Audit in Kubernetes, the Future is Here

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kubernetes


Quick history lesson anyone?
QUARTZ
https://unsplash.com

Basic Audit

```
AUDIT: id="5c3b8227-4af9-4322-8a71-542231c3887b"
    ip="127.0.0.1" method="GET" user="admin" as="<self>"
    asgroups="<lookup>" namespace="default"
    uri="/api/v1/namespaces/default/pods"


AUDIT: id="5c3b8227-4af9-4322-8a71-542231c3887b" response="200"
```

Advanced Audit

https://unsplash.com

Advanced Audit

Meta data output & **full objects** for request/response

JSON or **text**-based **file output** & **webhook** support

Filtering with a policy

Configurable consistency with batching and flush

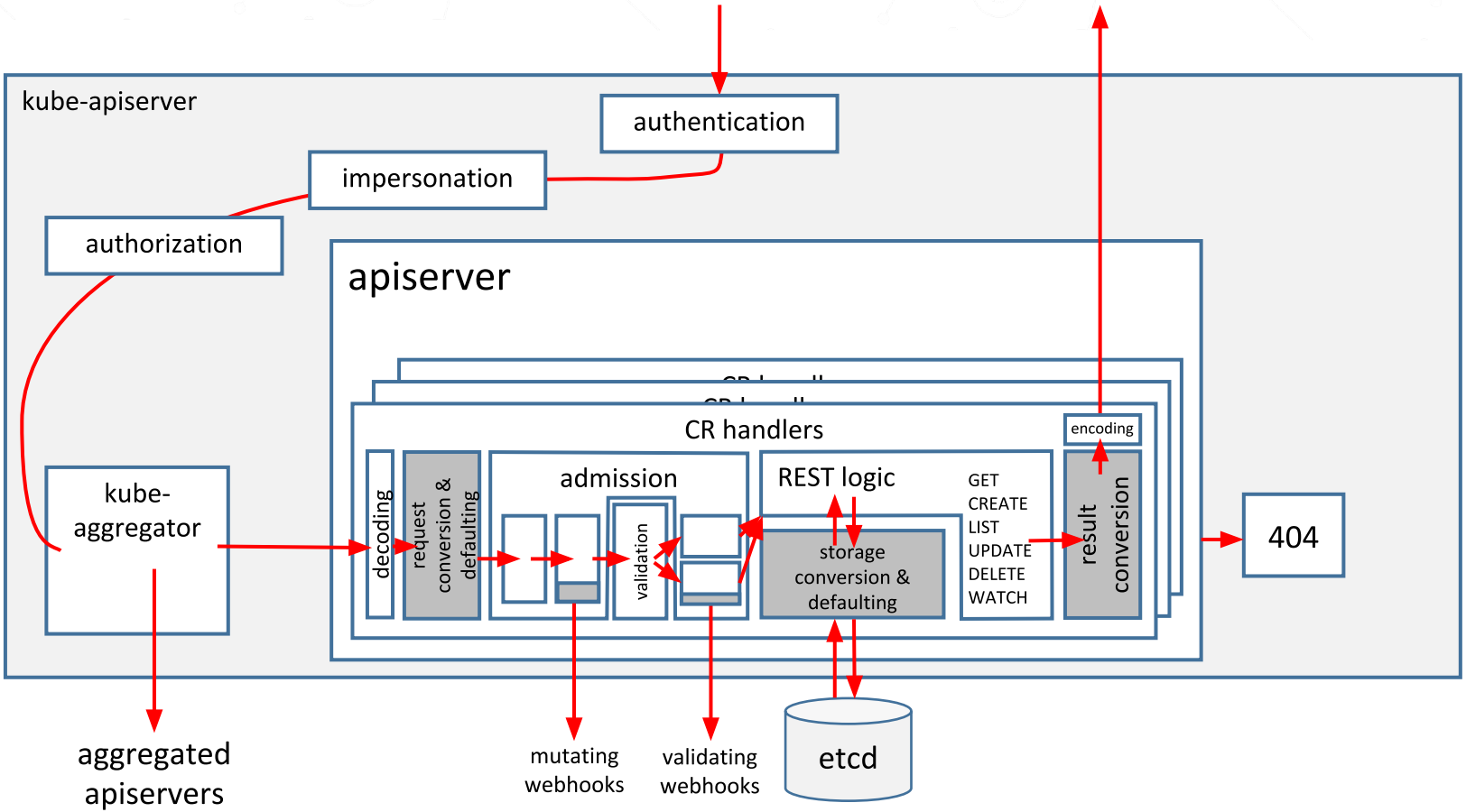

Advanced Audit
GA’d in 1.12
https://unsplash.com

An Audit Event

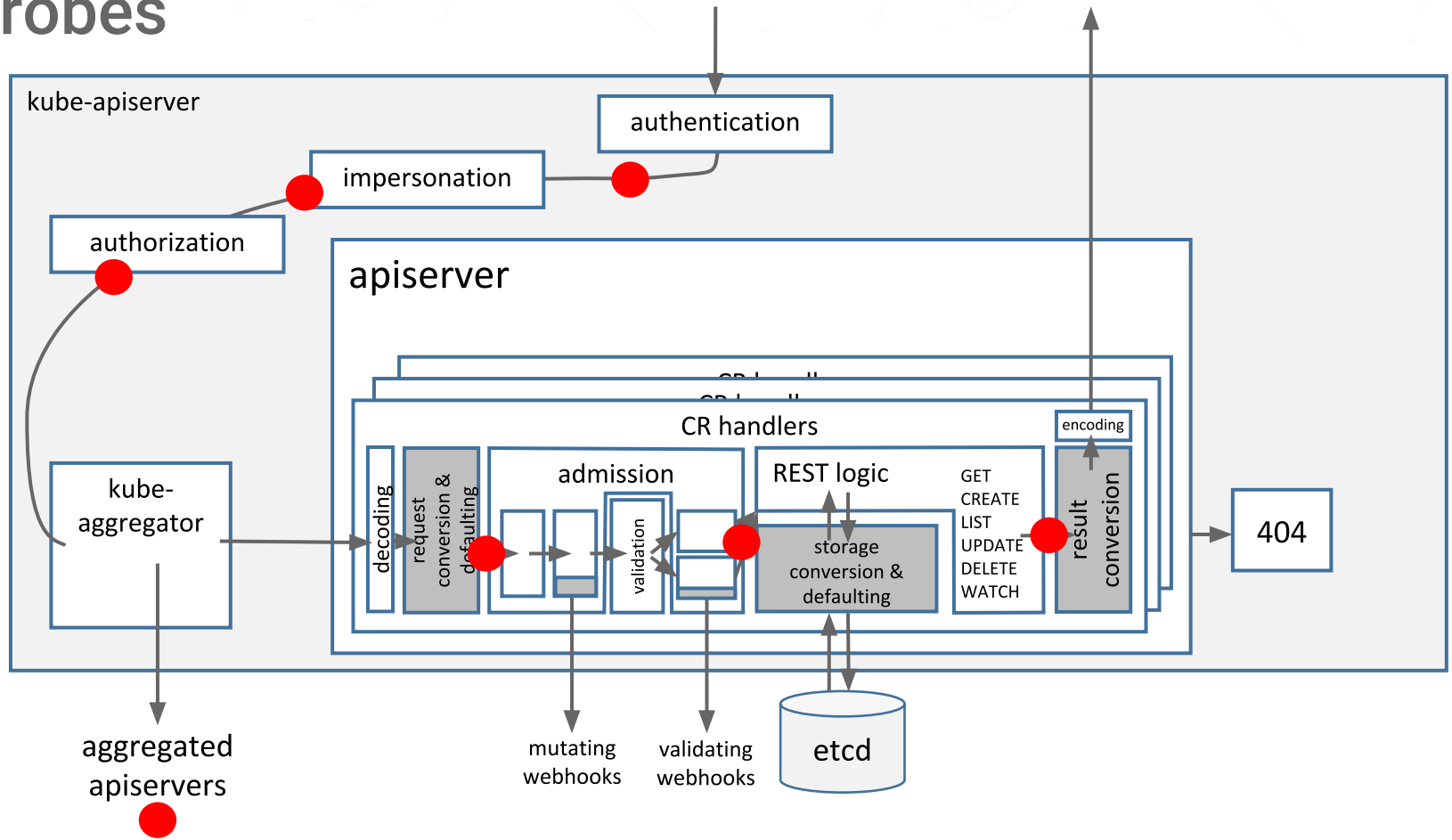
audit.k8s.io/v1

- one event per request
- to be filled by apiservers
- sent to audit backend

```
type Event struct {
    Level Level
    AuditID types.UID
    Stage Stage
    RequestURI string
    Verb string
    User authnv1.UserInfo
    ImpersonatedUser *authnv1.UserInfo
    SourceIPs []string
    UserAgent string
    ObjectRef *ObjectReference
    ResponseStatus *metav1.Status
    RequestObject *runtime.Unknown
    ResponseObject *runtime.Unknown
    RequestReceivedTimestamp metav1.MicroTime
    StageTimestamp metav1.MicroTime
    Annotations map[string]string
}
```


kube-apiserver
authentication
impersonation
authorization
apiserver
CR handlers
encoding
kube-
aggregator
decoding
request
conversion &
defaulting
admission
validation
REST logic
storage
conversion &
defaulting
GET
CREATE
LIST
UPDATE
DELETE
WATCH
result
conversion
404
aggregated
apiservers
mutating
webhooks
validating
webhooks
etcd

