Automated Incident Handling with IntelMQ
TF-CSIRT/FIRST Malaga

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The IntelMQ project

Started in 2014 by Tomas Lima (CERT.pt at that time) and Aaron Kaplan (CERT.at)

- We receive “Threat intelligence” feeds for AT
  - Infected systems, vulnerable servers, hacked websites, etc
- We want to contact the infrastructure owners

For CERTs, SOCs, other security teams

Included in MeliCERTes and csirt-kit

github.com/certtools/intelmq

CERT.at's role

Contributing development

Maintainer role

- Packaging
- Release management
- Coordination

Co-financed by the Connecting Europe Facility of the European Union

Where to get help?

Ask us in case of problems or questions
IntelMQ is a community

- User Guide: https://github.com/certtools/intelmq/blob/develop/docs/User-Guide.md#where-to-get-help
- Users mailinglist: https://lists.cert.at/cgi-bin/mailman/listinfo/intelmq-users
- Developers mailinglist: https://lists.cert.at/cgi-bin/mailman/listinfo/intelmq-dev
- For bugs: https://github.com/certtools/intelmq/issues

Core idea

- Getting (high volume) data (infections, vulnerabilities, ...)
- Sharing the data with the affected parties
  - Requires joining some other context data
  - Exact workflows differ from CERT to CERT
  - Recipient should not need any tool

Requirements I

- Data Format
  - Sanitation: Syntactical
- Harmonizes data:
  - Add Malware Family Name (optional)
  - Classification
    - Reference Incident Classification Taxonomy
- Scalability

Requirements II

- Easy to use
- Easy to extend
- Flexible in the data format
  - Extensible
  - But syntactical correctness
- Sharing code / community work
- Handle changes in feeds


SHADOWSERVER
MISP
Threat Sharing
CERT.at
INTELMQ

Demo / Familiarization

- Check SSH connection
- Check HTTP connection
  - IntelMQ-manager configuration tab
  - http://localhost:8080/?page=configs

Base Concept

- Structured data in
- Processing
- Data out
- → **no state** (with exceptions)

Concepts I

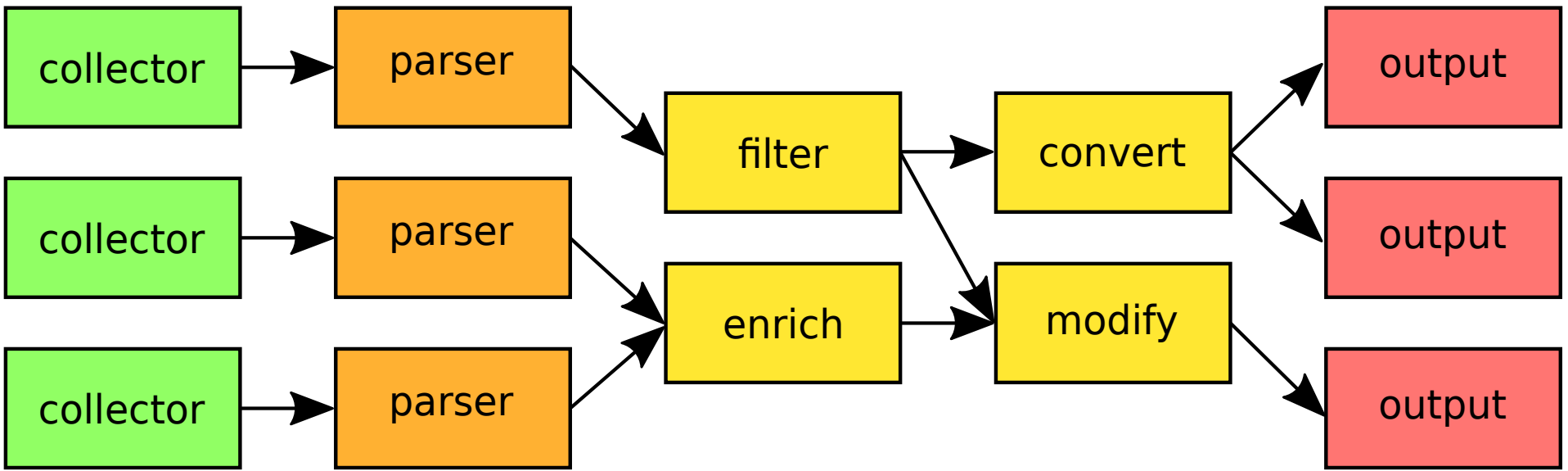
- “Bots”
  - Single & separated programs (processes)
  - One task per bot
  - “botnet” is the entirety of bots
- Pipeline
  - Connection between bots
  - “message broker” (messaging queue)
  - Message types: “Report” & “Event” in JSON format

