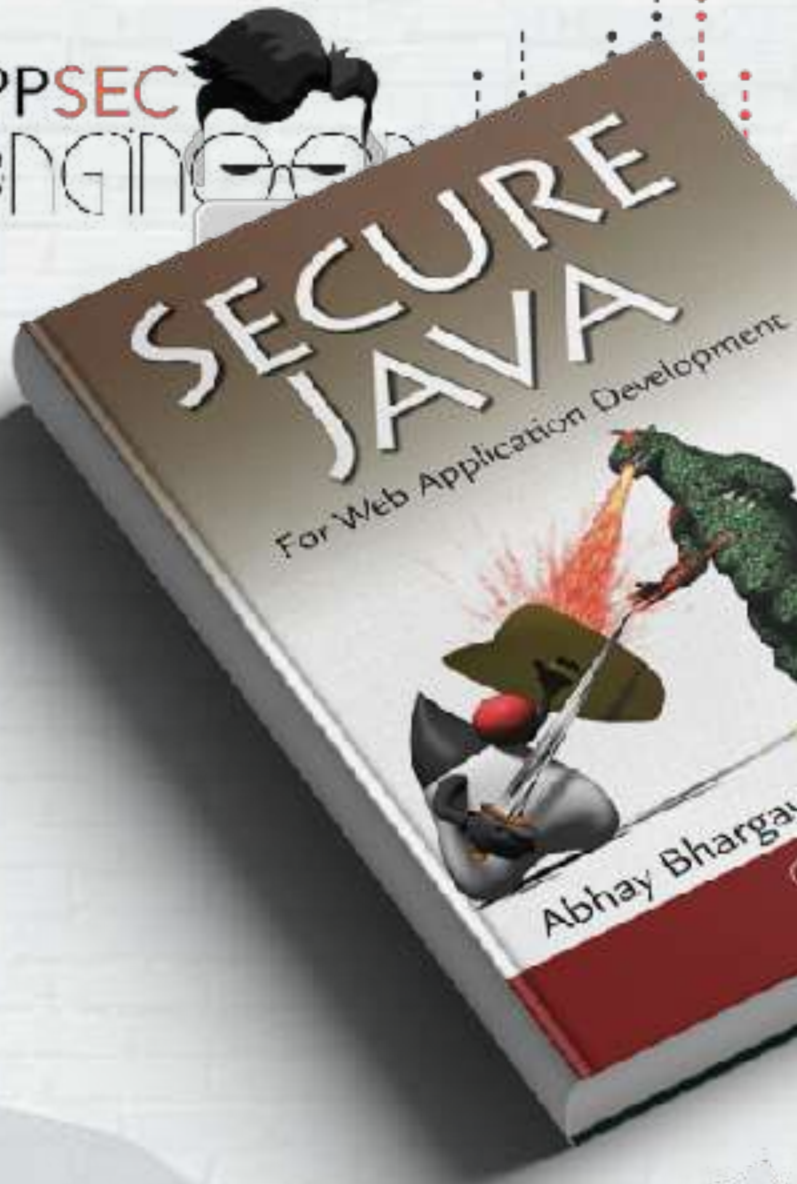
Fantastic Supply-Chain Vulnerabilites

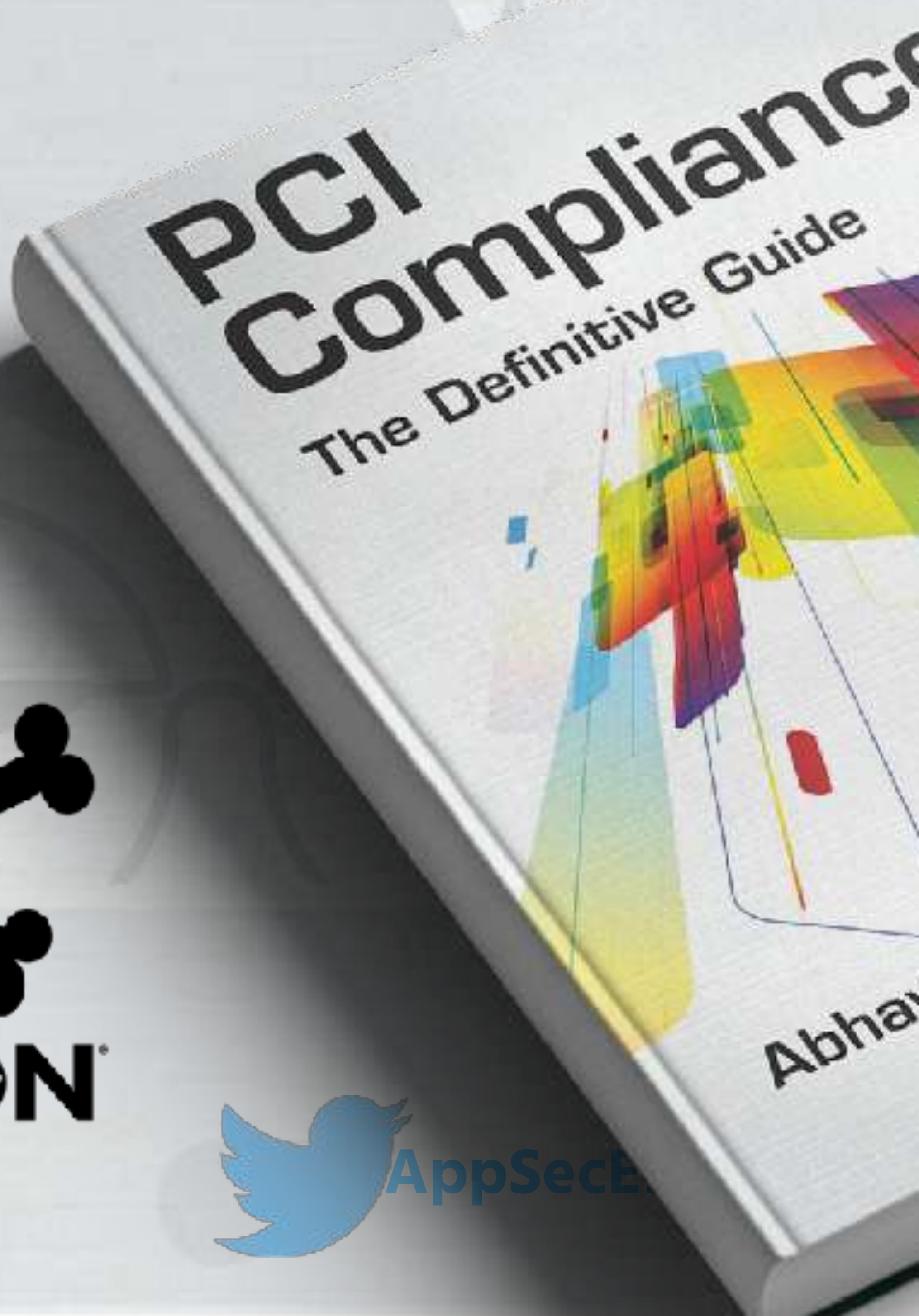
Abhay Bhargav

Yours Truly

- Founder @ we45 and AppSecEngineer
- Chief Architect - Orchestron
- Avid Pythonista and AppSec Automation Junkie
- Trainer/Speaker at DEF CON, BlackHat, OWASP Events, etc world-wide
- Lead Trainer - we45 Training and Workshops
- Co-author of Secure Java For Web Application Development
- Author of PCI Compliance: A Definitive Guide

abhaybhargav





Community Initiatives

📹 Youtube Channel: youtube.com/appsecengineer

📜 Blog: we45.com/blog

🗣 Talks/Workshops at several Events

My talk...

abhaybhargav

My talk...

abhaybhargav

“the network of all the individuals, organizations, resources, activities and technology involved in the creation and sale of a product.”

–Definition of Supply Chain

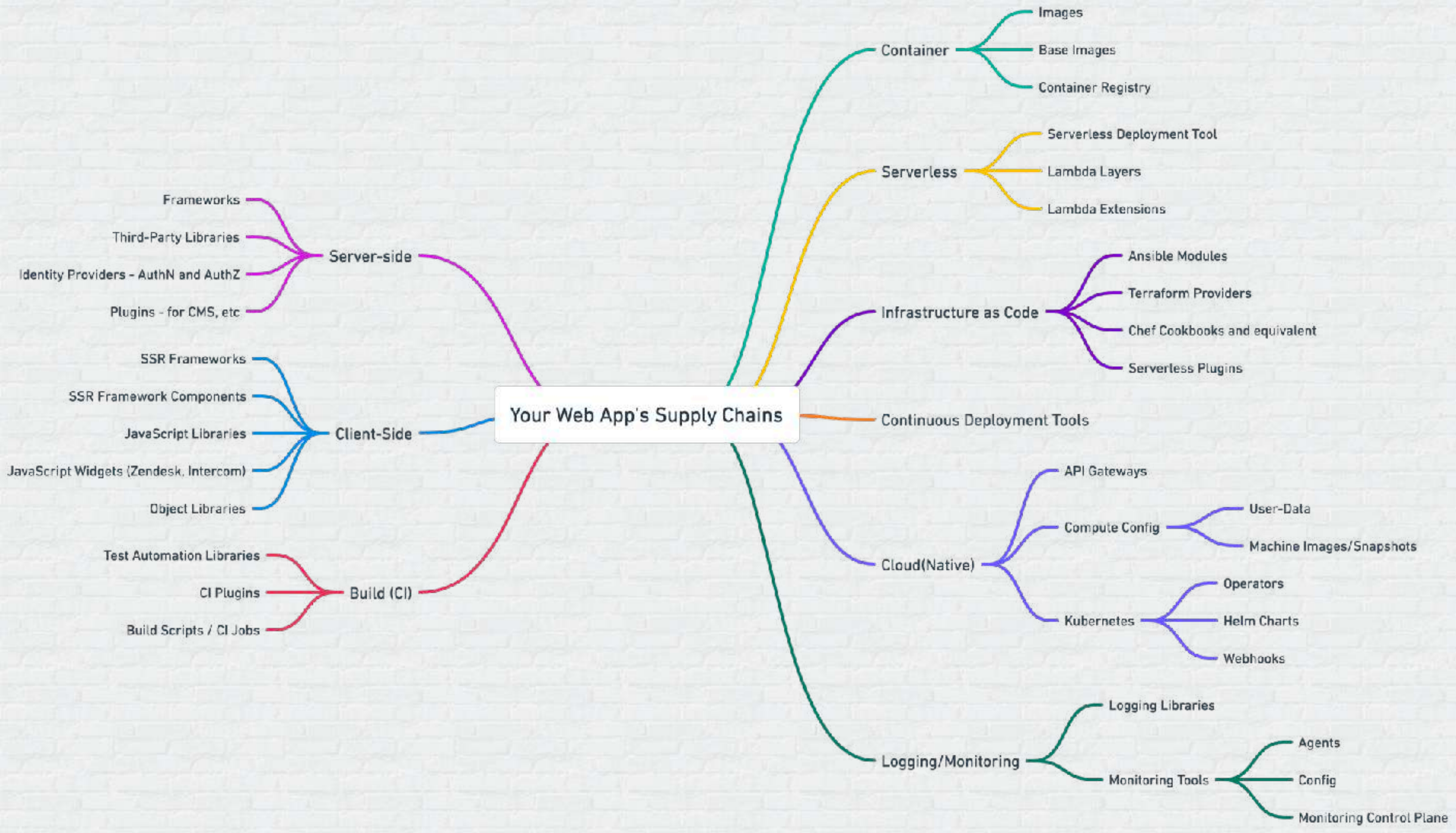
abhaybhargav

AppSecEngineer

“A software supply chain is composed of the components, libraries, tools, and processes used to develop, build, and publish a software artifact.”

–Usenix Paper coauthored by Dan Geer

Your Application's Supply-Chains



abhaybhargav

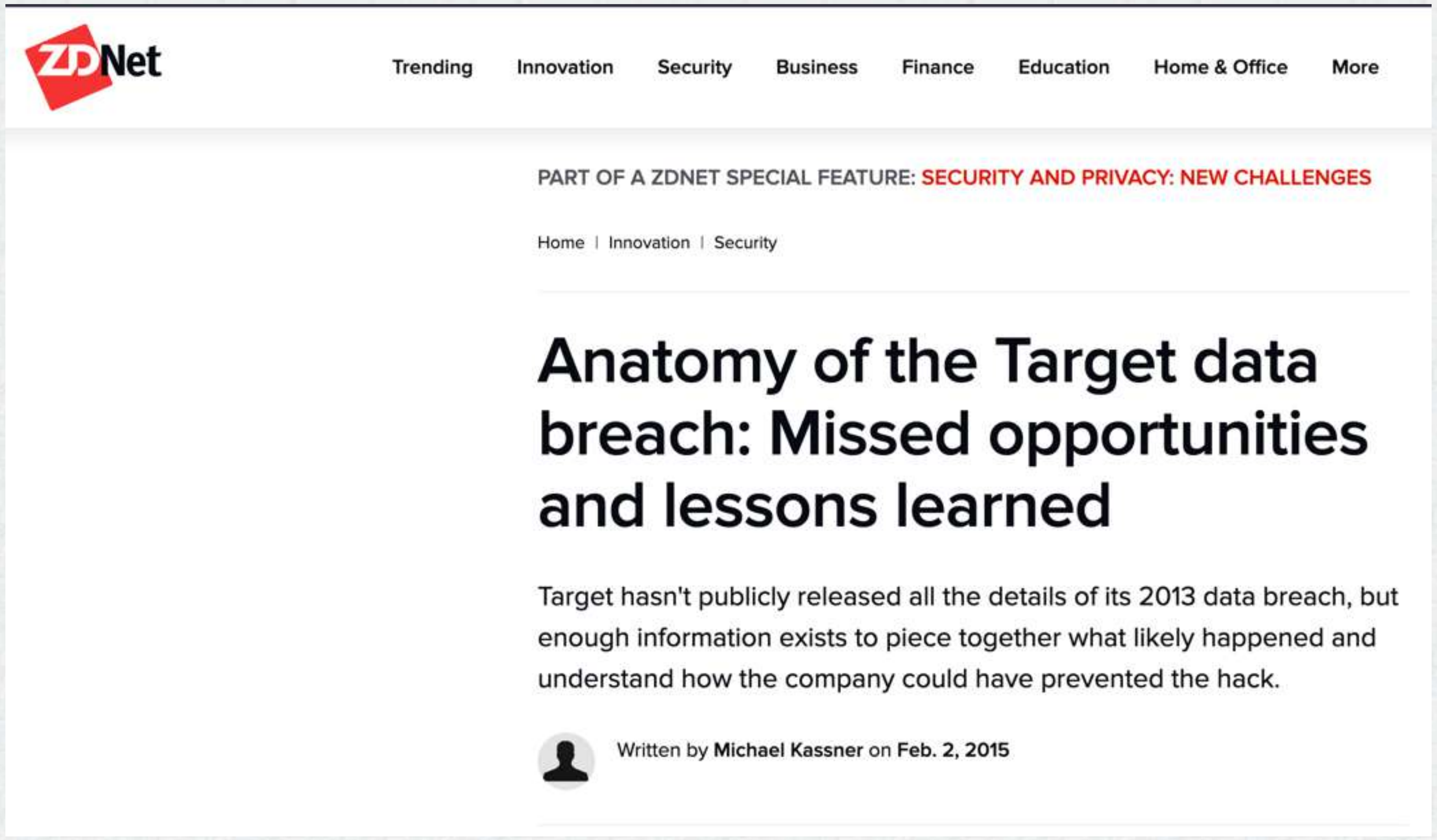
AppSecEngineer

A Recent History of Supply-Chain Attacks

abhaybhargav

AppSecEngineer

A Recent History of Supply-Chain Attacks



PART OF A ZDNET SPECIAL FEATURE: SECURITY AND PRIVACY: NEW CHALLENGES

Home | Innovation | Security

Anatomy of the Target data breach: Missed opportunities and lessons learned

Target hasn't publicly released all the details of its 2013 data breach, but enough information exists to piece together what likely happened and understand how the company could have prevented the hack.

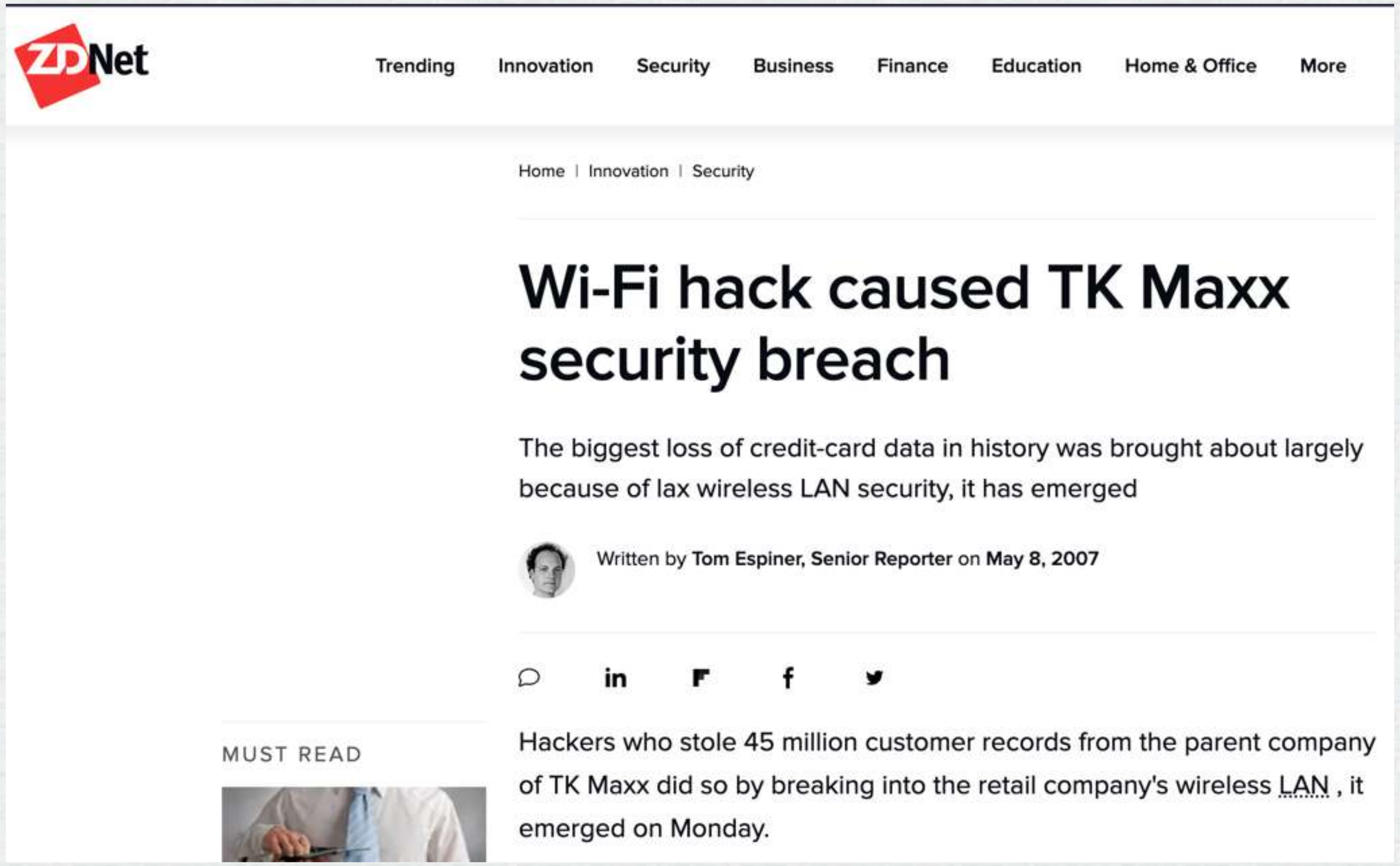
Written by **Michael Kassner** on **Feb. 2, 2015**

A Recent History of Supply-Chain Attacks

abhaybhargav

AppSecEngineer

A Recent History of Supply-Chain Attacks


ZDNet Trending Innovation Security Business Finance Education Home & Office More

Home | Innovation | Security

Wi-Fi hack caused TK Maxx security breach

The biggest loss of credit-card data in history was brought about largely because of lax wireless LAN security, it has emerged

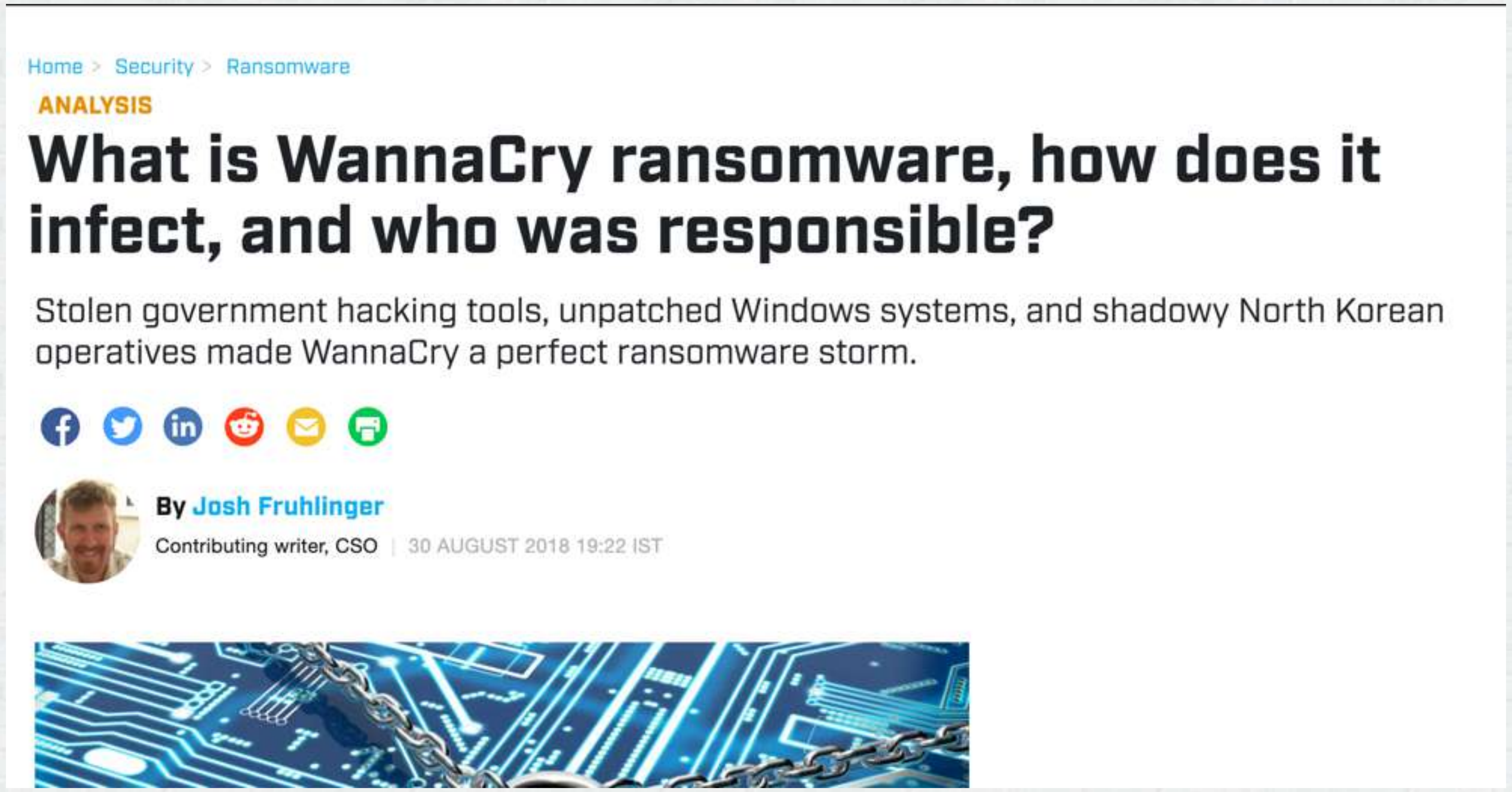
Written by Tom Espiner, Senior Reporter on May 8, 2007

MUST READ

Hackers who stole 45 million customer records from the parent company of TK Maxx did so by breaking into the retail company's wireless LAN , it emerged on Monday.

A Recent History of Supply-Chain Attacks

A Recent History of Supply-Chain Attacks



Home > Security > Ransomware

ANALYSIS

What is WannaCry ransomware, how does it infect, and who was responsible?

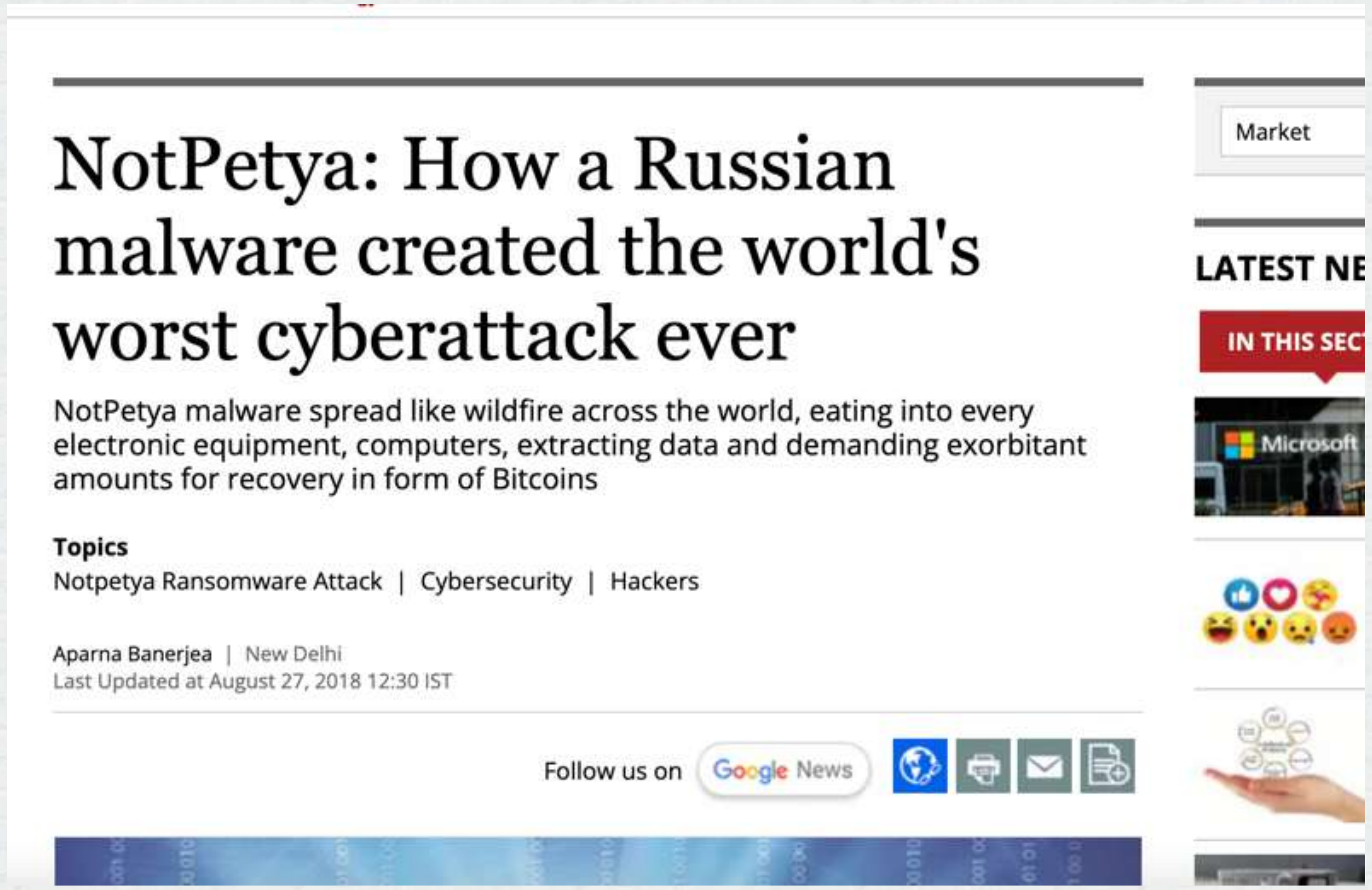
Stolen government hacking tools, unpatched Windows systems, and shadowy North Korean operatives made WannaCry a perfect ransomware storm.

By Josh Fruhlinger

Contributing writer, CSO | 30 AUGUST 2018 19:22 IST

A Recent History of Supply-Chain Attacks

A Recent History of Supply-Chain Attacks



NotPetya: How a Russian malware created the world's worst cyberattack ever

NotPetya malware spread like wildfire across the world, eating into every electronic equipment, computers, extracting data and demanding exorbitant amounts for recovery in form of Bitcoins

Topics
Notpetya Ransomware Attack | Cybersecurity | Hackers

Aparna Banerjea | New Delhi
Last Updated at August 27, 2018 12:30 IST

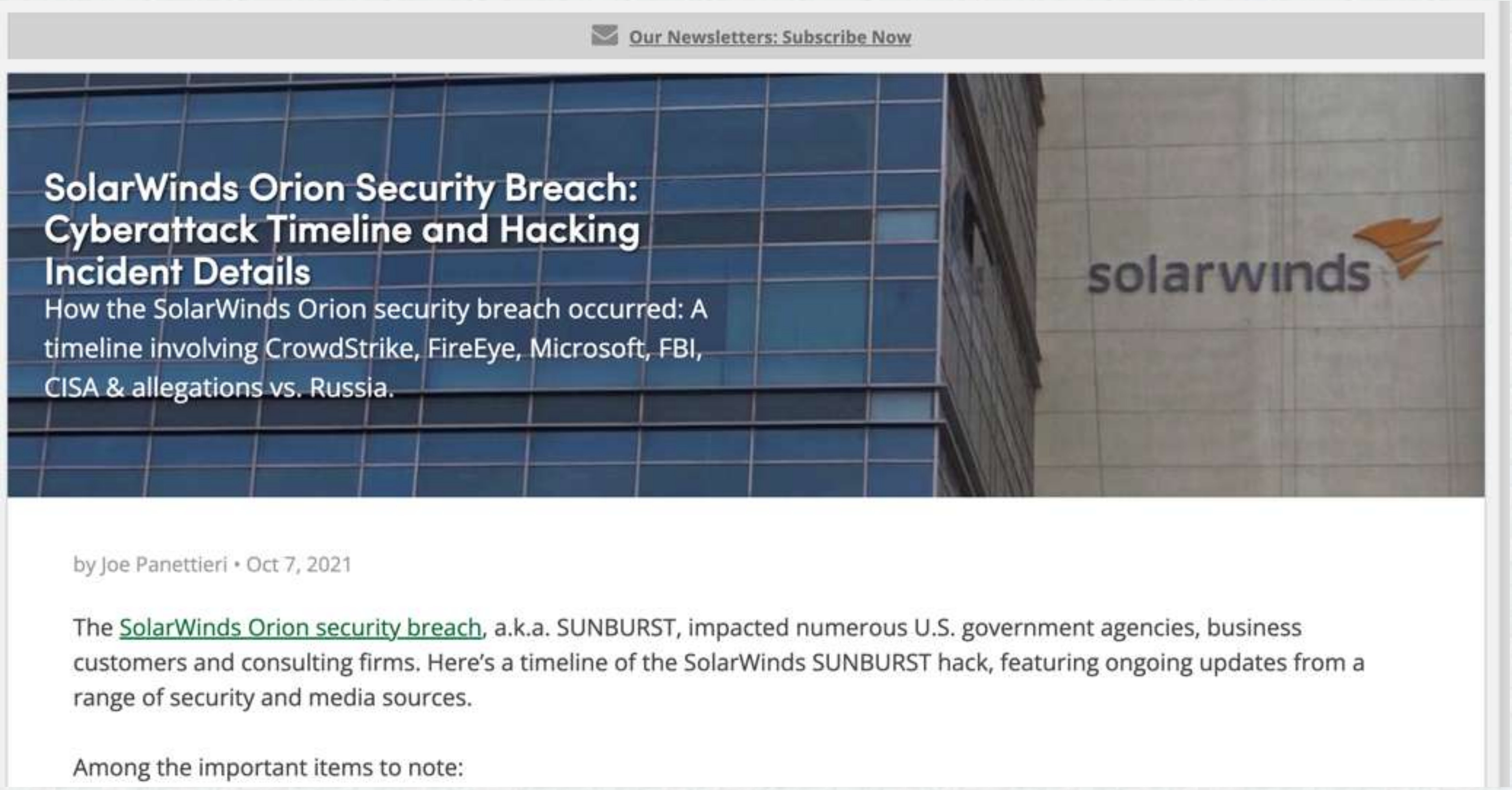
Follow us on Google News

@abhaybhargav

@AppSecEngineer

A Recent History of Supply-Chain Attacks

A Recent History of Supply-Chain Attacks


Our Newsletters: Subscribe Now

SolarWinds Orion Security Breach: Cyberattack Timeline and Hacking Incident Details

How the SolarWinds Orion security breach occurred: A timeline involving CrowdStrike, FireEye, Microsoft, FBI, CISA & allegations vs. Russia.

by Joe Panettieri • Oct 7, 2021

The SolarWinds Orion security breach, a.k.a. SUNBURST, impacted numerous U.S. government agencies, business customers and consulting firms. Here's a timeline of the SolarWinds SUNBURST hack, featuring ongoing updates from a range of security and media sources.

Among the important items to note:

abhaybhargav

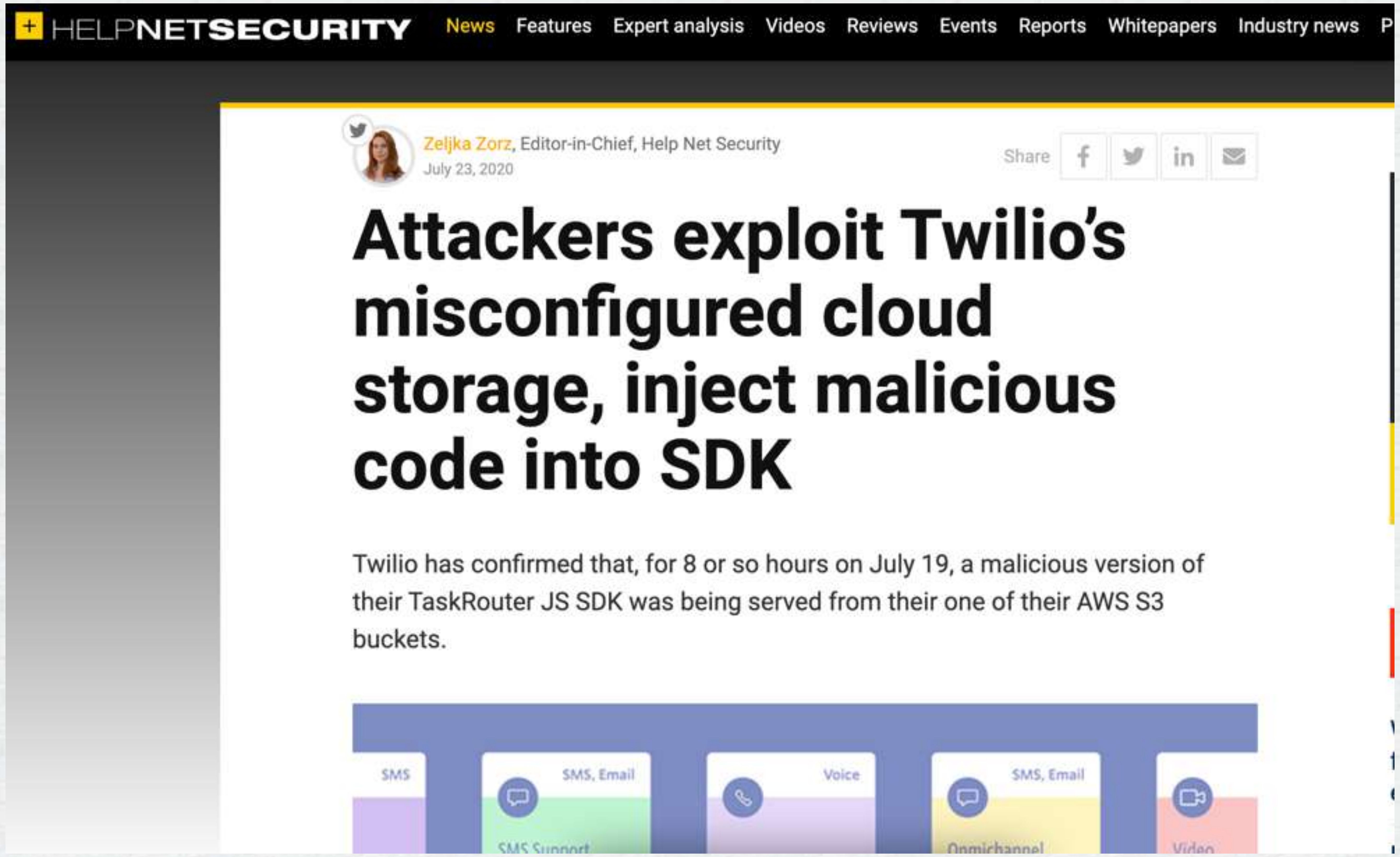
AppSecEngineer

A Recent History of Supply-Chain Attacks

abhaybhargav

AppSecEngineer

A Recent History of Supply-Chain Attacks


HELPNETSECURITY
News Features Expert analysis Videos Reviews Events Reports Whitepapers Industry news
Share

Zeljka Zorz, Editor-in-Chief, Help Net Security
July 23, 2020

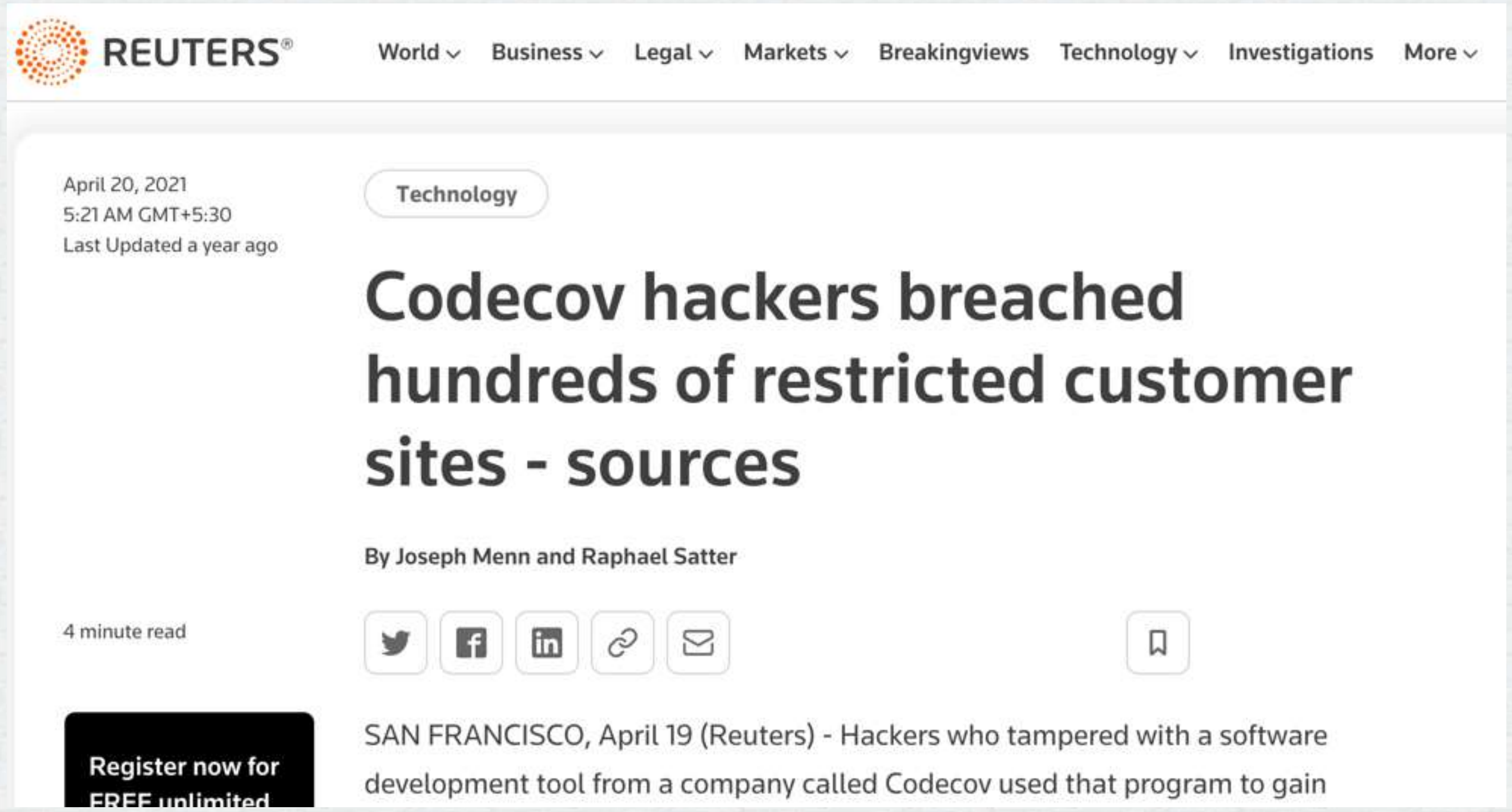
Attackers exploit Twilio's misconfigured cloud storage, inject malicious code into SDK

Twilio has confirmed that, for 8 or so hours on July 19, a malicious version of their TaskRouter JS SDK was being served from their one of their AWS S3 buckets.

