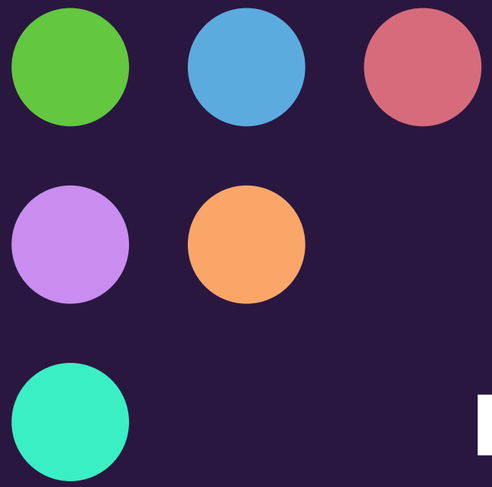
Fleet and osquery - open source device visibility



fleet

Guillaume Ross

Head of Security @ Fleet
I haven't spoken at Northsec in years!

Previously at:

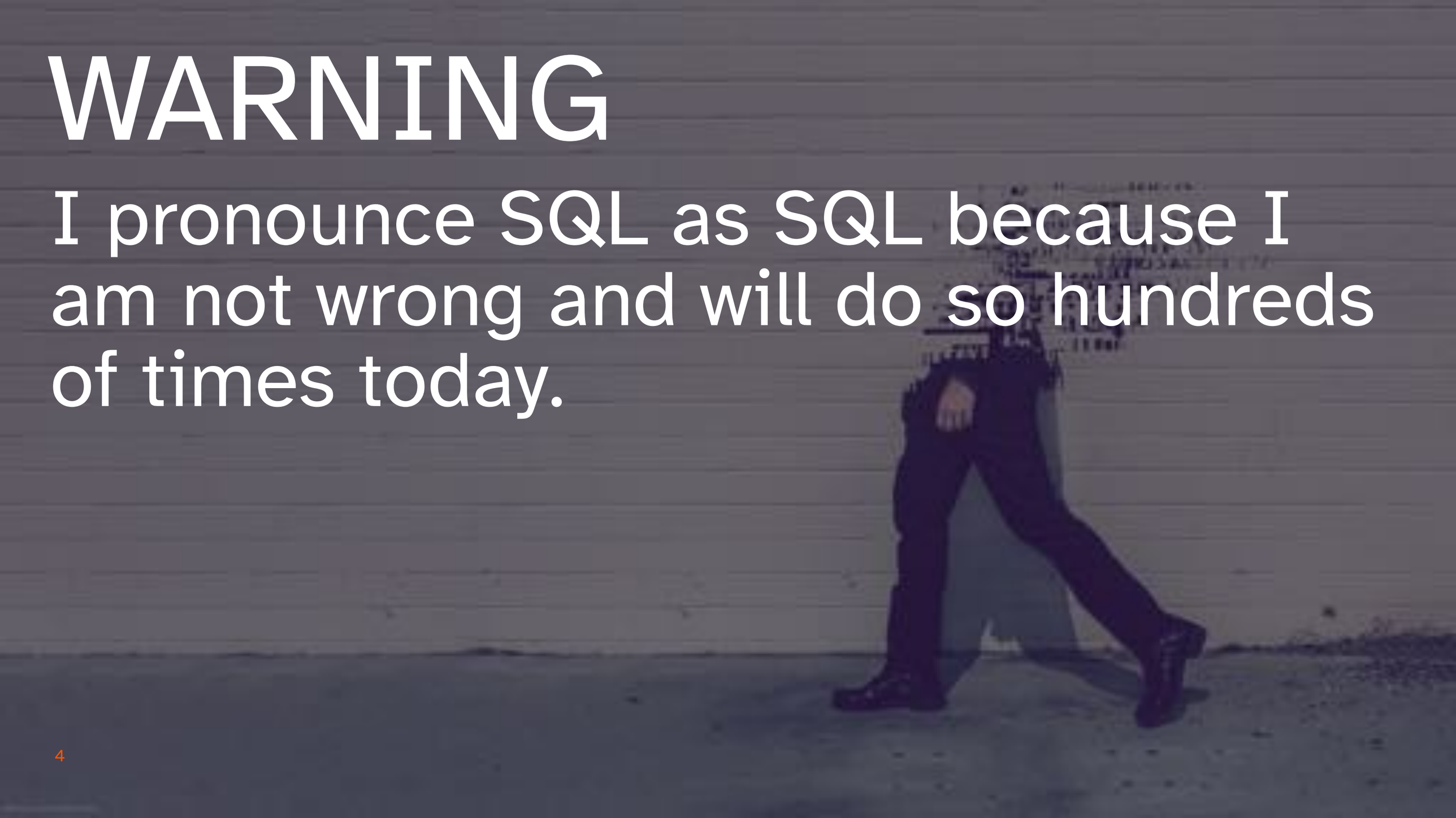
- Finaptic 🪦
- Uptycs (Also uses `osquery`!)
- Nuance
- Rapid7

