SOC
FORUM
2024

Kubernetes Audit Log в арсенале SOC

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Обо мне

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- Основатель и технический директор Luntry
- Опыт в ИБ более 15 лет
- Специализация безопасность контейнеров и Kubernetes
- CFP DevOpsConf, HighLoad++
- Бывший автор статей и редактор рубрик в журнале “ХАКЕР”
- Автор Telegram-канала “k8s (in)security”
- Автор курса “Cloud Native безопасность в Kubernetes”
- Не верит, что систему можно сделать надежной и безопасной, не понимая ее
- Организатор конференции по безопасности контейнеров - БеКон
- Докладчик: BlackHat, HITB, ZeroNights, HackInParis, Confidence, SAS, OFFZONE, PHDays, Kazhackstan, DevOpsConf, DevOops, KuberConf, VK Kubernetes Conference, HighLoad++, БЕКОН и др.

LUNTRY

План доклада

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ВВЕДЕНИЕ В ИБ-МОНИТОРИНГ ЗА KUBERNETES КЛАСТЕРАМИ

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МЕХАНИЗМ KUBERNETES AUDIT LOG

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ЗАКЛЮЧЕНИЕ

Введение в ИБ-мониторинг за Kubernetes кластерами

Источники данных

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CODE (КОД)

Логи приложения

CONTAINER (КОНТЕЙНЕР)

Runtime события

CLUSTER (КЛАСТЕР)

Kubernetes Audit Log

CLOUD/CORPORATE DATACENTER (ОБЛАКО/ДАТА-ЦЕНТР)

Логи облачного провайдера

Модели нарушителя

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ВНЕШНИЙ

Попадает внутрь контейнера Pod и оттуда обращается к Kubernetes API, или делает побег из контейнера на Node и оттуда обращается к Kubernetes API

ВНУТРЕННИЙ

Злоумышленник с Node или из одной сети с Kubernetes обращается к Kubernetes API

СКОМПРОМЕТИРОВАННЫЙ РАЗРАБОТЧИК

Пытается выкатить YAML ресурсы с вредоносной нагрузкой, которые потом идут на Kubernetes API

Механизм Kubernetes Audit Log

База

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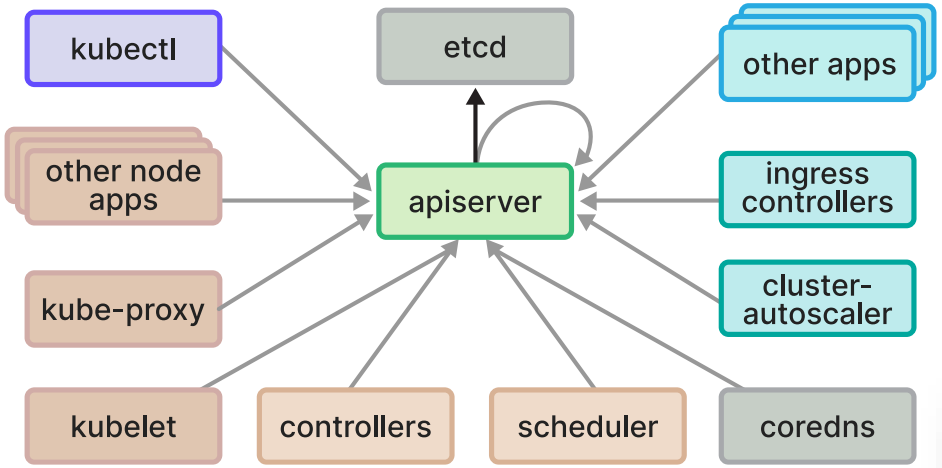
- По умолчанию выключен
- Нужно включать на всех Master Nodes в Control Plane
- Дает дополнительную нагрузку на систему
- Требует определения Audit Policy
- Смотрит за всеми* операциями с YAML файлами



"Вы еще не читаете Kubernetes Audit Log? Тогда мы идем к вам!", Алиса Кириченко, БеКон 2024

The audit logging feature increases the memory consumption of the API server because some context required for auditing is stored for each request. Memory consumption depends on the audit logging configuration.

