3 июня 2025 Москва, LOFT HALL#2

БЕКОН '25

Конференция по БЕзопасности
КОНтейнеров и контейнерных сред

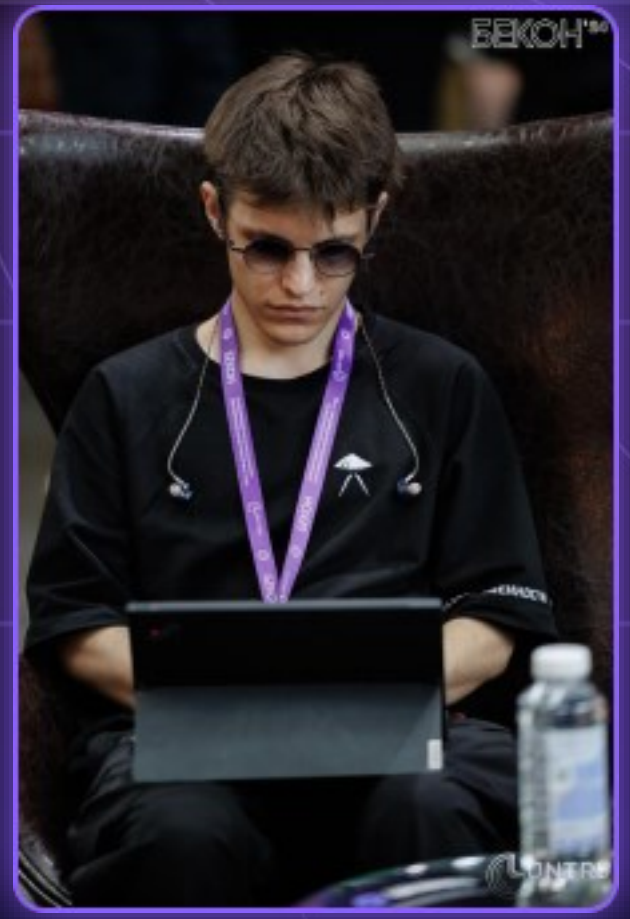
# Чем собирать контейнеры параноику?

Кожуховский Михаил

Flowmaster

# whoami

- Архитектор платформы Flowmaster
- Поддерживаю и развиваю CI/CD инфраструктуру в компании с 2020 года
- 11 лет в программировании,  7 из них в коммерческой разработке
- Интересуюсь ИБ с 2017



# План доклада

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- Небольшое вступление
- Обзор возможных решений
  - Kaniko
  - Buildah
  - Builkit
- Небольшой эксперимент с unshare
- Альтернативный подход к сборке(Ko/Jib)
- Итоги

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# Вступление

# CI Threat Matrix

БЕКОН

| Initial Access | Execution | Persistence | Privilege Escalation | Defense Evasion | Credential Access | Lateral Movement | Exfiltration | Impact |
|---|---|---|---|---|---|---|---|---|
| Supply Chain Compromise on CI/CD | Modify CI/CD Configuration | Compromise CI/CD Server | Get credential for Deployment(CD) on CI stage | Add Approver using Admin permission | Dumping Env Variables in CI/CD | Exploitation of Remote Services | Exfiltrate data in Production environment | Denial of Services |
| Valid Account of Git Repository (Personal Token, SSH key, Login password, Browser Cookie) | Inject code to IaC configuration | Implant CI/CD runner images | Privileged Escalation and compromise other CI/CD pipeline | Bypass Review | Access to Cloud Metadata | (Monorepo) Get credential of different folder's context | Clone Git Repositories | |
| Valid Account of CI/CD Service (Personal Token, Login password, Browser Cookie) | Inject code to source code | Modify CI/CD Configuration | | Access to Secret Manager from CI/CD kicked by different repository | Read credentials file | Privileged Escalation and compromise other CI/CD pipeline | | |
| Valid Admin account of Server hosting Git Repository | Supply Chain Compromise on CI/CD | Inject code to IaC configuration | | Modify Caches of CI/CD | Get credential from CI/CD Admin Console | | | |
| | Inject bad dependency | Inject code to source code | | Implant CI/CD runner images | | | | |
| | SSH to CI/CD pipelines | Inject bad dependency | | | | | | |
| | Modify the configuration of Production environment | | | | | | | |
| | Deploy modified applications or server images to production environment | | | | | | | |

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# K8s Threat Matrix

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| Using Cloud credentials | Exec into container | Backdoor container | Privileged container | Clear container logs | List K8S secrets | Access the K8S API server | Access cloud resources | Data Destruction |
| Compromised images in registry | bash/cmd inside container | Writable hostPath mount | Cluster-admin binding | Delete K8S events | Mount service principal | Access Kubelet API | Container service account | Resource Hijacking |
| Kubeconfig file | New container | Kubernetes CronJob | hostPath mount | Pod / container name similarity | Access container service account | Network mapping | Cluster internal networking | Denial of service |
| Application vulnerability | Application exploit (RCE) | | Access cloud resources | Connect from Proxy server | Applications credentials in configuration files | Access Kubernetes dashboard | Applications credentials in configuration files | |
| Exposed Dashboard | SSH server running inside container | | | | | Instance Metadata API | Writable volume mounts on the host | |
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# CI in k8s Threats

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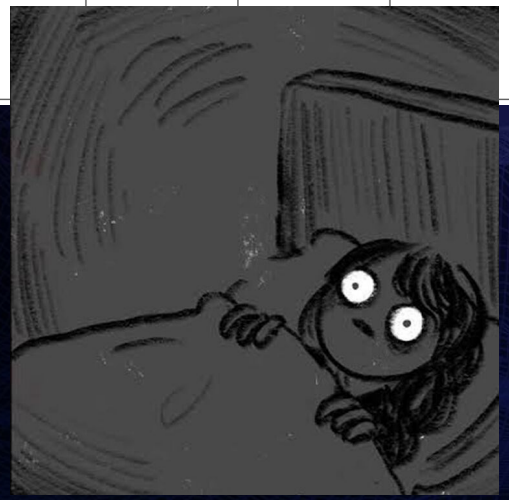

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# CI in k8s admin

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Побеги из контейнеров

Разработчики жалуются что образы долго собираются

А мы точно все капы дропнули?