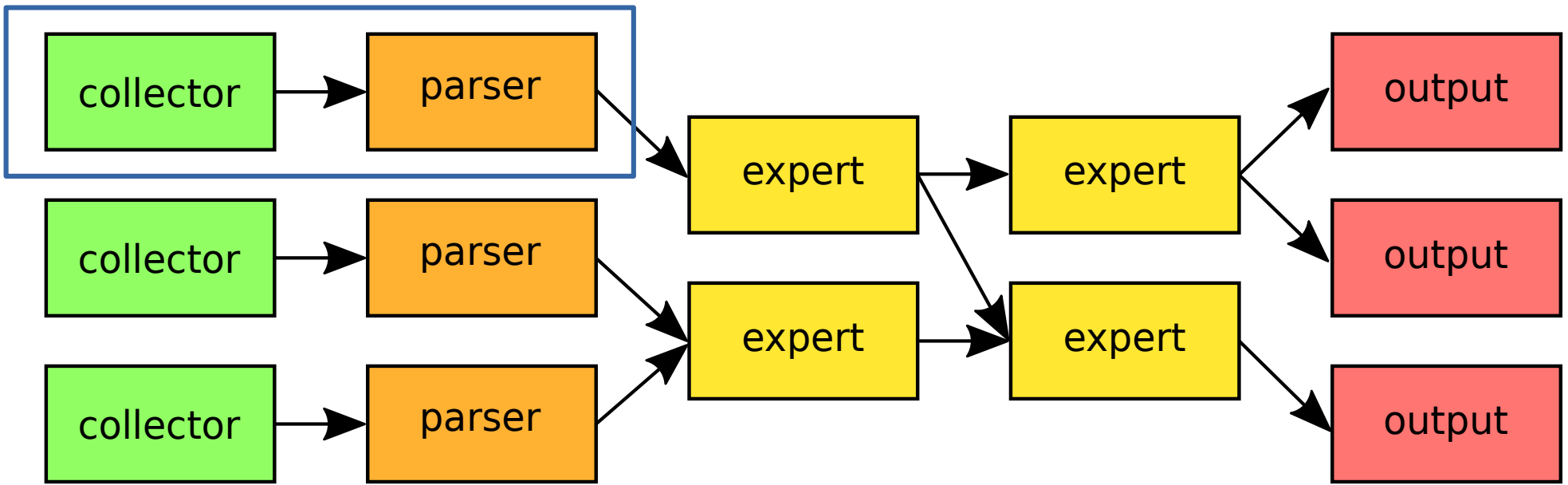
4 types of “bots”