Kathy Satterlee

ENTER DETAILS HERE

WARNING

I pronounce SQL as SQL because I am not wrong and will do so hundreds of times today.



The workshop

- We will install Fleet in preview mode
- We'll configure it via command line
- Create custom osquery installers with Orbit
- Use Fleet and osquery to detect unsafe configurations
- Use Fleet and osquery to hunt for threats
- Integrate it with 3rd party tools!

Notes and links

- Notes and links on Google Docs: https://bit.ly/37W7elB
  - Keep it open in a tab. We might paste more into it as we go.

Includes a link to a Google Drive folder - keep for later!

Workshop / Support/ Chat

Please join the #Fleet channel on the osquery Slack.

Go to http://fleetdm.com/slack and click "Join the conversation."

What is osquery?

- Open source, cross-platform agent
- Converts your system into a virtual relational database

Ask systems: What files are present? What account exists? Are there unencrypted SSH keys? What startup items run on boot?

- ~300 different tables

Bookmark this https://osquery.io/schema/

How osquery works

- `osqueryi`: terminal/interactive version
- `osqueryd` - daemon
- Configured with local files or over TLS (Fleet!)
- Logs locally, over TLS (Fleet!) or other outputs.
- If using osquery over TLS, real-time queries can be performed. `test`

What is Fleet?

- https://github.com/fleetdm/fleet

Fleet is the most widely used open source, osquery manager. Deploying osquery with Fleet enables programmable live queries, streaming logs, and effective management of osquery across 100,000+ servers, containers, and laptops. It's handy for talking to multiple devices at the same time.

What we'll run

1) Fleet in preview mode on your laptop
2) VMs pointing to a centralized Fleet server (not "real" ones!)
3) A VM or your laptop with vanilla osquery to test local things
4) A free account on Tines to try orchestration

How we'll work

- Feel free to post questions in the Slack channel (#Fleet on osquery Slack)
- Team up to brainstorm queries together
- Please be nice on the shared server - I don't want to rebuild it live 😅
- You'll suggest use cases and we can brainstorm them together and on Slack as well!

Let's get rolling!

Let's get a test Fleet environment running!

https://fleetdm.com/get-started

Pre-requisites

- Docker
  - Mac and Windows: Desktop
  - Linux: Installed from Docker and not your distro's packages
- npm and nodeJS (https://nodejs.org/en/download/)
  - Mac: `brew install npm` works too
  - Linux: Recent Ubuntu LTS `apt-get install npm` works too

Pre-requisites (part two)

- `docker-compose` (python) (dependency being removed as we speak)
  - Check if `docker-compose` is available in a terminal (Desktop version includes it)
  - `apt-get install docker-compose`

Installing fleetctl

Do NOT tell my boss @mikermcneil I pronounce it fleet-cuttle.

`sudo npm install -g fleetctl` (On Windows, replace sudo with using an admin `cmd/PowerShell`)

Running it

`sudo fleetctl preview` (Same as previous for Windows)

What happens in preview mode

1. Fleet server will be run using Docker.
2. A dockerized osquery will be run on your laptop, enrolled to the local Fleet.
3. Simulated Linux hosts will get enrolled to the local Fleet.
4. http://localhost:1337 - `admin@example.com` / `admin123#`

Test it

- Go to **Queries** and then **Create new query**

```
SELECT * from osquery_info;
```

Run it on all hosts. Did they all reply including your laptop host?

SQL in osquery

- Uses SQLite
- Standard SQL

```
SELECT username FROM users ORDER BY username;
```

Run it against your actual host.