SMS
SMS, Email
SMS Support
Voice
SMS, Email
Omnichannel
Video

A Recent History of Supply-Chain Attacks

A Recent History of Supply-Chain Attacks



April 20, 2021
5:21 AM GMT+5:30
Last Updated a year ago

Technology

Codecov hackers breached hundreds of restricted customer sites - sources

By Joseph Menn and Raphael Satter

4 minute read

Register now for
FREE unlimited

SAN FRANCISCO, April 19 (Reuters) - Hackers who tampered with a software development tool from a company called Codecov used that program to gain

abhaybhargav

AppSecEngineer

A Recent History of Supply-Chain Attacks

abhaybhargav

AppSecEngineer

Today's Agenda

Today's Agenda

- Three Stories

abhaybhargav

AppSecEngineer

Today's Agenda

- Three Stories
- From different phases of the SDLC

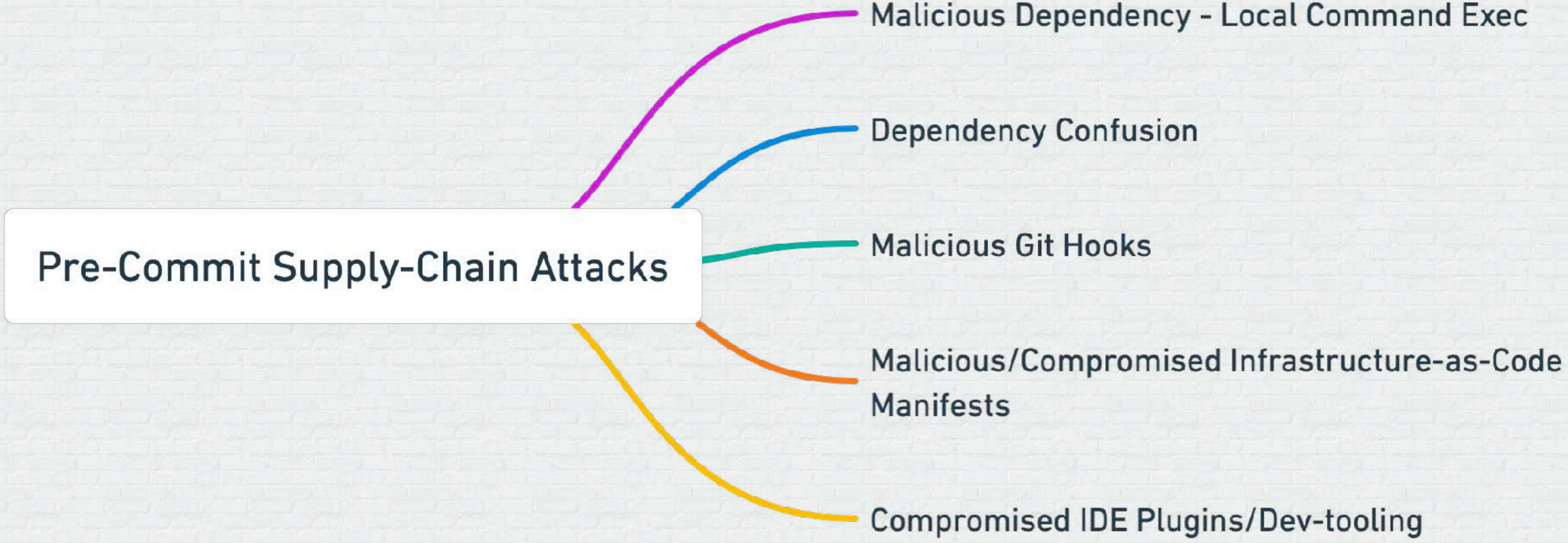
Today's Agenda

- Three Stories
- From different phases of the SDLC
- With completely different supply-chain implications

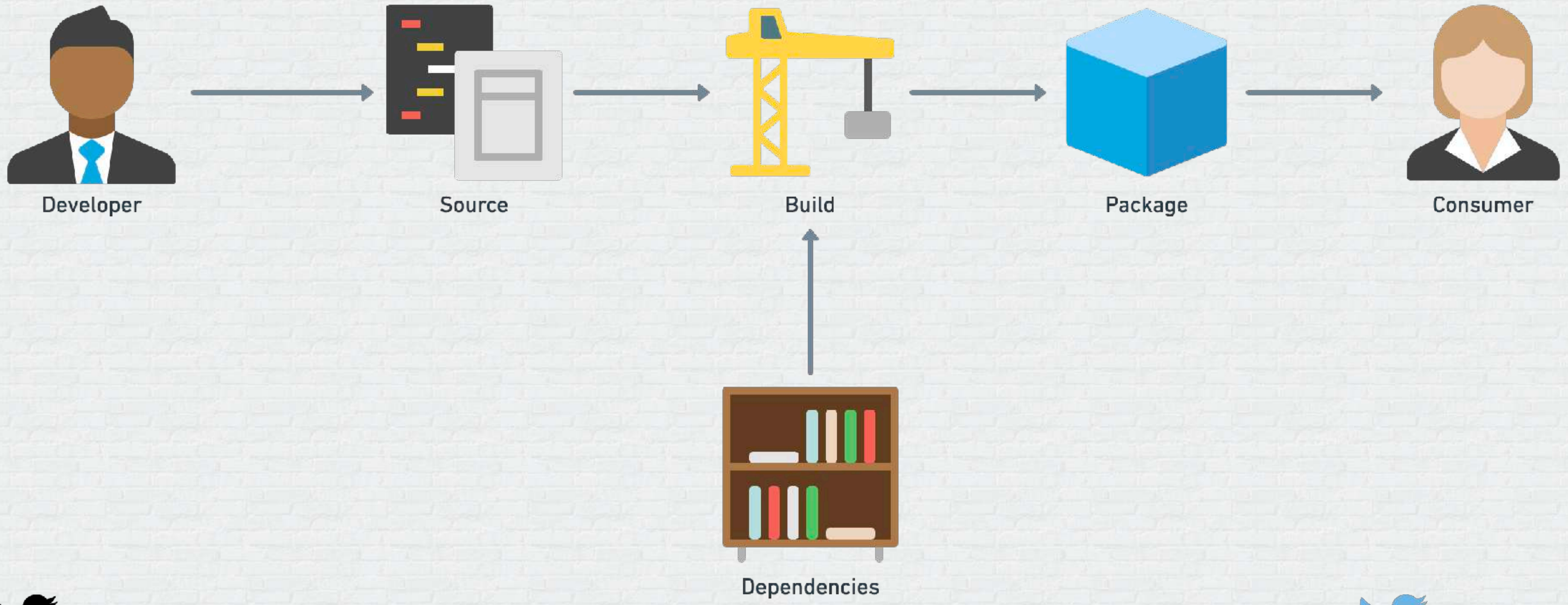
abhaybhargav

AppSecEngineer

Pre-Commit Supply-Chain Attacks

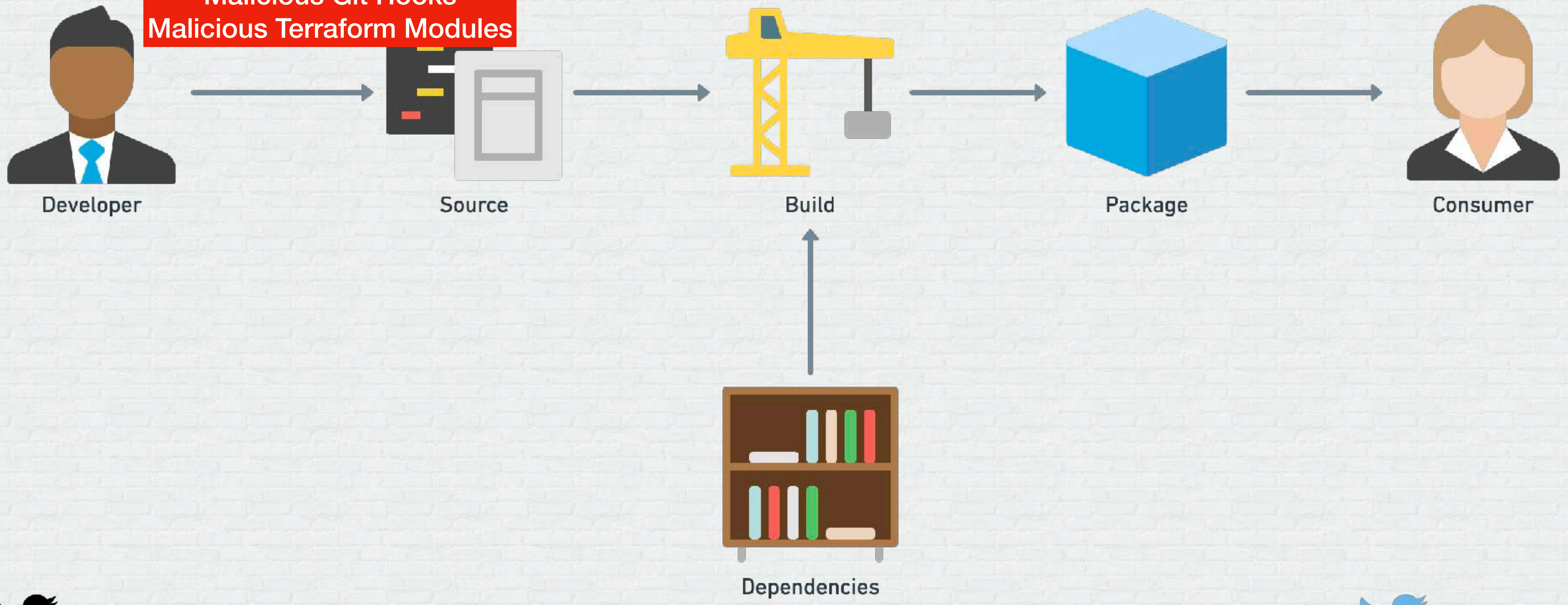

Pre-Commit Supply-Chain Attacks
Malicious Dependency - Local Command Exec
Dependency Confusion
Malicious Git Hooks
Malicious/Compromised Infrastructure-as-Code Manifests
Compromised IDE Plugins/Dev-tooling

Supply-Chain Lifecycle

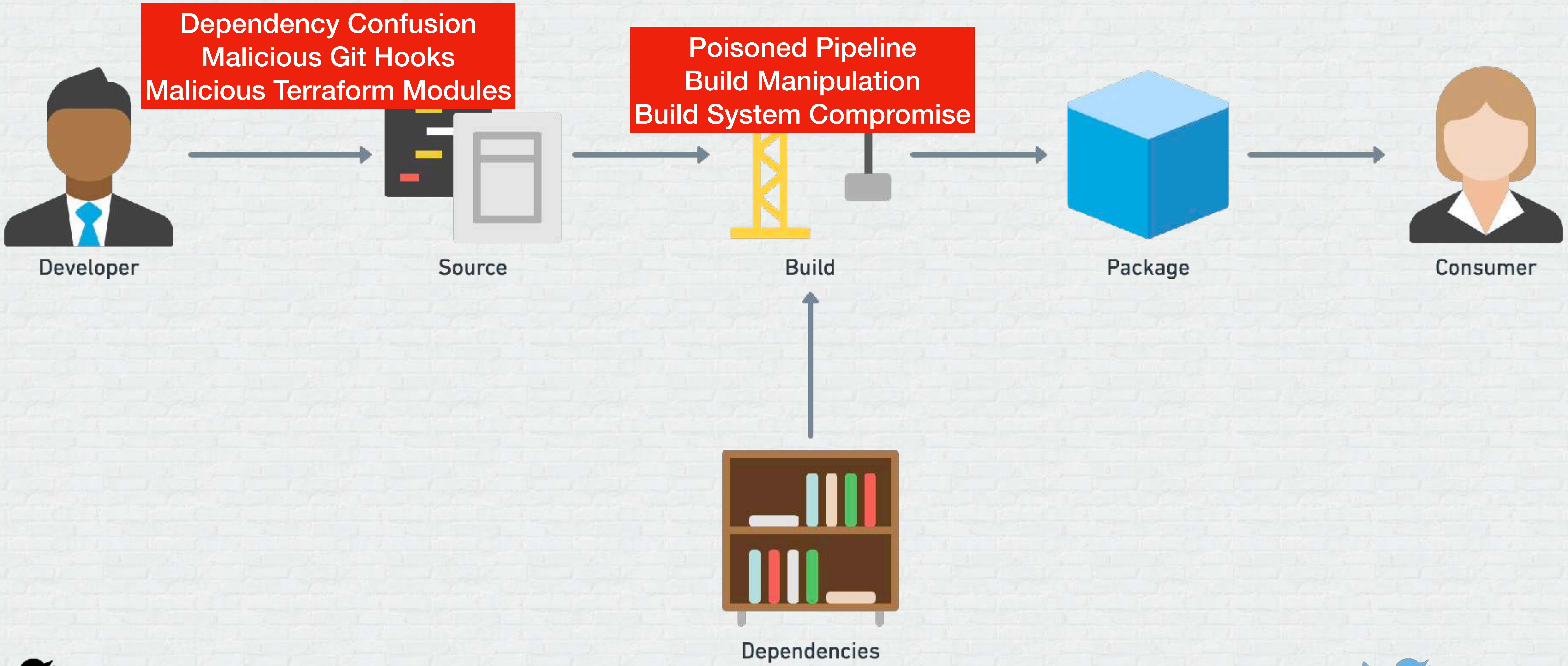


Supply-Chain Lifecycle

Dependency Confusion
Malicious Git Hooks
Malicious Terraform Modules



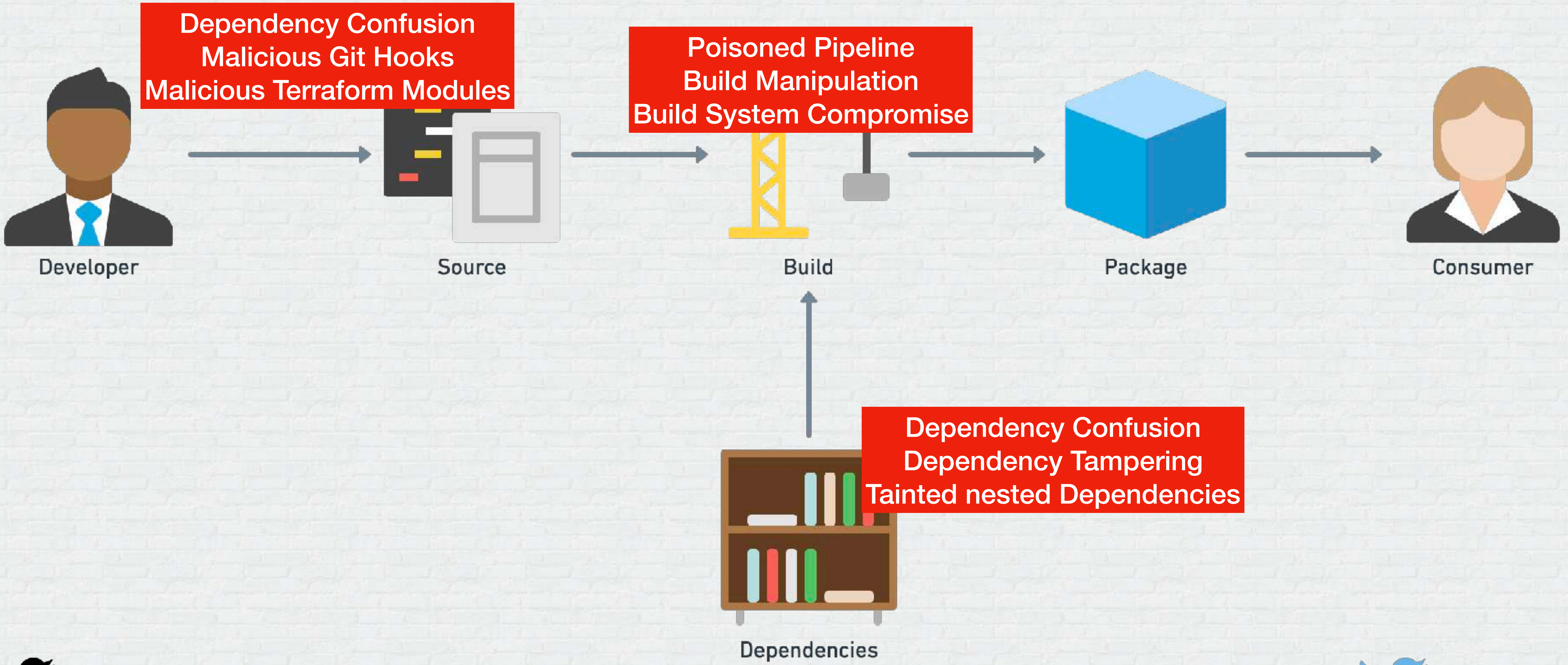
Supply-Chain Lifecycle



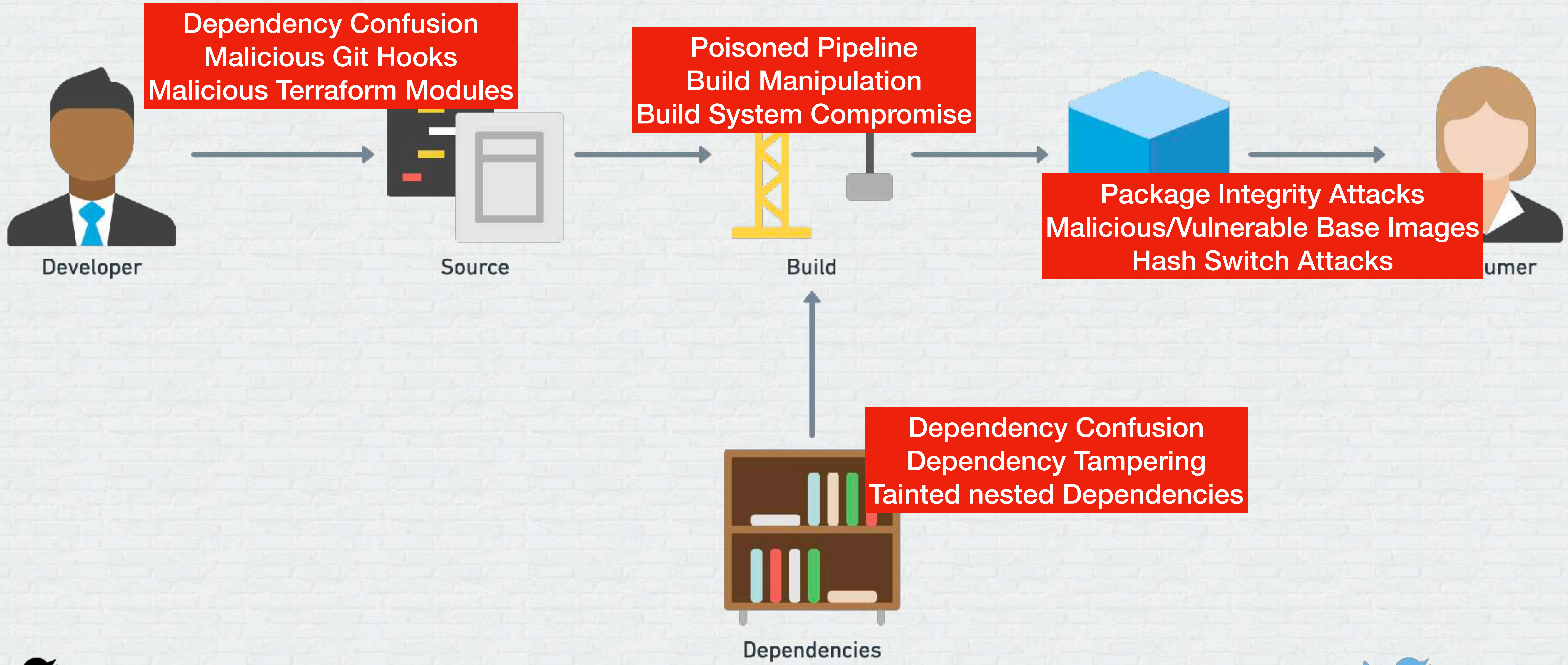
abhaybhargav

AppSecEngineer

Supply-Chain Lifecycle



Supply-Chain Lifecycle



abhaybhargav

AppSecEngineer

Dependency Confusion

abhaybhargav

AppSecEngineer

How does it work?

abhaybhargav

AppSecEngineer

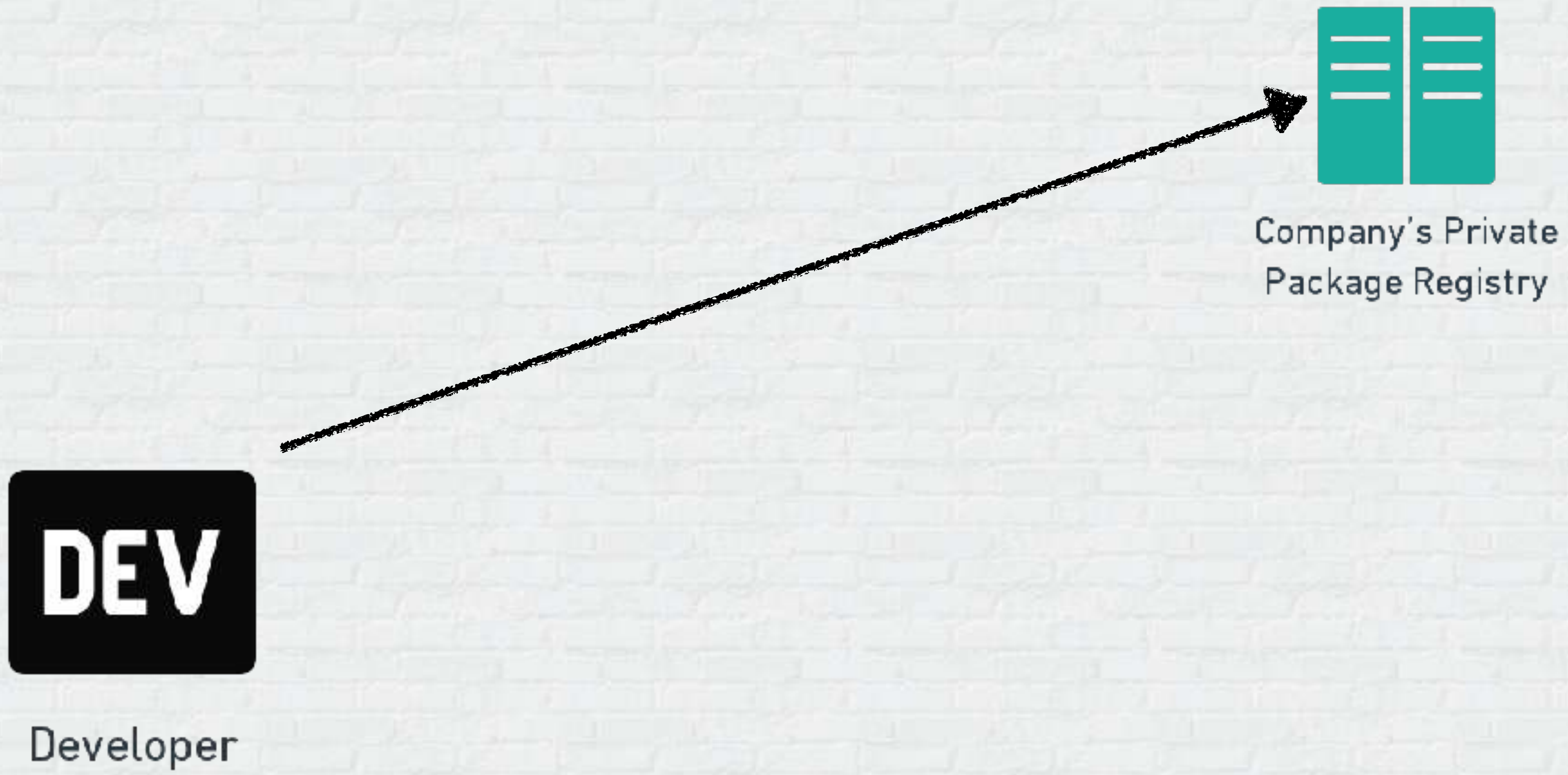
How does it work?

Developer

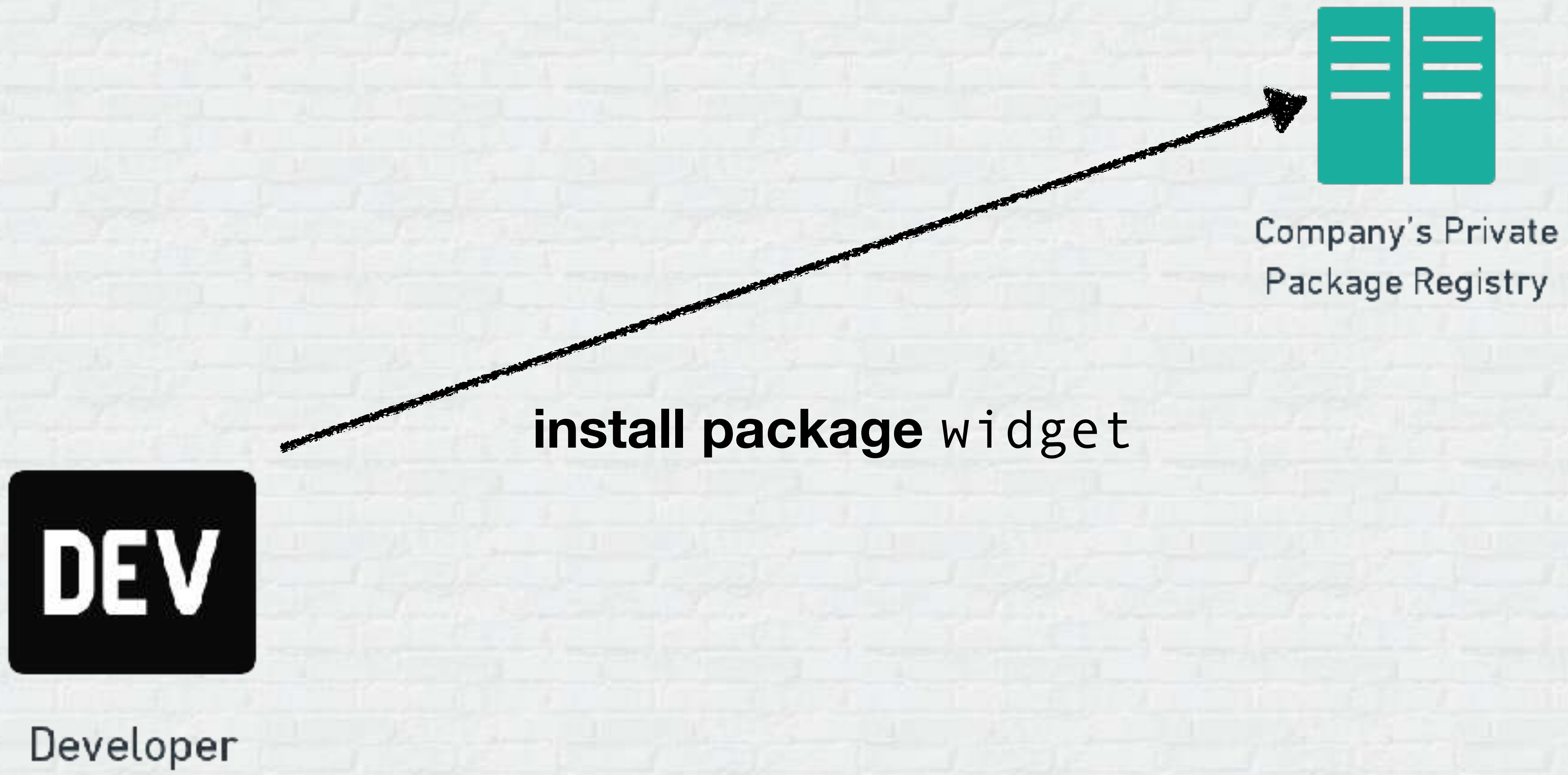
How does it work?

Company's Private Package Registry
DEV
Developer

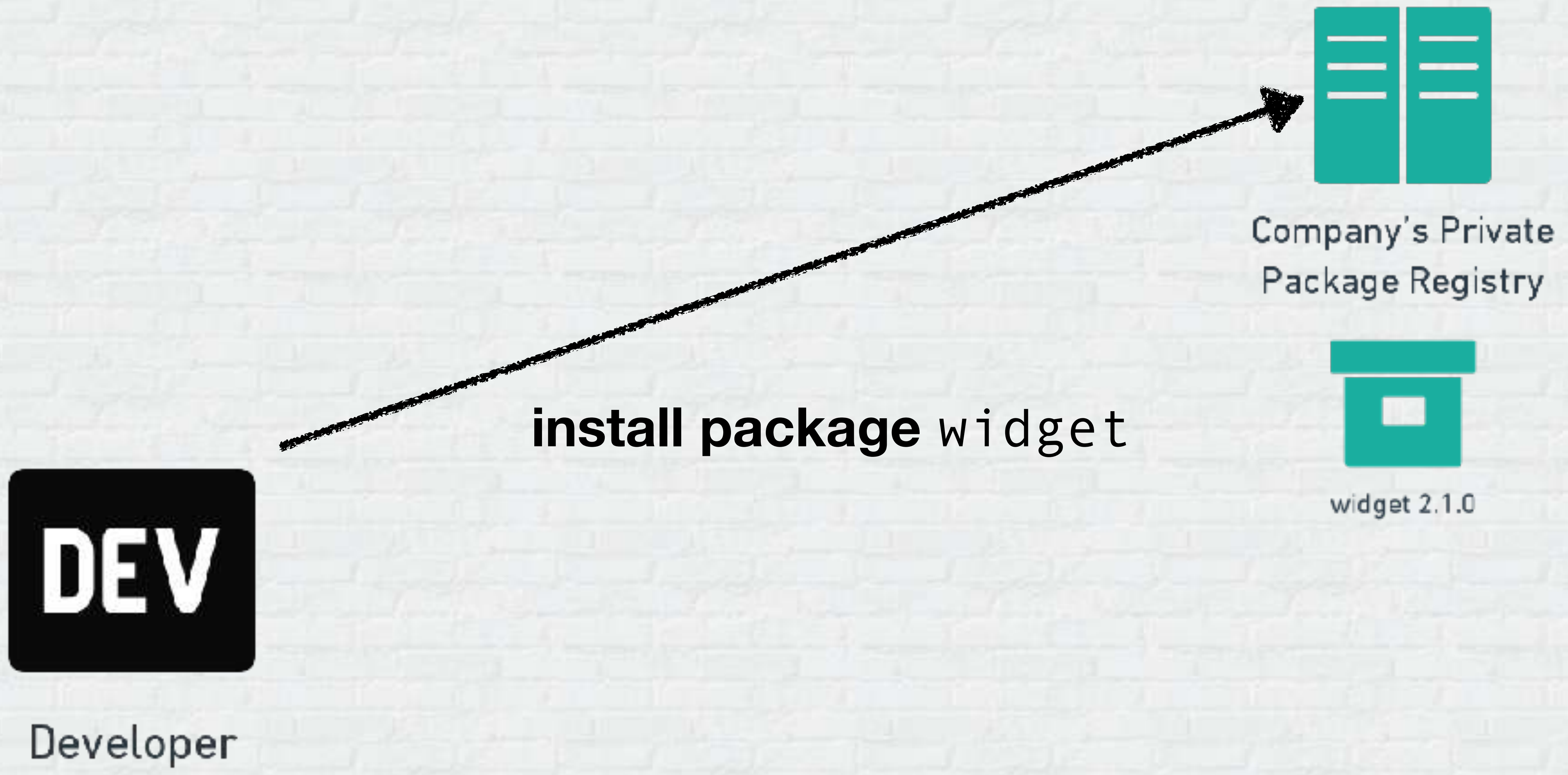
How does it work?



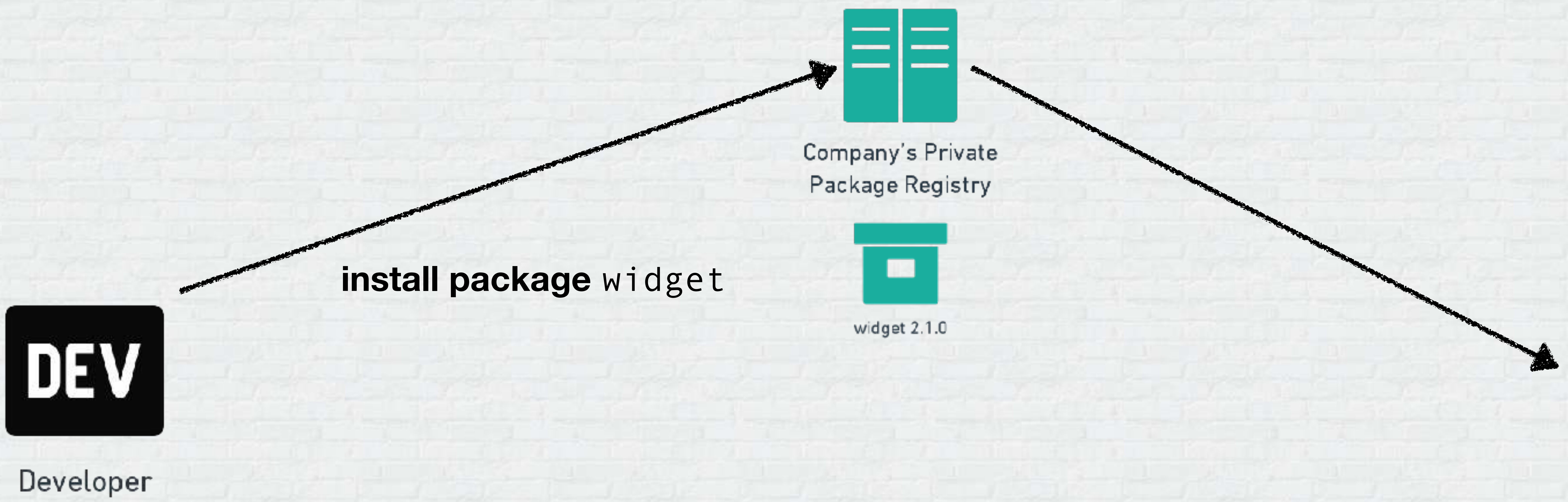
How does it work?



