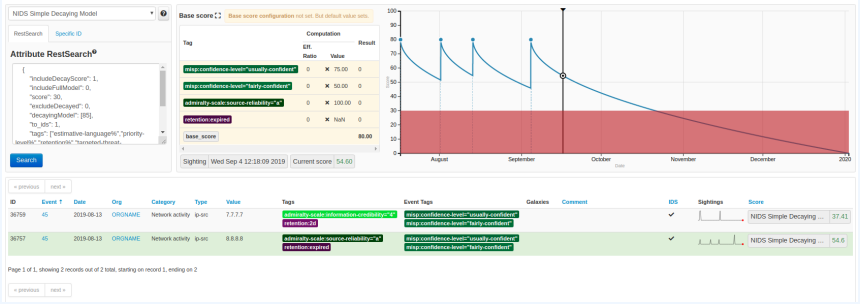
Configure models: Create, modify, visualise, perform mapping

Implementation in MISP: base_score tool





Implementation in MISP: simulation tool



Simulate decay on *Attributes* with different *Models*

Implementation in MISP: simulation tool

Simulate decay on Attributes with different Models

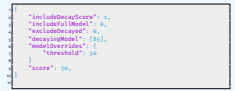
Implementation in MISP: API query body

/attributes/restSearch

```
{
    "includeDecayScore": 1,
    "includeFullModel": 0,
    "excludeDecayed": 0,
    "decayingModel": [85],
    "modelOverrides": {
        "threshold": 30
    }
    "score": 30,
}

```


Implementation in MISP: API query body
/attributes/restSearch



Creating a new decay algorithm

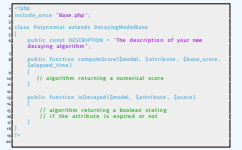
```php
<?php
include_once 'Base.php';

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
    }
}
?>
```


Creating a new decay algorithm



Decaying Models 2.0

- 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*

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