SQL

```
SELECT * FROM users;

SELECT * FROM crontab;

SELECT * FROM processes;
```

SQL: Your turn

Take 5 minutes

1. Look at the osquery schema.
2. Find a way to query a few of those:
    - Is disk encryption enabled?
    - What Linux kernel modules are loaded?
    - Does the file `/etc/hosts` exist on the system?

SQL: Your turn

Time to look at your examples!

SQL - filtering

- Select only the columns you need: `SELECT column1, column2 FROM table;`
- Filter with WHERE: `SELECT column1, column2 FROM table WHERE column1 'string';`
- Wildcards with LIKE: `SELECT column1, column2 FROM table WHERE column2 LIKE '%potato%';`

`%` matches any sequence. `_` matches a single character. For file paths, `%` can be used in a directory: `/Users/%/Downloads`

SQL - you can get advanced!

You can also SPLIT, concatenate create temporary tables, essentially do almost anything you could think of doing with SQL.

```
WITH pstree AS (
  SELECT 0 as level, pid, name, parent, name as pparent, uid,  cast(uid as varchar(10)) puid
  FROM processes   WHERE parent = 0
  UNION ALL
  SELECT level+1 as level, t.pid, t.name, t.parent, pstree.pparent || '->' || t.name as pparent, t.uid, pstree.puid || '->' || t.uid as puid
   FROM processes t   INNER join pstree on t.parent = pstree.pid )
SELECT level, pid, name, pparent as process_chain, puid as user_chain  FROM pstree;
```

(Query available on our centralized server)

VERY useful to split **registry paths** on Windows!

Processes table

The previously shown query uses the processes table, cross-platform.

```
SELECT * FROM processes;
```

This is a snapshot of what is happening.

What potential issue could this create if not taken into account?

How would you find a specific process that you know is running?

User specific tables

- What Chrome extensions are installed? (or shell history, or Firefox extensions, etc.)

These questions require a "per-user" answer. They have a **UID** column.

The users table also has a **UID** column.

Try this

```
SELECT * FROM table with uids WHERE
```

Results

What did you get?

Could you tell precisely what user was related to each entry?

How would you do it?

List the actual users?

```
SELECT users.username,
table_with_uids.what_you_want,
table_with_uids.what_you_want2 FROM users CROSS
JOIN table_with_uids USING (uid);
```

Chrome extensions example

Time to make a real one! There are a few ways to achieve it, but the previous example works too.

Chrome extensions example

```
SELECT users.username, chrome_extensions.name,
chrome_extensions.description FROM users CROSS
JOIN chrome_extensions USING (uid);
```

Events table

- file_events (macOS and Linux)
- ntfsjournalevents (Windows)
- powershell_events (Windows + requires script block logging)
- process_events (macOS and Linux)
- socket_events (macOS and Linux)

And many more!

Try one of the _events tables

Pick one that works with the OS of your host enrolled to Fleet.

Results?

The *osquery_flags* table

osquery flags: configuration - can be passed via TLS, in local config files, or at startup

Fleet manages flags.

`select * from osquery_flags;` to see flags currently applied on a host.

Events flags

`disable-events` must be turned off.

OS permissions also apply, which is why you are likely getting no results now. In a regular environment, deploy osquery and grant it full disk access on macOS: https://fleetdm.com/docs/using-fleet/adding-hosts#grant-full-disk-access-to-osquery-on-mac-os

Then, there are settings per type of events.

Install vanilla osquery on another VM

If you have an available Linux VM (not used for the Fleet preview), install osquery.
https://osquery.io/downloads/official/5.2.3

On vanilla osqueryi

```
osqueryi --audit_allow_config=true --
audit_allow_sockets=true --audit_persist=true --
disable_audit=false --events_expiry=1 --
events_max=50000 --logger_plugin=filesystem --
disable_events=false
```

This will run an interactive osquery terminal with file, socket and process events enabled.

Generate activity

In another terminal on the same machine (ssh, screen, anything), run a few commands (`ping`, `ls`, `top`, whatever!)

Go back to your running osqueryi

```
select * FROM process_events;
```

Events and Fleet

- Fleet does not "store" all osquery data (it's not a SIEM!)
- Send them to something such as Firehose to ingest in a SIEM, Graylog, Elastic, Splunk, etc.
- https://fleetdm.com/docs/using-fleet/osquery-logs#firehose

Use cases for events

- Detection and investigation (processevents, processopen_files, etc.)
- File integrity monitoring (FIM) (fileevents, ntfsjournal_events)
- Tracking the use of USB storage (hardware_events)

Generating pre-configured osquery installers with fleetctl

- Do this on the machine you installed `fleetctl`.
- Go to your Fleet instance. On **Hosts** - click **Add new hosts**.