Ситуация в Managed Kubernetes

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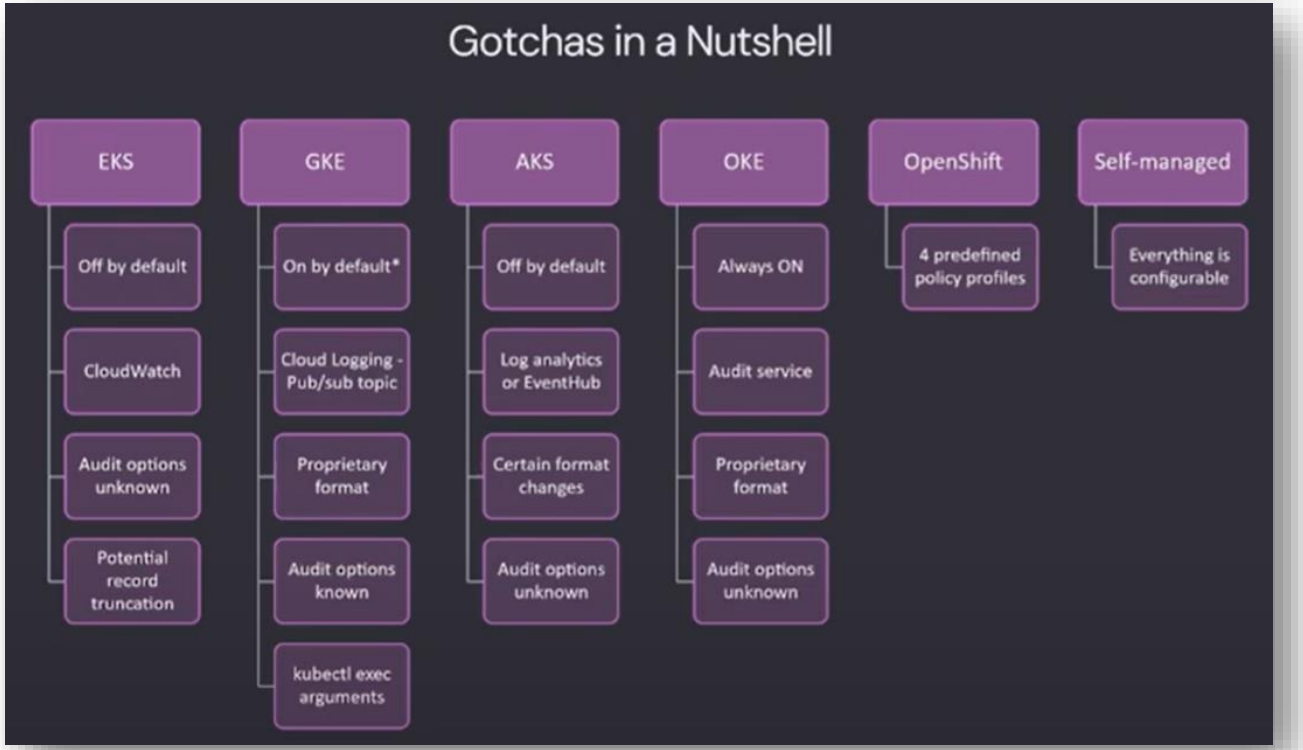
- Нельзя контролировать конфигурацию механизма Audit Log
- Нельзя влиять на детализацию Audit Policy
- Ситуация может варьироваться от провайдера к провайдеру



"Kubernetes Audit Log Gotchas", Shay Berkovich, fwd:cloudsec Europe 2024

Лучшие практики

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- CIS Kubernetes Benchmark
- NSA/CISA Kubernetes Hardening Guide
- Kubernetes Security Technical Implementation Guide (STIG)
- PCI Security Standards Council: Guidance for Containers and Container Orchestration Tools
- NIST Special Publication 800-190 "Application Container Security Guide“
- Приказ ФСТЭК России №118. Требования по безопасности информации к средствам контейнеризации

3.2.1 Ensure that a minimal audit policy is created (Manual)

Profile Applicability:

- Level 1 - Master Node

Description:

Kubernetes can audit the details of requests made to the API server. The `--audit-policy-file` flag must be set for this logging to be enabled.

7. Container Orchestration Tool Auditing	
7.1 Existing inventory management and logging solutions may not suffice due to the ephemeral nature of containers and container orchestration tools integration.	**a.** Access to the orchestration system API(s) should be audited and monitored for indications of unauthorized access. Audit logs should be securely stored on a centralized system.

National Security Agency | Cybersecurity and Infrastructure Security Agency | Kubernetes Hardening Guidance

Another precaution to take when utilizing an external log server is to configure the log forwarder within Kubernetes with append-only access to the external storage. This protects the externally stored logs from being deleted or overwritten from within the cluster.

Kubernetes native audit logging configuration

The `kube-apiserver` resides on the Kubernetes control plane and acts as the front end, handling internal and external requests for a cluster. Each request, whether generated by a user, an application, or the control plane, produces an audit event at each stage in its execution. When an audit event registers, the `kube-apiserver` checks for an audit policy file and applicable rule. If such a rule exists, the server logs the event at the level defined by the first matched rule. Kubernetes' built-in audit logging capabilities perform no logging by default.

Kubernetes audit logging capabilities are disabled by default

<Rule id="SV-242401r712559_rule" weight="10.0" severity="medium">
<version>CNTR-K8-000600</version>
<title>The Kubernetes API Server must have an audit policy set.</title>
<description><VulnDiscussion>When Kubernetes is started, components and user services are started. For auditing startup events, and events for components and services, it is important that auditing begin on startup. Within Kubernetes, audit data for all components is generated by the API server. To enable auditing to begin, an audit policy must be defined for the events and the information to be stored with each event. It is also necessary to give a secure location where the audit logs are to be stored. If an audit log path is not specified, all audit data is sent to studio.</VulnDiscussion><FalsePositives></FalsePositives><FalseNegatives></FalseNegatives><Documentable>false</Documentable><Mitigations></Mitigations><SeverityOverrideGuidance></SeverityOverrideGuidance><PotentialImpacts></PotentialImpacts><ThirdPartyTools></ThirdPartyTools><MitigationControl></MitigationControl><Responsibility></Responsibility><IAControls></IAControls></description>
<reference>
<dc:title>DPMS Target Kubernetes</dc:title>
<dc:publisher>DISA</dc:publisher>
<dc:type>DPMS Target</dc:type>
<dc:subject>Kubernetes</dc:subject>
<dc:identifier>5376</dc:identifier>
</reference>
<ident system="http://cyber.mil/cci">CCI-001464</ident>
<fixtext fixref="F-45634r717023_fix">Edit the Kubernetes API Server manifest and set "--audit-policy-file" to the audit policy file.