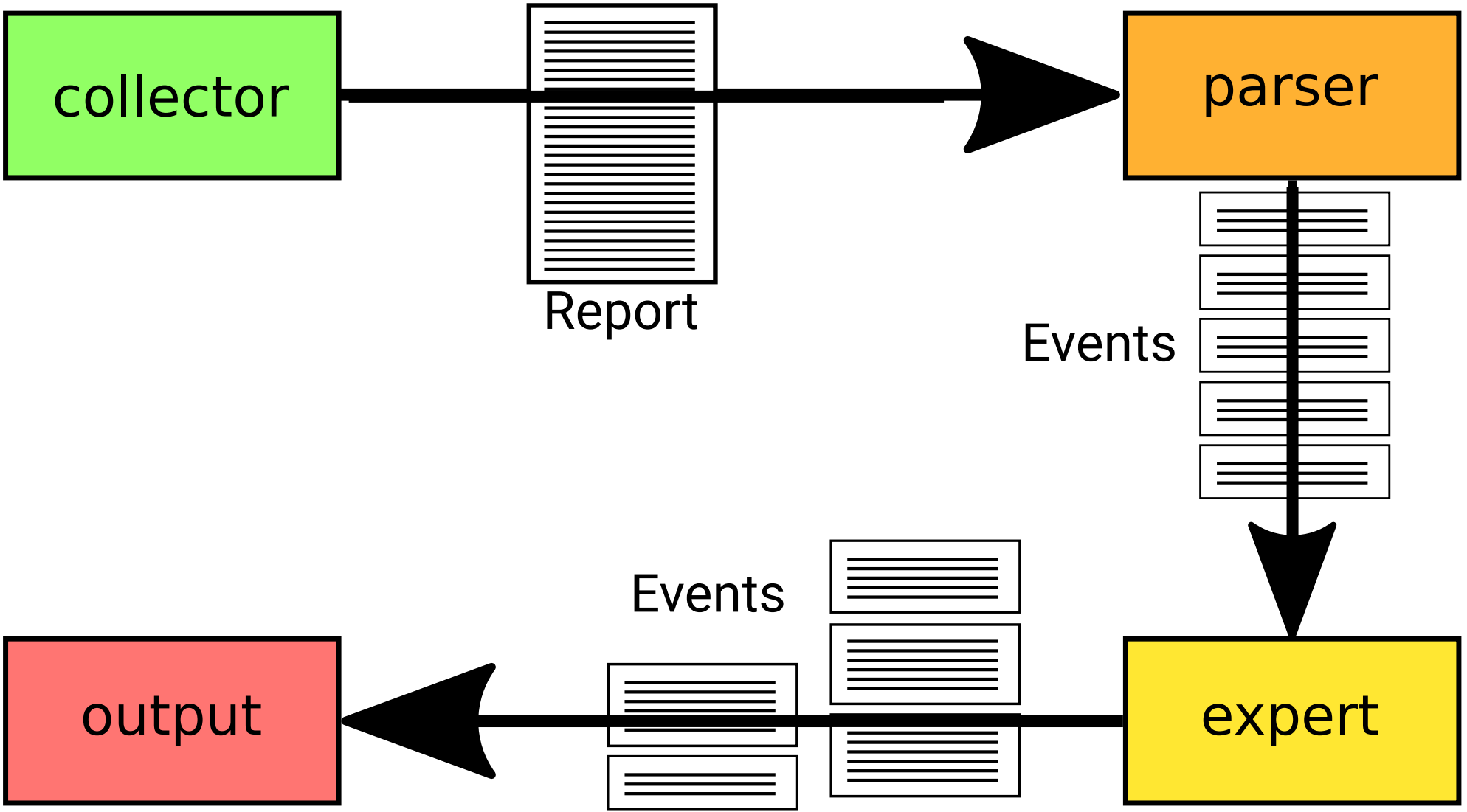
- Collectors
- Parsers
- Experts*n
- Output

2 types of messages

- Reports
  - Raw data + some metadata
- Events
  - Parsed data + some metadata


collector
collector
collector
parser
parser
parser
filter
enrich
convert
modify
output
output
output


collector
parser
collector
parser
collector
parser
expert
expert
expert
expert
output
output
output


collector
Report
parser
Events
Events
output
expert

Concepts II

- EventDB (optional)
  - (PostgreSQL) event database
  - Same schema as IntelMQ’s format
- “Data Harmonization Ontology”
  - Data format specification
  - (structured) input data is converted to internal data format
  - Syntactical checks on data
  - Normalizationv

Demo / Hands-On

Normalization examples

- Time: “Thu 27 Jun 2019 14:02:03+02” → “2019-06-27T14:02:03+02:00”
- Classification: conficker infection → “Malicious code” > “infected device” > “conficker”
- Malware names: b67-ss-kins → zeus, avalanche-panda-banker g→ zeus
- Network number: AS65536 → 65536
- FQDN: example.com. → example.com
- FQDN: österreich.gv.at → xn--sterreich-z7a.gv.at
- IP address: 127.0.0.1/32 → 127.0.0.1
- Protocol: HTTP → http
- TLP: tlp:amber → AMBER
- Country Code: “si” → “SI”

Sanitation

- *Syntactical* Validation
  - Not a *verification on correctness* of information (can be added though)
- Check for syntactical correctness
- Check for completeness of information
- Further processing steps can rely on these checks

Concepts III

- No data should get lost
  - Parsing errors
    - As strict as possible but not more
    - Handling of changes in data feeds
  - Any other problems
  - Raise admin attention

Data collection

- Active / passive
- Direct (API) / Indirect (Ticketing system, IMAP)
- Pull / Push
- Wide range of formats
- Stateless / Stateful (keeping track of fetched data)
- Stream / bulk
- Global / specific scope (filtering)
- Public / private

Expert functions

- Filtering & Dropping
- Routing
- Modifying & Extending (“Lookups”)

Enrichment challenges

- Online Lookups latency (Name resolution)
  - Example:
    - 99% 5ms, 1% 10s: 543/minute
    - 100% 10ms: 600/minute
  - → Download databases
- Accuracy of data

SetUp Workflow

- get data from
  - HTTP APIs, E-Mails (IMAP, RTIR, ...)
  - internal sources, public sources
- define data processing flow
  - filtering
  - routing
  - enriching
- define how to act
  - output to other systems
  - direct actions

