Cloud Custodian @ Scale 17x

Your public cloud swiss army knife

Kapil Thangavelu @kapilvt

Cloud Custodian

Custodian is an open source rules engine for account and resource management on AWS, Azure, and GCP.

YAML DSL for policies based on querying resources, filtering them and taking actions.

Intended to scale from mom and pop shops to large enterprise needs.

Cloud Custodian

Policies target a particular resource type, like AWS Elastic Compute Cloud (EC2)

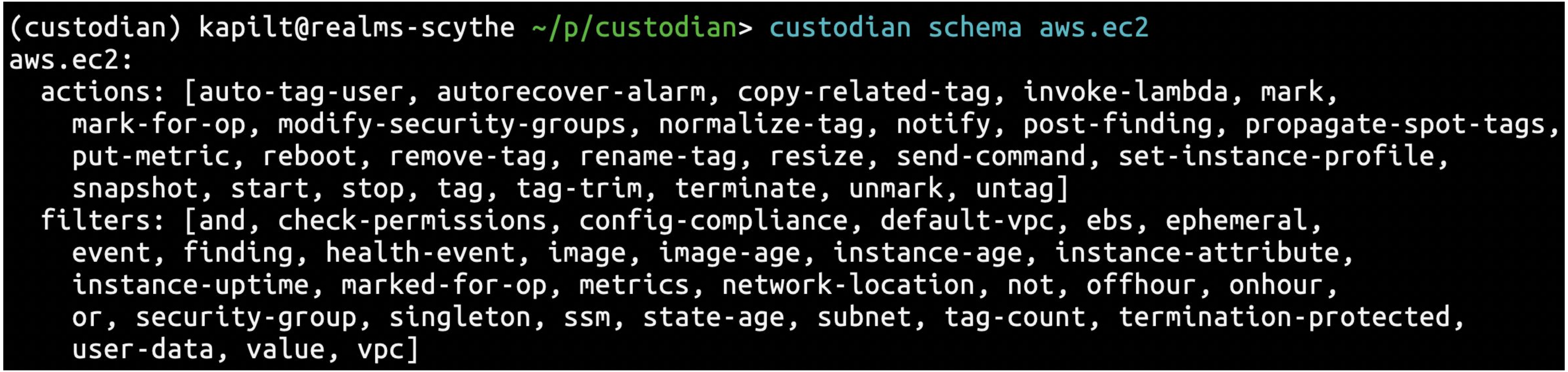
Filter resources, invoke actions on matched.

Vocabularies of actions, and filters for policy construction.

```
- name: ebs-unused
  resource: ebs
  mode:
    type: config-rule
  filters:
    - Attachments: empty
    - “tag:Retain”: absent
  actions:
    - type: mark-for-op
      days: 5
```

Installation

```
$ pip install c7n

$ docker pull cloudcustodian/c7n

$ custodian run -m aws --log-group -s output_dir
```



```
(custodian) kapilt@realms-scythe ~/p/custodian> custodian schema aws.ec2
aws.ec2:
  actions: [auto-tag-user, autorecover-alarm, copy-related-tag, invoke-lambda, mark,
    mark-for-op, modify-security-groups, normalize-tag, notify, post-finding, propagate-spot-tags,
    put-metric, reboot, remove-tag, rename-tag, resize, send-command, set-instance-profile,
    snapshot, start, stop, tag, tag-trim, terminate, unmark, untag]
  filters: [and, check-permissions, config-compliance, default-vpc, ebs, ephemeral,
    event, finding, health-event, image, image-age, instance-age, instance-attribute,
    instance-uptime, marked-for-op, metrics, network-location, not, offhour, onhour,
    or, security-group, singleton, ssm, state-age, subnet, tag-count, termination-protected,
    user-data, value, vpc]
```

Rich Filtering

JMESPath Expressions

Value Type (size, cidr_size, age, expiration, etc)

Operators (>=, <=, list in/not-in, regex, etc)

Arbitrary nesting with and, or blocks

Values from url/s3.

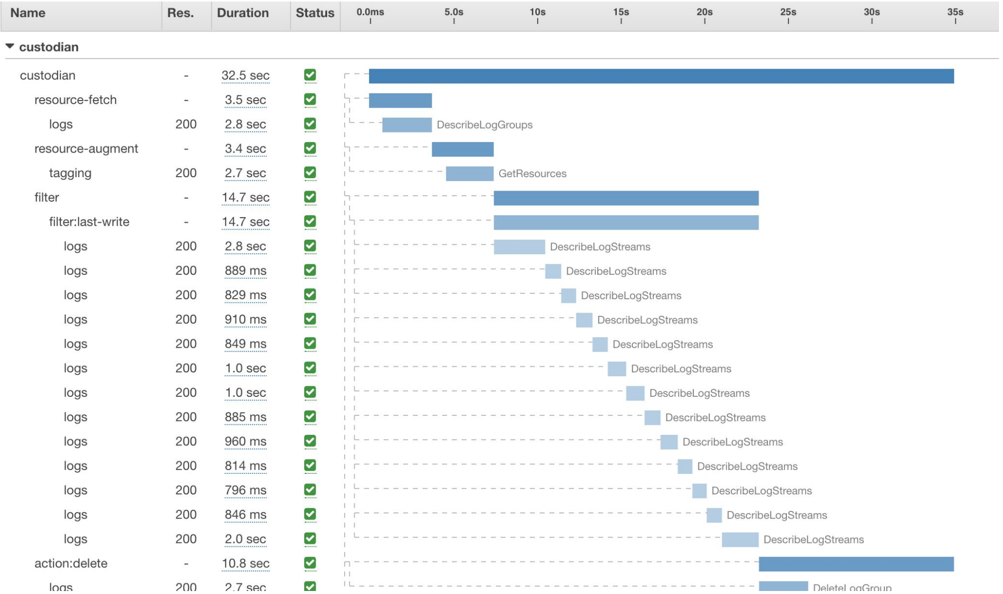
```
       # This filter is to take out EMR instances
     - type: event
       key: "detail.userIdentity.invokedBy.serviceName"
       value: "elasticmapreduce.amazonaws.com"
       op: not-equal

     - type: value
       # Ignore keys that start with 'aws:' as they don't
count towards the limit.
       key: "[length(Tags[?!starts_with(Key,'aws:')])][0]"
       op: lt
       value: 10

     - type: value
       key: “tag:AccountId”
       op: not-in
       values_from:
         expr: "accounts.*.accountNumber"
         url: s3://mybucket/mykey
```

Custodian outputs

Per policy execution outputs.