- **Protect: Protective Technology**
  - PR.PT-1: Audit/log records are determined, documented, implemented, and reviewed in accordance with policy

регистрации событий безопасности в средстве контейнеризации;

Kubernetes Audit Log против Dynamic Admission Webhook

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На базе Dynamic Admission Webhook создаются Policy Engine.

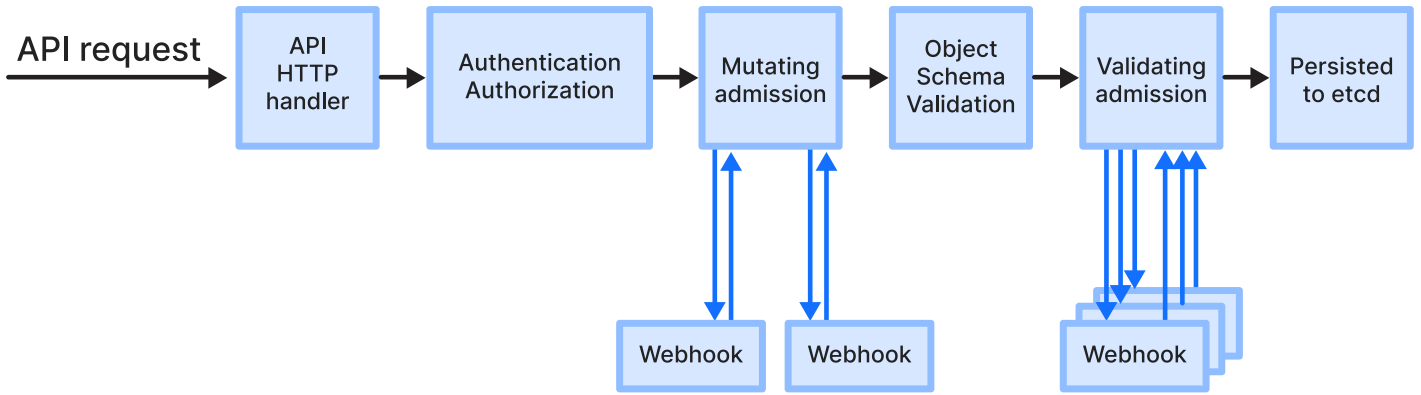
Плюсы:

- Можно получать информацию о взаимодействии с Kubernetes API без настройки Control Plane
- Фиксированный формат данных
- Отвязка от облачного провайдера

Минусы:

- Не фиксирует операции чтения (get/list/watch)
- Работает только с аутентифицированными и авторизированными событиями
- Не смотрит за ресурсами Events, ValidatingWebhookConfiguration, MutatingWebhookConfiguration
- Не знает ничего про impersonation
- Не видит сессию в рамках pods/exec

Пример: утилита kube-audit-rest



Политика аудита для Kubernetes Audit Log

Политика

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- Audit Policy - audit.k8s.io/v1 "unpublished" API
- PolicyRule сопоставляет запросы к Kubernetes API на основе метаданных с уровнем аудита. Запросы должны соответствовать правилам в каждом поле.
- Примеры политик:
  - Google Cloud
  - Alibaba Cloud
  - Yandex Cloud

Field	Description
`level` **[Required]** `Level`	The Level that requests matching this rule are recorded at.
`users` `[]string`	The users (by authenticated user name) this rule applies to. An empty list implies every user.
`userGroups` `[]string`	The user groups this rule applies to. A user is considered matching if it is a member of any of the UserGroups. An empty list implies every user group.
`verbs` `[]string`	The verbs that match this rule. An empty list implies every verb.
`resources` `[]GroupResources`	Resources that this rule matches. An empty list implies all kinds in all API groups.
`namespaces` `[]string`	Namespaces that this rule matches. The empty string "" matches non-namespaced resources. An empty list implies every namespace.
`nonResourceURLs` `[]string`	NonResourceURLs is a set of URL paths that should be audited. `*` s are allowed, but only as the full, final step in the path. Examples: • `/metrics` - Log requests for apiserver metrics • `/healthz*` - Log all health checks
`omitStages` `[]Stage`	OmitStages is a list of stages for which no events are created. Note that this can also be specified policy wide in which case the union of both are omitted. An empty list means no restrictions will apply.
`omitManagedFields` `bool`	OmitManagedFields indicates whether to omit the managed fields of the request and response bodies from being written to the API audit log. • a value of 'true' will drop the managed fields from the API audit log • a value of 'false' indicates that the managed fileds should be included in the API audit log Note that the value, if specified, in this rule will override the global default If a value is not specified then the global default specified in

Принцип написания

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Политику можно разбить на 3 блока:

1. Детализируем важное
2. Исключаем лишнее
3. Остальное в общем режиме

```yaml
apiVersion: audit.k8s.io/v1
kind: Policy
omitStages:
  - "RequestReceived"
rules:
  - level: RequestResponse
    resources:
    - group: ""
      resources: ["pods"]
  ...
  - level: None
    users: ["system:kube-proxy"]
    verbs: ["watch"]
    resources:
      - group: ""
        resources: ["endpoints", "services", "services/status"]
  ...
  - level: Metadate
```

Высокий уровень детализации
Отказ от логирования
Все остальное

Сообщение

Event – сообщение со всей информацией по аудиту.