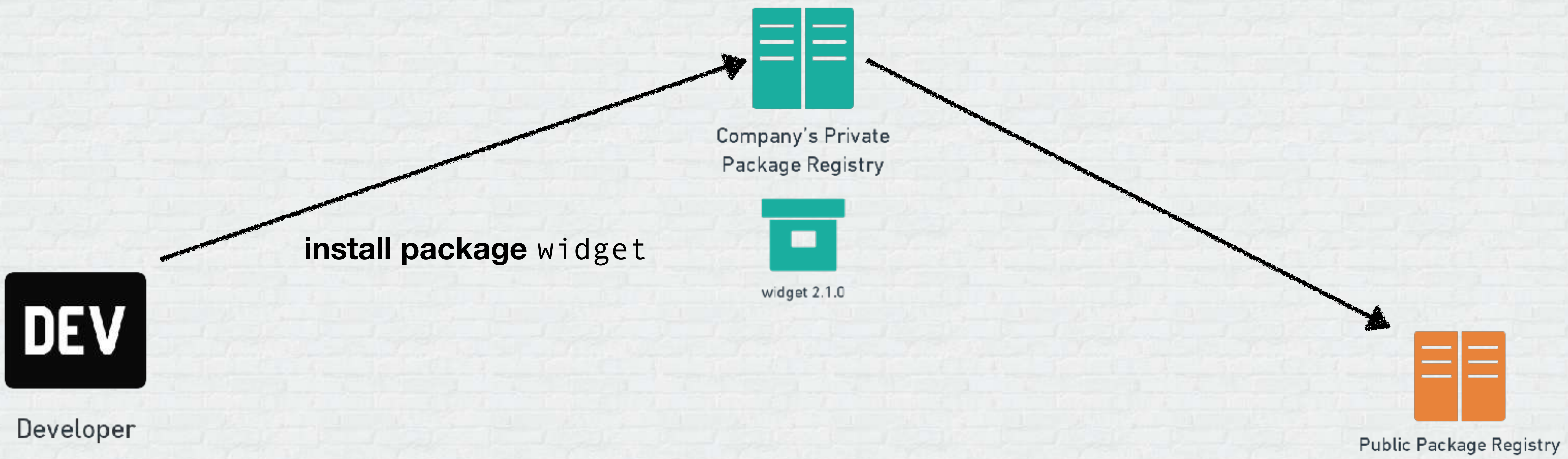
How does it work?



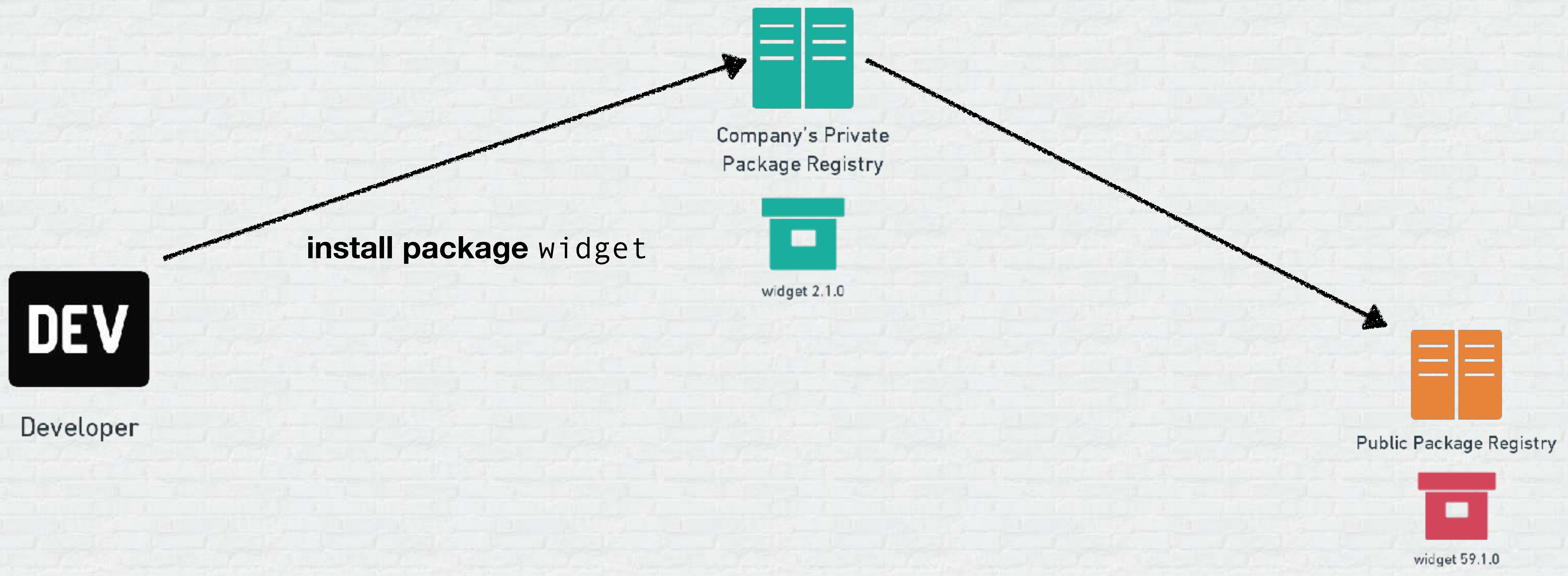
How does it work?



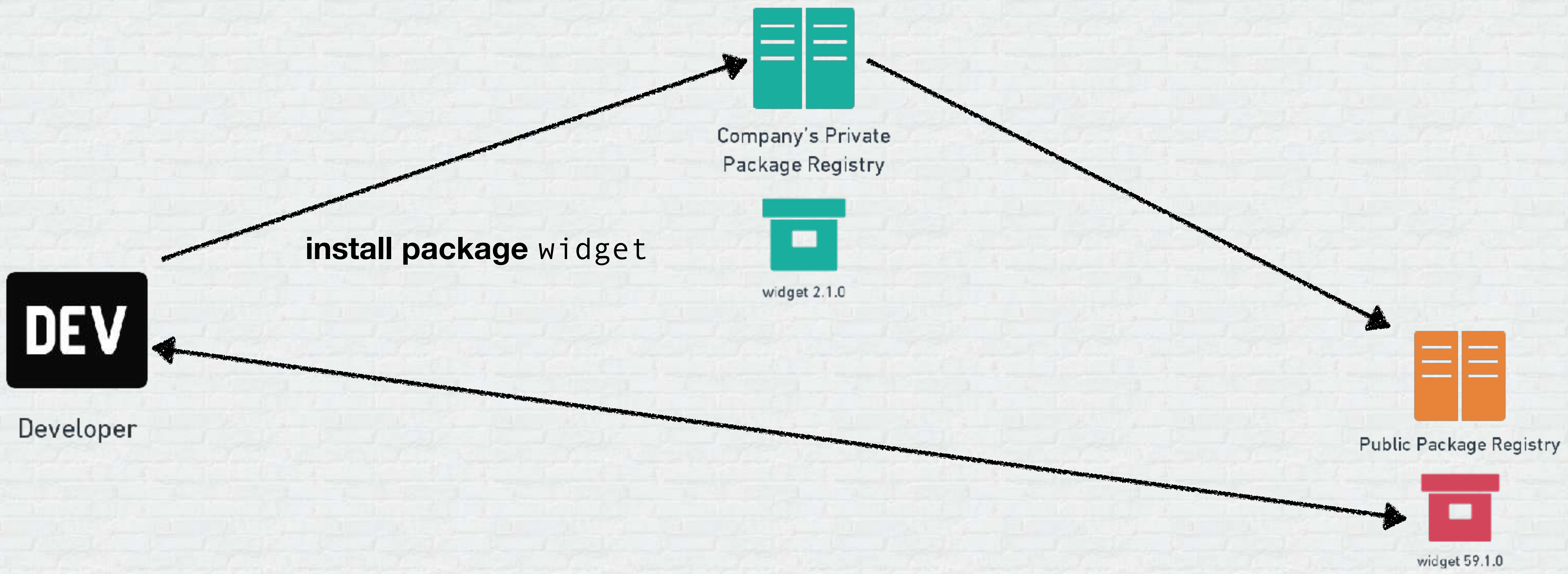
How does it work?



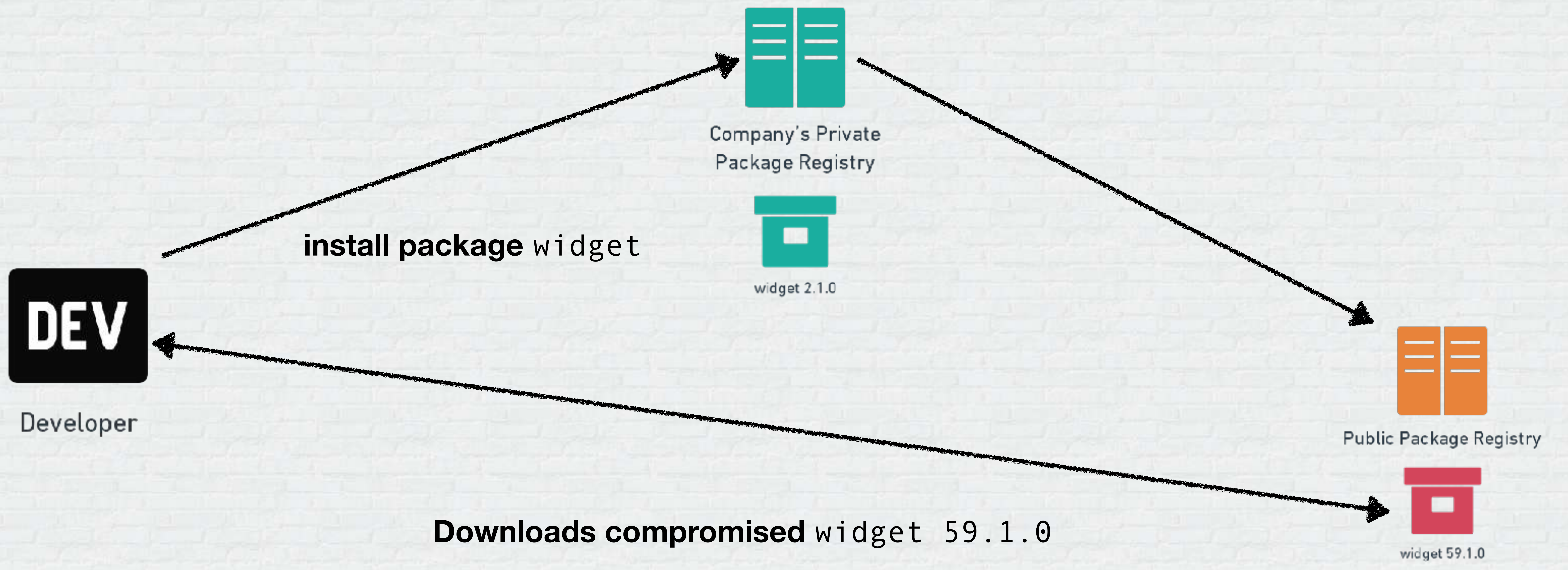
How does it work?



How does it work?



How does it work?

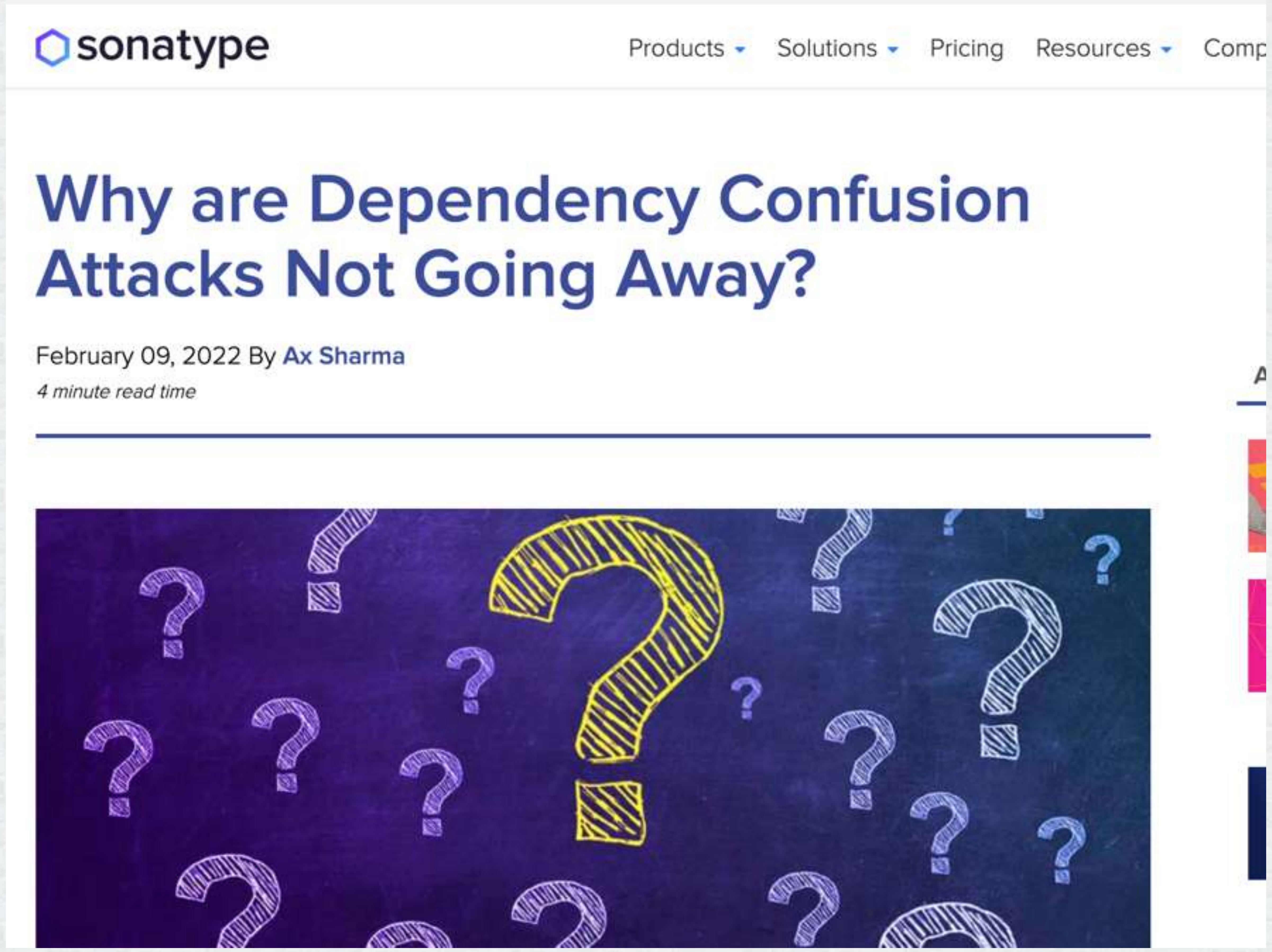


Who does it affect?

- Orgs with private packages in private repositories
- Orgs with private packages in artifactories (JFrog, etc)

Examples

Examples



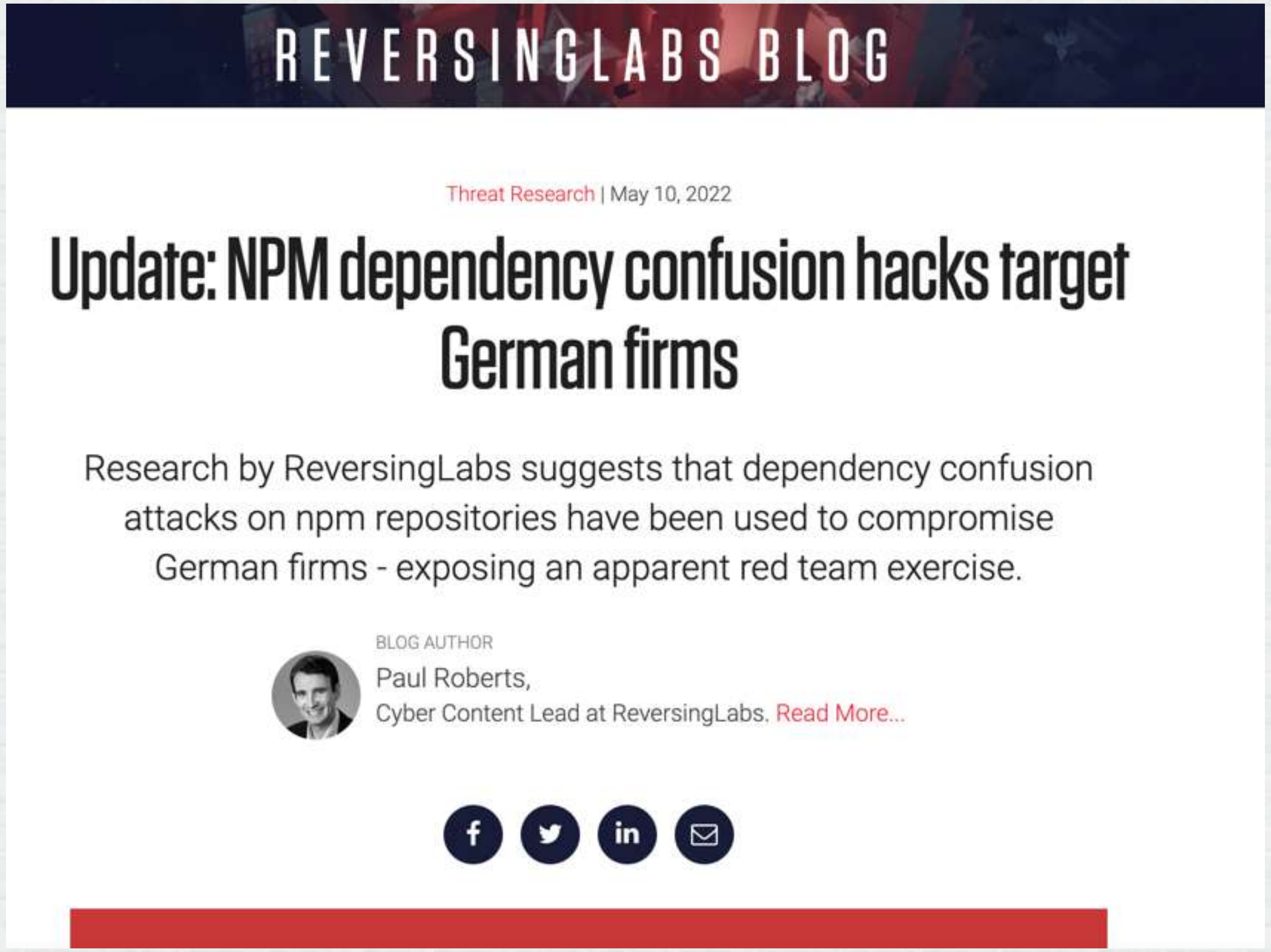
Why are Dependency Confusion Attacks Not Going Away?

February 09, 2022 By Ax Sharma

4 minute read time

Examples

Examples


REVERSINGLABS BLOG

Threat Research | May 10, 2022

Update: NPM dependency confusion hacks target German firms

Research by ReversingLabs suggests that dependency confusion attacks on npm repositories have been used to compromise German firms - exposing an apparent red team exercise.

BLOG AUTHOR
Paul Roberts,
Cyber Content Lead at ReversingLabs. Read More...

@abhaybhargav

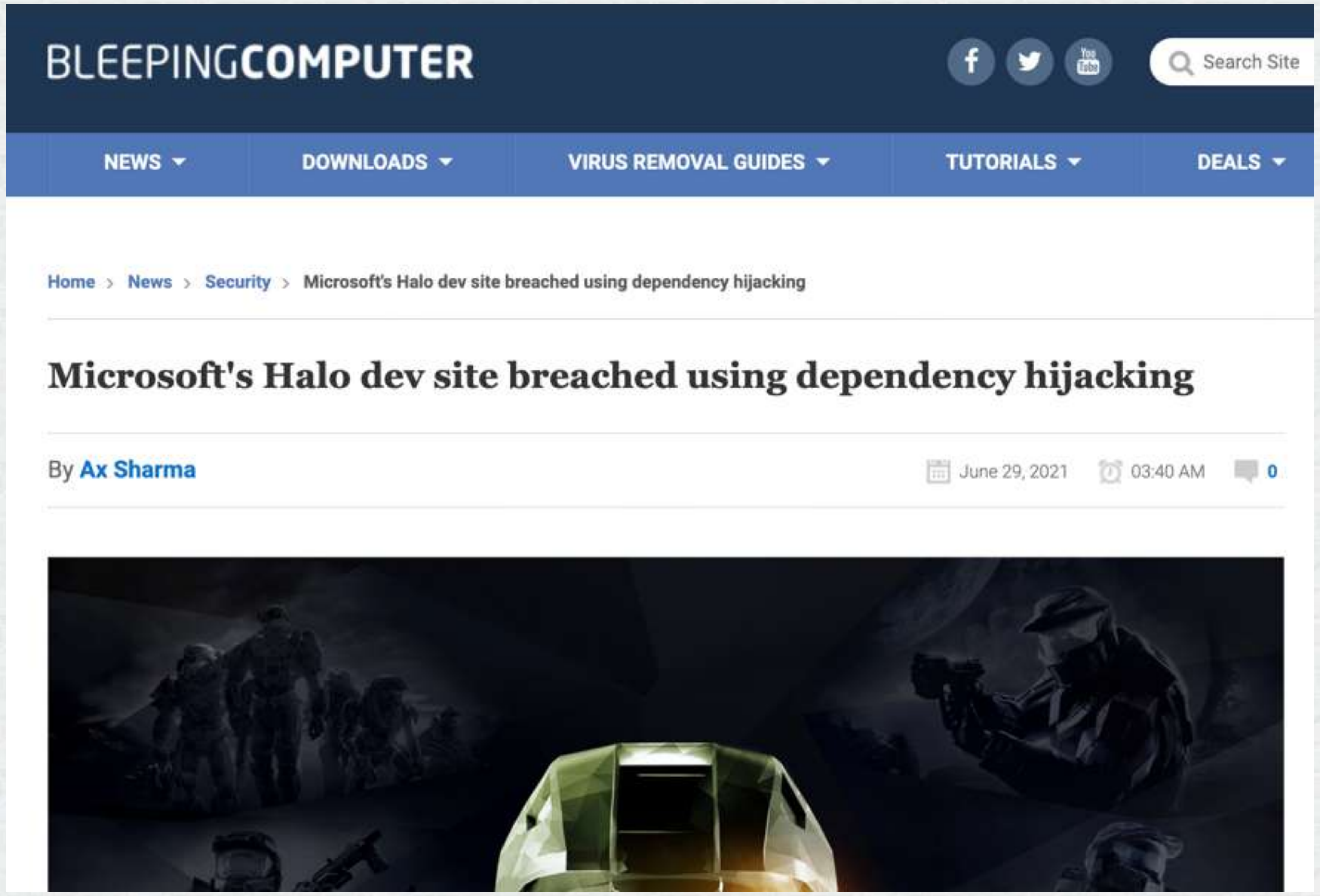
@AppSecEngineer

Examples

abhaybhargav

AppSecEngineer

Examples



Home › News › Security › Microsoft's Halo dev site breached using dependency hijacking

Microsoft's Halo dev site breached using dependency hijacking

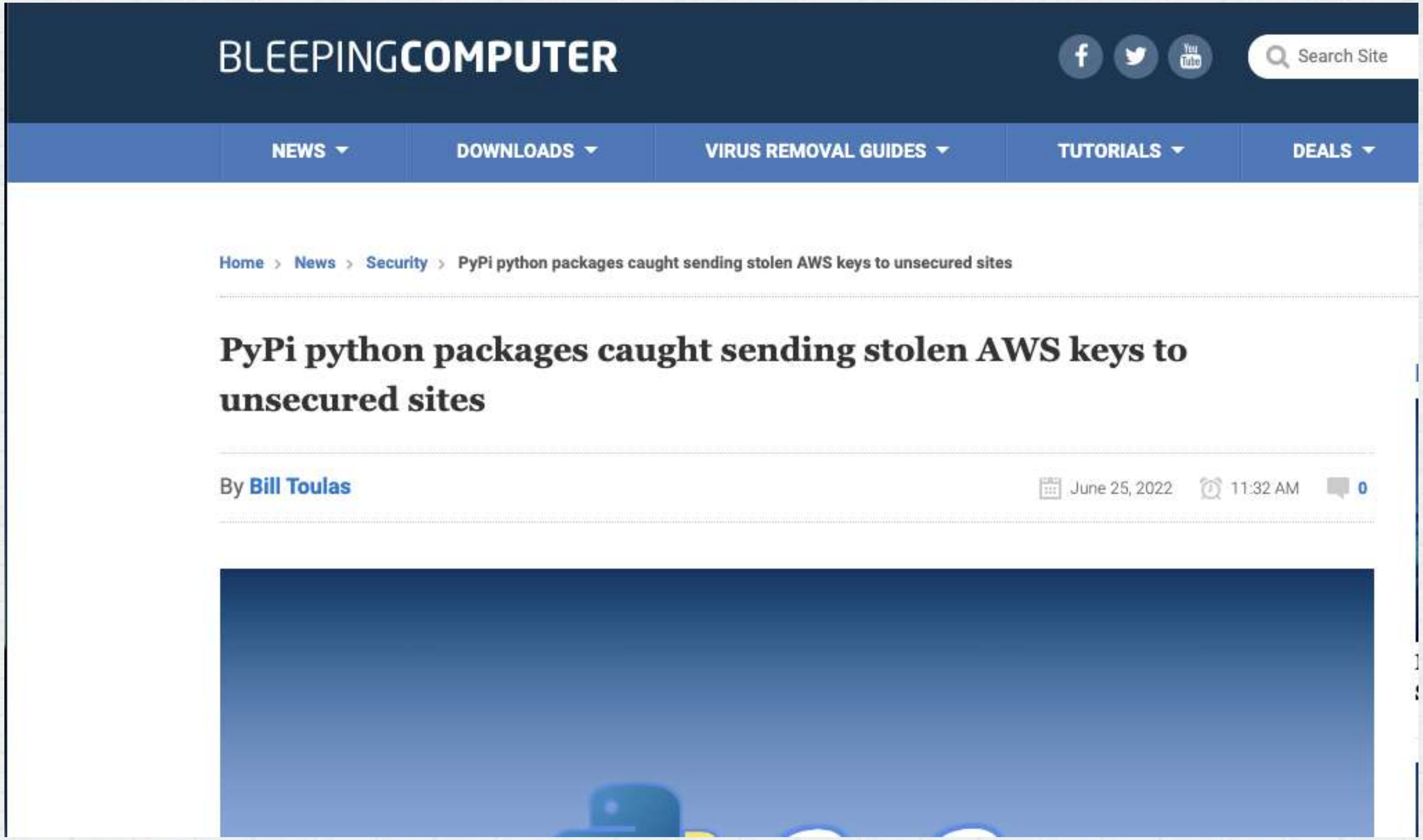
By Ax Sharma June 29, 2021 03:40 AM 0

@abhaybhargav

@AppSecEngineer

Examples

Lab: Dependency Confusion



BLEEPINGCOMPUTER

Search Site

NEWS DOWNLOADS VIRUS REMOVAL GUIDES TUTORIALS DEALS

Home › News › Security › PyPi python packages caught sending stolen AWS keys to unsecured sites

PyPi python packages caught sending stolen AWS keys to unsecured sites

By Bill Toulas June 25, 2022 11:32 AM 0

@abhaybhargav

@AppSecEngineer

Terror with Terraform

abhaybhargav

AppSecEngineer

Terraform Terminology

- Providers => Plugins to interact with cloud environments. Found in the Terraform Registry (example: AWS)
- Modules => Container for multiple resources that are used together (example - your app stack with specific resources, network and variable definitions)
- Resources => API Resources that refer to resources in specific cloud providers (example `aws_ssm_parameter`)

Provider Types

- Community Providers - Anyone can submit. Will be signed. No additional verification
- Verified Providers -> Verified by Hashicorp Alliances Team
- Official Provider -> Managed by Hashicorp

Terraform Modules

- Can be loaded from local directories
- Can be loaded from registry
- Can be loaded from Git repos
- No concept of verified or unverified Modules
- No signature for Terraform modules

Implant Mechanisms

Implant Mechanisms

- Developers using module in $environment

Implant Mechanisms

- Developers using module in $environment
- Developers using providers that use the module

Implant Mechanisms

- Developers using module in $environment
- Developers using providers that use the module
- Terraform containers using module (prebuilt)

Implant Mechanisms

- Developers using module in $environment
- Developers using providers that use the module
- Terraform containers using module (prebuilt)
- Cross-Build Injection - Forced use of terraform module

abhaybhargav

AppSecEngineer

What about IaC SAST?

What about IaC SAST?

- Bypassing IaC SAST rules entirely possible with base64-encoding, other techniques

What about IaC SAST?

- Bypassing IaC SAST rules entirely possible with base64-encoding, other techniques
- Its all about studying the rules and identifying bypasses based on the checks

Recommendations

- Only use modules/providers that have been audited
- Run SAST rules on modules to identify possible anomalies - use of base64, credential usage, etc.
- When running with CI/CD systems, try and build hermetically to avoid possible tainting of modules/providers
- Commit and Leverage lock files across the source artefact supply-chain