Supply chain

Внутренние нарушители тоже бывают

А если переменные украдут?

А куда из раннера получится распространиться?

Кластер могут захватить

# 2 самых опасных файла в репозитории

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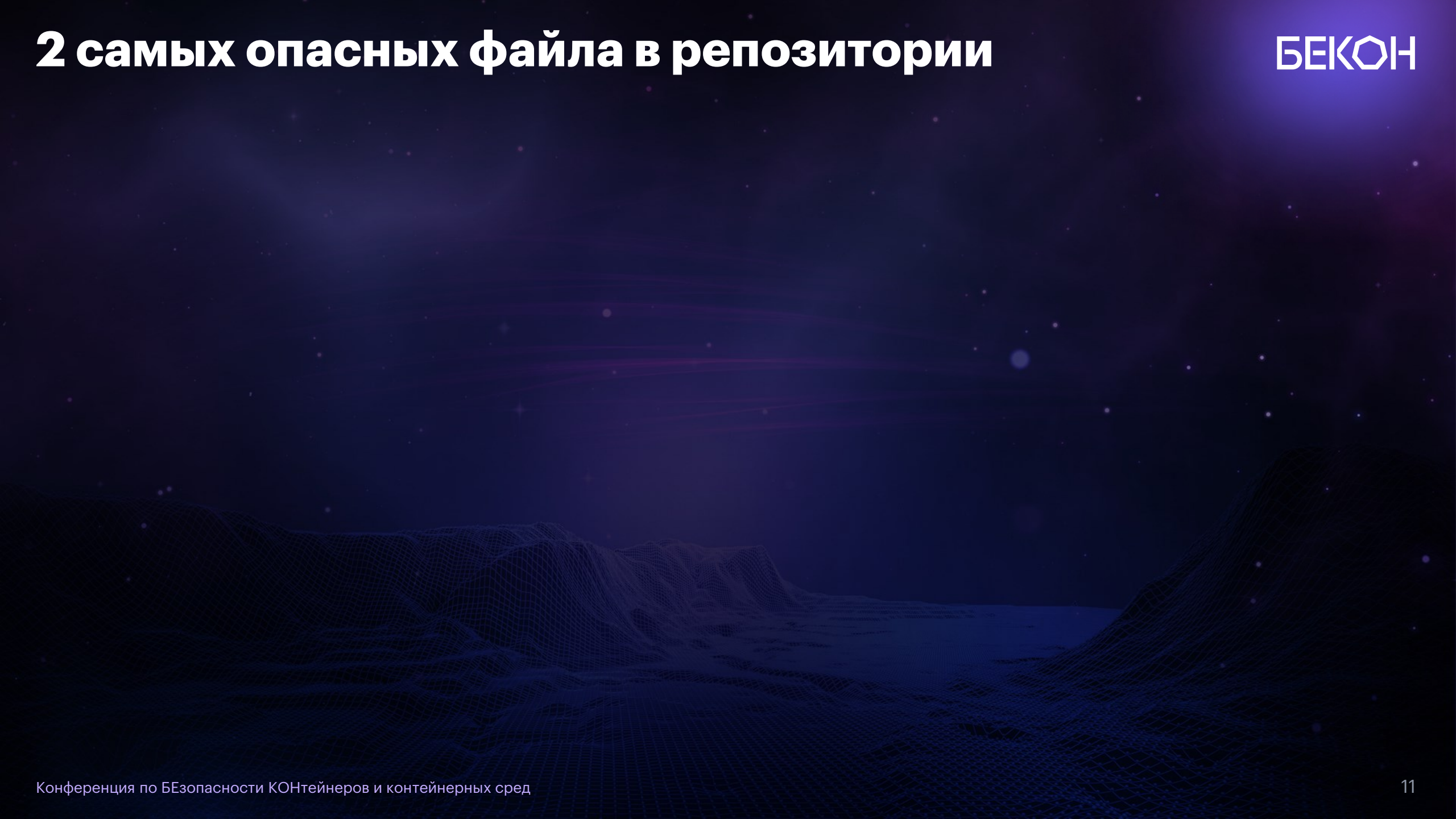