- AWS X-Ray - Policy api call tracing
- Amazon CloudWatch Metrics - (Resource Counts, API calls, Execution time)
- Amazon CloudWatch Logs - Policy execution logs
- Amazon S3 - JSON resource, metadata, logs archive
- GCP StackDriver Logging & Metrics
- Azure Application Insights & Blob Store

Streaming notifications via Amazon Simple Queue Service and Amazon Simple Notification Service, with delivery channels to Amazon SES, Slack, and SMTP.



Name	Res.	Duration	Status	0.0ms 5.0s 10s 15s 20s 25s 30s 35s
▾ custodian				
custodian	-	32.5 sec	✓	
resource-fetch	-	3.5 sec	✓	
logs	200	2.8 sec	✓	DescribeLogGroups
resource-augment	-	3.4 sec	✓	
tagging	200	2.7 sec	✓	GetResources
filter	-	14.7 sec	✓	
filter:last-write	-	14.7 sec	✓	
logs	200	2.8 sec	✓	DescribeLogStreams
logs	200	889 ms	✓	DescribeLogStreams
logs	200	829 ms	✓	DescribeLogStreams
logs	200	910 ms	✓	DescribeLogStreams
logs	200	849 ms	✓	DescribeLogStreams
logs	200	1.0 sec	✓	DescribeLogStreams
logs	200	1.0 sec	✓	DescribeLogStreams
logs	200	885 ms	✓	DescribeLogStreams
logs	200	960 ms	✓	DescribeLogStreams
logs	200	814 ms	✓	DescribeLogStreams
logs	200	796 ms	✓	DescribeLogStreams
logs	200	846 ms	✓	DescribeLogStreams
logs	200	2.0 sec	✓	DescribeLogStreams
action:delete	-	10.8 sec	✓	
logs	200	2.7 sec	✓	DeleteLogGroup

Multi Step Workflows

“Poorly tagged instances, should be stopped in 1 day, and then terminated in 3”

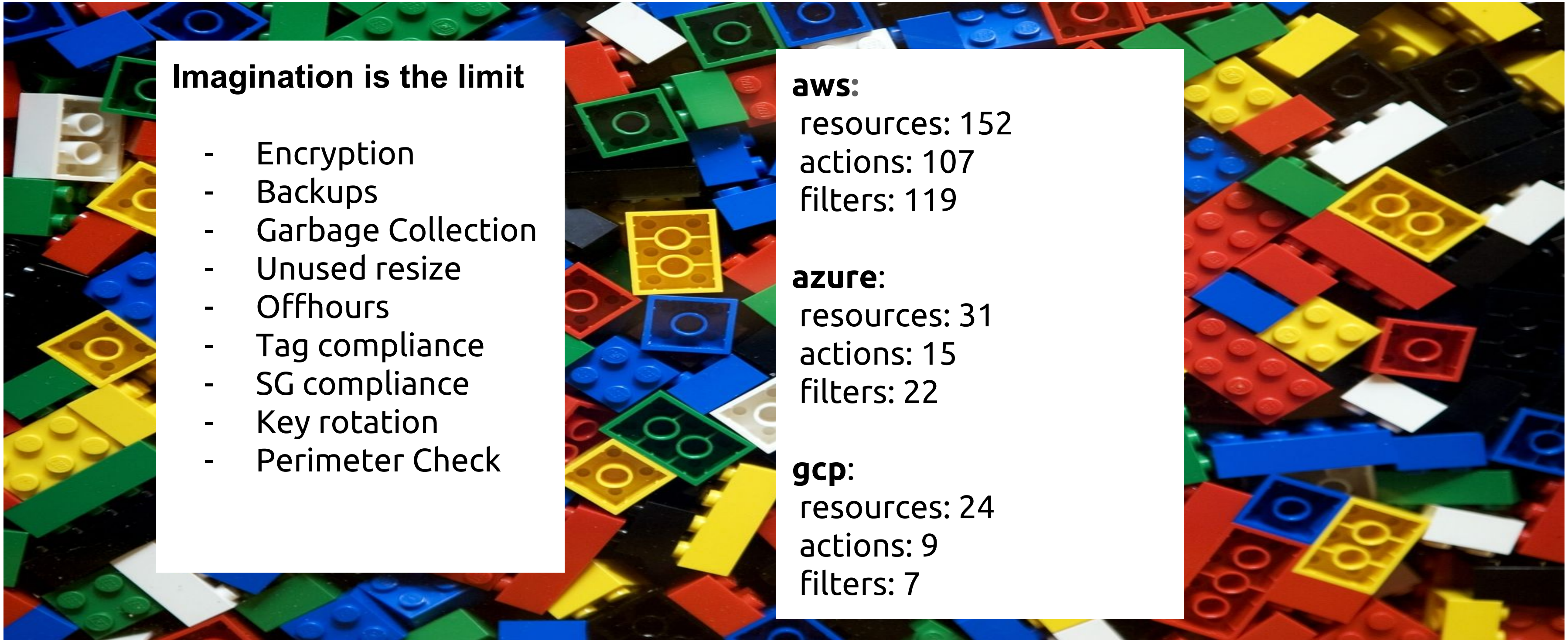
- Action: mark-for-op
- Filter: marked-for-op

Chain together multiple policies.

```
- name: ec2-tag-compliance-mark
  resource: ec2
  description: |
    Find all non-compliant tag
    instances for stoppage in 1 days.
  mode:
    type: config-rule
  filters:
    - "tag:maid_status": absent
    - or:
      - "tag:App": absent
      - "tag:Env": absent
      - "tag:Owner": absent
  actions:
    - type: mark-for-op
      op: stop
      days: 1
```

```
- name: ec2-tag-compliance-stop
  resource: ec2
  description: |
    Stop poorly tagged and schedule
    Terminate.
  mode:
    type: periodic
    schedule: rate(1 day)
  filters:
    - type: marked-for-op
      op: stop
    - or:
      - "tag:App": absent
      - "tag:Env": absent
      - "tag:Owner": absent
  actions:
    - stop
    - type: mark-for-op
      op: terminate
      days: 2
```

