MODULE 5

Automating App Deployment

Module Objectives

By the end of this module, you should understand:

- Interfaces into providing initialization of “cloud” instances
  - Cloud-Init
  - Puppet/Chef in a master-less environment
  - Use via CLI/Horizon
- Alternate Ways of initializing/managing instances
  - HEAT (and Ceilometer for triggering events)

App Deployment - Then vs. Now

Then

- Request VM (wait for IT to deploy)
- Load ISO, deploy OS
- Log in, install pre-compiled packages
- Configure Instance
- Request new REAL added to SLB

- Sometimes
- Create golden image with app pre-set
- Deploy new copy, log in, tweak configs, restart services
- Request new REAL added to SLB

Now

- Run Script…
  - Script launches generic image
  - Script passes init script to image
  - Image boots, runs init
  - Init loads application from repository
  - Config automated via puppet/chef
  - Script requests SLB update

- Sometimes
- Ceilometer monitor adds/removes instances (based on script)

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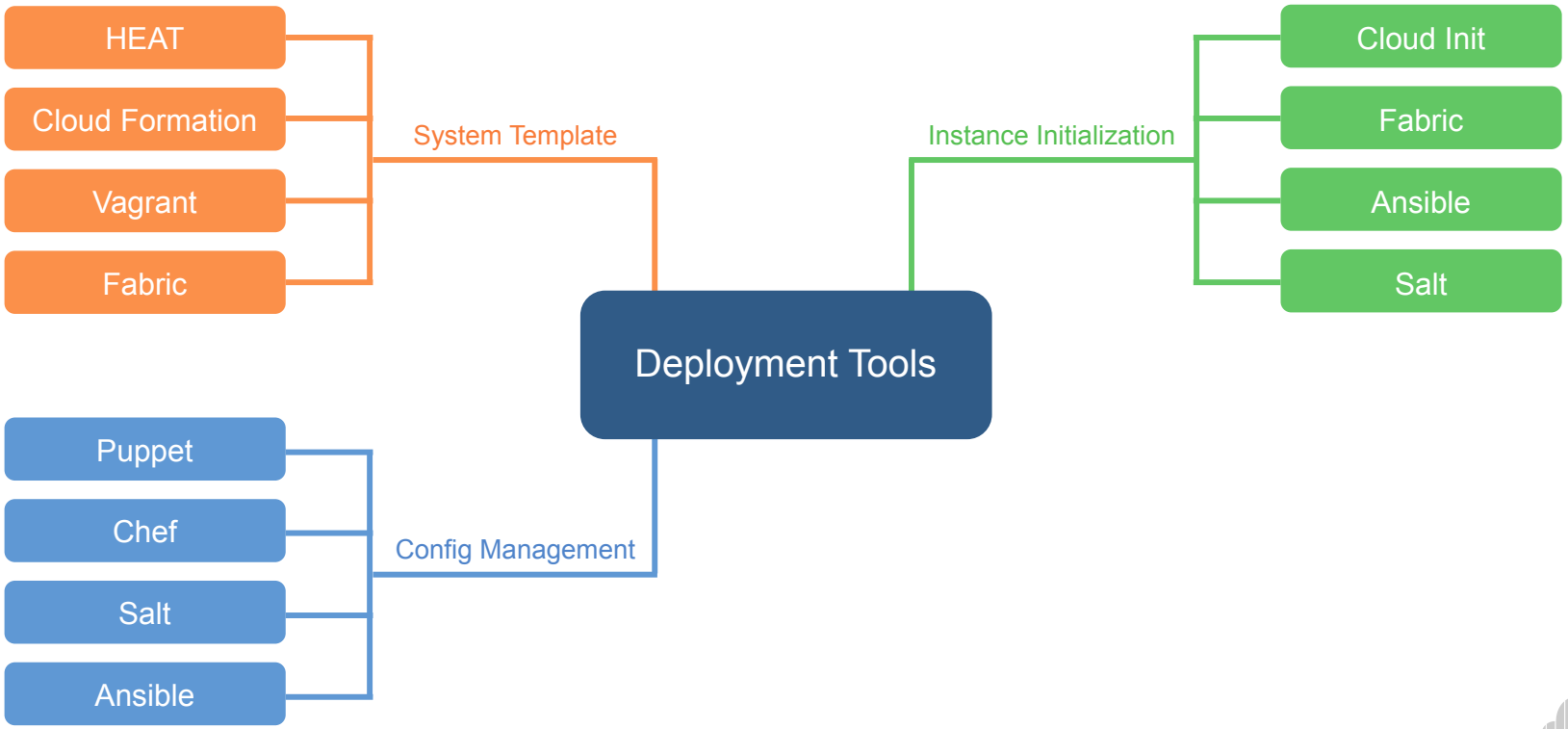
Tool Map



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Step 1: Initialize

- Get basic info onto the new Instance
- SSH keys (avoid passwords)
- Perhaps update/install packages/fix DNS
- Download code (possibly)
- Download config management tools/components

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Cloud-Init Overview

- https://cloudinit.readthedocs.org/en/latest/
- Requires software on the “golden image”
- Embedded into Nova boot process and Neutron network setup
  - Metadata web service interface
  - Config_drive mini-iso based model
  - Can pass script, yaml config, multi-part MIME message with scripts, config, etc.
- Principal Functions:
  - SSH key management (user, server)
  - User management
  - Package and Repository Management
  - Arbitrary Scripts
  - File creation

