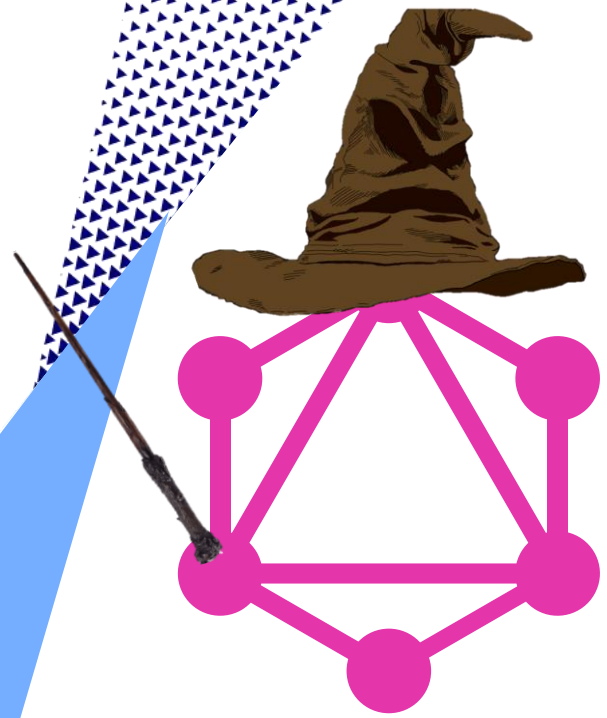
CyberCX

Cyber Security + Customer Experience



Fantastic GraphQL Bugs and Where To Find Them

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Without them, OWASP New Zealand Day couldn't happen

whoami

- Security Consultant @ CyberCX
- Been working in the industry for 4 years

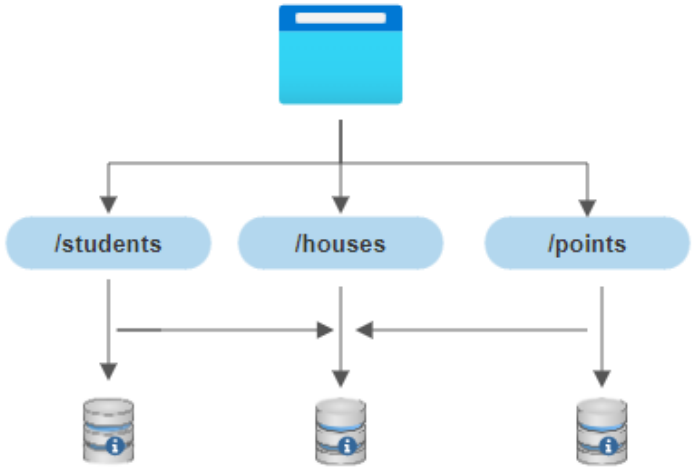
What is GraphQL

- GraphQL is a query language for APIs
- Allows you to query data as well as perform CRUD operations via a single endpoint
- Schema based
- GraphQL is designed for efficiency, you retrieve only what you need, nothing more nothing less

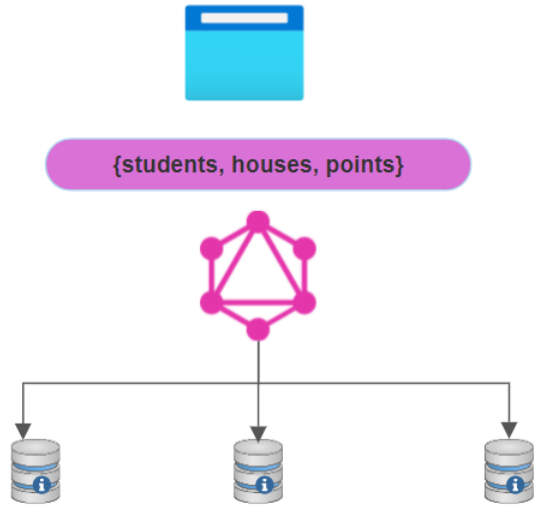
https://apievangelist.com/2018/06/29/graphql-and-rest-differences-explained-with-burgers/

