AIL Framework for Analysis of Information Leaks

Workshop - A generic analysis information leak open source software

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Objectives of the workshop

Our objectives of the workshop

- Demonstrate why data-analysis is critical in information security
- Explain challenges and the design of the AIL framework
- Learn how to install and start AIL
- Learn how to properly feed AIL with custom data
- Learn how to manage current modules
- Learn how to create new modules
- Practical part

Your objectives of the workshop

What are your expectations?

Sources of leaks

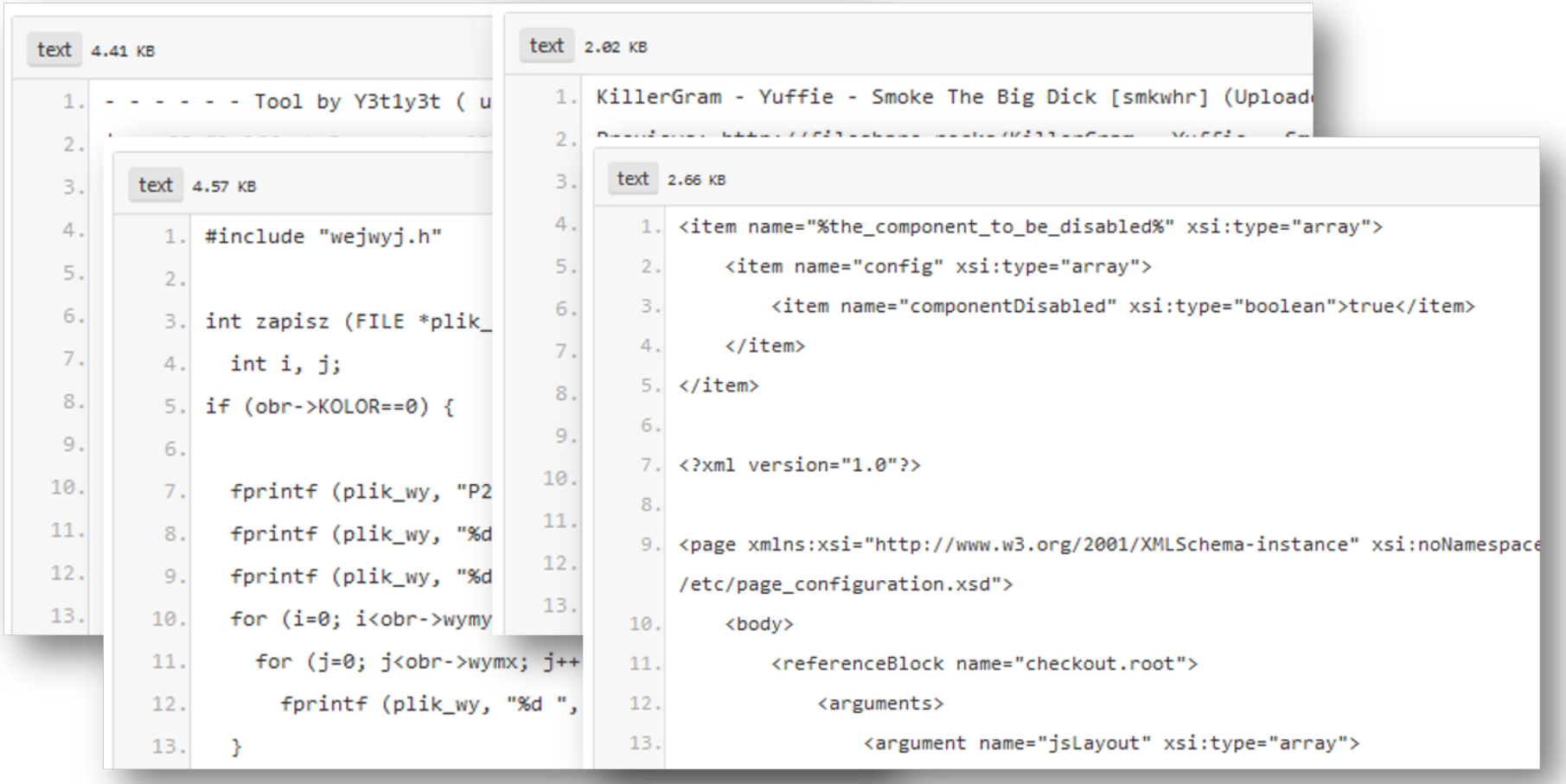
Sources of leaks: Paste monitoring

- Example: `http://pastebin.com/`
  - Easily storing and sharing text online
  - Used by programmers and legitimate users
    $\rightarrow$ Source code & information about configurations

Sources of leaks: Paste monitoring

- Example: `http://pastebin.com/`
  - Easily storing and sharing text online
  - Used by programmers and legitimate users
    $\rightarrow$ Source code & information about configurations
- Abused by attackers to store:
  - List of vulnerable/compromised sites
  - Software vulnerabilities (e.g. exploits)
  - Database dumps
    $\rightarrow$ User data
    $\rightarrow$ Credentials
    $\rightarrow$ Credit card details
  - More and more ...

Examples of pastes



text 4.41 KB

```
- - - - - - Tool by Y3t1y3t ( u
```

text 2.02 KB

```
KillerGram - Yuffie - Smoke The Big Dick [smkwhr] (Upload
```

text 4.57 KB

```
#include "wejwyj.h"

int zapisz (FILE *plik_
  int i, j;
if (obr->KOLOR==0) {

  fprintf (plik_wy, "P2
  fprintf (plik_wy, "%d
  fprintf (plik_wy, "%d
  for (i=0; i<obr->wymy
    for (j=0; j<obr->wymx; j++
      fprintf (plik_wy, "%d ",
  }
```

text 2.66 KB

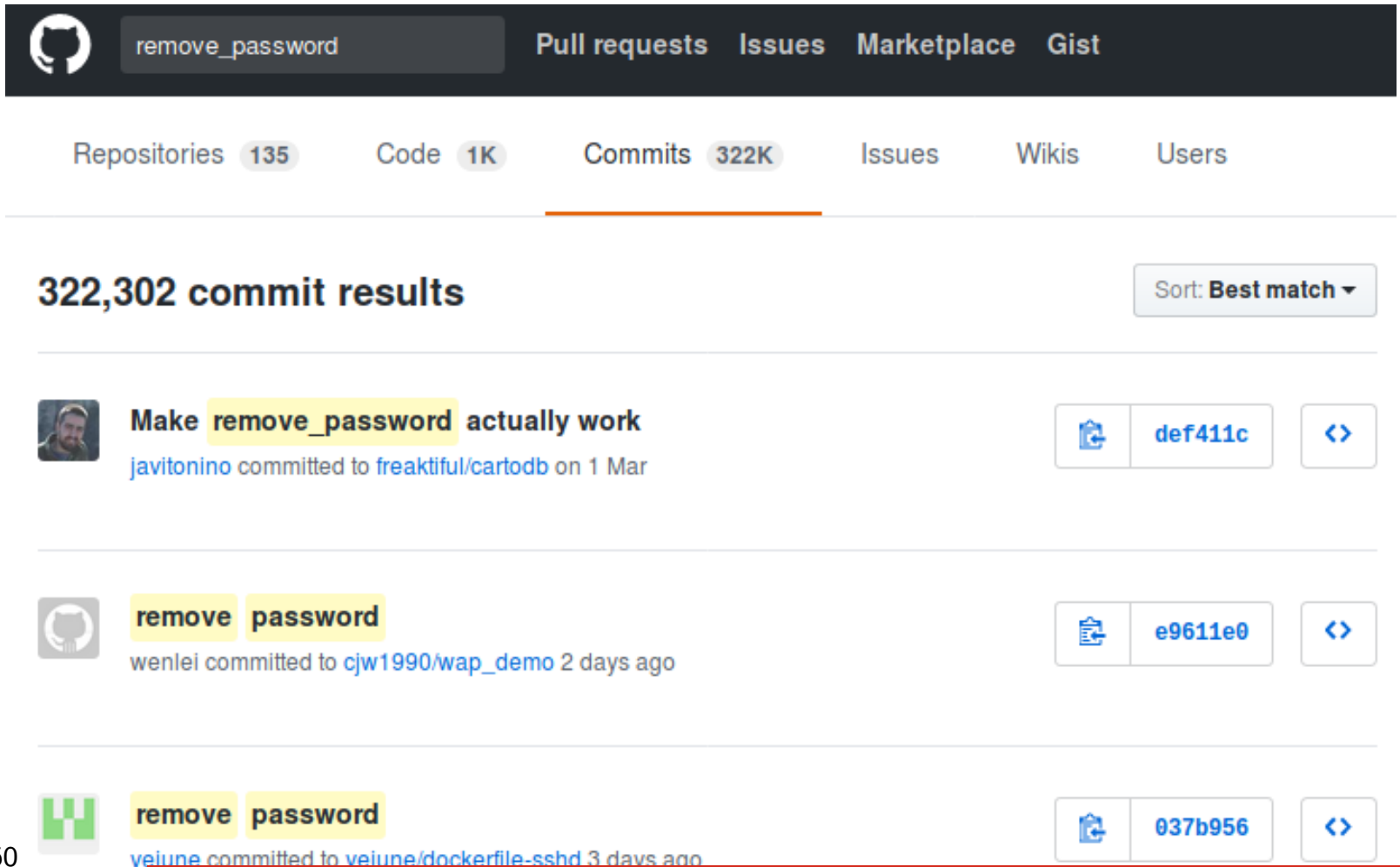
```
<item name="%the_component_to_be_disabled%" xsi:type="array">
    <item name="config" xsi:type="array">
        <item name="componentDisabled" xsi:type="boolean">true</item>
    </item>
</item>

<?xml version="1.0"?>

<page xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespace
/etc/page_configuration.xsd">
    <body>
        <referenceBlock name="checkout.root">
            <arguments>
                <argument name="jsLayout" xsi:type="array">
```