Cluster Buster: Kubernetes Admission Control Scandal

abhaybhargav

AppSecEngineer

Typical Players – Containers and K8s

argo

GitOps CD Tools

Typical Players – Containers and K8s

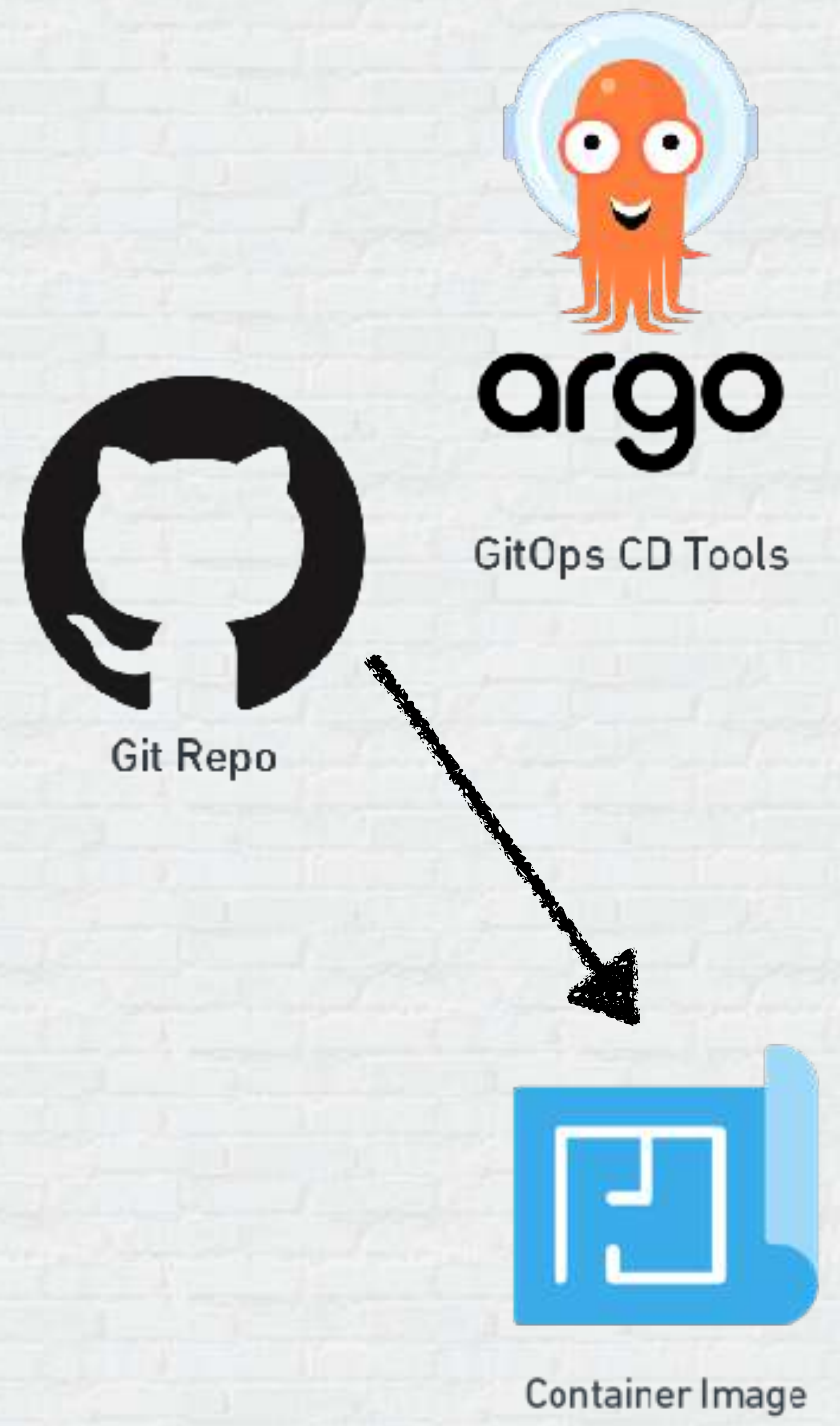
Git Repo

GitOps CD Tools

Typical Players – Containers and K8s

argo
GitOps CD Tools
Git Repo

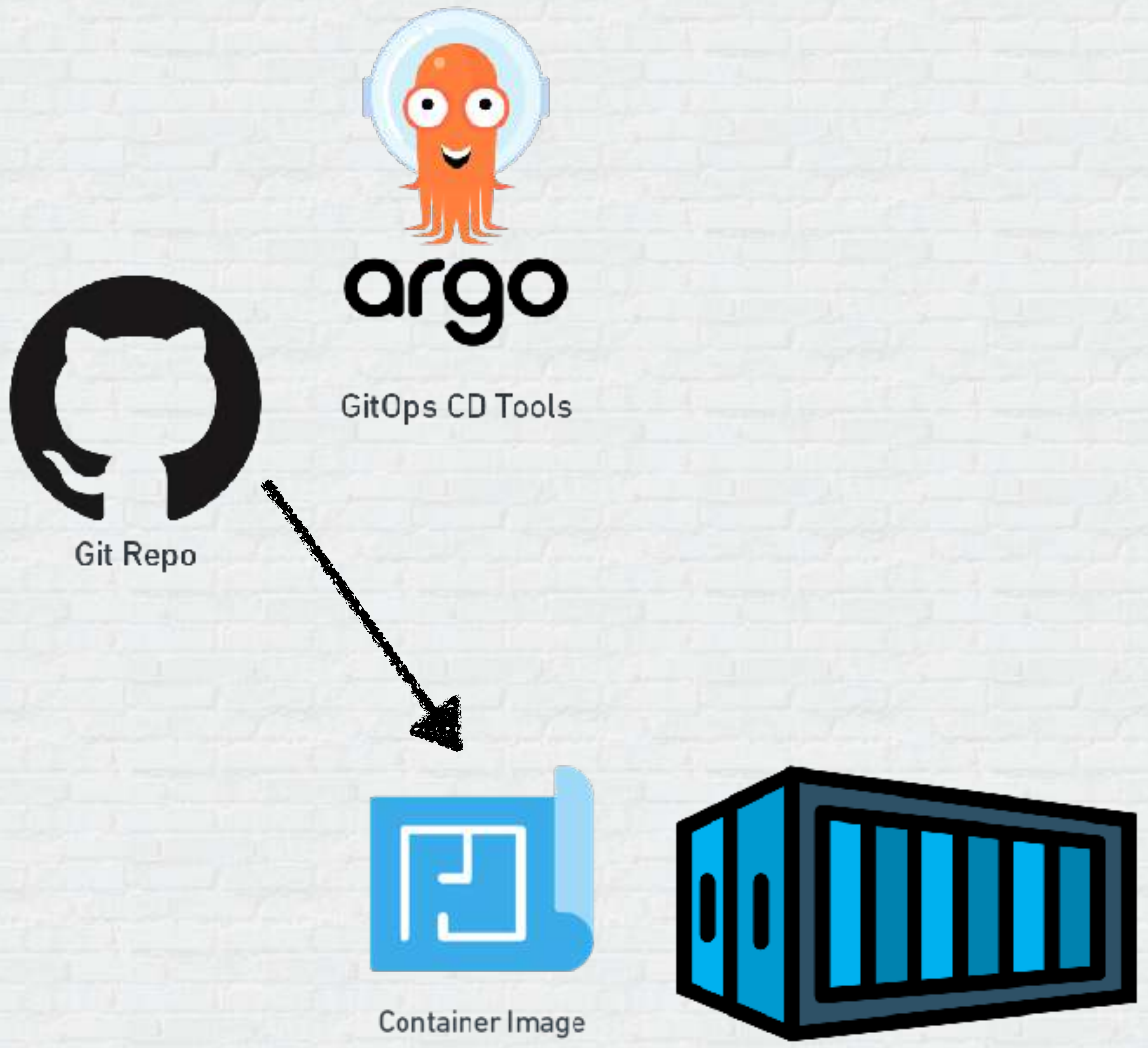
Typical Players – Containers and K8s



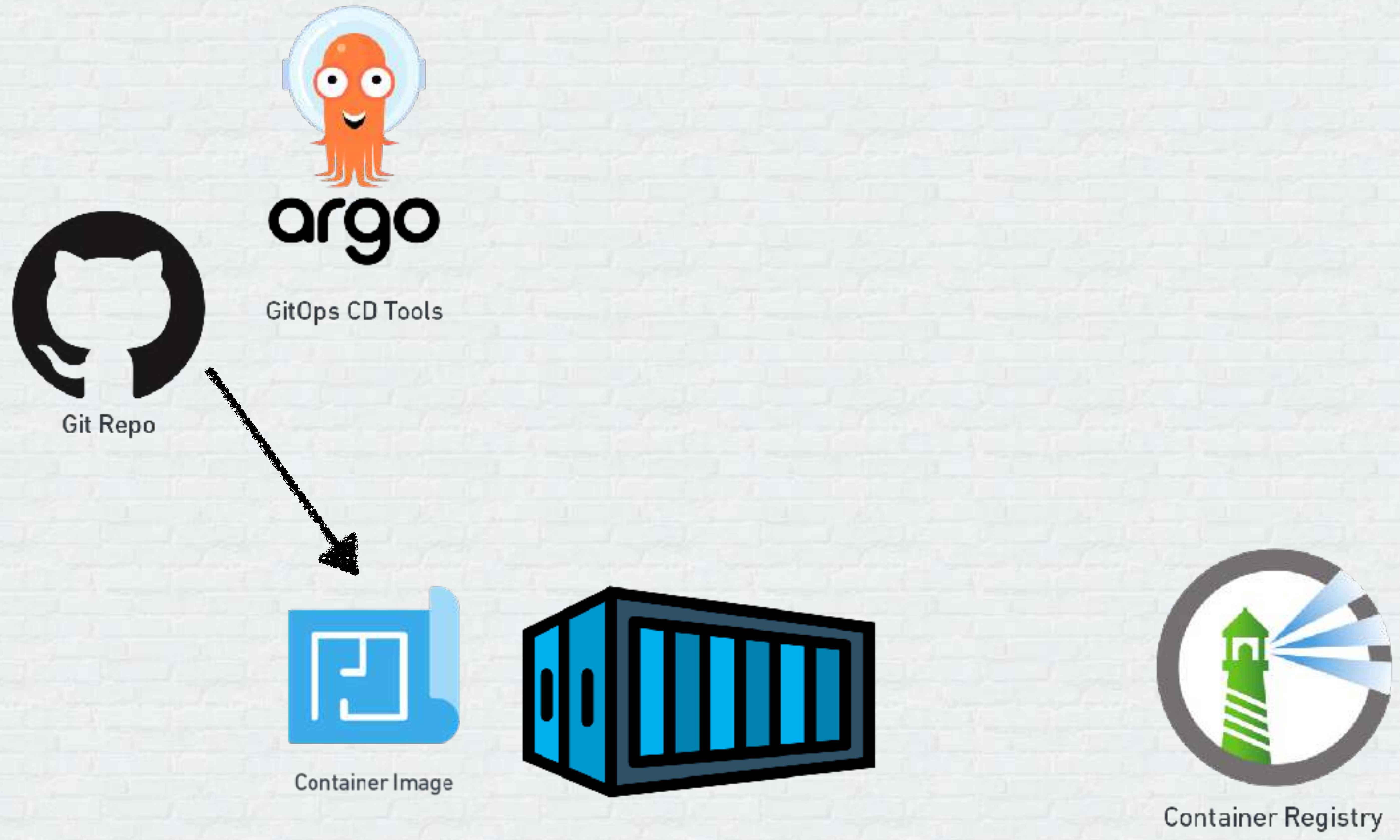
@abhaybhargav

@AppSecEngineer

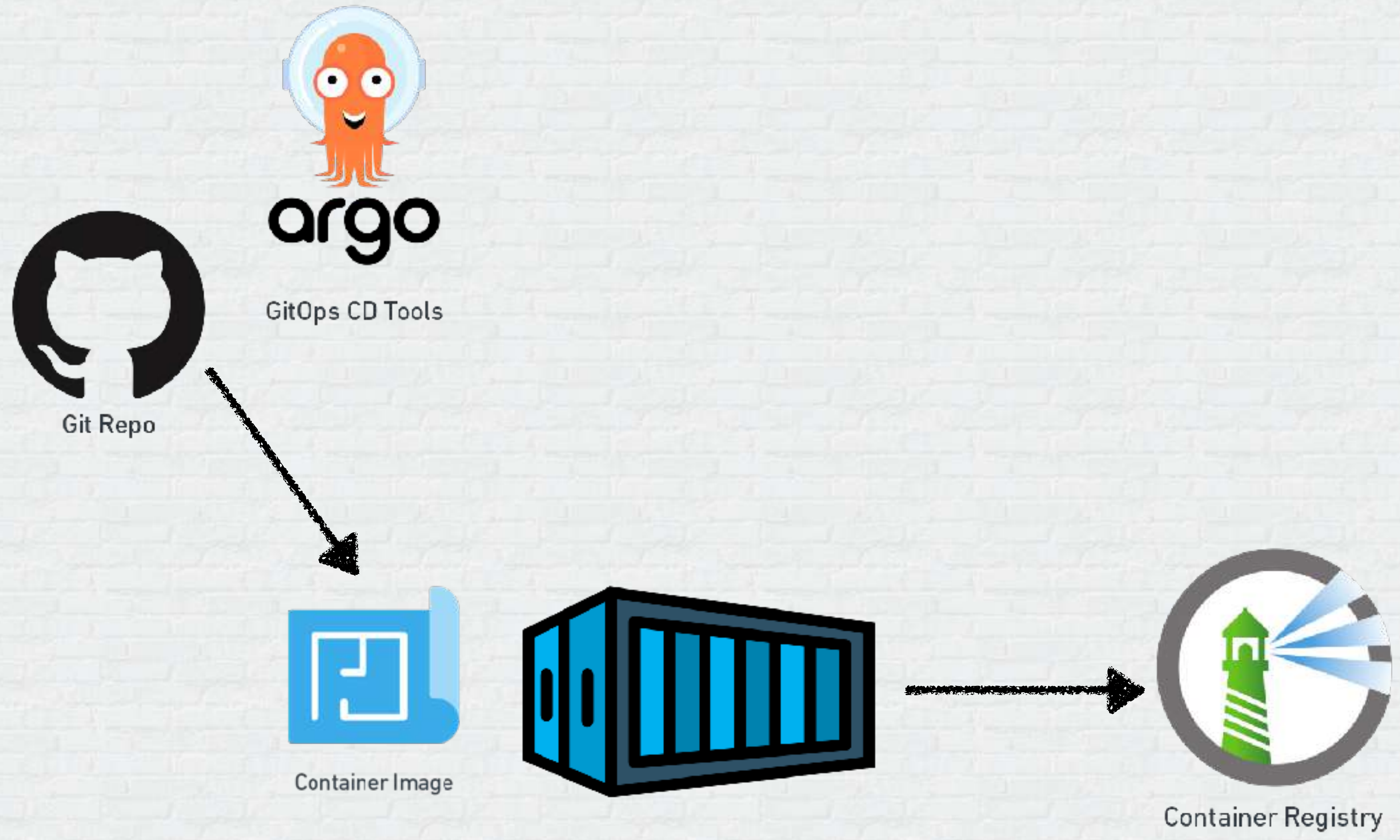
Typical Players – Containers and K8s



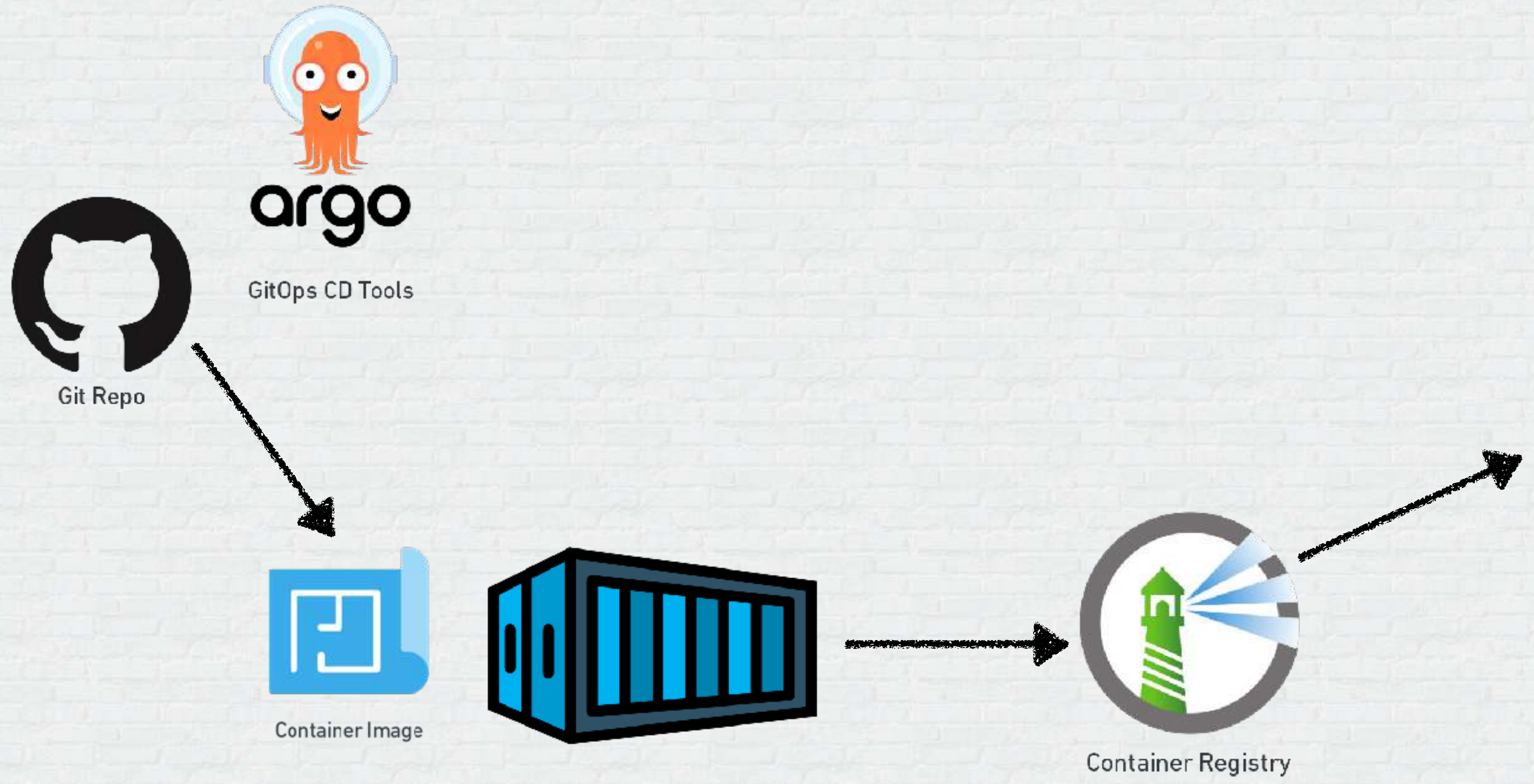
Typical Players – Containers and K8s



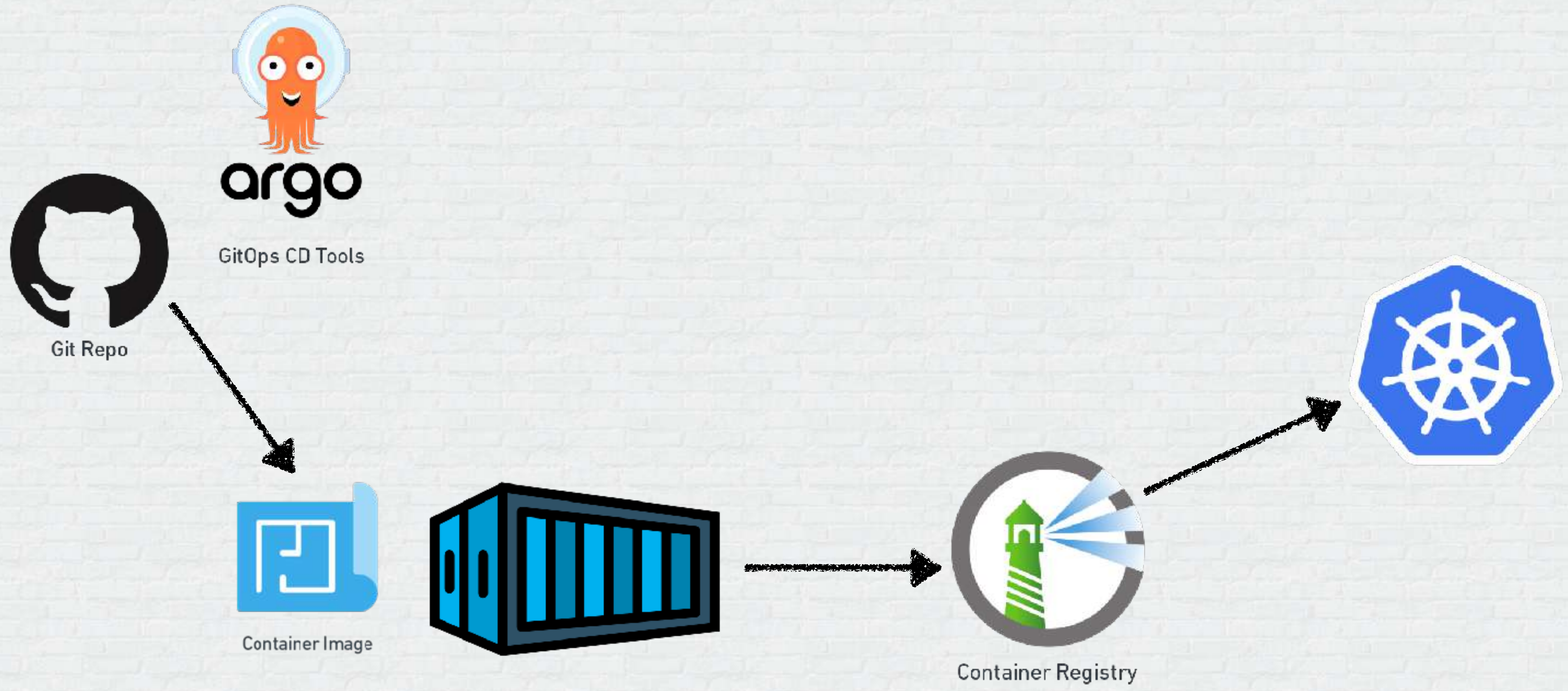
Typical Players – Containers and K8s



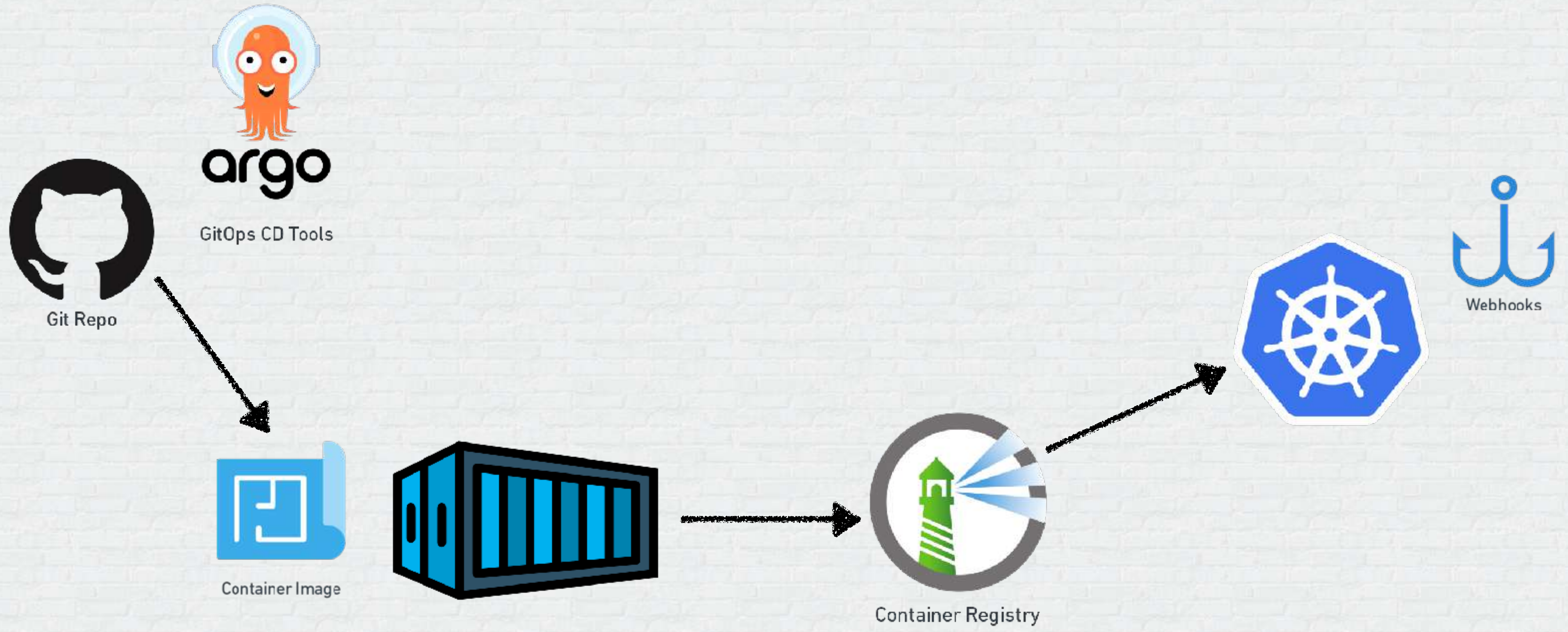
Typical Players – Containers and K8s



Typical Players – Containers and K8s



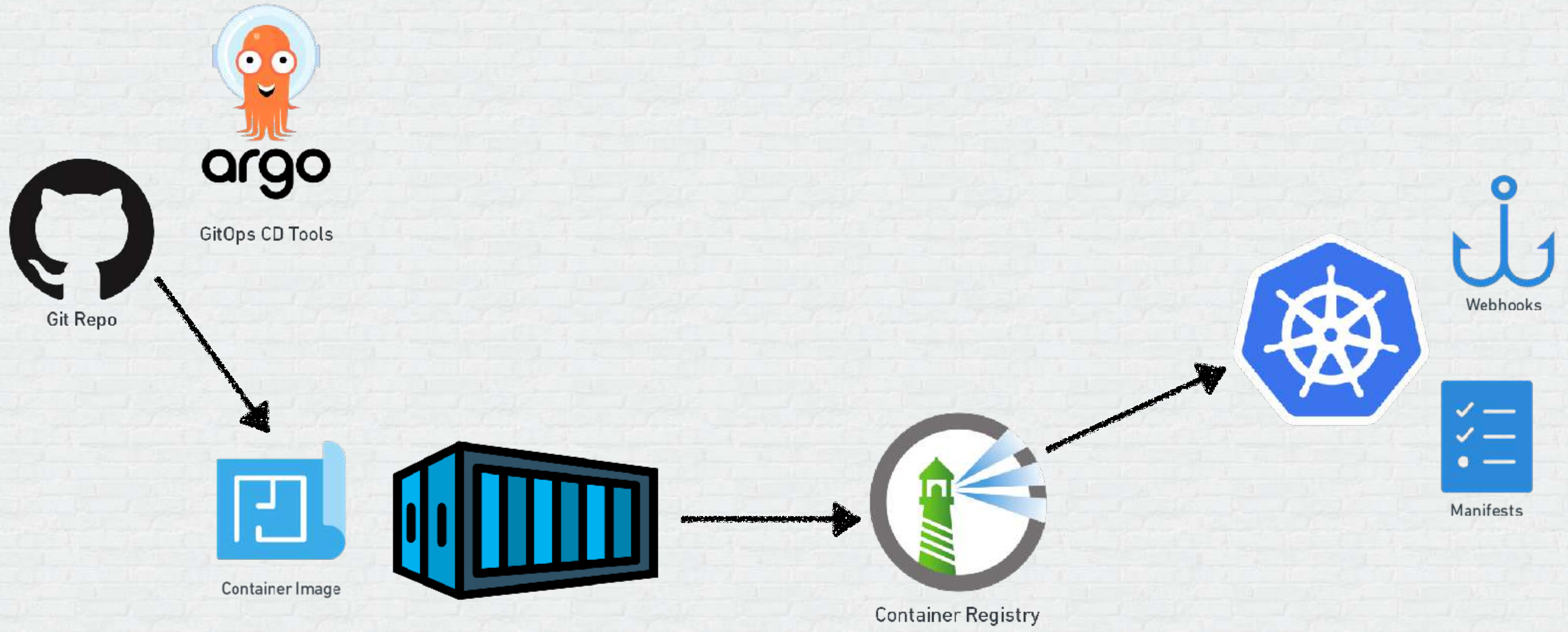
Typical Players – Containers and K8s



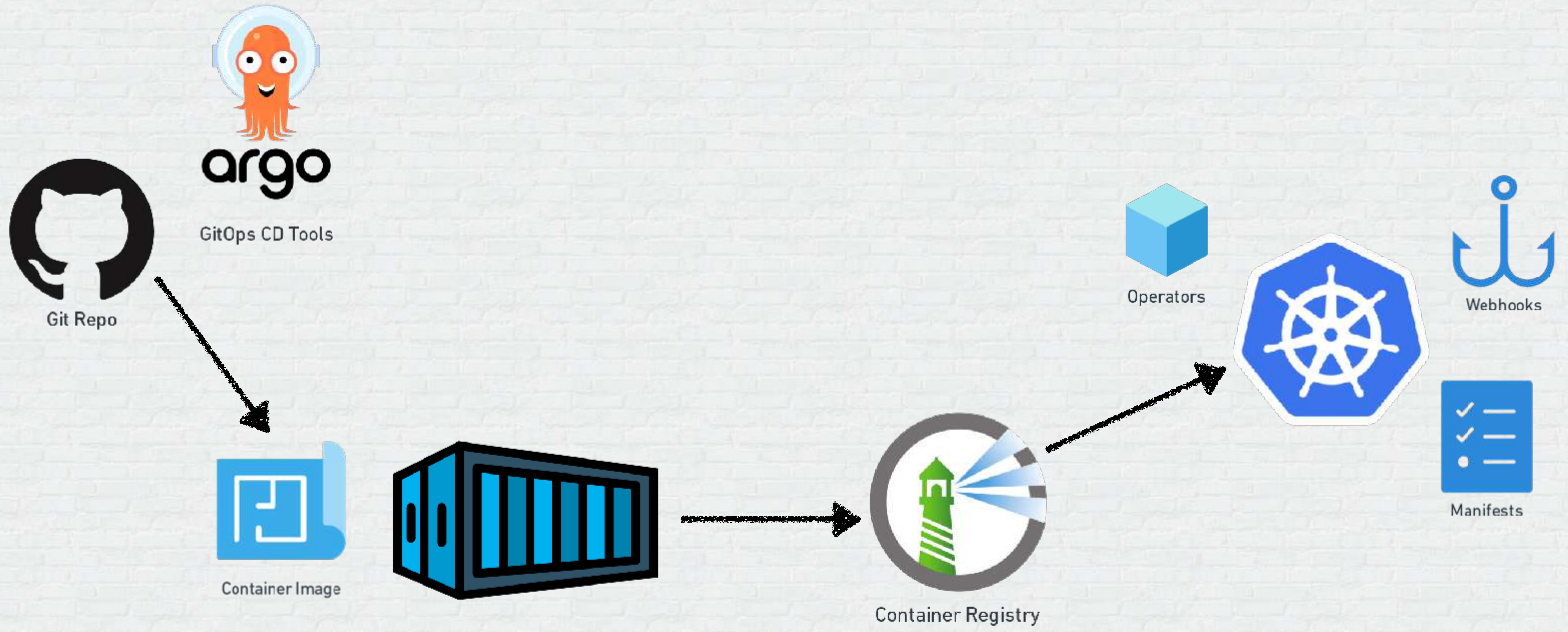
abhaybhargav

AppSecEngineer

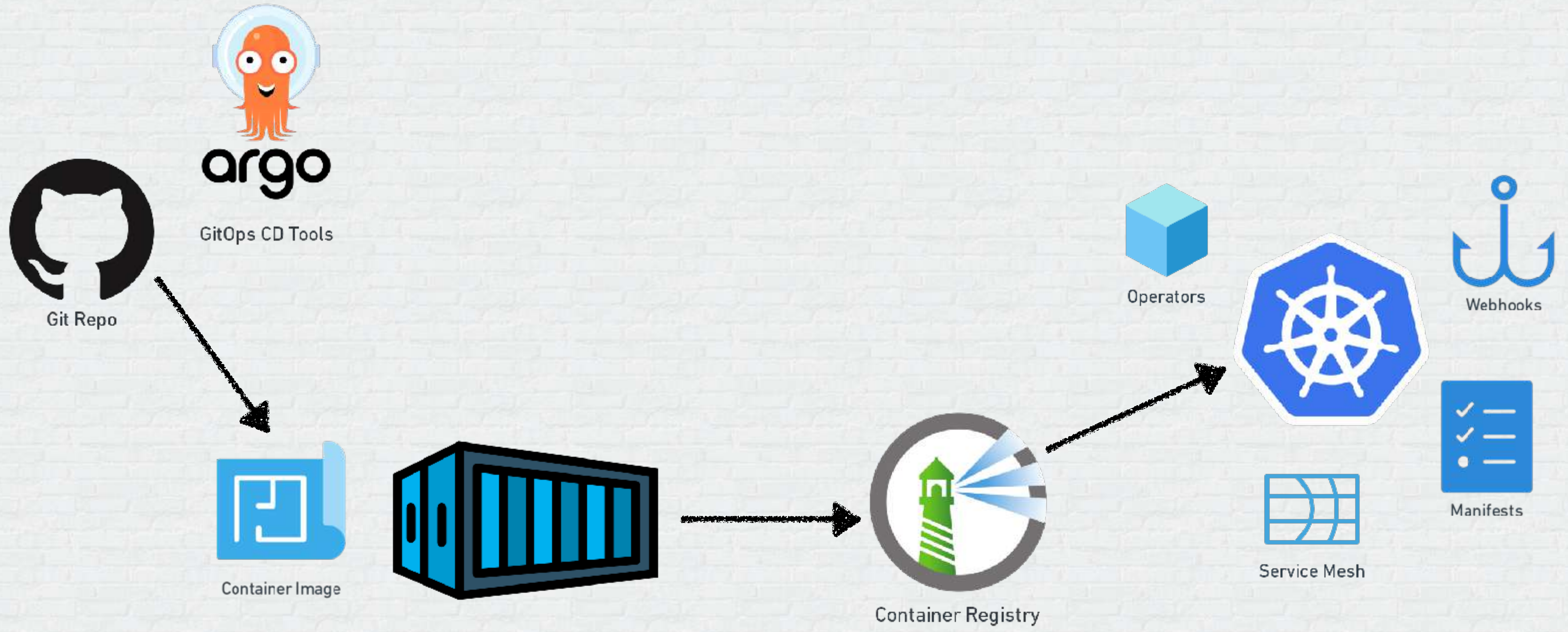
Typical Players – Containers and K8s



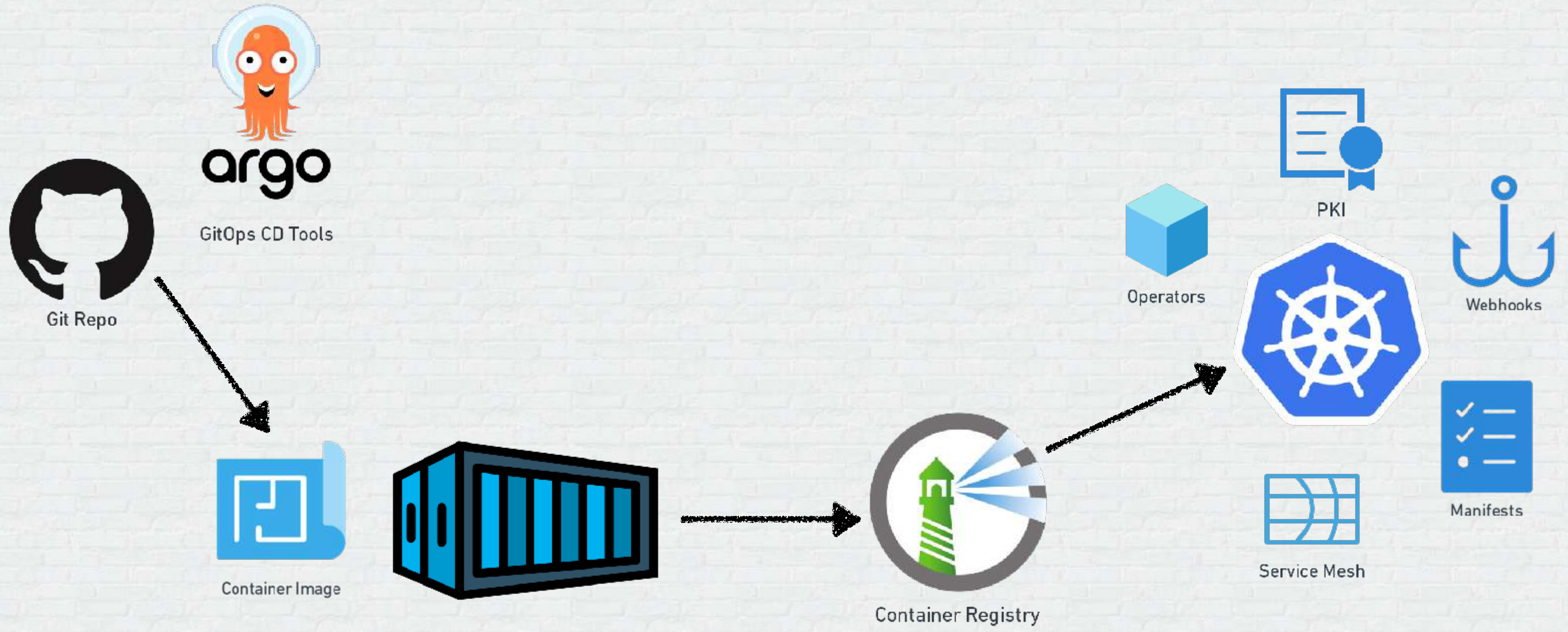
Typical Players – Containers and K8s



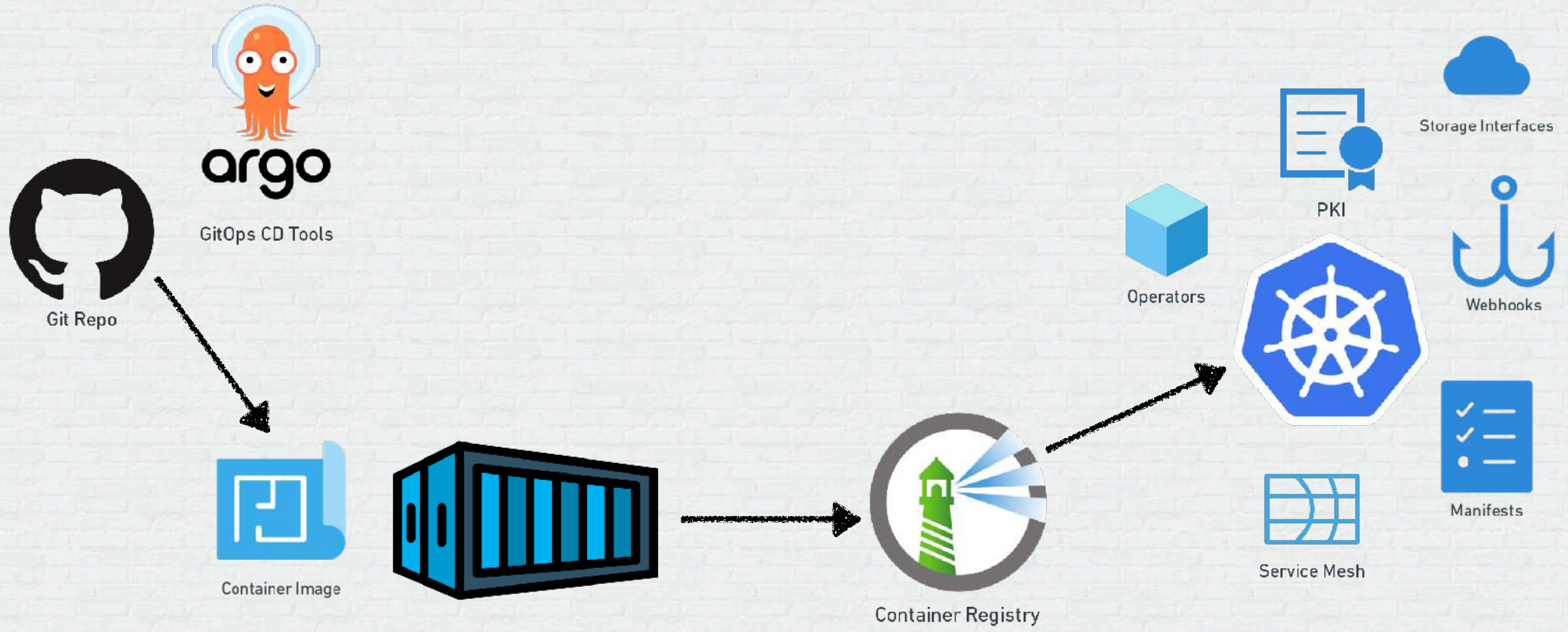
Typical Players – Containers and K8s



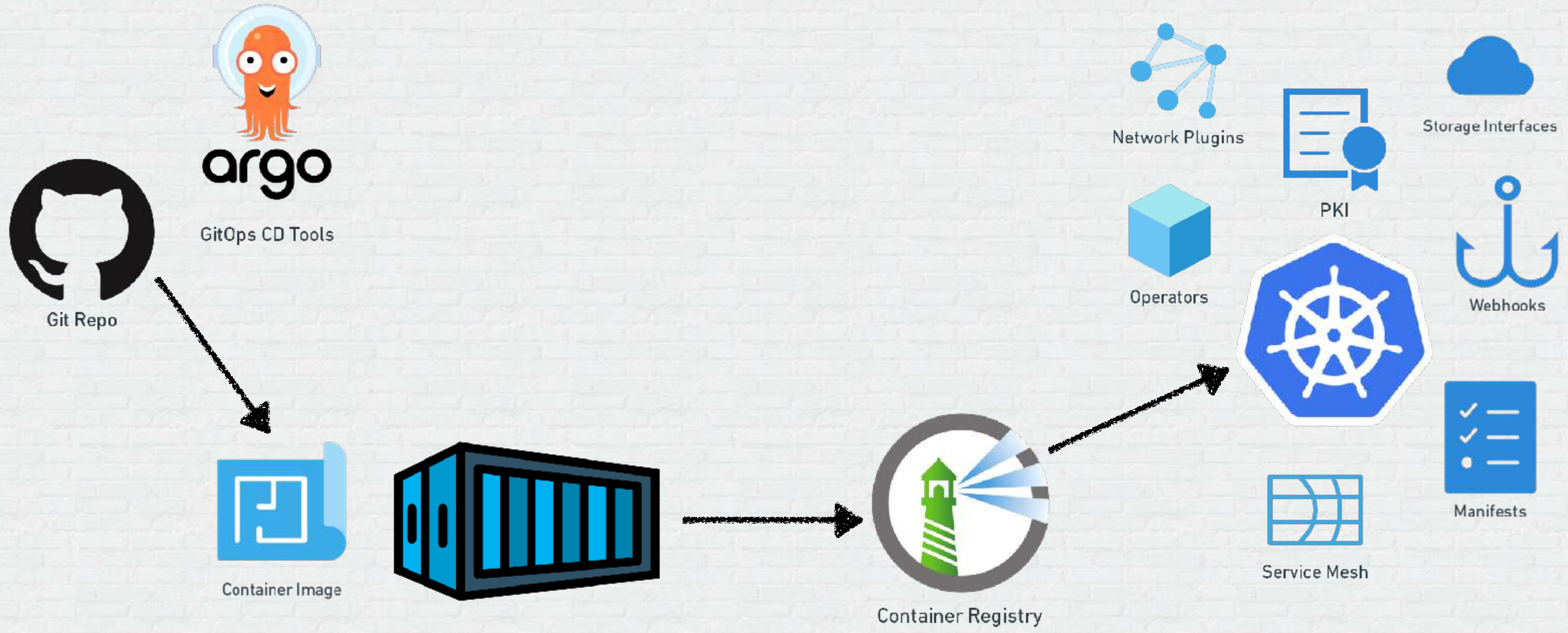
Typical Players – Containers and K8s



Typical Players – Containers and K8s



Typical Players – Containers and K8s



Container Supply-Chain Security Considerations

GitOps CD Tools

Container Supply-Chain Security Considerations

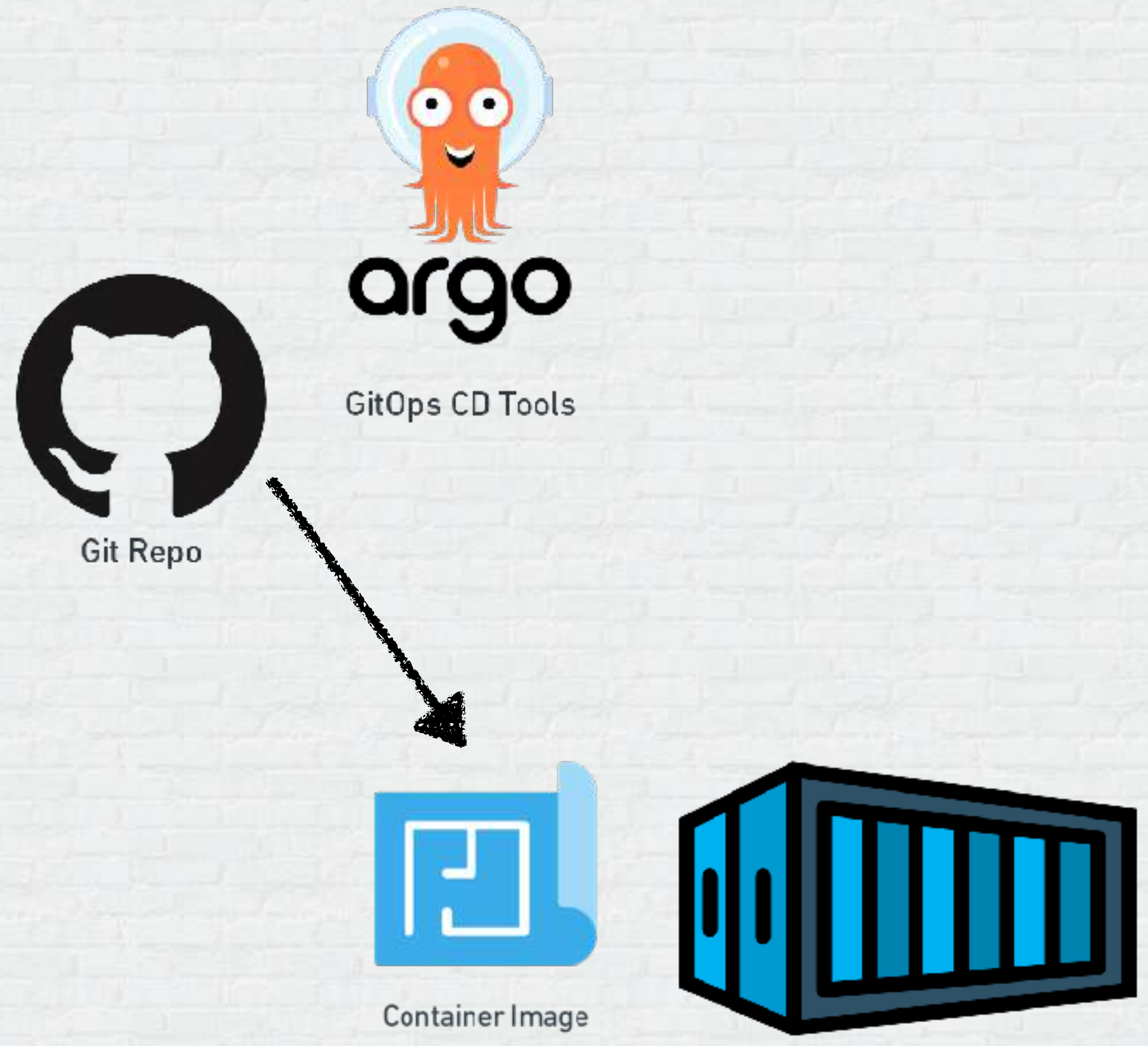
Container Supply-Chain Security Considerations

