Build Your Own Malware Analysis Pipeline Using New Open Source Tools

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Jarosław Jedynak
Paweł Pawliński

CERT.PL

FIRST Workshop Series
15th April 2021

Agenda

- **mwdb.cert.pl**
  - What the heck is **MWDB?**
  - Tour de **mwdb.cert.pl**
  - Scripting and automation with **mwdblib**
- **mwdb-core** and **karton**
  - Run a **self-hosted** mwdb-core and karton instances
  - Experiment with **karton-playground**
  - Automated unpacking with **malduck**

Prerequisites

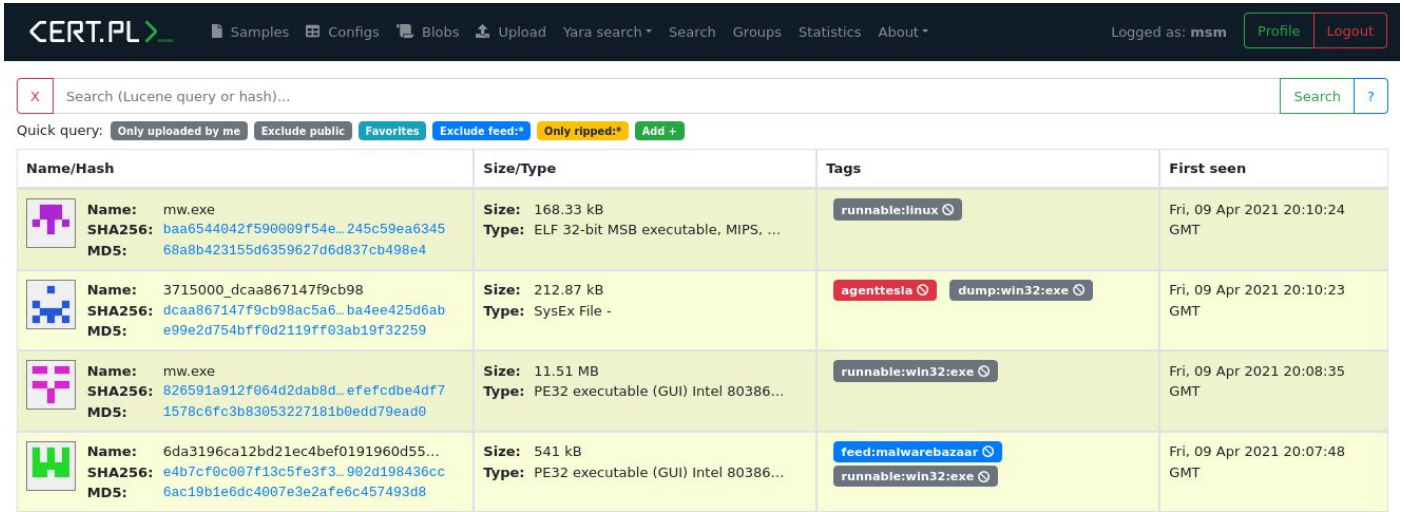
Open a terminal and check if these tools are installed:

- `$ python3 -m pip`
- `$ git`
- `$ docker-compose`
  https://docs.docker.com/engine/install/ubuntu/
  https://docs.docker.com/compose/install/

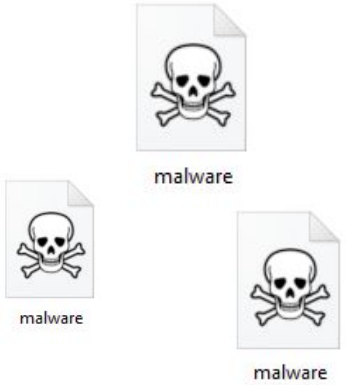
mwdb.cert.pl

What the heck is MWDB?

Introduction to **the interface**

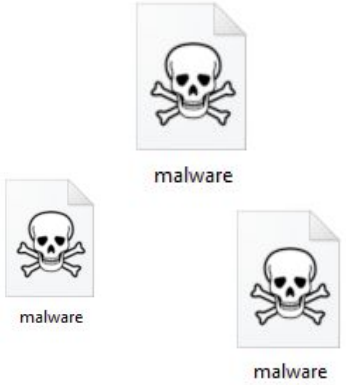


mwdb.cert.pl



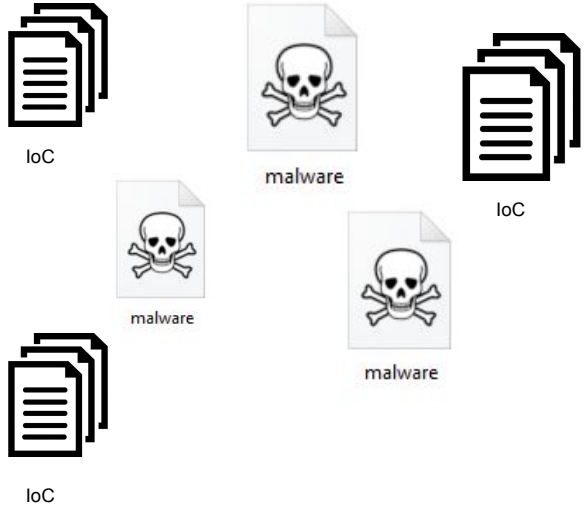
mwdb.cert.pl

Malware reverse engineer



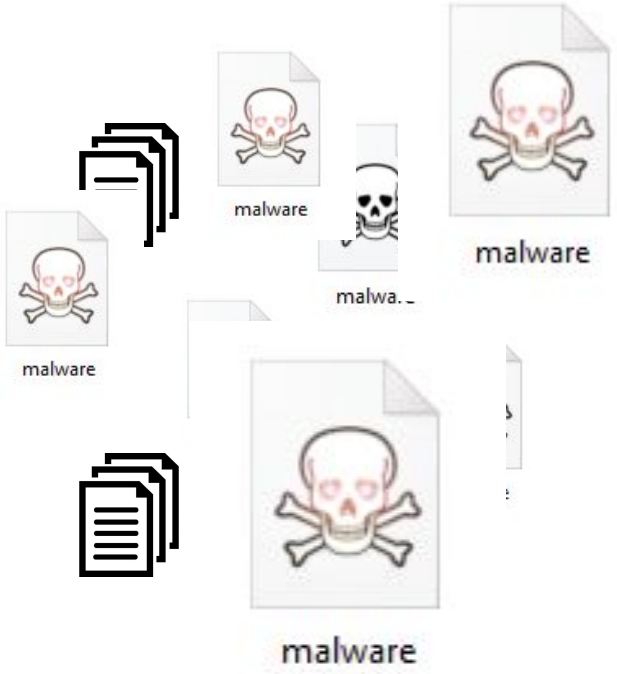
mwdb.cert.pl

Malware reverse engineer



mwdb.cert.pl

Malware reverse engineer

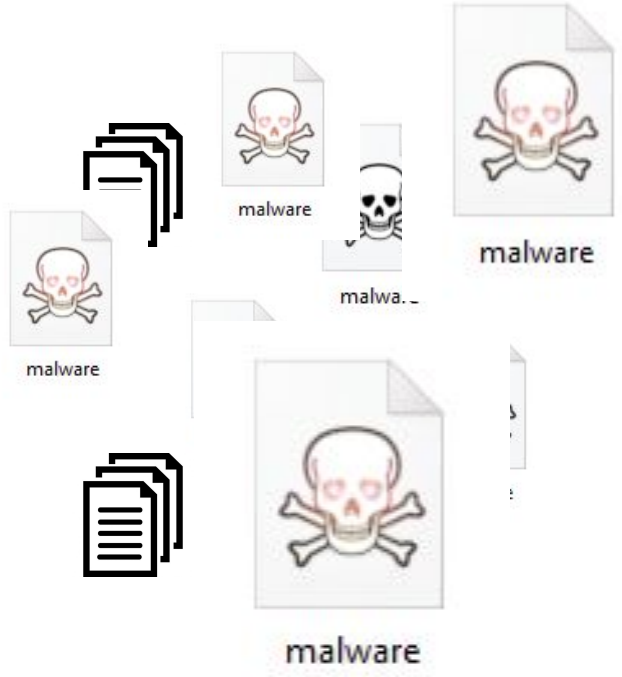


mwdb.cert.pl

researcher.py

researcher.py

researcher.py



mwdb.cert.pl

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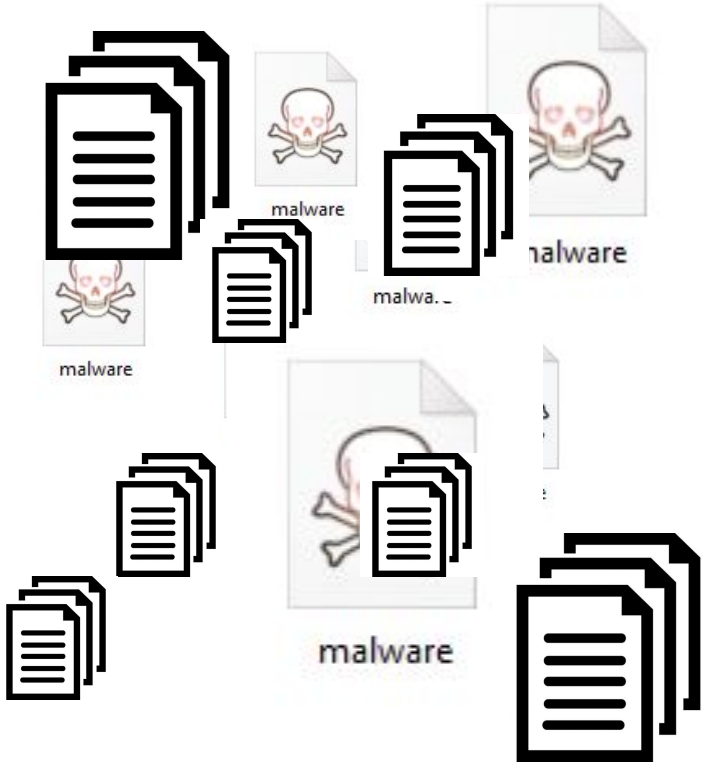

mwdb.cert.pl

researcher.py

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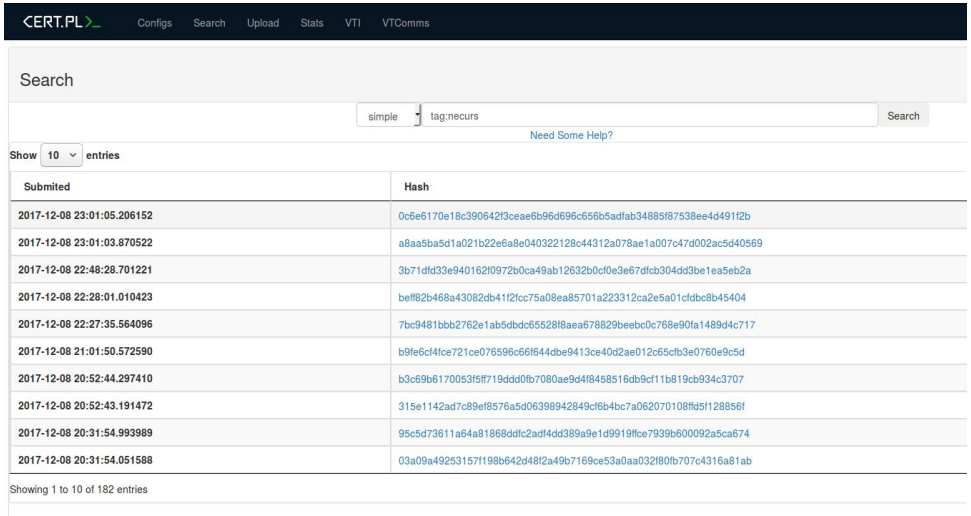
MalWare DataBase



CERT.PL

mwdb.cert.pl

researcher.py

researcher.py

researcher.py

MalWareDB

CERT.PL Configs Search Upload Stats VTI VTComms

Search

simple tag:necurs Search

Need Some Help?