Sources of leaks: Others

- Mistakes from users
  - https://github.com/search?q=remove_password&type=Commits&ref=searchresults



Sources of leaks: Others

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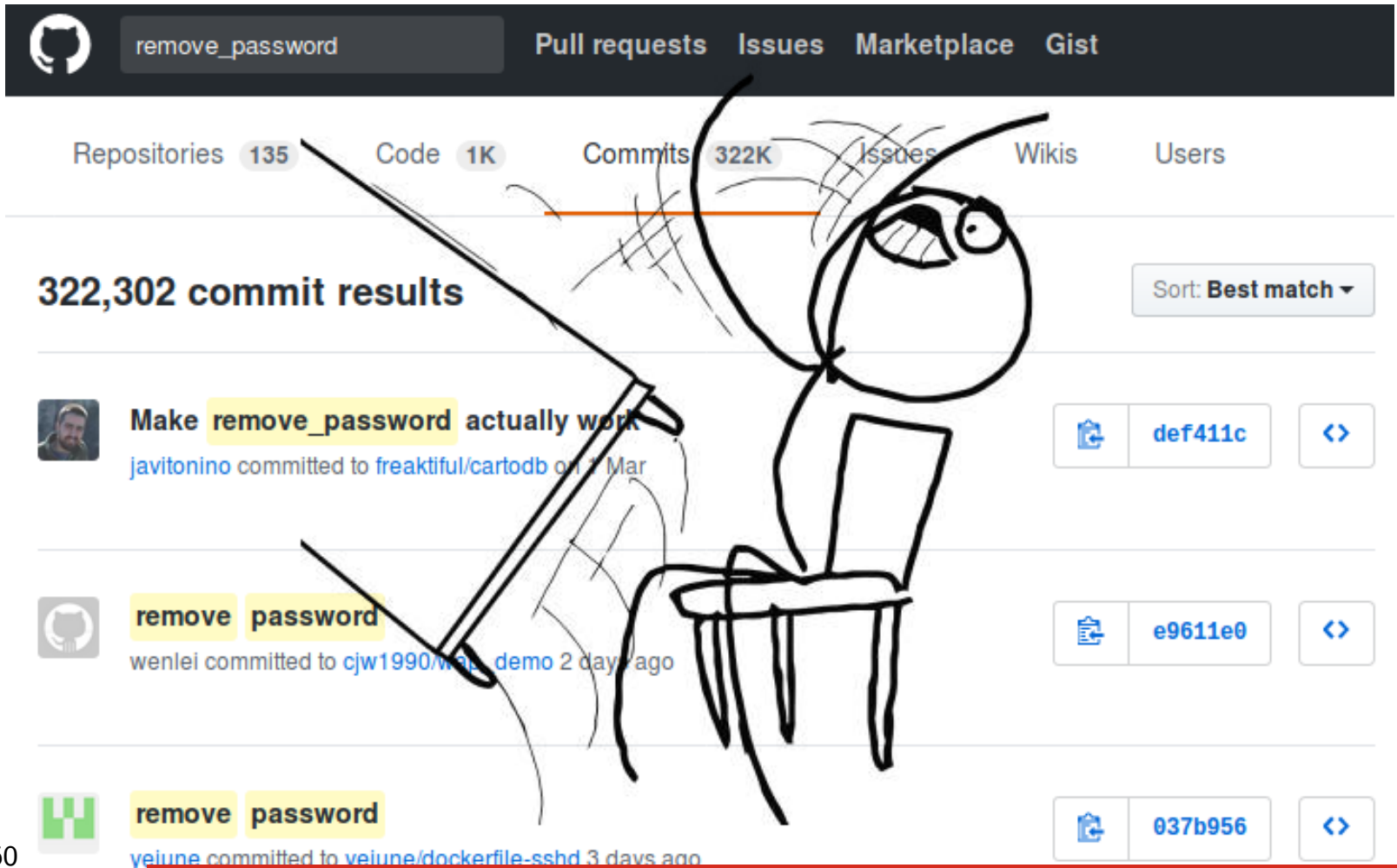


Are leaks frequent?

Yes!

And it's important to detect them.

Paste monitoring at CIRCL: Statistics

- Monitored paste sites: 27
  - *pastebin.com*
  - *ideone.com*
  - ...

Table: Statistics for 2016

Pastes 2016	Monthly average	Total
Fetched pastes	1 547 094	18 565 124
Security related (TR-46)	21	252
Incidents & investigations	54	649

AIL Framework

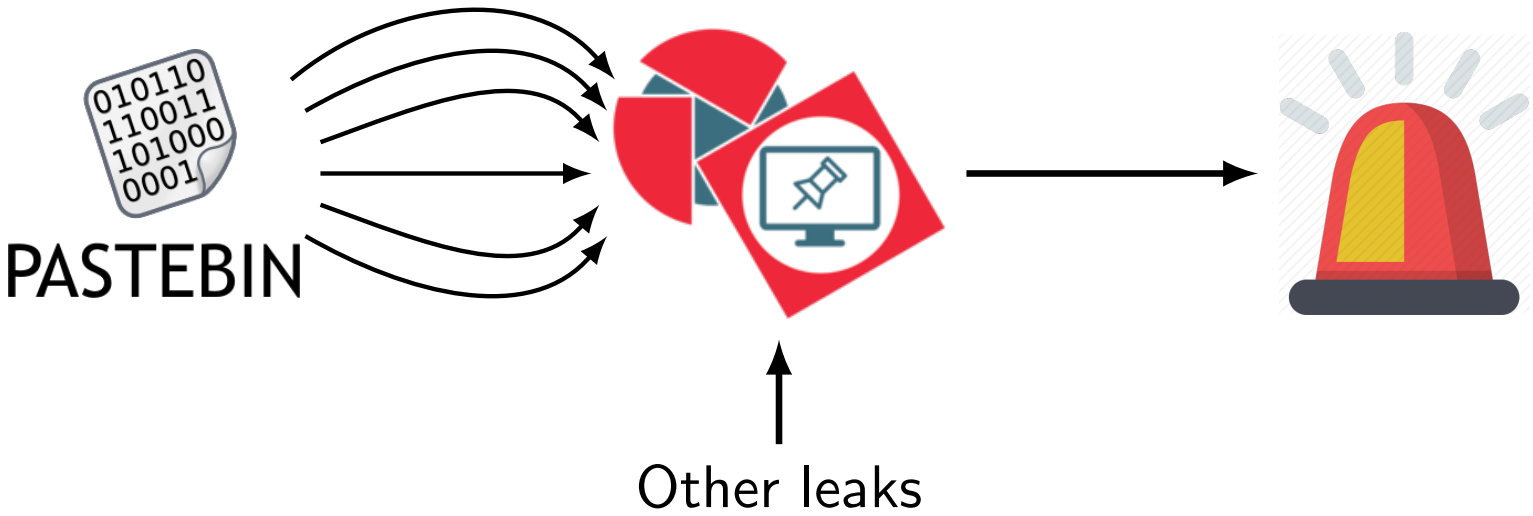
From a requirement to a solution: AIL Framework

History:

- AIL initially started as an internship project (2014) to evaluate the feasibility to automate the analysis of (un)structured information to find leaks.
- In 2017, AIL framework is an open source software in Python. The software is actively used (and maintained) by CIRCL.