argo
GitOps CD Tools
Git Repo

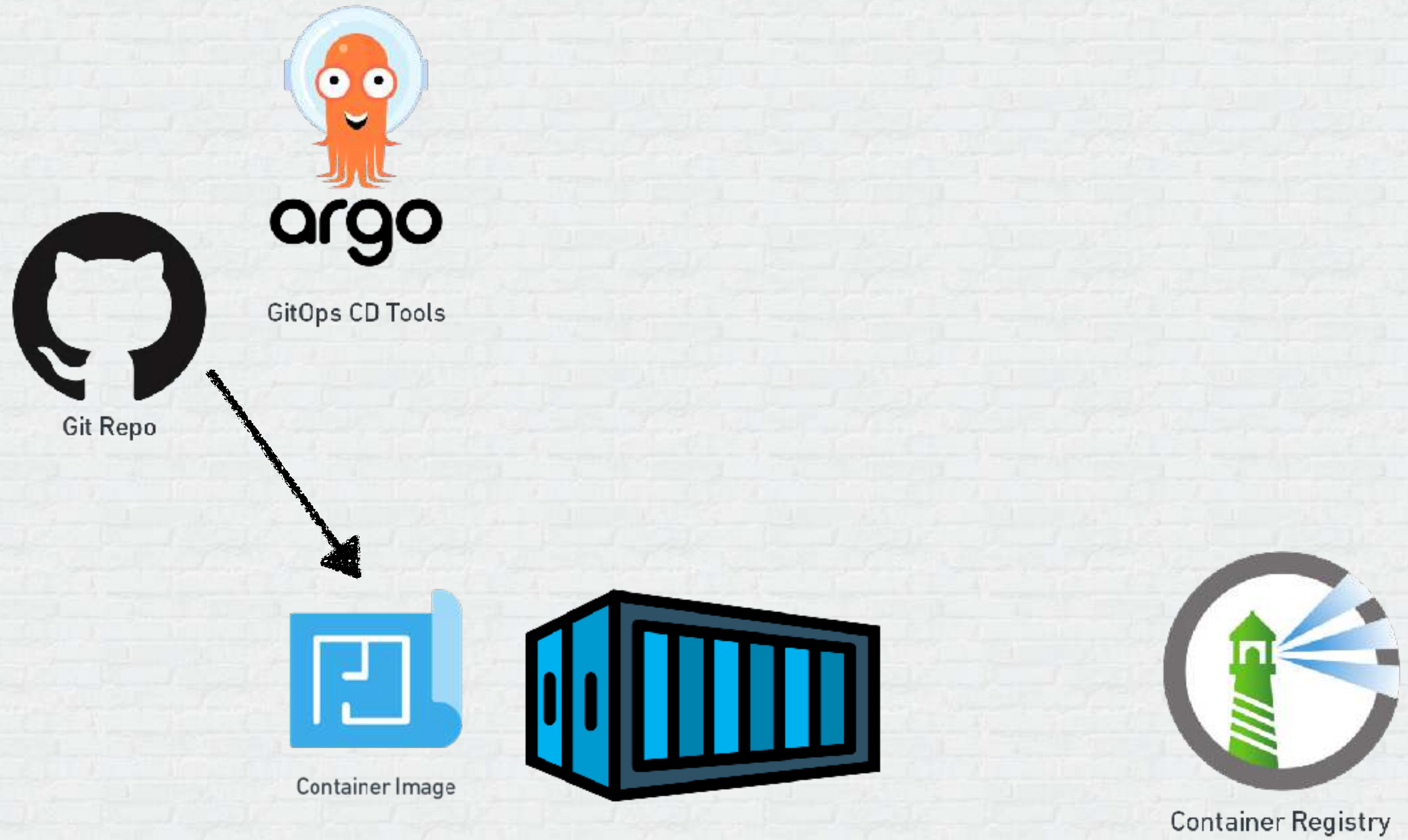
Container Supply-Chain Security Considerations

argo
GitOps CD Tools
Git Repo
Container Image

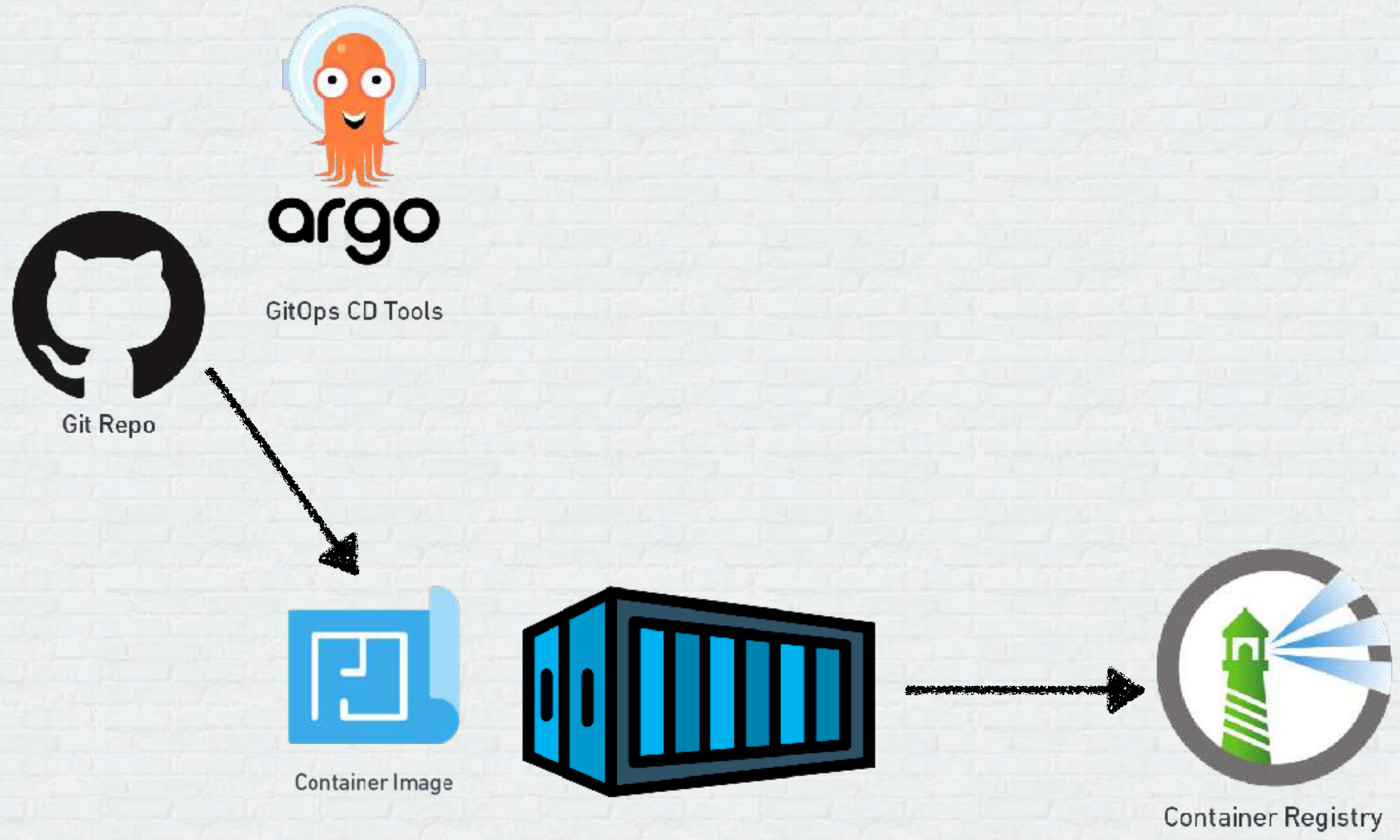
Container Supply-Chain Security Considerations



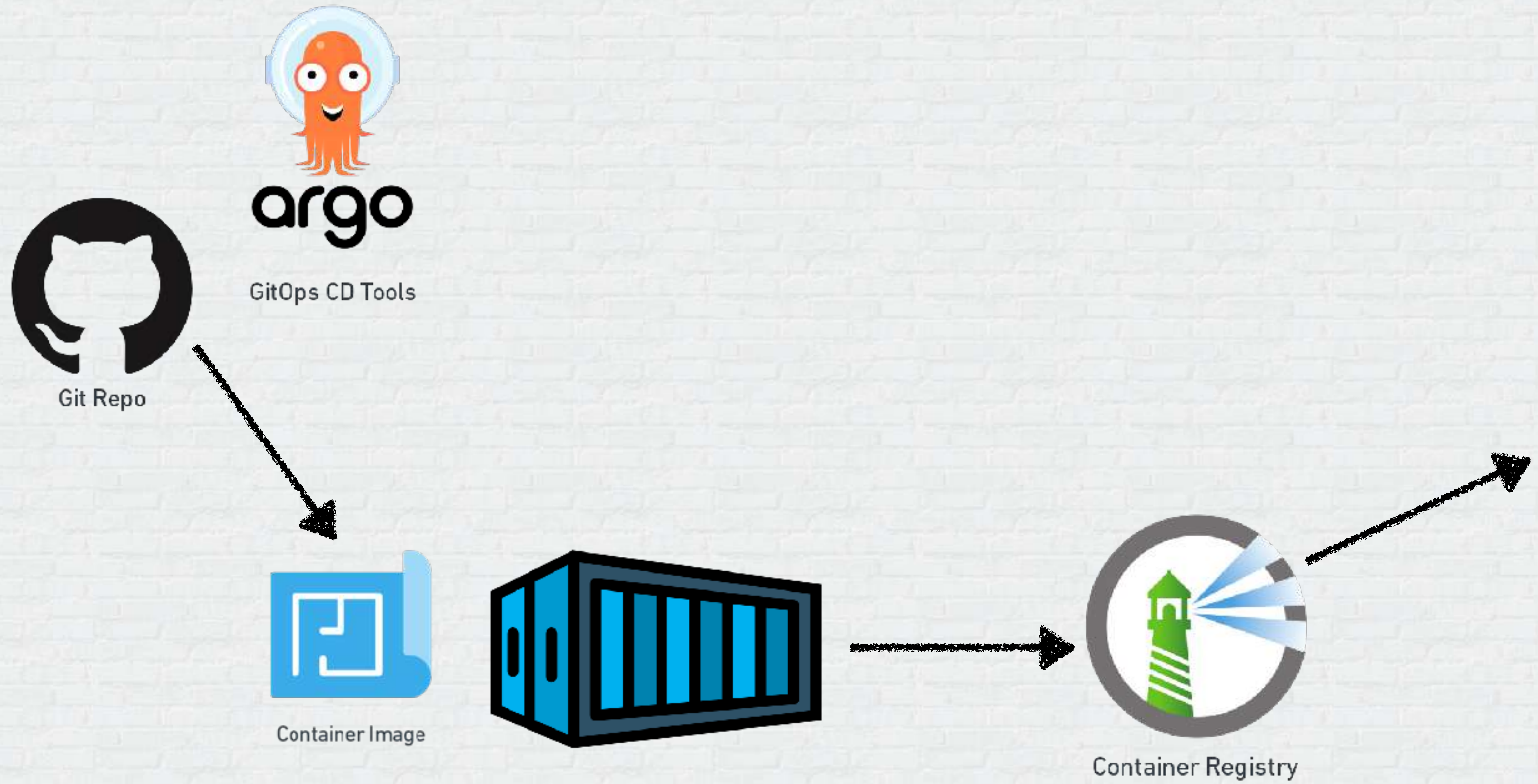
Container Supply-Chain Security Considerations



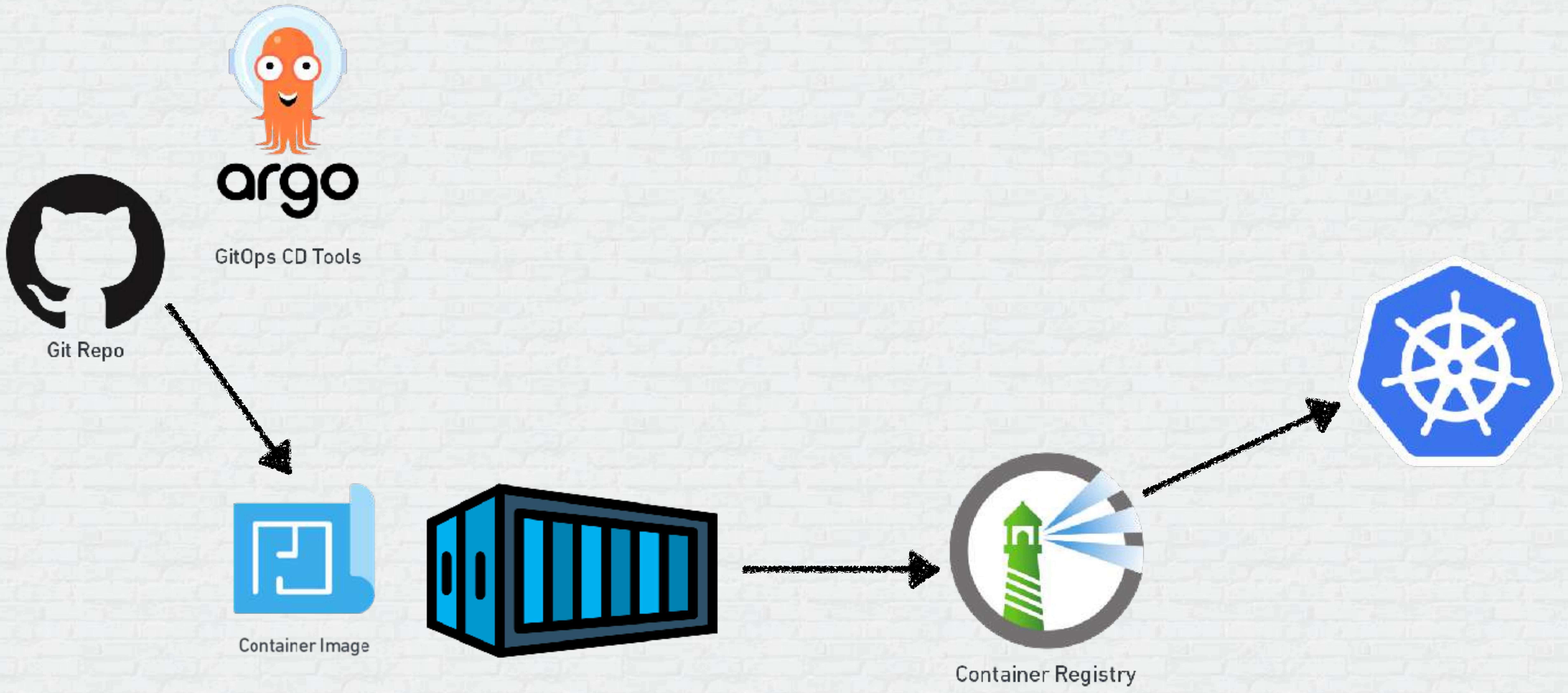
Container Supply-Chain Security Considerations



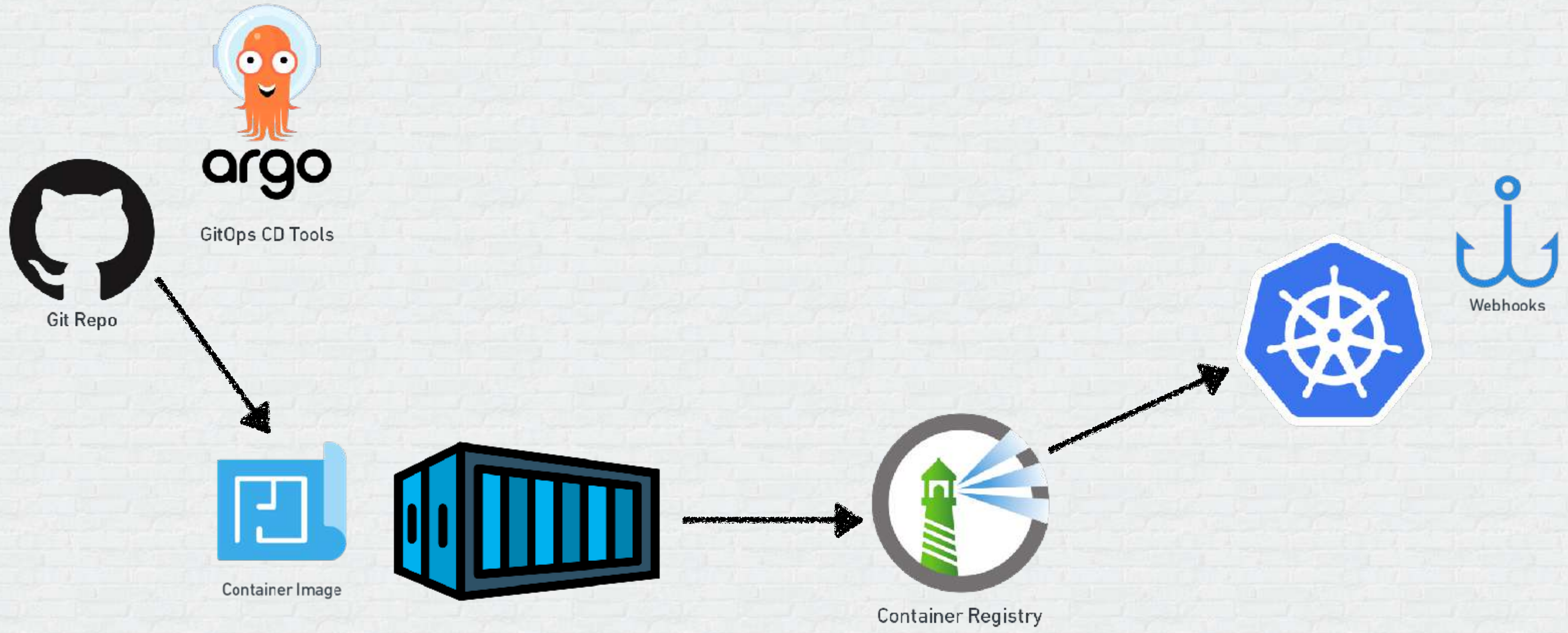
Container Supply-Chain Security Considerations



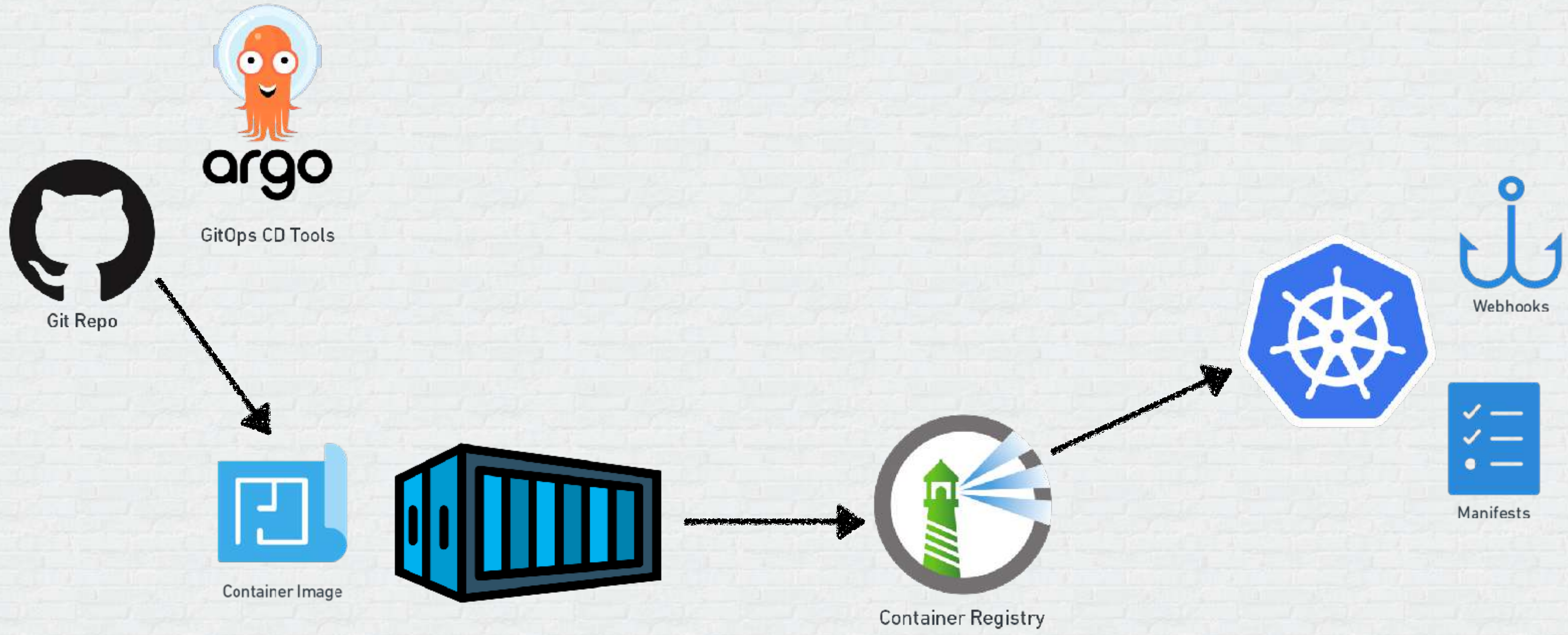
Container Supply-Chain Security Considerations



Container Supply-Chain Security Considerations



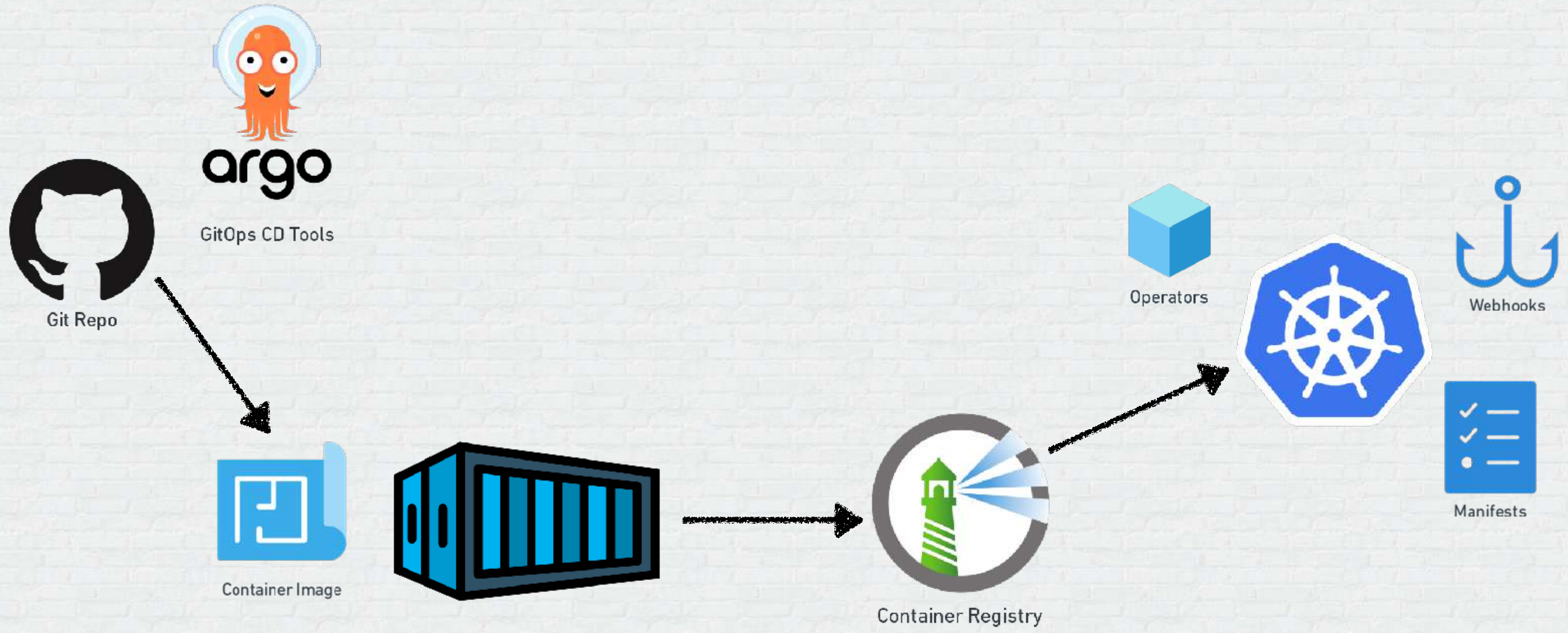
Container Supply-Chain Security Considerations



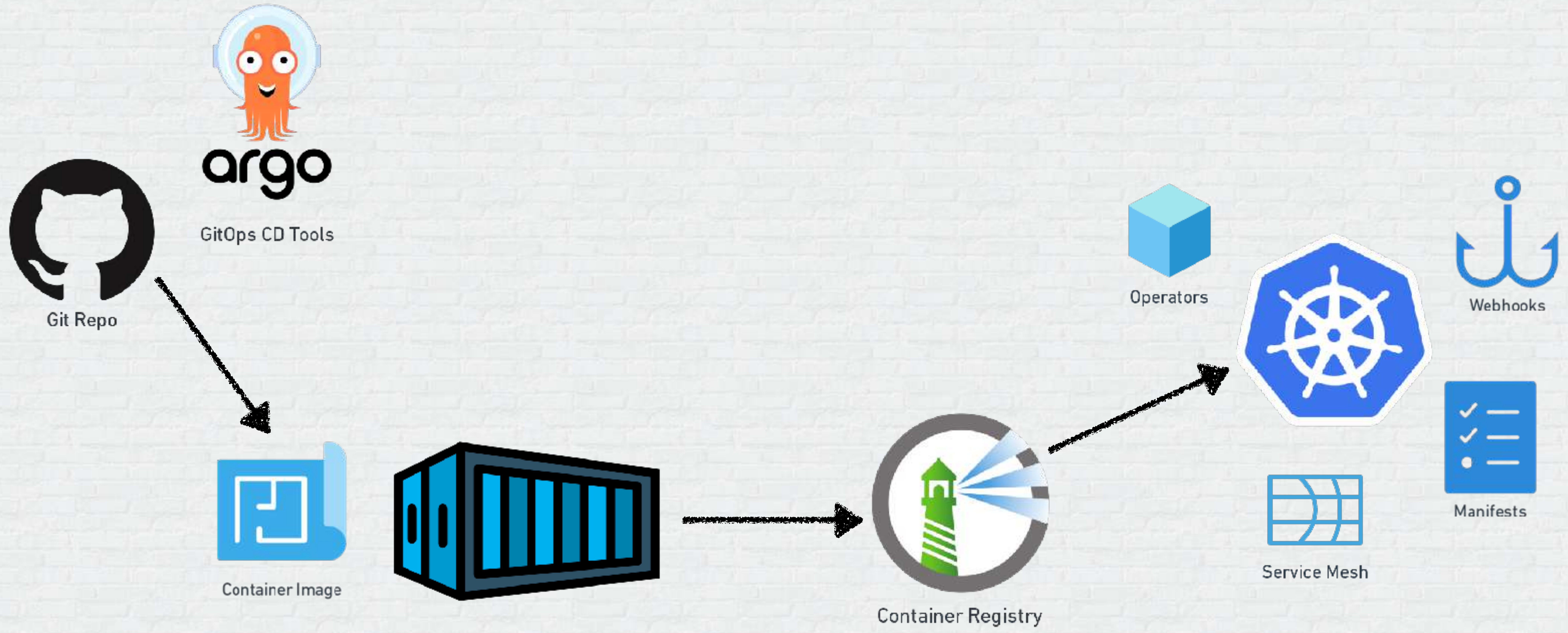
@abhaybhargav

@AppSecEngineer

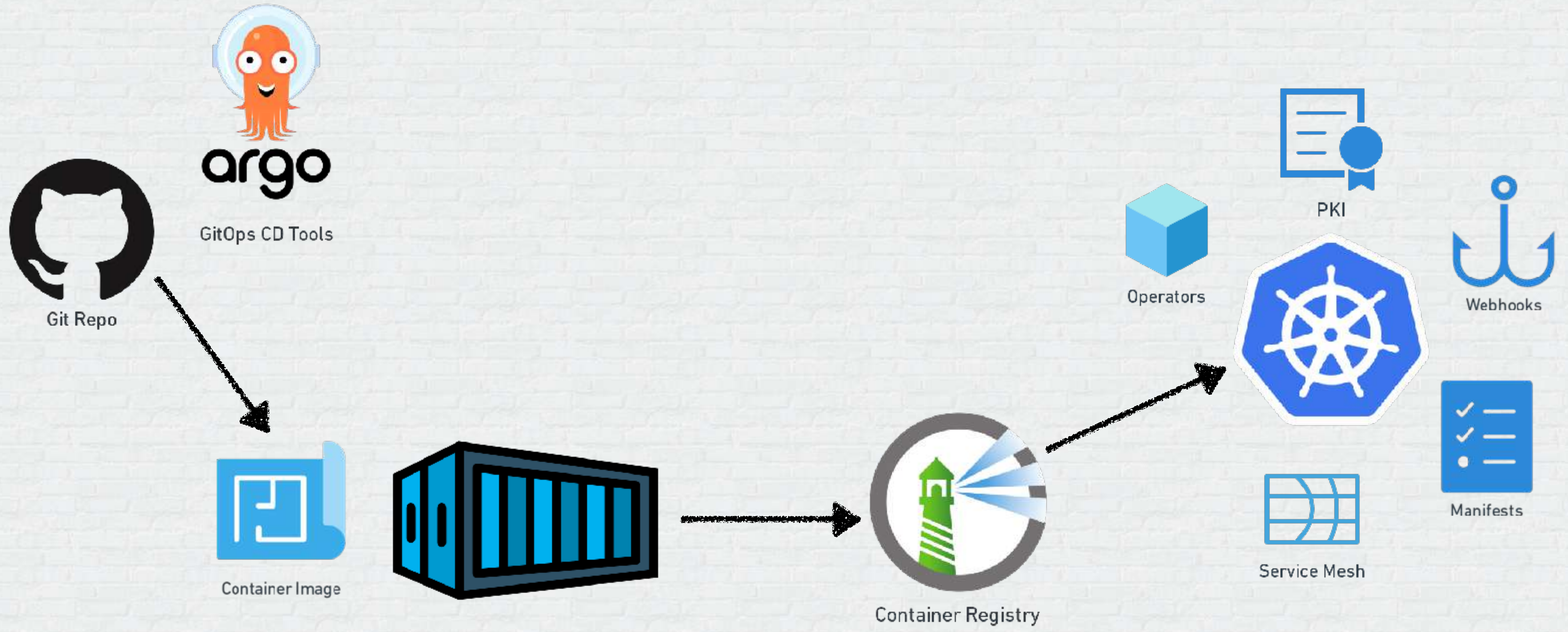
Container Supply-Chain Security Considerations



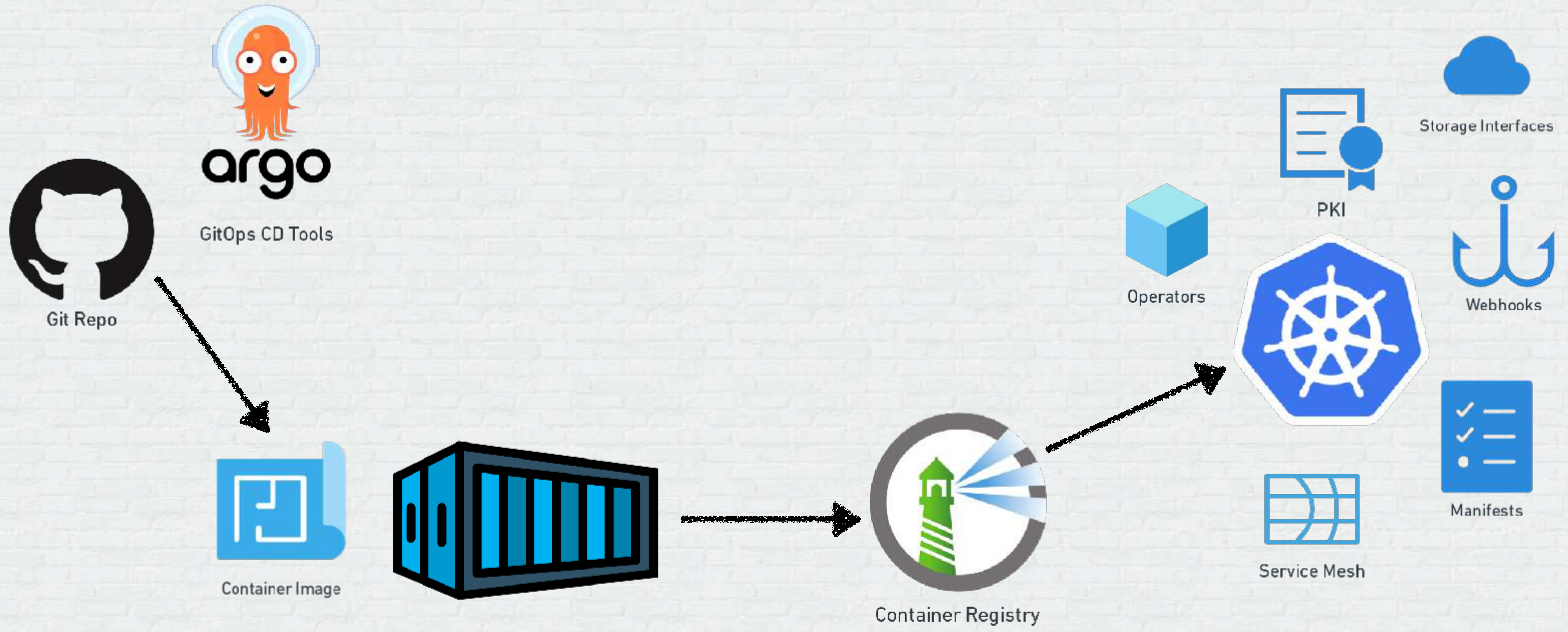
Container Supply-Chain Security Considerations



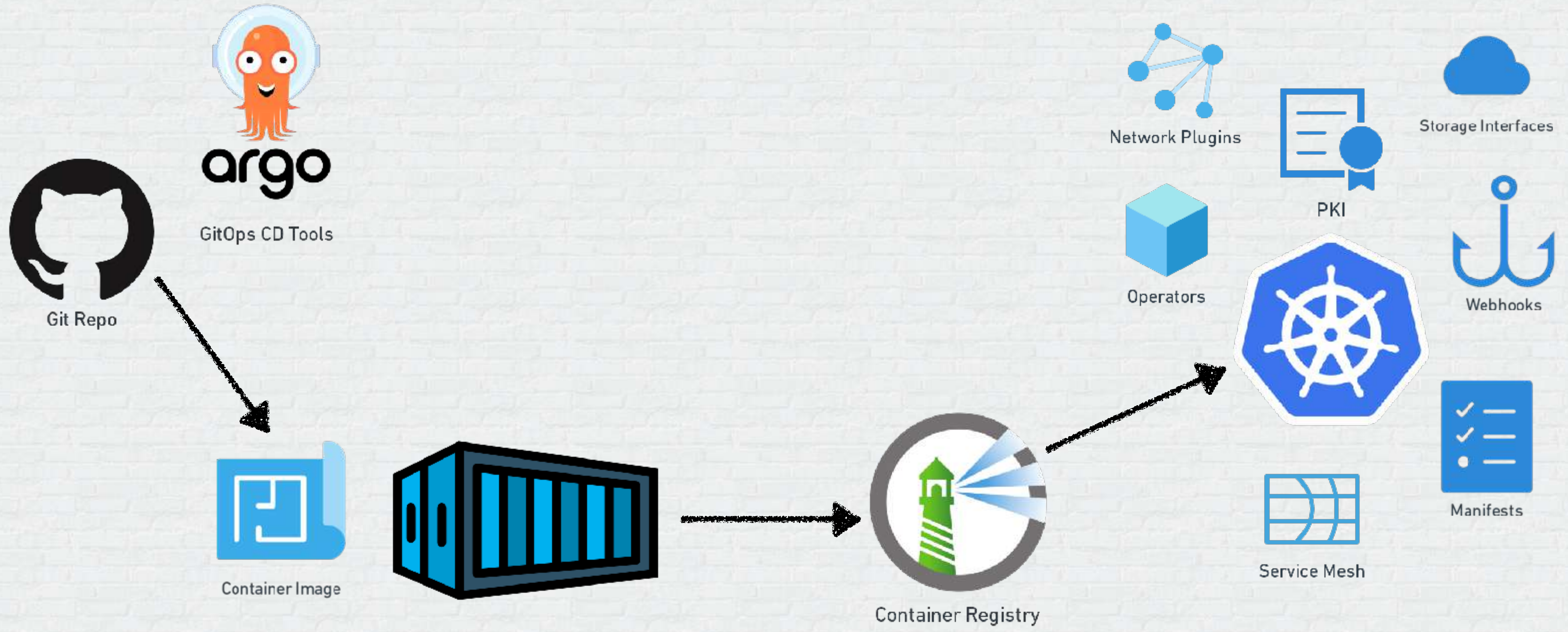
Container Supply-Chain Security Considerations