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Sample UserData as YAML

```
#cloud-config
write_files:
  - path: /etc/resolv.conf
    permissions: 0644
    owner: root
    content: |
      nameserver 8.8.8.8

apt_update: true
packages:
 - python-pip
 - git

runcmd:
- mkdir /home/ubuntu/gitrepo
- git clone "https://github.com/mjhea0/flaskr-tdd.git" /home/ubuntu/gitrepo
- pip install -r /home/ubuntu/gitrepo/requirements.txt
- sed -i 's/app.run()/app.run(host="0.0.0.0",port=1234)/g' /home/ubuntu/gitrepo/app.py
- python /home/ubuntu/gitrepo/app.py &
```

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Puppet

What is it?

- Puppet is a data driven, idempotent configuration management system that allows you to define the state of your infrastructure and/or application and enforce the end state of the environment.

What can it do?

- Manage packages (versions, installation, etc.)
- Manage configuration of components (add vhost to apache config)
- Report on state of configuration/ installation
- Enable a ‘workflow’ model for deployment

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Puppet hierarchy

- Module
  - Manifest
    - Init.pp
      - Class
      - Types/defines
- Example: class to define user

```
class robert ($state_val='present') {
  user {"robert":
    ensure=>$state_val,
  } }
```

- In order to do something though, we have to instantiate the class, so we can add:

```
class {'robert': state_val=>'absent'}
```

- And then we can "execute this (assuming we put it in a file test.pp)

```
puppet apply -vd init.pp
```

- Or we could put the file in /etc/puppet/modules/robert/manifests/init.pp and:

```
puppet apply -ve 'class {"robert": }'
```

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Masterless Puppet

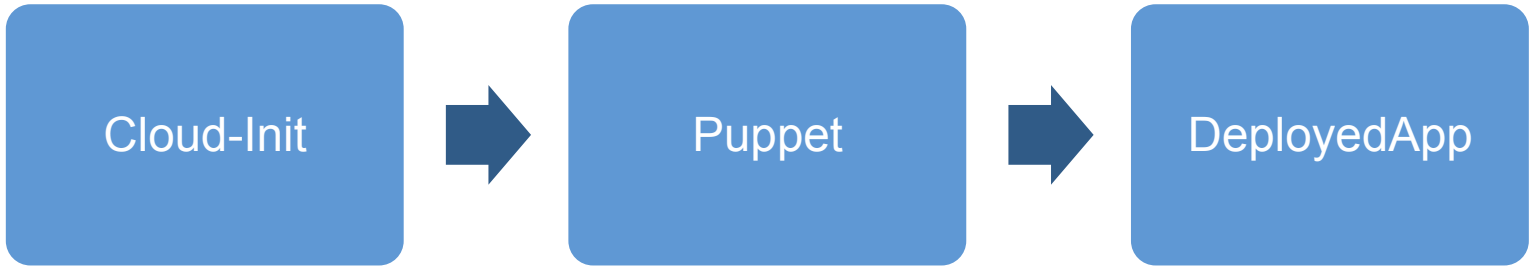
Advantages:

- Masterless puppet modules are about as simple as writing bash scripts, however they are more maintainable, easily made to be cross platform.
- Still gives you the advantage of the abstraction layer that puppet provides

Disadvantages:

- More difficult to distribute to nodes, need pulp, git or other distribution techniques

How To Tie It All Together



Use cloud-Init to install puppet

Puppet triggers puppet apply and run manifests to deploy the given app

Your deployed app on the openstack instances are ready to served.

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Using Heat and Ceilometer

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Ceilometer Overview

- Initial intent was to develop a tool to support billing against consumption
- Service Metering is a long standing solution, and has well understood models
- Data collected has uses besides metering
  - Alarm (something has happened)
  - Assurance (is my service alive)
  - Scale management (do I have too much/little)
  - Profiling (is my app running efficiently)

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Getting metrics from Ceilometer

- Principally via CLI, additional interactions are possible via HEAT ceilometer meters-list
- The list is long and includes more than you probably want to see, this is a more concise list:

Name	Type	Unit
cpu	cumulative	ns
cpu_util	gauge	%
disk.read.bytes.rate	gauge	B/s
disk.read.requests.rate	gauge	request/s
disk.write.bytes.rate	gauge	B/s
disk.write.requests.rate	gauge	request/s
network.incoming.bytes.rate	gauge	B/s
network.incoming.packets.rate	gauge	packet/s
network.outgoing.bytes.rate	gauge	B/s
network.outgoing.packets.rate	gauge	packet/s

Ceilometer Alarm Notifier

- Allows you to set alarms based on threshold evaluation for a collection of samples.
- An alarm can be set on a single meter, or on a combination
- To setup an alarm, you will call Ceilometer's API server specifying the alarm conditions and an action to take

```
ceilometer alarm-threshold-create --name cpu_high --description 'instance running
hot'     --meter-name cpu_util  --threshold 70.0 --comparison-operator gt  --
statistic avg    --period 600 --evaluation-periods 3    --alarm-action 'log://'
--query resource_id=VM_ID
```