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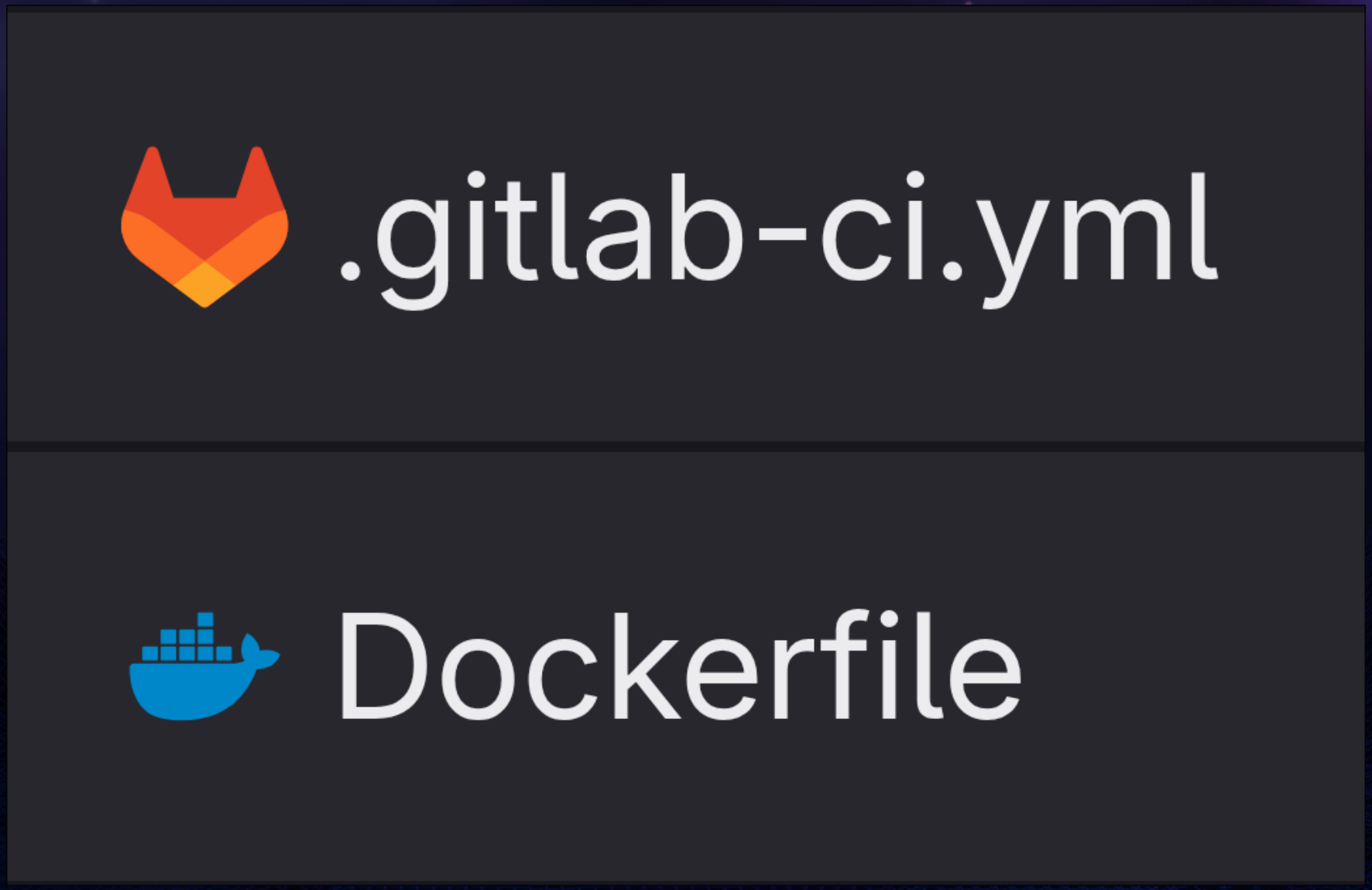

# Сплошной RCE

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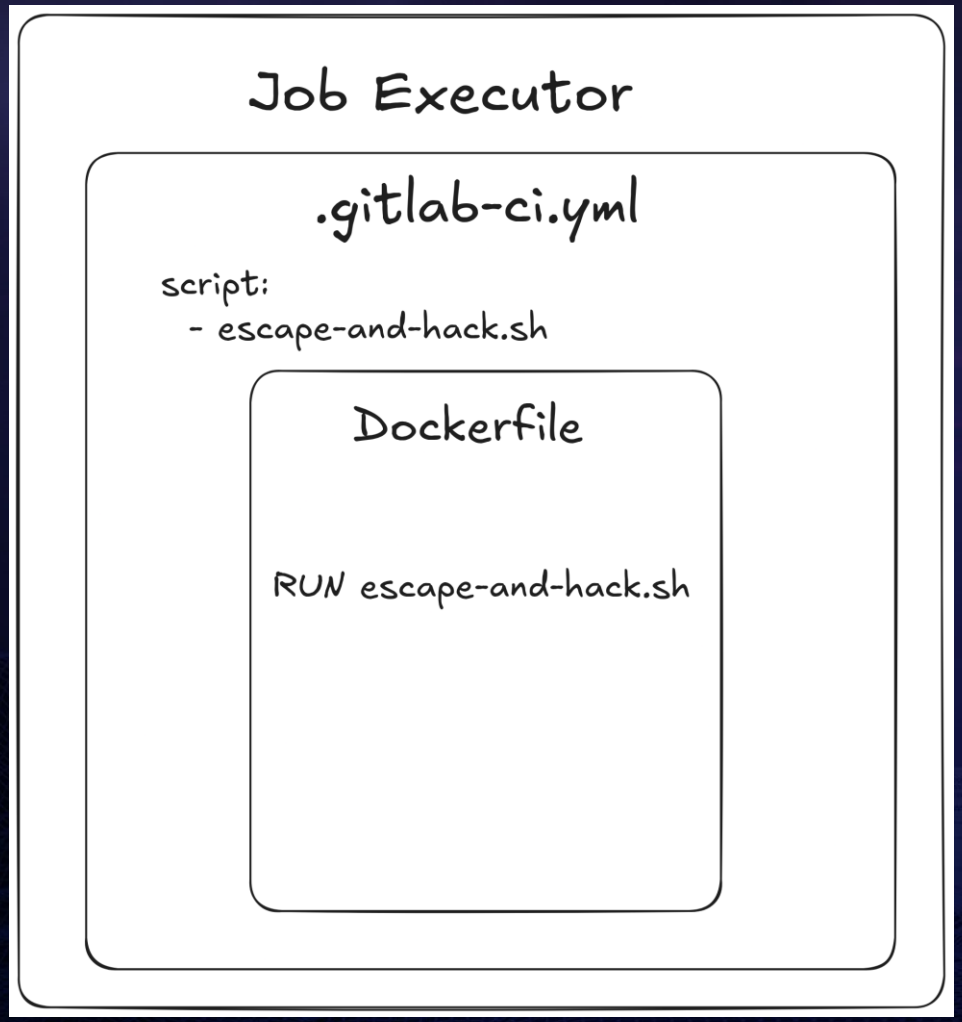


.gitlab-ci.yml

Dockerfile

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# Ищем решение

# Чем можно собирать образы

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## Low level

- Kaniko
- Buildah
- Buildkit

## High level

- Buildpacks
- Nixpacks
- Werf
- Buildx
- Etc...

