Empirical Bootstrapping of EVE-JSON Schema Documentation

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About DCSO

TLP:WHITE

- Managed (IT-)Security Service Provider
- Based in Berlin, Germany
- Founded by (and mostly for) German DAX 30 companies and scientific institutions
- Focus on advanced attack detection, mitigation and attacker profiling
- Cyber Defense Services
  - Strategic/Technical Threat Intelligence
  - Information/Identity Leakage Monitoring
  - Network Security Monitoring (“TDH”)
  - Incident Response
  - . . .
- TDH is long-time Suricata user with community ties

Documentation #2699

Edit Watch

document all eve record types and fields

« Previous | 1 of 4 | Next »

Added by Victor Julien 11 months ago. Updated about 1 month ago.

Status:	Assigned		
Priority:	Normal		
Assignee:	Sascha Steinbiss		
Target version:	TBD		
Affected Versions:		**Difficulty:**	
Effort:	medium	**Label:**	

Description

Quote

For each document type, document fields and their types. Add examples.

It's probably best to add specific tickets for each of the record types.

Related issues

Add

Related to Support #2685: SuriCon 2018 brainstorm	New	
Related to Documentation #2620: Documentation: tagged_packets / event_type packet	New	

Issues

View all issues
Summary

Custom queries

OISF community

Before EVE-JSON: Text formats

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fast.log

```
02/04/2016-13:13:00.137024  [**] [1:2200074:2] SURICATA TCPv4 invalid checksum [**]
↪  [Classification: Generic Protocol Command Decode] [Priority: 3] {PROTO:006}
↪  172.16.16.181:80 -> 172.16.16.164:60433
02/04/2016-13:13:16.694946  [**] [1:2002752:4] ET POLICY Reserved Internal IP Traffic [**]
↪  [Classification: Potentially Bad Traffic] [Priority: 2] {PROTO:006} 172.16.16.154:53271
↪  -> 172.16.16.181:80
```

dns.log and friends

```
04/07/2010-17:29:29.782934 [**] Query TX 9a6b [**] www.espn.com [**] A [**]
↪  172.16.0.122:56346 -> 4.2.2.1:53
04/07/2010-17:29:29.782934 [**] Response TX 9a6b [**] Recursion Desired [**] 4.2.2.1:53 ->
↪  172.16.0.122:56346
04/07/2010-17:29:29.782934 [**] Response TX 9a6b [**] www.espn.com [**] A [**] TTL 432 [**]
↪  199.181.132.250 [**] 4.2.2.1:53 -> 172.16.0.122:56346
```

Before EVE-JSON: Unified2

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```
$ u2spewfoo unified2.alert.1570453464
(Event)
        sensor id: 0  event id: 41  event second: 1454591580  event microsecond: 156852
        sig id: 2200074        gen id: 1   revision: 2  classification: 26
        priority: 3   ip source: 172.16.16.181        ip destination: 172.16.16.164
        src port: 80  dest port: 60432  protocol: 6  impact_flag: 0  blocked: 0

Packet
        sensor id: 0        event id: 41        event second: 1454591580
        packet second: 1454591580        packet microsecond: 156852
        linktype: 1        packet_length: 2962
[    0] F8 16 54 F8 91 AC 00 0C 29 D8 DD 2B 08 00 45 00  ..T.....)..+..E.
[   16] 0B 84 9C FB 40 00 40 06 18 FF AC 10 10 B5 AC 10  ....@.@.........
[   32] 10 A4 00 50 EC 10 69 3B B7 C3 40 B8 B4 8F 80 10  ...P..i;..@.....
[   48] 00 EB 84 F0 00 00 01 01 08 0A 00 EC 2B 3A 76 36  ............+:v6
[   64] 52 5C 48 54 54 50 2F 31 2E 31 20 32 30 30 20 4F  R\HTTP/1.1 200 O
[   80] 4B 0D 0A 44 61 74 65 3A 20 54 68 75 2C 20 30 34  K..Date: Thu, 04
[   96] 20 46 65 62 20 32 30 31 36 20 31 33 3A 31 33 3A   Feb 2016 13:13:
[  112] 30 30 20 47 4D 54 0D 0A 53 65 72 76 65 72 3A 20  00 GMT..Server:
                                    ...
```

[Oisf-users] Suricata 2.0 Available!

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Victor Julien victor at inliniac.net
Tue Mar 25 10:41:03 UTC 2014

- Previous message (by thread): [Oisf-users] suricata-2.0rc3 'make' error with Nvidia K20/Tesla
- Next message (by thread): [Oisf-users] Suricata 2.0 Available!
- **Messages sorted by:** [date] [thread] [subject] [author]

```
The OISF development team is proud to announce Suricata 2.0. This
release is a major improvement over the previous releases with regard to
performance, scalability and accuracy. Also, a number of great features
have been added.

The biggest new features of this release are the addition of "Eve", our
all JSON output for events: alerts, HTTP, DNS, SSH, TLS and (extracted)
files; much improved VLAN handling; a detectionless 'NSM' runmode; much
improved CUDA performance.

