Salting things up in the Devops' World

Things just got real

whoami

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- Using Salt for a couple of years now, no regrets.
- Or all regrets.

Disclaimer

- I am just a user.
- I do not develop Salt, although I do annoy the team on IRC.
- Only had 72 hours to prepare this.

Why Salt?

- Configuration Management System
- Like Puppet / Chef / Ansible (only better ;)
- Python / YAML / Jinja
- Relatively easy to understand.
- Extremely powerful.
- Allows “root-less” operation (via SSH).

Previously...

- https://ep2016.europython.eu/conference/talks/salting-things-up-in-the-sysadmins-world

- Master / minion
- States / highstates
- Matching
- Grains / Pillar
- Unfortunately, still no Python 3 support:
  - https://github.com/saltstack/salt/issues/11995

Salt Mine

- Collect arbitrary data on the minions. Ship it to the master.
- Only the most recent data is maintained.
- Data is made available for **all** minions.

- Grains?
- Mine data is more updated. Grains are mainly static (can be updated manually though).
- If minions need data from other (slower) minions, the mine caches it. It is at least *mine-interval* fresh.

Salt Mine

- Mine can be populated by either:
  - Pillar
  - Minion’s configuration file

- In the case of salt-ssh:
  - Roster data
  - Pillar
  - Master configuration

Salt Mine - example

```
# /srv/pillar/top.sls:
base:
  'G@roles:web':
    - web

# /srv/pillar/web.sls:
mine_functions:
  network.ip_addrs: [eth0]

# /etc/salt/minion.d/mine.conf:
mine_interval: 5
```

Salt Mine - example

```
# /srv/salt/haproxy.sls:
haproxy_config:
file.managed:
    - name: /etc/haproxy/config
    - source: salt://haproxy_config
    - template: jinja

# /srv/salt/haproxy_config:
<...file contents snipped...>
{% for server, addrs in salt['mine.get']('roles:web', 'network.ip_addrs', expr_form='grain') | dictsort() %}
server {{ server }} {{ addrs[0] }}:80 check
{% endfor %}
<...file contents snipped...>
```

Topologies

- Most common topology:
  - Master → Minion(sssss)

- Alternative topologies?
- Moar masters?
- Segregation?