Hands-On

Available Bots and Feeds

- 22 collectors
- 60 parsers
- 26 experts
- 16 outputs

  https://github.com/certtools/intelmq/blob/develop/docs/Bots.md

- 142 *documented* feeds

  (as of version 2.1.1)
  https://github.com/certtools/intelmq/blob/develop/docs/Feeds.md

Classification

- 3 levels
- c*lassification.taxonomy* (ENISA WG/RSIT)
- *classification.type* (ENISA WG/RSIT)
- *Classification.identifier* (freetext)
- https://github.com/certtools/intelmq/blob/develop/docs/Data-Harmonization.md#classification

IntelMQ Manager

- Graphical (pipeline) Configuration
  - Including live view (queued messages)
  - Reads/Writes configuration files
  - Visualization interface
- Botnet management
  - Interface for *intelmqctl*
- (User-based) Monitoring
- Simple PHP Backend

Hands-On

The last mile

- Everybody has a different workflow
  - SMTP vs different Ticketing systems
  - Different grouping
  - Providing API or rending data
  - ...
- No standard-procedure

IntelMQ vs. MISP

- MISP:
  - Synchronization and collaboration as core-feature
  - manually curated IoCs
  - Database represents a state
    - Linking & correlation
- IntelMQ:
  - Stream-processing for mass-automation
  - little/no human interaction
  - (more or less) stateless

Run modes

- Continuous vs scheduled
- Enabled true / false (“autostart”)
- rate_limit (seconds)

