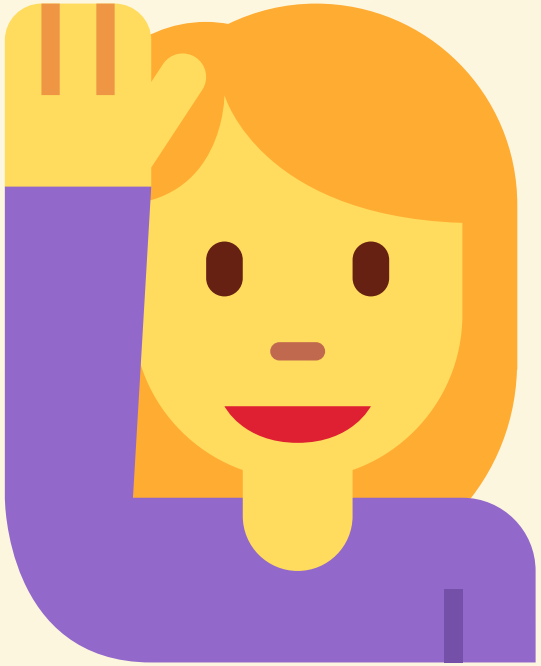
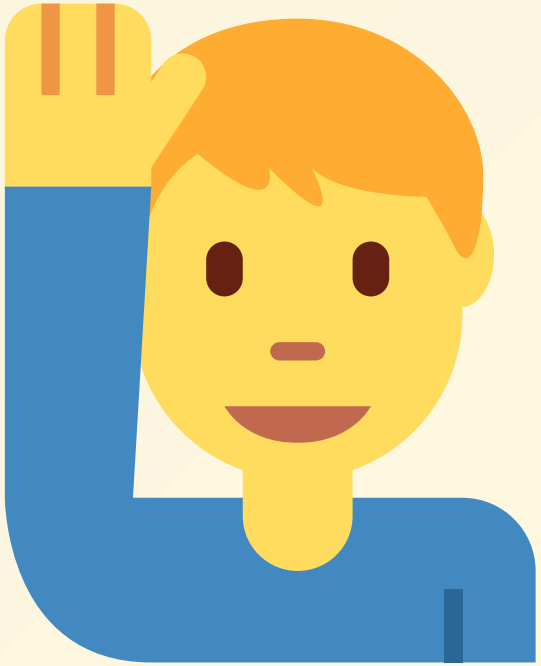
Microservices Security Pattern

Chris Nesbitt-Smith

LearnK8s | Appvia

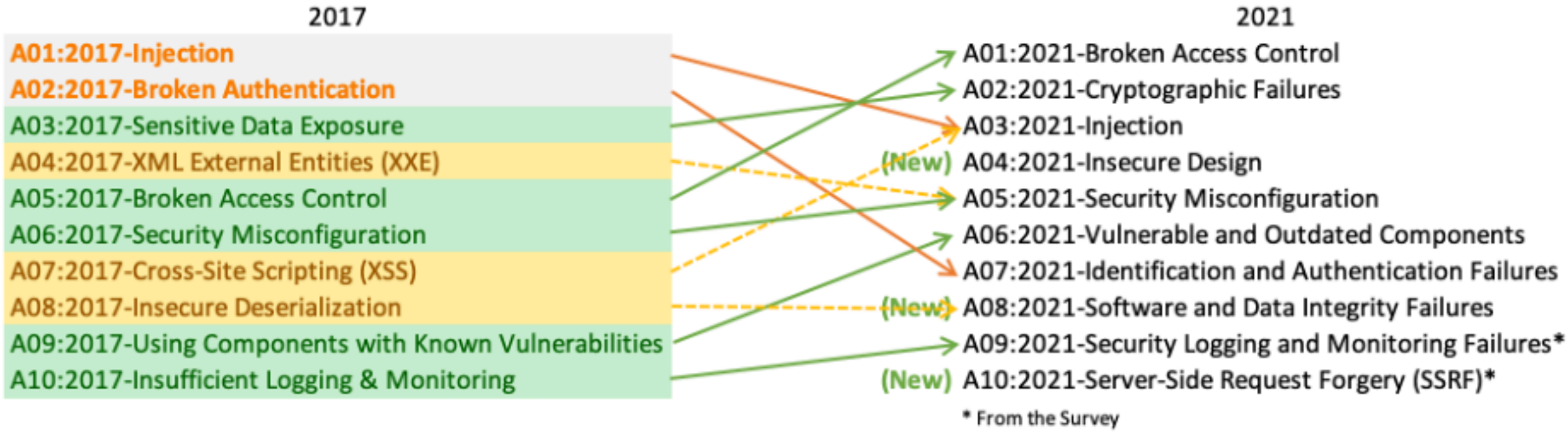
Chris Nesbitt-Smith

- Learnk8s - Instructor
- Appvia - Digital Transformation Consultant
- Home Office (uk gov) - Consultant
- Opensource:
  - OpenZWave
  - Z-Wave JS
  - Many small projects