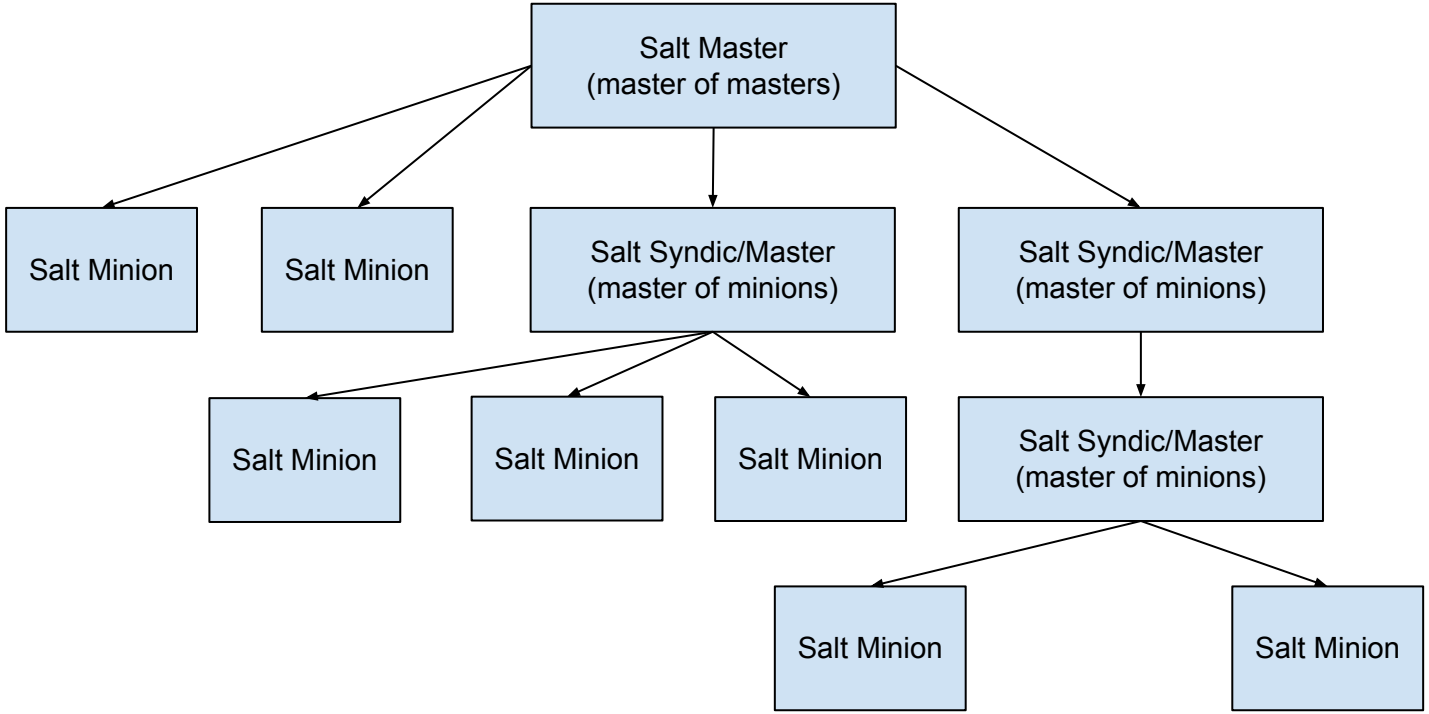
Topologies

Syndic Node

- Intermediate node type, special passthrough one.
- Controls a given set of lower level minions.
- Two daemons running: *salt-syndic* & *salt-master* (optionally but recommended, a *salt-minion* too).

- *salt-syndic* receives ‘orders’ from the **master of masters**.
- *salt-syndic* relays those orders to the local master.
- *salt-master* gets the ‘orders’ and relays them to the lower minions.
- The Syndic node is now a **master of minions**.

Syndic Node



Syndic Node - configuration

- On the Syndic node:

```
# /etc/salt/master
syndic_master: 10.10.0.1  # may be either an IP address or a hostname

# /etc/salt/minion
# id is shared by the salt-syndic daemon and a possible salt-minion daemon
# on the Syndic node
id: my_syndic
```

- On the master node:

```
# /etc/salt/master
order_masters: True
```

Syndic Node - running it

- On the Syndic node:
  - salt-syndic

- On the master node:
  - salt-key -A my_syndic

Syndic Node

- Different syndics per environment (production, development, QA, etc).
- Different syndics to comply with InfoSec standards.
- We can even do multimaster:
  - https://docs.saltstack.com/en/latest/topics/tutorials/multimaster.html

The Event System

- Track events.
- That’s it? No.
- Events can be acted upon.
- The Event System is at the base of many other subsystems.

- The event bus is a ZeroMQ PUB interface.
- Every event has a tag.
- Every event has a data structure.

The Event System

- Viewing events:

```
# salt-run state.event pretty=True
```

- Sending events to the master:

```
# salt-call event.send 'myevent/mytag/success' '{success: True, message: "It works!"}'
```

- Events can also be sent from Python code.

The Event System

- If watching the event bus, this shows up:

```
salt/job/20160717180356279472/ret/gantrithor    {
    "_stamp": "2016-07-17T21:03:56.280813",
    [...]
    "fun": "event.send",
    "fun_args": [
        "myevent/mytag/success",
        "{success: True, message: \"It works!\"}"
    ],
    "id": "minion_id",
    [...]
}
```

State (Execution) modules vs Runner modules

- Execution modules run on the targeted minions.
- Runner modules run on the master.
- They can be either asynchronous or synchronous.
- Added via *runner_dirs* configuration variable in */etc/salt/master*.
- Runner modules can be written in pure Python code.
- Convenience: any print statements will generate events.

State (Execution) modules vs Runner modules

```
def a_runner(outputter=None, display_progress=False):
    print('Hello world')
    …
```

```
Event fired at Tue Jan 13 15:26:45 2015
*************************
Tag: salt/run/20150113152644070246/print
Data:
{'_stamp': '2015-01-13T15:26:45.078707',
 'data': 'hello',
  'outputter': 'pprint'}
```

State (Execution) modules vs Runner modules

- You don’t have to forcefully write runner modules.
- Full list: https://docs.saltstack.com/en/latest/ref/runners/all/index.html

Beacons

- Like in the picture, Salt Beacons serve as a signal.
- Beacons use the Salt Event System to monitor things outside Salt.
- Send notifications (an event) when something changes.
- Are configured via the minion’s configuration file.

- inotify anyone?
- In fact...