- Forms of action
  - HTTP/HTTPs Callback
  - Log

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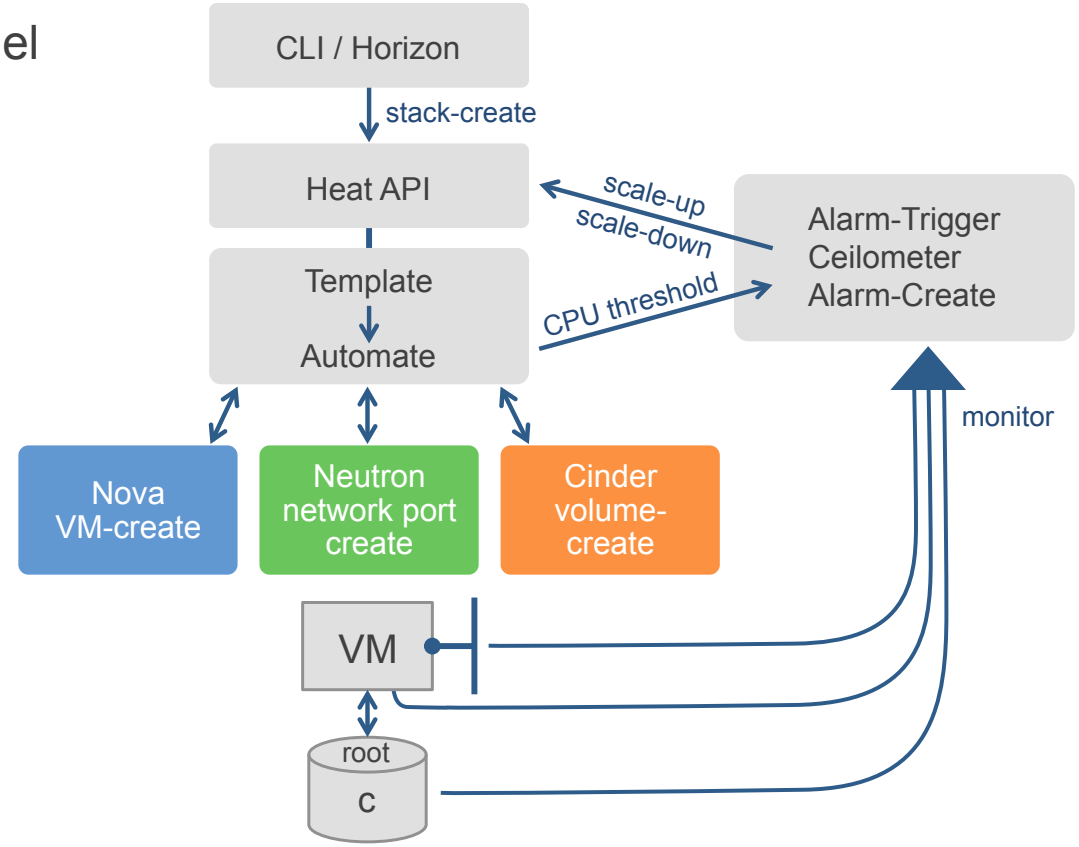
Heat Model

Heat Model



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Example HOT template

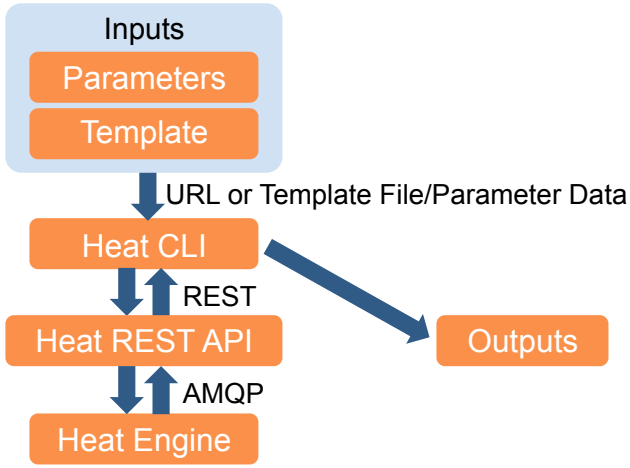
```
heat_template_version: 2013-05-23

description: Test Template
```

```
parameters:
  ImageID:
    type: string
    description: Image use to boot a server
  NetID:
    type: string
    description: Network ID for the server
```

```
resources:
  server1:
    type: OS::Nova::Server
    properties:
      name: "Test server"
      image: { get_param: ImageID }
      flavor: "m1.tiny"
      networks:
        - port: { get_resource: server1_port }
```

```
server1_port:
    type: OS::Neutron::Port
    properties:
      network_ID: { get_param: NetID }
```

```
outputs:
  server1_private_ip:
    description: IP address of the server in the private network
    value: { get_attr: [ server1, first_address ] }
```



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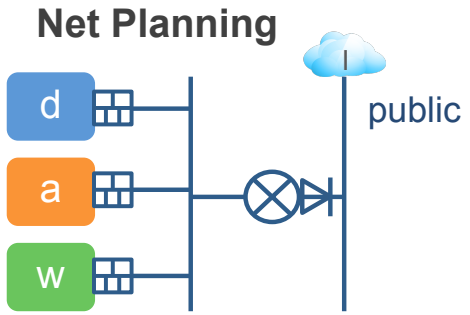
Template Model considerations