sql-injection-k8s.herokuapp.com


2017
A01:2017-Injection
A02:2017-Broken Authentication
A03:2017-Sensitive Data Exposure
A04:2017-XML External Entities (XXE)
A05:2017-Broken Access Control
A06:2017-Security Misconfiguration
A07:2017-Cross-Site Scripting (XSS)
A08:2017-Insecure Deserialization
A09:2017-Using Components with Known Vulnerabilities
A10:2017-Insufficient Logging & Monitoring
2021
A01:2021-Broken Access Control
A02:2021-Cryptographic Failures
A03:2021-Injection
(New) A04:2021-Insecure Design
A05:2021-Security Misconfiguration
A06:2021-Vulnerable and Outdated Components
A07:2021-Identification and Authentication Failures
(New) A08:2021-Software and Data Integrity Failures
A09:2021-Security Logging and Monitoring Failures*
(New) A10:2021-Server-Side Request Forgery (SSRF)*
* From the Survey

```
92.105.22.161 - - [14/Feb/2022:03:48:55 +0000] "POST /HNAP1/ HTTP/1.1" 404 134 "-" "Mozila/5.0"

7.53.212.184 - - [14/Feb/2022:04:11:57 +0000] "GET /.env HTTP/1.1" 404 162 "-"
"Mozilla/5.0 (Windows NT 10.0; Win64; x64; rv:58.0) Gecko/20100101 Firefox/58.0"

92.105.22.161 - - [14/Feb/2022:04:16:54 +0000] "GET /.env HTTP/1.1" 404 197 "-" "Mozilla/5.0
(X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/81.0.40

24.99.105.22.161 - - [14/Feb/2022:04:16:55 +0000] "POST / HTTP/1.1" 405 568 "-" "Mozilla/5.0
(X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/81.0.4044.129 Safari/537.36"

7.51.240.114 - - [14/Feb/2022:04:18:57 +0000] "GET /dispatch.asp HTTP/1.1" 404 134 "-"
"Mozilla/5.0 (iPad; CPU OS 7_1_2 like Mac OS X; en-US) AppleWebKit/531.5.2 (KHTML, like Gecko)
Version/4.0.5 Mobile/8B116 Safari/6531.5.2"

215.74.51.24 - - [14/Feb/2022:04:42:23 +0000] "HEAD / HTTP/1.0" 200 0 "-" "-"

193.246.247.130 - - [14/Feb/2022:07:38:40 +0000] "GET /icons/ubuntu-logo.png HTTP/1.1" 404 197
"http://79.155.234.179/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/98.0.4758.87 Safari/537.36"

193.246.247.130 - - [14/Feb/2022:07:38:42 +0000] "GET /favicon.ico HTTP/1.1" 404 197
"http://79.155.234.179/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/98.0.4758.87 Safari/537.36"

193.246.247.130 - - [14/Feb/2022:07:44:02 +0000] "GET / HTTP/1.1" 304 0 "-" "Mozilla/5.0
(Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/98.0.4758.87
Safari/537.36"

193.246.247.130 - - [14/Feb/2022:07:44:02 +0000] "GET /icons/ubuntu-logo.png HTTP/1.1" 404 197
"http://79.155.234.179/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/98.0.4758.87 Safari/537.36"
```


SQL

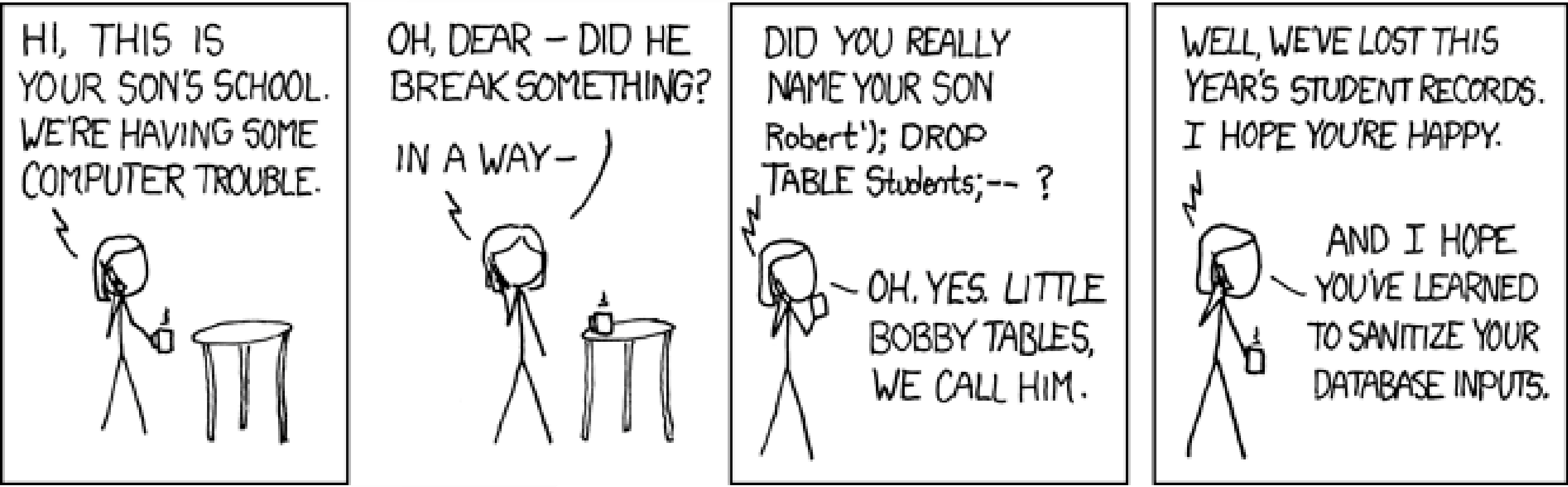
```
SELECT * FROM table;
+-----------+-----------+-----------+
| lastname  | firstname | jobtitle  |
+-----------+-----------+-----------+
| Jennings  | Leslie    | Sales Rep |
| Thompson  | Leslie    | Sales Rep |
| Gerard    | Martin    | Sales Rep |
+-----------+-----------+-----------+
3 rows in set (0.00 sec)
```

```
SELECT name, password FROM users WHERE email = 'user@example.com';

+--------+--------------------+
| name   | password           |
+--------+--------------------+
| myuser | MySecretPassw0rd! |
+--------+--------------------+
1 rows in set (0.00 sec)
```

```
INSERT INTO users (name, password, email)
VALUES('anotheruser', 'letmein', 'user2@example.com');

1 row(s) affected
```