Probes


kube-apiserver
authentication
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request
conversion &
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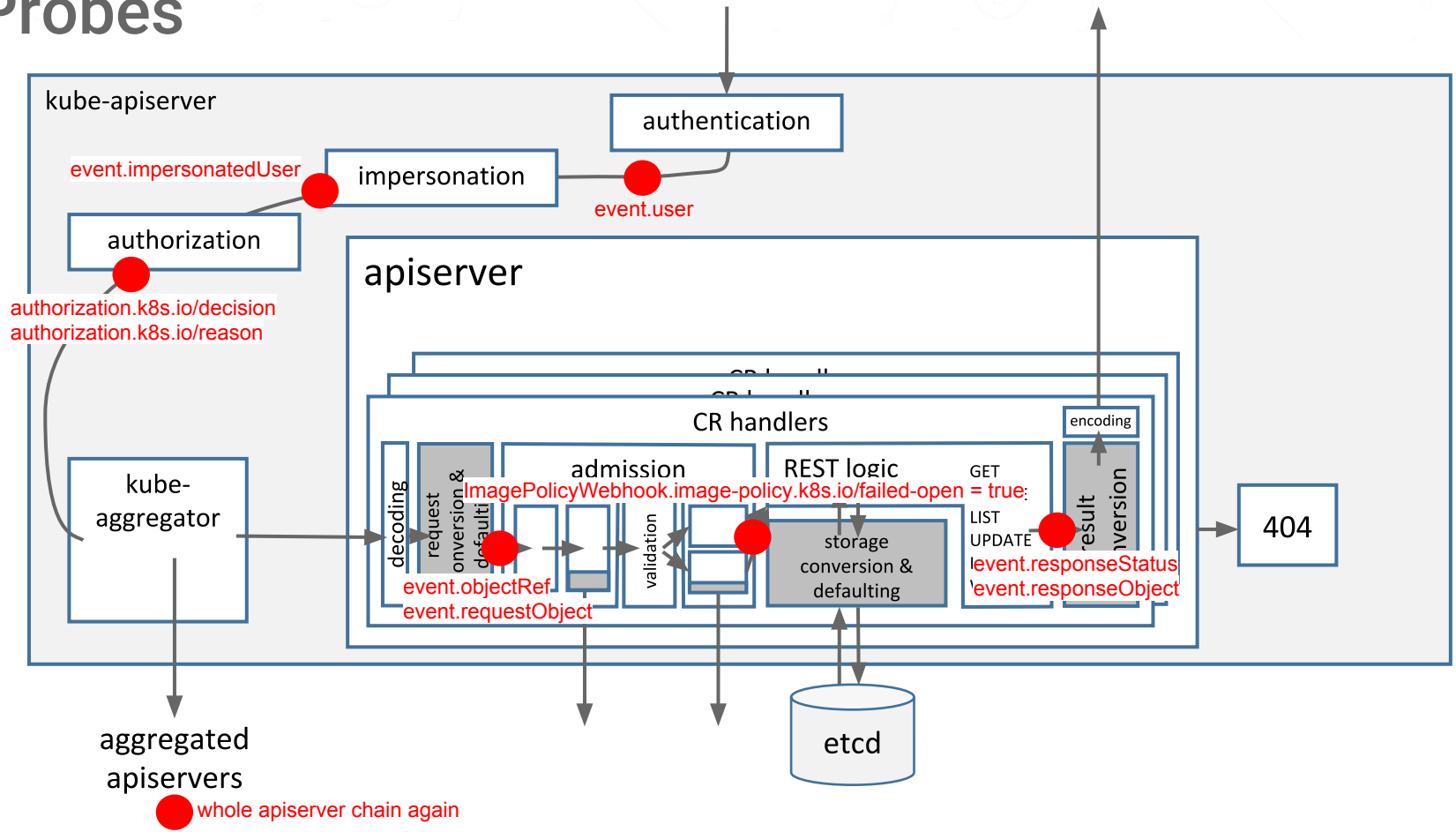
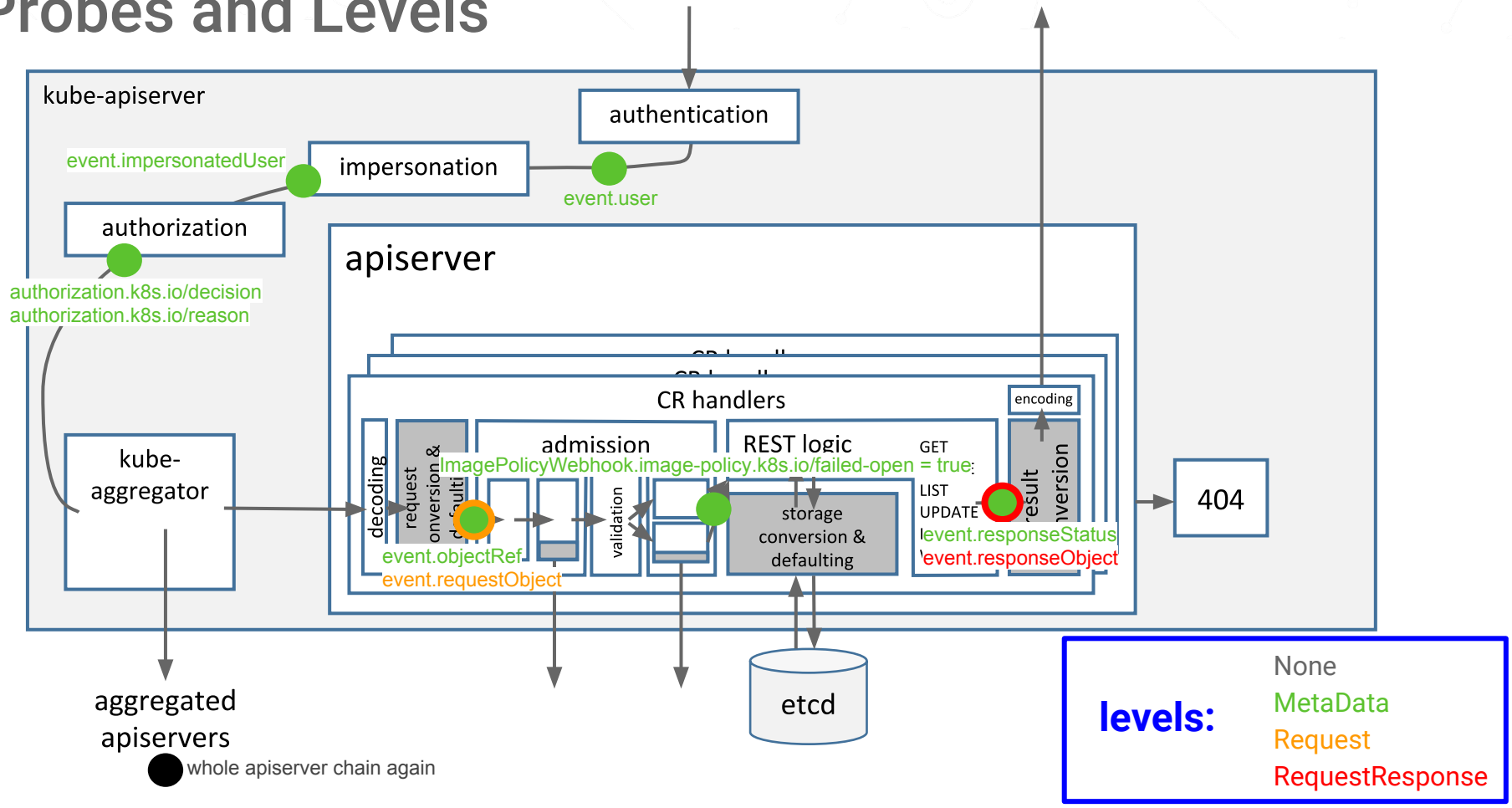
Probes