- How your network works (floating Ips, SLB, etc.) still need to be considered
- Map the resources together to determine how pieces should fit
- Individual “public” VMs need Floating IPs associated



- Interaction between VMs (scale groups)
  - Scale up and Scale down resources
  - Associated Ceilometer alarms

- With SLB
  - Define pool (associate floating IP with pool)
  - Associate scale VMs with pool

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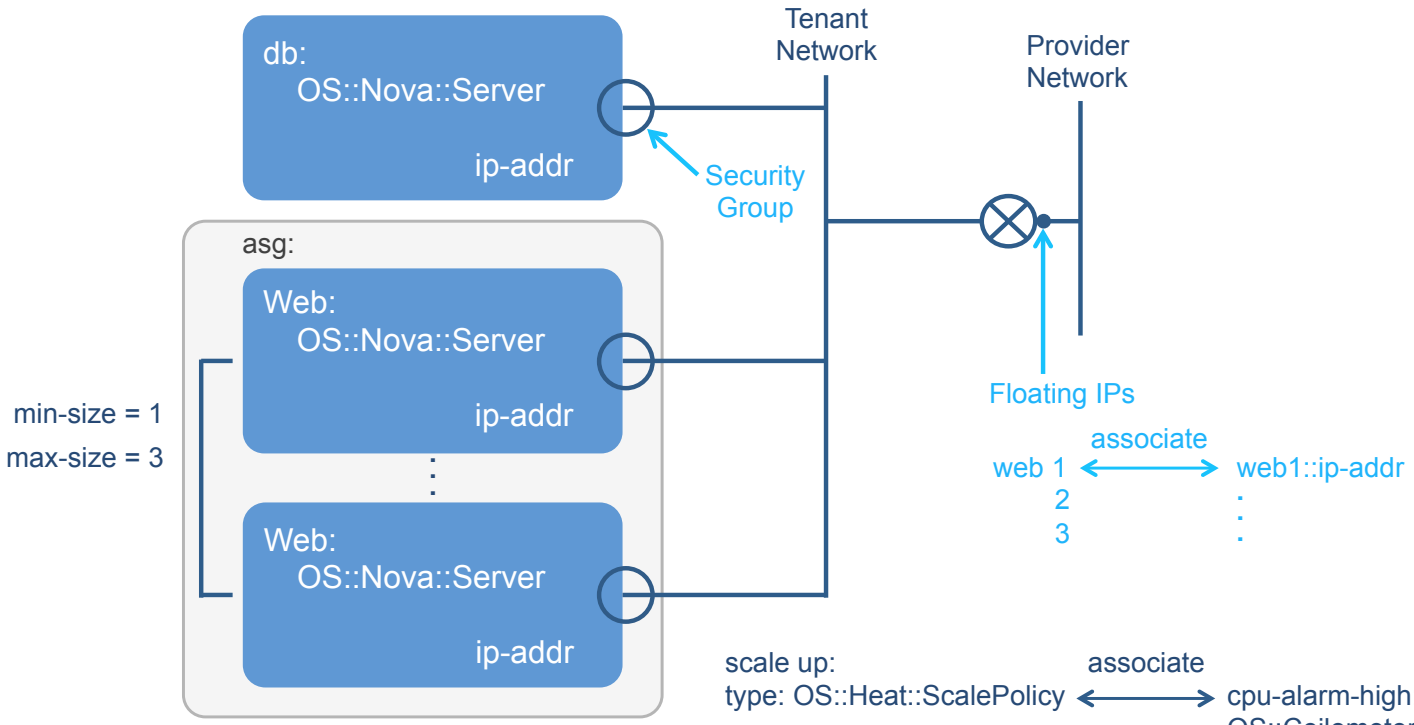

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Example Scaling HOT

- From Github: https://github.com/openstack/heat-templates/tree/master/hot
- https://raw.githubusercontent.com/openstack/heat-templates/master/hot/autoscaling.yaml
- https://raw.githubusercontent.com/openstack/heat-templates/master/hot/lb_server.yaml

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Stack Creation

- `$ heat stack-list`

```
+--------------------------------------+--------------+-----------------+----------------------+
| id                                   | stack_name   | stack_status    | creation_time        |
+--------------------------------------+--------------+-----------------+----------------------+
| 4c712026-dcd5-4664-90b8-0915494c1332 | stackone     | CREATE_COMPLETE | 2013-08-12T13:33:47Z |
| 7edc7480-bda5-4e1c-9d5d-f567d3b6a050 | stacktwo     | CREATE_FAILED   | 2013-08-12T13:33:59Z |
+--------------------------------------+--------------+-----------------+----------------------+
```