AIL Framework: A framework for Analysis of Information Leaks

"AIL is a modular framework to analyse potential information leaks from unstructured data sources like pastes from Pastebin."



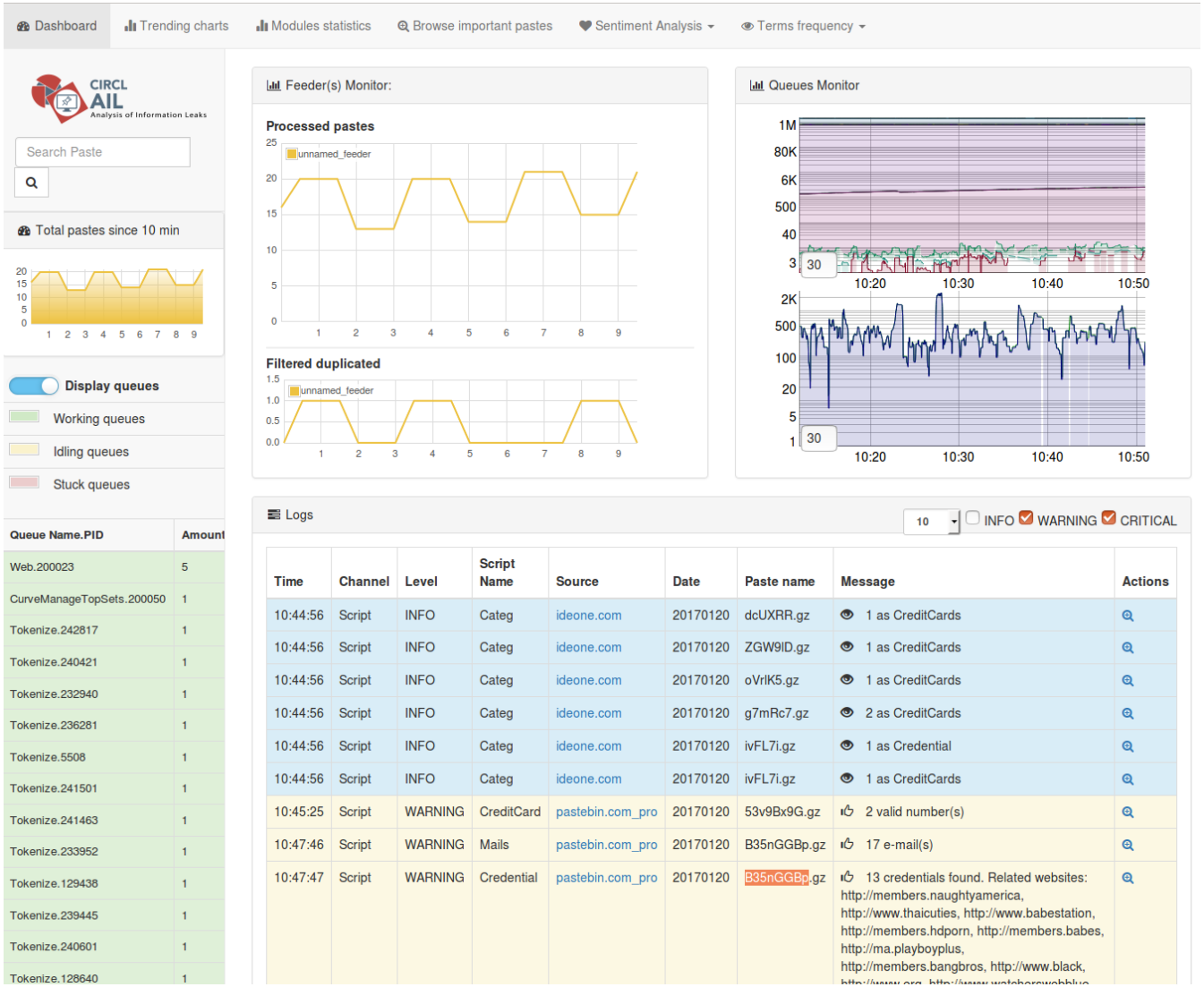
AIL Framework: Current capabilities

- Extending AIL to add a new **analysis module** can be done in 50 lines of Python
- The framework **supports multi-processors/cores by default**. Any analysis module can be started multiple times to support faster processing during peak times or bulk import
- **Multiple** concurrent **data input**

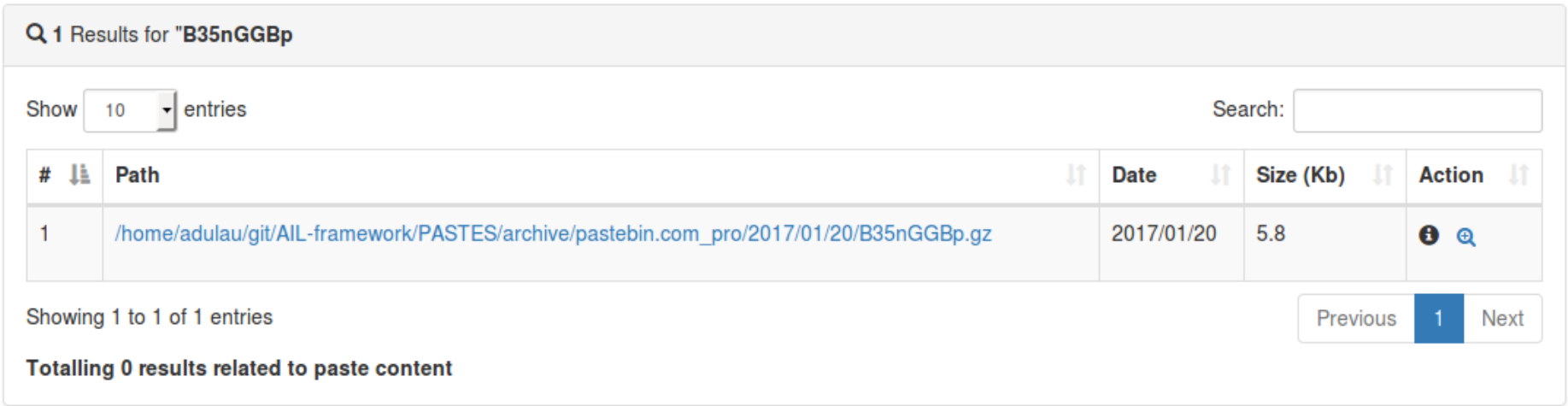
AIL Framework: Current features

- Extracting **credit cards numbers, credentials, phone numbers, ...**
- Extracting and validating potential **hostnames**
- Keeps track of **duplicates**
- **Full-text indexer** to index unstructured information
- Terms, sets and regex **tracking and occurences**
- **Sentiment/Mood analyser** for incoming data
- Modules manager
- And many more

Example: Following a notification (0) - Dashboard



Example: Following a notification (1) - Searching



1 Results for "B35nGGBp

Show 10 entries

Search:

#	Path	Date	Size (Kb)	Action
1	/home/adulau/git/AIL-framework/PASTES/archive/pastebin.com_pro/2017/01/20/B35nGGBp.gz	2017/01/20	5.8	

Showing 1 to 1 of 1 entries

Previous 1 Next

Totalling 0 results related to paste content

Example: Following a notification (2) - Metadata

Date	Source	Encoding	Language	Size (Kb)	Mime	Number of lines	Max line length
20/01/2017	pastebin.com_pro	text/plain	('en', 1.0)	5.8	text/plain	510	336

Duplicate list:

Show 10 entries Search:

Hash type	Paste info	Date	Path
tlsh	Similarity: 93%	2017-01-12	/home/adulau/git/AIL-framework/PASTES/archive/pastebin.com_pro/2017/01/12/WeizLQUx.gz
tlsh	Similarity: 93%	2017-01-17	/home/adulau/git/AIL-framework/PASTES/archive/pastebin.com_pro/2017/01/17/Xqbx62vU.gz
tlsh	Similarity: 93%	2017-01-10	/home/adulau/git/AIL-framework/PASTES/archive/pastebin.com_pro/2017/01/10/iyfet4UM.gz
tlsh	Similarity: 92%	2017-01-14	/home/adulau/git/AIL-framework/PASTES/archive/pastebin.com_pro/2017/01/14/G7AB7q1m.gz
tlsh	Similarity: 92%	No date available	/home/adulau/git/AIL-framework/PASTES/archive/pastebin.com_pro/2016/12/31/CpDdkKbU.gz

Example: Following a notification (3) - Browsing content

Content:

```
http://members2.mofosnetwork.com/access/login/
somosextremos:buddy1990
brazzers_glenn:cocklick
brazzers61:braves01

http://members.naughtyamerica.com/index.php?m=login
gernblanston:3unc2352
Janhuss141200:310575
igetalliwant:1377zeph
pwilks89:mon22key
Bman1551:hockey

MoFos IKnowThatGirl PublicPickUps
http://members2.mofos.com
Chrismagg40884:loganm40
brando1:zzbrando1
aacoen:1q2w3e4r
1rstunkle23:my8self

BraZZers
http://ma.brazzers.com
gcjensen:gcj21pva
skycsc17:rbcdnd

                                ############################################################
                                    >| Get Daily Update Fresh Porn Password Here |<

                                          =>   http://www.erq.io/4mF1
```

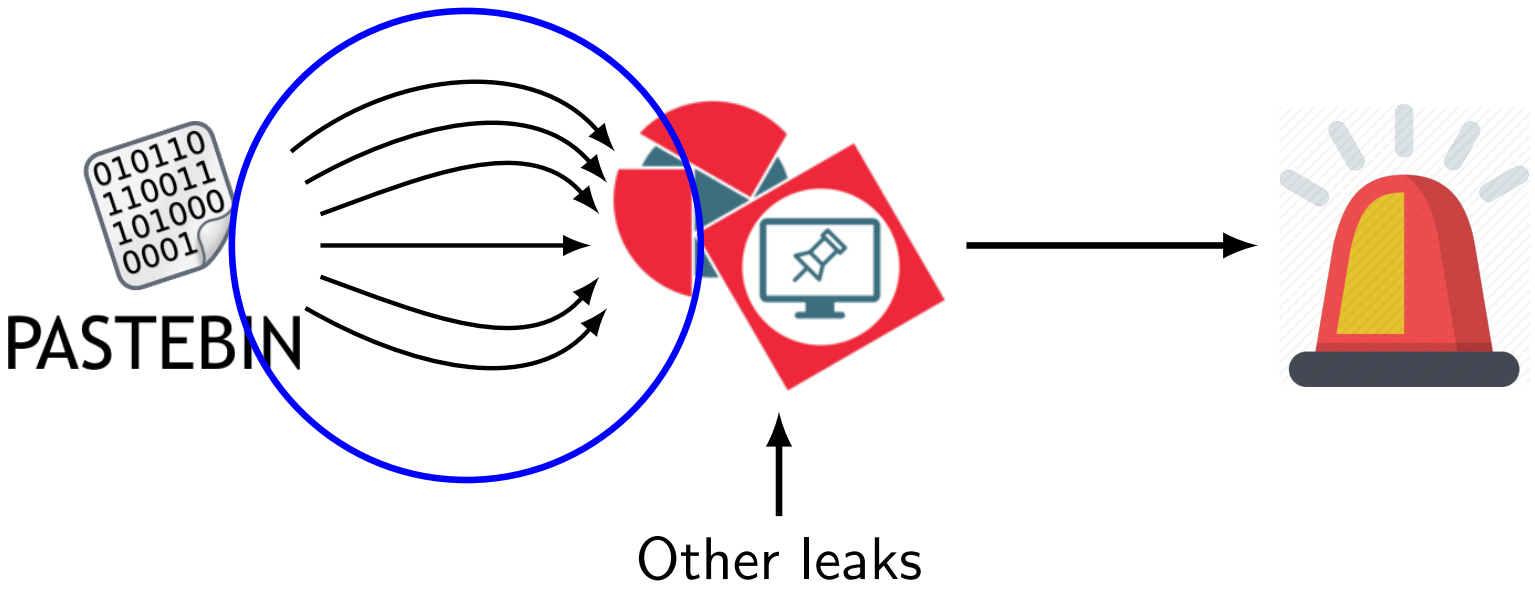
Example: Following a notification (3) - Browsing content

Content:

```
Over 50000+ custom hacked xxx passwords by us! Thousands of free xxx passwords to the hottest paysites!

##########################################################
 >| Get Fresh New Premium XXX Site Password Here |<

  =>   http://www.erq.io/4mF1


##########################################################



http://ddfnetwork.com/home.html
eu172936:hCSBgKh
UecwB6zs:159X0$!r#6K78FuU

http://pornxn.stiffia.com/user/login
feldwWek8939:RObluJ8XtB
dabudka:17891789
brajits:brajits1

http://members.pornstarplatinum.com/sblogin/login.php/
gigiriveracom:xxxjay
jayx123:xxxjay69

http://members.vividceleb.com/
Rufio99:fairhaven
ScHiFRvi:102091
Chaos84:HOLE5244
Riptor705:blade7
Domi8
```

Pystemon

Pystemon: A monitoring tool for PasteBin-alike sites



Pystemon: Current capabilities

- Flexible design, minimal effort to add another paste* site
- Use custom download functions for complex pastie sites
- Uses multiple threads per unique site to download the pastes
- (optional) Uses random User-Agents
- (optional) Uses random proxies
- Removes a proxy if it is unreliable (fails 5 times)
- (optional) Compress saved files with Gzip. (no zip to limit external dependencies)
- And more...

Setting up the framework

Setting up AIL-Framework from source or virtual machine

Setting up AIL-Framework from source

```
git clone https://github.com/CIRCL/AIL-framework.git
cd AIL-framework
./installing_deps.sh
cd var/www/
./update_thirdparty.sh
```

Using the virtual machine:

1. Download `https://www.circl.lu/assets/files/ail-training/AIL_v@4986352.ova`
2. Start virtualbox
3. File → import appliance → select AIL_v@4986352.ova
4. (for now) Prevent the automatic launch and `git pull` the changes

AIL ecosystem - Challenges and design

AIL ecosystem: Technologies used

Programing language: Essentially python2 (slowly migrating to python3)