# Среднее устройство low level сборщика

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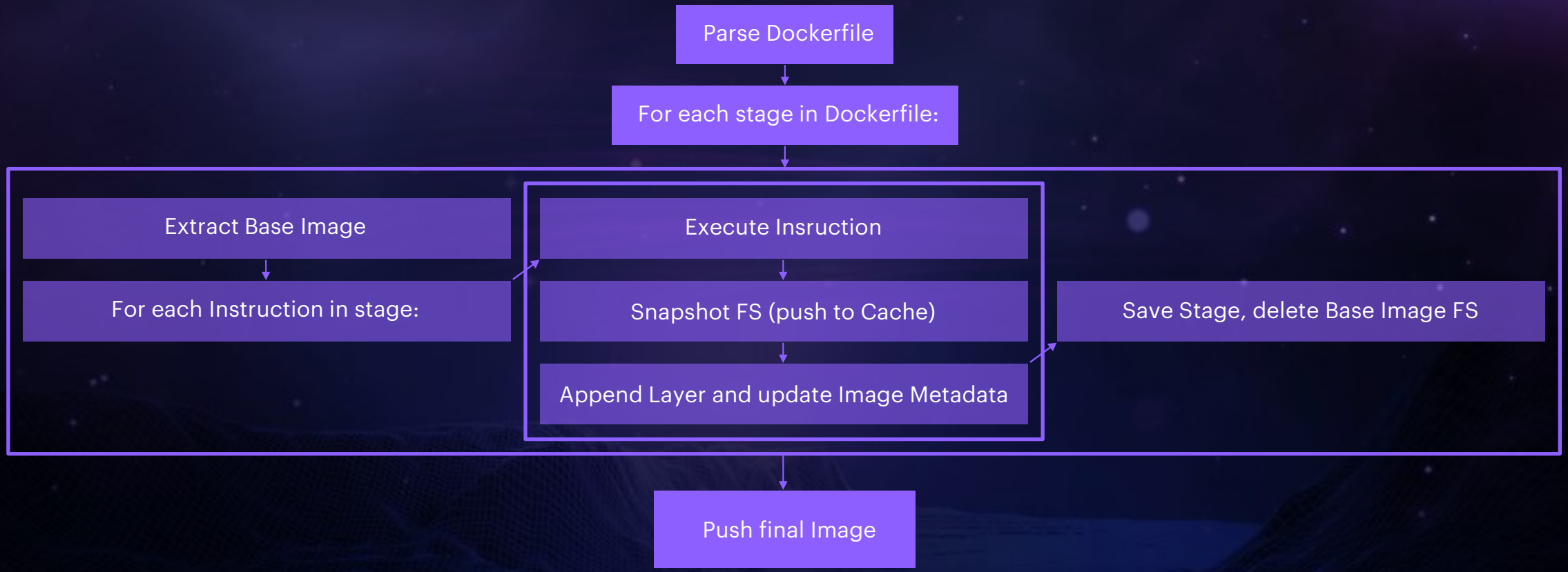

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# Kaniko

# Kaniko

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- Неофициальный проект Google
- Популярен, много сторонних гайдов
- Мейнтейнеры уходят из проекта
- Поддерживает не весь синтаксис докерфайлов
- Изоляция через chroot
- Требует root в контейнере