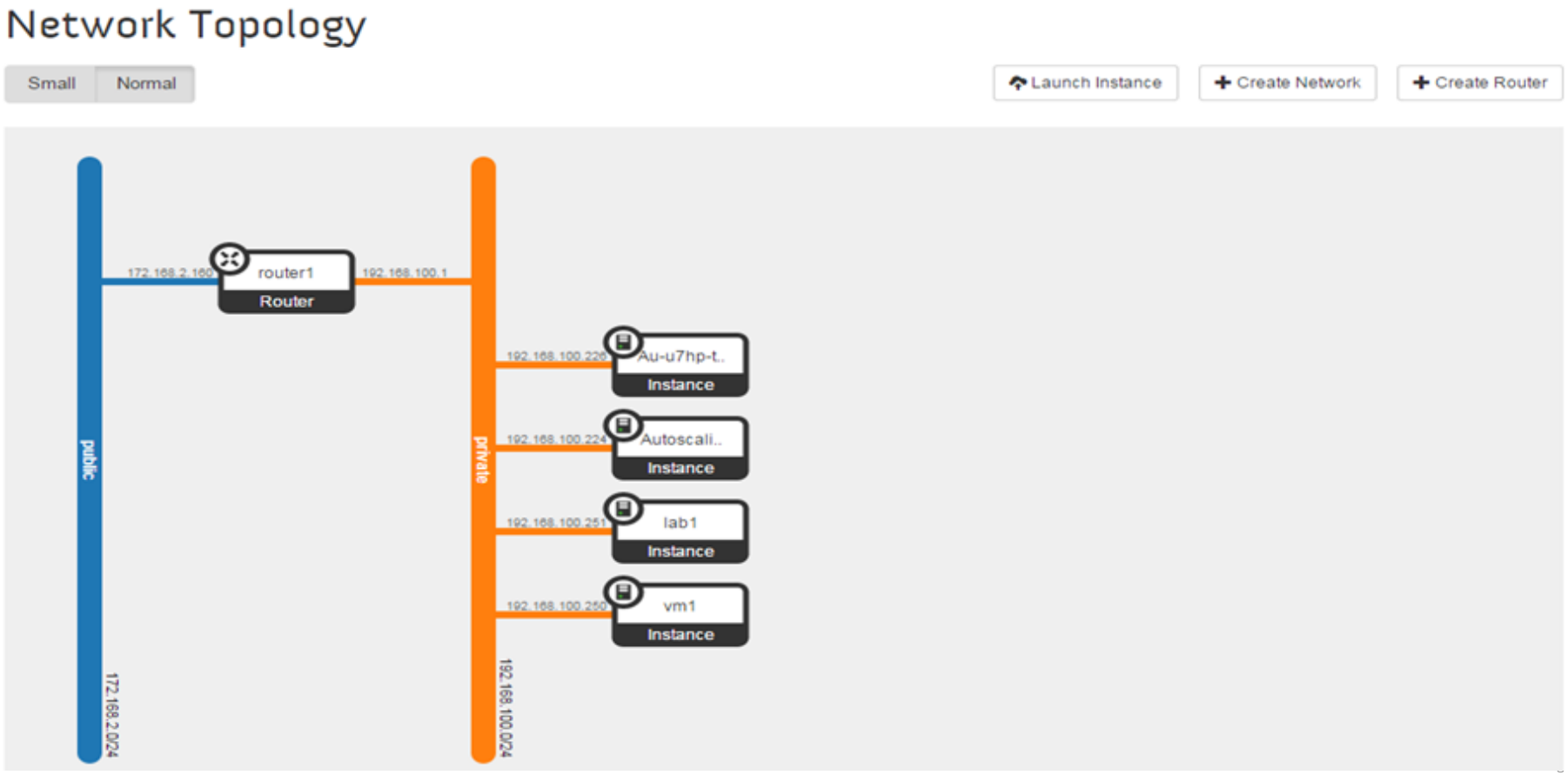
- `$ heat resource-list mystack`

```
+----------------------+--------------------+-----------------+----------------------+
| logical_resource_id | resource_type       | resource_status | updated_time         |
+----------------------+--------------------+-----------------+----------------------+
| Database             | OS::NOVA::Instance | CREATE_COMPLETE | 2013-08-12T13:34:56Z |
+----------------------+--------------------+-----------------+----------------------+
```