Show 10 entries

Submited	Hash
2017-12-08 23:01:05.206152	0c6e6170e18c390642f3ceae6b96d696c656b5adfab34885f87538ee4d491f2b
2017-12-08 23:01:03.870522	a8aa5ba5d1a021b22e6a8e040322128c44312a078ae1a007c47d002ac5d40569
2017-12-08 22:48:28.701221	3b71dfd33e940162f0972b0ca49ab12632b0cf0e3e67dfcb304dd3be1ea5eb2a
2017-12-08 22:28:01.010423	beff82b468a43082db41f2fcc75a08ea85701a223312ca2e5a01cfdbc8b45404
2017-12-08 22:27:35.564096	7bc9481bbb2762e1ab5dbdc65528f8aea678829beebc0c768e90fa1489d4c717
2017-12-08 21:01:50.572590	b9fe6cf4fce721ce076596c66f644dbe9413ce40d2ae012c65cfb3e0760e9c5d
2017-12-08 20:52:44.297410	b3c69b6170053f5ff719ddd0fb7080ae9d4f8458516db9cf11b819cb934c3707
2017-12-08 20:52:43.191472	315e1142ad7c89ef8576a5d06398942849cf6b4bc7a062070108ffd5f128856f
2017-12-08 20:31:54.993989	95c5d73611a64a81868ddfc2adf4dd389a9e1d9919ffce7939b600092a5ca674
2017-12-08 20:31:54.051588	03a09a49253157f198b642d48f2a49b7169ce53a0aa032f80fb707c4316a81ab

Showing 1 to 10 of 182 entries

CERT.PL

mwdb.cert.pl

researcher.py

researcher.py

researcher.py

MWDB

CERT.PL >_ Configs Search Upload Stats VTI VTComms

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simple tag:necurs Search

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Submited	Hash
2017-12-08 23:01:05.206152	0c6e6170e18c390642f3ceae6b96d696c656b5adfab34885f87538ee4d491f2b
2017-12-08 23:01:03.870522	a8aa5ba5d1a021b22e6a8e040322128c44312a078ae1a007c47d002ac5d40569
2017-12-08 22:48:28.701221	3b71dfd33e940162f0972b0ca49ab12632b0cf0e3e67dfcb304dd3be1ea5eb2a
2017-12-08 22:28:01.010423	beff82b468a43082db41f2fcc75a08ea85701a223312ca2e5a01cfdbc8b45404
2017-12-08 22:27:35.564096	7bc9481bbb2762e1ab5dbdc65528f8aea678829beebc0c768e90fa1489d4c717
2017-12-08 21:01:50.572590	b9fe6cf4fce721ce076596c66f644dbe9413ce40d2ae012c65cfb3e0760e9c5d
2017-12-08 20:52:44.297410	b3c69b6170053f5ff719ddd0fb7080ae9d4f8458516db9cf11b819cb934c3707
2017-12-08 20:52:43.191472	315e1142ad7c89ef8576a5d06398942849cf6b4bc7a062070108ffd5f128856f
2017-12-08 20:31:54.993989	95c5d73611a64a81868ddfc2adf4dd389a9e1d9919ffce7939b600092a5ca674
2017-12-08 20:31:54.051588	03a09a49253157f198b642d48f2a49b7169ce53a0aa032f80fb707c4316a81ab

Showing 1 to 10 of 182 entries

CERT.PL >_

mwdb.cert.pl

MWDB

The Interface

CERT.PL >_ Configs Search Upload Stats VTI VTComms

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2017-12-08 23:01:03.870522	a8aa5ba5d1a021b22e6a8e040322128c44312a078ae1a007c47d002ac5d40569
2017-12-08 22:48:28.701221	3b71dfd33e940162f0972b0ca49ab12632b0cf0e3e67dfcb304dd3be1ea5eb2a
2017-12-08 22:28:01.010423	beff82b468a43082db41f2fcc75a08ea85701a223312ca2e5a01cfdbc8b45404
2017-12-08 22:27:35.564096	7bc9481bbb2762e1ab5dbdc65528f8aea678829beebc0c768e90fa1489d4c717
2017-12-08 21:01:50.572590	b9fe6cf4fce721ce076596c66f644dbe9413ce40d2ae012c65cfb3e0760e9c5d
2017-12-08 20:52:44.297410	b3c69b6170053f5ff719ddd0fb7080ae9d4f8458516db9cf11b819cb934c3707
2017-12-08 20:52:43.191472	315e1142ad7c89ef8576a5d0639894 2649cf6b4bc7a062070108ffd5f128856f
2017-12-08 20:31:54.993989	95c5d73611a64a81868ddfc2adf4dd389a9e1d9919ffce7939b600092a5ca674
2017-12-08 20:31:54.051588	03a09a49253157f198b642d48f2a49b7169ce53a0aa032f80fb707c4316a81ab

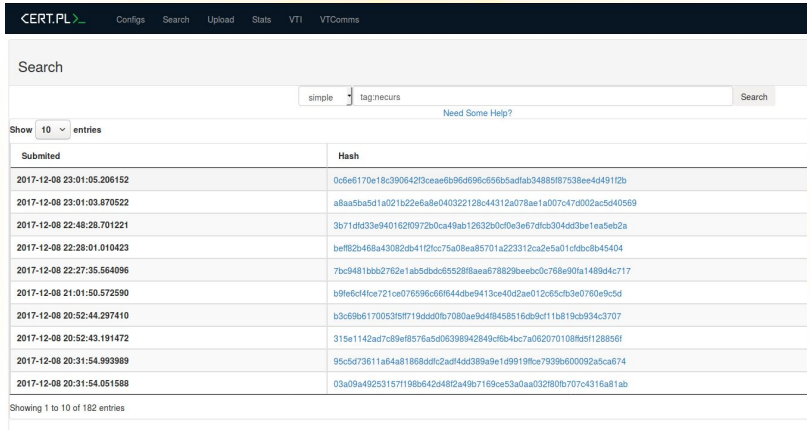
Showing 1 to 10 of 182 entries

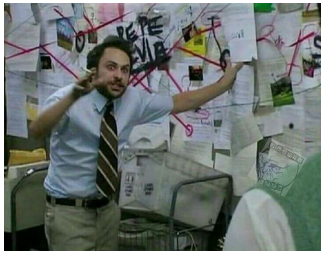
CERT.PL >_

mwdb.cert.pl

MWDB

The Interface



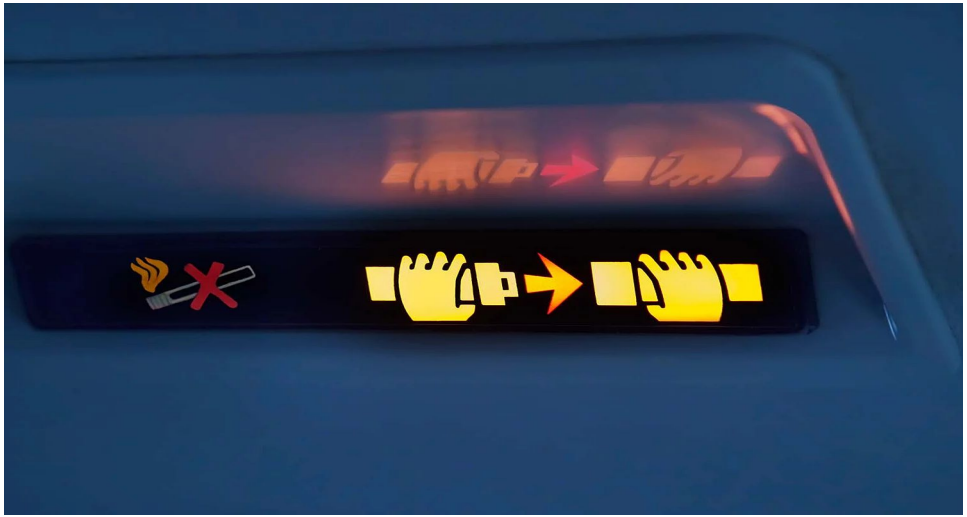


CERT.PL

mwdb.cert.pl

Tour de **mwdb.cert.pl**

https://mwdb.cert.pl



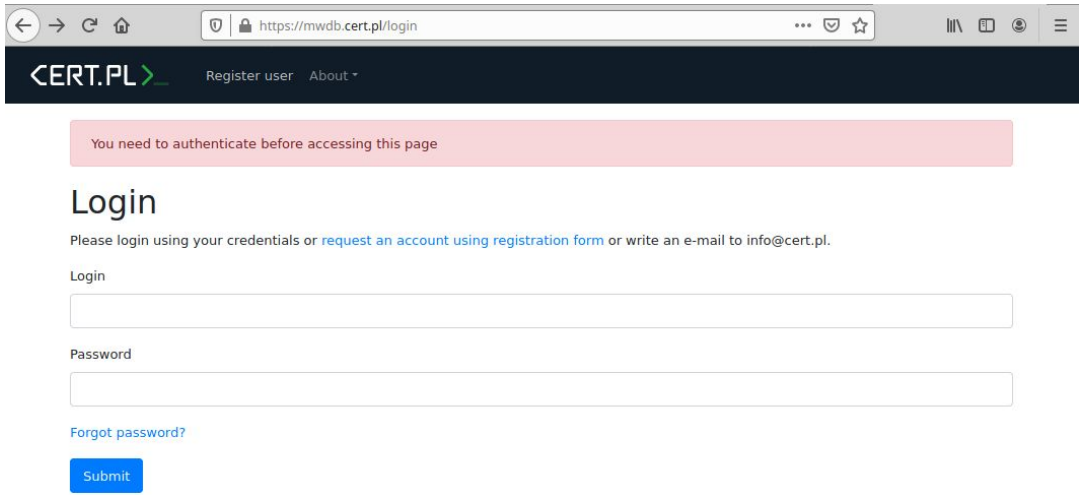
Training materials
https://github.com/CERT-Polska/training-mwdb

CERT.PL

mwdb.cert.pl

Login with workshop creds (`first2020-xx`)

Check your inbox (information was sent in the last 24h)
if you do not have credentials let us know



Training materials
https://github.com/CERT-Polska/training-mwdb

CERT.PL

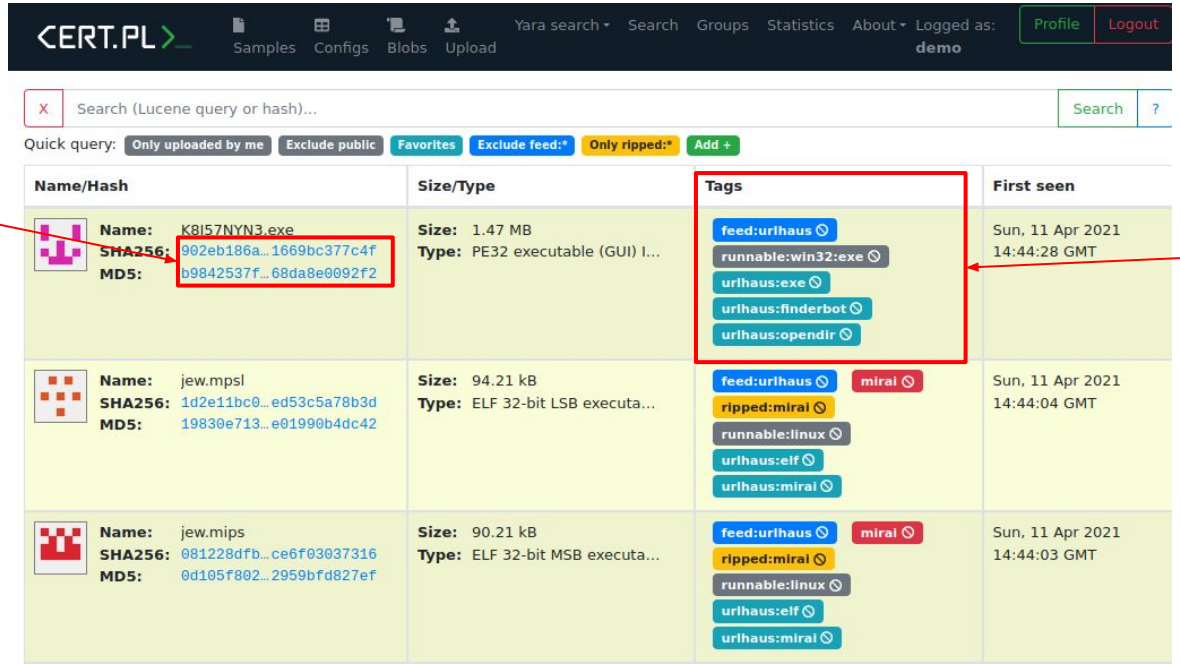
Exercise #0: Getting familiar with the interface

https://mwdb.readthedocs.io/en/latest/user-guide/1-Introduction-to-MWDB.html

mwdb.cert.pl

Exercise #0: Getting familiar with the interface

Link to sample details



Click on tags to filter (or filter out)