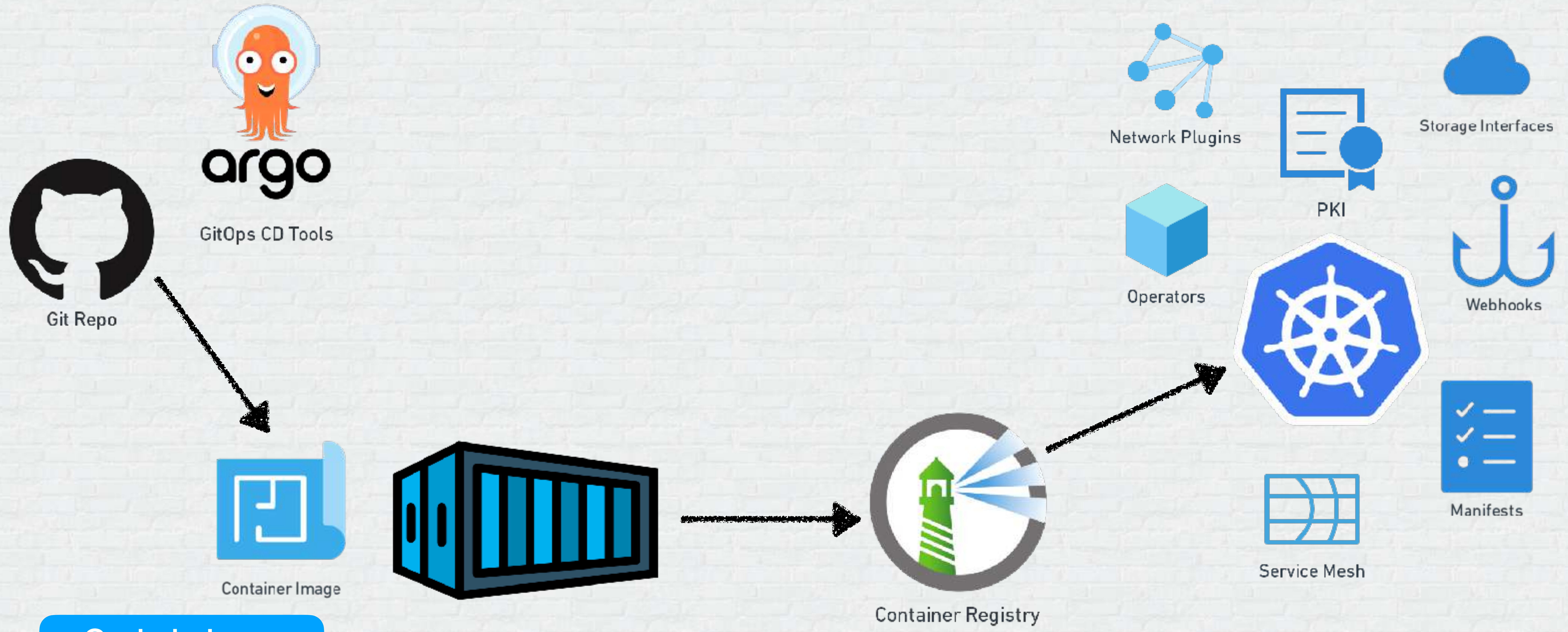
Container Supply-Chain Security Considerations



Container Supply-Chain Security Considerations



Container Supply-Chain Security Considerations

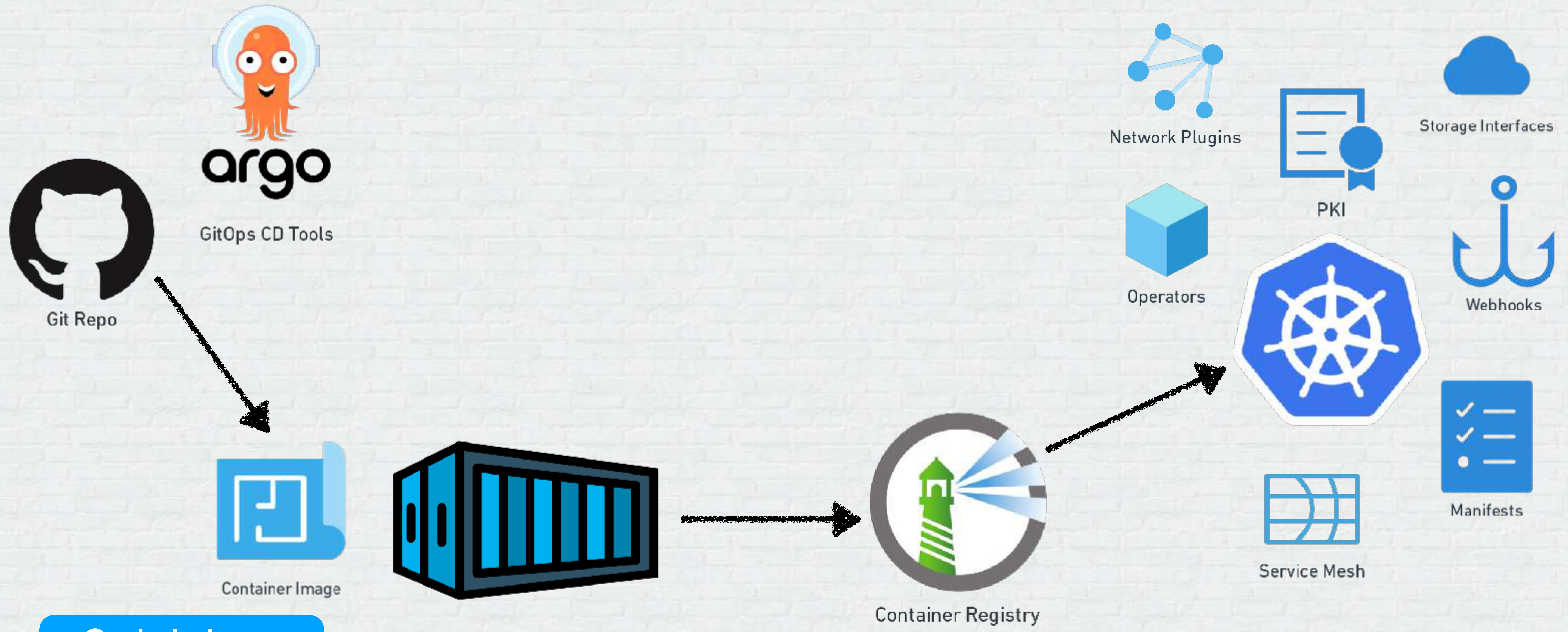


- Code in layers

ab

AppSecEngineer

Container Supply-Chain Security Considerations

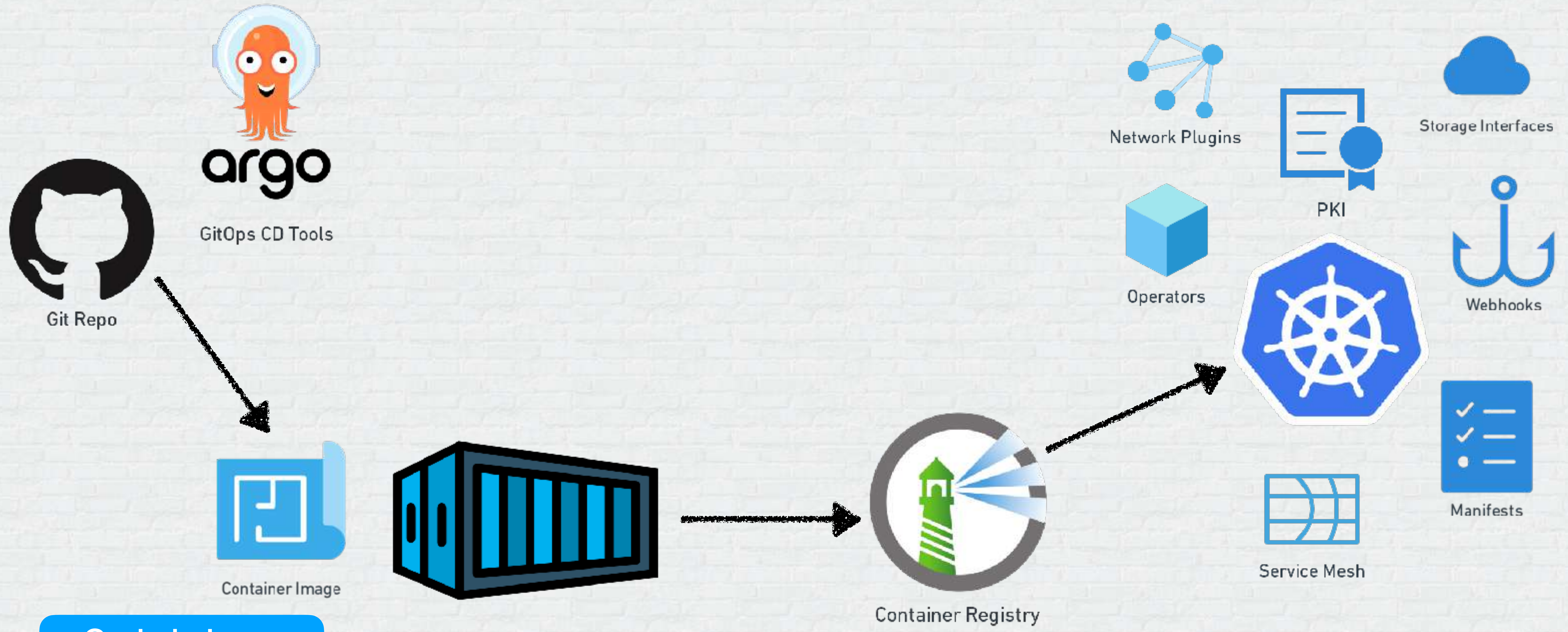


- Code in layers
- Base Image

ab

AppSecEngineer

Container Supply-Chain Security Considerations

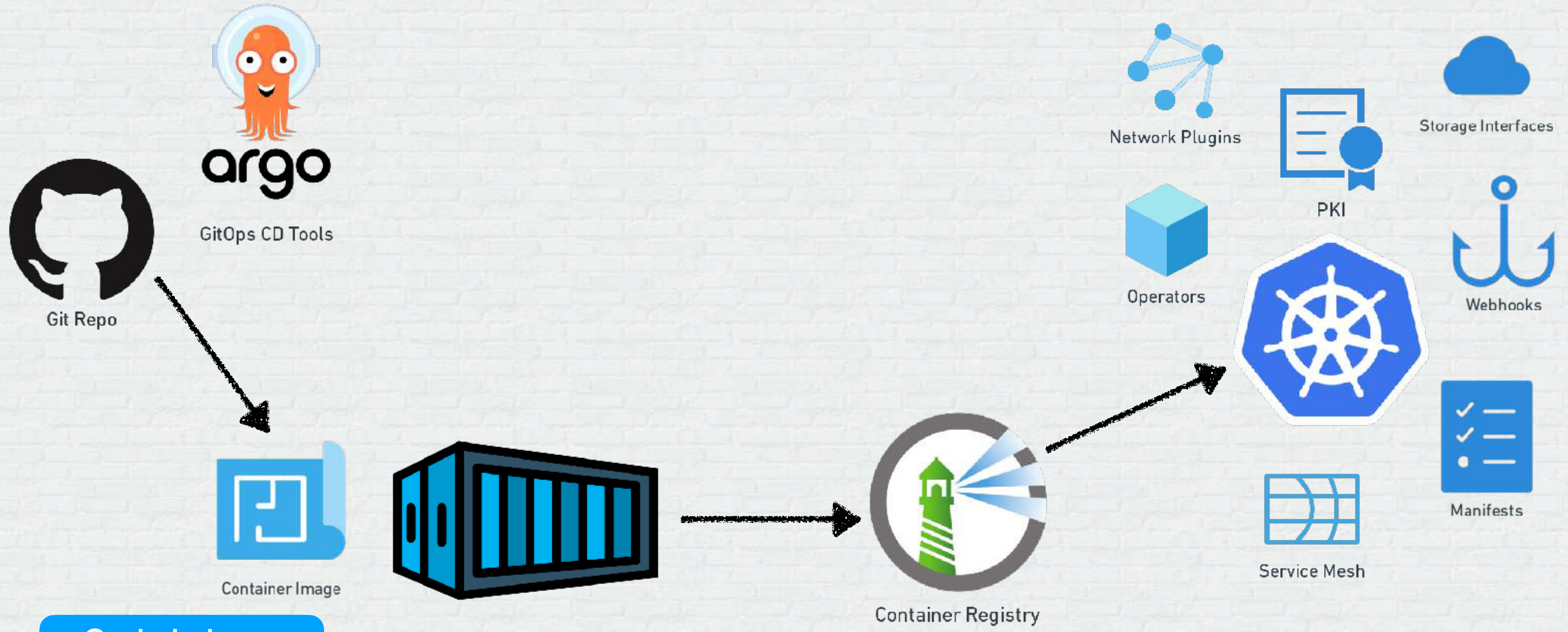


- Code in layers
- Base Image
- Secrets

ab

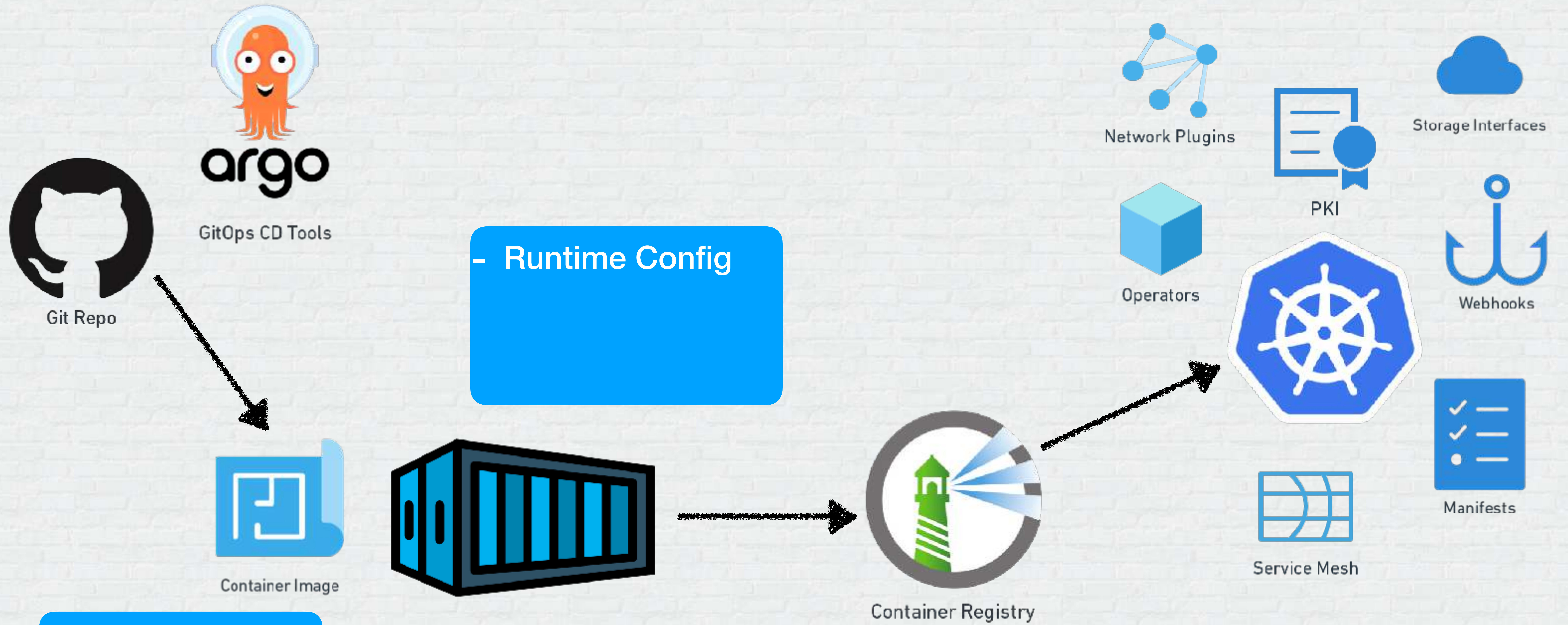
AppSecEngineer

Container Supply-Chain Security Considerations



- Code in layers
- Base Image
- Secrets
- AuthN

Container Supply-Chain Security Considerations



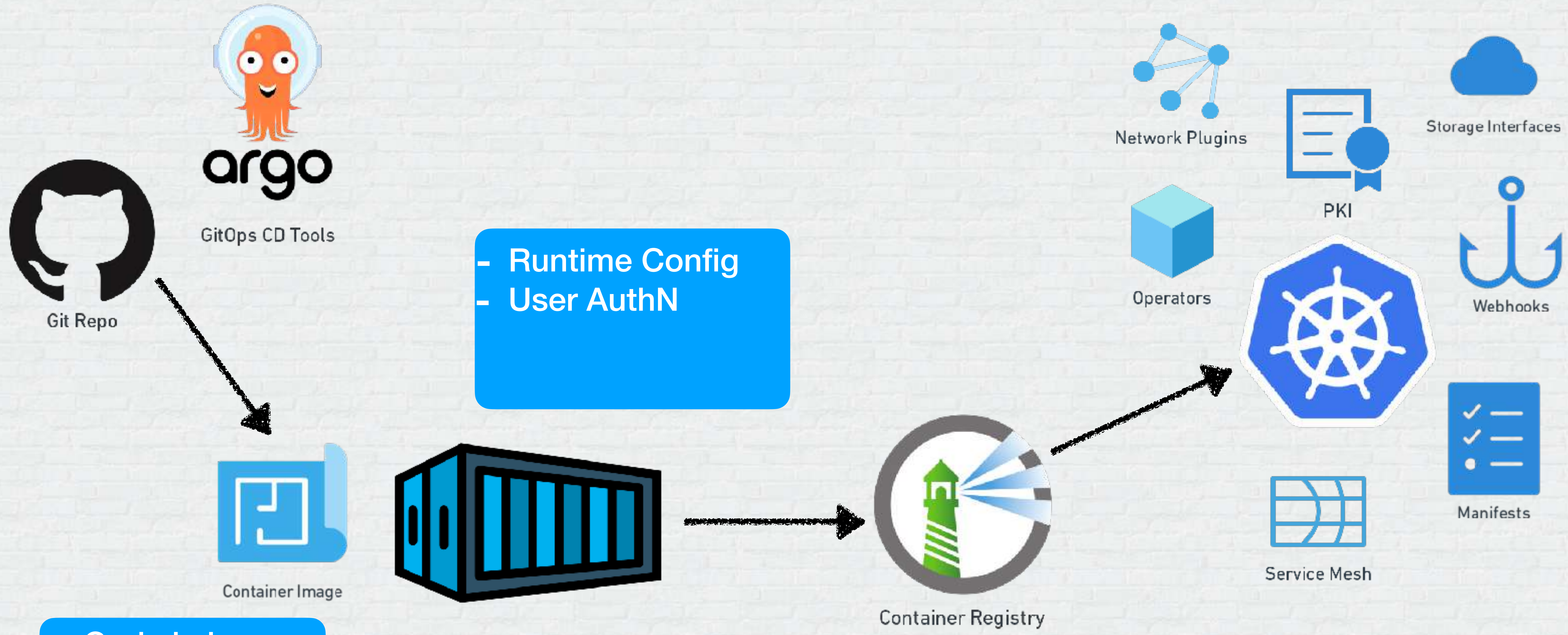
- Runtime Config

- Code in layers
- Base Image
- Secrets
- AuthN

ab

AppSecEngineer

Container Supply-Chain Security Considerations



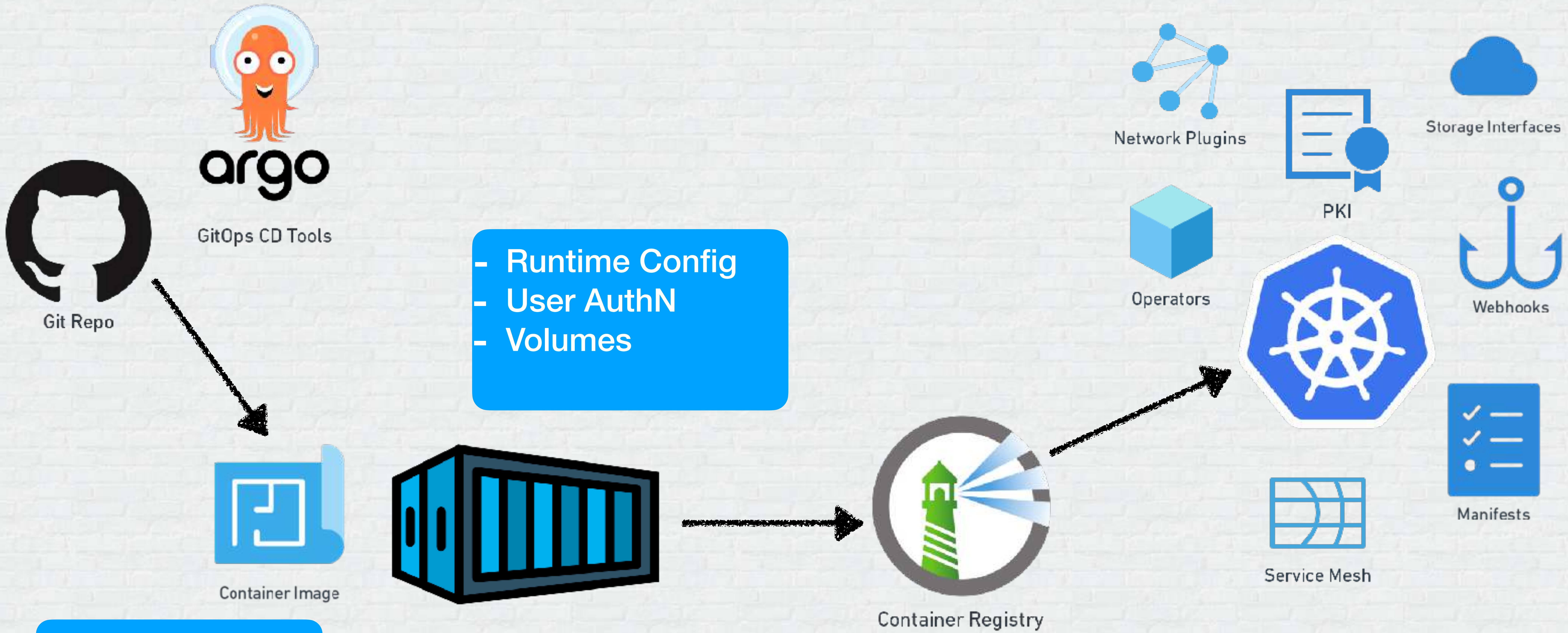
- Runtime Config
- User AuthN

- Code in layers
- Base Image
- Secrets
- AuthN

ab

AppSecEngineer

Container Supply-Chain Security Considerations



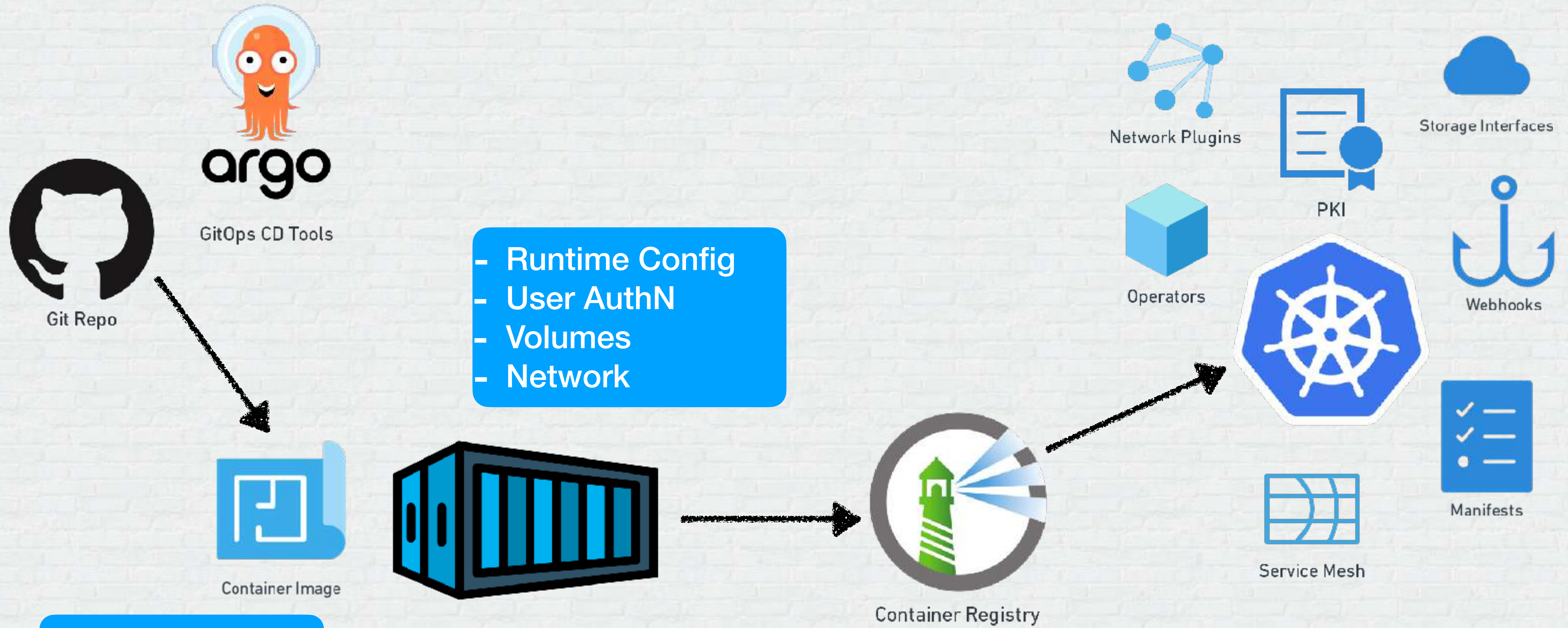
- Runtime Config
- User AuthN
- Volumes

- Code in layers
- Base Image
- Secrets
- AuthN

ab

AppSecEngineer

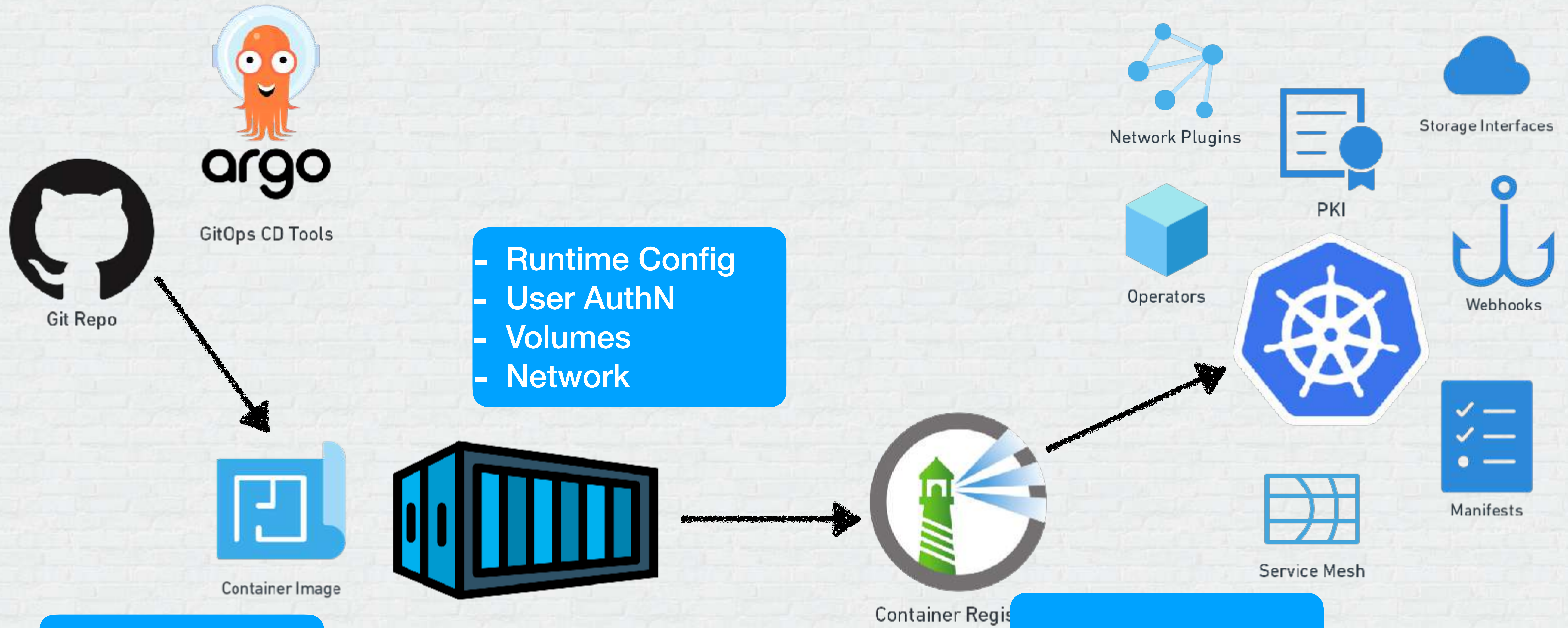
Container Supply-Chain Security Considerations