kube-apiserver
authentication
event.impersonatedUser
impersonation
event.user
authorization
apiserver
authorization.k8s.io/decision
authorization.k8s.io/reason
CR handlers
encoding
kube-
aggregator
admission
REST logic
GET
ImagePolicyWebhook.image-policy.k8s.io/failed-open = true
LIST
UPDATE
decoding
validation
storage
conversion &
defaulting
event.responseStatus
event.responseObject
event.objectRef
event.requestObject
404
etcd
aggregated
apiservers
whole apiserver chain again

Probes and Levels



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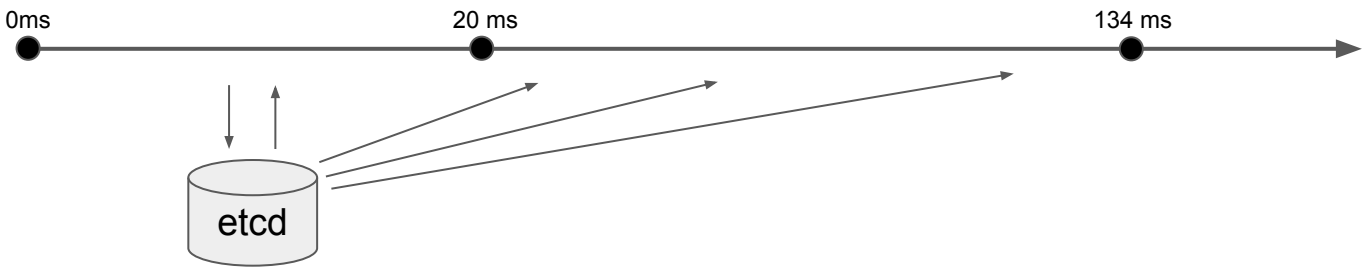
Performance impact vs. consistency

- Levels: how deep to log

```
None, MetaData, Request, RequestRespone
```

- Stages: when to log

```
RequestReceived, ResponseStarted, Panic, ResponseComplete
```



multiple events!