Custodian Capabilities



Imagination is the limit

- Encryption
- Backups
- Garbage Collection
- Unused resize
- Offhours
- Tag compliance
- SG compliance
- Key rotation
- Perimeter Check

aws:
resources: 152
actions: 107
filters: 119

azure:
resources: 31
actions: 15
filters: 22

gcp:
resources: 24
actions: 9
filters: 7

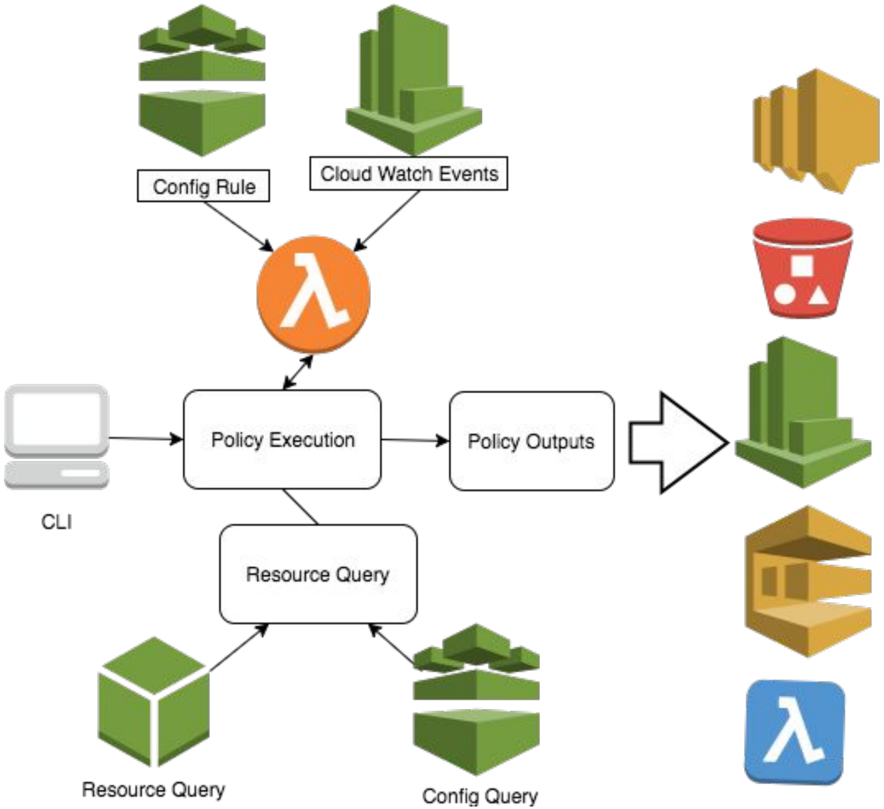
Custodian Architecture

Stateless, Multiple Execution modes, Integrated Provisioning.

Execution Modes

- Poll (Default)
- AWS Events (Cloud Trail, Health, GuardDuty, etc)
- AWS Config Rule
- GCP Audit Log
- Azure ARM Events
- Azure/AWS/GCP Periodic

Custodian will automatically provision event sources and serverless resources.



Compliance as Code

Policy as Code - Authoring

- Versioning (Rollbacks & Audit)
- Peer Review
- Abstraction and encapsulation
- Code Reuse
- Automation

Policy as Code - Visualize & Index

PolicyStream for event stream of policy changes from git history.

Policy as Code - Delivery

Continuous Integration

- Drone or Jenkins
  - custodian validate mypolicy.yml
  - custodian run --dryrun mypolicy.yml
- LGTM or Github Reviews
  - Multi-person signoff

Continuous Delivery

- git pull & custodian run policy files.

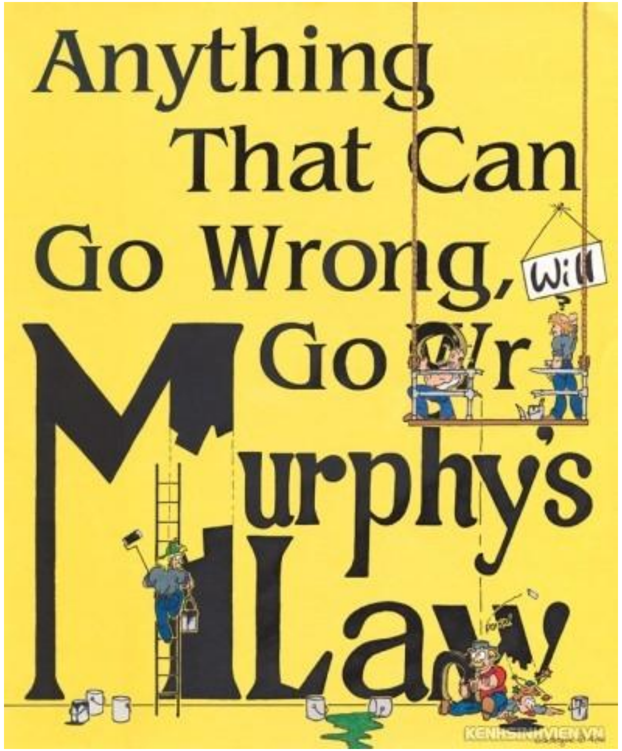
Safety Belts

Three liner to nuke all your instances

```
import boto3, jmespath
client = boto3.client(‘ec2’)
client.terminate_instances(
    InstanceIds=jmespath.search(
      'Reservations.Instances[].InstanceId',
      client.describe_instances()))
```

Custodian has built-in safety belts, that can be set on any policy

- max-resources
- max-resources-percent



AWS CloudTrail - Inspection

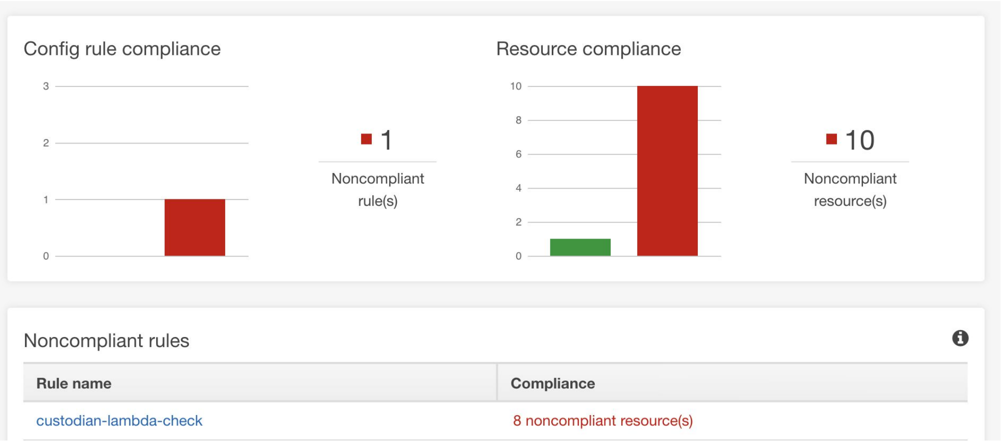
```
- name: require-rds-auto-tag
  resource: rds
  mode:
     - type: cloudtrail
     - events:
        - CreateDBInstance
  filters:
     - or:
       - Encrypted: false
       - PubliclyAvailable: true
  actions:
     - type: delete
       skip-snapshot: true
```

Powered by Amazon CloudWatch Events

- Powerful infrastructure observation capabilities
- Enables “realtime” rules enforcement and reaction with wide coverage of AWS product APIs.
- Dozen of event sources.