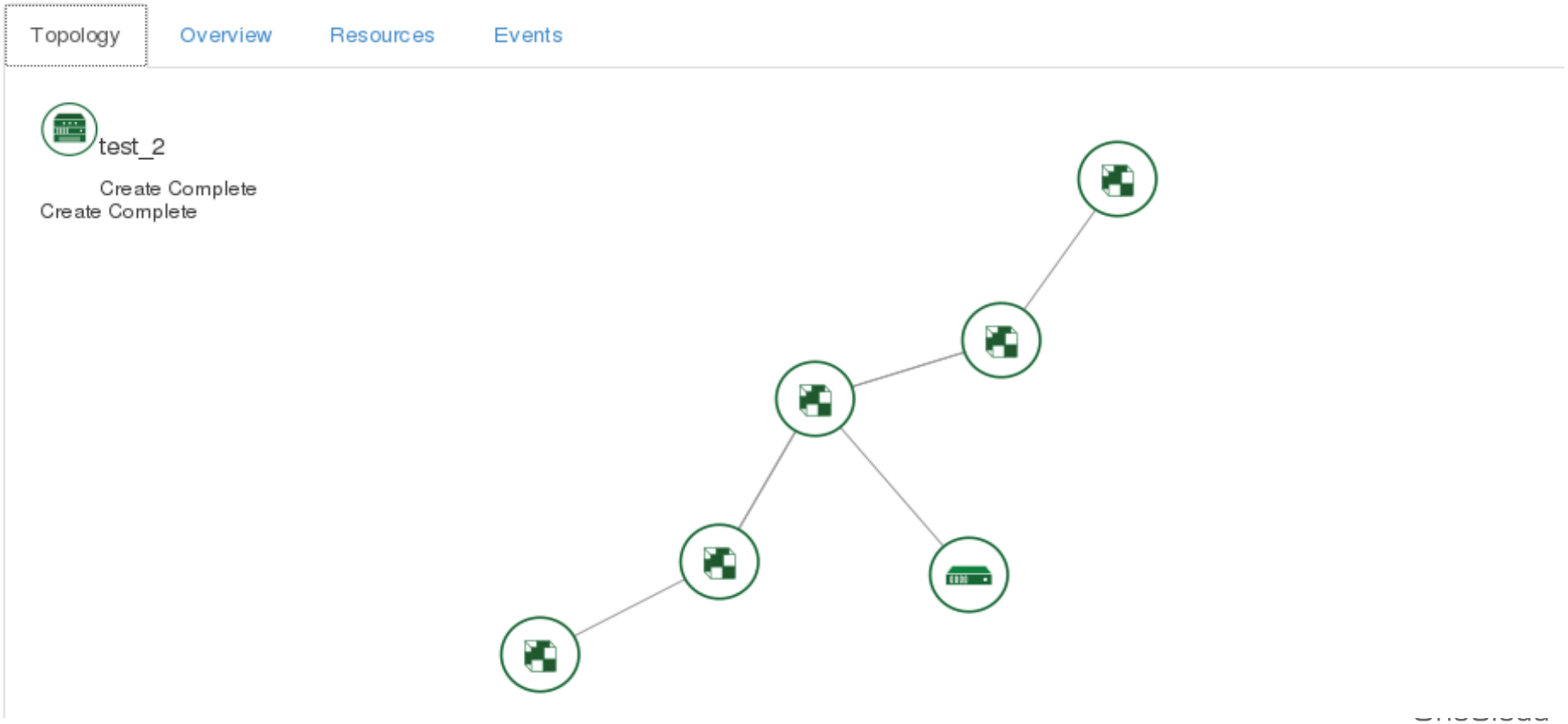
- `$ heat event-list mystack`

```
+----------------------+----+-----------------------+-----------------+----------------------+
| logical_resource_id | id | resource_status_reason | resource_status | event_time           |
+----------------------+----+-----------------------+-----------------+----------------------+
| Database             | 1  | state changed          | IN_PROGRESS     | 2013-08-12T13:42:19Z |
| Database             | 2  | state changed          | CREATE_COMPLETE | 2013-08-12T13:45:44Z |
+----------------------+----+-----------------------+-----------------+----------------------+
```

Network Topology



HEAT Topology



Scaling without Ceilometer

- Can trigger HEAT scale up/scale down with URL from scale group.

- From example heat template:

```
scale_up_url:
    value: { get_attr: [web_server_scaleup_policy, alarm_url] }

scale_dn_url:
    value: { get_attr: [web_server_scaledown_policy, alarm_url] }
```

```
heat output-list stack
heat output-show stack scale_up_url
curl -X POST "http://10.1.10.13:8000/v1/signal/arn%3Aopenstack%3Aheat%3A%3Ae71d06beb59a40d1a9e29df6b014444e
%3Astacks%2Fasg%2F8e386fdc-a872-493d-946b-c9f3e63878c3%2Fresources%2Fweb_server_scaleup_policy?
Timestamp=2015-02-19T07%3A47%3A54Z&SignatureMethod=HmacSHA256&AWSAccessKeyId=bcd012555b7949bd953598f0090bb2c
d&SignatureVersion=2&Signature=p3kbk%2F2v8zLiwUlsToobhPiHB4n8lRTfhnDsZMfbYhU%3D"
```

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MONASCA

Monitoring as a Service - MONaaS

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Current Status

- Monasca and Stacktach.v3 is open-sourced in StackForge
- Not an OpenStack incubated project, but we are targeting incubation
- Metrics, Alarm Definitions, Alarms and Notification Methods completely
- supported/functional and ready for production deployment
- Who is working on it?
- • HP
- • RackSpace
- • IBM
- Who is deploying it?
- • HP: Public Cloud and Helion distribution
- • Time Warner Cable (TWC)
- • Workday

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Current Status- Progress

- Events/StackTach.v3 integration is in progress
- Anomaly detection is in progress
- Formalize micro-services architecture
  - Define message formats
  - Define how services are published and registered
- Python port is in progress:
  - All components Python except for API and Threshold Engine
  - API is 75% ported to Python. Note, Java API is 100% functional
  - Threshold Engine is the only remaining Java component

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What is Monasca?