Beacons - examples

- inotify

```
# cat /etc/salt/minion.d/beacons.conf
beacons:
      inotify:
            /etc/resolv.conf:
                  auto_add: True
            interval: 30
      [...]
```

Beacons - examples

- Process

```
# cat /etc/salt/minion.d/beacons.conf
beacons:
      [...]
      service:
            process_name:
                  onchangeonly: True
            interval: 120
```

Beacons - examples

- Memory usage
- Disk usage
- System load
- Network settings
- [...]
- Your own

https://docs.saltstack.com/en/latest/ref/beacons/all/index.html#all-salt-beacons

Salt Reactor

Salt Reactor

- Its job is to “react” (not JS :)
- Trigger actions in response to an event
- So it needs the event system
- Actions → states!
- In reality:
  - *Something happened* → Event → Reactor → Action (state)
- Reactors are defined in the **master**’s configuration file.

Salt Reactor - associating events to states

- In the master's configuration file:

```
reactor:                            # Master config section "reactor"
  - 'salt/minion/*/start':          # Match tag "salt/minion/*/start"
    - /srv/reactor/start.sls        # Things to do when a minion starts
    - /srv/reactor/monitor.sls      # Other things to do

  - 'salt/cloud/*/destroyed':       # Globs can be used to match tags
    - /srv/reactor/destroy/*.sls    # Globs can be used to match file names

  - 'myevent/custom/event/tag':     # React to custom event tags
    - salt://reactor/mycustom.sls   # Reactor files can come from the salt fileserver
```

Salt Reactor - Caveats

- State system in the Reactor is limited.
- When compared to the normal state system, things will be missing.
- Grains and pillar are unavailable inside the reactor subsystem.
- Plus, reactor sls are processed sequentially and handled over to a pool of worker threads.
- **TL;DR: do not handle logic in reactor states**
  - Use them for matching (‘Which minions? Which states?’).
  - Call normal Salt states instead and handle the logic there.
  - This is due to a ‘disconnect’ between the reactor & master engines (different namespaces).

Salt Reactor - associating events to states

```
  - 'myevent/custom/event/tag':     # React to custom event tags
    - salt://reactor/mycustom.sls   # Reactor files can come from the salt fileserver
```

```
# /srv/salt/reactor/mycustom.sls
{% if data['id'] == 'mysql1' %}
state_run:
  local.state.sls:
    - tgt: mysql1
    - arg:
        - a_long_running_and_complex_state
{% endif %}
```

Salt Reactor - full example

- Need to have minions' keys automatically accepted.

```
# /etc/salt/master.d/reactor.conf:
reactor:
  - 'salt/auth':
    - /srv/reactor/auth-pending.sls
  - 'salt/minion/nice*/start':
    - /srv/reactor/auth-complete.sls
```

Salt Reactor - full example

```
# /srv/reactor/auth-pending.sls:
{# Nice server failed to authenticate -- remove accepted key #}
{% if not data['result'] and data['id'].startswith('nice') %}
minion_remove:
  wheel.key.delete:
    - match: {{ data['id'] }}


minion_rejoin:
  local.cmd.run:
    - tgt: salt-master.domain.tld
    - arg:
      - ssh -o UserKnownHostsFile=/dev/null -o StrictHostKeyChecking=no "{{ data['id'] }}" 'sleep
10 && /etc/init.d/salt-minion restart'
{% endif %}
[...]
```

Salt Reactor - full example

```
[...]

{# Nice server is sending new key -- accept this key #}
{% if 'act' in data and data['act'] == 'pend' and data['id'].startswith(nice') %}
minion_add:
  wheel.key.accept:
    - match: {{ data['id'] }}
{% endif %}



# /srv/reactor/auth-complete.sls:
{# When a Nice server connects, run state.apply. #}
highstate_run:
  local.state.apply:
    - tgt: {{ data['id'] }}
```

Salt API

- REST API allowing to send commands to a running Salt master server.
- Supports encryption.
- Supports **authentication**.
- Authentication provided via Salt's External Authentication System.
- Controlled by the **salt-api** daemon.