Performance impact vs. consistency

- Levels: how deep to log

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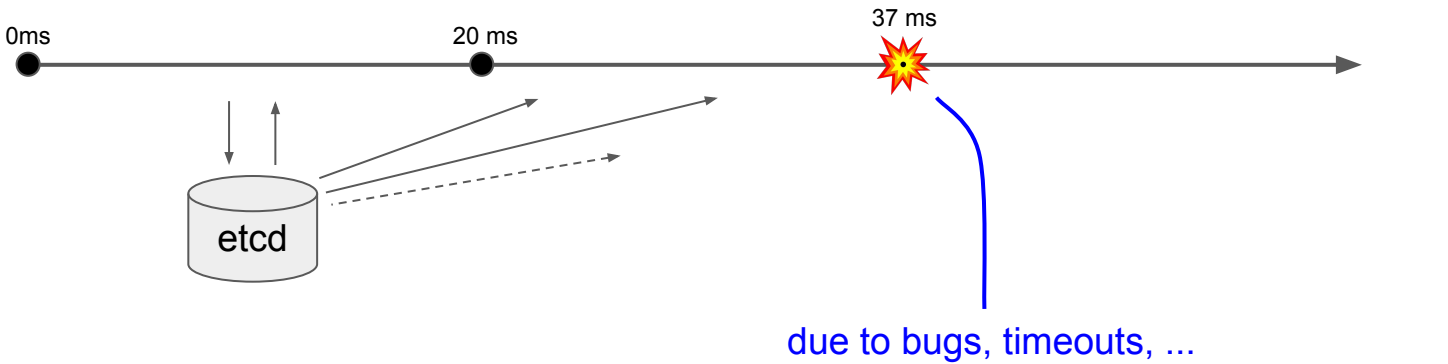
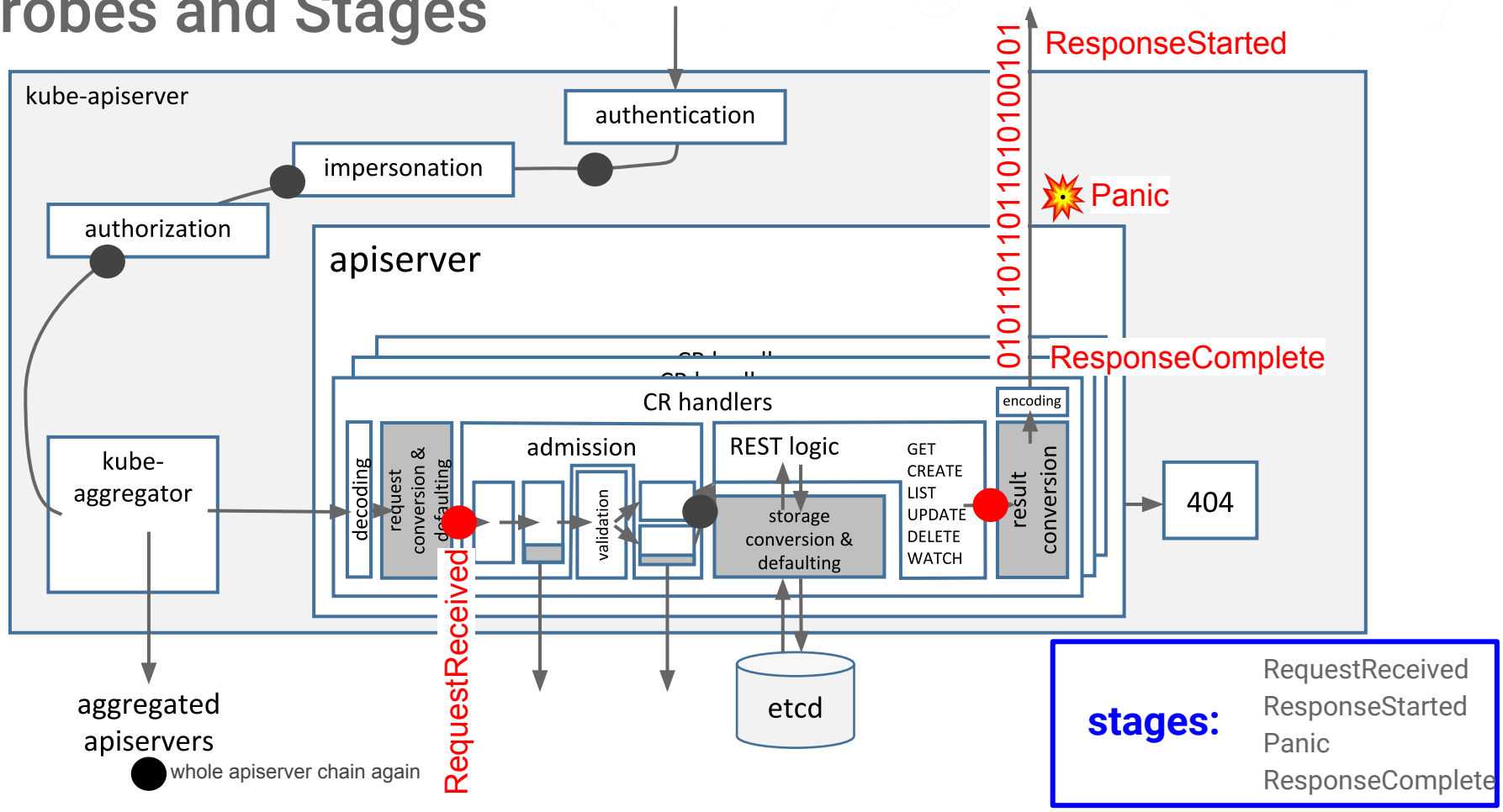
```

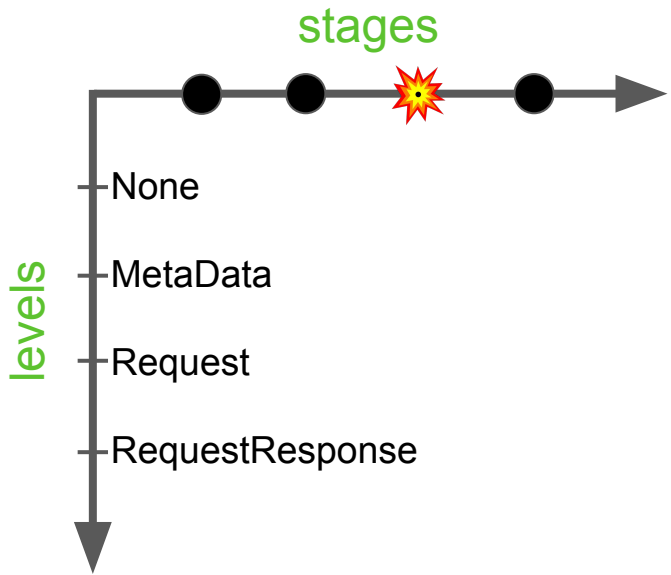
- Stages: when to log