Hands-On

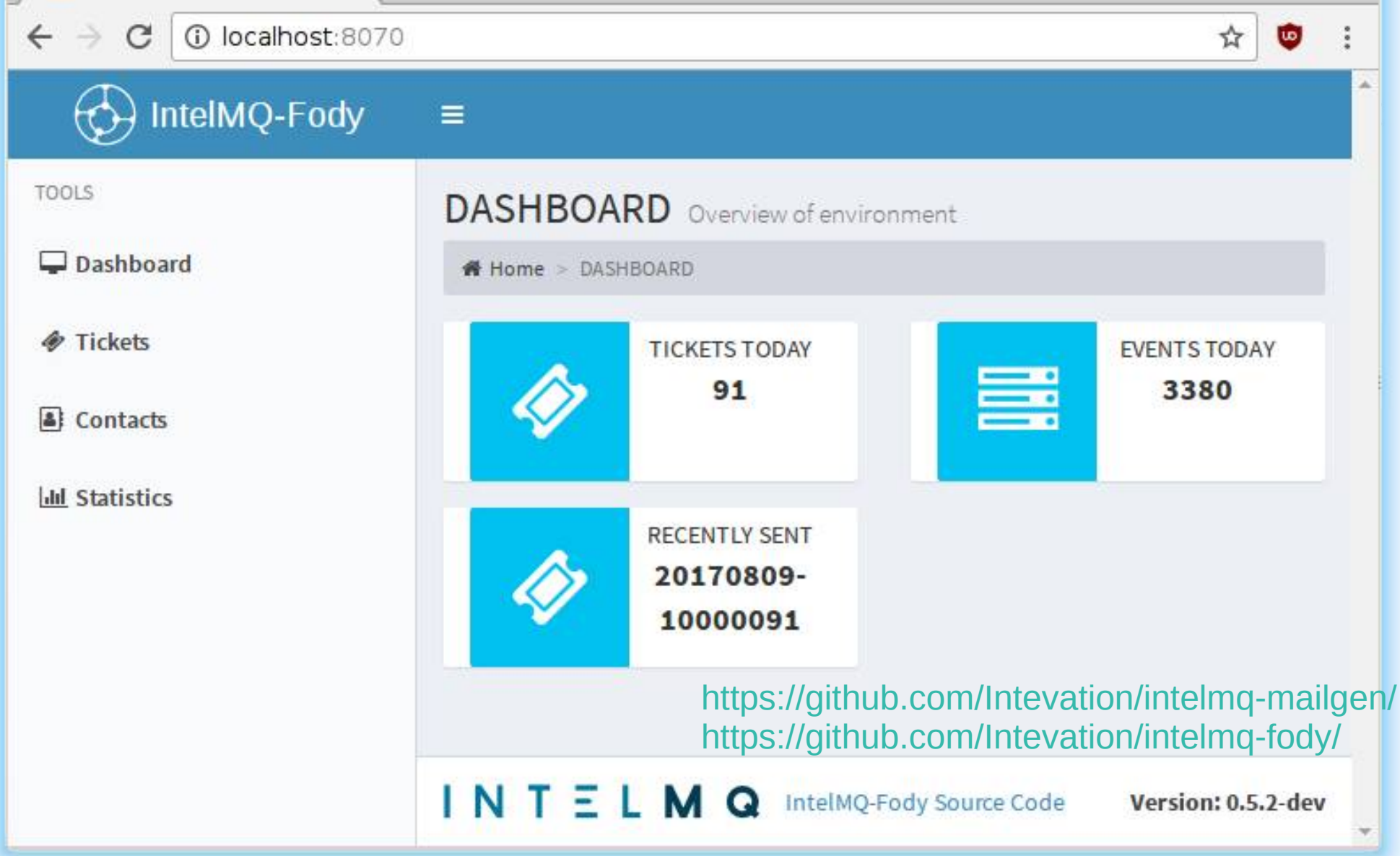
Some related software

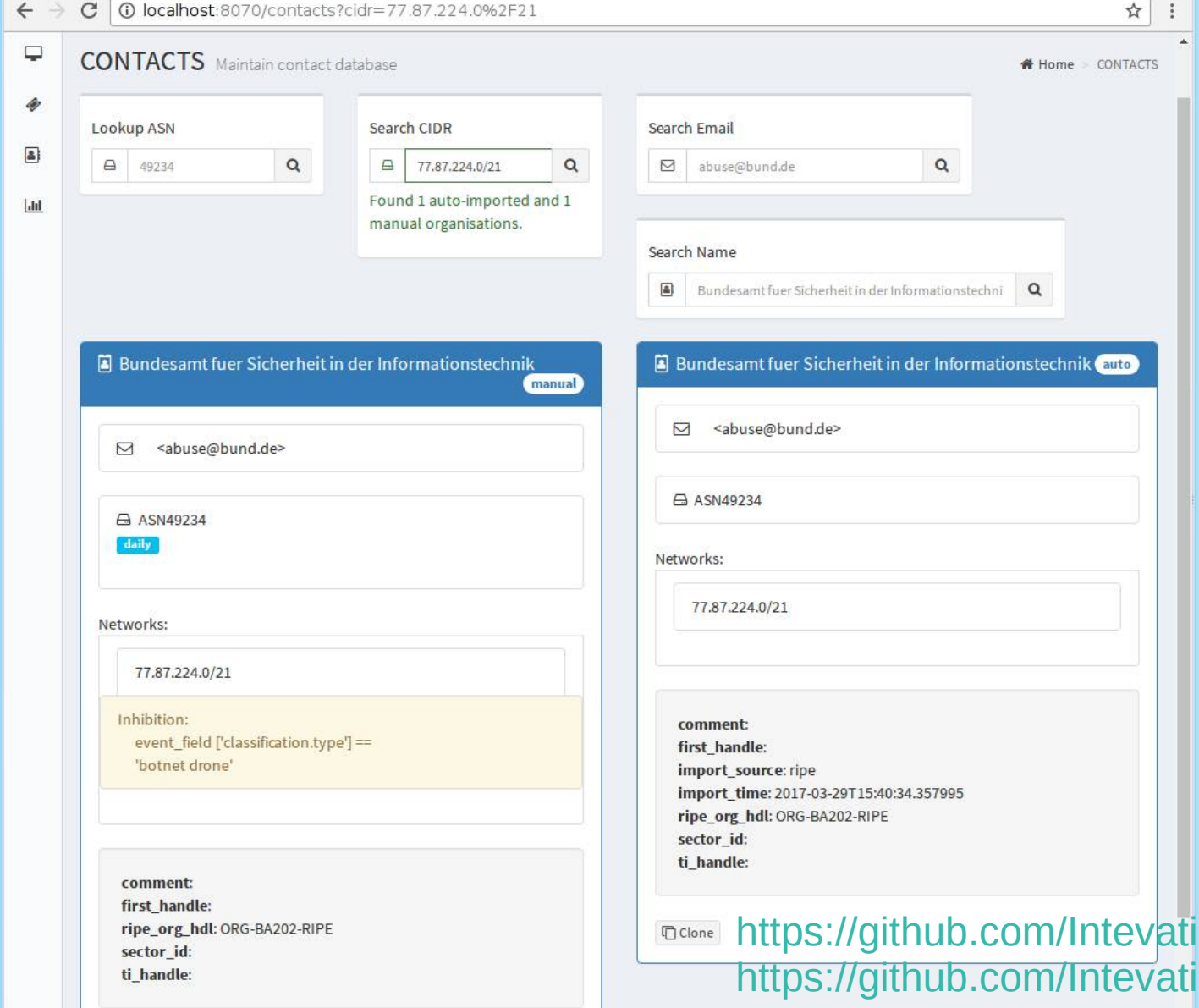
https://github.com/certtools/intelmq/blob/develop/**docs/Ecosystem.md**