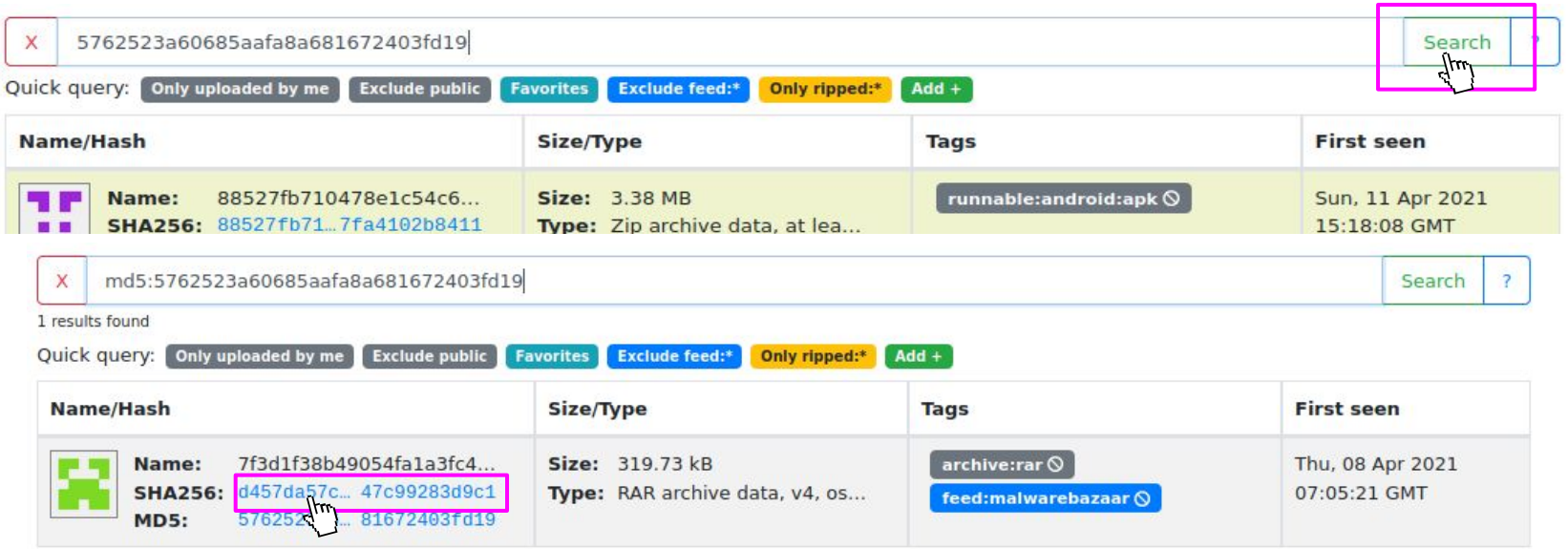
mwdb.cert.pl

Exercise #0: Getting familiar with the interface

CERT.PL

mwdb.cert.pl

Exercise #0: Getting familiar with the interface



CERT.PL

Exercise #1: Filtering samples by tags

See: https://github.com/CERT-Polska/training-mwdb

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Exercise #1: Filtering samples by tags

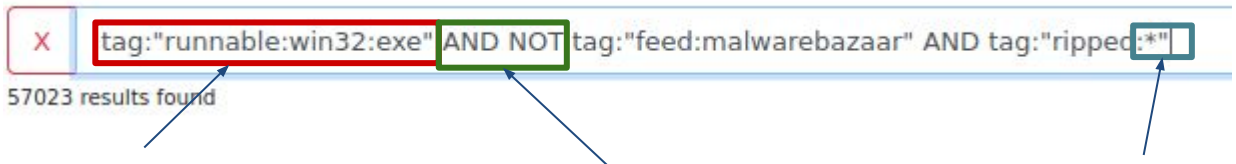
formbook	Simple tag, mostly used for marking artifacts that are associated with malware family
feed:sample	Tag describing the source of malware sample
ripped:formbook	Tag for the original sample, indicating recognized malware family
runnable:win32:exe	Tag describing the type of sample
yara:win_formbook	Generic metadata tag with additional information that are useful for filtering

https://mwdb.readthedocs.io/en/latest/user-guide/5-Tagging-objects.html#built-in-tag-conventions

mwdb.cert.pl

Exercise #1: Filtering samples by tags

Lucene-based query syntax



conditions

`<field>:<value>`

operators

`AND, OR, NOT`

`(uppercase only)`

wildcards

https://mwdb.readthedocs.io/en/latest/user-guide/7-Lucene-search.html

mwdb.cert.pl

Everything related with formbook

X | tag:*formbook* | Search | ?

8472 results found

Quick query: Only uploaded by me | Exclude public | Favorites | Exclude feed:* | Only ripped:* | Add +

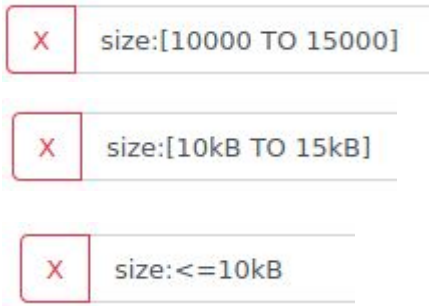
Name/Hash	Size/Type	Tags	First seen
Name: 3310000_55996a8917b... **SHA256:** 55996a891…c1b1122ca8d7 **MD5:** cedc1abf7…2d89abd544fd	**Size:** 154.75 kB **Type:** data	dump:win32:exe formbook	Sun, 11 Apr 2021 08:13:01 GMT
Name: 5f85c45be7b228140ce5... **SHA256:** b9a1fe9ef…bccca5623704 **MD5:** 430a47302…5a335d184bc4	**Size:** 551 kB **Type:** PE32 executable (GUI) I...	et:formbook feed:malwarebazaar ripped:formbook runnable:win32:exe yara:win_formbook	Sun, 11 Apr 2021 07:59:08 GMT