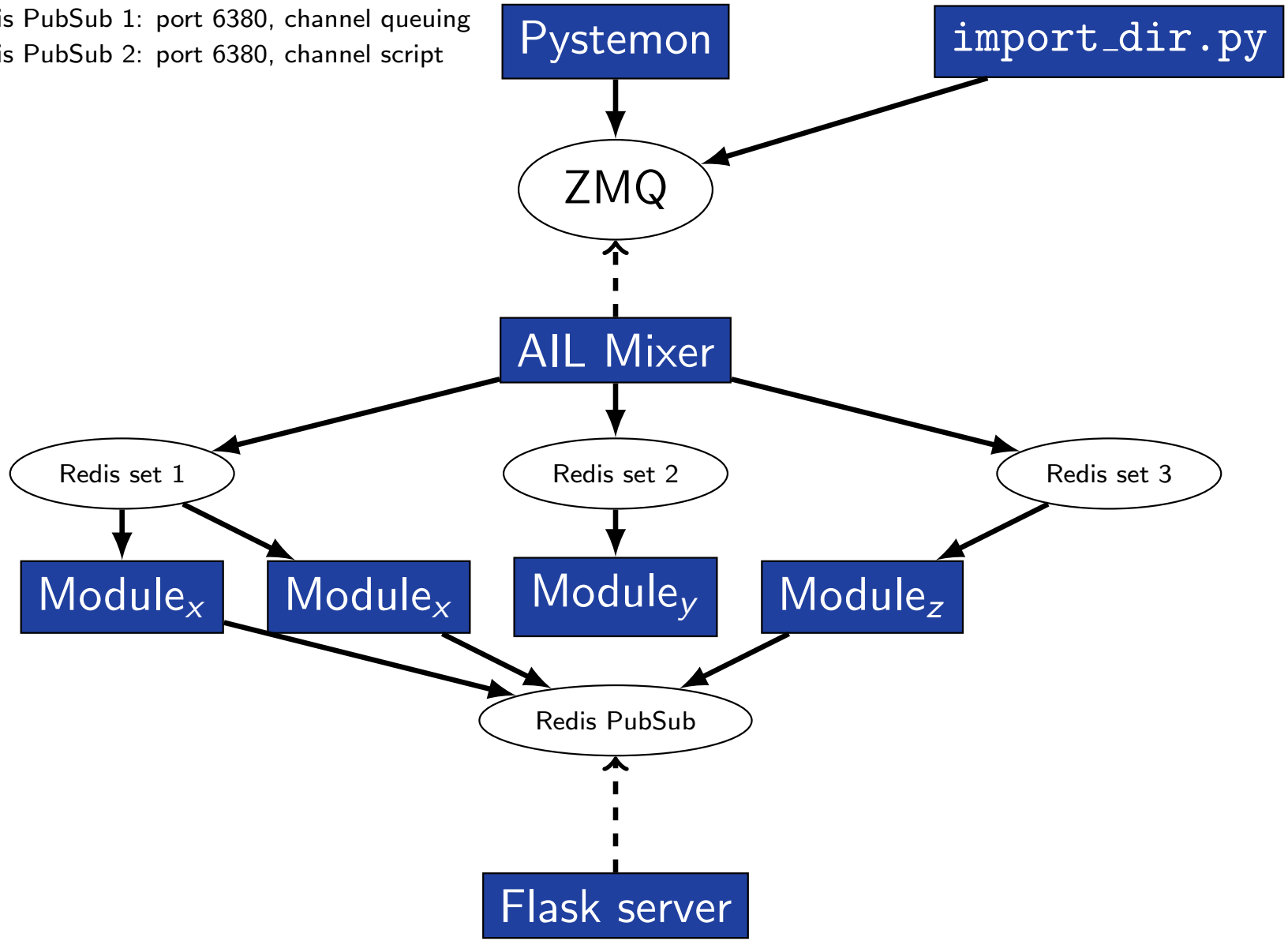
Databases: Redis and Redis-levelDB

Server: Flask

Data message passing: ZMQ and Redis Publisher/Subscriber

AIL global architecture

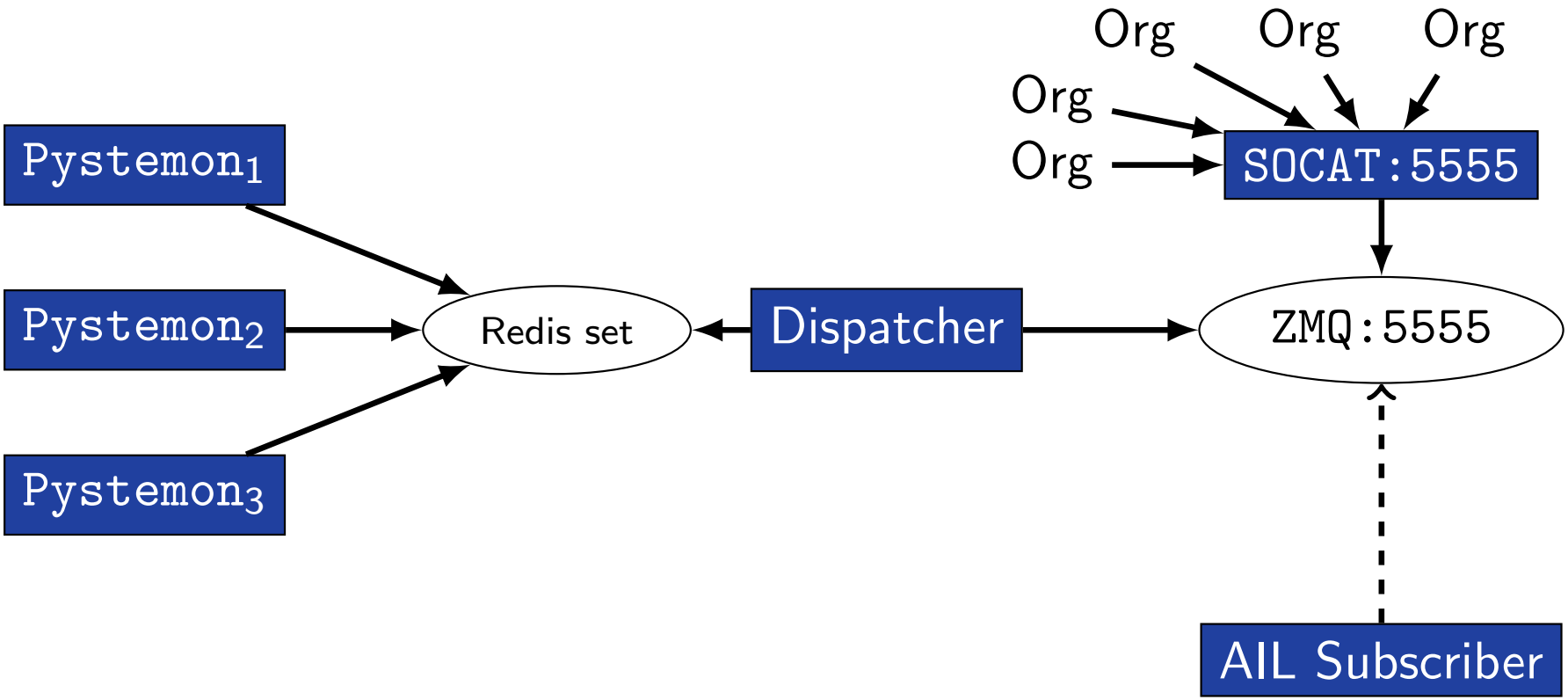
Redis PubSub 1: port 6380, channel queuing
Redis PubSub 2: port 6380, channel script