You will see the command to generate the package.

Warning: the preview will not listen on all interfaces and you will likely have a hard time adding hosts. Let's generate a package for `nsecfleet2.evil.plumbing` instead!

My server...

I should be seeing some of your VMs pop-up.

DON'T POINT YOUR REAL MACHINE TO THIS as we will all have access to query it!
Feel free to point Mac VMs, Linux VMs, Windows VMs!

https://nsecfleet2.evil.plumbing:8080
Username: `workshop@evil.plumbing`
Password: `urea-BANDANA-fireside2`

Observer account

As you can see, on my server, you have access to predefined queries at the moment.

Great for giving some access for support cases, but without having people have creepy levels of access to endpoints.

What we have so far

1. Local preview instances, with our own laptops enrolled.
2. Random VMs pointed to a centralized server (https://nsecfleet2.evil.plumbing:8080)

We'll refer to these as **preview** and **nsecfleet** instances.

Policies

Policies in Fleet are queries that pass or fail.

If results are returned, that's a pass.

E.g., `SELECT 1 WHERE 1=1;` will always pass.

Making things faster

By default - policies update hourly and the webhooks for integrations once a day.

Let's use `fleetctl` to update that.

Log in with `fleetctl`

1. Configure `fleetctl` to point to your localhost, no HTTPS instance.

```
sudo fleetctl config set --address http://
localhost:1337 --tls-skip-verify
```

1. Log in to the instance.

```
sudo fleetctl login
```

Applying a config with `fleetctl`

Create a file called `config.yml` with this content:

```
apiVersion: v1
kind: config
spec:
  webhook_settings:
    interval: 1m
```

Or grab it from the Google Drive.

Applying a config with `fleetctl`

```
sudo fleetctl apply -f config.yml
```

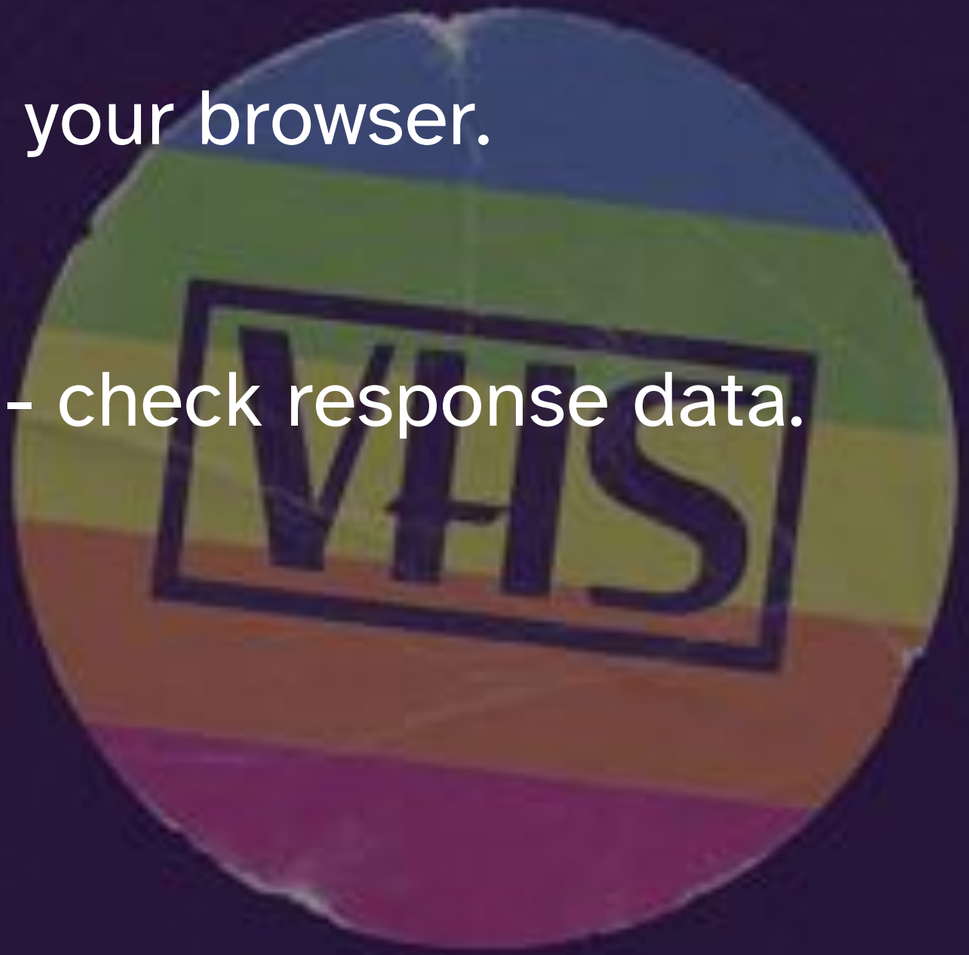
Why is this useful? Make sure you have the correct config, put it in CI/CD pipelines, avoid human error, etc!