Real world

- Tesla (2014)
- Cisco Prime License Manager (2018)
- Fortnite (2019)



https://xkcd.com/327


https://ww

- GET
- PUT
- POST
- PATCH
- DELETE
- ETC

```
POST /echo/post/json?query=hi HTTP/1.1
Host: example.com
Content-Type: application/x-www-form-urlencoded
Content-Length: 3

a=b
```

```
POST /echo/post/json?query=hi HTTP/1.1
a=b
```

```
$result = $con->query("SELECT * FROM products WHERE id = \"{$id}\"");
```

```
$result = $con->query("SELECT * FROM products WHERE id = \"{$_GET['id']}\"");
```

```
http://mydomain.com/products?id=unchecked things
```

```
SELECT * FROM products WHERE id = "unchecked bad things";
```

```
http://mydomain.com/products?id=1" OR id="2"
```

```
SELECT * FROM products WHERE id = "1" OR id = "2";
```

Truncate a table

```
-- http://mydomain.com/products?id=1"; TRUNCATE TABLE products; -- //
SELECT * FROM products WHERE id = "1"; TRUNCATE TABLE products; --//";
```

Delete a row

```
-- http://mydomain.com/products?id=1"; DELETE FROM products WHERE id="1"; -- //
SELECT * FROM products WHERE id = "1"; DELETE FROM products WHERE id="1"; --//";
```

Insert a row

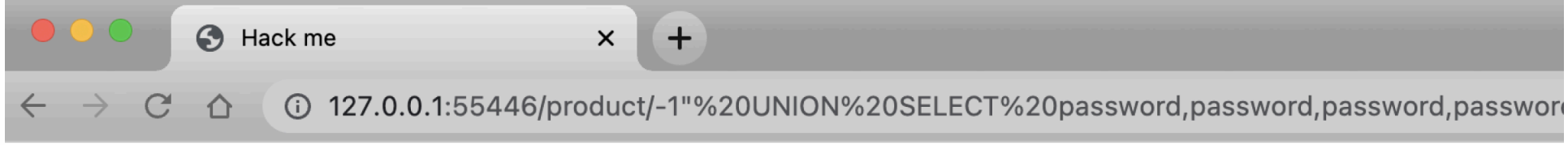
```
-- http://mydomain.com/products?id=1"; INSERT INTO payments(orderid, success) VALUES("123", "yes"); -- //
SELECT * FROM products WHERE id = "1"; INSERT INTO payments(orderid, success) VALUES("123", "yes"); --//";
```

Encrypt

```
UPDATE customers SET email = AES_ENCRYPT(email, PRIVATEKEY);
```


hama
USB 2.0 Card Reader 9in1
ACCESS
POWER
extreme
THE DEFINITIVE PROTECTION
COMPACT disc Recordable
fieldshield
scratch resistant
CD-R
700 MB 80 MIN
multiSPEED
ULTRA COMPATIBLE READ
WRITE ONLY ON THIS SURFACE WITH SPECIAL MARKER
iriver
CORSAIR
DataTraveler 100 G2
EMTEC
Kingston
microSD
ADAPTER
Flash Voyager
1GB X100
GOOD RAM
SAMSUNG
WARRANTY VOID IF REMOVED
SP1614N
(160GB/7200rpm/8M/PATA)
SAMSUNG ELECTRONICS CO., LTD
Jumper Pin Setting
General Pin Setting
Limit Capacity to 32GB
WARNING DELICATE PRODUCT SENSITIVE PARTS INSIDE. DAMAGE MAY OCCUR IF SHOCKED.
TOUCHING THE CIRCUITS MAY CAUSE MALFUNCTION. REMOVAL OF THIS COVER WILL VOID
ANY AND ALL WARRANTIES. Product of KOREA http://www.samsunghdd.com

Fatal error: Uncaught mysqli_sql_exception: XPATH syntax error: '::pas5w0rd' in /var/www/html/product.php:23 Stack trace: #0 /var/www/html/product.php(23): mysqli->multi_query('SELECT * FROM p...') #1 {main} thrown in **/var/www/html/product.php** on line **23**



« Return to the homepage

pas5w0rd

pas5w0rd

Product ID	pas5w0rd
Price	$pas5w0rd

Description

pas5w0rd

```
SELECT '* * * * * root rm -rf /' INTO outfile /etc/cron.d/bad
```

```php
$result = $mysqli->query(sprintf("SELECT * FROM products WHERE id ='%s'",
  $mysqli->real_escape_string($_GET['id'])));
```