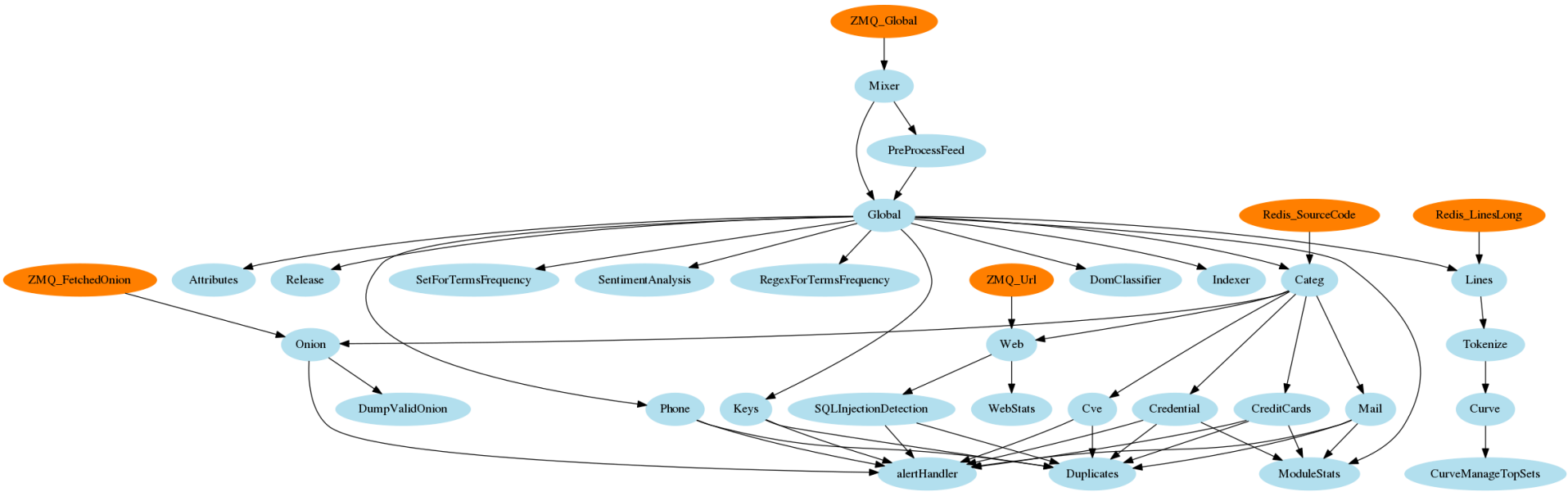
Data feeder: Gathering pastes with pystemon

Pystemon global architecture

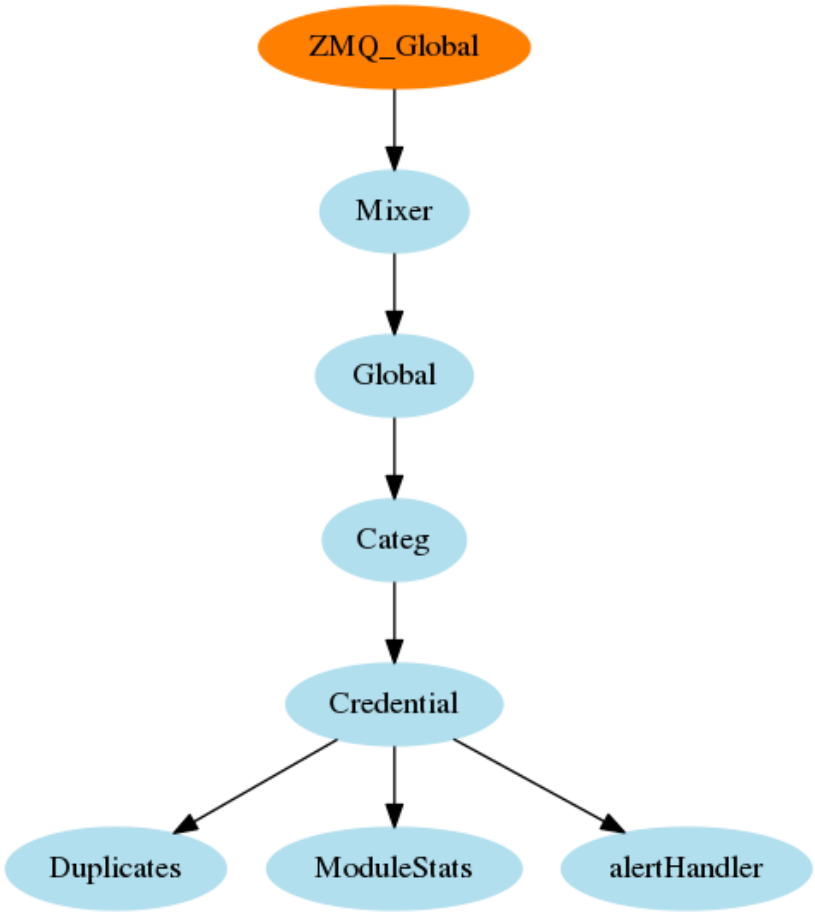
Redis PubSub 1: port 6380, channel queuing
Redis PubSub 2: port 6380, channel script



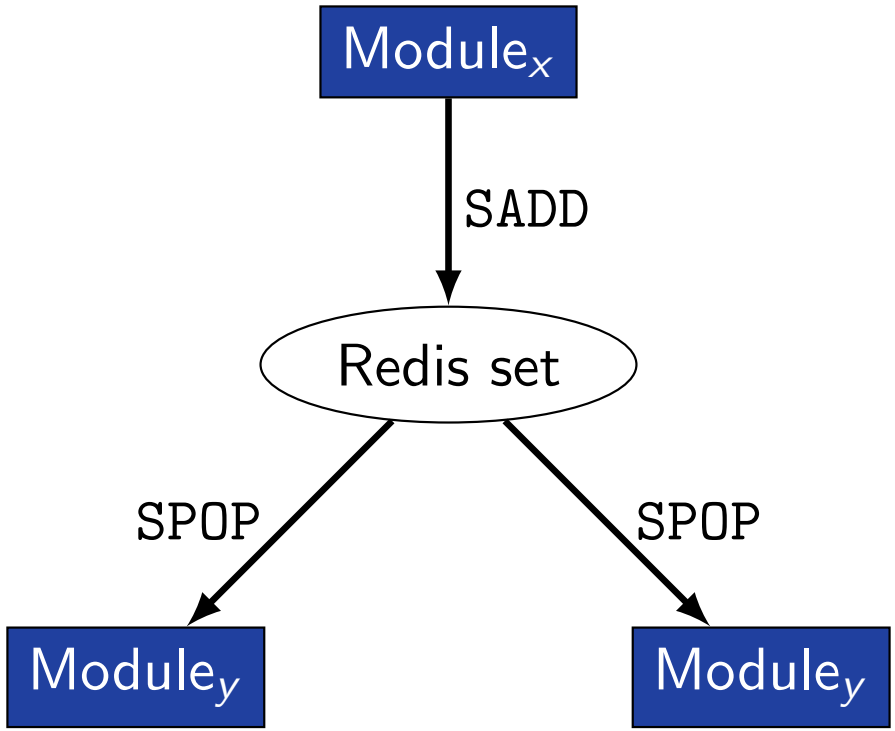
AIL global architecture: Data streaming between module



AIL global architecture: Data streaming between module (Credential example)



Message consuming



→ No message lost nor double processing

→ Multiprocessing!

Starting the framework

Running your own instance from source

Accessing the environment and starting AIL

```
# Activate the virtualenv
. ./AILENV/bin/activate

# Launch the system
cd bin/
./LAUNCH
    # check options 1->5

# Start web interface
cd var/www/
./Flask_server.py
    # -> Browse http://localhost:7000/
```

Running your own instance using the virtual machine

Login and passwords:

```
1 Web interface (default network settings):
2     http://192.168.56.51:7000/
3 Shell/SSH:
4     ail/Password1234
5
```