What did we change?

`webhook_settings.interval` to one minute instead of 24 hours, so when we configure policy automation, they'll get triggered super fast.

Check the effective config

1. Open dev tools in your browser.
2. Reload
3. Look for `config` - check response data.



Disk encryption

On your **preview** - you should have three policies for disk encryption.

Do you have hosts passing/failing them?

Firewall

Can you write a policy to check if the firewall is enabled?

Pick the OS you want.

Tips:

- Look through the osquery schema
- Use `SELECT 1 FROM` to only return results if a specific condition is passed. (Look at the built-in queries for examples)

Firewall

macOS

```
SELECT 1 FROM alf WHERE global_state >= 1;
```

`global_state` could be set to 1 or 2 meaning it's enabled, or enabled and blocking all inbound, and this would pass.

Firewall

Windows

We do not have a table for firewall status itself, but `windows_security_center` has a firewall column!

```
SELECT 1 FROM windows_security_center WHERE
firewall='good';
```

Unwanted software

Let's make a **negative** policy. One that fails **if** something **is found**.

Assume you hit your head cartoon-style and suddenly started preferring emacs.
You want to detect any use of any package that starts with **vim** on Debian machines (such as the enrolled fake-Linux machines on your **preview**.)

Tip: Look at the built-in "SSH Keys encrypted" policy for ideas on making a negative policy.

Unwanted software

```
SELECT 1 WHERE NOT EXISTS (SELECT * FROM
deb_packages WHERE name LIKE 'vim%');
```

1. `deb_packages` table. You can query all of it and see, one of your fake machines should have `vim-tiny` and `vim-common`.
2. We use `WHERE NOT EXISTS` with `SELECT 1` to return results IF the sub-query is empty. So `1` is returned only if nothing that has a name `LIKE vim%` is found.

No unencrypted SSH keys

Enable this built-in policy.

Automations

See that manage automations on the top right?