AWS Config - Rule Support

```
name: lambda-check
resource: lambda
mode:
 type: config-rule
filters:
 - or:
   - tag:Owner: absent
   - type: cross-account
```



Config rule compliance

🟥 1

Noncompliant rule(s)

Resource compliance

🟥 10

Noncompliant resource(s)

Noncompliant rules

Rule name	Compliance
custodian-lambda-check	8 noncompliant resource(s)

Amazon Guard Duty - Remediation Support

```
name: ec2-guard-remediate
resource: ec2
mode:
 type: guard-duty
 member-role: arn:aws:iam::{account_id}:role/Duty
filters:
 # Filter for medium and high severity events
 - type: event
   key: detail.severity
   op: gte
   value: 4.5
actions:
  # remove any instance profile on the instance
  - type: set-instance-profile
    profile: null
  # stop the instance
  - stop
  # snapshot the disk for forensics
  - type: snapshot
    copy_tags: [Name]
```

We also distribute tools like c7n_guardian that automate multi-account, organization enrollment.

```
name: audit-guard-duty
description: “Alert if guard duty not enabled”
resource: account
mode:
 type: periodic
 schedule: “rate(1 day)”
filters:
 - type: guard-duty
   Detector.Status: ENABLED
   Master.AccountId: "00011001"
   Master.RelationshipStatus: ENABLED
```

GCP - Cloud Functions

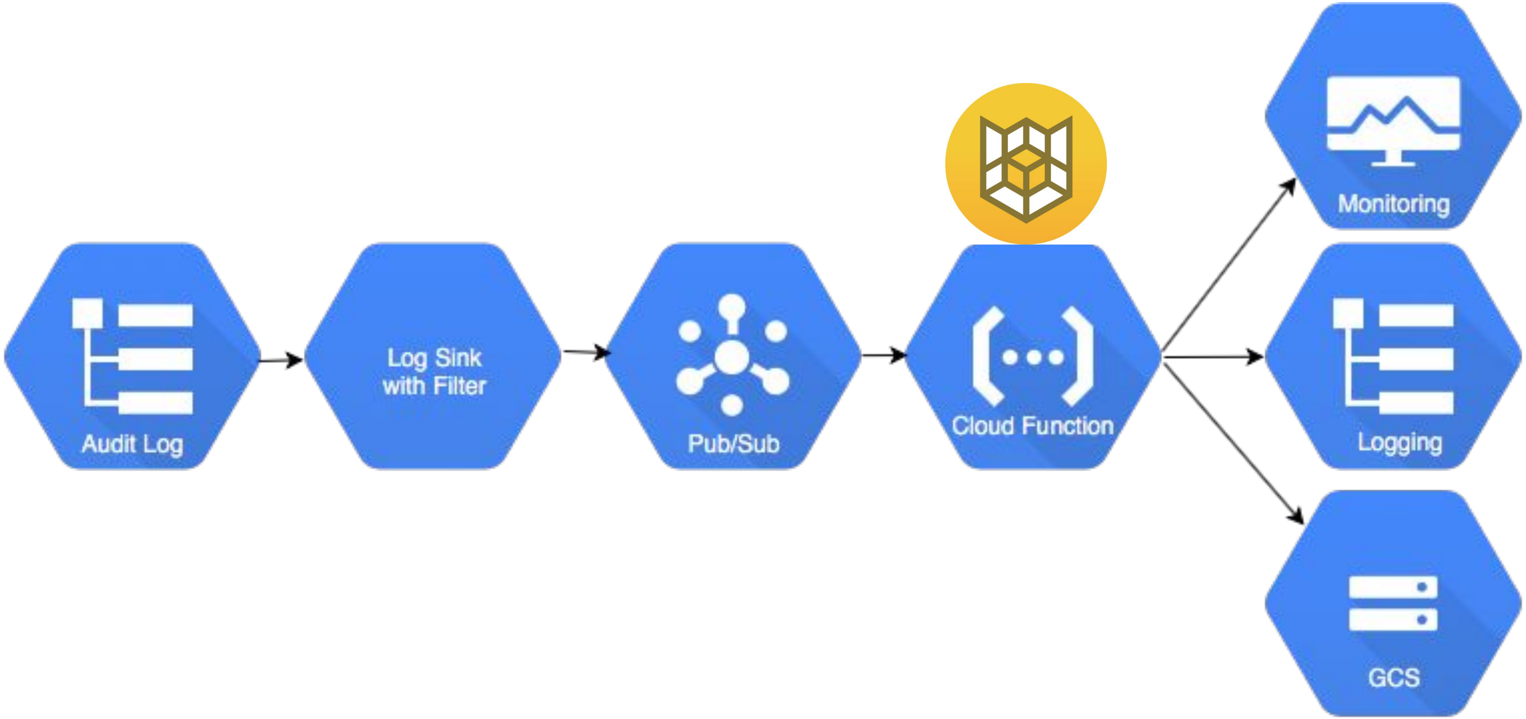
Python Runtime (Beta)

Server Side Dependency Building...

```
- name: serverless-ftw
  resource: gcp.instance
  mode:
    type: gcp-audit
    methods:
      - "v1.compute.instances.start"
  filters:
    - “tag:Quarantined”: present
  actions:
    - stop
```

```
$ custodian run gcp.yml -s out
2018-07-31 10:19:58: custodian.gcp.funce:INFO provisioning
policy function compute-state
2018-07-31 10:20:03: c7n_gcp.mu:INFO function code uploaded
2018-07-31 10:20:04: c7n_gcp.mu:INFO updating function config
```

GCP - Auditing API Calls



Azure - Auditing API Calls

Azure Function Python Runtime

Consumption or App Service Plan

Event Grid subscribing to resource group events.

```
name: tag-key-vault-creator
resource: azure.keyvault
mode:
 type: azure-event-grid
 events:
   - resourceProvider: Microsoft.KeyVault/vaults
     event: write
 filters:
   - "tag:CreatorEmail": null
 actions:
   - type: auto-tag-user
     tag: CreatorEmail
```