# Kaniko problems

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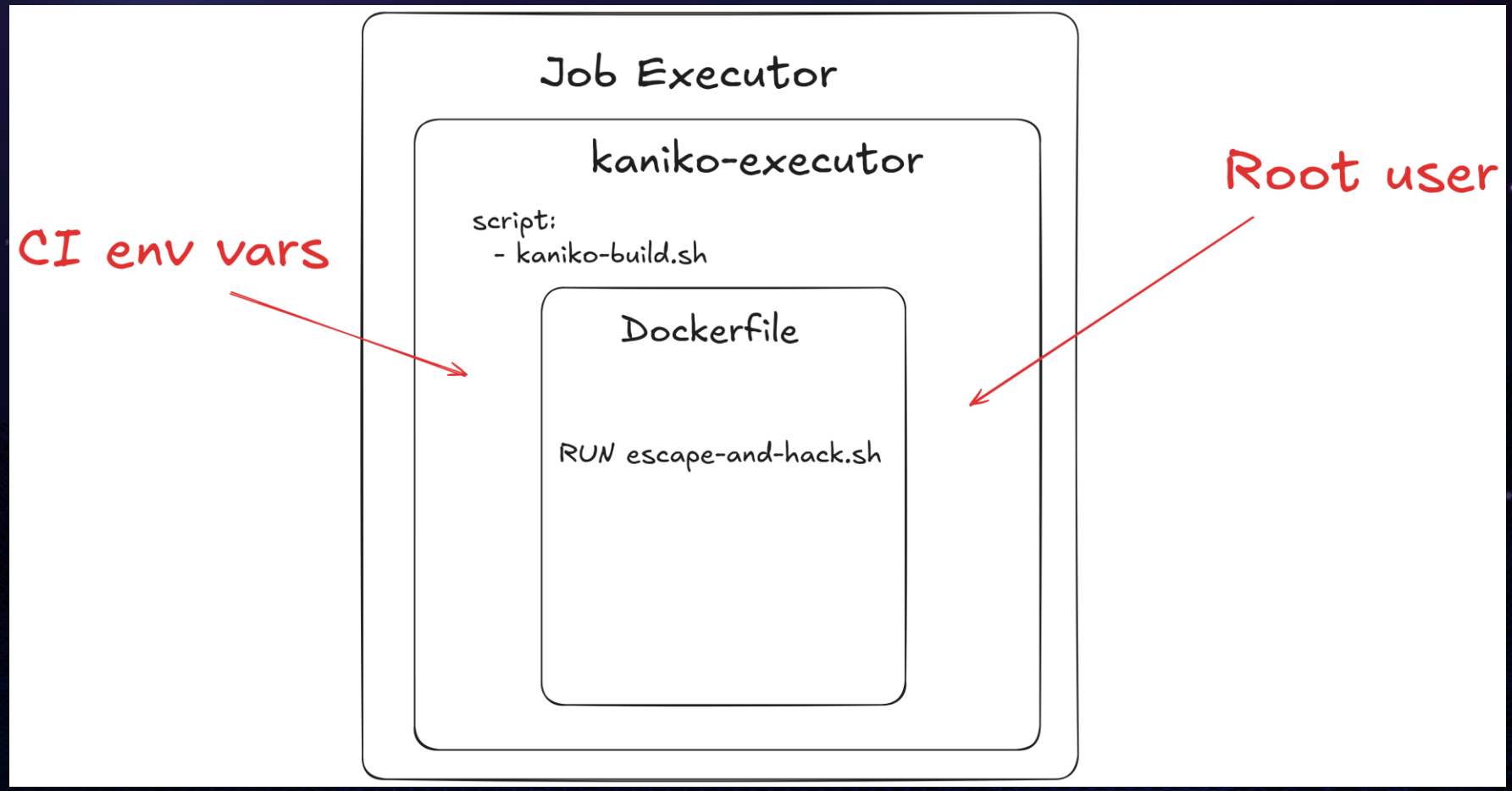
- Работает от рута
- При побеге из chroot доступны все переменные окружения CI джобы



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# Buildah

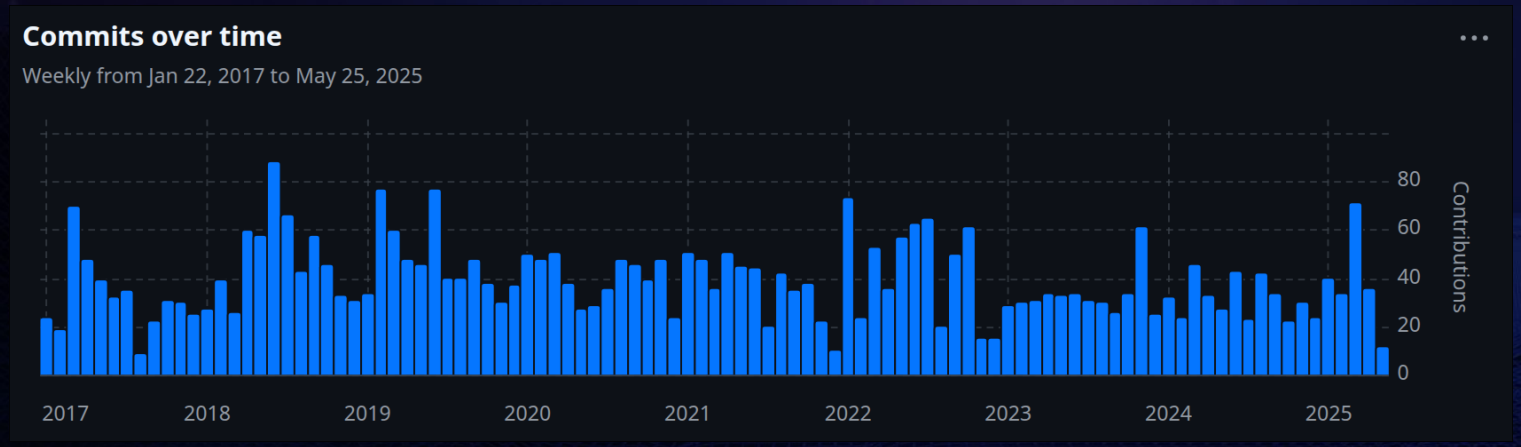
# Buildah

БЕКОН

- В CNCF как часть Podman Container Tools
- Документация могла быть лучше, но для начала хватит
- Изоляция через chroot или вложенную контейнеризацию
- Может быть rootless(только при использовании chroot)
- Проект стабильно развивается

buildah

Tutorial: Use Buildah in a rootless container with GitLab Runner Operator on OpenShift