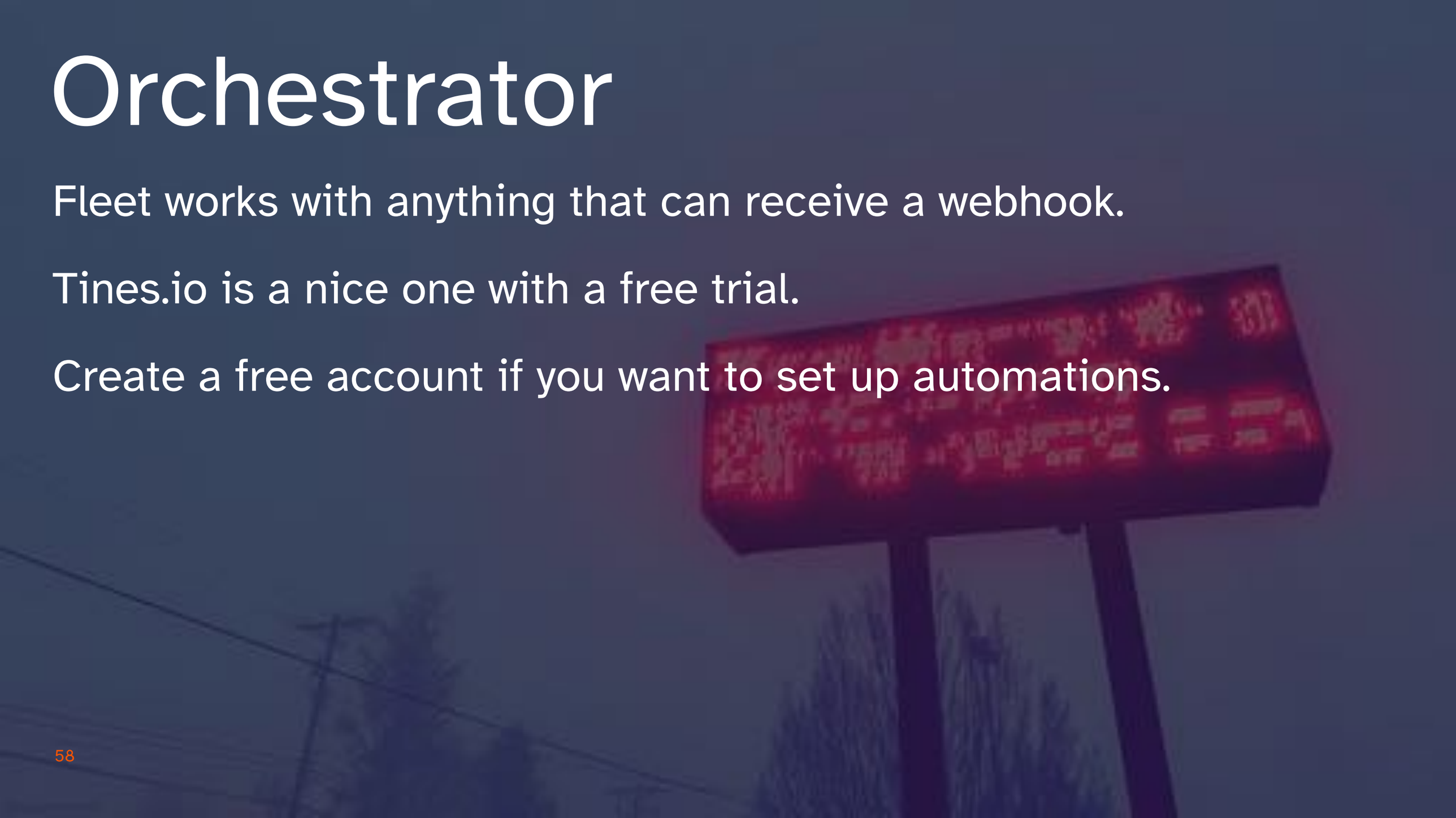
We need something to receive that webhook!

Orchestrator

Fleet works with anything that can receive a webhook.

Tines.io is a nice one with a free trial.

Create a free account if you want to set up automations.



Policy webhook

In Tines, create a story.

- Drag the "Webhook" action from the top left.
- On the right pane, copy the Webhook URL.
- In Fleet, on the Policies page, click **Manage Automations**.
- Select all policies, and paste the Tines URL at the bottom.
- Save!

Sending fake data

To populate the data structure. Back in the **Manage Automations** pane, bottom left, **Preview Payload**.

Copy the JSON in a text editor.
Go to the Tines **Summary** pane for the **Webhook**, then select **Complex**.

Copy the first line of the `curl` including the `-d` command **above** the previously copied JSON in a text editor.

Sending fake data

Example

`curl -X POST https://bold-lake-4143.tines.com/webhook/13d0deb441fa0427ffc8e771bbb19a66/a94ebc3b2c81ce4db47ae1f69ed707b8 -H "Content-Type: application/json" -d` (JSON goes here between single quotes 'json')

Run it in a terminal from your laptop.

Emit the "held" event in Tines.

Explode the data

Create an **Event Transform** with mode **explode**. Set the path to `receive_policy.webhook.body.hosts`. Autocomplete should work if you sent the fake data and hit the emit button!

Send an email

Add an email action. Configure the text body to use variables like the hostname from the **Event Transform** and the policy name from the webhook!

The simplest example

Vulnerabilities have a similar webhook, and Tines includes pre-built Fleet actions to query the API for more advanced use cases. E.g., Identify **who** owns a machine and emailing **them** instead of you,

Create a policy to check for unencrypted SSH keys

Tips:

1. It can be a negative policy (Remember the `SELECT 1 WHERE NOT EXISTS (other query) trick)
2. You'll need to `JOIN`

Create an unencrypted SSH key

If you are on Mac or Linux.