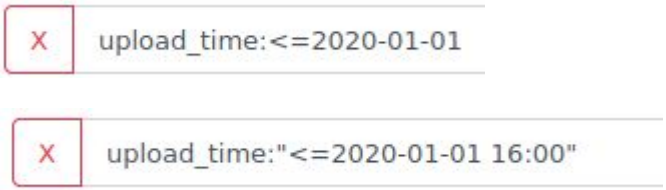
CERT.PL

mwdb.cert.pl

Exercise #1: Filtering samples by tags

Ranges



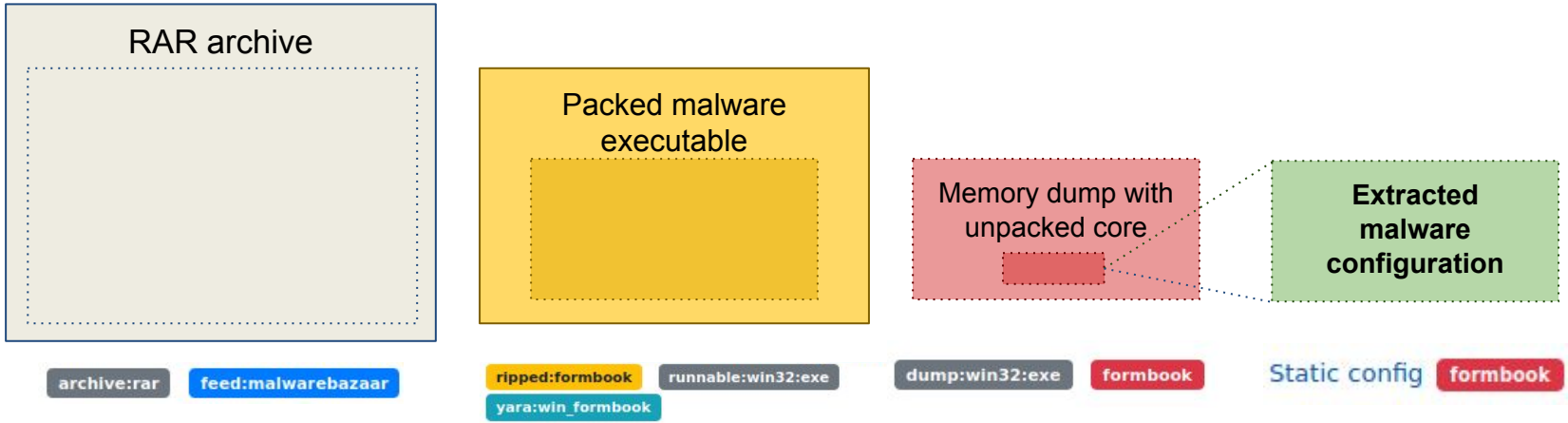


Exercise #2: Exploring sample view and hierarchy

See: https://github.com/CERT-Polska/training-mwdb

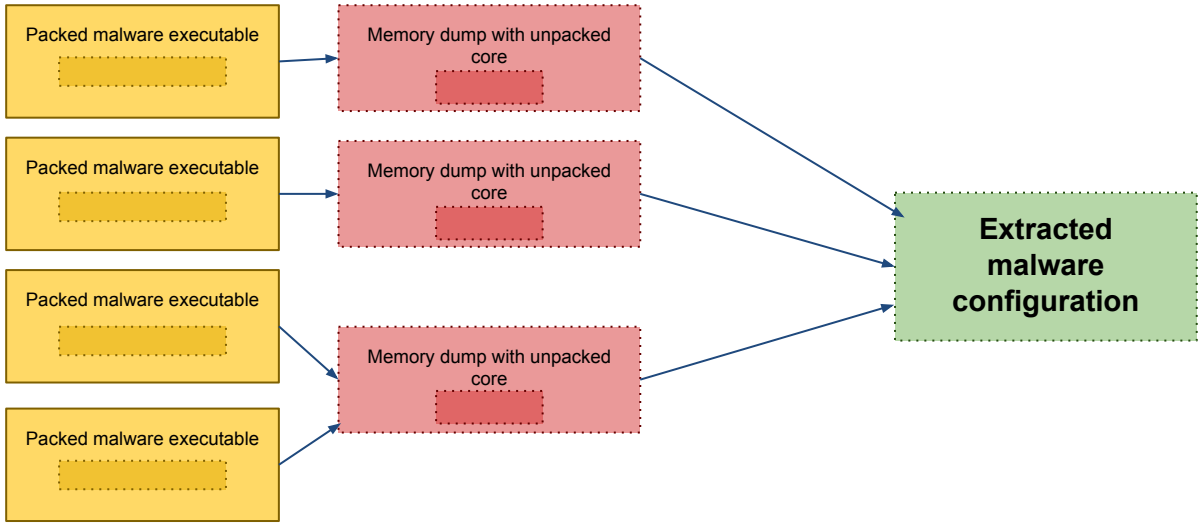
mwdb.cert.pl

Exercise #2: Exploring sample view and hierarchy



mwdb.cert.pl

Exercise #2: Exploring sample view and hierarchy



mwdb.cert.pl

When you upload 32 samples and all ripped to the same config

Exercise #3: Looking for similar configurations

See: https://github.com/CERT-Polska/training-mwdb

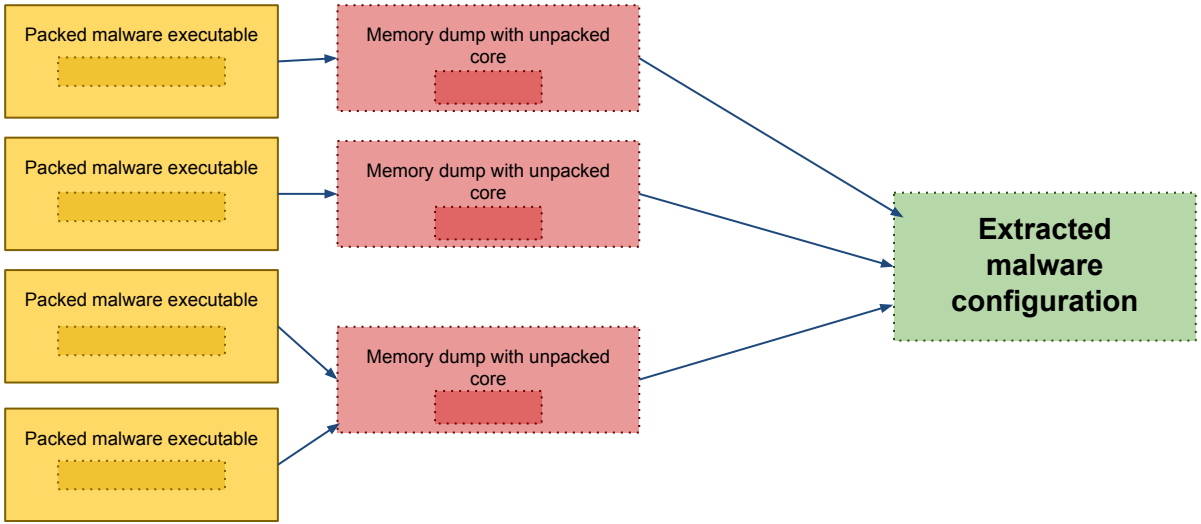
mwdb.cert.pl 

Exercise #4: Blobs and dynamic configurations

See: https://github.com/CERT-Polska/training-mwdb

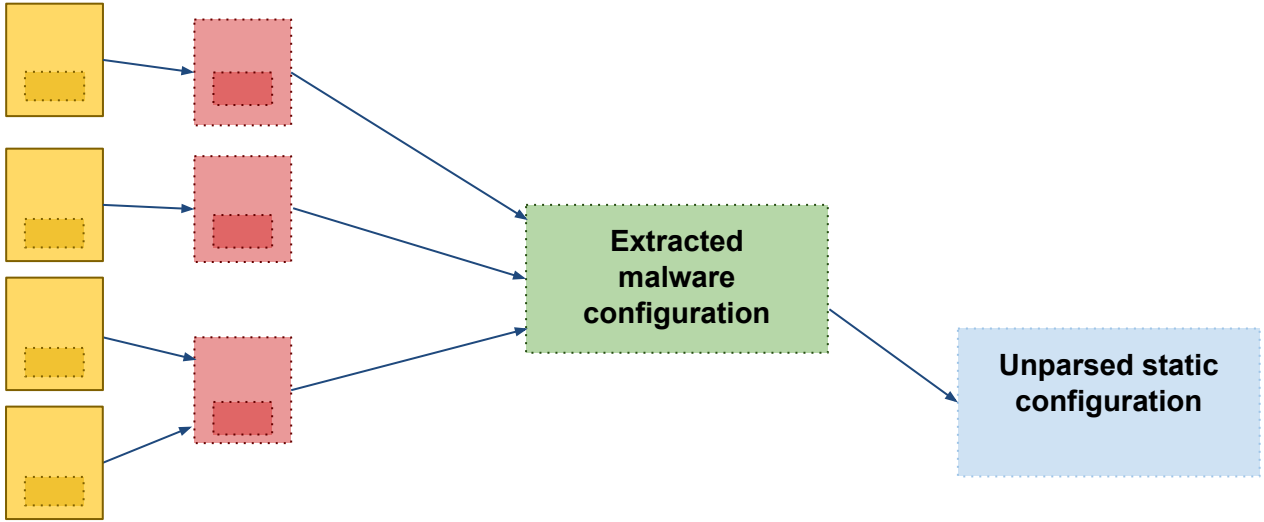
mwdb.cert.pl

Exercise #4: Blobs and dynamic configurations



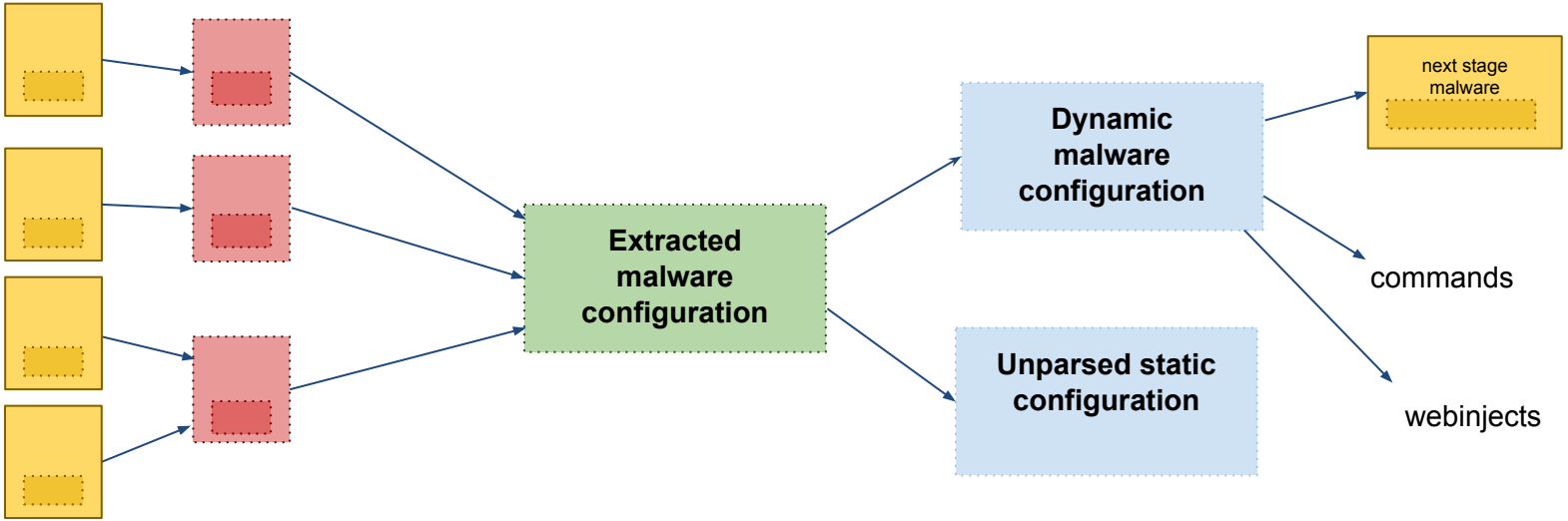
mwdb.cert.pl

Exercise #4: Blobs and dynamic configurations



mwdb.cert.pl

Exercise #4: Blobs and dynamic configurations

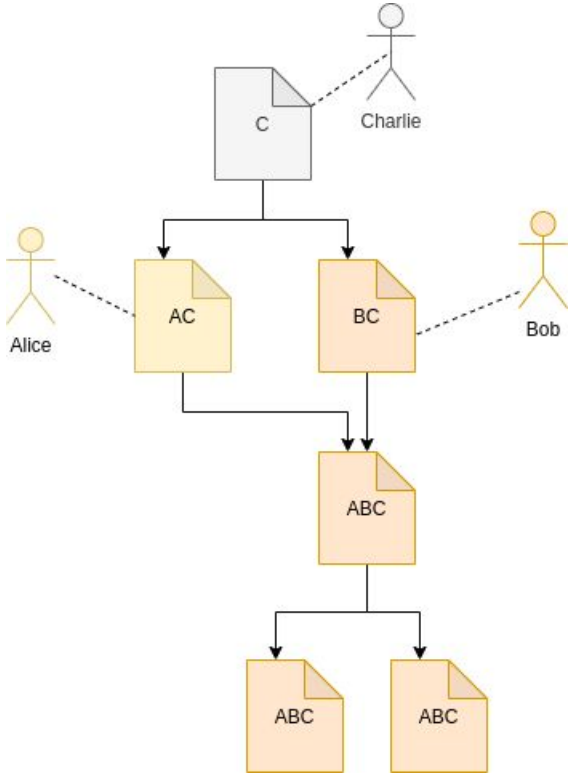


Exercise #5: Let’s upload something!

See: https://github.com/CERT-Polska/training-mwdb

mwdb.cert.pl

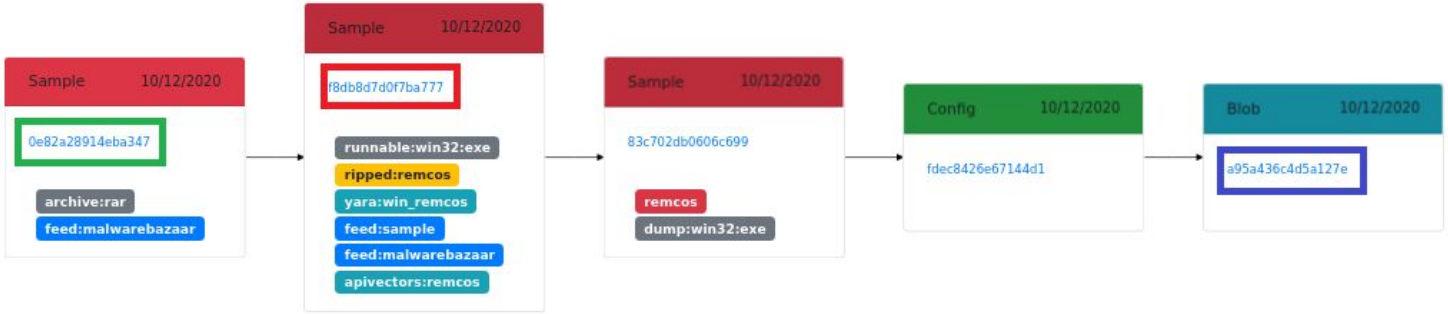
Exercise #5: Let’s upload something!



CERT.PL

mwdb.cert.pl

Exercise #5: Let's upload something!



Shares

Group name	Reason	Access time
certpl-systems	Added a95a436c4d5a127ed90a9c382476d9bc7c136efa39edbd912ab8935dc10d1b7d by karton	Mon, 12 Oct 2020 09:23:40 GMT
karton (uploader)	Added a95a436c4d5a127ed90a9c382476d9bc7c136efa39edbd912ab8935dc10d1b7d by karton	Mon, 12 Oct 2020 09:23:40 GMT
public	Added 0e82a28914eba347b95549eb4b7c5d642c2ee6f747407b3a0d8c8c8ff988c215 by Alice	Mon, 12 Oct 2020 09:23:40 GMT
Alice	Added 0e82a28914eba347b95549eb4b7c5d642c2ee6f747407b3a0d8c8c8ff988c215 by Alice	Mon, 12 Oct 2020 09:23:40 GMT
Chris	Added f8db8d7d0f7ba777f5f18452579f40a224a055c6624066b5dce501121cc91c5c by Chris	Tue, 13 Oct 2020 01:19:55 GMT

mwdb.cert.pl

Scripting and automation with **mwdblib**

CERT.PL

mwdblib installation

Setup environment

```
# Create virtualenv and activate
$ python3 -m venv venv
$ . venv/bin/activate
```

```
# Install mwdblib with CLI extras
(venv) $ pip install mwdblib[cli]
# ... and ipython for convenience
(venv) $ pip install ipython
```

If you don’t know what is virtualenv, read more:
Installing packages using pip and virtual environments — Python Packaging User Guide

Exercise #6: Get recent files

See: https://github.com/CERT-Polska/training-mwdb

Exercise #7: MWDBObject properties

See: https://github.com/CERT-Polska/training-mwdb

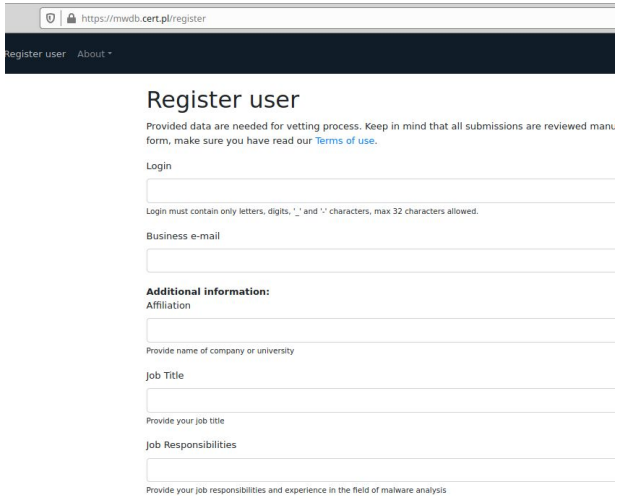
Exercise #8: Using mwdblib CLI

See: https://github.com/CERT-Polska/training-mwdb

mwdb.cert.pl

After the workshop, feel free to register!

https://mwdb.cert.pl/register



During vetting, we want to be able to identify you and get an actionable e-mail in case of problems

Hints for quick approval:

- use business e-mail (avoid gmail.com / protonmail.com / qq.com).

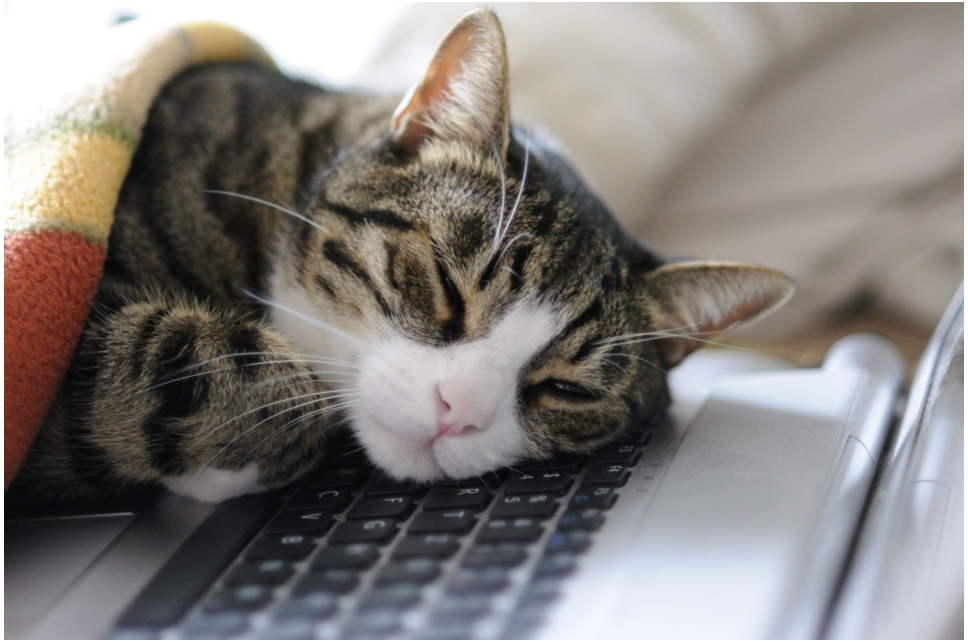
- provide some info about yourself (homepage, research blog, Twitter handle). Mention this workshop.