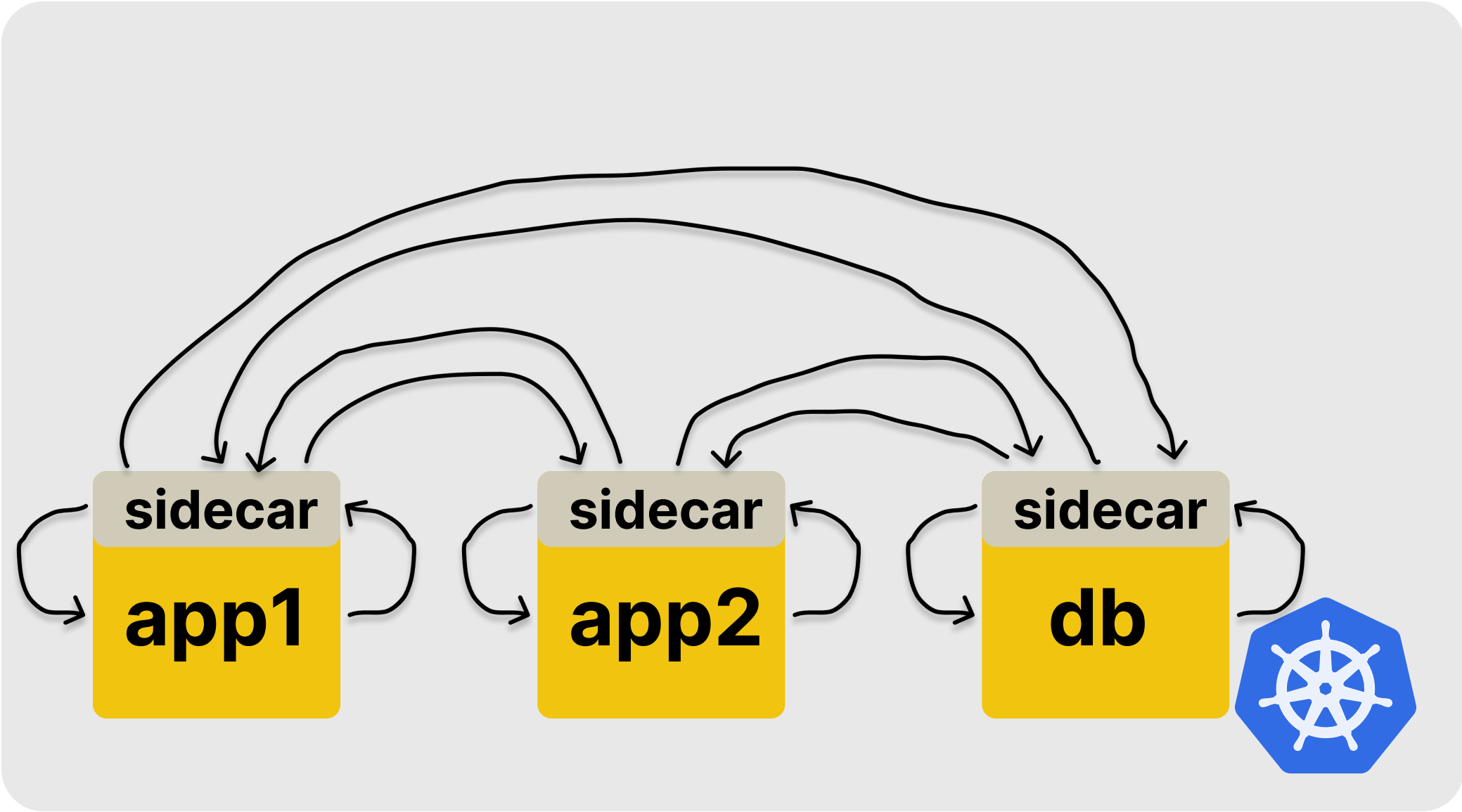

WARNING
DO NOT OPEN


1337
1337


0.0.0.0
STATUS
ALARM
POWER 1
POWER 2


learnk8s


MAXI-COSI
THE SOUL OF
TRIDAYS
TRIUMPH

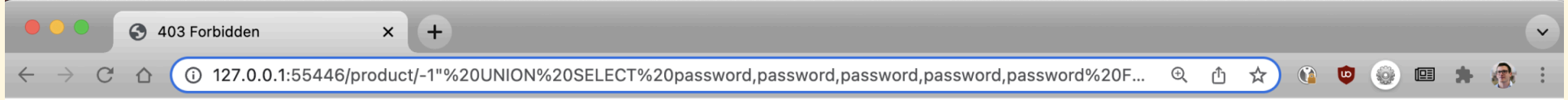

sidecar
app1
sidecar
app2
sidecar
db

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: myapp
spec:
  containers:
    - name: myapp
      image: myapp:v1.0.0
      ports:
        - containerPort: 80
```

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: myapp
spec:
  containers:
    - name: myapp
      image: myapp:v1.0.0
    - name: nginx # <-- sidecar
      image: nginx:1.14.2
      ports:
        - containerPort: 8080
      volumeMounts:
        - mountPath: /etc/nginx
          name: nginx-config
  volumes:
    - name: nginx-config
      configMap:
        name: myapp
```