Audit annotations – специализированные аннотации.

Field	Description
apiVersion string	audit.k8s.io/v1
kind string	Event
level **[Required]** Level	AuditLevel at which event was generated
auditID **[Required]** k8s.io/apimachinery/pkg/types.UID	Unique audit ID, generated for each request.
stage **[Required]** Stage	Stage of the request handling when this event instance was generated.
requestURI **[Required]** string	RequestURI is the request URI as sent by the client to a server.
verb **[Required]** string	Verb is the kubernetes verb associated with the request. For non-resource requests, this is the lower-cased HTTP method.
user **[Required]** authentication/v1.UserInfo	Authenticated user information.
impersonatedUser authentication/v1.UserInfo	Impersonated user information.

sourceIPs []string	Source IPs, from where the request originated and intermediate proxies. The source IPs are listed from (in order): 1. X-Forwarded-For request header IPs 2. X-Real-Ip header, if not present in the X-Forwarded-For list 3. The remote address for the connection, if it doesn't match the last IP in the list up to here (X-Forwarded-For or X-Real-Ip). Note: All but the last IP can be arbitrarily set by the client.
userAgent string	UserAgent records the user agent string reported by the client. Note that the UserAgent is provided by the client, and must not be trusted.
objectRef ObjectReference	Object reference this request is targeted at. Does not apply for List-type requests, or non-resource requests.
responseStatus meta/v1.Status	The response status, populated even when the ResponseObject is not a Status type. For successful responses, this will only include the Code and StatusSuccess. For non-status type error responses, this will be auto-populated with the error Message.
requestObject k8s.io/apimachinery/pkg/runtime.Unknown	API object from the request, in JSON format. The RequestObject is recorded as-is in the request (possibly re-encoded as JSON), prior to version conversion, defaulting, admission or merging. It is an external versioned object type, and may not be a valid object on its own. Omitted for non-resource requests. Only logged at Request Level and higher.
responseObject k8s.io/apimachinery/pkg/runtime.Unknown	API object returned in the response, in JSON. The ResponseObject is recorded after conversion to the external type, and serialized as JSON. Omitted for non-resource requests. Only logged at Response Level.
requestReceivedTimestamp meta/v1.MicroTime	Time the request reached the apiserver.
stageTimestamp meta/v1.MicroTime	Time the request reached current audit stage.
annotations map[string]string	Annotations is an unstructured key value map stored with an audit event that may be set by plugins invoked in the request serving chain, including authentication, authorization and admission plugins. Note that these annotations are for the audit event, and do not correspond to the metadata.annotations of the submitted object. Keys should uniquely identify the informing component to avoid name collisions (e.g. podsecuritypolicy.admission.k8s.io/policy). Values should be short. Annotations are included in the Metadata level.

Слепые зоны и обходы Kubernetes Audit Log

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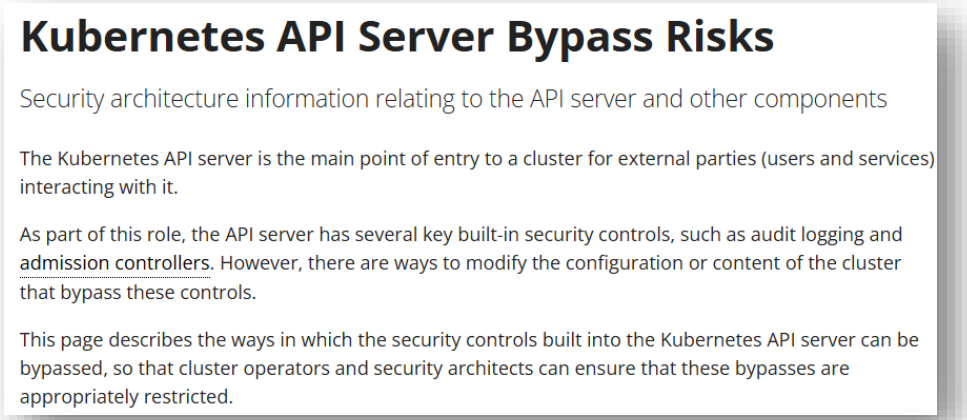
Что можно подделать: auditID, sourceIPs, userAgent



Kubernetes API Server Bypass Risks

Security architecture information relating to the API server and other components

The Kubernetes API server is the main point of entry to a cluster for external parties (users and services) interacting with it.

As part of this role, the API server has several key built-in security controls, such as audit logging and admission controllers. However, there are ways to modify the configuration or content of the cluster that bypass these controls.