- Monitoring-as-a-Service solution based on REST API
- Highly-performant, scalable, fault-tolerant and capable of big data retention
- Metrics storage/retrieval/statistics and alarm/thresholding engine
- Notification system
- Real-time event stream processing
- Open-source and built-on open-source technologies such as:
  - Kafka: Performant, scalable, fault-tolerant, durable message queue. Used by LinkedIn, Twitter, …
  - Apache Storm: distributed realtime computation system
  - Time-series databases: InfluxDB supported today. Elastic-search in progress.
  - Consolidates multiple monitoring systems into a single solution
  - Used for both operational and customer facing monitoring.
- Extensible based on micro-services message bus architecture

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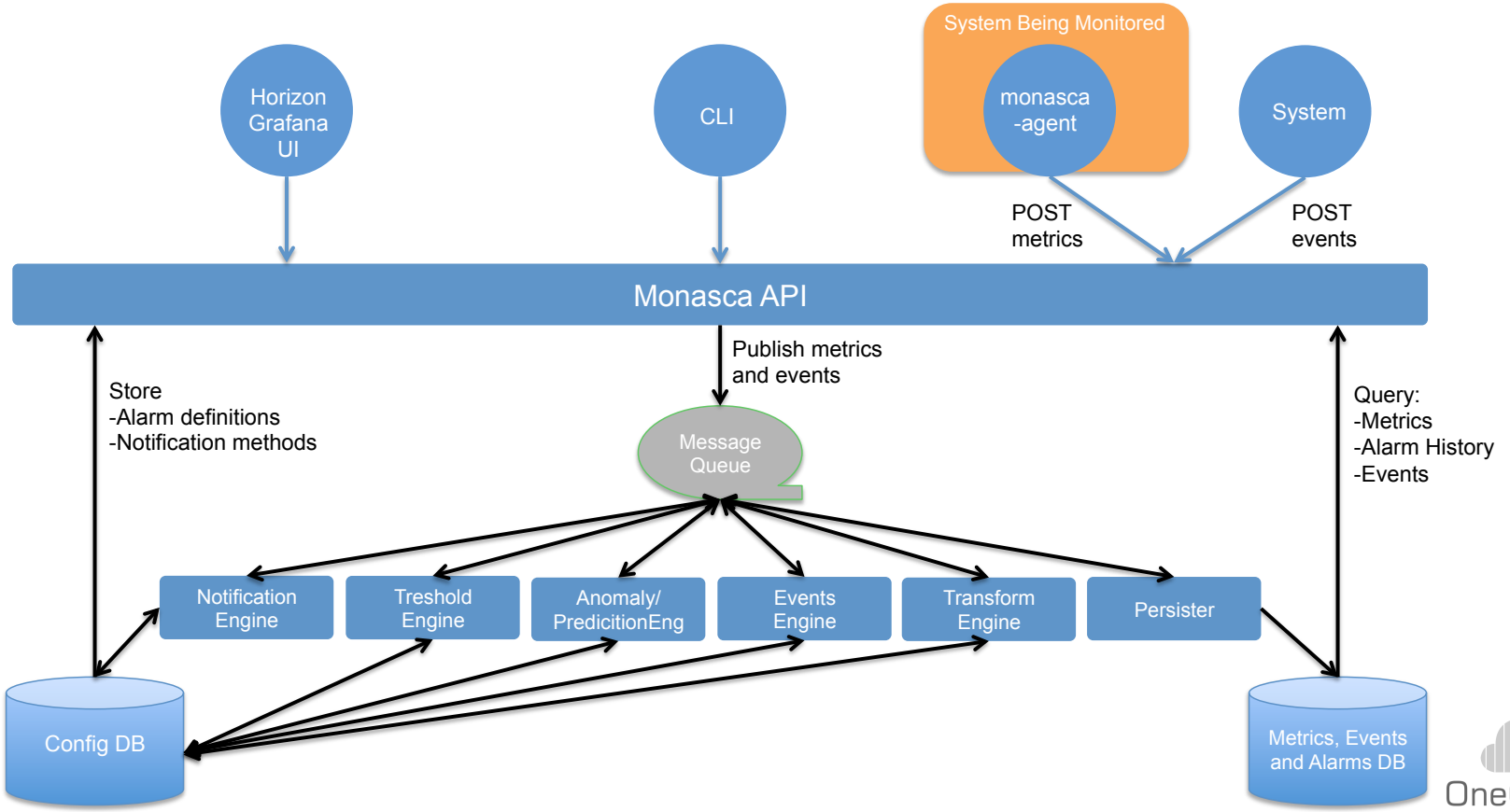
Architecture



Metrics - Rest API

- Metrics: Create, query and get statistics for metrics

```
{
     name: cpu.user_perc,
     dimensions: {
          hostname: hostname.domain.com,
          region: uswest,
          zone: 1,
          service: compute
     }
}
```

Simple, concise flexible description
Name (string)
Dimensions: Dictionary of arbitrary (key, value) pairs

- Alarm Definitions –
  - Are templates that are used to automatically create alarms based on matching metric names and dimensions
  - Simple compound expression grammar: `avg(cpu.user_perc{}) > 85 or avg(disk_read_ops{device=vda}, 120) > 1000`
  - Actions associated with alarms for state transitions to ALARM, OK and UNDETERMINED
  - Severity (LOW, MEDIUM, HIGH, CRITICAL).
- Alarms: Query and Delete alarms and query alarm state history
- Notification Methods: e.g. Email address. Associated with alarm definitions