Intelmq-mailgen / -fody

- Sending with SMTP
- Compatible with OTRS
- Rulesets and contacts from intelmq-fody
- Webinterface for tickets, contacts, rules, event database search & stats
- Developed by BSI/Intevation

https://github.com/Intevation/intelmq-mailgen/
https://github.com/Intevation/intelmq-fody/


localhost:8070
IntelMQ-Fody
TOOLS
Dashboard
Tickets
Contacts
Statistics
DASHBOARD
Overview of environment
Home > DASHBOARD
TICKETS TODAY
91
EVENTS TODAY
3380
RECENTLY SENT
20170809-
10000091
https://github.com/Intevation/intelmq-mailgen/
https://github.com/Intevation/intelmq-fody/
INTELMQ
IntelMQ-Fody Source Code
Version: 0.5.2-dev



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https://github.com/Intevation/intelmq-mailgen/
https://github.com/Intevation/intelmq-fody/

Hands-On

IntelMQ-fody events

intelmq-webinput-csv

- Webform to submit
- Shows data validity
- Python WSGI
- https://github.com/certat/intelmq-webinput-csv/

intelmq-webinput-csv

timezone

+00:00

dry run

Constant fields (fallback):

classification type

malware configuration

Taxonomy: malicious code

feed.code

oneshot

classification.identifier

test

time.source	source.ip	destination.ip	
timestamp	ip	protocol	po
2018-12-09 02:53:18	85.126.145.244	tcp	548
2018-12-09 02:53:18	77.119.237.121	tcp	548
2018-12-09 02:53:18	77.119.229.227	tcp	548
2018-12-09 02:53:21	178.18.164.3	tcp	548
2018-12-09 02:53:21	78.132.127.172	tcp	548
2018-12-09 02:53:49	62.40.138.97	tcp	548
2018-12-09 02:53:49	212.197.156.245	tcp	548