# Buildah problems

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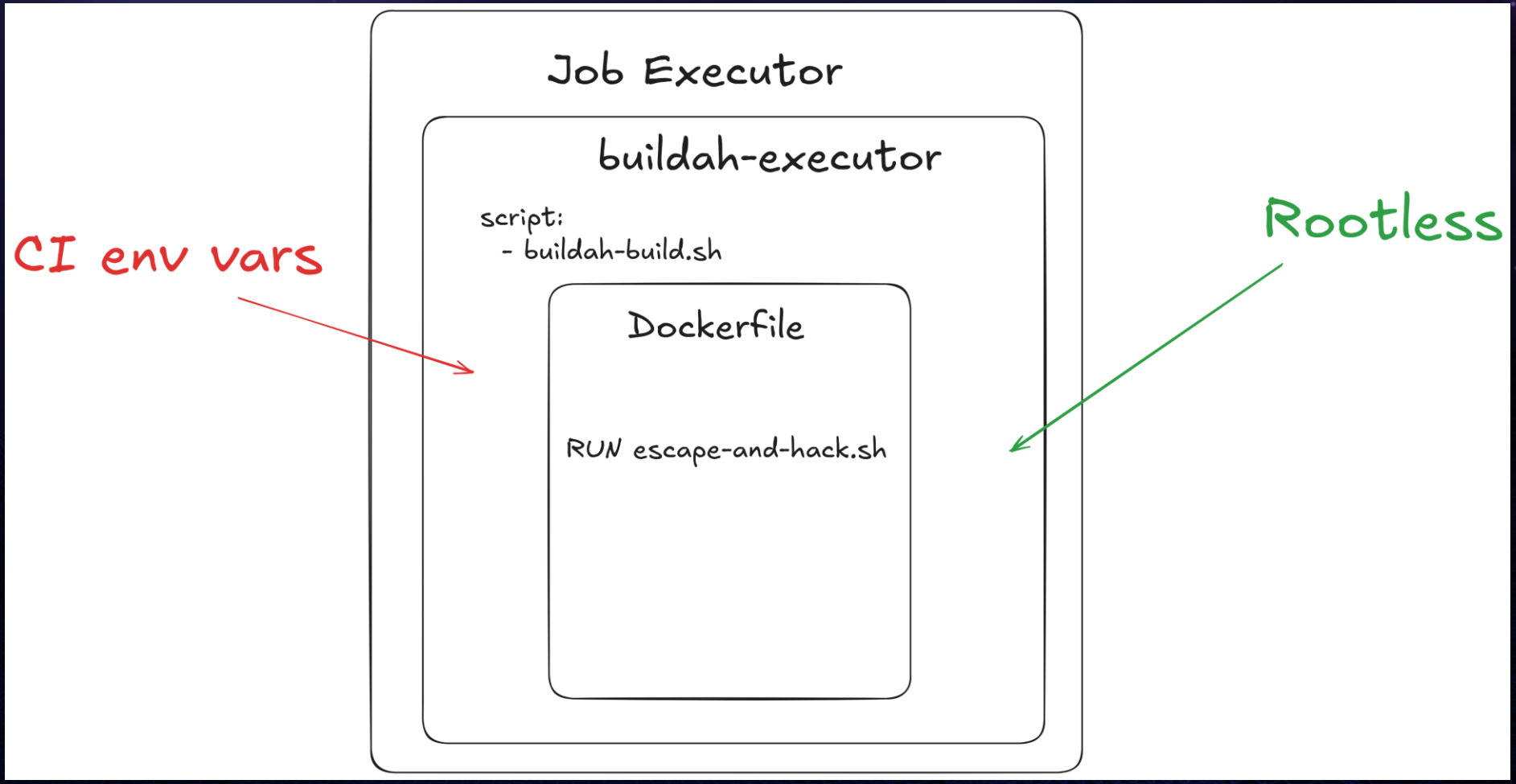


БЕКОН

# Buildkit

# Buildkit

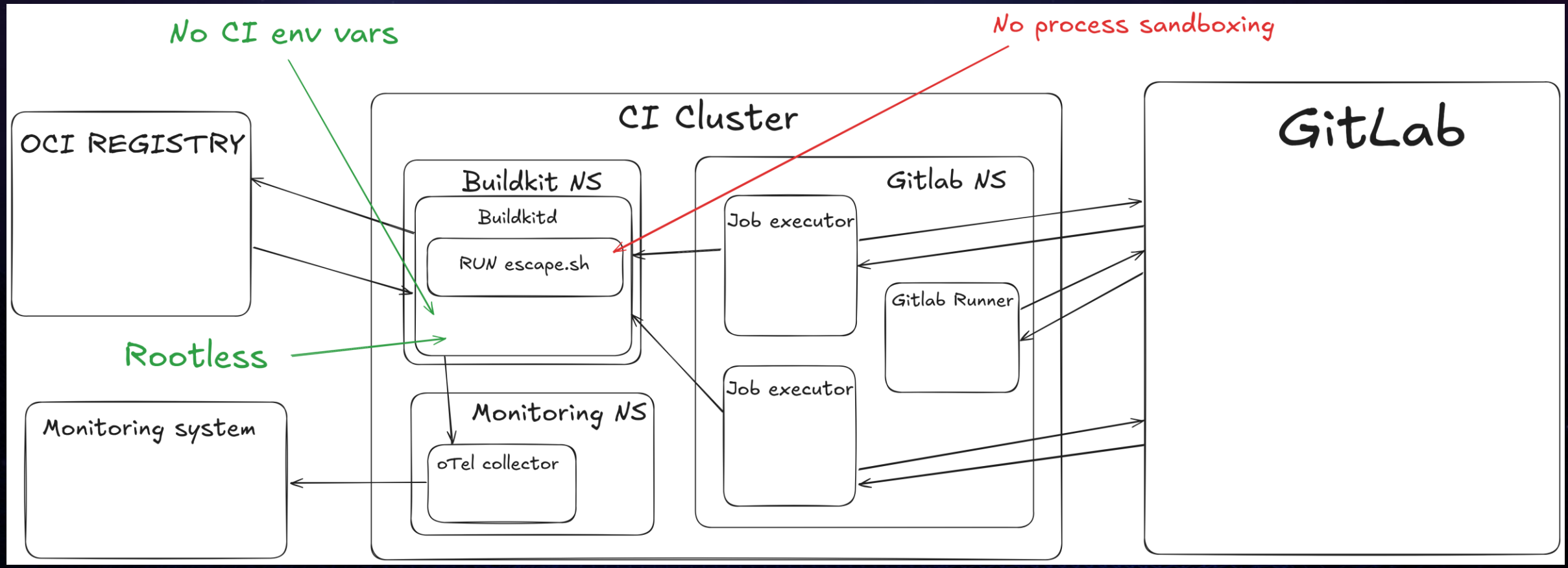
БЕКОН


- Часть moby project
- Мало документации, порой проще почитать исходники
- Много оптимизаций вокруг скорости сборки
- Изоляция через вложенную контейниризацию
  - Запускает с дефолтным seccomp профилем
  - Можно подложить AppArmor профиль
- Может быть rootless
- Работает как демон, можно запускать как внутри CI джобы на каждую сборку, так и держать в кластере общий демон
- Максимальная совместимость с окружением на машинах разрабов
- Умеет в opentelemetry