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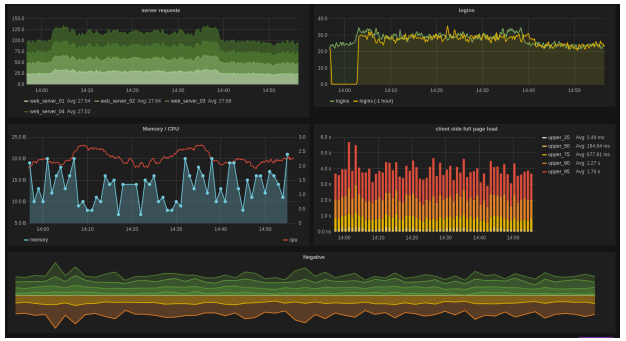
Metrics – monasca-agent

- Python monitoring agent
- System metrics (cpu, memory, …)
- Service metrics (RabbitMQ, MySQL, Kafka, and many other
- Application metrics (Built-in statsd daemon and Python Monasca Statsd library)
- VM metrics
- Active checks
  - HTTP status checks and response times
  - System up/down checks (ping and ssh)
- Runs any Nagios plugin
- Extensible/Pluggable: Additional services can be easily added

Metrics - UI

- Horizon Dashboard
  - Overview/Top-level drill-down
  - Create/Read/Update/Delete alarm definitions using an expression builder
  - Read/Delete alarms and alarm history
  - Create/Read/Update/Delete notification methods

- Grafana Dashboard (http://grafana.org/)
  - Provides visualization of metrics



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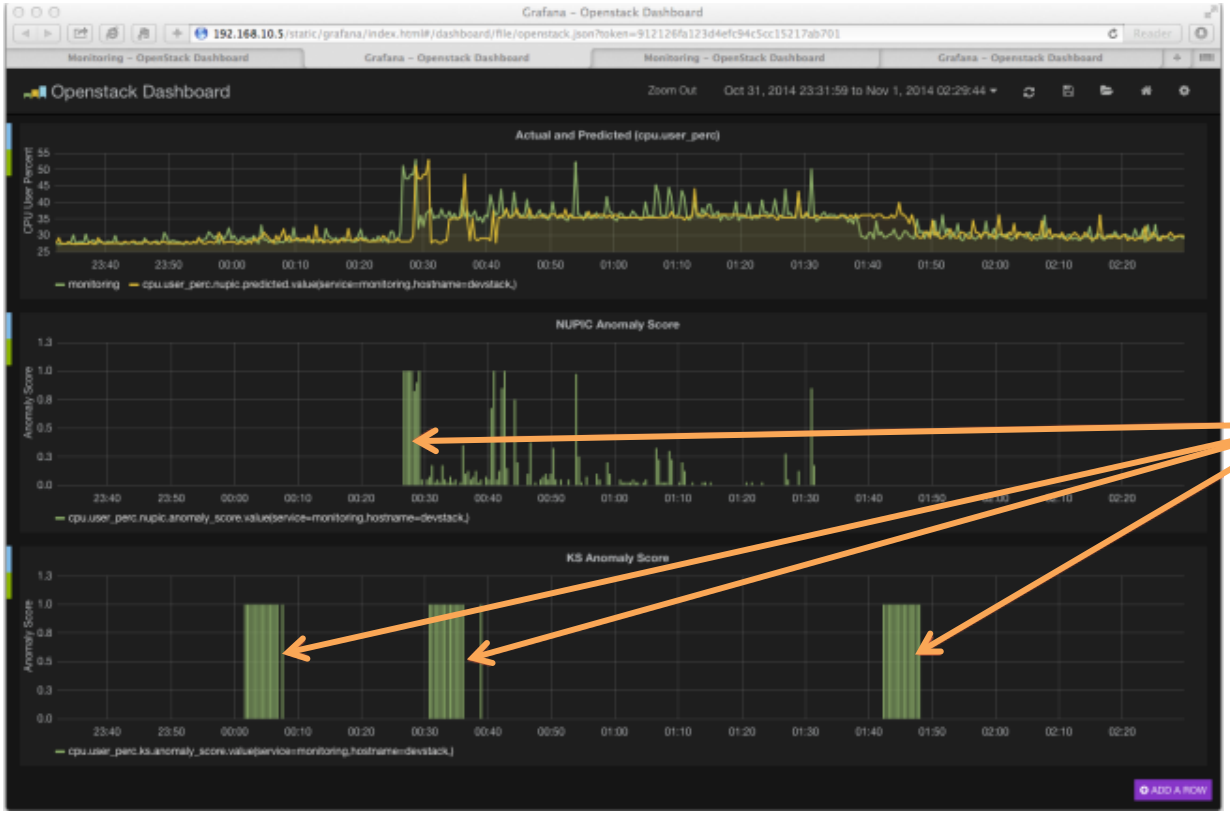
Events – Anomaly Detection

- Monasca Anomaly Engine implements real-time streaming anomaly detection
- Two algorithms used:
  - Numenta Platform for Intelligent Computing (NuPIC) used by Grok
    (An open-source Python/C++ implementation of Hierarchical Temporal Memory)
  - Kolmogorov-Smirnov (K-S) Two Sample Test
- Anomaly Engine
  - Consumes metrics from the Kafka metrics topic
  - Calculates predicted value and anomaly score (probability of an anomaly)
  - Publishes calculated values as metrics to the Kafka metrics topic
- Alarms can be created for Anomaly scores

Events – Anomaly Detection



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