REST vs GraphQL

REST



GraphQL



Queries and Mutations

- Query = GET

```
query {
  allPosts {
    edges {
      node {
        title
        body
        users
          { username }
        }
      }
    }
}
```


```
{
  "data": {
    "allPosts": {
      "edges": [
        {
          "node": {
            "title": "Yer a wizard Harry!",
            "body": "Yer gonna fly a broom, learn spells n shit. And yer gonna enjoy it",
            "users": {
              "username": "iliekdragons"
            }
          }
        },
        {
          "node": {
            "title": "HARRY DID YA PUT YA NAME IN DA GOBLET OF FIYAHH",
            "body": "said Dumbledore calmly",
            "users": {
              "username": "dumbledore"
            }
          }
        },
        {
          "node": {
            "title": "Pottah!",
            "body": "My father will hear about this",
            "users": {
              "username": "draco malfoy"
            }
          }
        }
      ]
    }
  }
}
```


- Mutation = POST, DELETE

```
mutation{
  userMutation(id:1, password:"AlasEarwax!"){
    id
    password
    updated_at
  }
}
```


```
{
  "data":{
    "userMutation":{
      "id":1,
      "password":"AlasEarWax!",
      "updated_at":"2022-03-02 23:02:22"
    }
  }
}
```

Accio Vulnerability

- IDOR
- SQLi
- Broken Access Control
- DoS

Tools?

- Burp Plugins – inQL and GraphQL Raider – helps formatting GraphQL in Burp
- GraphQL Voyager – Mapping out the schema
- Insomnia[.]rest – API Client
- GraphQL 😏

Introspection

- Allows you to retrieve the API schema

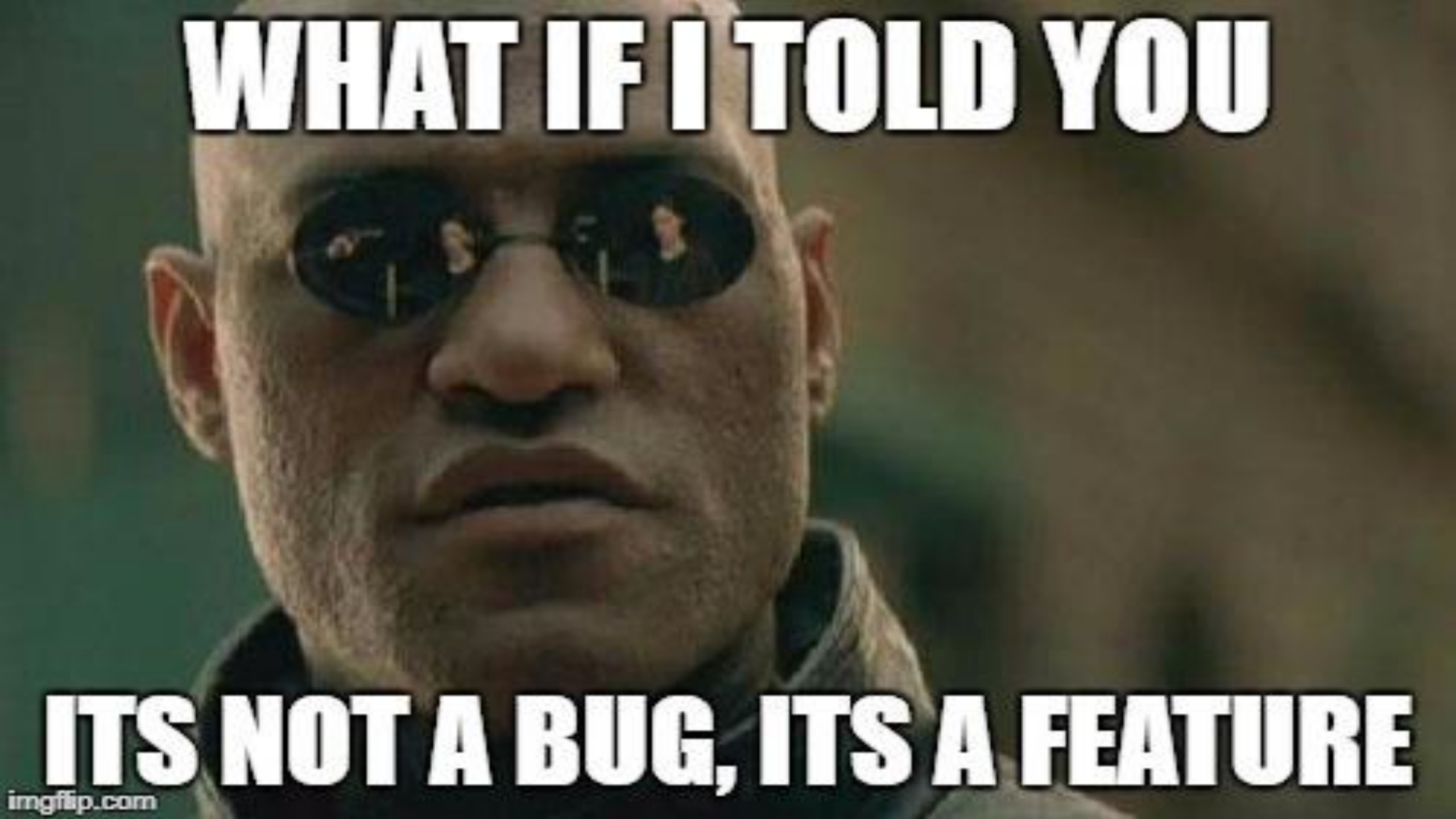
```
query MyQuery {
  __schema {
    types {
      name
      fields {
       name
      }

    }
  }
}
```


```
{
  "data": {
    "__schema": {
      "types": [
        {
          "name": "Query",
          "fields": [
            {
              "name": "node"
            },
            {
              "name": "allPosts"
            },
            {
              "name": "allUsers"
            }
          ]
        },
        {
          "name": "Node",
          "fields": [
            {
              "name": "id"
```