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: sidecar
data:
  nginx.conf: |-
    events {}
    http {
      server {
        listen 8080 default_server;
        listen [::]:8080 default_server;

        location ~* "(\'|\")(.*)(drop|insert|md5|select|union)" {
            deny all;
        }

        location / {
            proxy_pass http://localhost:80/;
        }
      }
    }
```

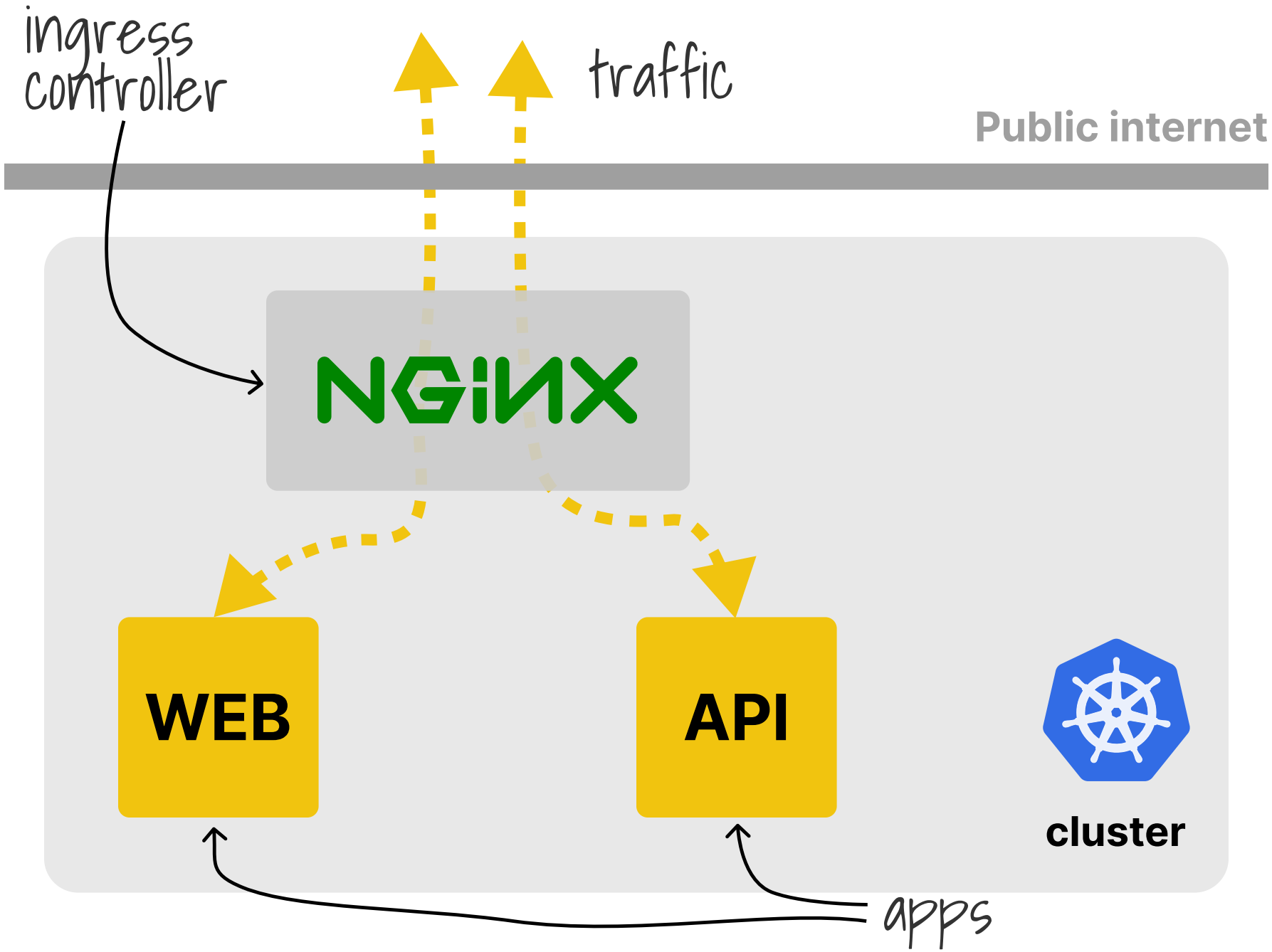
kubectl apply