The Eve log allows for easy 3rd party integration. It has been created
with Logstash in mind specifically and we have a quick setup guide here
https://redmine.openinfosecfoundation.org/projects/suricata/wiki/_Logstash_Kibana_and_Suricata_JSON_output


*Download*

Get the new release here:
http://www.openinfosecfoundation.org/download/suricata-2.0.tar.gz


*Notable new features, improvements and changes*

- Eve log, all JSON event output for alerts, HTTP, DNS, SSH, TLS and
files. Written by Tom Decanio of nPulse Technologies
- NSM runmode, where detection engine is disabled. Development supported
by nPulse Technologies
- Various scalability improvements, clean ups and fixes by Ken Steel of
Tilera
- Add --set commandline option to override any YAML option, by Jason Ish
of Emulex
```

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Download

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EVE-JSON Example

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```
{
    "timestamp": "2017-03-17T02:56:27.562994+0000",
    "flow_id": 2197033886090252,
    "pcap_cnt": 3291,
    "event_type": "alert",
    "src_ip": "173.247.245.85",
    "src_port": 80,
    "dest_ip": "192.168.1.46",
    "dest_port": 51704,
    "proto": "006",
    "community_id": "1:c0Va4aaivKFgZp5apSfVoTjqlKw=",
    "tx_id": 0,
    "alert": {
        "action": "allowed",
        "gid": 1,
        "signature_id": 2022962,
        "rev": 3,
        "signature": "ET CURRENT_EVENTS Evil Redirector
        ↪  Leading to EK Jul 12 2016",
        "category": "A Network Trojan was detected",
        "severity": 1,
    },
    "http": {
        "hostname": "www.keionline.org",
        "url": "\/",
        "http_user_agent": "Mozilla\/4.0",
        "http_content_type": "text\/html",
        "http_refer": "http:\/\/www.bing.com\/",
        "http_method": "GET",
        "protocol": "HTTP\/1.1",
        "status": 200,
        "length": 10406,
        "http_response_body_printable": "<span ....",
        "http_response_body":
        ↪  "PHNwYW4gc3R5bGU.../8fkw2PE6C1AAA="
    },
    "app_proto": "http",
    "flow": {
        "pkts_toserver": 7,
        "pkts_toclient": 12,
        "bytes_toserver": 1172,
        "bytes_toclient": 11273,
        "start": "2017-03-17T02:56:23.263180+0000"
    },
    "payload": "SFRUUC8xLjEgVDPzuMzY+9EMZ6gi",
    "payload_printable": "HTTP\/1.1 200 OK\r\nDate: Fri,
    ↪  .......T3.......g.\"",
    "stream": 1,
    "packet":
    ↪  "sMCQV9ZOEMN7Uyc4CA....GLCHFAQQOhe2AAAAAAAAAAA",
    "packet_info": {
        "linktype": 1
    },
}
```


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EVE-JSON: Current State of Documentation

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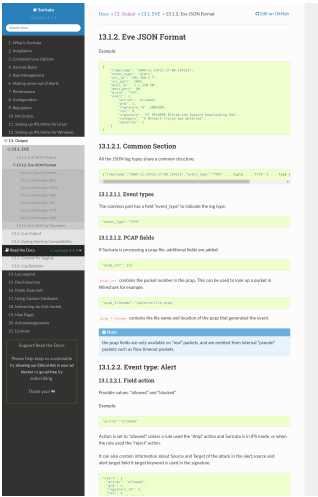

- Opportunistic EVE-JSON format documentation on ReadTheDocs
- Documentation is not exhaustive
  - **Semantics:** not clear which fields exist, what they mean and how they depend on each other
  - **Syntax:** downstream users need to parse the format correctly and unambiguously
- Safety checks vs. structure definition
- Adaption of downstream processing tools (e.g. `https://github.com/rhaist/surevego`) necessary for each JSON structure change

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Annotation Approach

Static checking won't do

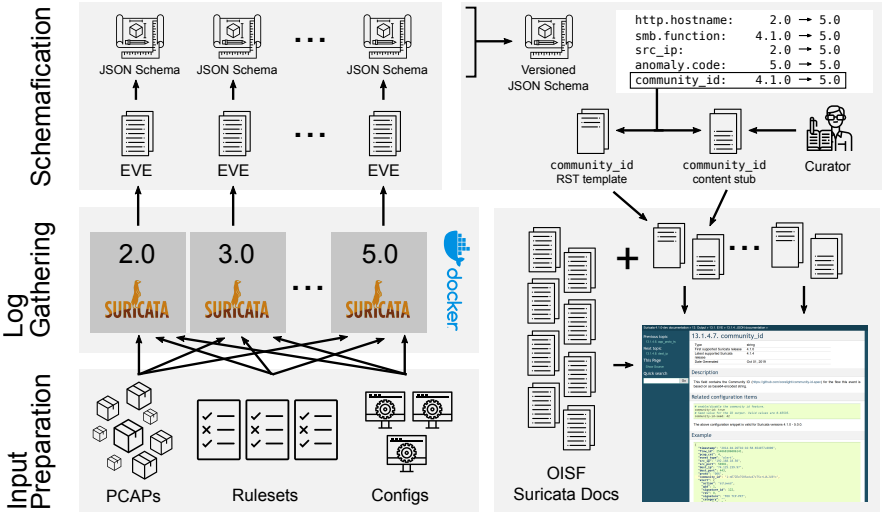
- Libjansson dynamically modifies JSON nodes in memory
- Non-trivial prediction of result structure using static source analysis

Empirical approach

- Use Suricata itself to create "real world" JSON output
- Use EVE-JSON results to derive schema $\rightarrow$ union across versions provides full field set
- Use field set to bootstrap per-field documentation to be integrated with Suricata's ReadTheDocs
- Bug discovery not goal of this approach, but welcome side effect