- don’t worry to ping us if we don’t answer for a few days

CERT.PL

mwdb.cert.pl

Coffee break



Agenda

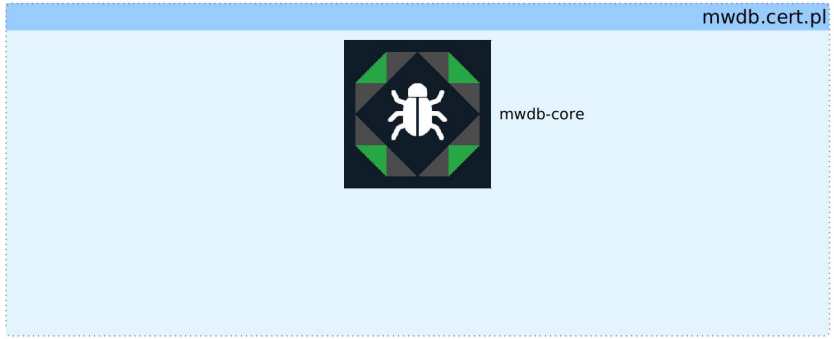
- **mwdb.cert.pl**
  - What the heck is **MWD**
  - Tour de **mwdb.cert.p**
  - Scripting and automati **mwdblib**
- **mwdb-core** and **karton**
  - Run a **self-hosted** mwdb-core and karton instances
  - Experiment with **karton-playground**
  - Distributed collaboration with mwdb **remotes**
  - Advanced programming techniques with **malduck**

Learn karton with the **karton-playground**

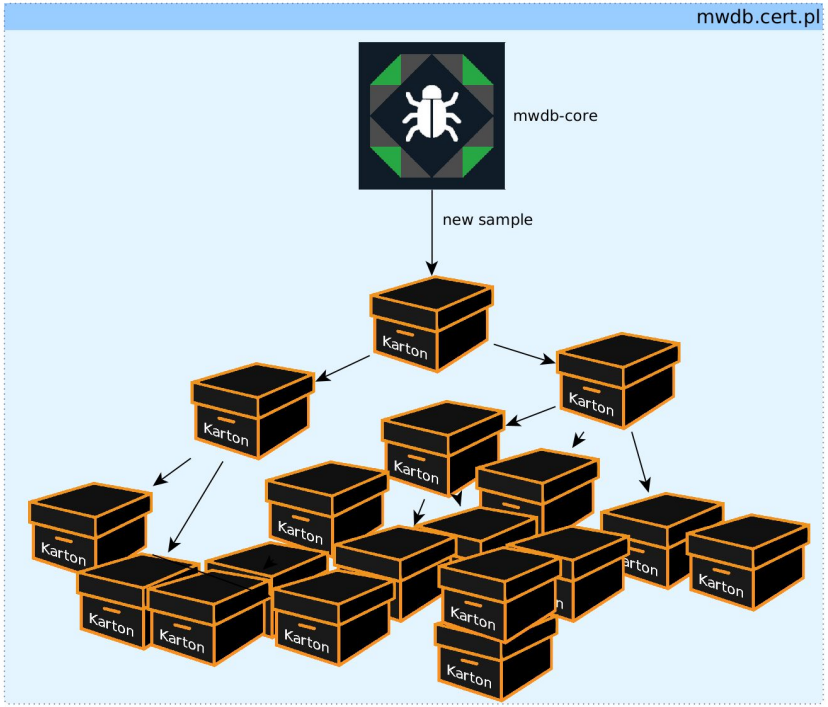
Run a **self-hosted** mwdb-core and karton instance

CERT.PL

mwdb-core



mwdb-core



mwdb-core

mwdb-core + karton = a usable service

MWDB is only a frontend.

To make it possible to create an environment similar to ours, we've decided to open-source the "engine" of our pipeline too.

- https://github.com/CERT-Polska/mwdb-core/
- https://github.com/CERT-Polska/karton

Karton Playground

- Karton Playground - a project dedicated for karton learners
- An easy way to set up the environment and get to work
- Not suitable for production
- https://github.com/CERT-Polska/karton-playground

image credit: wikipedia

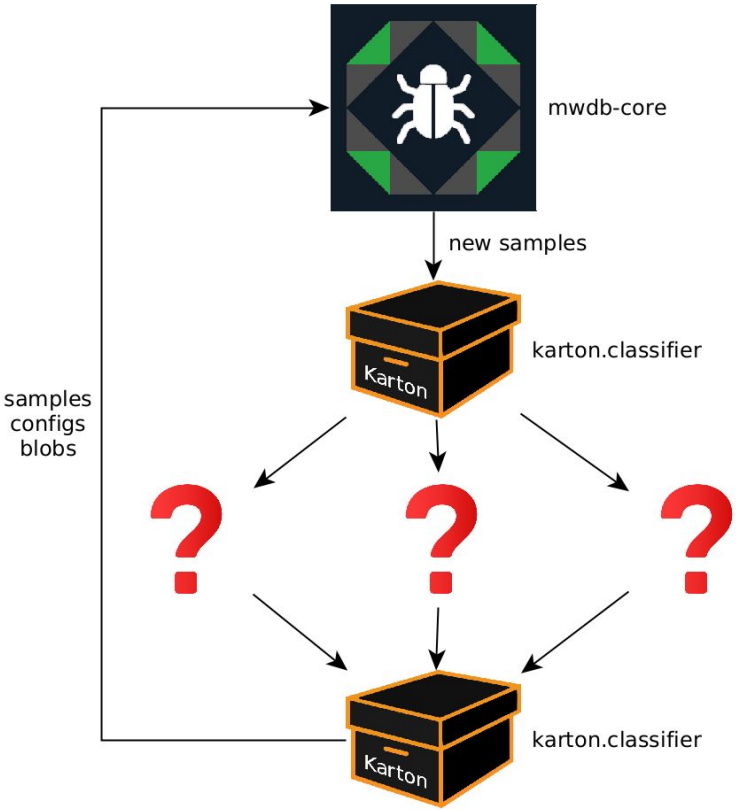
Karton Playground

```
git clone https://github.com/CERT-Polska/karton-playground.git
cd karton-playground
sudo docker-compose up  # this may take a while
```

- Go grab a cup of coffee - this will take a while
- But when it’s done, you will have a working instance on your local machine

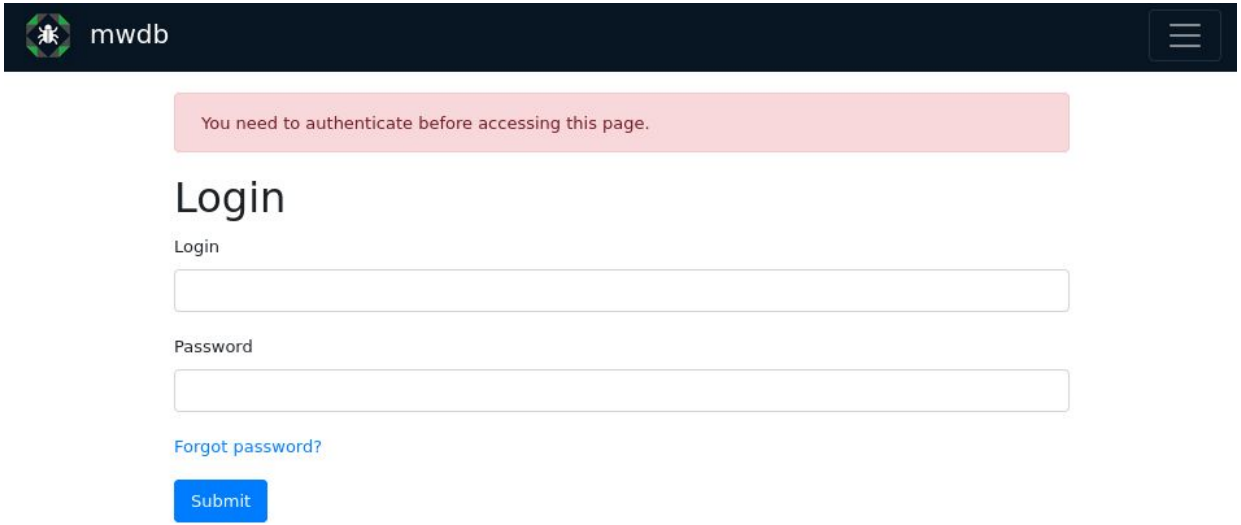
Karton Playground

While you wait...



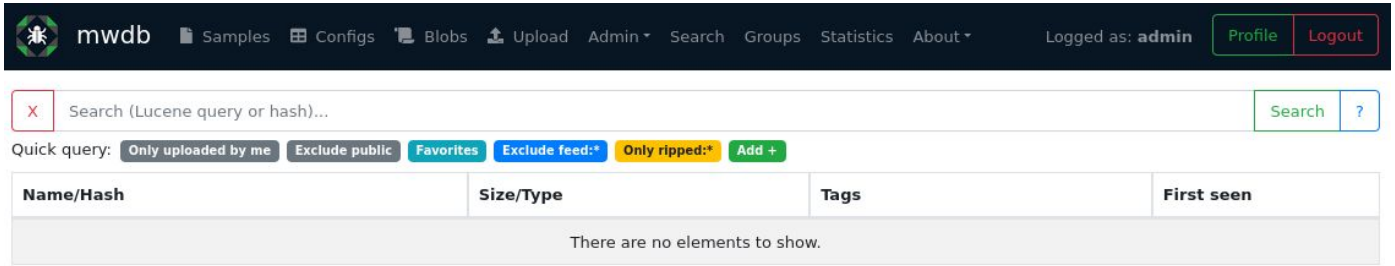
Karton Playground: click around

Navigate to http://127.0.0.1:8080. Login using `admin:admin`.



Karton Playground: click around

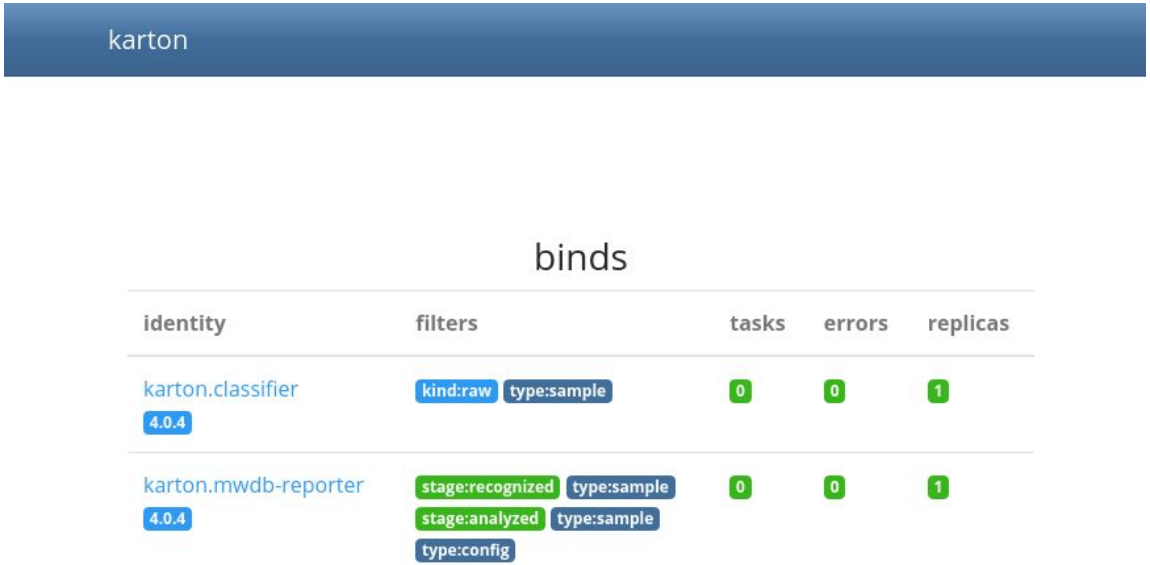
Navigate to http://127.0.0.1:8080. Login using `admin:admin`.



There is no malware yet… But that's about to change!