- Runtime Config
- User AuthN
- Volumes
- Network

- Code in layers
- Base Image
- Secrets
- AuthN

Container Supply-Chain Security Considerations

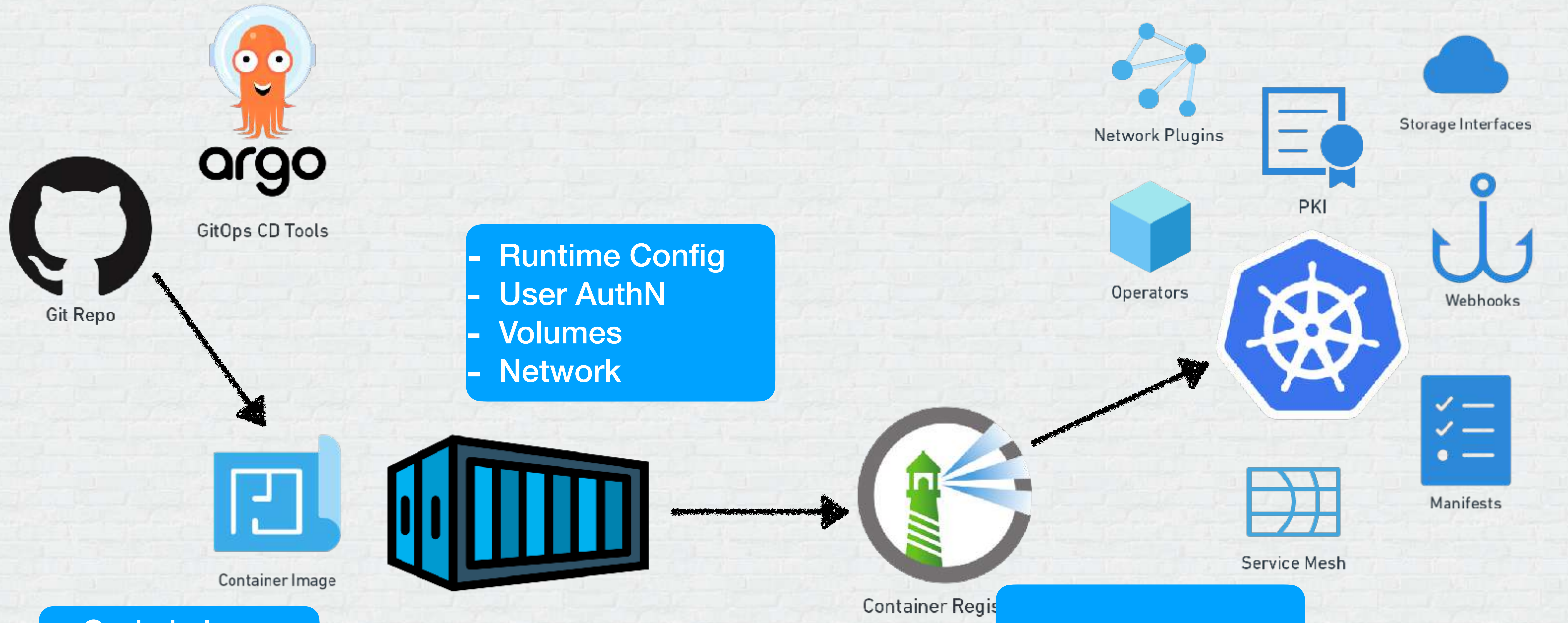


- Runtime Config
- User AuthN
- Volumes
- Network

- Code in layers
- Base Image
- Secrets
- AuthN

- AuthN

Container Supply-Chain Security Considerations

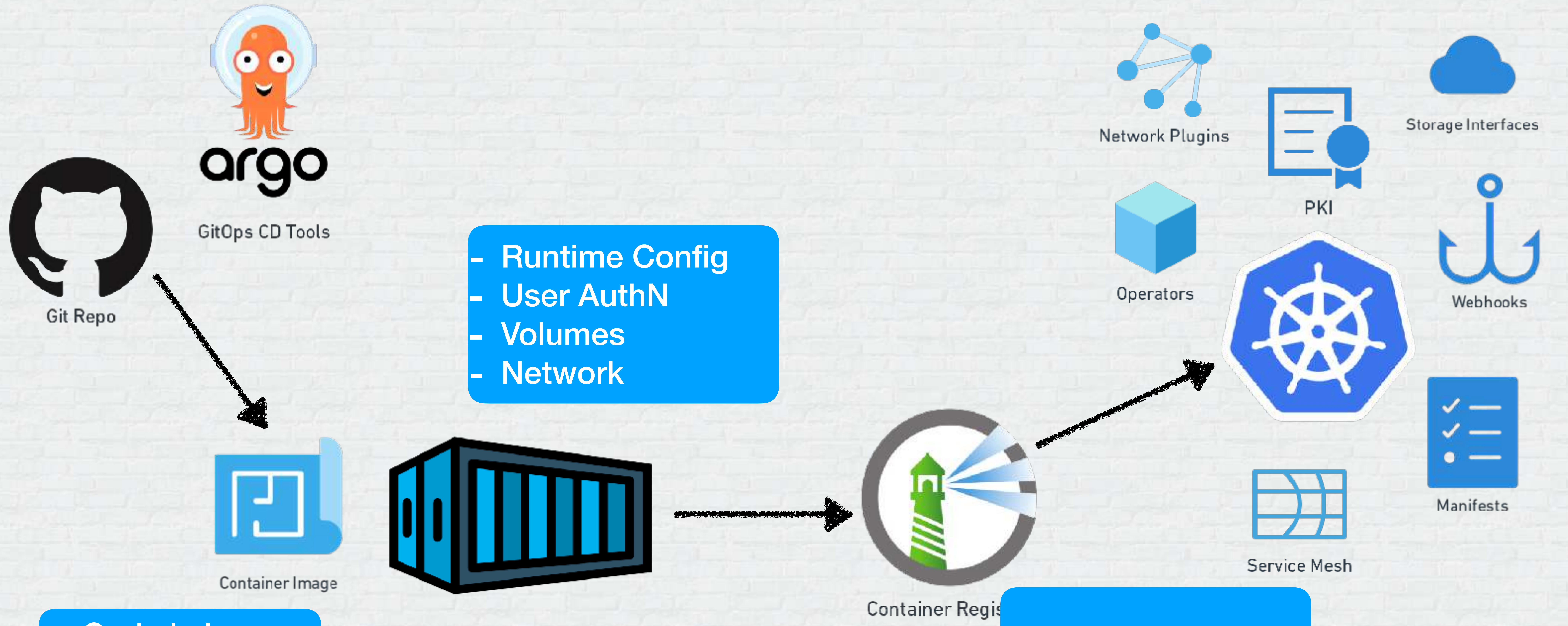


- Runtime Config
- User AuthN
- Volumes
- Network

- Code in layers
- Base Image
- Secrets
- AuthN

- AuthN
- AuthZ

Container Supply-Chain Security Considerations



- Runtime Config
- User AuthN
- Volumes
- Network

- Code in layers
- Base Image
- Secrets
- AuthN

- AuthN
- AuthZ
- Tag Security

ab

AppSecEngineer

$1 Tour of Kubernetes Admission Controllers

abhaybhargav

AppSecEngineer

Admission Control – K8s

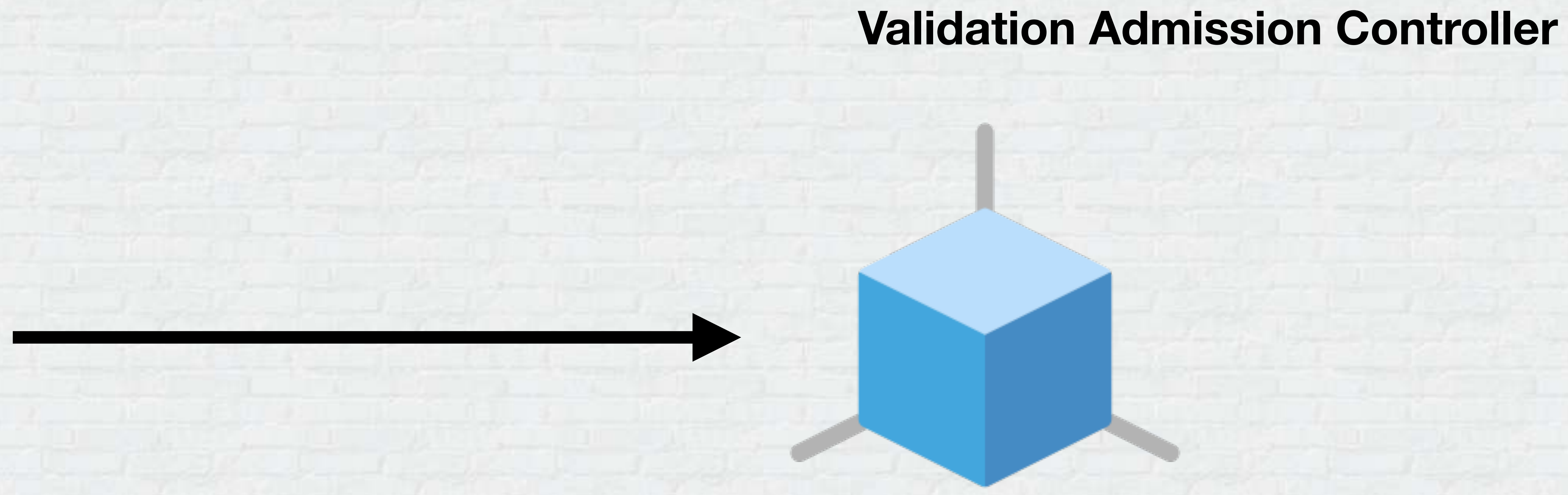
@abhaybhargav

@AppSecEngineer

Validating Web Hook

Validating Web Hook

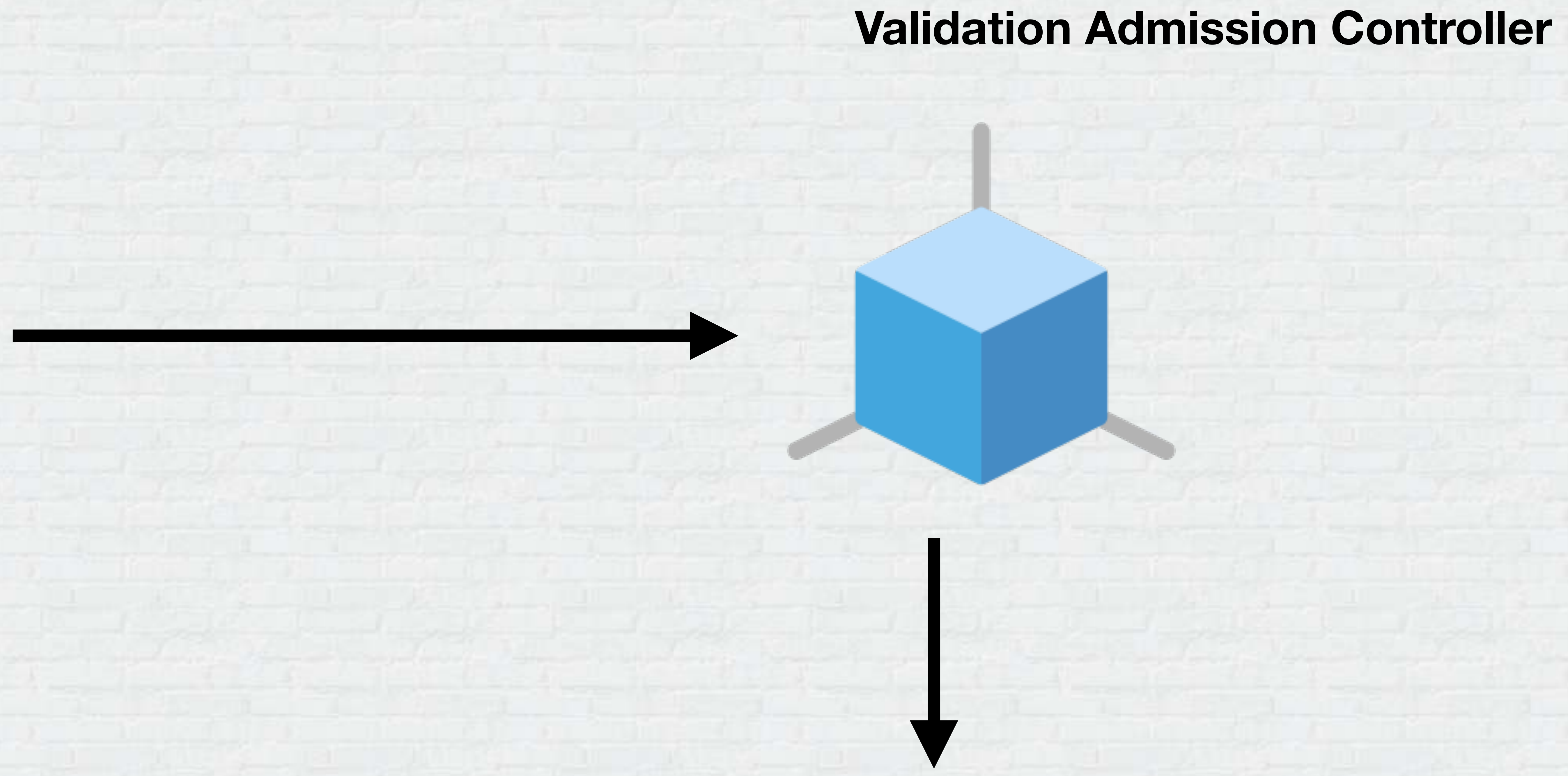
Validating Web Hook



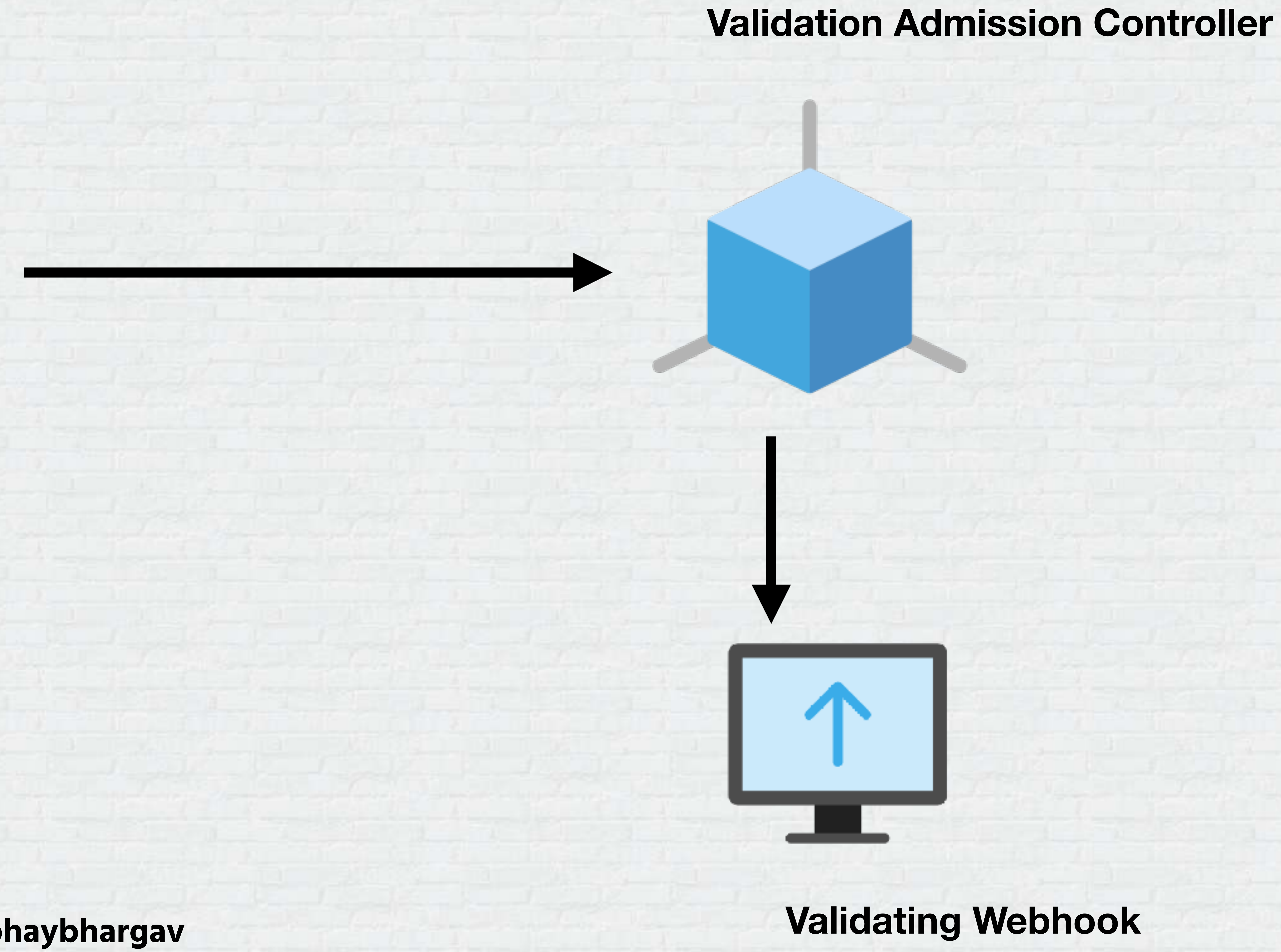
abhaybhargav

AppSecEngineer

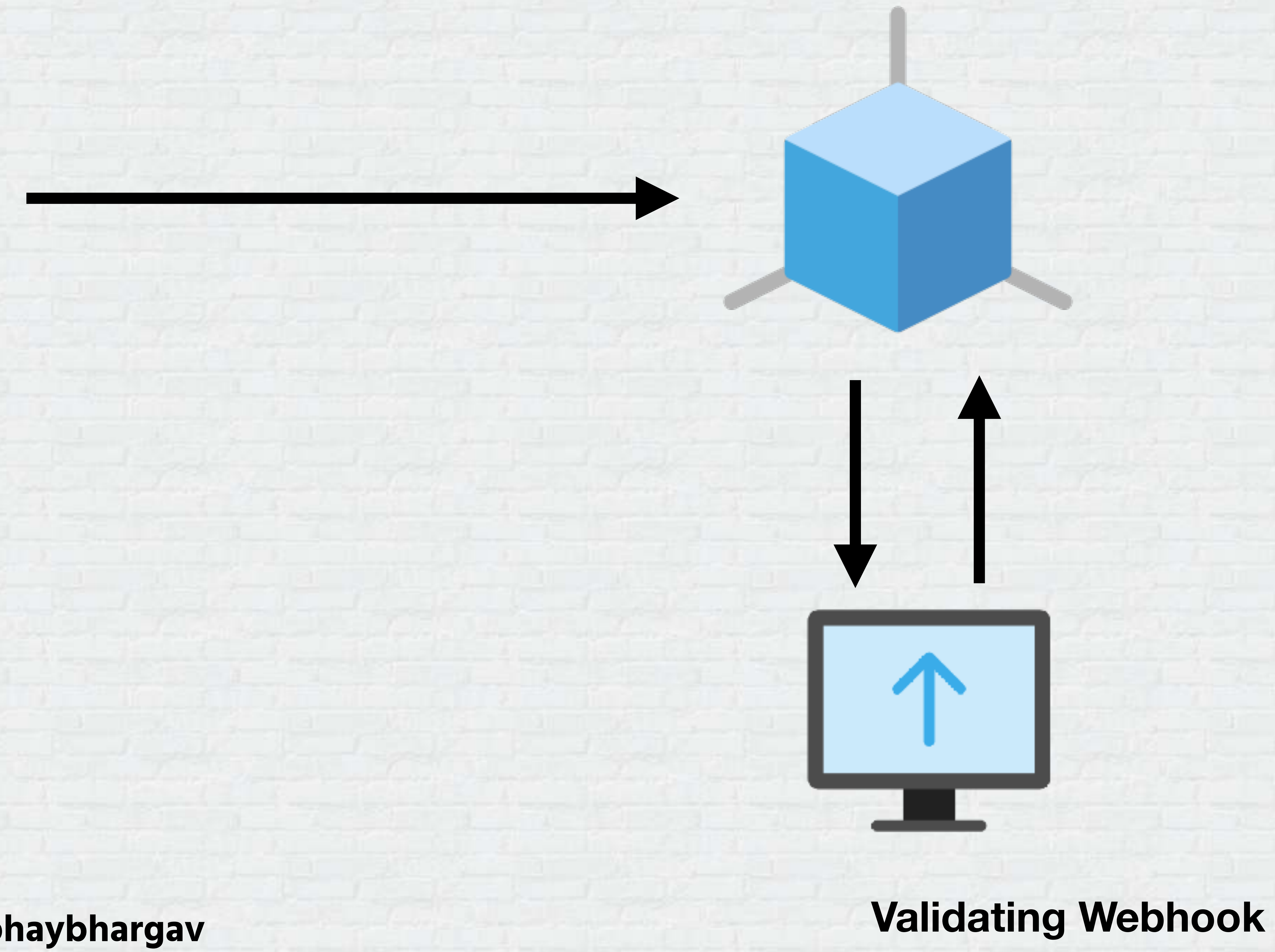
Validating Web Hook



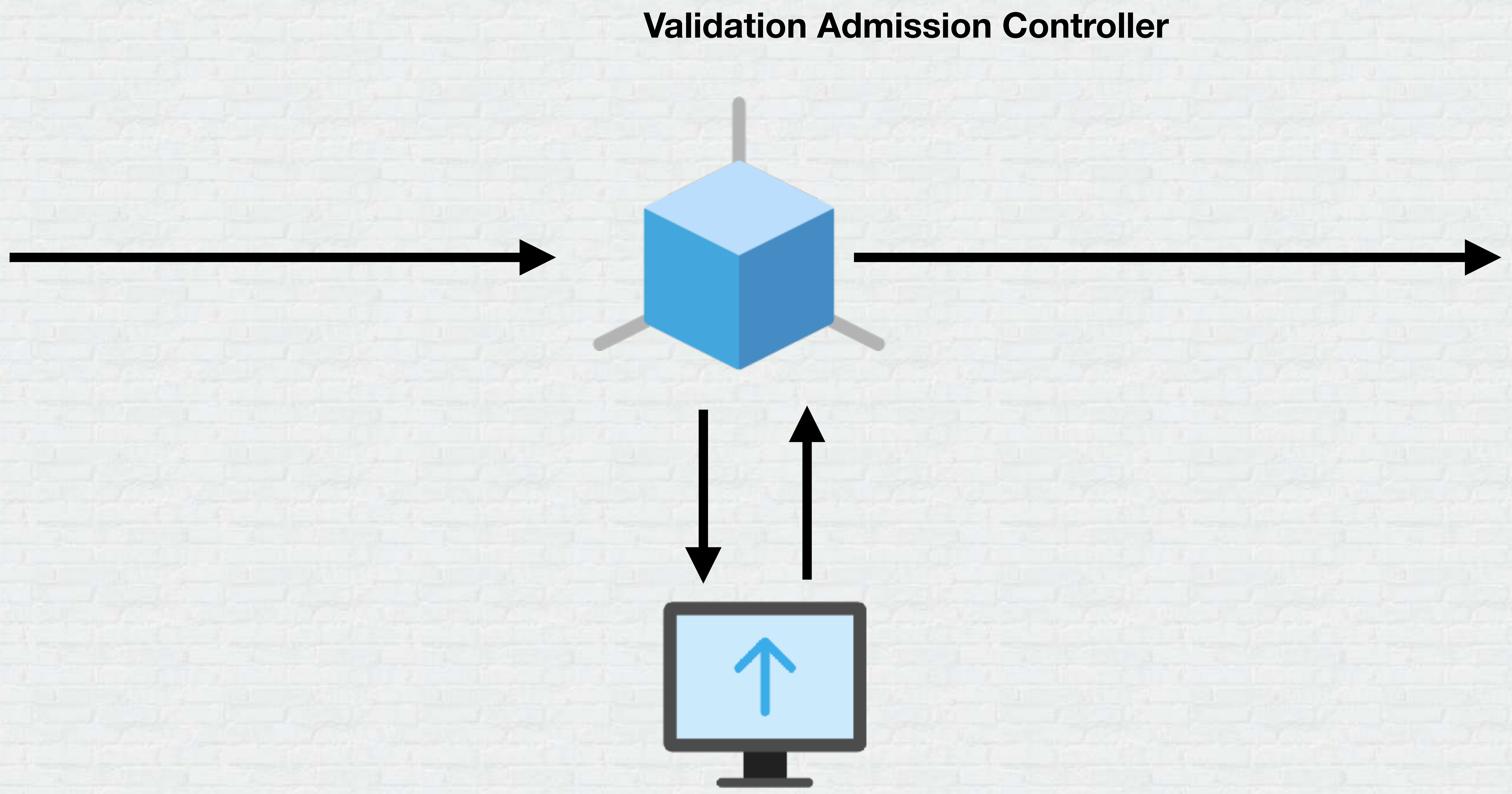
Validating Web Hook



Validating Web Hook

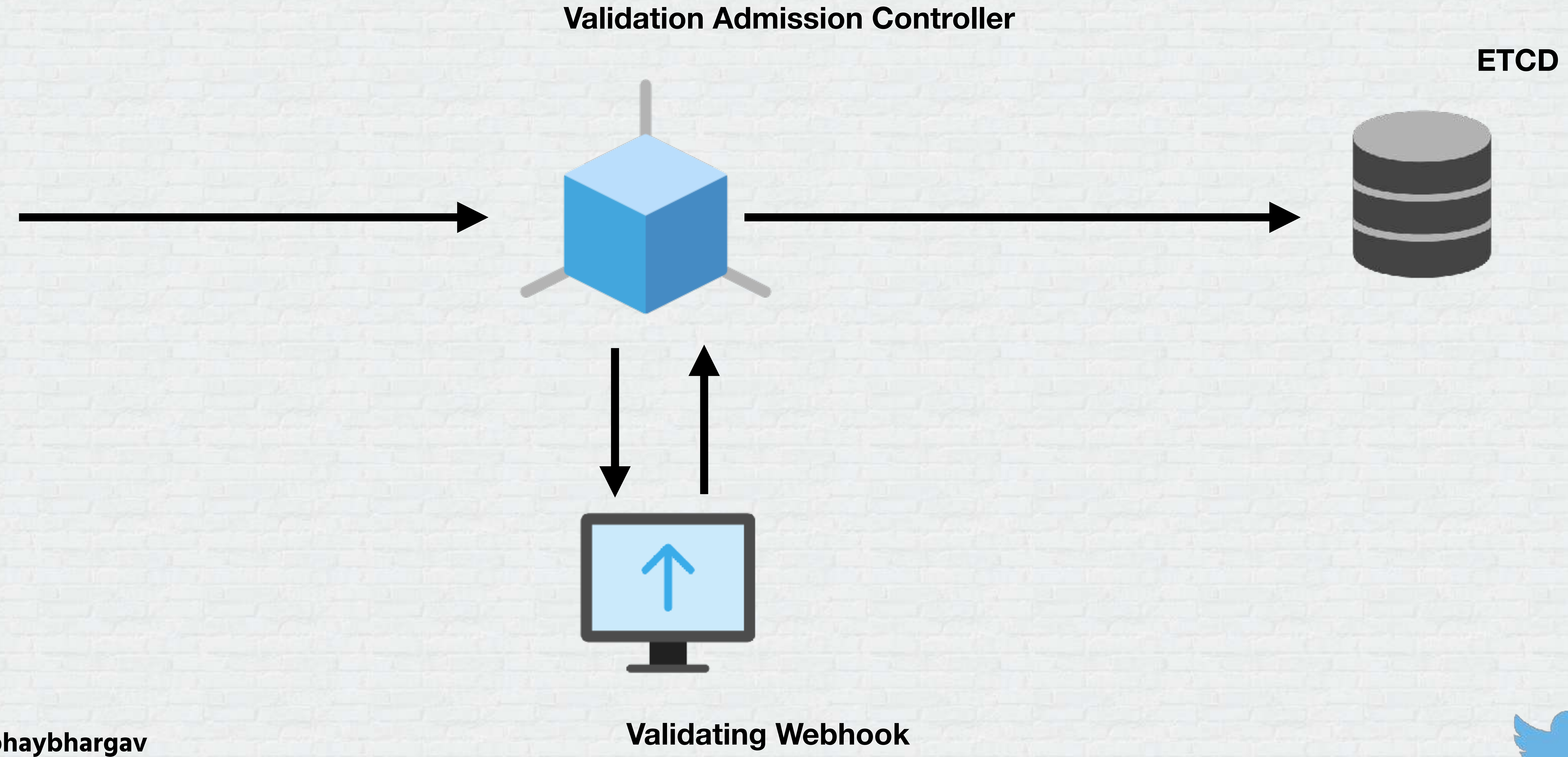


Validating Web Hook



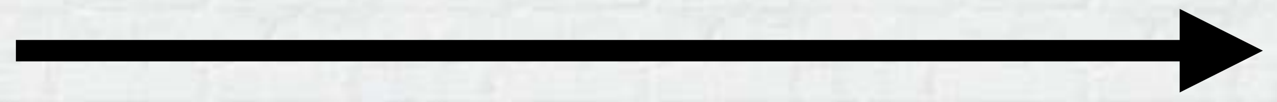
Validating Webhook

Validating Web Hook

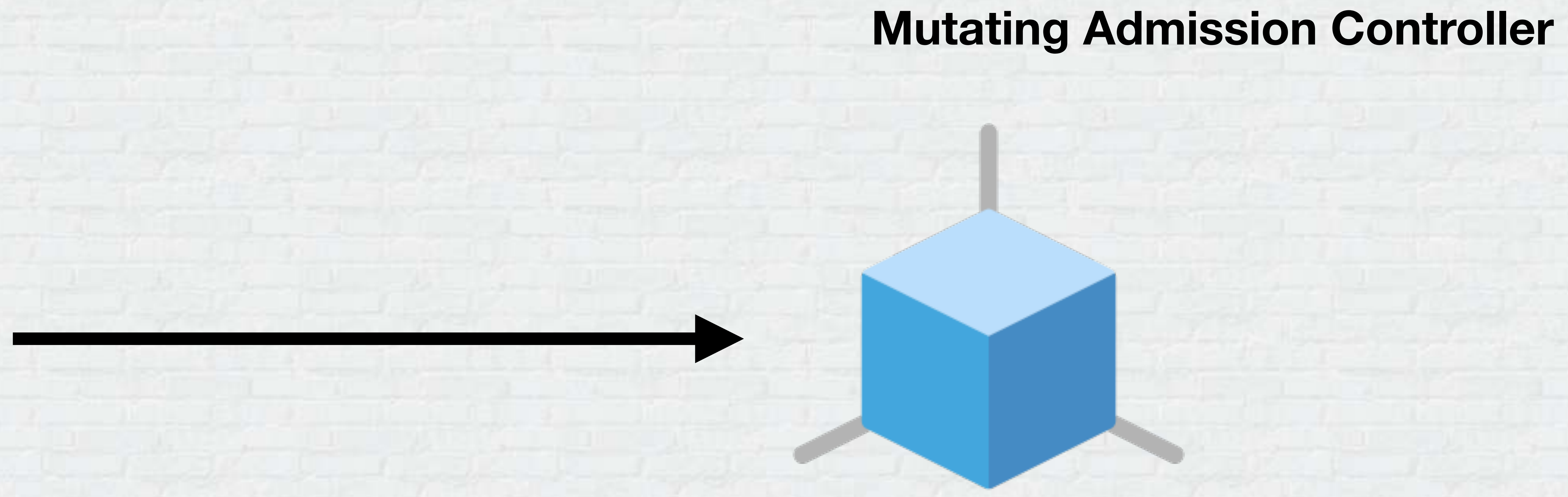


Mutating Web Hook

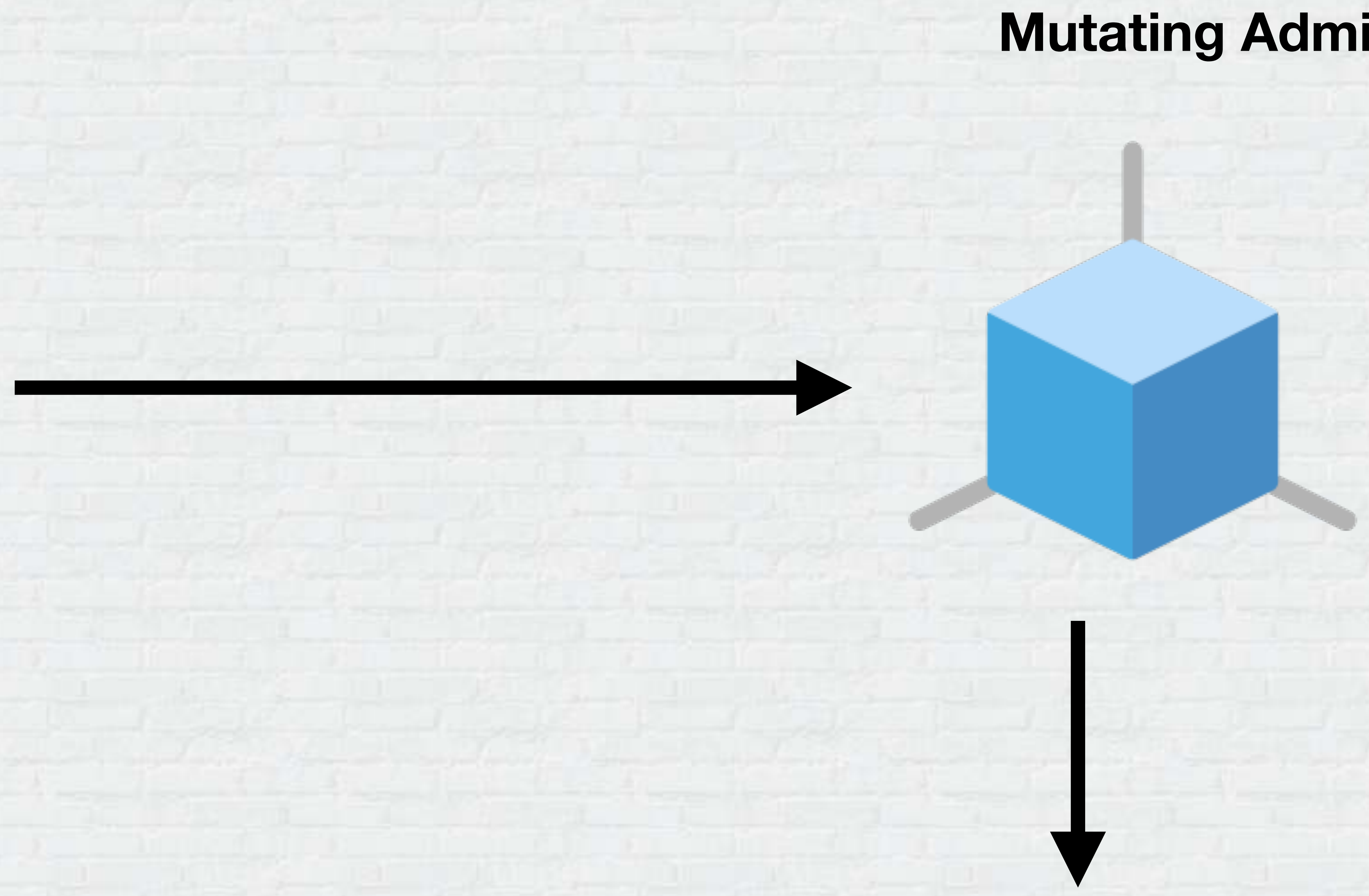
Mutating Web Hook



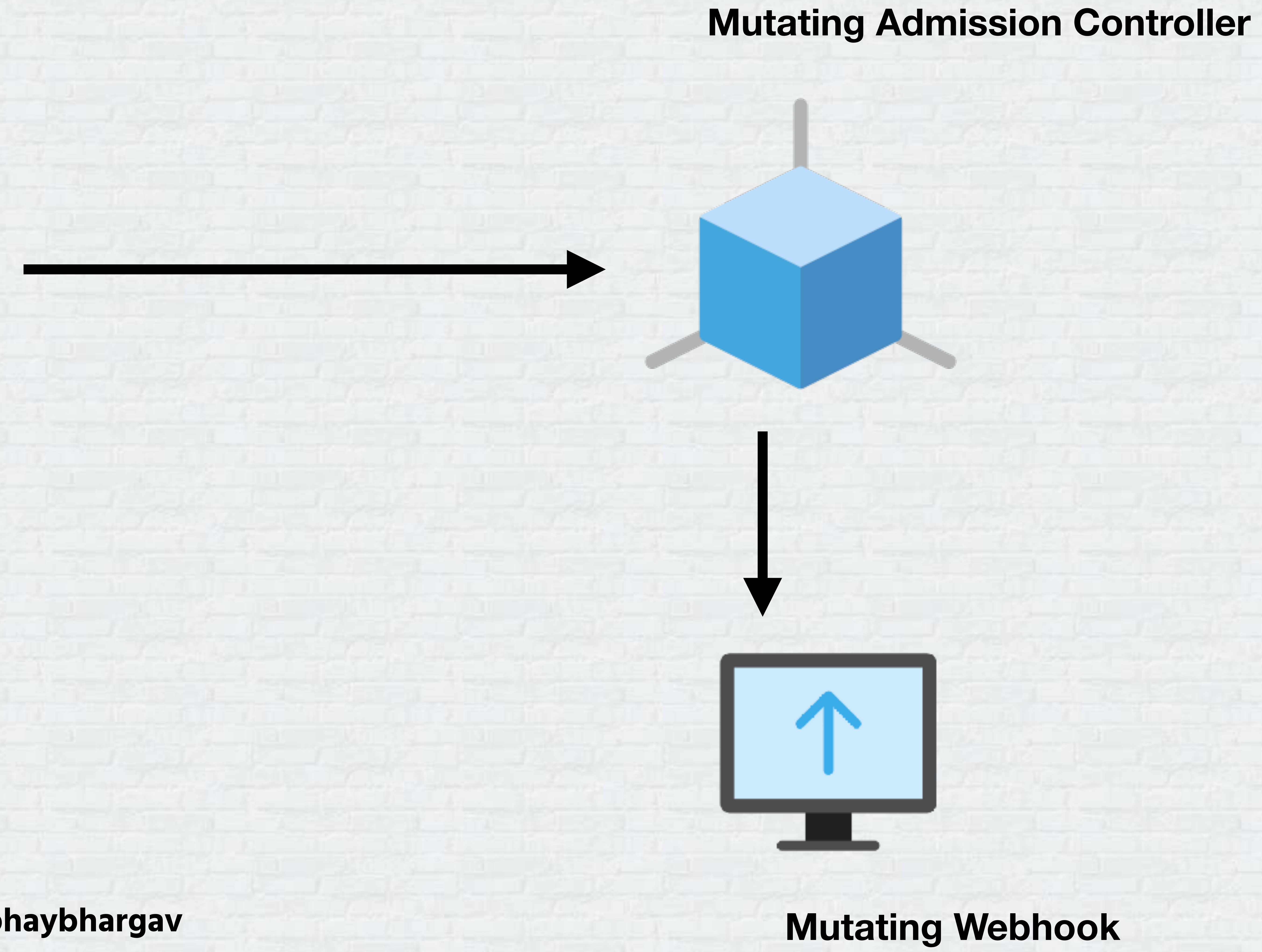
Mutating Web Hook



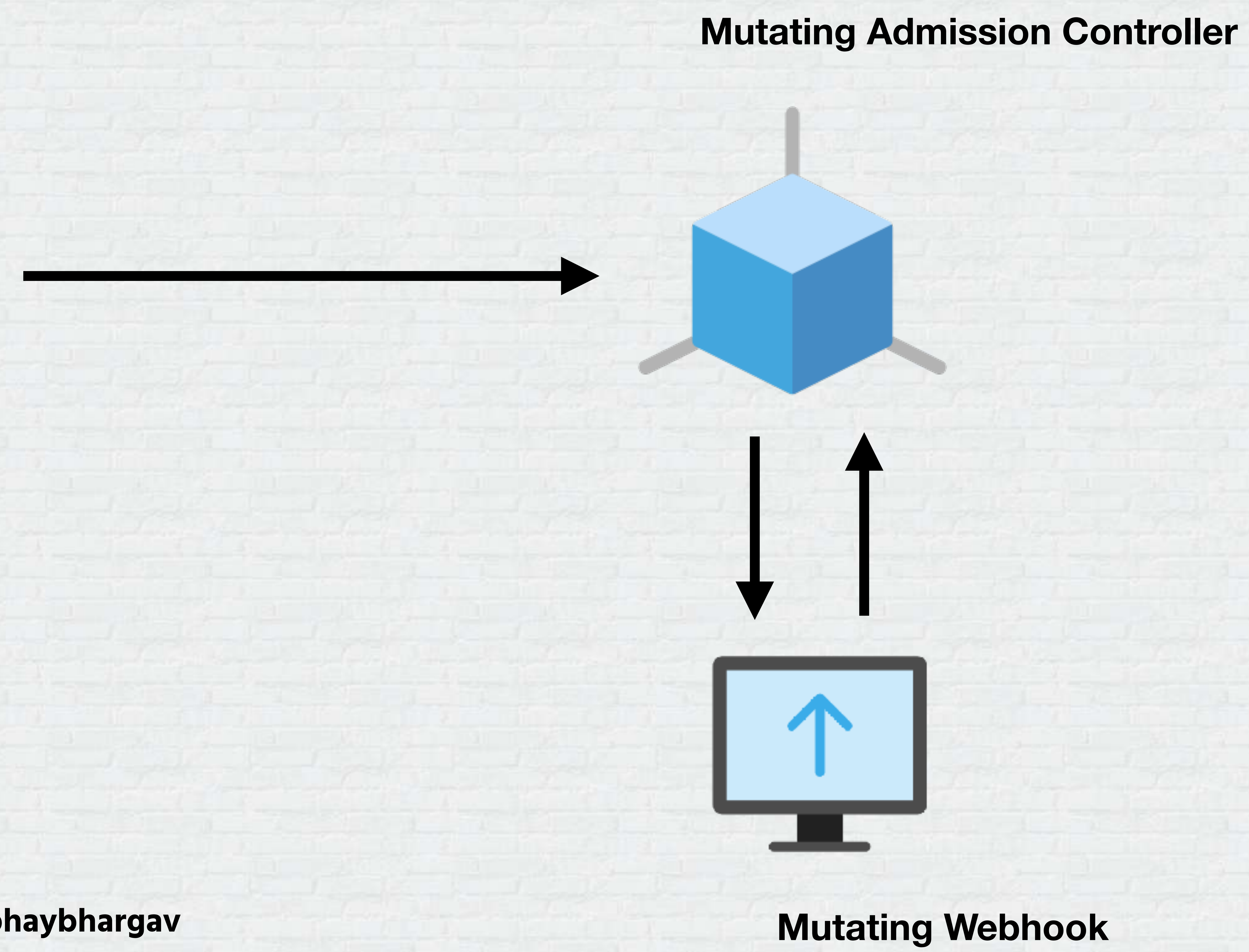
Mutating Web Hook



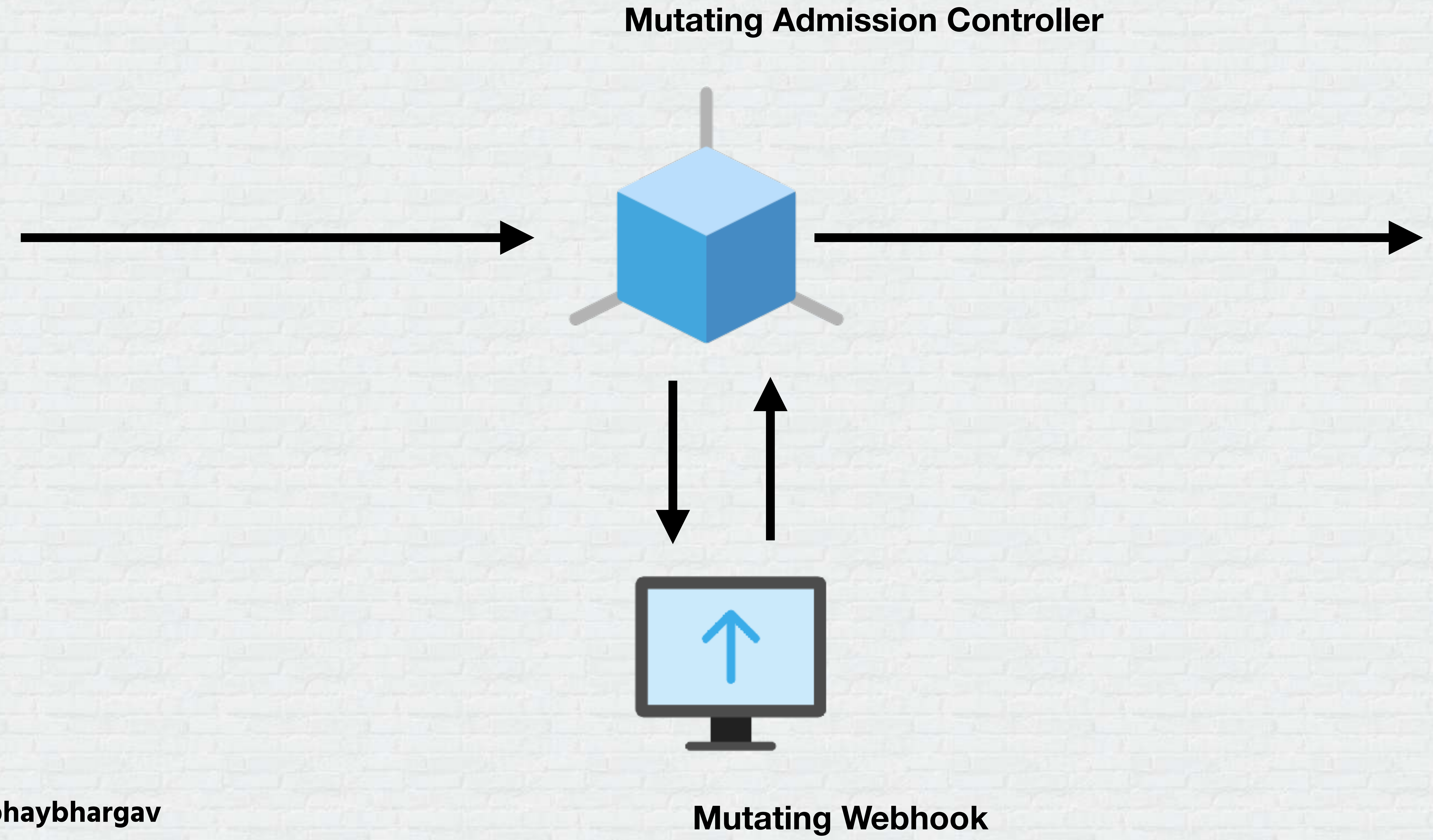
Mutating Web Hook



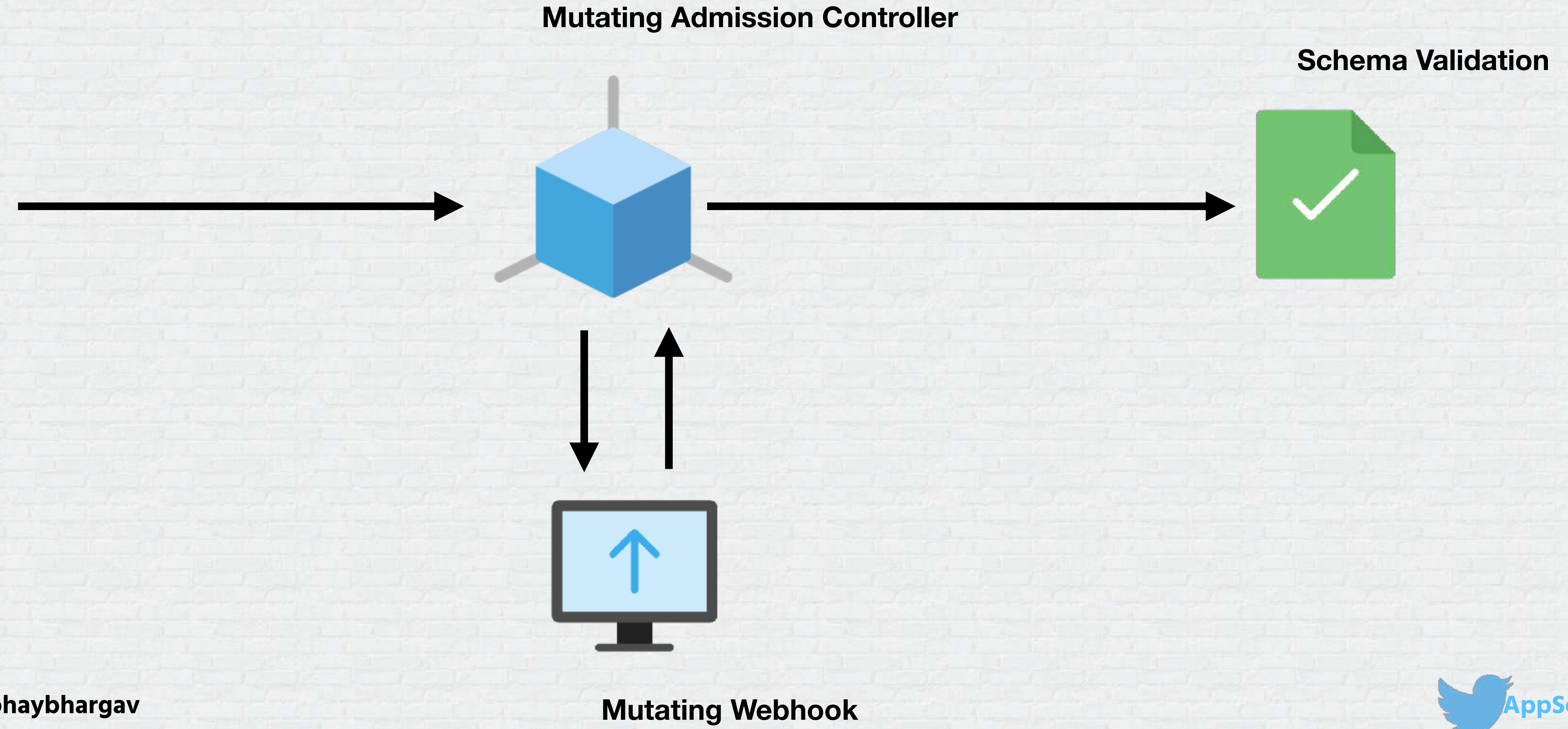
Mutating Web Hook



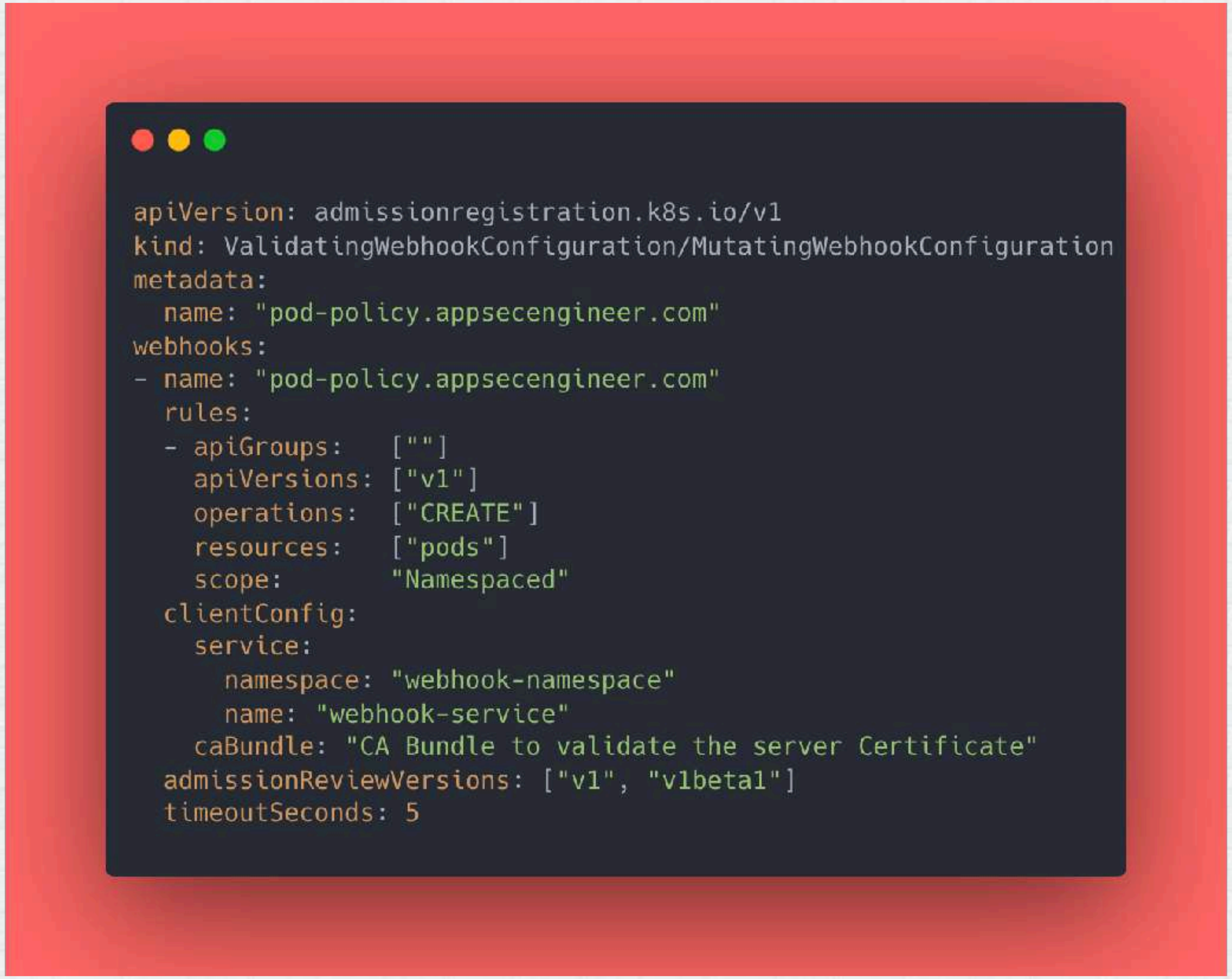
Mutating Web Hook



Mutating Web Hook



Registering the Admission Controller



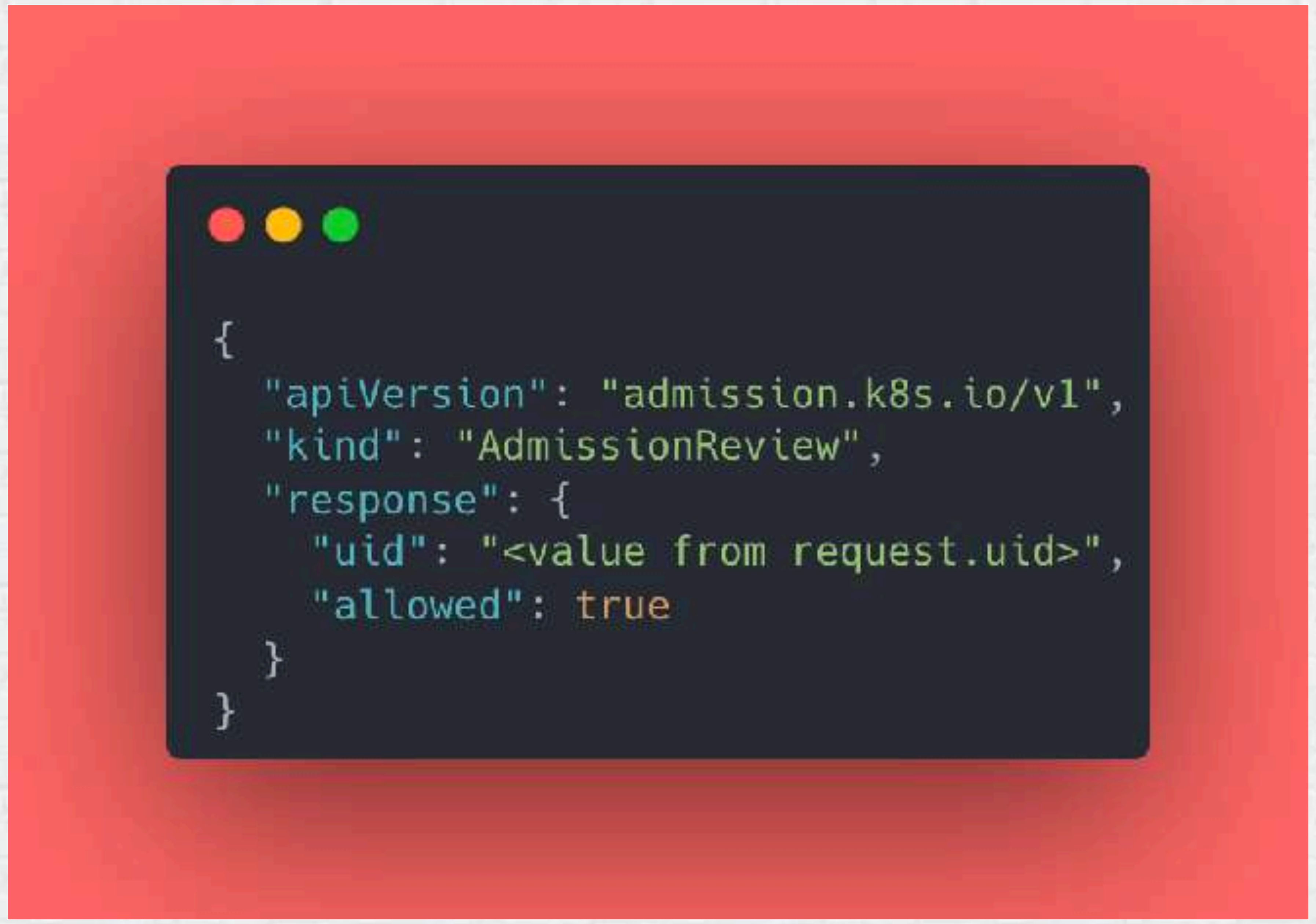
```yaml
apiVersion: admissionregistration.k8s.io/v1
kind: ValidatingWebhookConfiguration/MutatingWebhookConfiguration
metadata:
  name: "pod-policy.appsecengineer.com"
webhooks:
- name: "pod-policy.appsecengineer.com"
  rules:
  - apiGroups:   [""]
    apiVersions: ["v1"]
    operations:  ["CREATE"]