Workflow

TLP:WHITE



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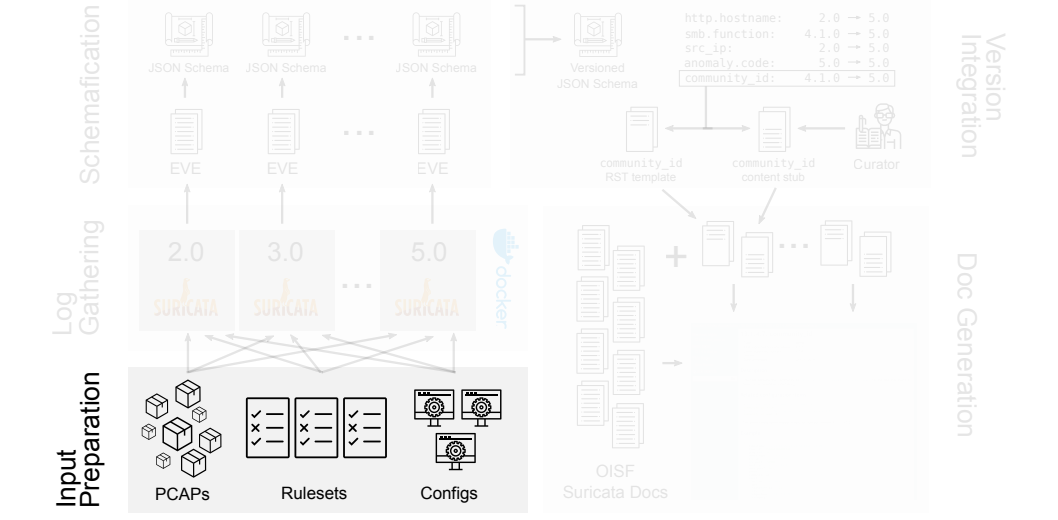
Workflow

TLP:WHITE



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Input: PCAPs

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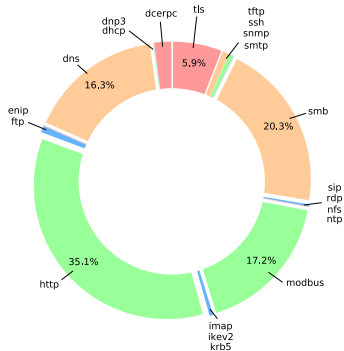
Sample collection

- Public pcap sets
  - Wireshark Wiki, MIT, Zeek, Chris Sanders, ICS/SCADA library, etc.
  - Manually curated samples
- Conversion to PCAP
- Intention: high diversity, covering typical anomalies
- 832 files, 934 MB, 5199084 packets
- Missing traffic samples can be added via GitHub PR

`app_proto` distribution



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Input: Rulesets & Configs

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Rulesets

- ET Open for Suricata 2.0/4.0/5.0
- `*-events.rules`
- Protocol-specific and filestore alerts

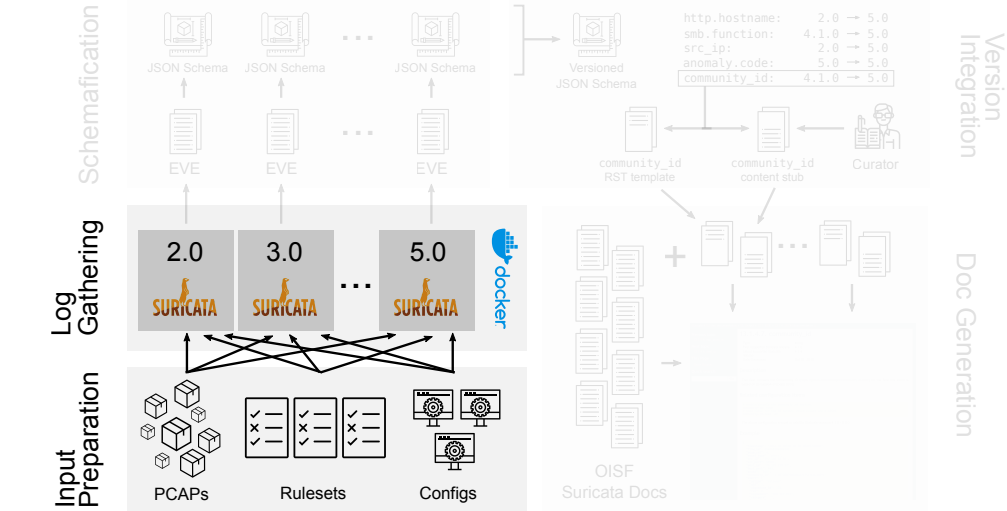
```
alert http any any -> any any (msg:"FOO HTTP"; threshold: type both, track by_src, count 5,
↪  seconds 60; sid:101;)
...
```

Configs

- Enable all protocols and additional output (e.g. X-Forwarded-For)
- Assume Rust is enabled and usage of latest possible version (e.g. DNS 1/2, filestore 1/2)

Workflow

TLP:WHITE



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Log Gathering

1. Build Docker images for all EVE-enabled Suricata versions ($\geq$ 2.0)
   - Docker images for all versions available from Docker Hub[1]
   - Build scripts can be found on GitHub in each version's `build` directory
2. Run every collected PCAP against each version and collect EVE (automated in parallel)