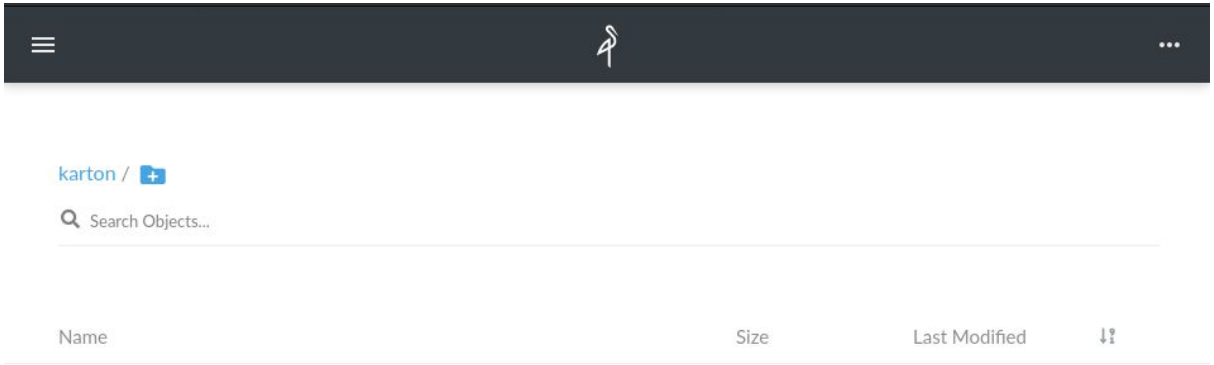
Karton Playground: click around

Check out the karton dashboard at http://127.0.0.1:8030/ too:



Karton Playground: click around

Optional: check out the minio interface http://127.0.0.1:8090/ (`mwdb:mwdbmwdb`)



Karton Playground exercise

Integrate an existing karton service into your pipeline: karton-autoit-ripper

https://github.com/CERT-Polska/karton-autoit-ripper

```
$ python3 -m venv venv
$ source ./venv/bin/activate
$ pip install karton-autoit-ripper

$ # playground-specific: copy local config to cwd
$ cp config/kartonlocal.ini karton.ini
$ karton-autoit-ripper
[2021-04-11 17:19:57,867][INFO] Service karton.autoit-ripper started
```

Karton Playground exercise

Download a sample, and verify its hash:

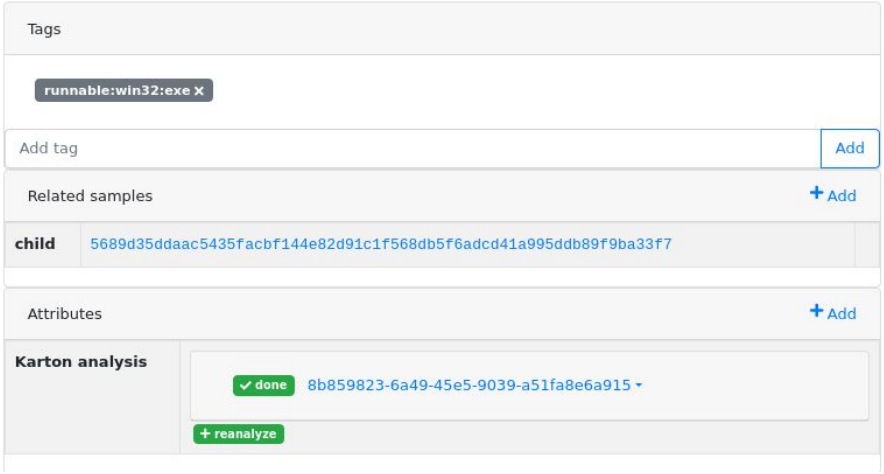
```
$ wget https://github.com/CERT-Polska/training-mwdb/blob/main/autoit-malware.bin
$ sha256sum autoit-malware.bin
a4816d4fecd6d2806d5b105c3aab55f4a1eb5deb3b126f317093a4dc4aab88a1 autoit-malware.bin
```

Finally, upload it to your local mwdb (http://127.0.0.1:8080, admin:admin)

```
$ karton-autoit-ripper
[2021-04-11 17:19:57,867][INFO] Service karton.autoit-ripper started
/home/msm/Projects/karton-playground/venv/lib/python3.8/site-packages/karton/core/logger.py:57: UserWarning: There is no active
  warnings.warn("There is no active log consumer to receive logged messages.")
[2021-04-11 17:19:57,871][INFO] Binding on: {'type': 'sample', 'stage': 'recognized', 'kind': 'runnable', 'platform': 'win32'}
[2021-04-11 17:19:57,871][INFO] Binding on: {'type': 'sample', 'stage': 'recognized', 'kind': 'runnable', 'platform': 'win64'}
[2021-04-11 17:20:10,645][INFO] Received new task - cbe177c0-a824-47be-a1c9-fb0aa4898f75
[2021-04-11 17:20:10,661][INFO] Found a possible autoit v3.26+ binary
[2021-04-11 17:20:14,149][INFO] Found embedded data, reporting!
[2021-04-11 17:20:14,150][INFO] Sending a task with script.au3
[2021-04-11 17:20:14,261][INFO] Looking for a binary embedded in the script
[2021-04-11 17:20:14,305][INFO] Task done - cbe177c0-a824-47be-a1c9-fb0aa4898f75
```

Karton Playground exercise

Volia!



Karton Playground exercise

- But using existing services is just half the fun
- For a real Karton experience, write your own service
- Download a template: https://github.com/CERT-Polska/training-mwdb/blob/main/karton-template.py

```python
class MyFirstKarton(Karton):
    identity = "karton.first"
    filters = [{"type": "sample", "stage": "recognized"}]

    def process(self, task: Task) -> None:
        sample_resource = task.get_resource("sample")  # Get the incoming sample
        self.log.info(f"Hi {sample_resource.name}, let me analyse you!")  # Log with self.log

        with sample_resource.download_temporary_file() as sample_file:  # Download to a temporary file
            result = do_your_processing(sample_file.name)  # And process it

        self.send_task(Task(
            {"type": "sample", "stage": "analyzed"},
            payload={"parent": sample_resource, "sample": Resource("result-name", result)},
        ))  # Upload the result as a sample:

if __name__ == "__main__":
    MyFirstKarton().loop()  # Here comes the main loop
```

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Karton Playground exercise

- Karton's "identity": `identity = "karton.first"`
- Python namespace: `import karton.first`
- Pypi package: `pip install karton-first`

```python
class MyFirstKarton(Karton):
    identity = "karton.first"
    filters = [{"type": "sample", "stage": "recognized"}]

    def process(self, task: Task) -> None:
        sample_resource = task.get_resource("sample")  # Get the incoming sample
        self.log.info(f"Hi {sample_resource.name}, let me analyse you!")  # Log with self.log

        with sample_resource.download_temporary_file() as sample_file:  # Download to a temporary file
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        ))  # Upload the result as a sample:

if __name__ == "__main__":
    MyFirstKarton().loop()  # Here comes the main loop
```

Karton Playground exercise

- What **are** these?

```python
class MyFirstKarton(Karton):
    identity = "karton.first"
    filters = [{"type": "sample", "stage": "recognized"}]

    def process(self, task: Task) -> None:
        sample_resource = task.get_resource("sample")  # Get the incoming sample
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        with sample_resource.download_temporary_file() as sample_file:  # Download to a temporary file
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        ))  # Upload the result as a sample:

if __name__ == "__main__":
    MyFirstKarton().loop()  # Here comes the main loop
```
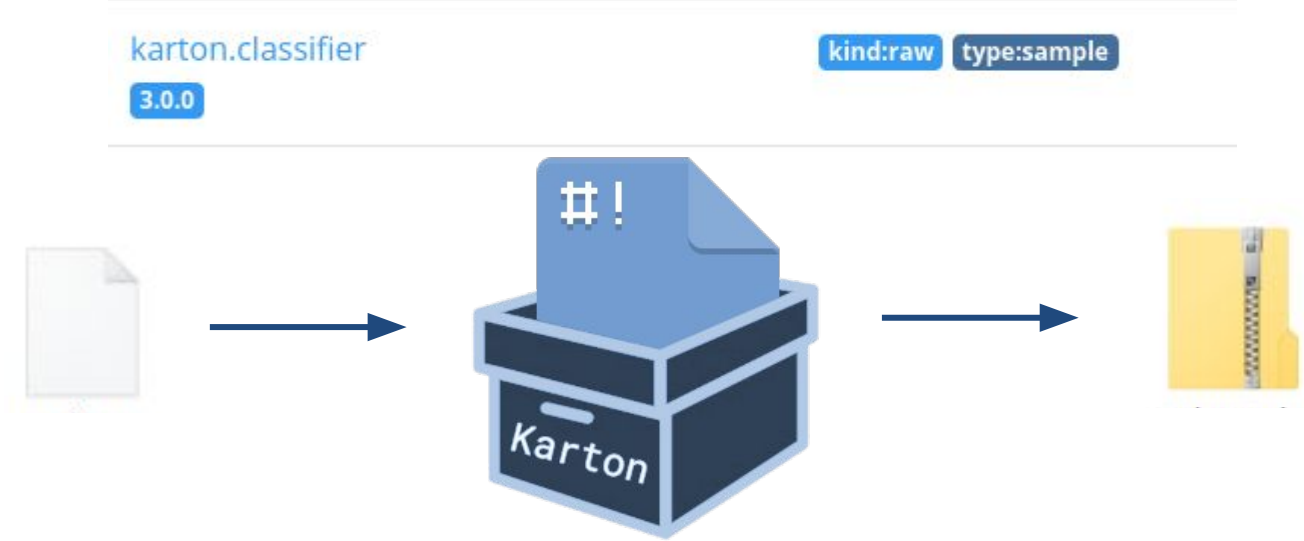
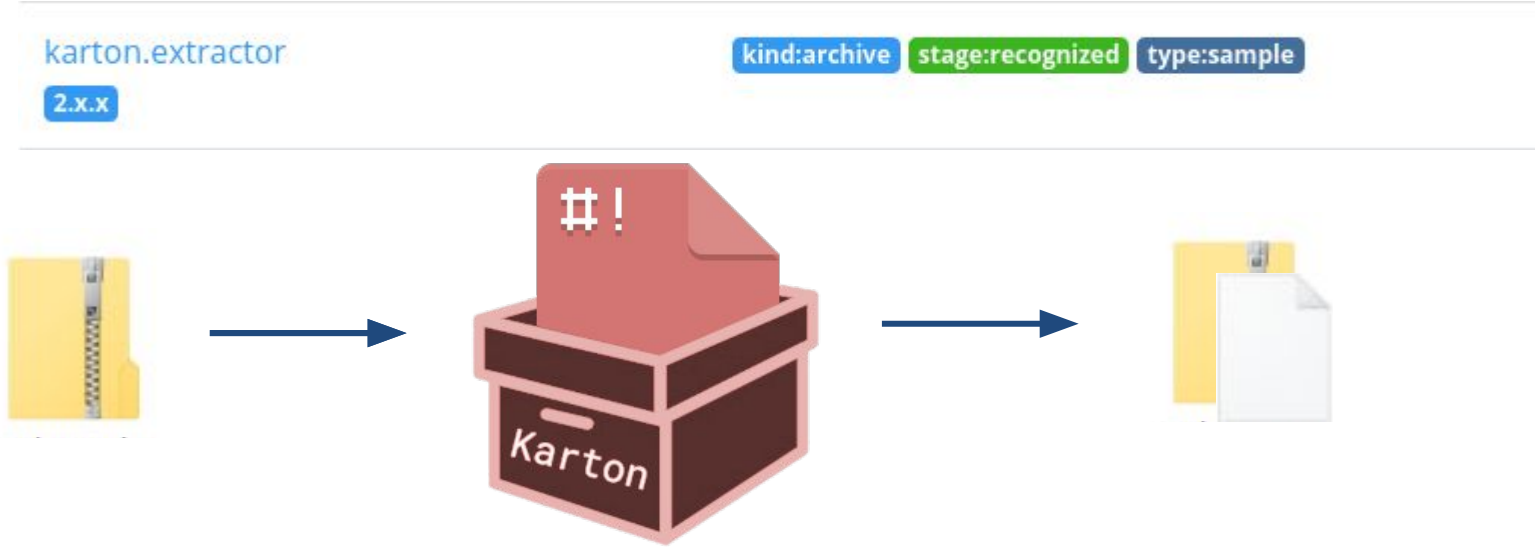
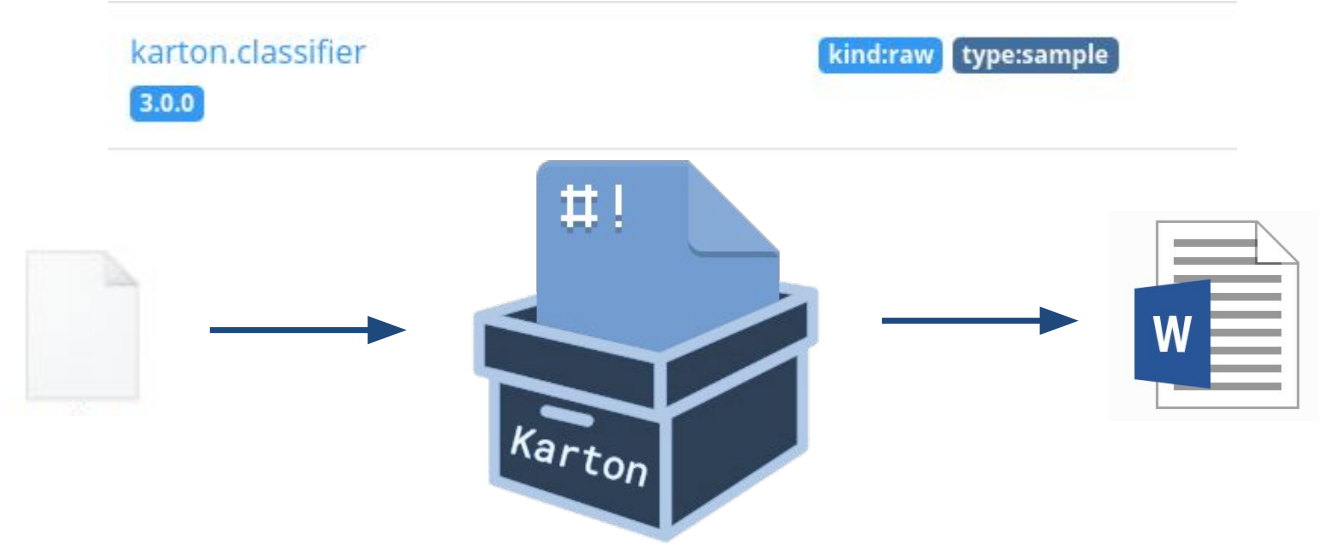