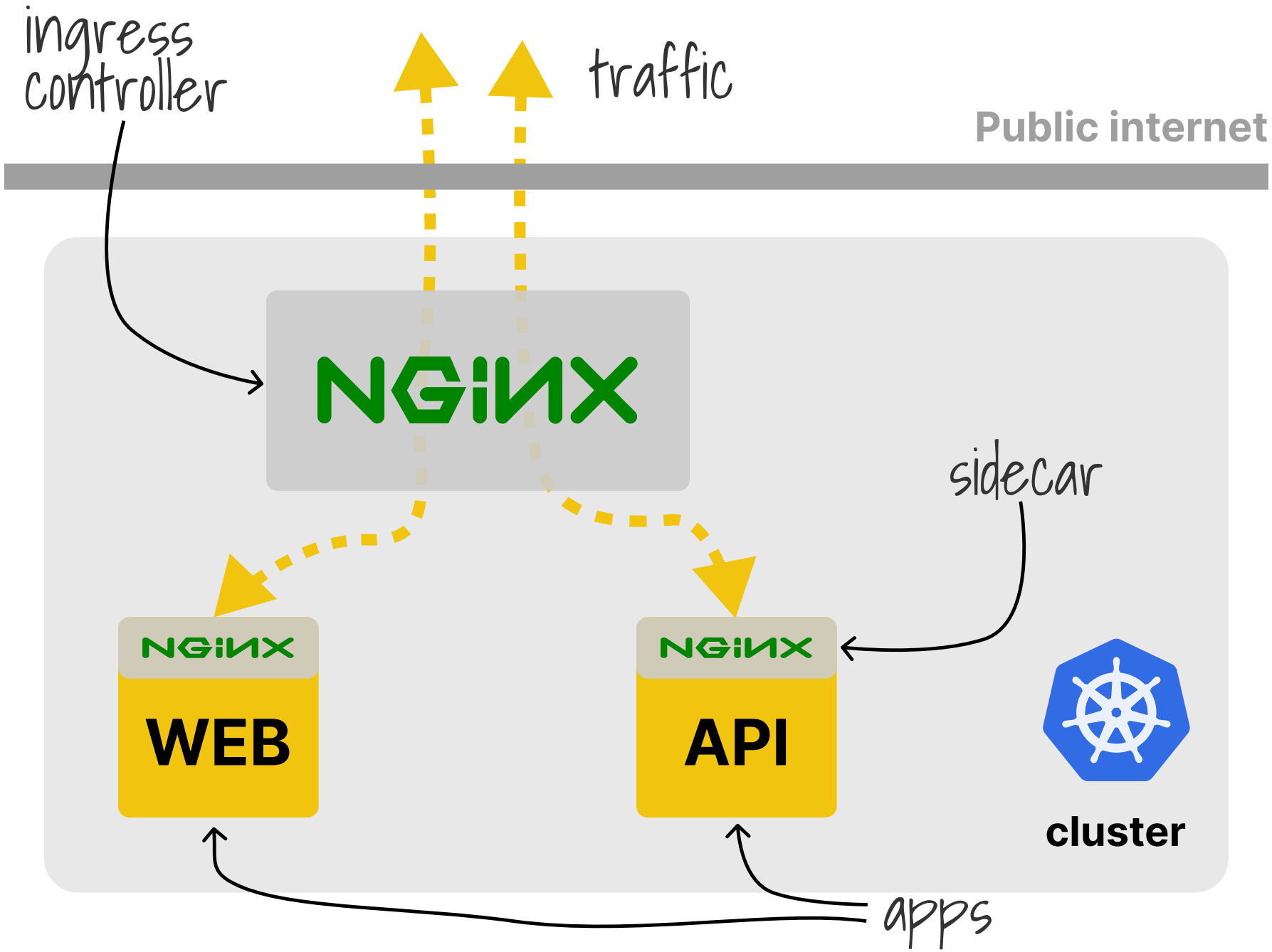


403 Forbidden

---

nginx/1.21.5

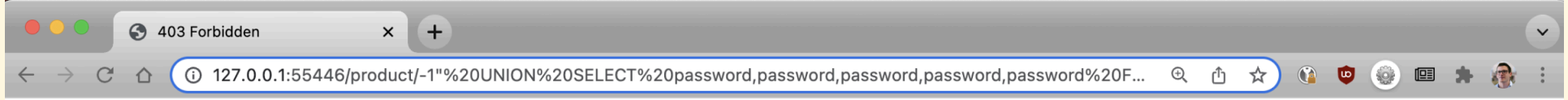

ingress controller
traffic
Public internet
NGINX
WEB
API
cluster
apps


ingress controller
traffic
Public internet
NGINX
sidecar
NGINX
WEB
NGINX
API
cluster
apps

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: myapp
spec:
  containers:
    - name: myapp
      image: myapp:v1.0.0
      ports:
        - containerPort: 80
```