Managing the framework

Managing AIL: Old fashion way

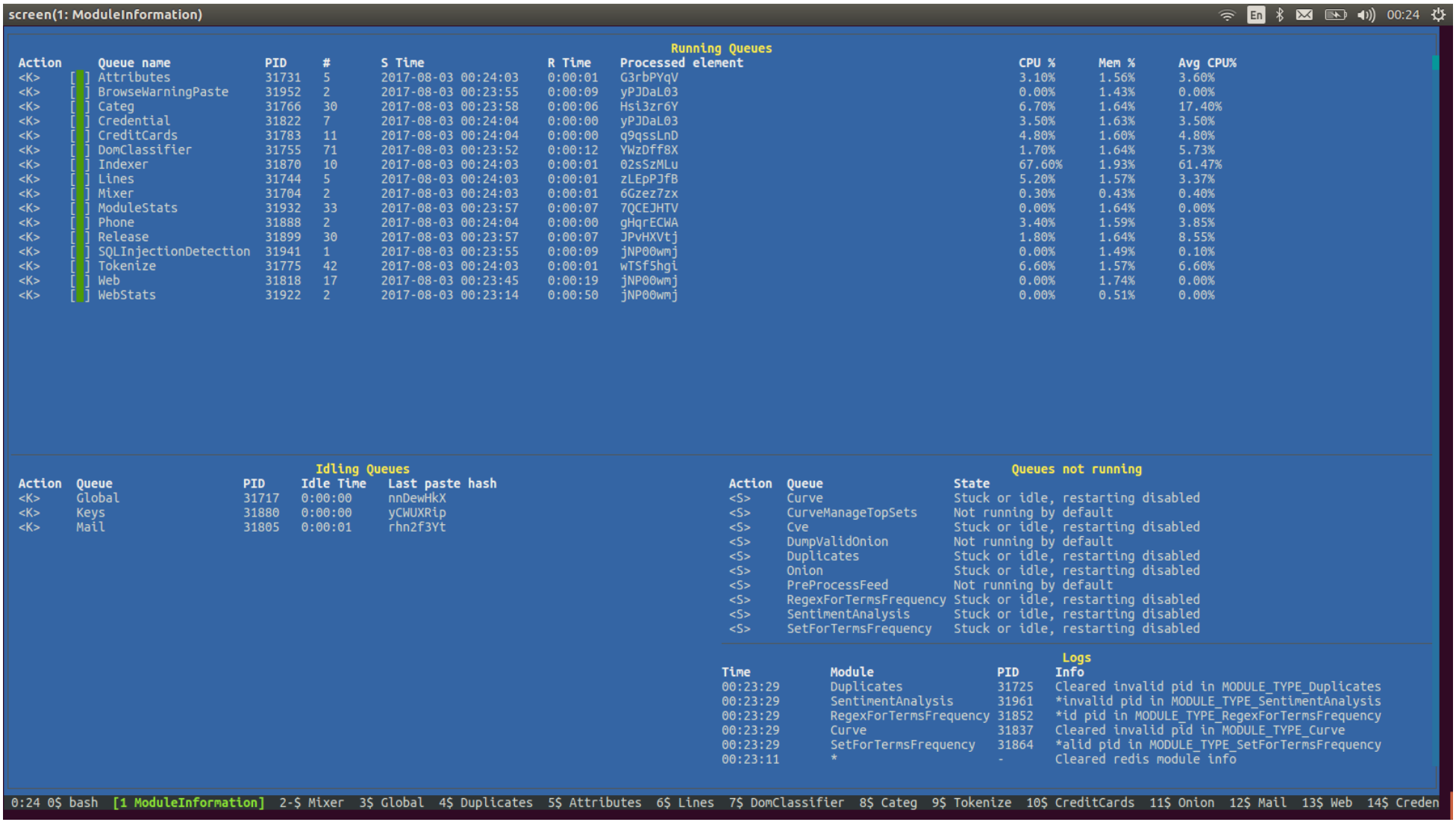
Access the script screen

```
screen -r Script
```

Table: GNU screen shortcuts

Shortcut	Action
C-a d	detach screen
C-a c	Create new window
C-a n	next window screen
C-a p	previous window screen

Managing your modules: Using the helper



Feeding the framework

Feeding AIL

There are differents way to feed AIL with data:

1. Be a partner with CIRCL and ask to get access to our feed info@circl.lu
2. Setup *pystemon* and use the custom feeder
   - *pystemon* will collect pastes for you
3. Feed your own data using the `import_dir.py` script

Feeding AIL

There are differents way to feed AIL with data:

1. CIRCL partners and ask to access our feed info@circl.lu
   - ▷ You already have access
2. ~~Setup *pystemon* and use the custom feeder~~
   - ~~*pystemon* will collect pastes for you~~
3. Feed your own data using the `import_dir.py` script

Plug-in AIL to the CIRCL feed

You can freely access the CIRCL feed during this workshop!

- In the file `bin/package/config.cfg`,
- Set `ZMQ_Global->address` to `tcp://crf.circl.lu:5556`

Feeding AIL with your own data - `import_dir.py` (1)

/!\ 2 requirements:

1. Data to be fed must have the path hierarchy as the following:
   1.1 `year/month/day/(textfile/gzfile)`
   1.2 This is due to the inner representation of paste in AIL

2. Each file to be fed must be of a raisonable size:
   2.1 $\sim$ 3 `Mb` is already large
   2.2 This is because some modules are doing regex matching
   2.3 If you want to feed a large file, better split it in multiple ones

Feeding AIL with your own data - `import_dir.py` (2)

1. Change your local configuration `bin/package/config.cfg`
   - In the file `bin/package/config.cfg`,
   - Add `127.0.0.1:5556` in `ZMQ_Global`
   - (should already be set by default)

Feeding AIL with your own data - `import_dir.py` (2)

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2. Launch `import_dir.py` with de directory you want to import
   - `import_dir.py -d dir_path`

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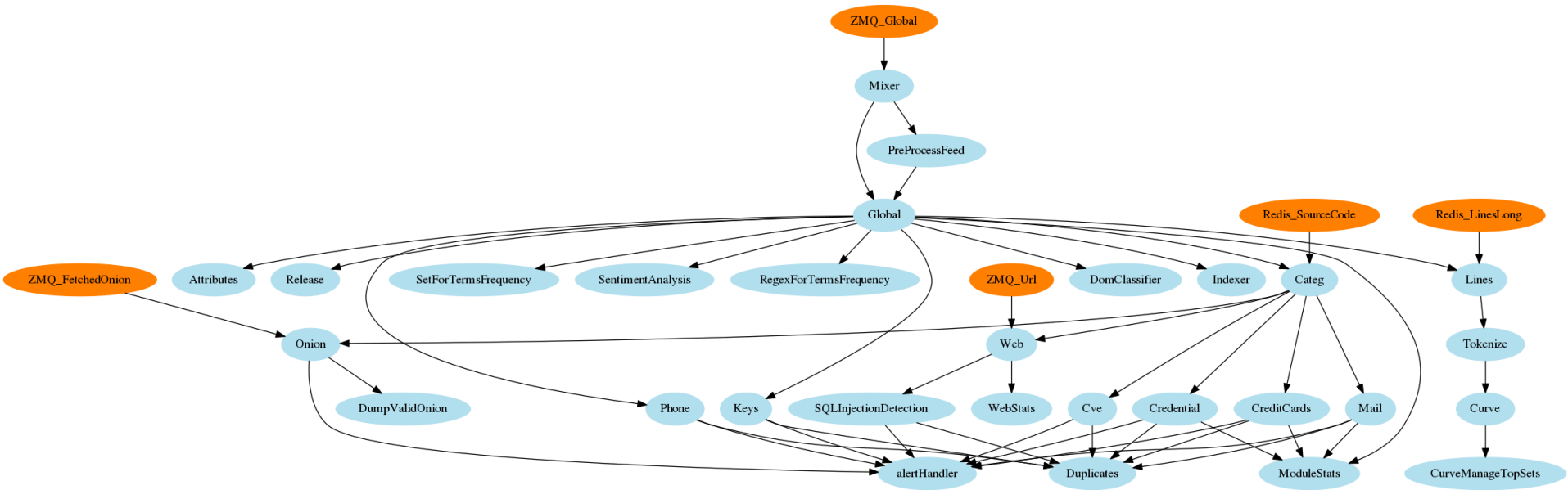
2. Launch `import_dir.py` with de directory you want to import
   - `import_dir.py -d dir_path`
3. Watch your data being feed to AIL

Creating new features

Developping new features: Plug-in a module in the system

Choose where to locate your module in the data flow:



Then, modify `bin/package/modules.cfg` accordingly

Writing your own modules - /bin/template.py

```
1  import time
2  from pubsublogger import publisher
3  from Helper import Process
4  if __name__ == '__main__':
5      # Port of the redis instance used by pubsublogger
6      publisher.port = 6380
7      # Script is the default channel used for the modules.
8      publisher.channel = 'Script'
9      # Section name in bin/packages/modules.cfg
10     config_section = '<section name>'
11     # Setup the I/O queues
12     p = Process(config_section)
13     # Sent to the logging a description of the module
14     publisher.info("<description of the module>")
15     # Endless loop getting messages from the input queue
16     while True:
17         # Get one message from the input queue
18         message = p.get_from_set()
19         if message is None:
20             publisher.debug("{} queue is empty, waiting".format(config_section))
21             time.sleep(1)
22             continue
23         # Do something with the message from the queue
24         something_has_been_done = do_something(message)
25
```

