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# HYPERSCAN IN SURICATA

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# Welcome and Goals



## ■ Goals:

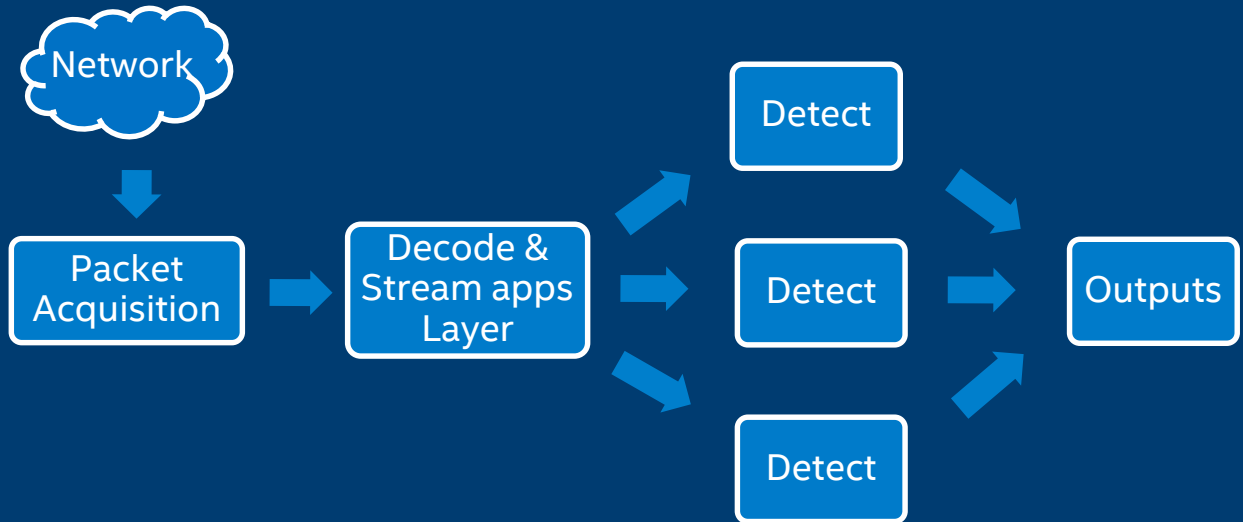
- Show what we've done with Suricata
- Show where we're hitting the limits
- Show how to get better for your models

# Suricata



- Suricata is a GPL-licensed Snort competitor with a similar design, rule format, run by the OISF and also widely used
- Fully support Snort rules
- Multi-threaded already, unlike Snort 2.x
- Developed in the open, using Github

# Suricata Block Diagram



# Suricata Integration



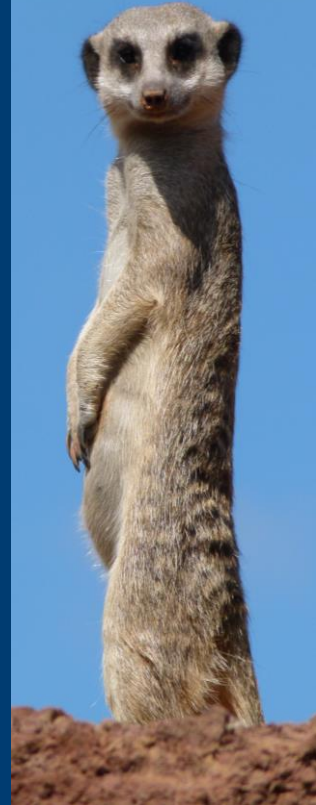
Our Suricata+Hyperscan patch has patched several places in scanning:

Suricata (Since 3.1 release) supports:

- Single literal match
- Multiple literal match
  - Default option on supported platforms

Experimental work only :

- Single regular expression match



# Suricata Integration: Single Literal Match



## Noodle: fast single literal matcher

- Tuned SIMD match on Intel – >100+Gbps typical
- Examine 1-2 characters, do the PCMPQB/shift/and SIMD tricks
  - Gets faster on AVX2, AVX 512
- Use Hyperscan opportunistically
  - Just literals in this pass

# Noodle: Single Literal Match Engine



To match literal */Hyperscan/*, build two 16-byte masks

H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y

For input data *"MATCHmyHyperscan"* at run-time, do PCMPEQB

0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0

LSHIFT and AND

0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---



# Suricata Integration: Multiple Literal Match



- Large scale literal match a 'staple' of Hyperscan
  - Three algorithms
    - FDR: 'bucketed super-character shift-or' (default)
    - Teddy: "SIMD-based bucketed matcher' (2-72 literals)
    - Noodle (SPM): fast SIMD matcher for 1 literal
- Just literals in this pass?
  - No: we do additional constructs like `/^A{10,50}xyz/s`
    - "Anchored" patterns
    - Avoid match "floods"

# Suricata Integration: Single Regex



Simulate behavior of backtracking regular expressions adequately

- Implement *all* regular expressions, including back-references and zero-width asserts, etc.

Standard escape hatch: Pre-filtering (false positive but not false negative)

- HS\_MODE\_PREFILTER: replace unsupported constructs with weaker substitutes
  - Example `\foo(\d)+bar\1baz\ -> \foo(\d)+bar(\d)+baz\`

# Suricata Integration – Performance results



Machine under test: Intel® Core i7 6700K CPU @ 4.0 GHz

Software versions:

- Hyperscan 4.3.1
- Suricata 3.1

The following disclaimer applies to the results presented in the next slides:

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# Suricata Integration – Performance results



## Rule sets

- Emerging Threats public set (“emerging-all-20161102.rules”)
- ET Pro set (“etpro-all-20161102.rules”)

## Input PCAPs: Alexa Top 100 browsing PCAP file

- Measurement is “all processing time” (not just scan)
  - But it’s not true end-to-end (not a network measurement)
  - If we compared head to head against Aho-Corasick the Hyperscan advantage would be bigger

# Hyperscan vs default Aho-Corasick



All Hyperscan vs AC+BM: Emerging Threats: 1.95x, ET Pro: 2.15x speedup

Measured in elapsed time in seconds for our PCAP file



# Performance: Regular Expression “Acceleration”



Rules	PCRE elapsed time	Hyperscan elapsed time
emerging-all-20161102.rules	18.3	18.5
etpro-all-20161102.rules	24.1	24.3

No benefit from Hyperscan overs libpcre for 1-at-a-time-regex

# Why No Regex Speedup?



Hyperscan is big and not optimized for single pattern scans

- Self-interference and interference with other Suricata code

What we can do:

- Cherry-pick some new cases?
- Move regex portion of workload to more appropriate place (multiple matching)
- Use Hyperscan in streaming mode

# Conclusions



Suricata integration with Hyperscan for MPM and SPM

Hyperscan **doubles performance** and has **less memory cost**

- **Call to action:** try Hyperscan if you haven't already

Single regex matching is an awkward fit

Plenty of low-hanging fruit in Suricata scanning model

- **Call to action:** fix model to use streaming & multi-matching

Questions?