    resources:   ["pods"]
    scope:       "Namespaced"
  clientConfig:
    service:
      namespace: "webhook-namespace"
      name: "webhook-service"
    caBundle: "CA Bundle to validate the server Certificate"
  admissionReviewVersions: ["v1", "v1beta1"]
  timeoutSeconds: 5
```

abhaybhargav

AppSecEngineer

Validating Webhook Response

Validating Webhook Response



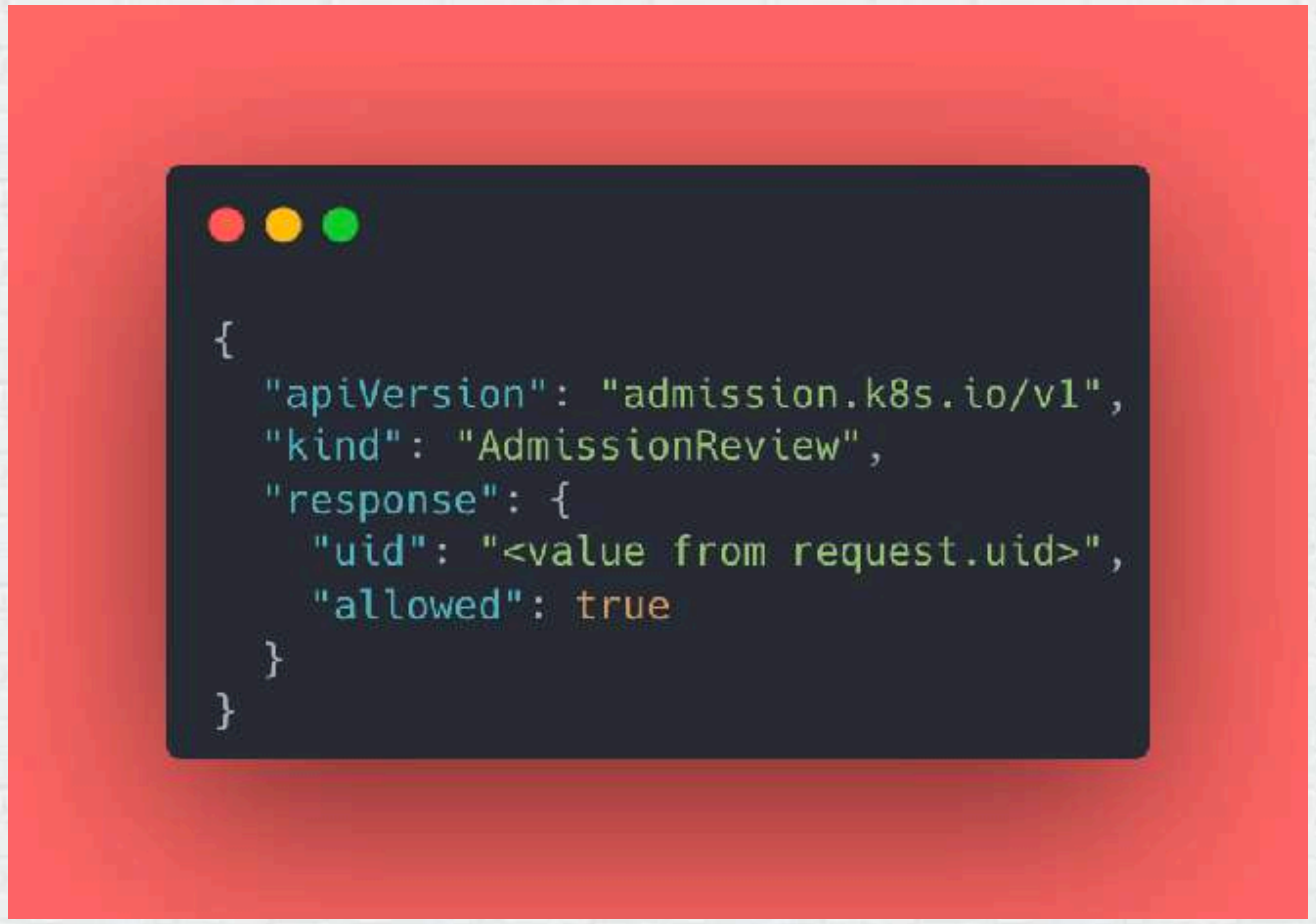
```
{
  "apiVersion": "admission.k8s.io/v1",
  "kind": "AdmissionReview",
  "response": {
    "uid": "<value from request.uid>",
    "allowed": true
  }
}
```

Allowed Response

abhaybhargav

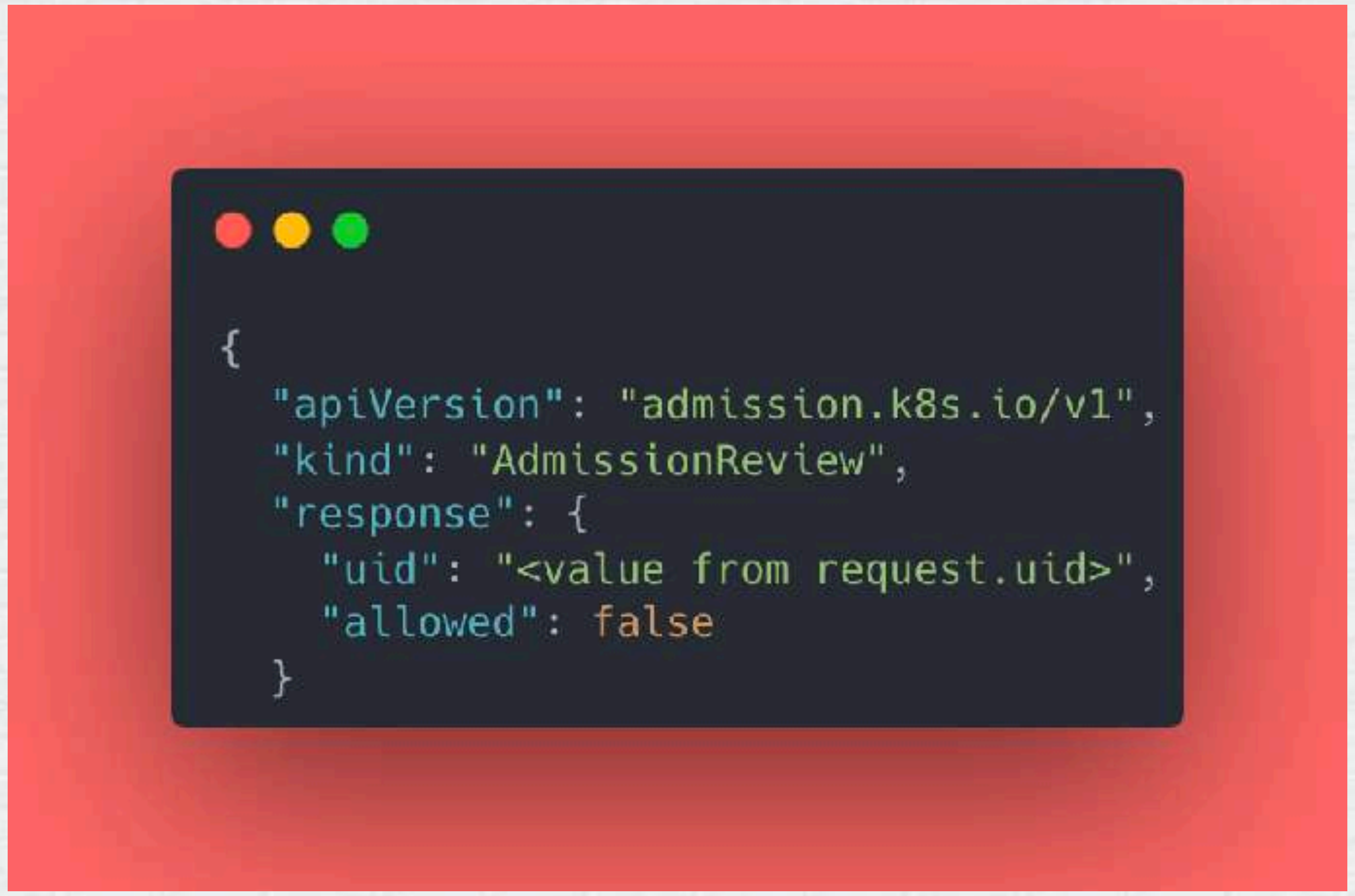
AppSecEngineer

Validating Webhook Response



```
{
  "apiVersion": "admission.k8s.io/v1",
  "kind": "AdmissionReview",
  "response": {
    "uid": "<value from request.uid>",
    "allowed": true
  }
}
```

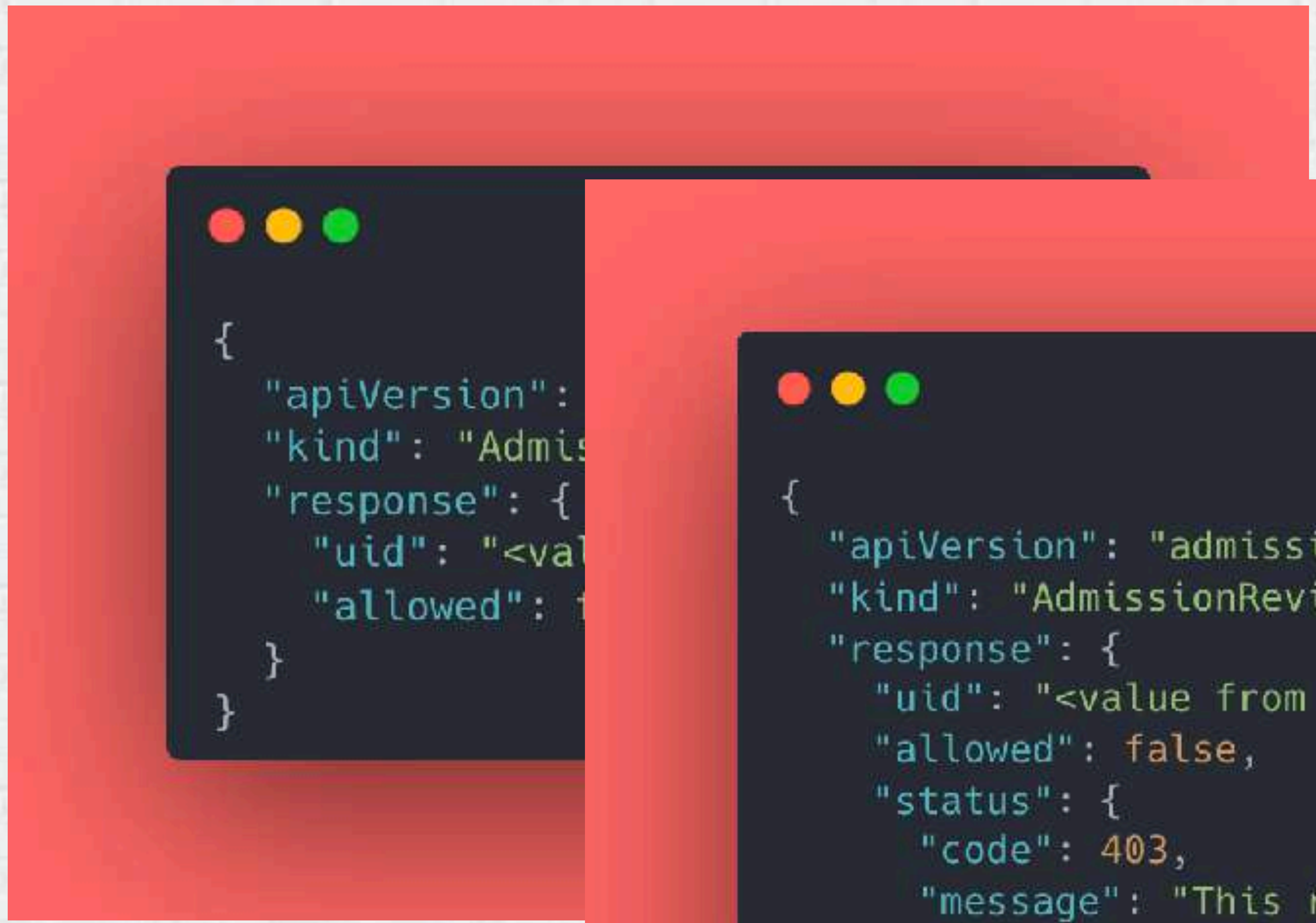
Allowed Response



```
{
  "apiVersion": "admission.k8s.io/v1",
  "kind": "AdmissionReview",
  "response": {
    "uid": "<value from request.uid>",
    "allowed": false
  }
```

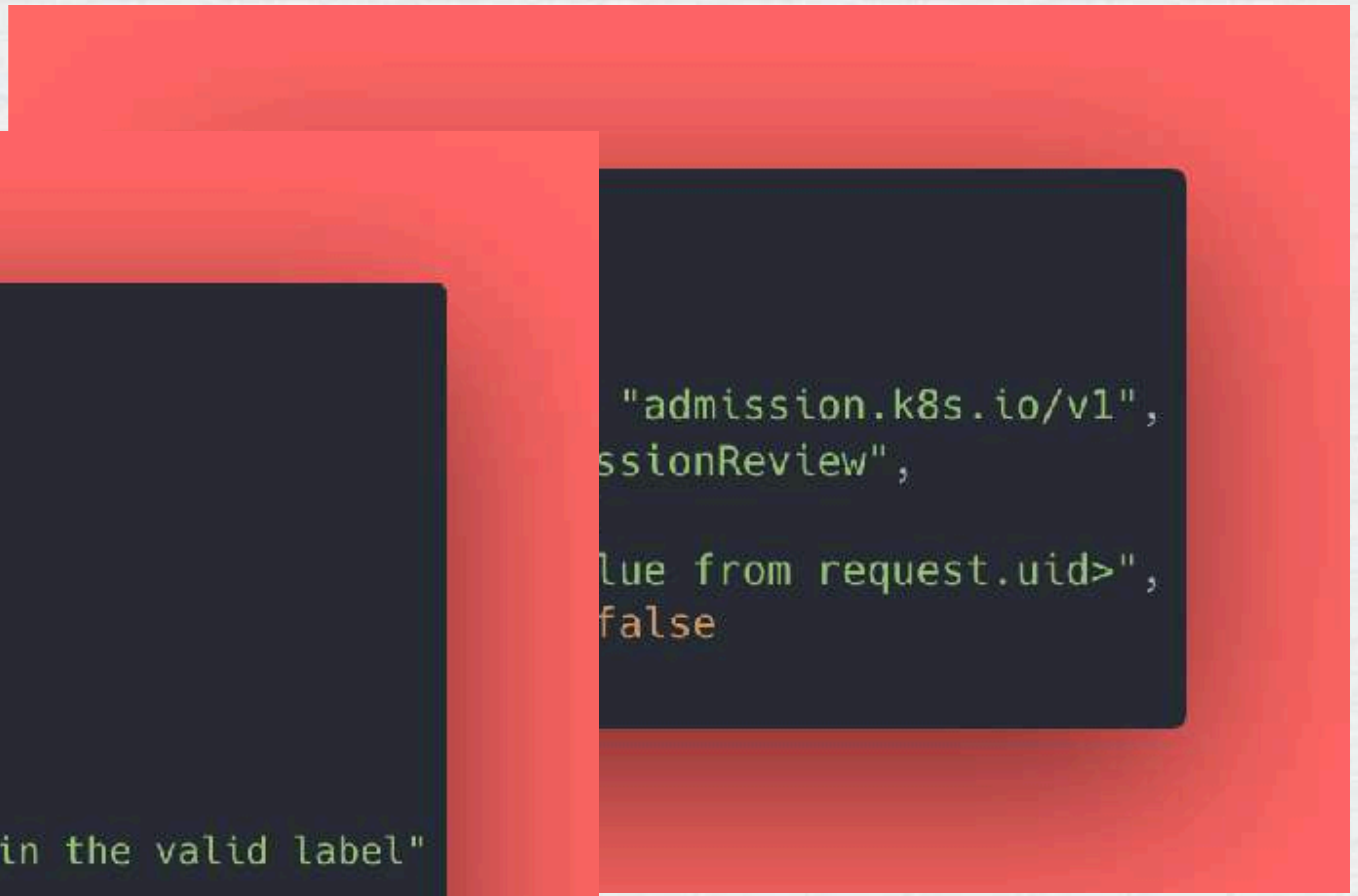
Denied Response

Validating Webhook Response



```
{
  "apiVersion":
  "kind": "Admis
  "response": {
    "uid": "<val
    "allowed":
  }
}
```

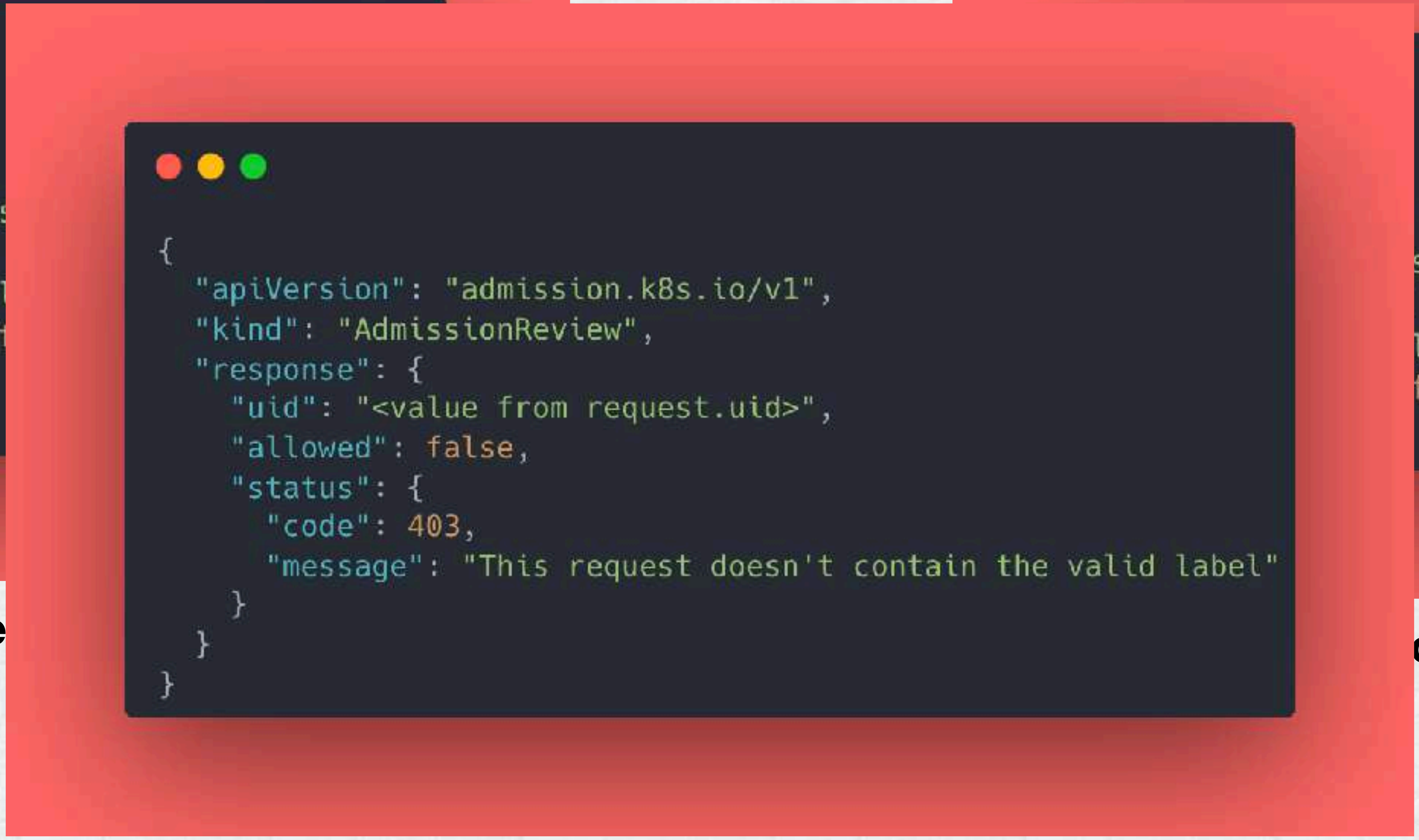
Allowe



```
 "admission.k8s.io/v1",
ssionReview",

lue from request.uid>",
false
```

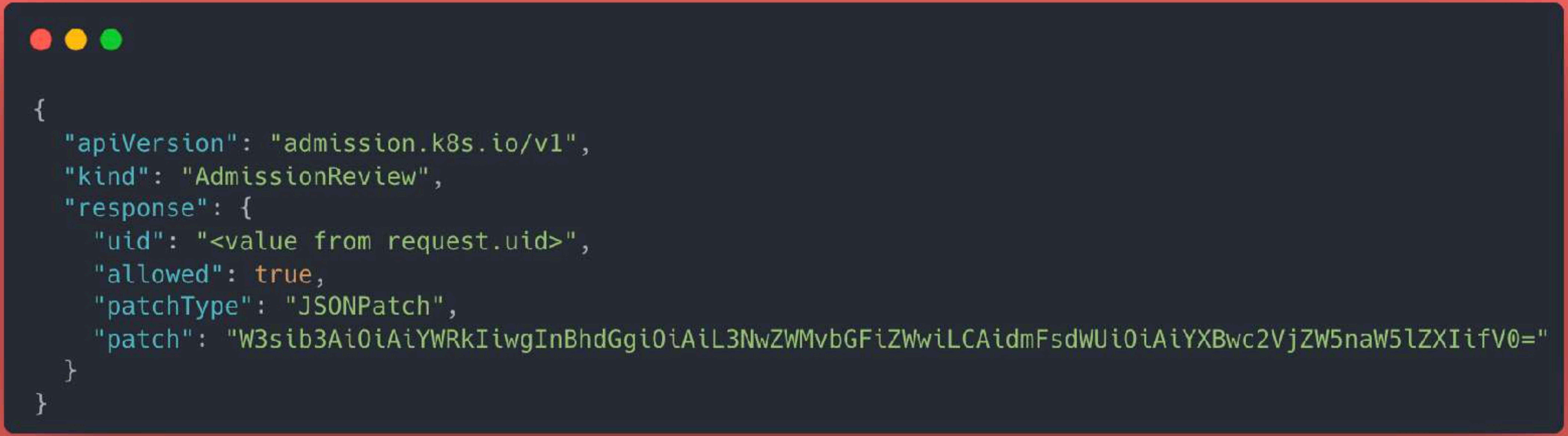
d Response



```
{
  "apiVersion": "admission.k8s.io/v1",
  "kind": "AdmissionReview",
  "response": {
    "uid": "<value from request.uid>",
    "allowed": false,
    "status": {
      "code": 403,
      "message": "This request doesn't contain the valid label"
    }
  }
}
```

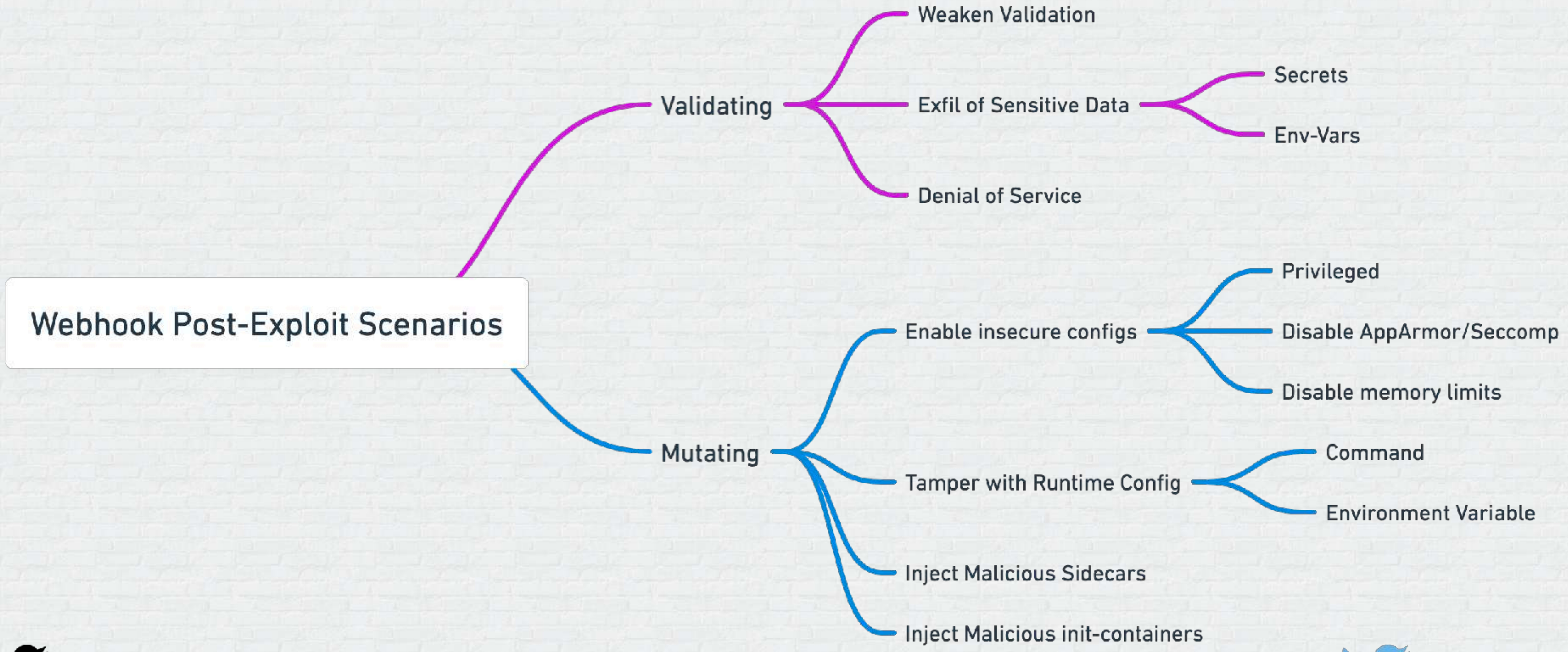
Denied Response with Custom Messages

Response in Mutating Webhook



```
{
  "apiVersion": "admission.k8s.io/v1",
  "kind": "AdmissionReview",
  "response": {
    "uid": "<value from request.uid>",
    "allowed": true,
    "patchType": "JSONPatch",
    "patch": "W3sib3AiOiAiYWRkIiwgInBhdGgiOiAiL3NwZWMvbGFiZWwiLCAidmFsdWUiOiAiYXBwc2VjZW5naW5lZXIifV0="
  }
}
```

Possible Post-Exploit Scenarios



@abhaybhargav

@AppSecEngineer

Demo