```
RequestReceived, ResponseStarted, Panic, ResponseComplete
```



Probes and Stages




stages
levels
None
MetaData
Request
RequestResponse

Defining a policy

kube-apiserver

--audit-policy-file string

Path to the audit policy configuration.

--audit-dynamic-configuration bool

Enables dynamic audit configuration.

v1alpha1 in 1.13

```
--audit-policy-file           string
--audit-dynamic-configuration bool
```

```
apiVersion: audit.k8s.io/v1
kind: Policy
omitStages:
  - "RequestReceived"
rules:
  - level: “None”
    ...
```

Deep object logging

```
- level: RequestResponse
  resources:
  - group: "" # core
  - group: "apps"
  omitStages:
  - RequestReceived
```


```
{
  "kind": "Event",
  "apiVersion": "audit.k8s.io/v1",
  "level": "RequestResponse",
  "auditID": "c69801e8-73c2-459f-966f-e34874bb6817",
  "stage": "ResponseComplete",
  "requestURI": "/api/v1/namespaces/default/pods/pi-1544108640-smwwq",
  "verb": "get",
  "user": {
    "username": "system:admin",
    "groups": [
      "system:masters",
      "system:authenticated"
    ]
  },
  "sourceIPs": [
    "::1"
  ],
  "userAgent": "kubectl/v1.14.0 (linux/amd64) kubernetes/82b0d8f",
  "objectRef": {
    "resource": "pods",
    "namespace": "default",
    "name": "pi-1544108640-smwwq",
    "apiVersion": "v1"
  },
  "responseStatus": {
    "metadata": {},
    "code": 200
  },
  "responseObject": {
    "kind": "Pod",
    "apiVersion": "v1",
    "metadata": {
      "name": "pi-1544108640-smwwq",
      "generateName": "pi-1544108640-",
      "namespace": "default",
      "selfLink": "/api/v1/namespaces/default/pods/pi-1544108640-smwwq",
      "uid": "2f1fbfc1-f968-11e8-8679-52540098c2e3",
      "resourceVersion": "504",
      "creationTimestamp": "2018-12-06T15:04:09Z",
      "labels": {
        "controller-uid": "2f1cc913-f968-11e8-8679-52540098c2e3",
        "job-name": "pi-1544108640",
        "run": "pi"
      }
    },
    "spec": {
      "volumes": [
        {
          "name": "default-token-8xtw7",
          "secret": {
            "secretName": "default-token-8xtw7",
            "defaultMode": 420
          }
```

Excluding secrets