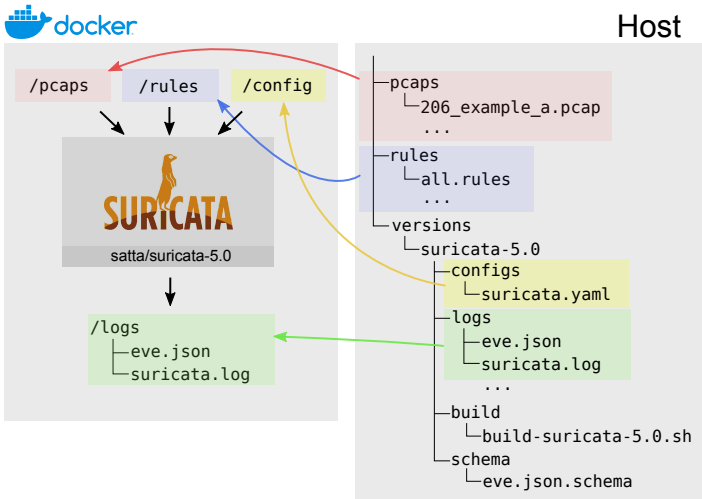
```
for pcap in `find /pcaps -type f -name '*.pcap*'`; do
  echo "$pcap"
  suricata -r $pcap -c /configs/suricata.yaml -l /logs/ -k none
done

echo "--simulate-ips with /pcaps/http_drop.pcap"
suricata -r /pcaps/http_drop.pcap -c /configs/suricata.yaml -l /logs/ -k none
↪  --simulate-ips
```

[1] `https://hub.docker.com/u/satta`

Log Gathering: Docker Setup

TLP:WHITE



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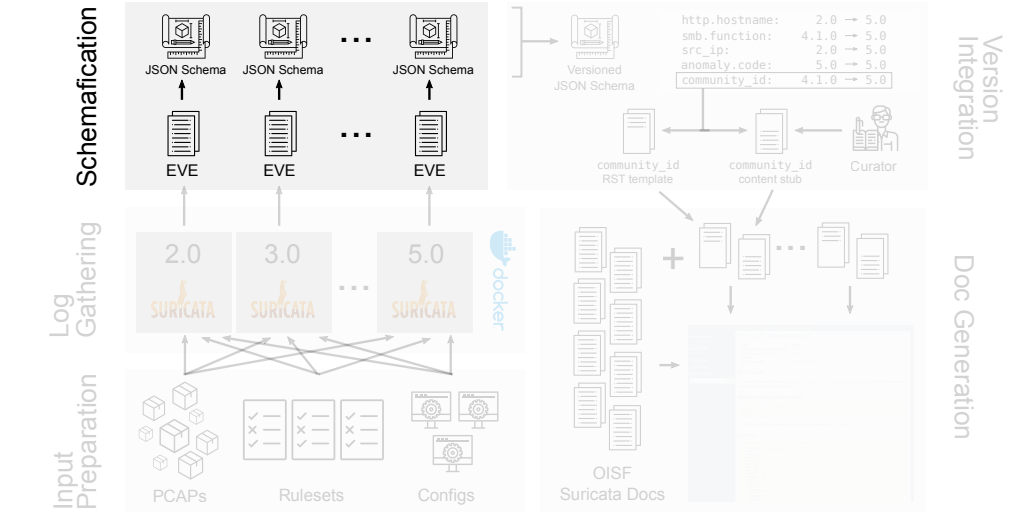
Workflow

TLP:WHITE



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Schemafication

JSON Schema

- Vocabulary that enables annotation and validation of JSON documents
- Structure, value types, presence requirement, ...
- Specified in JSON itself

GenSON (`https://github.com/wolverdude/genson`)

- "Powerful, user-friendly JSON Schema generator built in Python."
- Runs evidence JSON against seed schema (e.g. $\{\}$) and extends schema with each document seen
- Used to bootstrap one JSON schema for each version

Schemafication: Seed Adjustments

TLP:WHITE

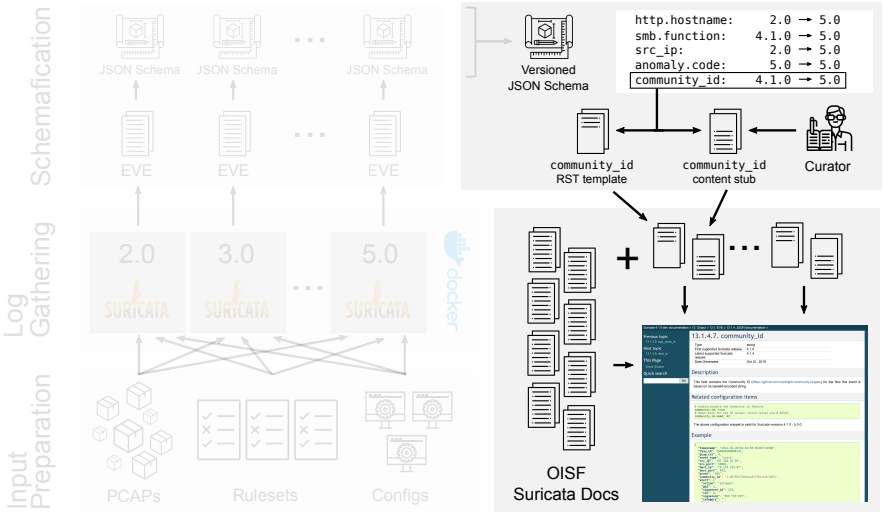
```
{
  "event_type": "stats",
  "stats": {
    "threads": {
      "RX#01": {
        "decoder": {
          "pkts": 1,
          "pkts_delta": 1,
          ...
```

```
{
  "type": "object",
  "properties": {
    "stats": {
      "type": "object",
      "properties": {
        "threads": {
          "patternProperties": {
            ".*": {}
          }
        }
      }
    }
  }
}
```

```
{
  "event_type": "alert",
  "pcap_cnt": 3100,
  ...
  "in_iface": "eth0",
  ...
}
```

```
{
  "type": "object",
  "properties": {
    "in_iface": {
      "type": "string"
    }
  }
}
```