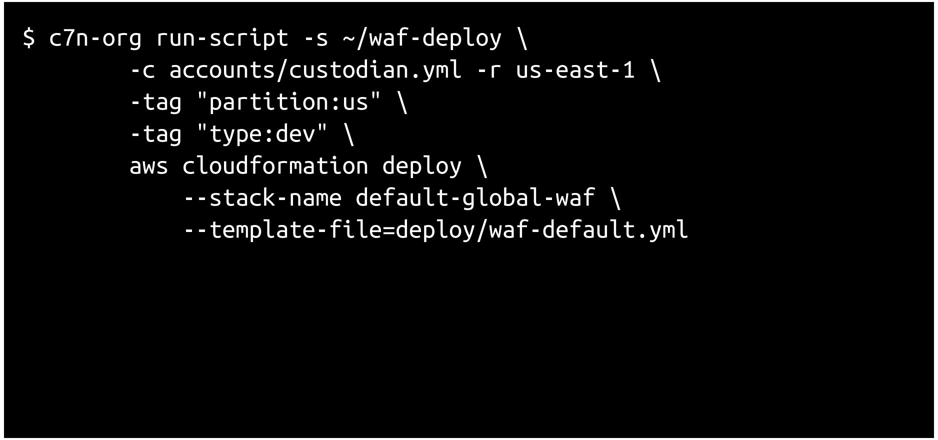
Custodian Multi Cloud

	AWS	GCP	Azure
Serverless	✓	✓	✓
Api Subscriber	✓	✓	✓
Storage	✓	Q2	✓
Logging	✓	✓	✓
Metrics	✓	✓	✓
Resource Query	✓	✓	✓
Multi Account	✓	✓	✓
Status	Stable	Alpha	Beta

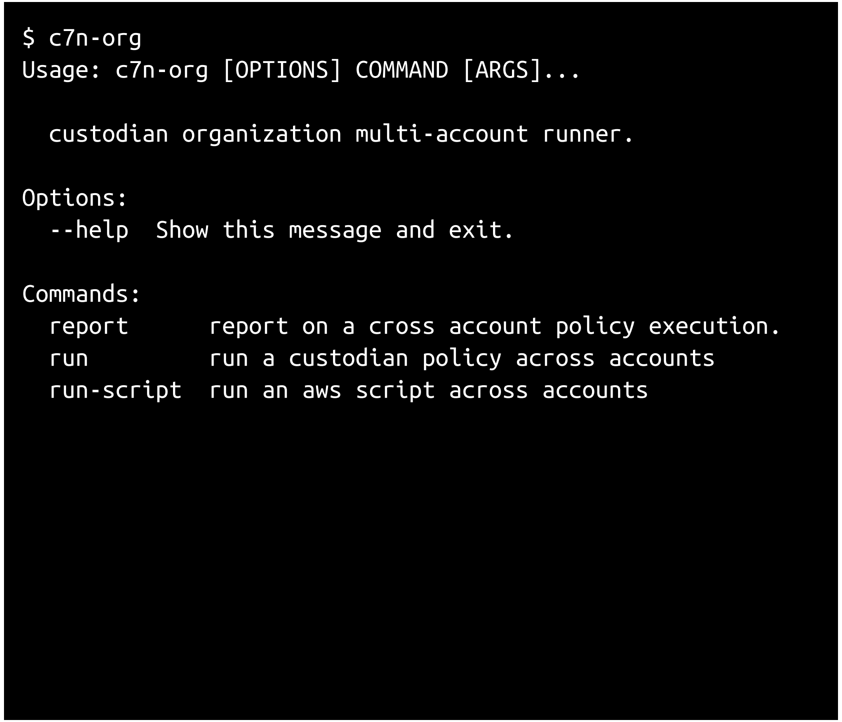
c7n_org - Multi Account Execution

Run and report custodian policies across multiple accounts.

Bonus run arbitrary scripts across accounts.



```
$ c7n-org run-script -s ~/waf-deploy \
    -c accounts/custodian.yml -r us-east-1 \
    -tag "partition:us" \
    -tag "type:dev" \
    aws cloudformation deploy \
      --stack-name default-global-waf \
      --template-file=deploy/waf-default.yml
```



```
$ c7n-org
Usage: c7n-org [OPTIONS] COMMAND [ARGS]...

  custodian organization multi-account runner.

Options:
  --help  Show this message and exit.

Commands:
  report      report on a cross account policy execution.
  run         run a custodian policy across accounts
  run-script  run an aws script across accounts
```

c7n_mailer - Notification Delivery

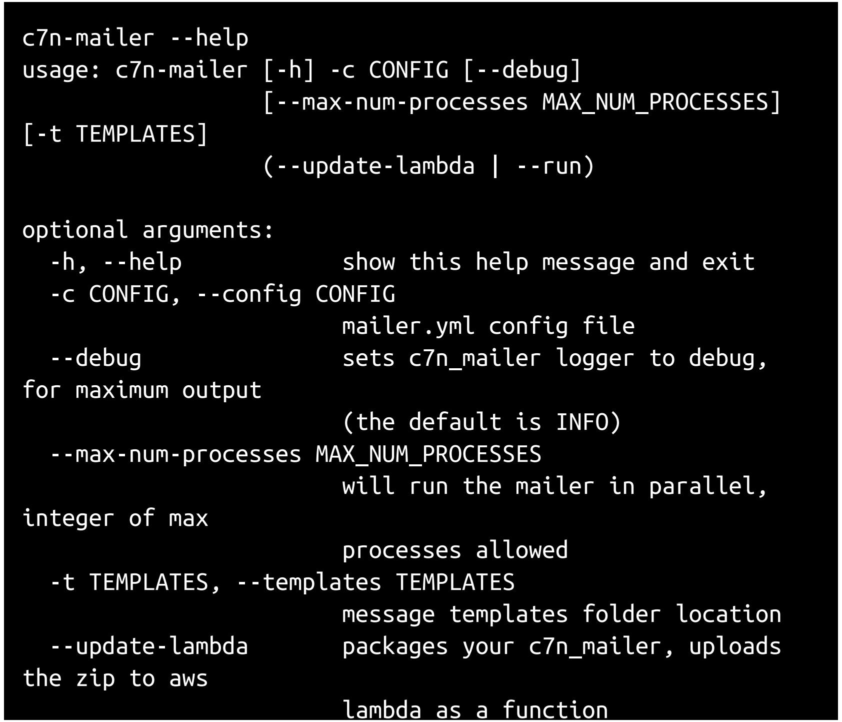
Deliver policy notifications to users.