Karton pipeline



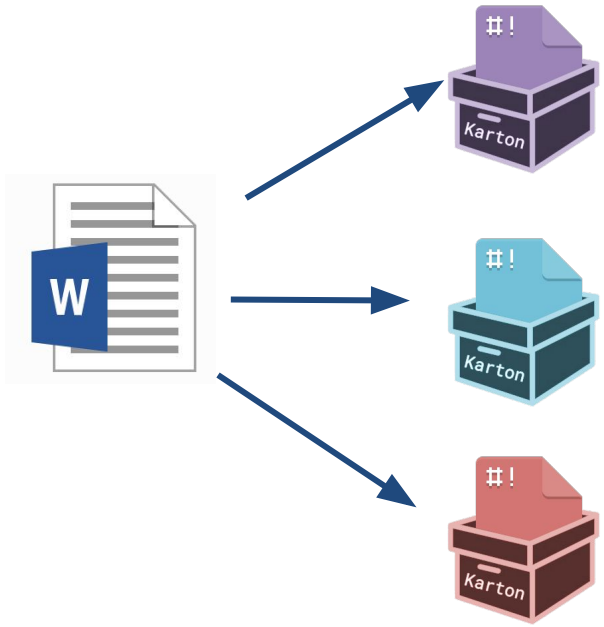
Karton pipeline



Karton pipeline



Karton pipeline



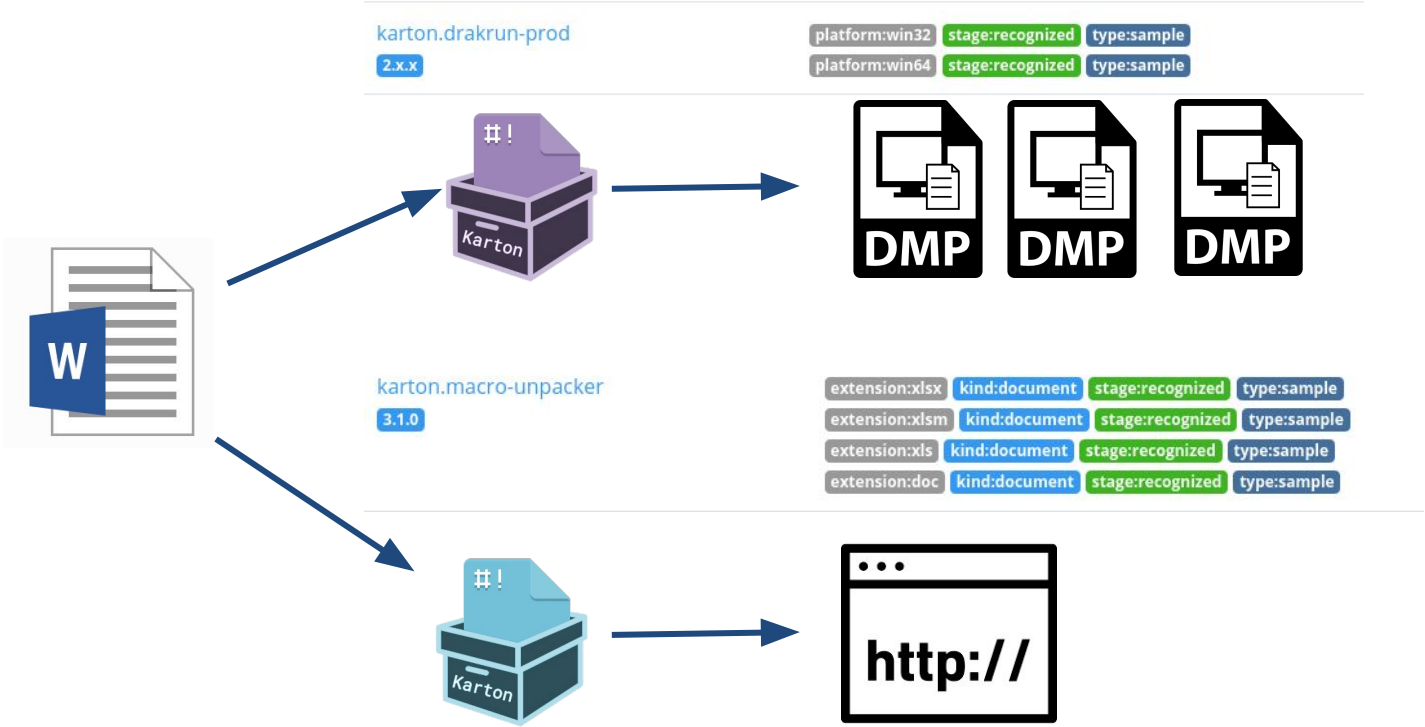
karton.cuckoo1
2.x.x
platform:win32 quality:high stage:recognized type:sample

karton.drakrun-prod
2.x.x
platform:win32 stage:recognized type:sample
platform:win64 stage:recognized type:sample

karton.macro-unpacker
3.1.0
extension:xlsx kind:document stage:recognized type:sample
extension:xlsm kind:document stage:recognized type:sample
extension:xls kind:document stage:recognized type:sample
extension:doc kind:document stage:recognized type:sample

karton.emodoc
2.x.x
extension:doc kind:document stage:recognized type:sample
extension:docx kind:document stage:recognized type:sample

Karton pipeline



Karton pipeline

karton.roach-ripper

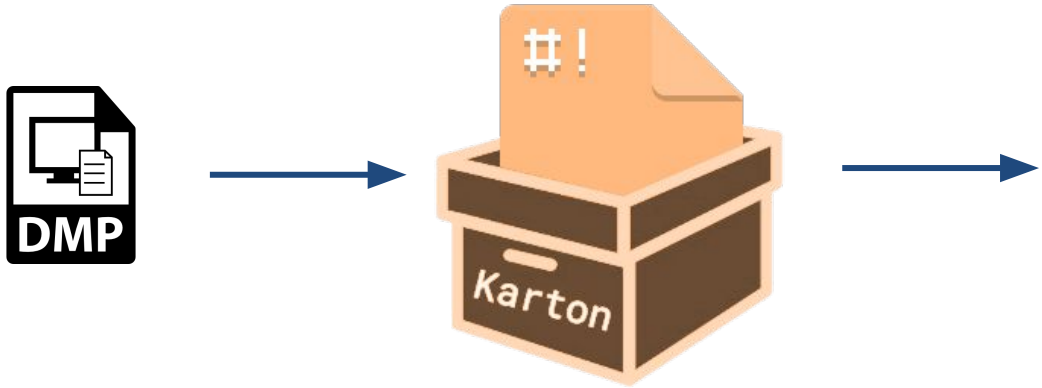
2.x.x

kind:runnable platform:win32 stage:recognized type:sample

kind:runnable platform:win64 stage:recognized type:sample

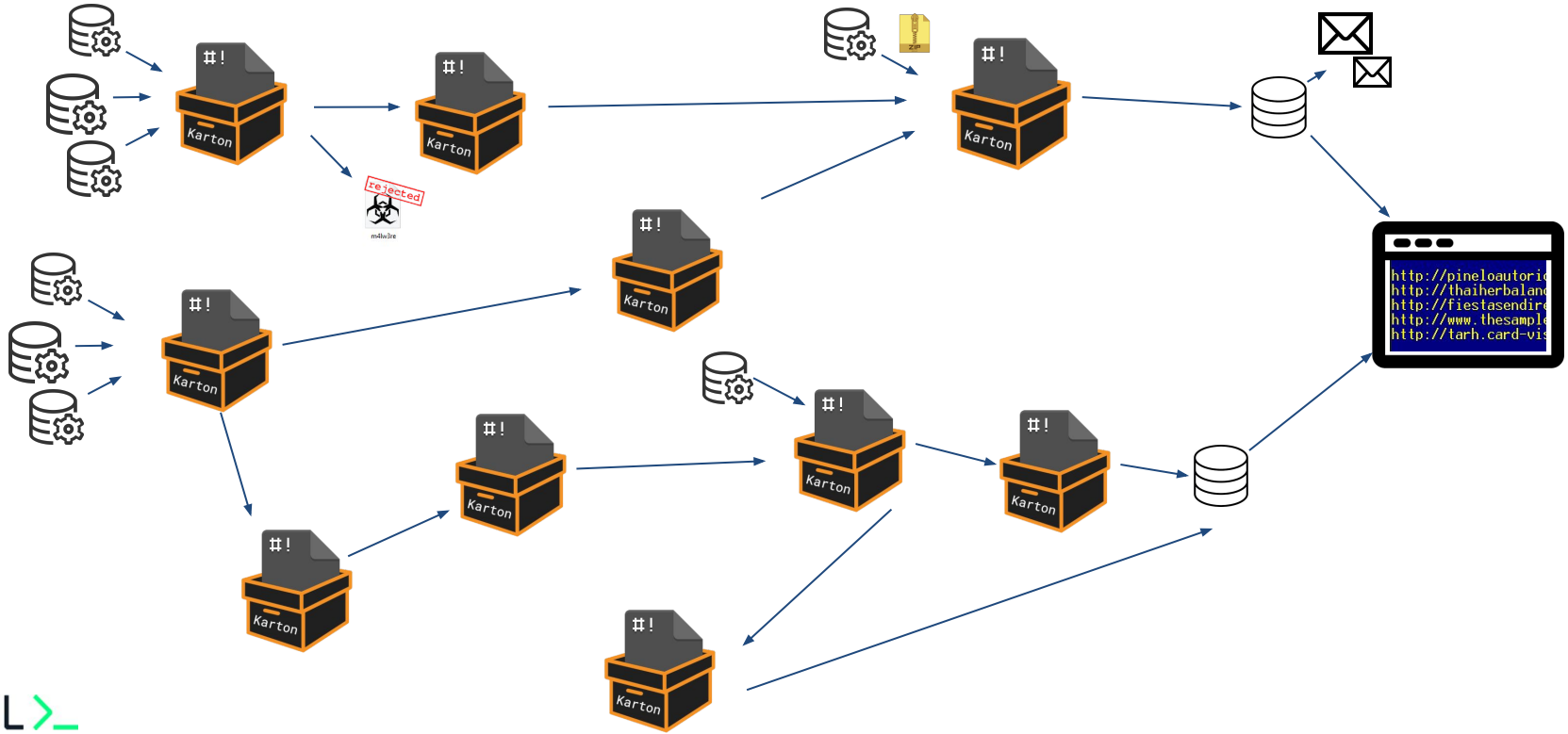
kind:runnable platform:linux stage:recognized type:sample

kind:drakrun-prod type:analysis



Family	zloader
Config type	static
+ binary_id	bot7
+ rc4key	NvuVIV3kbg7
+ rsa_key	-----BEGIN PUBLIC KEY----- MIG
+ type	zloader
+ urls	[{ "url": "https://militanttr

Karton pipeline in the real world



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Karton Playground exercise

- Karton tasks are routed in the system based on their headers
- Consumer declares what kind of tasks is it interested in
- Producer indicates the kind of produced task

```python
class MyFirstKarton(Karton):
    identity = "karton.first"
    filters = [{"type": "sample", "stage": "recognized"}]

    def process(self, task: Task) -> None:
        sample_resource = task.get_resource("sample")  # Get the incoming sample
        self.log.info(f"Hi {sample_resource.name}, let me analyse you!")  # Log with self.log

        with sample_resource.download_temporary_file() as sample_file:  # Download to a temporary file
            result = do_your_processing(sample_file.name)  # And process it

        self.send_task(Task(
            {"type": "sample", "stage": "analyzed"},
            payload={"parent": sample_resource, "sample": Resource("result-name", result)},
        ))  # Upload the result as a sample:

if __name__ == "__main__":
    MyFirstKarton().loop()  # Here comes the main loop
```