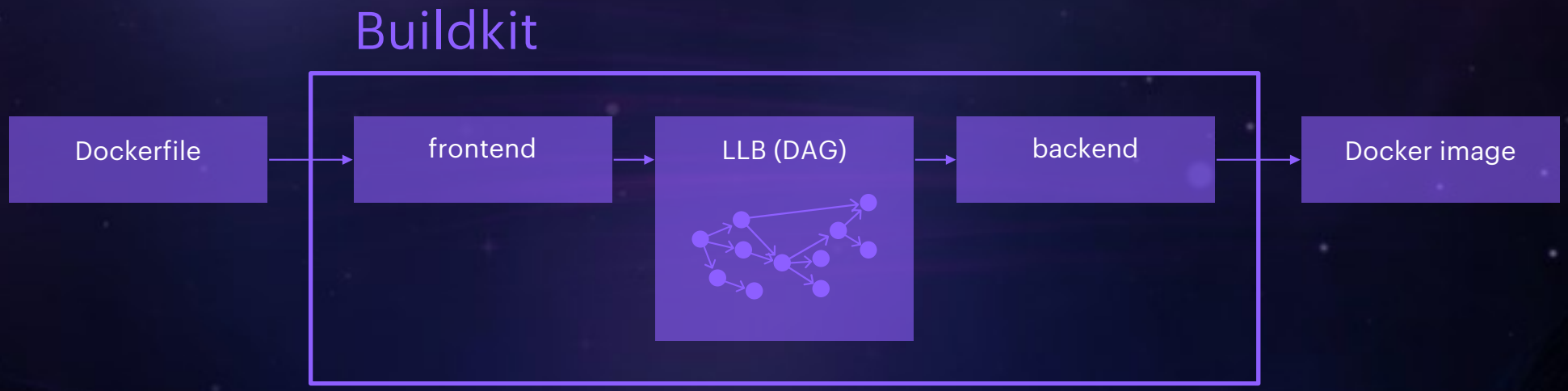
# Buildkit problems

БЕКОН

- Архитектура на первый взгляд сложнее
- Приходится отключать process sandboxing в rootless режиме



# Buildkit Flow Diagram



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# Время пробовать

# Эээээксперименты

БЕКОН

```
FROM docker.io/library/debian:bookworm

RUN useradd user
USER user

RUN whoami # user
RUN unshare -r whoami # Operation not permitted OR root
```

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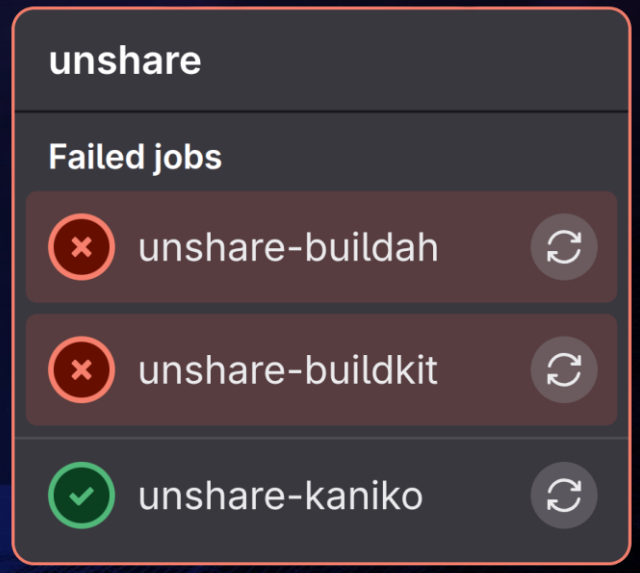


БЕКОН

# Альтернативный способ

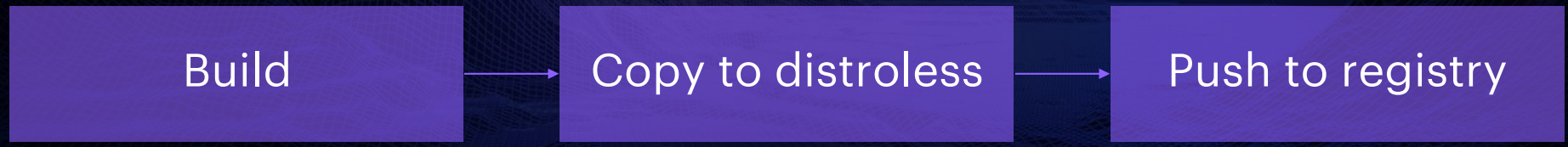
# Ko и Jib

БЕКОН

- Собирают бинарник/jar и копируют на последний слой distroless образа
- Ko передан в CNCF(sandbox)
- Jib поддерживается GoogleContainerTools
- Меньше компонентов – проще

## Минусы

- Ko не поддерживает CGO
- Не хватает возможностей кастомизации
- Нет поддержки кэшей вне файловой системы
- Не решают проблемы изоляции от избыточных переменных окружения