This page describes the ways in which the security controls built into the Kubernetes API server can be bypassed, so that cluster operators and security architects can ensure that these bypasses are appropriately restricted.

Источник

Слепые зоны:

- “Скрытые” StaticPod
  - Создание Pod в несуществующем namespace с настройкой hostNetwork:true
  - Нужно отключать поддержку StaticPod на kubelet, где это не требуется
- Интерактивные команды в kubectl exec
  - Передача данных по стриминговому протоколу SPDY/3.1 или WebSocket (зависит от версии)
  - Атакующий может использовать kubectl-execws
  - Нужен Privileged Access Management (PAM)
- Взаимодействие с kubelet API через ресурс node/proxy
  - Работа с контейнерами на Node
  - Нужно следовать принципу наименьших привилегий в RBAC, настройки безопасности для kubelet, нужен Container Runtime Security
- Прямое взаимодействие с etcd
  - Утилиты etcdctl, kubetcd
  - Никто не должен находиться на Node с etcd
- Прямое взаимодействие с Container Runtime Socket
  - Утилиты типа crictl, nerdctl и т.д.
  - Нужно ограничить доступ пользователей на Nodes

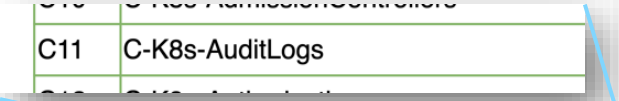
Покрытие

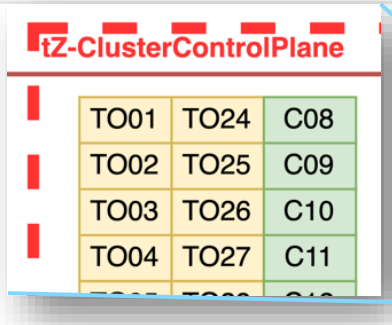
Источник [kubernetes-for-soc]

Attack Vectors (AV)	
ID	Description
AV01	Publicly exposed host with vulnerable non-K8s endpoint(s)/service(s)/port(s).
AV02	Compromised kubeconfig file.
AV03	Compromised K8s service account token with cluster details.
AV04	Malicious container image in public registry.
AV05	Publicly exposed vulnerable K8s workload: e.g. RCE.
AV06	Malicious 3rd party dependency.
AV07	kube-apiserver vulnerability.
AV08	kube-apiserver's options configured incorrectly.
AV09	kube-apiserver's authorization configured incorrectly.
AV10	etcd's authentication configured incorrectly.
AV11	Compromised credentials of publicly exposed host.
AV12	Container runtime configured incorrectly.
AV13	Compromised OIDC token with cluster details.
AV14	Host with vulnerable non-K8s endpoint(s)/service(s)/port(s).
AV15	Legitimately obtained kubeconfig file.
AV16	Legitimately obtained K8s service account token with cluster details.
AV17	Malicious container image in private registry.
AV18	Vulnerable K8s workload: e.g. RCE.
AV19	kubelet vulnerability.
AV20	kubelet's options configured incorrectly.
AV21	Compromised credentials of host.
AV22	Legitimately obtained OIDC token with cluster details.
AV22	Legitimately obtained credentials of host.

Assumptions (AS)	
ID	Description
AS01	Fault-tolerance and high availability are not in scope for this model
AS02	Two certificate authorities (CAs) are in scope for this model: one for the cluster and one for etcd.
AS03	Within this model, the kube-proxy is running as a service in the host and using a config file.
AS04	Container Runtime installation and related files are out of scope for this model.
AS05	Within this model, there are no business-type K8s workloads scheduled in the master node.
AS06	Within this model, K8s admission controllers include: ResourceQuota, LimitRanger, PodSecurity(Policy), and ImagePolicyWebhook.
AS07	Within this model, K8s authorisation is limited to: RBAC, Node, and Webhook.
AS08	Within this model, K8s encryption is implemented via EncryptionConfiguration and applies for data at rest only.
AS09	Within this model, K8s MutatingAdmissionController enables: disable service account token auto-mount, PodSecurityContext/ContainerSecurityContext, AppArmor, container sandboxing, and application logging consumption.
AS10	Within this model, K8s authentication is limited to: client certificates, service account tokens, and OIDC tokens.
AS11	AV02, AV03, AV07, AV08, AV09, AV10, AV12, and AV13 are being taken into account under the assumption that the hosts holding the cluster control plane's components are publicly exposing them.