https://github.com/certat/intelmq-webinput-csv/

Hands-On

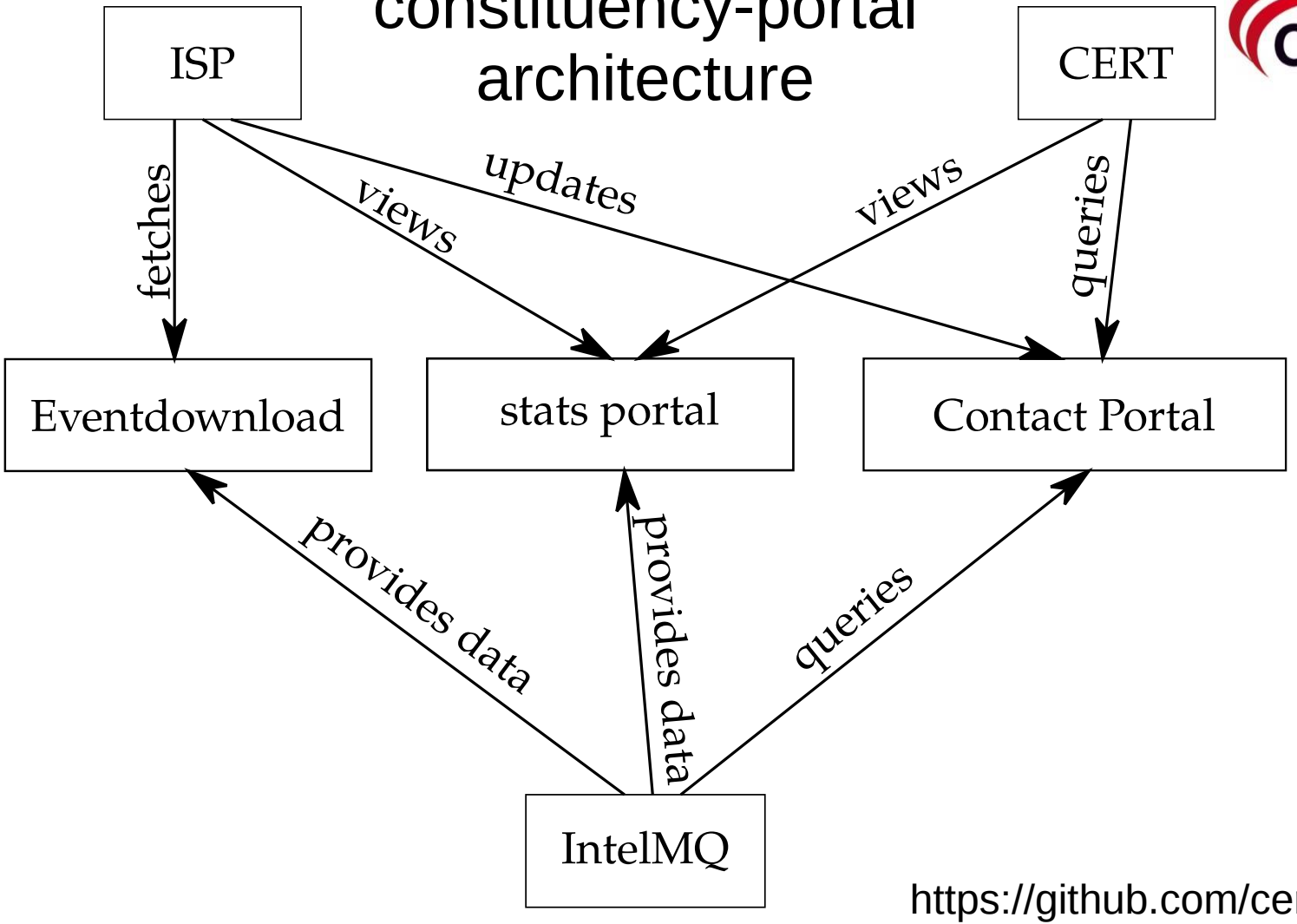
webinput-csv

constituency-portal

- In development at cert.at
- Provides self-administration for constituents
- Integrates RIPE-data
- Shows statistics to constituents (stats-portal)

https://github.com/certat/do-portal/

constituency-portal architecture



https://github.com/certat/do-portal/

My Account Organizations Contacts Statistics Logout (wagner@cert.at)

top tags over time filtered by taxonomy

Last 90 days

taxonomies All

ASN list 30971 + 49488 + 201612 + 35492 + 1901 + 8447 + 8562 + 12793 + 15824 + 5403 + 13008 + 201951 + 1764 + 29330 + 50047 + 44865 + 25575 + 12605 + 16305 + 42587 + 24792 + 34347 + 12577 + 200026 + 21039 + 34885 + 28889

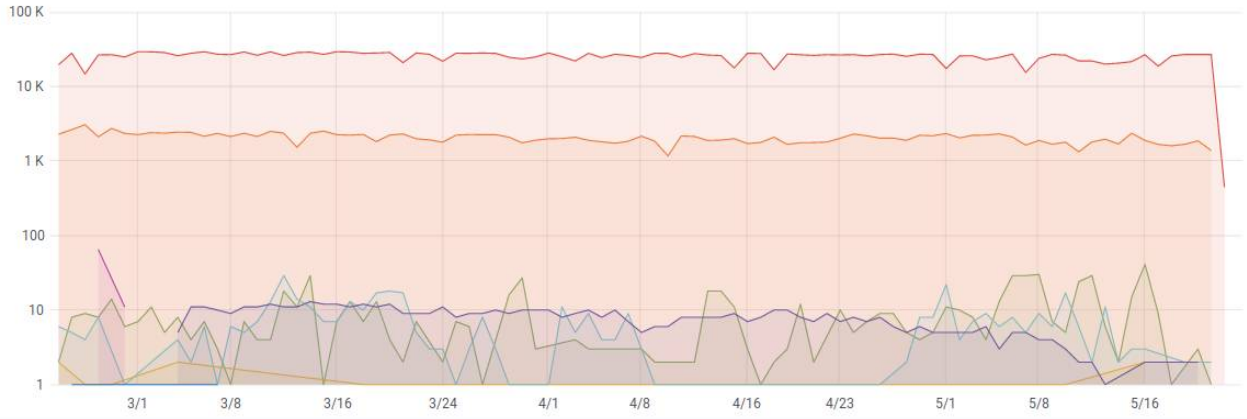
Panel Title

Classification.* over time

The following graph shows the 3 classification.* fields over time:

- "classification.taxonomy",
- "classification.type",
- "classification.identifier".