Salt API - example

```
# curl -i saltmaster:8000/minions/minion-id



GET /minions/minion-id HTTP/1.1
Host: localhost:8000
Accept: application/x-yaml


HTTP/1.1 200 OK
Content-Length: 129005
Content-Type: application/x-yaml

return:
- minion-id:
    Grains.items:
        ...
```

Salt API

- `/`
- `/login`
- `/logout`
- `/minions`
- `/jobs`
- `/run`
- `/events`
- `/hook`
- `/keys`
- `/ws`
- `/stats`

Salt API - /hook

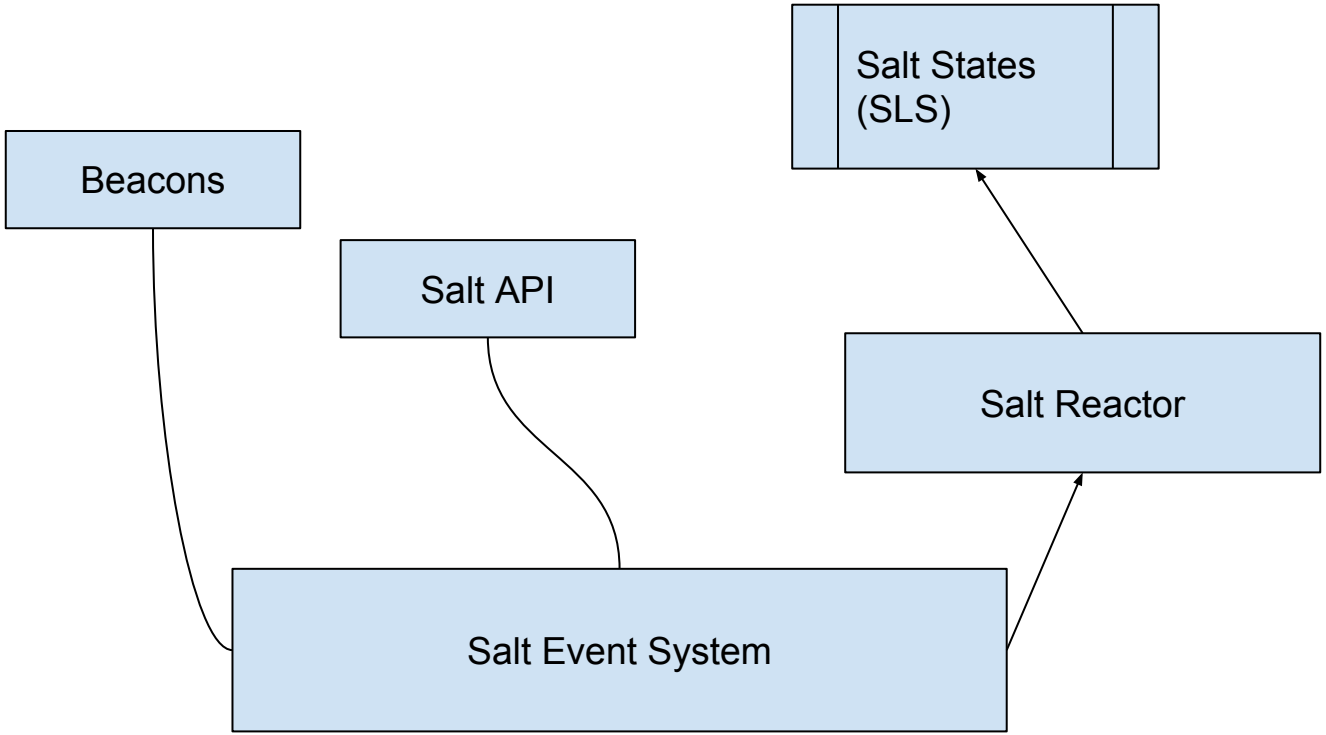
- Generic webhook entry point.
- Fires events on Salt's event bus.
- Data is passed as-is to an event.
- Authentication can be explicitly disabled here (think legacy apps).
- This does not mean you can make do without security!

Putting them all together

Recapping

- Events
- Beacons
- Reactor
- API

Recapping



Recapping

- With great responsibility comes great power.
- If configured properly, Salt can allow for full control of an infrastructure.
- Don’t fear the power; beware of the security risks though.

Possibilities

- Self healing your applications / systems.
- The endless CI cycle of push → build → test → deploy
- Scaling:
  - Both ways (growing and shrinking the environment)
  - Provisioning required.
- Keep environments consistent: react immediately upon changes.

Docs

- https://docs.saltstack.com/en/latest/
- #salt @ irc.freenode.net

Q&A

- Twitter: @godlike64
- Freenode: godlike

EUROPYTHON 2016 Bilbao, 17-24 July

Thank you!