Controls	
ID	Description
C01	C-Harden-Component
C02	C-Control-Traffic-Flow
C03	C-Harden-Config-Compl-Mon / C-Mon-Drift
C04	C-Evt-Log-App / C-Evt-Log-Sec / C-Evt-Log-Sys
C05	C-Mon-File-Integrity
C06	C-Mon-Log
C07	C-Mon-Health
C08	C-Vuln-Scan
C09	C-K8s-Harden-Component
C10	C-K8s-AdmissionControllers
C11	C-K8s-AuditLogs
C12	C-K8s-Authorisation
C13	C-K8s-CNI-NetworkPolicies





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Обнаружение злоумышленника

Kubernetes Audit Log и матрица угроз

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"Threat Matrix for Kubernetes" от Microsoft

Initial Access	Execution	Persistence	Privilege Escalation	Defense Evasion	Credential Access	Discovery	Lateral Movement	Collection	Impact
Using cloud credentials	Exec into container	Backdoor container	Privileged container	Clear container logs	List K8S secrets	Access Kubernetes API server	Access cloud resources	Images from a private registry	Data destruction
Compromised image In registry	bash/cmd inside container	Writable hostPath mount	Cluster-admin binding	Delete K8S events	Mount service principal	Access Kubelet API	Container service account	Collecting data from pod	Resource hijacking
Kubeconfig file	New container	Kubernetes CronJob	hostPath mount	Pod / container name similarity	Container service account	Network mapping	Cluster internal networking		Denial of service
Application vulnerability	Application exploit (RCE)	Malicious admission controller	Access cloud resources	Connect from proxy server	Application credentials in configuration files	Exposed sensitive interfaces	Application credentials in configuration files		
Exposed sensitive interfaces	SSH server running inside container	Container service account			Access managed identity credentials	Instance Metadata API	Writable hostPath mount		
	Sidecar injection	Static pods			Malicious admission controller		CoreDNS poisoning		
							ARP poisoning and IP spoofing		

"Экскурсия по матрицам угроз для контейнеров и Kubernetes", Сергей Канибор, VK Kubernetes Conf 2023

- то, что можно обнаружить в Kubernetes Audit Log

Детекты

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ТОЛЬКО НА ОСНОВАНИИ МЕТАДАННЫХ В СОБЫТИЯХ

Опираемся только на данные сообщения

НА ОСНОВАНИИ БИЗНЕС ЛОГИКИ

С учетом условий выкатки, специфики роли кластера и т.д.

Пример 1

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- Pods без metadata.ownerReferences
- Продакшен нагрузка так не запускается
- Большинство примеров атак в интернете демонстрируется на примере Pod и часто копируется script kiddie

```
"requestObject": {
  "kind": "Pod",
  "apiVersion": "v1",
  "metadata": {
    "name": "priv-exec-pod",
    "namespace": "bank",
    "creationTimestamp": null,
    "labels": {
      "app": "pentest"
    }
  },
  "spec": {
    "containers": [
      {
        "name": "priv-pod",
        "image": "ubuntu",
        "command": [
          "/bin/sh",
          "-c",
          "--"
```

```
"requestObject": {
  "kind": "Pod",
  "apiVersion": "v1",
  "metadata": {
    "generateName": "nginx-deployment-6f87fb7ccf-",
    "creationTimestamp": null,
    "labels": {
      "app": "nginx",
      "pod-template-hash": "6f87fb7ccf"
    },
    "ownerReferences": [
      {
        "apiVersion": "apps/v1",
        "kind": "ReplicaSet",
        "name": "nginx-deployment-6f87fb7ccf",
        "uid": "70ea79a8-3c18-410d-95fc-000edcfed244",
        "controller": true,
        "blockOwnerDeletion": true
      }
    ]
  },
  "spec": {
    "containers": [
      {
        "name": "nginx",
        "image": "nginx:1.27.2",
```

Пример 2

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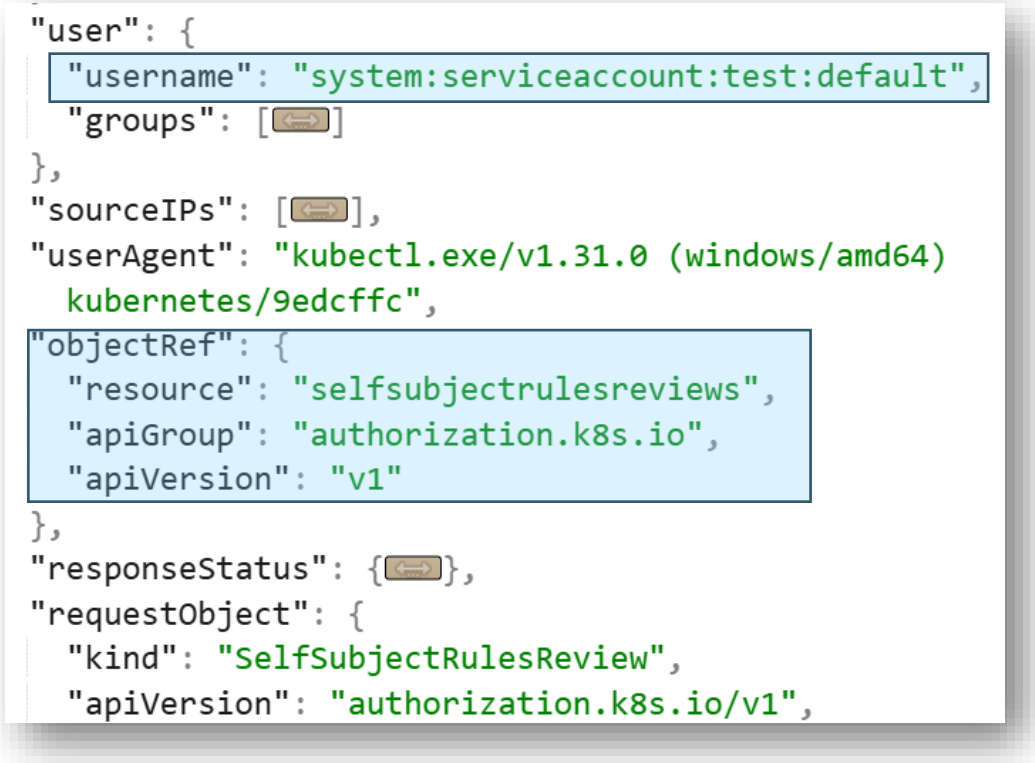
- Обращение к ресурсу SelfSubjectRulesReview от ServiceAccount микросервиса
- Сами микросервисы не узнают, какие у них права
  - Если только не началось восстание машин ;)
- Атакующий внутри Pod может попытаться выяснить, какими правами обладает данный Service Account Token