`ssh-keygen -t rsa -b 4096 -C "your_email@domain.lulz"` -> Make sure you don't overwrite your real keys. But store it in your `.ssh` (e.g., `/Users/g/.ssh/unencrypted_ssh_rsa.pub`)

Policy will fail

The policy will fail. You can hit "refresh" on your host to speed things up. Eventually you should get an email about it.

Fleet in SOAR via REST API

- Postman collection: https://bit.ly/3lo8Yau
- Tines already has pre-built Fleet actions

Use these to augment anything. For example, on policy violation, you could Get Host to Human Mapping in Fleet to find the email address of the laptop's owner.

API Token for nsecfleet2: See the Google Drive

Hunting & secure configuration!

Let's look at ways you can hunt for threats and dangerous configs with osquery & Fleet.

Hunting

1. In the real world, I highly recommend sending _events to your centralized logs/SIEM etc.
    - Setting up multiple Fleet instances was already a lot for a 2.5hour workshop, didn't want to add Graylog to it :)
2. Let's use MITRE ATT&CK for some ideas.

MITRE ATT&CK For Linux

I am using the Linux Matrix - as everyone has Linux machines simulated in the **preview**!

https://attack.mitre.org/matrices/enterprise/linux/

Execution: Do you see something in there we could look at (excluding events)?

MITRE ATT&CK for all OSes

Privilege escalation: T1543 - Create or modify system process
https://attack.mitre.org/techniques/T1543/

Pick an OS and make an example!

PowerShell Script Block Logging + osquery

One of the most valuable ways to dig into PowerShell shenanigans. Requires enabling events

First, check if script block logging is enabled!

It's in HKEYLOCALMACHINE\Software\Policies\Microsoft\Windows\PowerShell\ScriptBlockLogging\EnableScriptBlockLogging. How would you query that?

Scheduling queries to send to centralized logs

1. Come up with a query that would make sense to repeat often.

E.g., What services are running on my Windows servers?

Should not change often!

1. Create query. Save it in Fleet.
2. Schedule query

Note the **performance impact** column.

See all current network connections

How would you look at a snapshot of all network connections?

Then, how would you filter on an IP address IOC? (e.g., 8.8.8.8)

Yara

A great way to look for "freeware"!

1. Can pre-load Yara rules and configure them in the **yara** configuration section (not great for opsec)
2. Can point to URLs
3. Can specify the signature in the query
4. If events are enabled, can run constantly!

For workshop purposes we'll go **inline**.

Yara

1. Download eicar.com on your host running the Fleet preview.

wget https://secure.eicar.org/eicar.com

Warning: On Mac, put it on your home directory, **not** Downloads or Desktop. Those are protected folders the preview osquery can't read.

1. Create a query using the **yara** table and this signature. Don't look at the whole filesystem - too slow for demo purposes. Point it at the directory containing the file.

Yara

The query:

```
SELECT * FROM yara WHERE path like '/root/%%' AND sigrule IN (
    'rule eicar {
    strings:
    $s1 = "X5O!P%@AP[4\\PZX54(P^)7CC)7}$EICAR-STANDARD-ANTIVIRUS-TEST-FILE!$H+H*" fullword ascii
    condition:
    all of them
}'
) AND matches='eicar';
```

Yara - policy

Make it a negative query so the policy passes if nothing is found!

```
SELECT 1 WHERE NOT EXISTS (SELECT * FROM yara WHERE path like '/root/%%' AND sigrule IN (
    'rule eicar {
    strings:
    $s1 = "X5O!P%@AP[4\\PZX54(P^)7CC)7}$EICAR-STANDARD-ANTIVIRUS-TEST-FILE!$H+H*" fullword ascii
    condition:
    all of them
}'
) AND matches='eicar');
```

Yara - production grade

In production, you'd likely not scan the filesystem for malware like this, but either use:

yara_events

OR

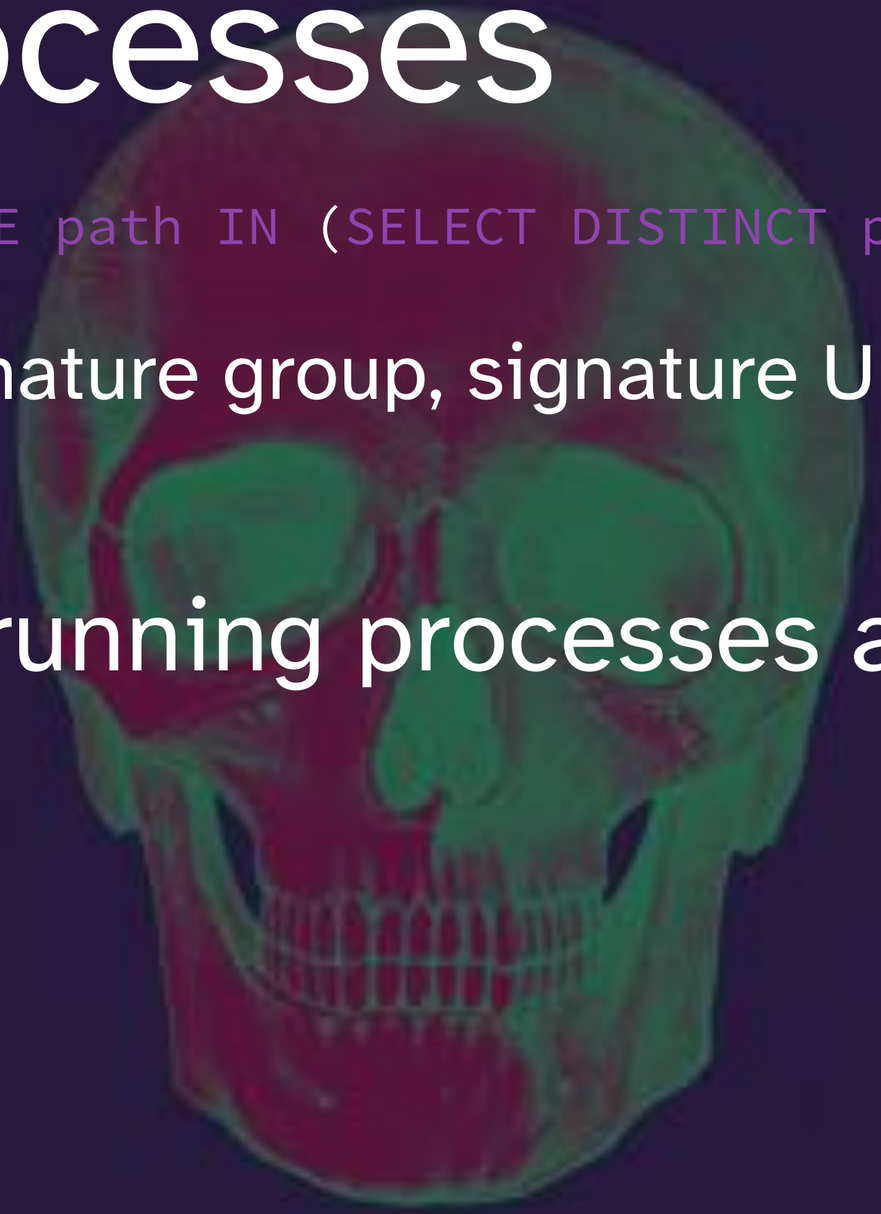
Match a set of rules against **processes**. Load a standard library locally, then look up new things either live or via URL (opsec warnings go here).

Yara - processes

```
SELECT * FROM yara WHERE path IN (SELECT DISTINCT path FROM processes) AND
```

-> Then add your signature group, signature URLs.

This scans only running processes against a set of yara rules.



Yara - processes

Let's try it with eicar. nothing will match since eicar is not running.

```
SELECT * FROM yara WHERE path IN (SELECT DISTINCT path FROM processes) AND sigrule IN (
    'rule eicar {
    strings:
    $s1 = "X5O!P%@AP[4\\PZX54(P^)7CC)7}$EICAR-STANDARD-ANTIVIRUS-TEST-FILE!$H+H*" fullword ascii
    condition:
    all of them
}'
) AND matches='eicar';
```

Notice it was pretty quick to run! Good query to schedule with a decent yara db.

If we have time left...

Open use case time!

Suggest use cases in Slack. The one that gets the most emoji reactions is the one we'll look at next!

Thank you for your time!

- Fleet channel if you have questions later!
- Twitter: @gepeto42 and @fleetctl
- https://www.pluralsight.com/authors/guillaume-ross
- Hecklers -> **Detection & Response Block** in Ville-Marie-17h55
- I might host a more advanced version of this workshop with **events** sent to **Graylog** or similar this summer! Stay tuned.

Wallpapers provided by the great Rob Sheridan!