```
- level: Metadata
  resources:
  - group: "" # core
    resources: ["secrets", "configmaps"]
  - group: authentication.k8s.io
    resources: ["tokenreviews"]
  omitStages:
  - RequestReceived
```

Logging objects at different levels

```
- level: Request
  verbs: ["get", "list", "watch"]
  resources:
  - group: "batch"
  omitStages:
  - RequestReceived
- level: RequestResponse
  resources:
  - group: "batch"
  omitStages:
  - RequestReceived
```

```
- level: None
  nonResourceURLs:
  - /healthz*
  - /version
  - /swagger*
```

Logging events performed by a particular user

```
- level: RequestResponse
    users: ["naughtyuser"]
    omitStages:
      - RequestReceived
```

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Config

kube-apiserver

```
Auditing flags:

      --audit-dynamic-configuration
               Enables dynamic audit configuration. This feature also requires the DynamicAuditing feature flag
      --audit-log-batch-buffer-size int
               The size of the buffer to store events before batching and writing. Only used in batch mode. (default 10000)
      --audit-log-batch-max-size int
               The maximum size of a batch. Only used in batch mode. (default 1)
      --audit-log-batch-max-wait duration
               The amount of time to wait before force writing the batch that hadn't reached the max size. Only used in batch mode.
      --audit-log-batch-throttle-burst int
               Maximum number of requests sent at the same moment if ThrottleQPS was not utilized before. Only used in batch mode.
      --audit-log-batch-throttle-enable
               Whether batching throttling is enabled. Only used in batch mode.
      --audit-log-batch-throttle-qps float32
               Maximum average number of batches per second. Only used in batch mode.
      --audit-log-format string
               Format of saved audits. "legacy" indicates 1-line text format for each event. "json" indicates structured json format. Known formats are legacy,json. (default "json")
      --audit-log-maxage int
               The maximum number of days to retain old audit log files based on the timestamp encoded in their filename.
      --audit-log-maxbackup int
               The maximum number of old audit log files to retain.
      --audit-log-maxsize int
               The maximum size in megabytes of the audit log file before it gets rotated.
      --audit-log-mode string
               Strategy for sending audit events. Blocking indicates sending events should block server responses. Batch causes the backend to buffer and write events asynchronously. Known modes are
               batch,blocking,blocking-strict. (default "blocking")
      --audit-log-path string
               If set, all requests coming to the apiserver will be logged to this file.  '-' means standard out.
      --audit-log-truncate-enabled
               Whether event and batch truncating is enabled.
      --audit-log-truncate-max-batch-size int
               Maximum size of the batch sent to the underlying backend. Actual serialized size can be several hundreds of bytes greater. If a batch exceeds this limit, it is split into several batches
               of smaller size. (default 10485760)
      --audit-log-truncate-max-event-size int
               Maximum size of the audit event sent to the underlying backend. If the size of an event is greater than this number, first request and response are removed, and if this doesn't reduce
               the size enough, event is discarded. (default 102400)
      --audit-log-version string
               API group and version used for serializing audit events written to log. (default "audit.k8s.io/v1")
      --audit-policy-file string
               Path to the file that defines the audit policy configuration.
      --audit-webhook-batch-buffer-size int
               The size of the buffer to store events before batching and writing. Only used in batch mode. (default 10000)
      --audit-webhook-batch-max-size int
               The maximum size of a batch. Only used in batch mode. (default 400)
      --audit-webhook-batch-max-wait duration
               The amount of time to wait before force writing the batch that hadn't reached the max size. Only used in batch mode. (default 30s)
      --audit-webhook-batch-throttle-burst int
               Maximum number of requests sent at the same moment if ThrottleQPS was not utilized before. Only used in batch mode. (default 15)
      --audit-webhook-batch-throttle-enable
               Whether batching throttling is enabled. Only used in batch mode. (default true)
      --audit-webhook-batch-throttle-qps float32
               Maximum average number of batches per second. Only used in batch mode. (default 10)
      --audit-webhook-config-file string
               Path to a kubeconfig formatted file that defines the audit webhook configuration.
      --audit-webhook-initial-backoff duration
               The amount of time to wait before retrying the first failed request. (default 10s)
      --audit-webhook-mode string
               Strategy for sending audit events. Blocking indicates sending events should block server responses. Batch causes the backend to buffer and write events asynchronously. Known modes are
               batch,blocking,blocking-strict. (default "batch")
      --audit-webhook-truncate-enabled
               Whether event and batch truncating is enabled.
      --audit-webhook-truncate-max-batch-size int
               Maximum size of the batch sent to the underlying backend. Actual serialized size can be several hundreds of bytes greater. If a batch exceeds this limit, it is split into several batches
               of smaller size. (default 10485760)
      --audit-webhook-truncate-max-event-size int
               Maximum size of the audit event sent to the underlying backend. If the size of an event is greater than this number, first request and response are removed, and if this doesn't reduce
```

How to send audit events

stdout

--audit-log-path {-,some-file-name}
--audit-webhook-config-file <kubeconfig>

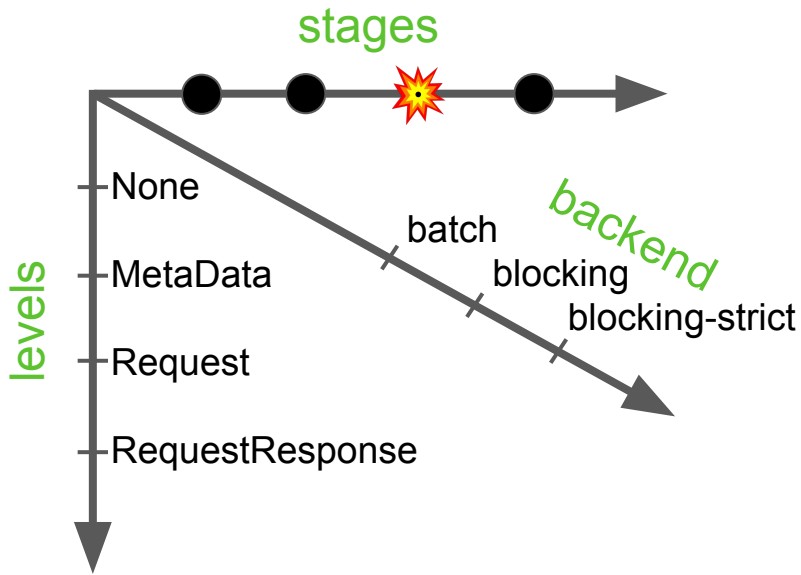
--audit-{log,webhook}**-mode** string

Strategy for sending audit events. Blocking indicates sending events should block server responses. Batch causes the backend to buffer and write events asynchronously. Known modes are: **batch**, **blocking**, **blocking-strict**. (default: "blocking" for log, "batch" for webhook)