CERT.PL >_

Karton Playground exercise

- Karton = Consumer + Producer

```python
class Karton(Consumer, Producer):
    """
    This glues together Consumer and Producer - which is the most common use case
    """
```

```python
class MyFirstKarton(Karton):
    identity = "karton.first"
    filters = [{"type": "sample", "stage": "recognized"}]

    def process(self, task: Task) -> None:
        sample_resource = task.get_resource("sample")  # Get the incoming sample
        self.log.info(f"Hi {sample_resource.name}, let me analyse you!")  # Log with self.log

        with sample_resource.download_temporary_file() as sample_file:  # Download to a temporary file
            result = do_your_processing(sample_file.name)  # And process it

        self.send_task(Task(
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            payload={"parent": sample_resource, "sample": Resource("result-name", result)},
        ))  # Upload the result as a sample:

if __name__ == "__main__":
    MyFirstKarton().loop()  # Here comes the main loop
```

Karton Playground exercise

- Resource - bigger files, hosted on minio (or other s3 compatible storage server)

```python
class MyFirstKarton(Karton):
    identity = "karton.first"
    filters = [{"type": "sample", "stage": "recognized"}]

    def process(self, task: Task) -> None:
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        with sample_resource.download_temporary_file() as sample_file:  # Download to a temporary file
            result = do_your_processing(sample_file.name)  # And process it

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            {"type": "sample", "stage": "analyzed"},
            payload={"parent": sample_resource, "sample": Resource("result-name", result)},
        ))  # Upload the result as a sample:

if __name__ == "__main__":
    MyFirstKarton().loop()  # Here comes the main loop
```

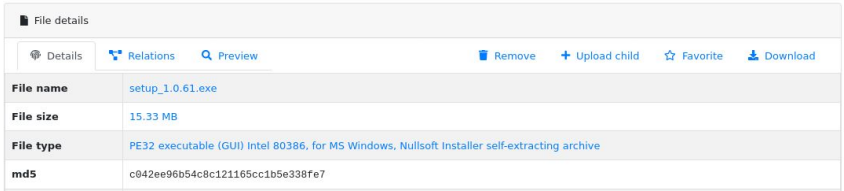
Karton Playground exercise

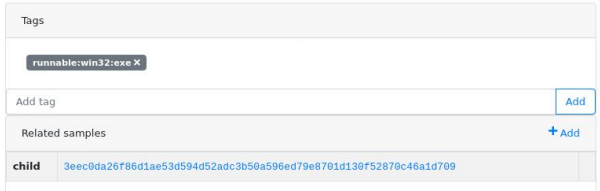
- Download a template: https://github.com/CERT-Polska/training-mwdb/blob/main/karton-template.py
- Your task: edit the template, and:
  - Run the `strings` utility on every incoming sample
  - Save the result in a variable (use `subprocess.check_output`)
  - Upload the result to mwdb (already handled in the template
- Start your first karton!

```
$ python3
Python 3.8.5 (default, Jan 27 2021, 15:41:15)
>>> import subprocess
>>> s = subprocess.check_output(["strings", "/bin/ls"])
>>> print(s.decode())
/lib64/ld-linux-x86-64.so.2
.j<c~
MB#F-
Libselinux.so.1
...
```

Karton Playground exercise: solution

```
$ python3 karton-template.py
[2021-04-14 20:56:28,927][INFO] Service karton.first started
/home/msm/Projects/karton-playground/venv/lib/python3.8/site-packages/karton/core
  warnings.warn("There is no active log consumer to receive logged messages.")
[2021-04-14 20:56:28,928][INFO] Binding on: {'type': 'sample', 'stage': 'recogniz
[2021-04-15 08:45:10,546][INFO] Received new task - c17c9659-49d6-444c-b208-f00fc
[2021-04-15 08:45:10,547][INFO] Hi setup_1.0.61.exe, let me analyse you!
[2021-04-15 08:45:11,100][INFO] Task done - c17c9659-49d6-444c-b208-f00fcd36bc5b
```





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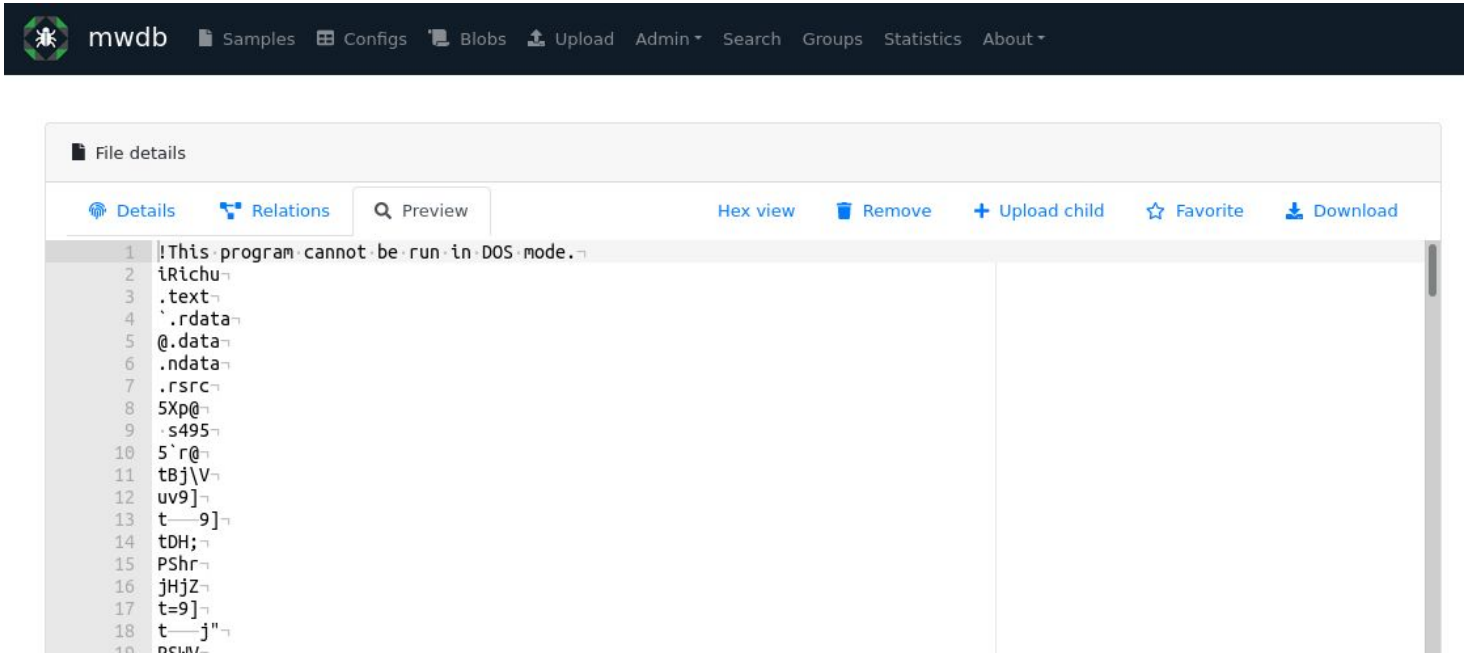
Karton Playground exercise: solution



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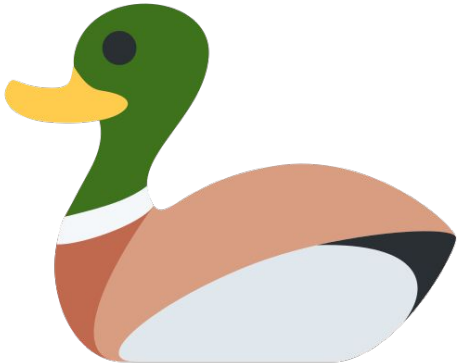
Learn karton with the **karton-playground**

Automated unpacking with **malduck**



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Malduck 🦆

- Malduck is a swiss army knife for malware researchers
  - Cryptographic functions
  - Compression algorithms
  - Hashing functions
  - Bit-twiddling hacks
  - String utilities
  - Memory model objects (unified view of PE, ELF, IDA, cuckoo or raw files, etc)
  - Binary extraction engine
- It’s generic enough to be used everywhere, but developed with malware in mind

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  - **Binary extraction engine**
- It’s generic enough to be used everywhere, but developed with malware in mind

Malduck 🦆

- Module file structure:

```
$ fdfind . modules
modules/__init__.py
modules/citadel
modules/citadel/__init__.py
modules/citadel/citadel.py
modules/citadel/citadel.yar
```

```
from .citadel import Citadel
```

Malduck 🦆 Framework

```
rule citadel : zeus
{
    meta:
        author = "mak"
        module = "citadel"
    strings:
        $briankerbs = "Coded by BRIAN KREBS for personal use only. I love my job & wife."

        $cit_aes_xor = {  81 30 [4] 0F B6 50 03 0F B6 78 02 81 70 04 [4] 81 70 08 [4] 81
                          70 0C [4] C1 E2 08 0B D7 }
        $cit_salt = { 8A D1 80 E2 07 C0 E9 03 47 83 FF 04 }
        $cit_login = { 30 [1-2] 8A 8? [4] 32  }
        $cit_getpes = { 68 [2] 00 00 8D ( 84 24 | 85) [4] 50 8D ( 85 ?? ?? ?? ?? | 44 24 ?? )
                        50 E8 [4] B8 [2] 00 00 50 68 }
        $cit_base_off = { 5? 8D 85 [4] E8 [4] 6A 20 68 [4] 8D [2] 50 E8 [4] 8D 85 [4] 50 }

    condition:
        3 of them
}
```

Malduck 🦆 Framework

```python
import logging

from malduck.extractor import Extractor

log = logging.getLogger()


class Citadel(Extractor):
    family = "citadel"
    yara_rules = "citadel",
    overrides = ["zeus"]

    @Extractor.extractor("briankerbs")
    def citadel_found(self, p, addr):
        log.info('[+] `Coded by Brian Krebs` str @ %X' % addr)
        return {'family': 'citadel'}

    @Extractor.extractor
    def cit_salt(self, p, addr):
        salt = p.uint32v(addr - 8)
        log.info('[+] Found salt @ %X - %x' % (addr, salt))
        return {'salt': salt}
```

Malduck 🦆 Framework

- Install malduck config extractor from pypi
- Download and extract modules
- Start the extractor

```
$ python3 -m venv venv
$ source ./venv/bin/activate.fish
$ pip install karton-config-extractor
$
$ wget https://github.com/CERT-Polska/training-mwdb/raw/main/modules.7z
$ 7z x modules.7z
$ karton-config-extractor --modules modules/
```

Malduck 🦆 Framework

- Install malduck config extractor from pypi
- Download and extract modules
- Start the extractor

```
$ python3 -m venv venv
$ source ./venv/bin/activate.fish
$ pip install karton-config-extractor
$
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$ 7z x modules.7z
$ karton-config-extractor --modules modules/
```

```
$ karton-config-extractor --modules modules/
[2021-04-15 16:30:14,998][INFO] Service karton.config-extractor started
/home/msm/Projects/karton-playground/venv/lib/python3.8/site-packages/karton/core/logger.py:57:
  warnings.warn("There is no active log consumer to receive logged messages.")
[2021-04-15 16:30:15,001][INFO] Binding on: {'type': 'sample', 'stage': 'recognized', 'kind': '
[2021-04-15 16:30:15,001][INFO] Binding on: {'type': 'sample', 'stage': 'recognized', 'kind': '
[2021-04-15 16:30:15,001][INFO] Binding on: {'type': 'sample', 'stage': 'recognized', 'kind': '
[2021-04-15 16:30:15,001][INFO] Binding on: {'type': 'analysis', 'kind': 'drakrun-prod'}
[2021-04-15 16:30:15,001][INFO] Binding on: {'type': 'analysis', 'kind': 'drakrun'}
[2021-04-15 16:30:22,000][INFO] Received new task - cecf2494-07b7-45a0-97c7-012bab4fe74f
[2021-04-15 16:30:22,002][INFO] Analyzing original binary
[2021-04-15 16:30:22,213][INFO] Got config: {"salt": 4073311727, "family": "citadel"}
[2021-04-15 16:30:22,215][INFO] Task done - cecf2494-07b7-45a0-97c7-012bab4fe74f
```

Malduck 🦆 Framework

- Stretch challenge: extend the module with extractor for **`login_key`**
  - It's very similar to the cit_salt
  - But instead of **`addr - 8`** use **`addr + 5`**
  - And read a string from that address (with `p.asciiz(addr)`)
  - Why? Ask a reverse-engineer :).

Malduck 🦆 Framework

- Stretch challenge: extend the module with extractor for **`login_key`**
  - It's very similar to the cit_salt
  - But instead of **`addr - 8`** use **`addr + 5`**
  - And read a string from that address (with `p.asciiz(addr)`)
  - Why? Ask a reverse-engineer :).

- Intended solution:

```
@Extractor.extractor
def cit_login(self, p, addr):
    log.info('[+] Found login_key xor @ %X' % addr)

    hit = p.uint32v(addr + 5)
    if p.is_addr(hit):
        return {'login_key': p.asciiz(hit)}
```

Q & A

https://**github.com**/CERT-Polska/
https://**mwdb.readthedocs.io/**
https://**karton-core.readthedocs.io**/en/latest/
https://**malduck.readthedocs.io/**
https://**mwdb.cert.pl/**
https://**www.cert.pl**/en/

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