Workflow


Schemafication
Log Gathering
Input Preparation
JSON Schema
JSON Schema
JSON Schema
EVE
EVE
EVE
2.0
3.0
5.0
SURICATA
SURICATA
SURICATA
docker
PCAPs
Rulesets
Configs
Versioned JSON Schema
http.hostname: 2.0 → 5.0
smb.function: 4.1.0 → 5.0
src_ip: 2.0 → 5.0
anomaly.code: 5.0 → 5.0
community_id: 4.1.0 → 5.0
community_id RST template
community_id content stub
Curator
Version Integration
13.1.4.7. community_id
Description
Related configuration items
Example
OISF Suricata Docs
Doc Generation

Version Integration

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- Merge all generated JSON schemas to create unified schema, annotating each field with supported version range
- `*_delta` fields collapsed into their regular counterparts
- Field list used as basis to create ReStructured Text page hierarchy
  - Object→subobject structure maps to sections/subsections
  - *Outer template*: updated with each re-run – name, value type, versions. Imports...
  - *Inner template*: untouched when existing – contains curated content in named paragraphs
- Output
  - Sphinx compatible RST tree
  - General JSON schema?

Format Evolution

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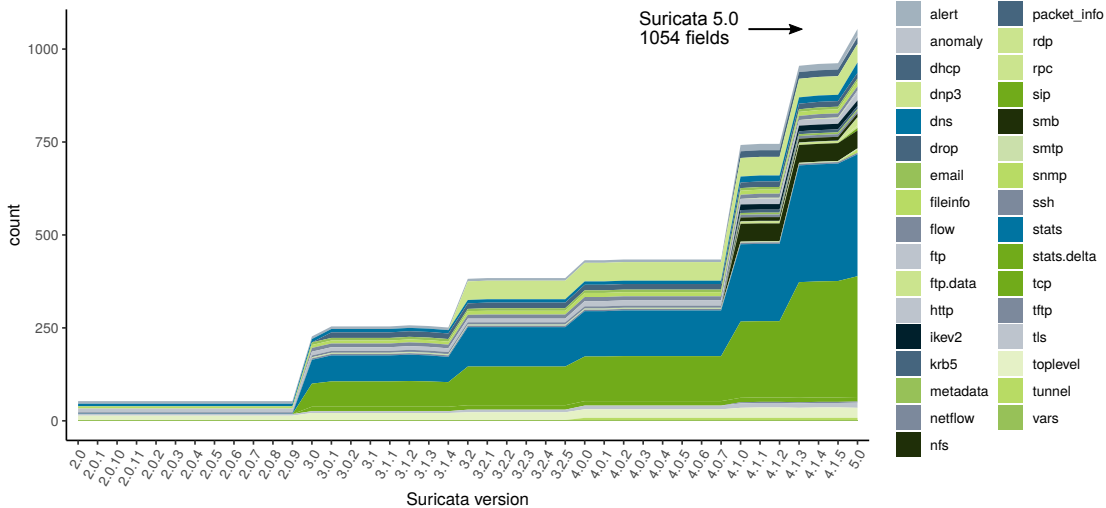

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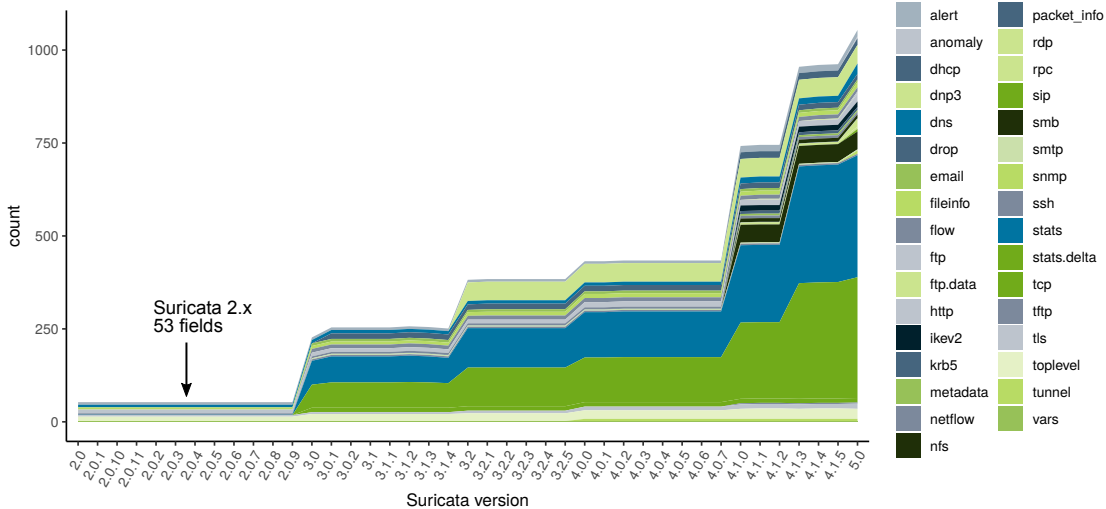