Пример 3

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- Отказы в выполнении действия
- Как правило не хватает прав
- Кто-то пытается сделать то, что ему нельзя


```
"requestReceivedTimestamp": "2024-10-30T11:19:19
  .911044Z",
"stageTimestamp": "2024-10-30T11:19:19.912790Z",
"annotations": {
  "authorization.k8s.io/decision": "forbid",
  "authorization.k8s.io/reason": "RBAC ..."
}
```

Пример 4

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- Создание Bad Pod
- Частный случай - privileged pod
- Обычно требуется только для малого количества системных, инфраструктурных сервисов, которые можно задать как whitelist
- Атакующий может использовать для побега из контейнера

```
"requestObject": {
  "kind": "Pod",
  "apiVersion": "v1",
  "metadata": {},
  "spec": {
    "containers": [
      {
        "name": "priv-pod",
        "image": "ubuntu",
        "command": [
          "/bin/sh",
          "-c",
          "--"
        ],
        "args": [
          "while true; do sleep 30; done;"
        ],
        "resources": {},
        "terminationMessagePath": "/dev/termination-log"
        ,
        "terminationMessagePolicy": "File",
        "imagePullPolicy": "Always",
        "securityContext": {
          "privileged": true
        }
```

Пример 5

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- Обнаружение, выполнение команд и создание интерактивных сессий внутри контейнеров
- kubectl exec, kubectl debug, kubectl port-forward и т.д.
- Данная необходимость очень опасная и редкая, особенно для production окружения


```
"requestURI": "/api/v1/namespaces/bank/pods/priv-exec
  -pod/exec?command=%2Fbin%2Fbash&container=priv
  -pod&stdin=true&stdout=true&tty=true",
"verb": "create",
"user": {⟺},
"sourceIPs": [⟺],
"userAgent": "kubectl.exe/v1.31.0 (windows/amd64)
  kubernetes/9edcffc",
"objectRef": {
  "resource": "pods",
  "namespace": "bank",
  "name": "priv-exec-pod",
  "apiVersion": "v1",
  "subresource": "exec"
```

Пример 6

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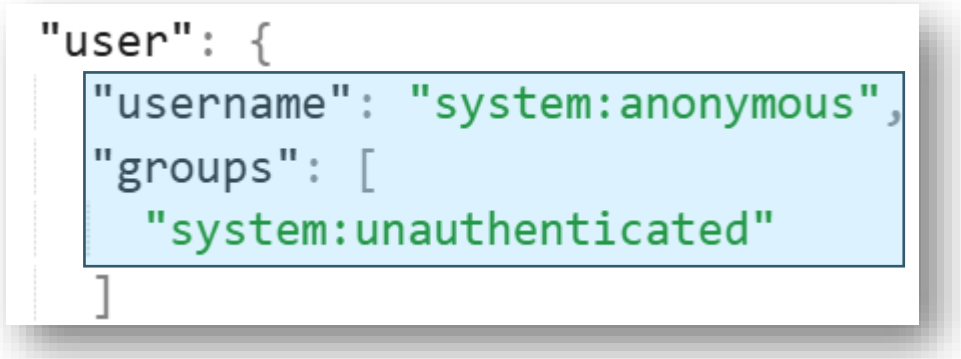
- Обращение от “system:anonymous”, “system:unauthenticated”
- Данные субъекты должны быть отключены и не использоваться



Пример 7

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- Редактирование правил межсетевого экрана для получения дополнительных сетевых доступов
- Создание, редактирование, удаление NetworkPolicy
  - Native
  - Custom от Calico и Cilium
- Данная операция может производится ограниченным кругом лиц


```
"verb": "create",
"user": {⟺},
"sourceIPs": [⟺],
"userAgent": "kubectl.exe/v1.31.0 (windows/amd64)
  kubernetes/9edcffc",
"objectRef": {
  "resource": "CiliumClusterwideNetworkPolicy",
  "name": "processing-np",
  "apiGroup": "cilium.io",
  "apiVersion": "v2"
},
```