Look for:

- /v1/explorer
- /v1/graphiql
- /graph
- /graphql
- /graphql/console/
- /graphql.php
- /graphiql
- /graphiql.php

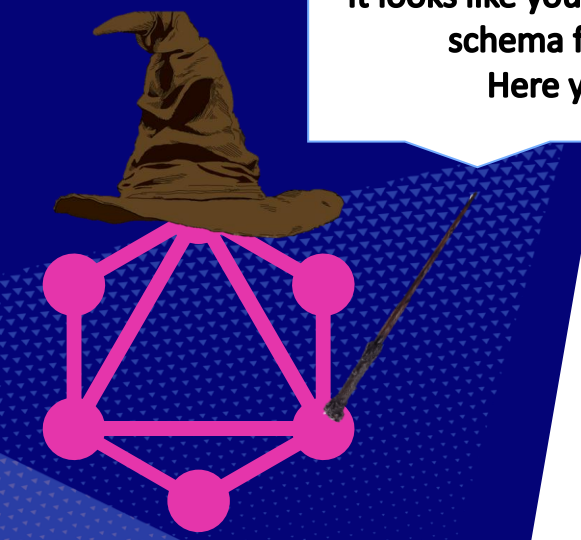

WHAT IF I TOLD YOU
ITS NOT A BUG, ITS A FEATURE
imgflip.com

Introspection

- Introspection Query

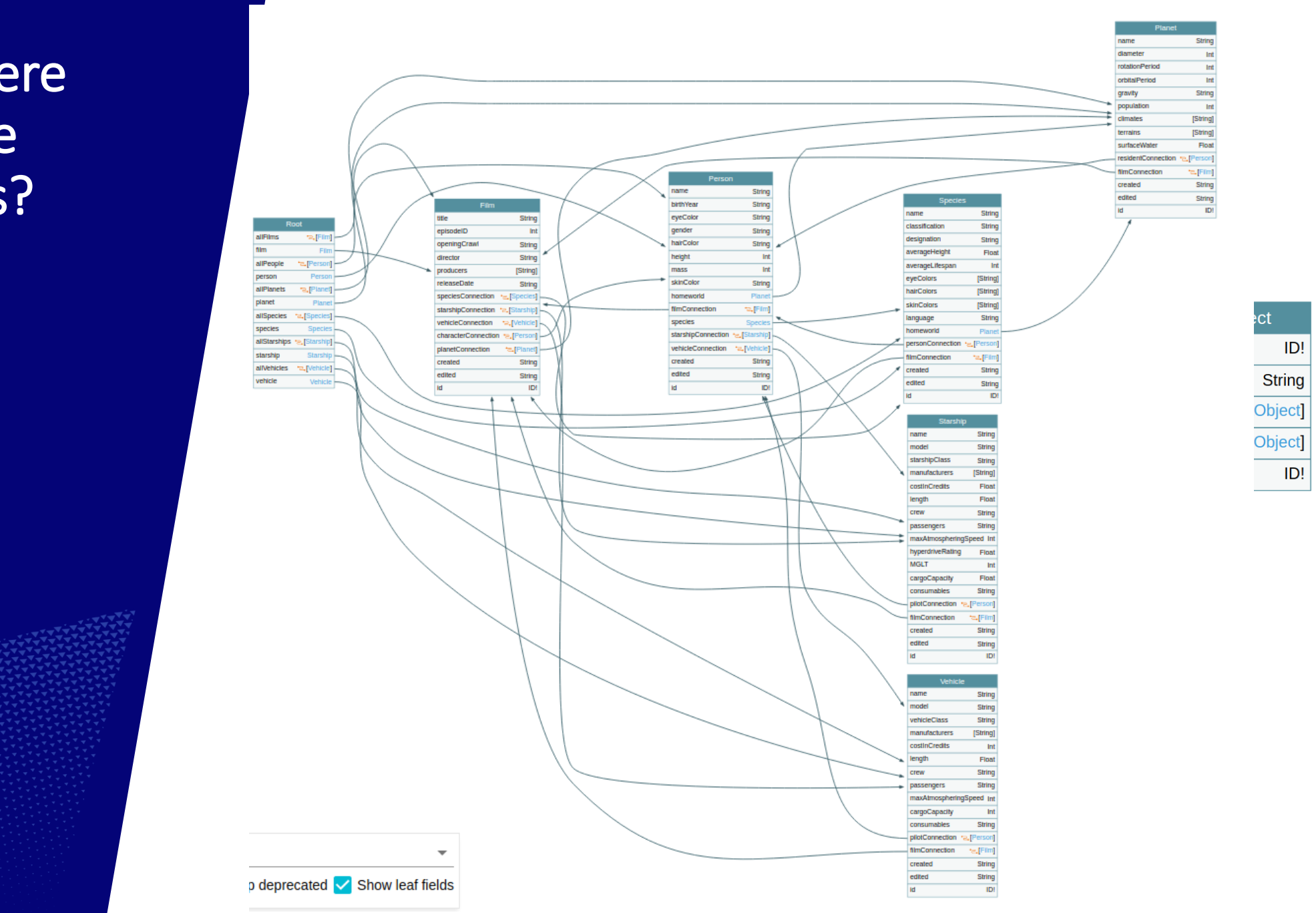
```
{__schema{queryType{name}mutationType{name}subscriptionType{name}types{...FullType}directives{name
description locations args{...InputValue}}}}fragment FullType on __Type{kind name description
fields(includeDeprecated:true){name description args{...InputValue}type{...TypeRef}isDeprecated
deprecationReason}inputFields{...InputValue}interfaces{...TypeRef}enumValues(includeDeprecated:true){name
description isDeprecated deprecationReason}possibleTypes{...TypeRef}}fragment InputValue on
__InputValue{name description type{...TypeRef}defaultValue}fragment TypeRef on __Type{kind name
ofType{kind name ofType{kind name ofType{kind name ofType{kind name ofType{kind name ofType{kind name
ofType{kind name}}}}}}}}
```

It looks like you want request the schema for this API.
Here you go ☺




```
{
  "data": {
    "__schema": {
      "queryType": {
        "name": "Query"
      },
      "mutationType": null,
      "subscriptionType": null,
      "types": [
        {
          "kind": "OBJECT",
          "name": "Query",
          "description": null,
          "fields": [
            {
              "name": "node",
              "description": "The ID of the object",
              "args": [
                {
                  "name": "id",
                  "description": null,
                  "type": {
                    "kind": "NON_NULL",
                    "name": null,
                    "ofType": {
                      "kind": "SCALAR",
                      "name": "ID",
                      "ofType": null
                    }
```

So where are the graphs?