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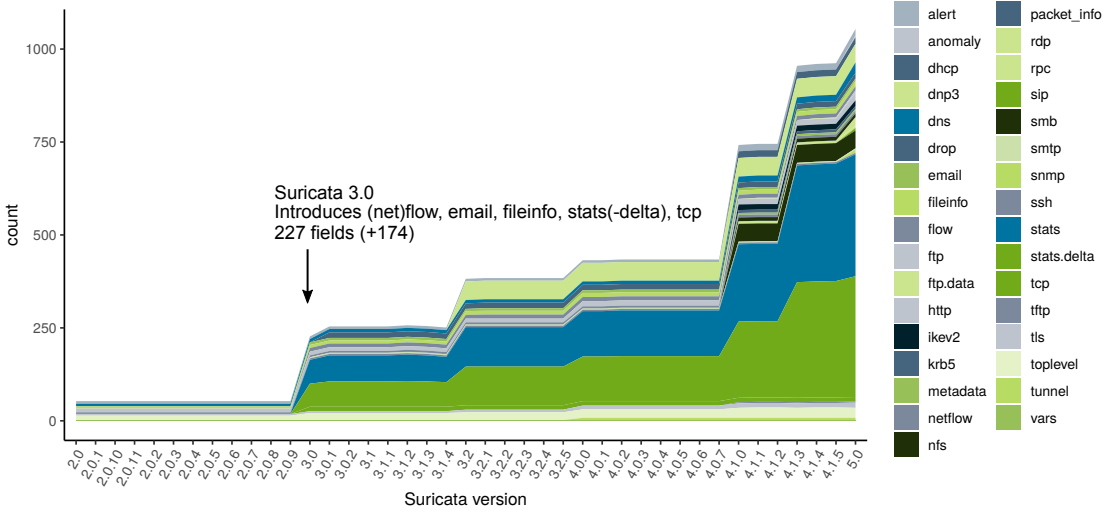

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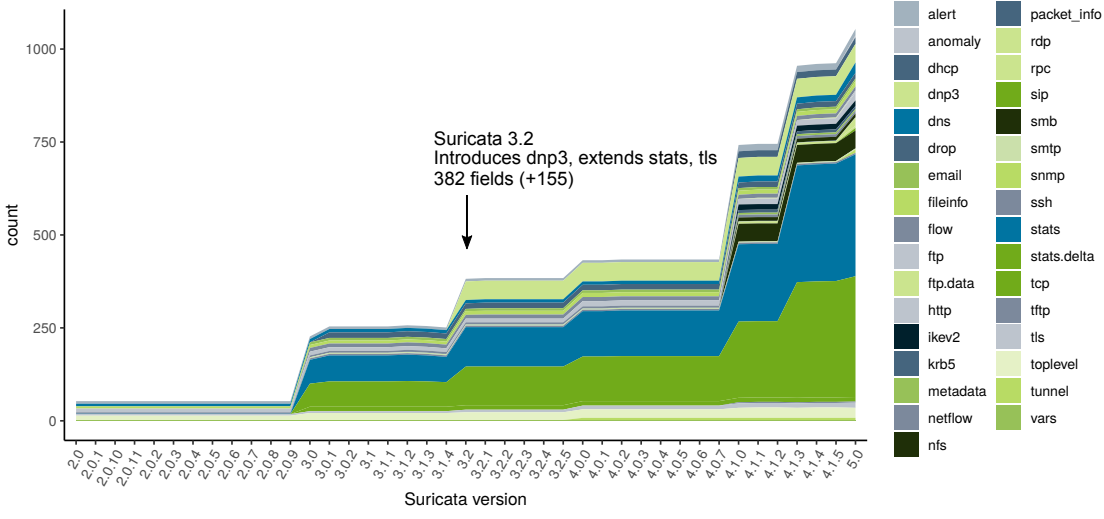

DCSO ENGINEERING SECURITY

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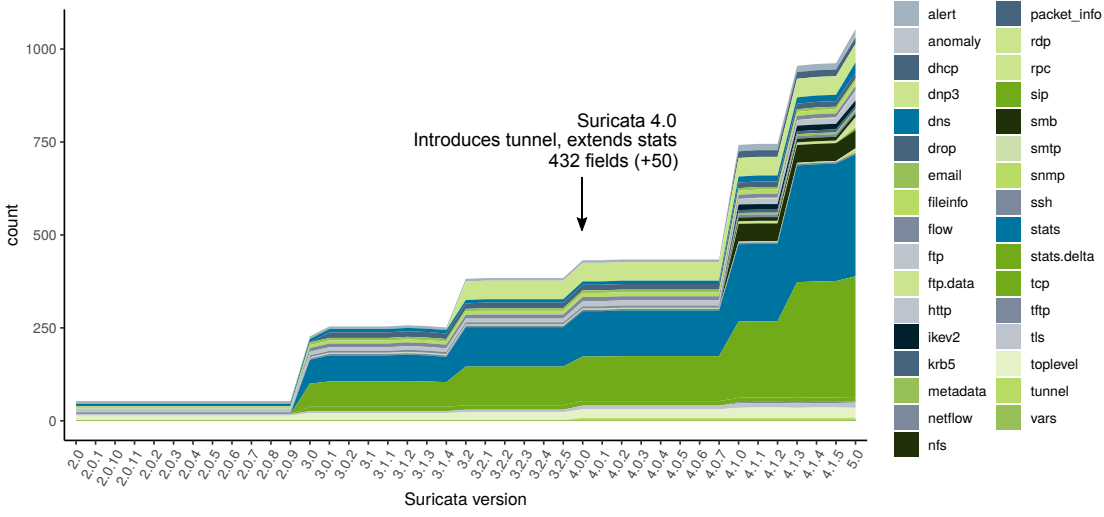