Jinja2 Message Templates

Supports LDAP Address Lookup

Supported delivery transports

- Slack
- SES
- SMTP
- SendGrid



```
c7n-mailer --help
usage: c7n-mailer [-h] -c CONFIG [--debug]
                  [--max-num-processes MAX_NUM_PROCESSES]
[-t TEMPLATES]
                  (--update-lambda | --run)

optional arguments:
  -h, --help            show this help message and exit
  -c CONFIG, --config CONFIG
                        mailer.yml config file
  --debug               sets c7n_mailer logger to debug,
for maximum output
                        (the default is INFO)
  --max-num-processes MAX_NUM_PROCESSES
                        will run the mailer in parallel,
integer of max
                        processes allowed
  -t TEMPLATES, --templates TEMPLATES
                        message templates folder location
  --update-lambda       packages your c7n_mailer, uploads
the zip to aws
                        lambda as a function
```

Auto Tag Creators

Who made X, Y, and Z

Just auto tag it.

```
policies:
  - name: auto-tag-buckets
    mode:
     type: cloud-trail
     events: [CreateBucket]
    actions:
     - type: auto-tag-owner
       tag: "ResourceCreator”
```

Cost Savings - Garbage Collection

Find underutilized or unused things and resize or remove them.

Very useful across resources like:

- Amazon Elastic Compute Cloud (EC2)
- Amazon Elastic Block Store (EBS)
- Amazon Elastic Load Balancing (ELB)
- Amazon CloudWatch Logs
- Amazon Redshift
- Amazon Relational Database Service

```
- name: rds-unused-mark
  resource: rds
  description: |
    Take the average connections over 14 days and mark unused RDS instances.
  filters:
    - "tag:custodian_cleanup": absent
    - type: value
      value_type: age
      key: InstanceCreateTime
      value: 14
      op: gt
    - type: metrics
      name: DatabaseConnections
      statistic: Sum
      days: 14
      value: 0
      op: equal
  actions:
    - type: mark-for-op
      tag: custodian_cleanup
      op: delete
      days: 14
```

Cost Savings - Lights Out

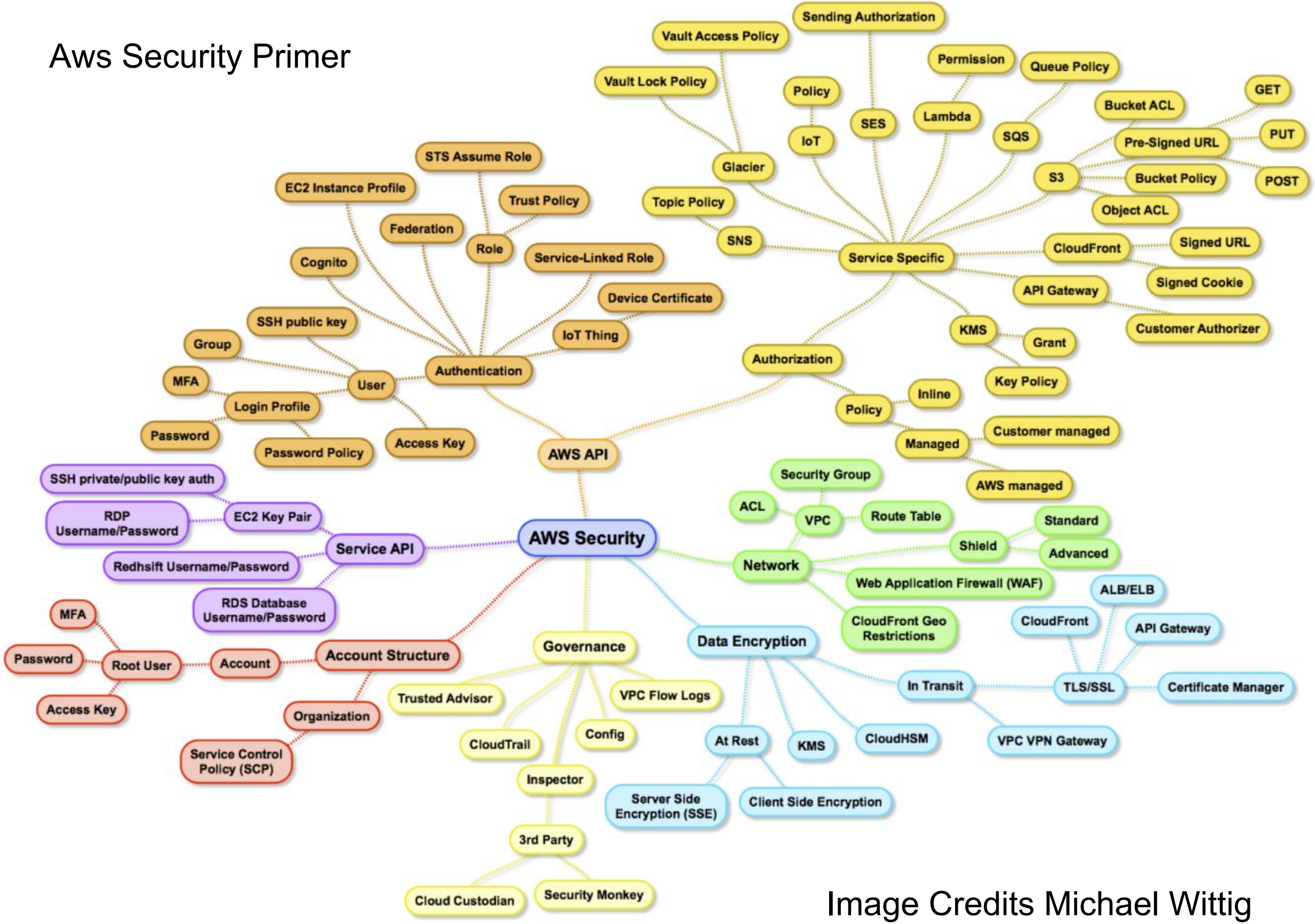
Let’s turn off all asg in our dev vpc at night and on weekends and save 64% on instance costs.

Also works for Amazon RDS / DocumentDB / Aurora / Neptune

Docs

```
policies:
 - name: offhours-stop
   resource: ec2
   filters:
    - VpcId: xyz
    - type: offhour
      weekends: false
      default_tz: pt
      tag: downtime
      opt-out: true
      onhour: 8
      offhour: 20
```