Пример 8

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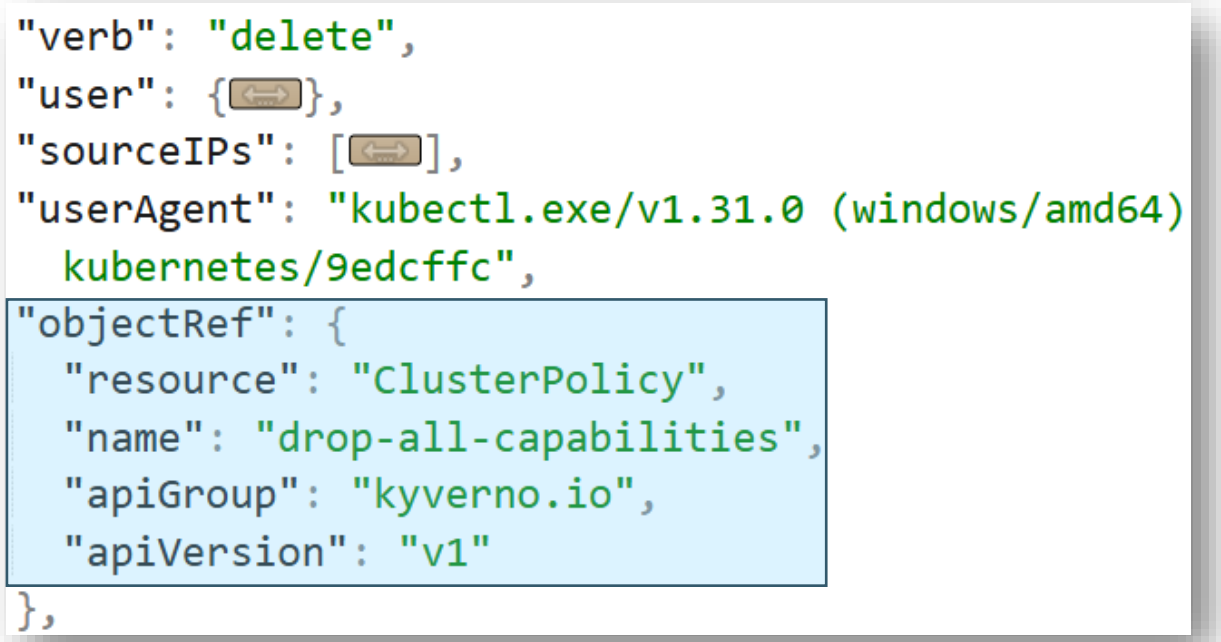
- Редактирование политик PolicyEngime или его отключение
- Создание, редактирование, удаление политик
  - OPA Gatekeeper, Kyverno и т.д.
- Данная операция может производится ограниченным кругом лиц
- Возможно атакующий пытается отключить средство безопасности



Пример 9

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- Учитываем бизнес логику работы
- Выкатки приложений только в рабочие часы по будням
- Остальное это аномалии, возможно действия атакующего

Пример 10

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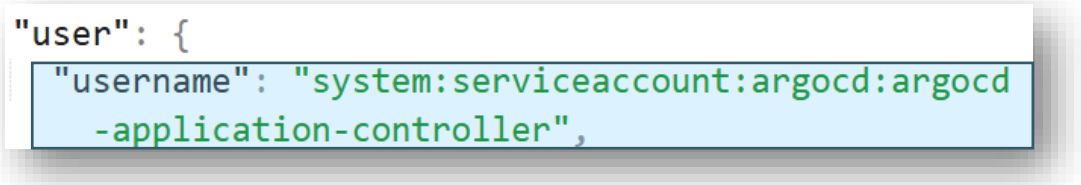
- С учетом роли кластера
- Например, в компании используется GitOps подход и все выкатывает только Flux или ArgoCD
- Выкатка от другой сущности - это аномалия



Пример 11

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- Используйте приманки и ловушки
  - “Detection through Deception”
  - “Security through Deception”
- Заготовленные ServiceAccount, Secret и т.д.
- Обнаруживаем их использование

"Безопасность Kubernetes: Фаза Deception"

Заключение

- Kubernetes - самая просматриваемая система
- Kubernetes Audit Log обязателен к использованию
- Внимательно подготавливайте Audit Policy
- При написании правил детектирования учитывайте и бизнес логику
- Создание правил детектирования в Kubernetes очень креативная задача ;)

Полезные материалы

SOC FORUM 2024

- "Kubernetes Audit Log Gotchas", Shay Berkovich, fwd:cloudsec Europe 2024
- "Making the Most Out of Kubernetes Audit Logs", Laurent Bernaille & Robert Boll, Kubecon 2019
- "A Guide To Kubernetes Logs That Isn't A Vendor Pitch", Graham Helton, 2024
- "Securing Continuous Delivery: Argo CD Threat Detection“, Mikhail Larin, 2024
- "Threat Detection in the K8s Environment“, Anton Medvedev, 2024
- "DeTT&CT(ing) Kubernetes ATT&CK(s) with Audit Logs”, Magno Logan, Blue Team Summit 2021
- "Detection Engineering for Kubernetes clusters", Ben Lister, 2021
- "Threat Hunting with Kubernetes Audit Logs", Ramesh Ramani, 2021
- "Threat Hunting with Kubernetes Audit Logs - Part 2", Ramesh Ramani, 2021
- Awesome Kubernetes (K8s) Threat Detection
- Sigma rules для Kubernetes
- Stratus Red Team для Kubernetes

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Спасибо за внимание!

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