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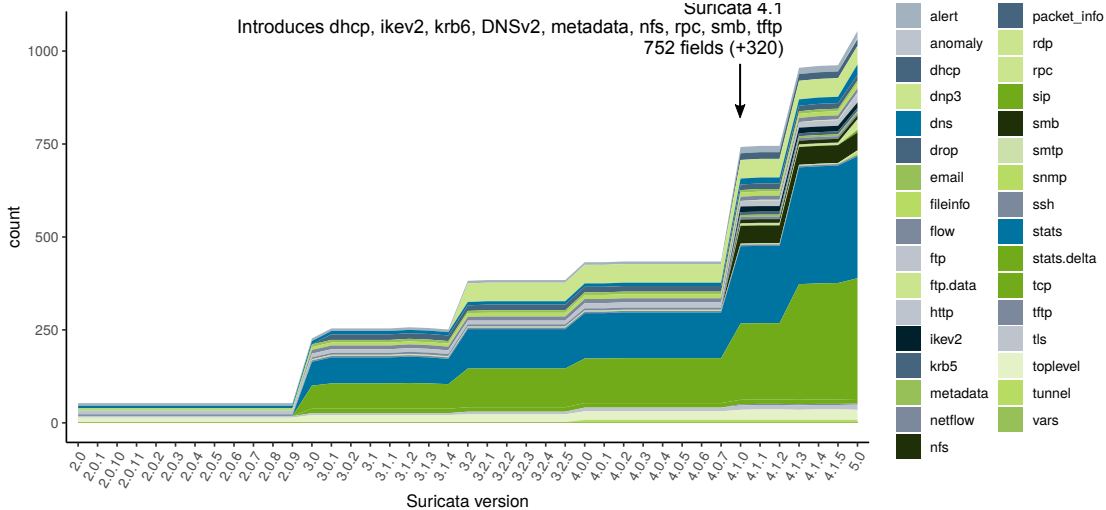

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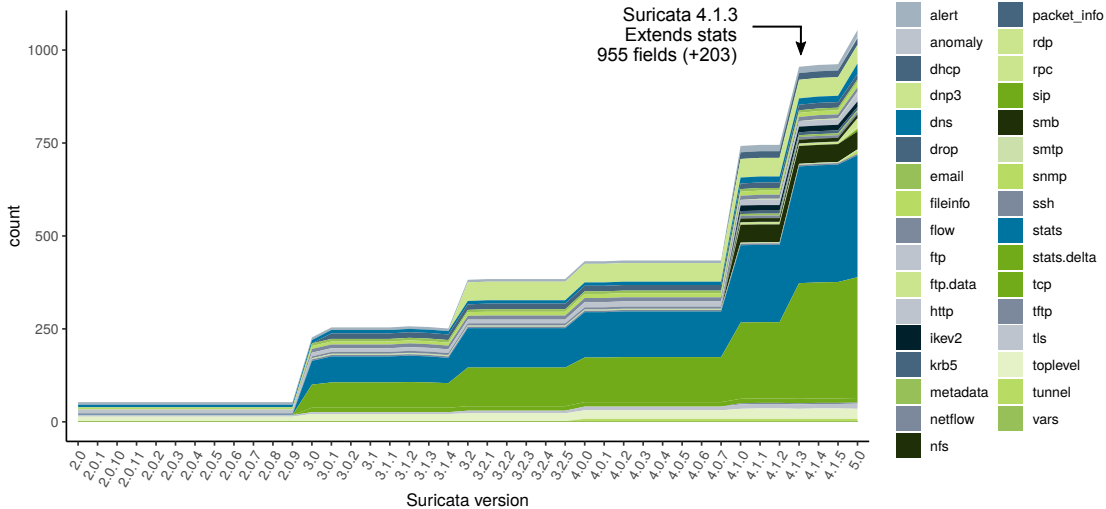

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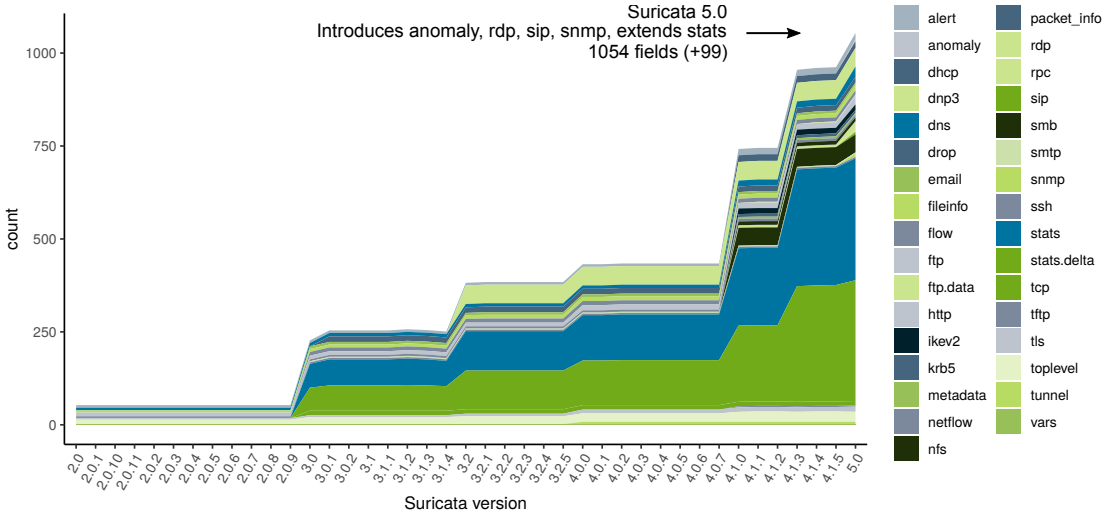

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Results: Bugs & Interesting Findings

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Reduction in `stats` fields:

- Suricata 3.1.2 → 3.1.3:

```
3whs_right_seq_wrong_ack_evasion
3whs_right_seq_wrong_ack_evasion_delta
```

- Suricata 3.1.3 → 3.1.4:

```
3whs_ack_in_wrong_dir
3whs_ack_in_wrong_dir_delta
3whs_async_wrong_seq
3whs_async_wrong_seq_delta
```