# Или свой велосипед

БЕКОН

- Лишние затраты на разработку своего решения
- Из-за потери слоев теряем в гибкости
- Distroless не всегда оправдано использовать

БЕКОН

# Итоги

# Итого

| | Kaniko | Buildah | Buildkit |
|---|---|---|---|
| Расширенный синтаксис | ✗ | ⚠ | ✓ |
| Скорость сборки | 2 / 5 | 3 / 5 | 4.5 / 5 |
| Кэш во внешних хранилищах | ✓ | ✓ | ✓ |
| Документация и сторонние гайды | 4 / 5 | 3 / 5 | 2 / 5 |
| Rootless image | ✗ | ✓ | ✓ |
| Работает с seccomp | ✓ | ✓ | ⚠ |
| Настраиваемые зеркала | ✓ | ✓ | ✓ |
| OCI spec features | Only annotations | Only annotations | in-toto attestations(SBOM, SLSA Provenance) |
| Дополнительный функционал | | Sbom scanner | Custom dockerfile syntax, sbom scanner, daemon mode, etc |

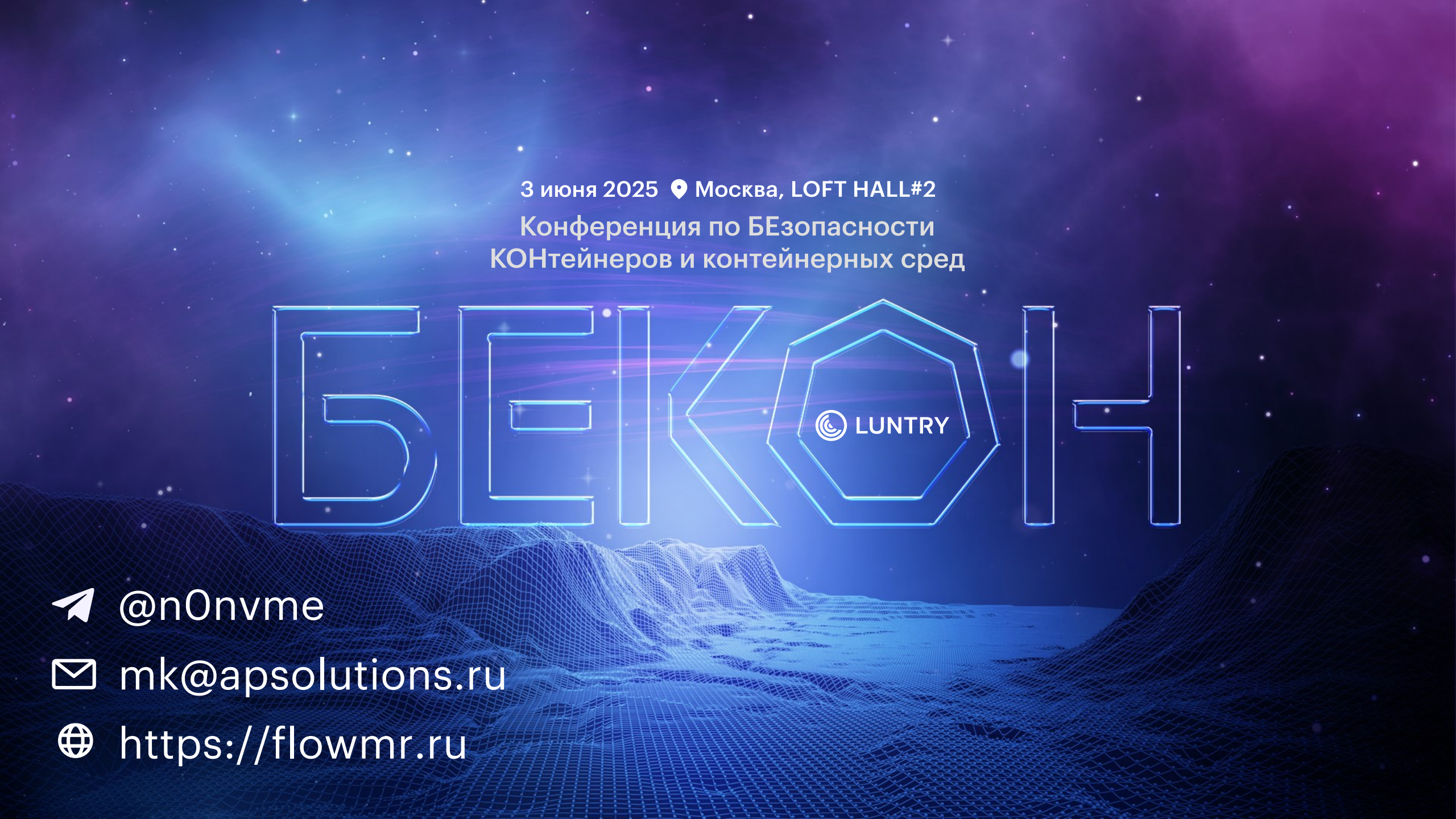
# Субъективное мнение

| | |
|---|---|
| Kaniko | просто не надо использовать |
| Buildah | хорошее решение по умолчанию |
| Builkit | лучшее что есть если не пугает порог входа |
| Ko и Jib или свой аналог | подойдет не всем, но познакомиться стоит |

# Этот доклад неплохо дополняют

БЕКОН

- Побеги из контейнеров: 2024 Kubernetes Edition - Дмитрий Евдокимов и Николай Панченко
- Buildkit in depth
- BuildKit: A Modern Builder Toolkit on Top of containerd - Tonis Tiigi & Akihiro Suda
- Павел Сорокин - OPA с shared Docker executor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