Aws Security Primer



- AWS Security
  - AWS API
    - Authentication
      - User
        - Group
        - SSH public key
        - Login Profile
          - MFA
          - Password
          - Password Policy
        - Access Key
      - Cognito
      - EC2 Instance Profile
      - Federation
      - Role
        - STS Assume Role
        - Trust Policy
      - Service-Linked Role
      - IoT Thing
        - Device Certificate
    - Authorization
      - Service Specific
        - Glacier
          - Vault Lock Policy
          - Vault Access Policy
        - SNS
          - Topic Policy
        - IoT
          - Policy
        - SES
          - Sending Authorization
        - Lambda
          - Permission
        - SQS
          - Queue Policy
        - S3
          - Bucket ACL
          - Pre-Signed URL
            - GET
            - PUT
            - POST
          - Bucket Policy
          - Object ACL
        - CloudFront
          - Signed URL
          - Signed Cookie
        - API Gateway
          - Customer Authorizer
        - KMS
          - Grant
          - Key Policy
      - Policy
        - Inline
        - Managed
          - Customer managed
          - AWS managed
  - Service API
    - EC2 Key Pair
      - SSH private/public key auth
      - RDP Username/Password
    - Redhsift Username/Password
    - RDS Database Username/Password
  - Account Structure
    - Account
      - Root User
        - MFA
        - Password
        - Access Key
    - Organization
      - Service Control Policy (SCP)
  - Governance
    - Trusted Advisor
    - CloudTrail
    - Inspector
    - 3rd Party
      - Cloud Custodian
      - Security Monkey
    - Config
    - VPC Flow Logs
  - Network
    - VPC
      - Security Group
      - ACL
      - Route Table
    - Shield
      - Standard
      - Advanced
    - Web Application Firewall (WAF)
    - CloudFront Geo Restrictions
  - Data Encryption
    - At Rest
      - Server Side Encryption (SSE)
      - Client Side Encryption
    - KMS
    - CloudHSM
    - In Transit
      - TLS/SSL
        - CloudFront
        - ALB/ELB
        - API Gateway
        - Certificate Manager
      - VPC VPN Gateway

Image Credits Michael Wittig

Ensuring Audit Trail - Amazon Cloud Trail

Cloud Trail - Control Plane API calls for services.

Great tools for working with cloud trail logs.

- Amazon Macie, ElasticSearch (ELK), Splunk, Custodian TrailDb, Zalando FullStop, Amazon Athena

```
policies:
  - name: aws-cloudtrail-not-enabled
    resource: account
    region: us-east-1
    tags:
     - level:high
    description: |
      Scans for accounts which do not have CloudTrails
      enabled.
    filters:
     - type: check-cloudtrail
       global-events: true
       multi-region: true
       running: true
       kms: true
       file-digest: true
```

Ensuring Audit Trail - Amazon Config

Config provides for periodic polling and archiving of current and historical revisions of resources (that it supports).

```
policies:
  - name: aws-config-not-enabled
    resource: account
    region: us-east-1
    tags:
     - level:high
    description: |
      Policy scans for accounts which do not have
      CloudTrails enabled.
    filters:
     - type: check-config
       all-resources: true
       global-resources: true
       running: true
```

Ensuring Audit Trail - Amazon VPC Flow Logs

Flow logs give basic metadata on connections between ips within a vpc.

```
policies:
  - name: flow-log-not-enabled
    resource: vpc
    filters:
     - type: flow-log
       state: absent
    actions:
      - <<: *notify_action
        subject: "Missing VPC Flow Logs"
```

AWS Identity and Access Management (AWS)

MFA

```
- name: user-missing-mfa
  resource: iam-user
  region: us-east-1
  filters:
    - type: credential
      key: password_enabled
    - type: mfa-device
      value: empty
  actions:
    - <<: *notify_action
      subject: "Enable MFA on user"
```

Password Policy

```
- name: iam-password-policy
  resource: account
  region: us-east-1
  filters:
    - or:
      - type: password-policy
        key: MaxPasswordAge
        value: 30
        op: gte
      - type: password-policy
        key: MinimumPasswordLength
        value: 8
        op: lte
```

AWS IAM - Unused & Over Privileged

```
name: ec2-overprivileged
resource: ec2
mode:
   type: config-rule
filters:
  - type: check-permission
    actions:
    - iam:CreateUser
```

```
name: unused-access-keys
resource: iam-user
region: us-east-1
filters:
  - type: credential
    key: access_keys.last_used_date
    value_type: age
    value: 120
    op: greater-than
actions:
  - type: post-finding
    confidence: 100
    compliance_status: FAILED
    recommendation: Rotate Key
    types: [
       "Software and Configuration Checks/
        AWS Security Best Practices"]
```

IAM (Continued)

Detect Root Logins

```
- name: root-login-detected
  resource: account
  description: |
    Notifies on root user logins
  mode:
     type: cloudtrail
     role: arn:aws:iam::{account_id}:role/Eg
     events:
      - ConsoleLogin
  filters:
    - type: event
      key: "detail.userIdentity.type"
      value: Root
  actions:
    - <<: *notify_action
      subject: "AWS Root Console Login Alert"
```

Detect Lack of Root Hardware MFA

```
- name: root-virtual-mfa
  resource: account
  description: |
    Notifies on root user without hw mfa
  filters:
    - type: iam-summary
      key: AccountMFAEnabled
      value: true
    - type: has-virtual-mfa
      value: true
  actions:
    - <<: *notify_action
      subject: "AWS Root Missing MFA"
```

Resources w/ Embedded IAM

- SNS
- SQS
- Glacier
- Lambda & Layers
- ECR
- KMS
- S3*
- API Gw
- Iam Role (Trust)
- Snapshots & Amis

ECR

```
vars:
  accounts_url: &aurl s3://mybucket/myaccounts.json

policies:
 - name: ecr-cross-account
   resource: ecr
   filters:
     - type: cross-account
       whitelist_from:
         expr: "accounts.*.accountNumber"
         url: *accounts_url
   actions:
     - <<: *notify_action
       subject: "[custodian] ECR available externally"
     - type: remove-statements
       statement_ids: matched
```

Ensuring Audit Trail - ALB/ELB/Cloudfront Logs

Capture access logs from all albs

```
policies:
  - name: appelb-logs
    resource: appelb
    filters:
     - type: value
       key: “Attributes.access_logs.s3.enabled”
       value: False
    actions:
     - type: set-s3-logging
       bucket: my-lb-logs
       prefix: “Logs/{AccountId}/{LoadBalancerName}”
```

Network Security - AWS Shield

CloudFront

```yaml
policies:
 - name: activate-cloudfront-shield
   resource: distribution
   region: us-east-1
   filters:
    - type: shield-enabled
      state: false
   actions:
    - type: set-shield
      state: true
```

ELB

```yaml
policies:
 - name: activate-elb-shield
   resource: elb
   filters:
    - type: value
      key: Scheme
      value: internal
      op: not-equal
    - type: shield-enabled
      state: false
   actions:
    - type: set-shield
      state: true
```

Network Security - AWS WAF

CloudFront

```
policies:
 - name: activate-cloudfront-waf
   resource: distribution
   region: us-east-1
   filters:
     - Status: Deployed
     - WebACLId: empty
   actions:
     - type: set-waf
       web-acl: global-default
       state: true
```

Application Load Balancer

```
policies:
 - name: activate-alb-waf
   resource: app-elb
   filters:
    - type: value
      key: Scheme
      value: internal
      op: not-equal
    - type: waf-enabled
      state: false
   actions:
     - type: set-waf
       web-acl: regional-default
       state: true
```

Encryption at REST

- SSE Protects against very specific threat models
- Provides ancillary protection around accidental snapshot sharing (image, redshift, ebs, rds).