```
--audit-{log,webhook}-batch-buffer-size int   (default: 10000 events)
--audit-{log,webhook}-batch-max-size int      (default: 400 events)
--audit-{log,webhook}-batch-max-wait int      (default: 30s)
```

Note: on shutdown, we gracefully flush audit events

Performance vs. consistency



Dynamic Audit Configuration

v1alpha1 in 1.13

--audit-dynamic-configuration

Enables dynamic audit configuration. This feature also requires the DynamicAuditing feature flag

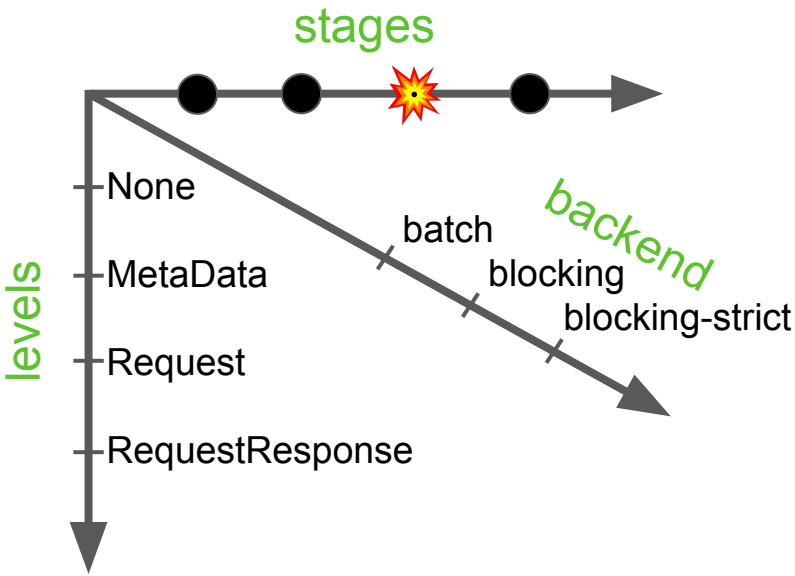
```
apiVersion: auditregistration.k8s.io/v1beta1
kind: AuditSink
metadata:
  name: <name>
policy:
  level: None/Metadata/Request/RequestResponse
  stages:
  - RequestReceived/ResponseStarted/ResponseComplete
webhook:
  clientConfig:
    url: <backend url>
    service: <optional service name>
    caBundle: <ca bundle>
  throttle: ...
```

References

kubernetes.io/docs/tasks/debug-application-cluster/audit

kubernetes/community/contributors/design-proposals/api-machinery/auditing.md

kubernetes/enhancements/keps/sig-auth/0014-dynamic-audit-configuration.md



Backend options:

- log
- webhook

```
apiVersion: audit.k8s.io/v1
kind: Policy
omitStages:
- "RequestReceived"
rules:
- level: “None”
  ...
```