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: myapp
spec:
  ingressClassName: nginx
  rules:
    - host: "example.com"
      http:
        paths:
          - backend:
              service:
                name: myapp
                port:
                  number: 80
            path: /
            pathType: Prefix
```

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
  name: myapp
  annotations:
    nginx.org/server-snippets: |
      location ~* "(\'|\")(.*)(drop|insert|md5|select|union)" {
          deny all;
      }
spec:
  ingressClassName: nginx
  rules:
    - host: "example.com"
      http:
        paths:
          - backend:
              service:
                name: myapp
                port:
                  number: 80
            path: /
            pathType: Prefix
```

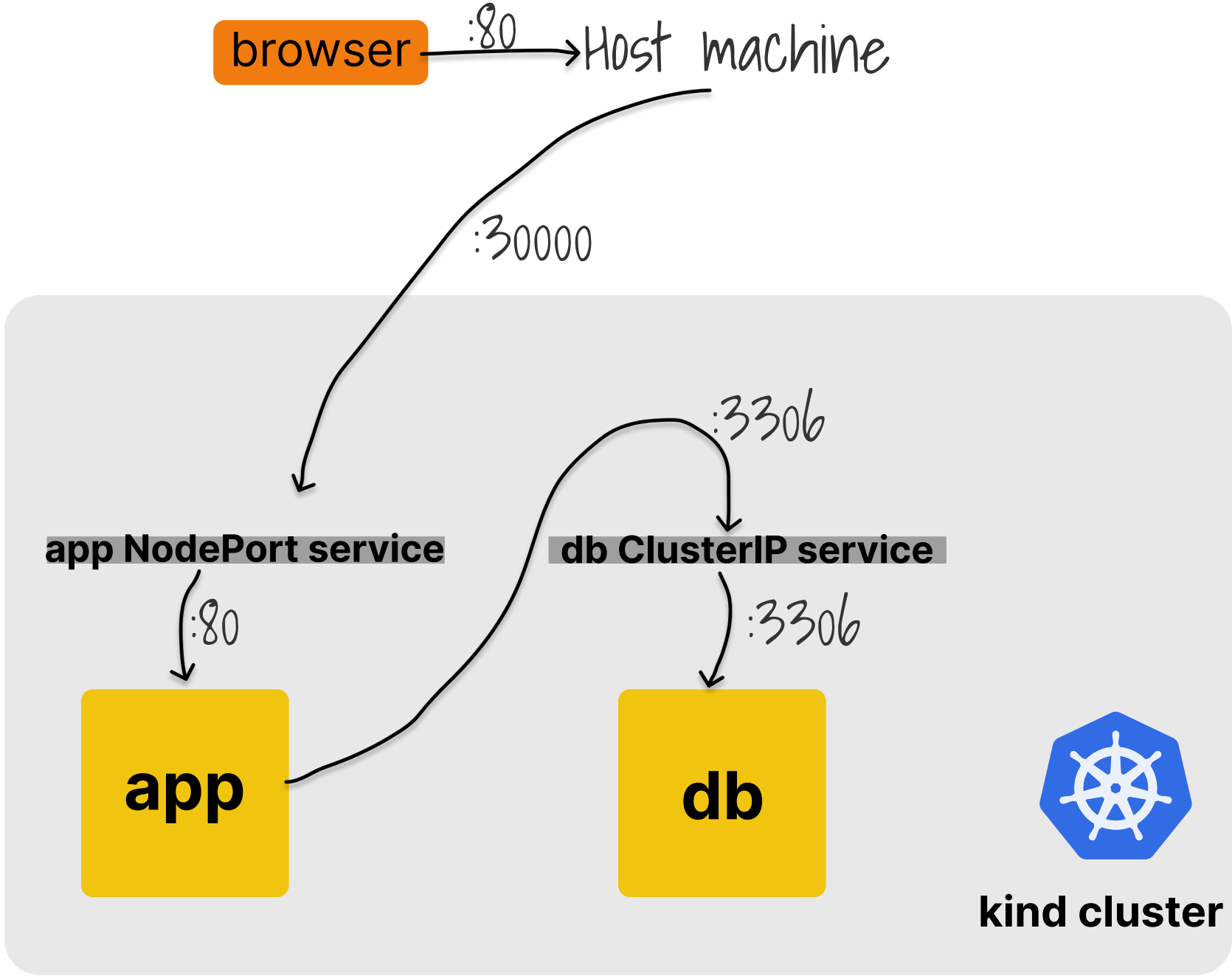


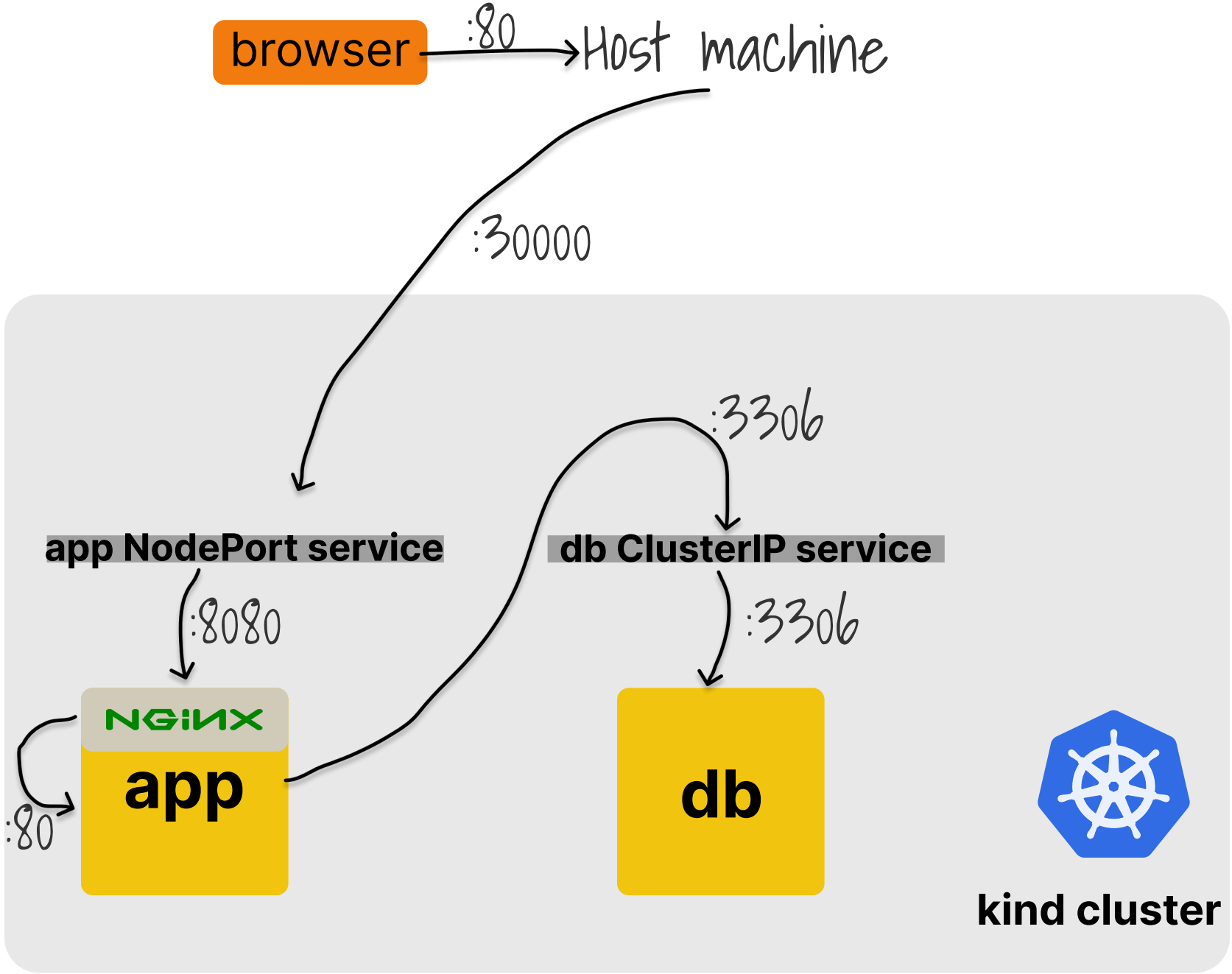
403 Forbidden

---

nginx/1.21.5

Live demo


browser
:80
Host machine
:30000
:3306
app NodePort service
db ClusterIP service
:80
:3306
app
db
kind cluster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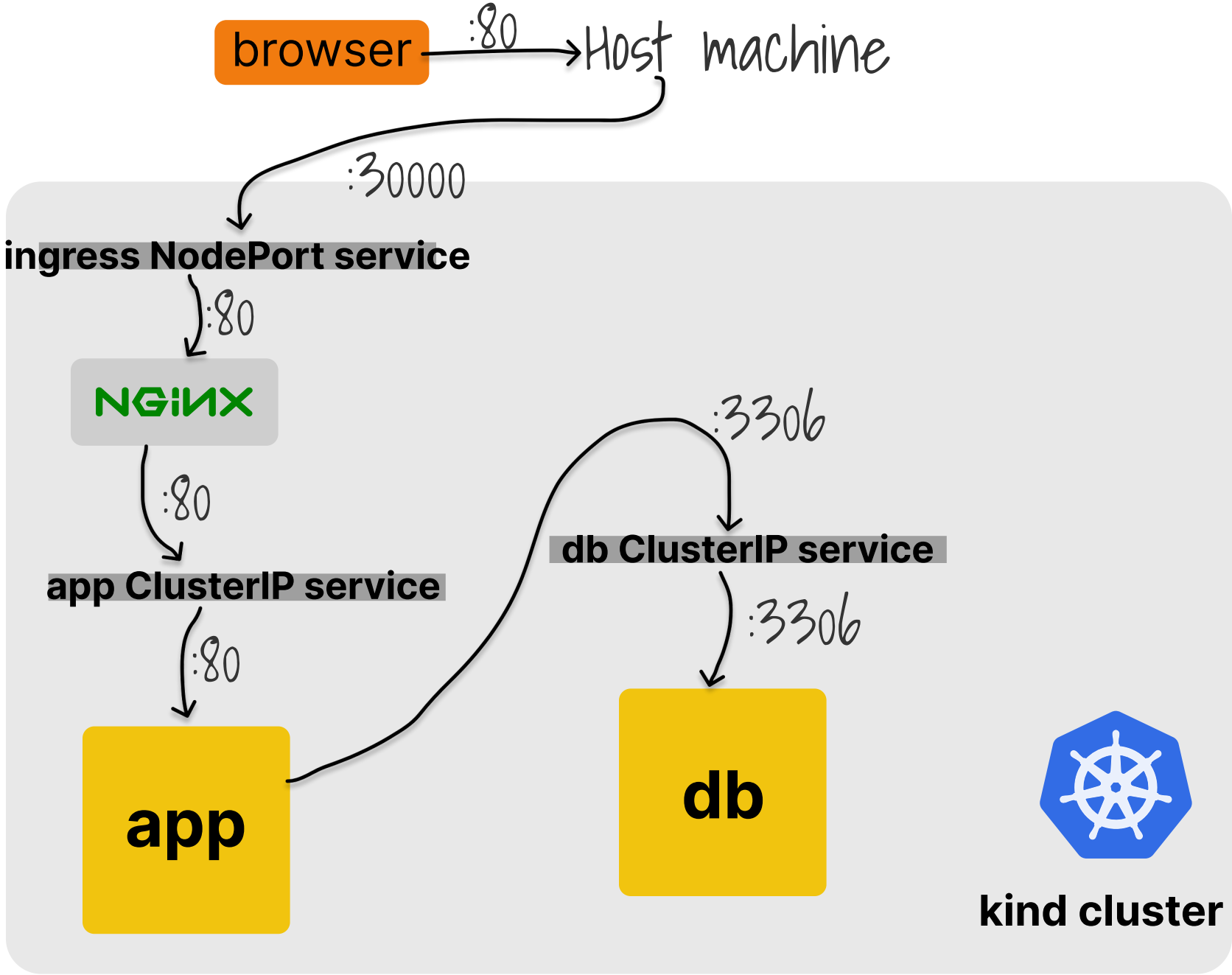
kind cluster


browser
:80
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:30000
ingress NodePort service
:80
NGINX
:80
app ClusterIP service
:80
app
:3306
db ClusterIP service
:3306
db
kind cluster

🙏 Thanks 🙏

- cns.me
- github.com/chrisns
- nginx.com/blog
- learnk8s.io/kubernetes-resources

Chris Nesbitt-Smith