Results: Bugs & Interesting Findings

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Bug #1707 (malformed json if message is too big) in Suricata 3.0.0:

- Overly large JSON output can not be parsed by consuming software (e.g. `jq`, GenSON)
- Fixed with Suricata 3.0.1
- Responsible fields: `payload`, `payload_readable`, `packet`
- Output:

```
ValueError: Expecting , delimiter: line 1 column 65537 (char 65536)

parse error: Invalid literal at line 1, column 65546
```

- Workaround:

```
cat eve.json | awk 'length($0) < 65500' > eve.json.clean
```

Results: Bugs & Interesting Findings

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Bug #3216 (MSN protocol detection/parser is not working):

- No EVE-JSON output for MSN protocol detection since version 2.0
- MSN detection removed in Suricata 5.0

The case of the missing “metadata” event_type:

- No output for “metadata” event_type in EVE-JSON (Suricata 4.1.0–5.0.0)

```
# Metadata event type. Triggered whenever a pktvar is saved
# and will include the pktvars, flowvars, flowbits and
# flowints.
- metadata
```

Results: Bugs & Interesting Findings

Segmentation faults (Suricata 2.0.0 - 2.0.11):

- Input

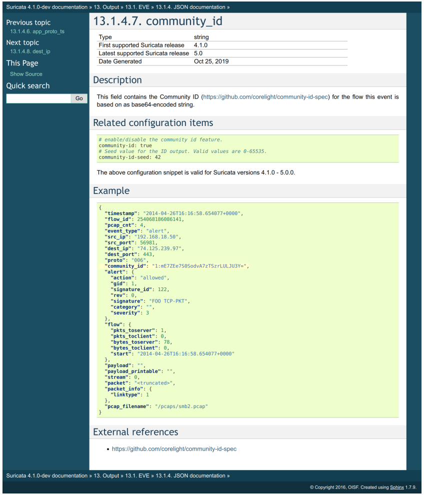
```
alert smtp any any -> any any (msg:"FOO FILESTORE SMTP"; filestore; sid:124;)
```

- Output

```
[33] 10/10/2019 -- 12:21:05 - (suricata.c:983) <Notice> (SCPrintVersion) -- This is
↪  Suricata version 2.0dev (rev bc70fc0f7)
[33] 10/10/2019 -- 12:21:05 - (detect-filestore.c:415) <Error> (DetectFilestoreSetup)
↪  -- [ERRCODE: SC_ERR_CONFLICTING_RULE_KEYWORDS(141)] - rule contains conflicting
↪  keywords.
free(): double free detected in tcache 2
```

Bug in the rule parsing engine?

Results: `community_id` documentation



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13.1.4.7. community_id

Type	string
First supported Suricata release	4.1.0
Latest supported Suricata release	5.0
Date Generated	Oct 25, 2019

Description

This field contains the Community ID (https://github.com/corelight/community-id-spec) for the flow this event is based on as base64-encoded string.

Related configuration items

```
# enable/disable the community id feature.
community-id: true
# Seed value for the ID output. Valid values are 0-65535.
community-id-seed: 42
```

The above configuration snippet is valid for Suricata versions 4.1.0 - 5.0.0.

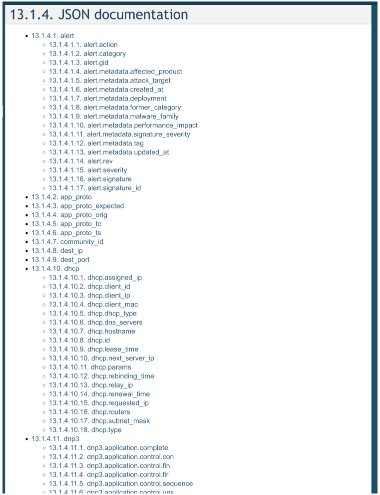
Example


```
{
  "timestamp": "2014-04-26T16:16:58.654077+0000",
  "flow_id": 254068186086141,
  "pcap_cnt": 4,
  "event_type": "alert",
  "src_ip": "192.168.18.50",
  "src_port": 56981,
  "dest_ip": "74.125.239.97",
  "dest_port": 443,
  "proto": "006",
  "community_id": "1:mE7ZEe7S0SodvA7zTSzrLULJU3Y=",
  "alert": {
    "action": "allowed",
    "gid": 1,
    "signature_id": 122,
    "rev": 0,
    "signature": "FOO TCP-PKT",
    "category": "",
    "severity": 3
  },
  "flow": {
    "pkts_toserver": 1,
    "pkts_toclient": 0,
    "bytes_toserver": 78,
    "bytes_toclient": 0,
    "start": "2014-04-26T16:16:58.654077+0000"
  },
  "payload": "",
  "payload_printable": "",
  "stream": 0,
  "packet": "<truncated>",
  "packet_info": {
    "linktype": 1
  },
  "pcap_filename": "/pcaps/smb2.pcap"
}
```


External references

- https://github.com/corelight/community-id-spec

Suricata 4.1.0-dev documentation » 13. Output » 13.1. EVE » 13.1.4. JSON documentation »



13.1.4. JSON documentation

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```

Next steps

TLP:WHITE

Limitations

- Only one build/runtime configuration per version
- Non-scalar value type formatting in documentation
- Inefficient log gathering (huge amount of data)
- Unclear PCAP coverage

Open tasks

- Integration into RTD?
- Call for missing PCAP, feature and fields submission
- Code polishing
- Discuss community requirements

Who wants to help fill the gaps?
→ `https://github.com/satta/suricata-json-schema`

Photo by Søren Astrup Jørgensen via Unsplash

Questions?

Talk to us!

- @ssatta
- @kk_onstantin