AIL - Add your own web interface

1. Launch `var/www/create_new_web_module.py`
2. Enter the module's name
3. A template and flask skeleton has been created for your new webpage in `var/www/modules/`
4. You can start **coding** server-side in:

   `var/www/modules/`*`your_module_name`*`/Flask_`*`your_module_name.py`*
5. You can start **coding** client-side in:

   `var/www/modules/`*`your_module_name`*`/templates/`*`your_module_name.html`*

   `var/www/modules/`*`your_module_name`*`/templates/header_`*`your_module_name.html`*

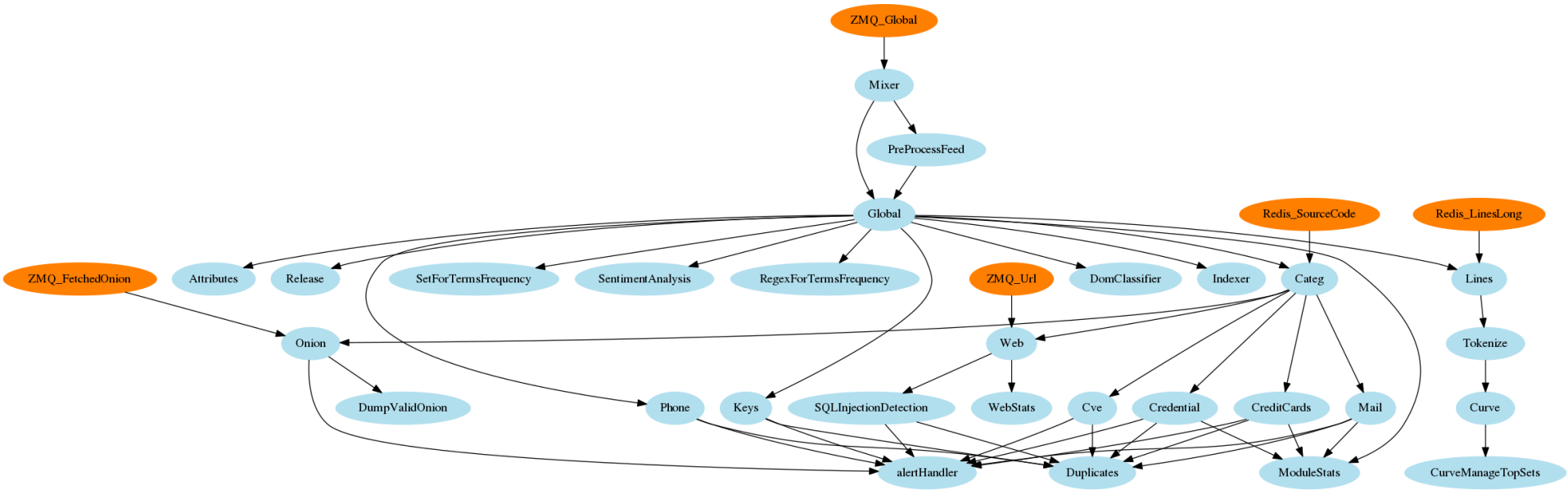
Case study: Push alert to MISP

Push alert to MISP

Goal: Every alert concering `Credential.py` and `CreditCards.py` are pushed to MISP

Case study: Finding the best place in the system

Best place to put it?



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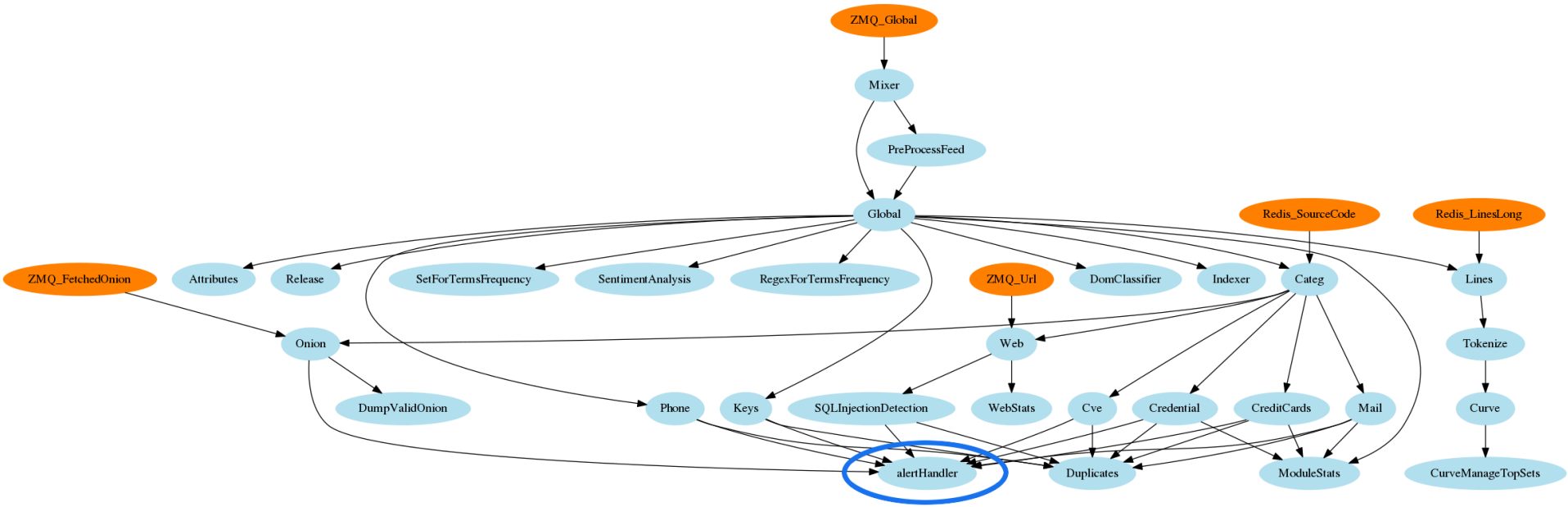

Case study: Updating alertHandler.py

alertHandler.py - commit 83e082e62a20a49e1ca2d546e4f19209135ac59d

```
1  [...]
2  if message is not None:
3      message = message.decode('utf8') #decode because of python3
4      module_name, p_path = message.split(';')
5  [...]
6
7  # Create MISP AIL-leak object and push it
8  if flag_misp: # MISP is connected
9      allowed_modules = ['credential', 'creditcards']
10     if module_name in allowed_modules:
11         # create and setup the MISP object
12         wrapper.add_new_object(module_name, p_path)
13         wrapper.pushToMISP()
14     else:
15         print('not pushing to MISP:', module_name, p_path)
16
```

Practical part

Practical part: Pick your choice

1. Improve module `keys.py` to support other type of keys (ssh, ...)
   - `https://github.com/veorq/blueflower/blob/master/blueflower/constants.py`
2. Graph database on `Credential.py`
   - Top used passwords, most compromised user, ...
3. Webpage scrapper
   - Download html from URL found in pastes
   - Re-inject html as paste in AIL
4. Integration of *truffleHog*
   - Searches through git repositories for high entropy strings and secrets, digging deep into commit history
   - `https://github.com/dxa4481/truffleHog`
5. Your custom feature

Contribution rules

How to contribute

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- Feel free to fork the code, play with it, make some patches or add additional analysis modules.

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- Feel free to make a pull request for your contribution

How to contribute

- Feel free to fork the code, play with it, make some patches or add additional analysis modules.
- Feel free to make a pull request for your contribution
- That's it!

Conclusion

- Building AIL helped us to find additional leaks which cannot be found using manual analysis and **improve the time to detect duplicate/recycled leaks**.

  $\rightarrow$ Therefore quicker response time to assist and/or inform proactively affected constituents.