Taxonomy 'All' over time (log scale!)



	min	max	avg	current	total
malicious code	1.17 K	3.08 K	2.05 K	1.39 K	180.70 K
vulnerable	446	29.32 K	25.36 K	446	2.25718 Mil
information content security	11	65	38	11	76
other	1	13	8	2	579
intrusion attempts	1	29	7	2	431
information gathering	1	2	1	2	17
intrusions	1	1	1	1	4
abusive content	1	41	9	1	701

Type over time (log scale!) / All

	min	max	avg	current	total

https://github.com/certtools/stats-portal/

(Unsorted) list of some features

Named queues aka *paths*

- One source queue
- One or more destination queues
  - Implicit name: *_default*
- Error path
  - *_on_error*
- Bot-specific ones (filter, sieve)
  - Filter: *action_other*, *filter_match*, *filter_no_match*
  - Sieve: user-defined

Hands-On

filtering

Sieve expert


```
if :exists source.fqdn {
    keep  // aborts processing of subsequent rules and forwards the event.
}
if :notexists source.abuse_contact || source.abuse_contact =~ '.*@example.com' {
    drop  // aborts processing of subsequent rules and drops the event.
}
if source.ip << '192.0.0.0/24' {
    add! comment = 'bogon'
}
if classification.type == ['phishing', 'malware'] && source.fqdn =~ '.*\.(ch|li)$' {
    path 'domainabuse'
    keep
} else {
    remove comment
}
```

Hands-On

Sieve expert

Working interactively

- intelmqctl run -l DEBUG bot_name
- intelmqctl run -l DEBUG bot_name process

    --show-sent

    --dryrun

    --msg ‘{“source.ip”: “127.0.0.1”}’

Hands-On

Intelmqctl run

Provided installation modes

- Pip / pypi
  - Default path is */opt/intelmq/*
  - *pip3 install -e* for editable installations
- rpm/deb
  - For various distributions
  - */etc/intelmq/ /var/lib/intelmq /var/run/intelmq*
- Switch used paths with `INTELMQ_PATHS_OPT=1` / `INTELMQ_PATHS_NO_OPT=1`

Error handling

- error_log_message: true/false
- error_log_exception: true/false
- error_procedure: stop/pass
- error_max_retries: int
- error_retry_delay: int (seconds)
- error_dump_message: true/false
- Special path ‘_on_error’

Error handling

- Dumped to *.dump files in log directory
  - *Not* kept in memory
  - Raise administrator attention
- JSON with exception and full message
- *intelmqdump* tool to inspect and re-insert

Malware Name Mapping

- Goal: different names in different *feeds* for the same or very similar malware (version)
- Non-goal: map names between av vendors
- Includes:
  - Malpedia
  - MISP Galaxy Threat Actors
- *malware.name* → *classification.identifier* (by default)
- https://github.com/certtools/malware_name_mapping

Malware Name Mapping

- ^b66(-(exe|https?(-unknown)?|ir|tv(ir)?))?$
  - andromeda
- ^(cridex|bugat|feodo)$
  - cridex
- ^dark-?mailer[23]?$
  - darkmailer

Write a Bot

CERT.at

```
class MyBot(Bot):
    def init(self):
        # optional initialization
    def process(self):
        event = self.receive_message()
        # process event
        self.send_message(event)
BOT = MyBot
```

Write a Bot

CERT.at

```
class MyBot(Bot):
    def init(self):
        with open('tor_nodes.txt') as db:
            self.database = db.readlines()
    def process(self):
        event = self.receive_message()
        if 'source.ip' in event:
            if event['source.ip'] in self.database:
                event['source.tor_node'] = True
        self.send_message(event)
BOT = MyBot
```

Hands-On

Performance and Monitoring

- Generic Multithreading for AMQP
  - Additional to Multiprocessing
- AMQP as optional message broker
- Bot load’s statistics
- Use local lookups, not over the Internet

Outlook (to IntelMQ 3.0)

- Expand to more use-cases
  - IDS/IPS, RPZ, SIEMs
  - Data-lakes, ML/AI input
  - Sensor networks
- Tighter IntelMQ – n6 (cert.pl) integration
- Data format changes
- Docker as optional process management
- Kafka as optional message queue
- Documentation: Tutorials and demo VMs
- Aggregation

Future discussion

Not a one-click solution

- You need to configure IntelMQ
- Everyone’s workflow differs
  - Sending E-Mails vs providing APIs vs stats-only
  - Grouping differs
  - Intervals differ
- IntelMQ can be extended
  - By bots
  - and programs interfacing the database

Wrap-Up

Contribute!

Sharing is caring

- Documentation
  - usage examples
  - Feed support
- Adaptions and extensions
- ...

Github.com/certtools/intelmq

Contributions

IHAP meetings

CERT.at Maintenance

Mailing Lists

Github

Github.com/certtools/intelmq

Thanks for listening!
Questions?

Aaron Kaplan <kaplan@cert.at>
Sebastian Wagner <wagner@cert.at>

github.com/certtools/intelmq

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