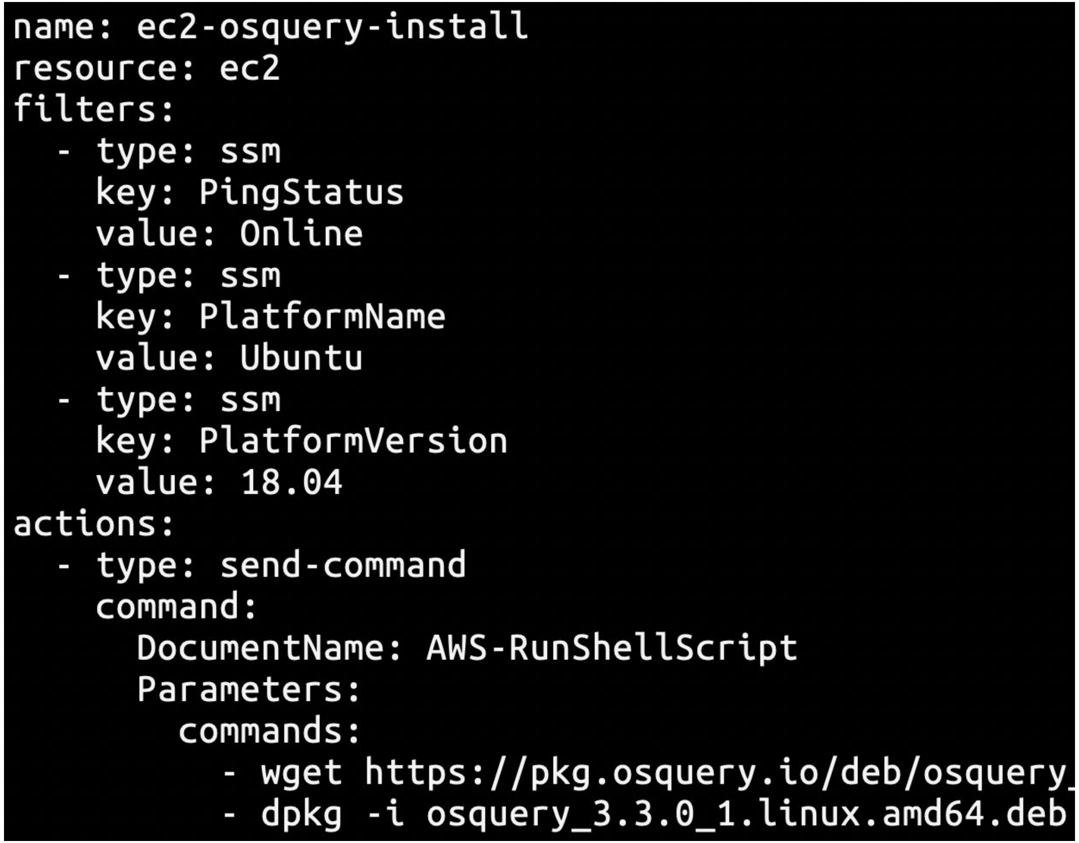
```
policies:
 - name: asg-unencrypted
   resource: asg
   filters:
    - type: not-encrypted
      exclude_images: true

 - name: kinesis-unencrypted
   resource: kinesis
   filters:
    - KeyId: absent

 - name: ec2-encrypted
   resource: ec2
   filters:
     - type: ebs
       key: Encrypted
       value: false
       skip-devices: [“dev/xvda”, “/dev/sda1”]
```

Server Management

With Amazon SSM Agent

You can manage servers with custodian.

See tools/omnissm in the repo.



```
name: ec2-osquery-install
resource: ec2
filters:
  - type: ssm
    key: PingStatus
    value: Online
  - type: ssm
    key: PlatformName
    value: Ubuntu
  - type: ssm
    key: PlatformVersion
    value: 18.04
actions:
  - type: send-command
    command:
      DocumentName: AWS-RunShellScript
      Parameters:
        commands:
          - wget https://pkg.osquery.io/deb/osquery_
          - dpkg -i osquery_3.3.0_1.linux.amd64.deb
```

Roadmap

Pycon 2019 (Ohio) Development Sprint

- Documentation
- Kubernetes Provider

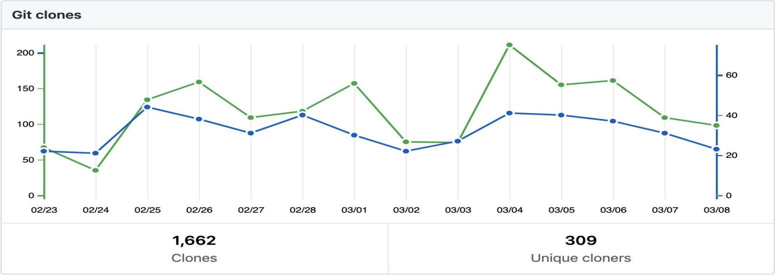
Stronger AWS IAM Management Capabilities

GCP parity

Policy Author Experience Improvements

Project Stats

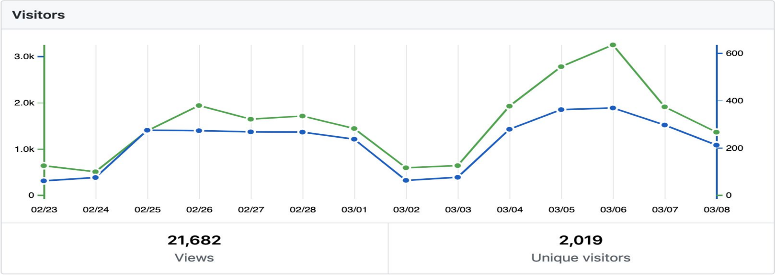
1m+ downloads
170+ contributors
2100+ pull requests
1500+ tests ~ 90% cov
~700 users in chatroom



Git clones

1,662
Clones

309
Unique cloners



Visitors

21,682
Views

2,019
Unique visitors

Community

Home Page http://cloudcustodian.io

Gitter https://gitter.im/capitalone/cloud-custodian

Github https://github.com/cloudcustodian/cloud-custodian

Reddit https://reddit.com/r/cloudcustodian

Mailing List -
https://groups.google.com/forum/#!forum/cloud-custodian

Any
Questions