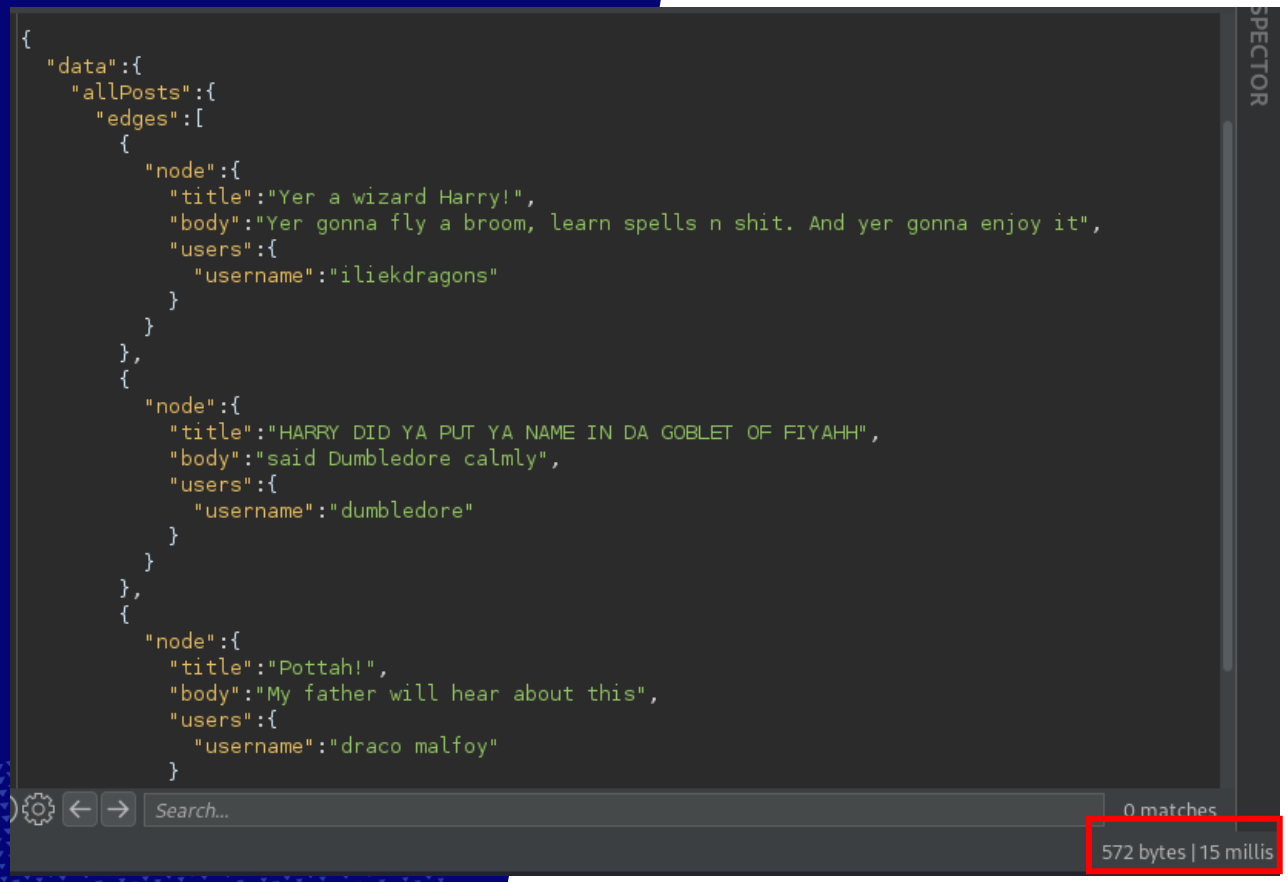
DoS

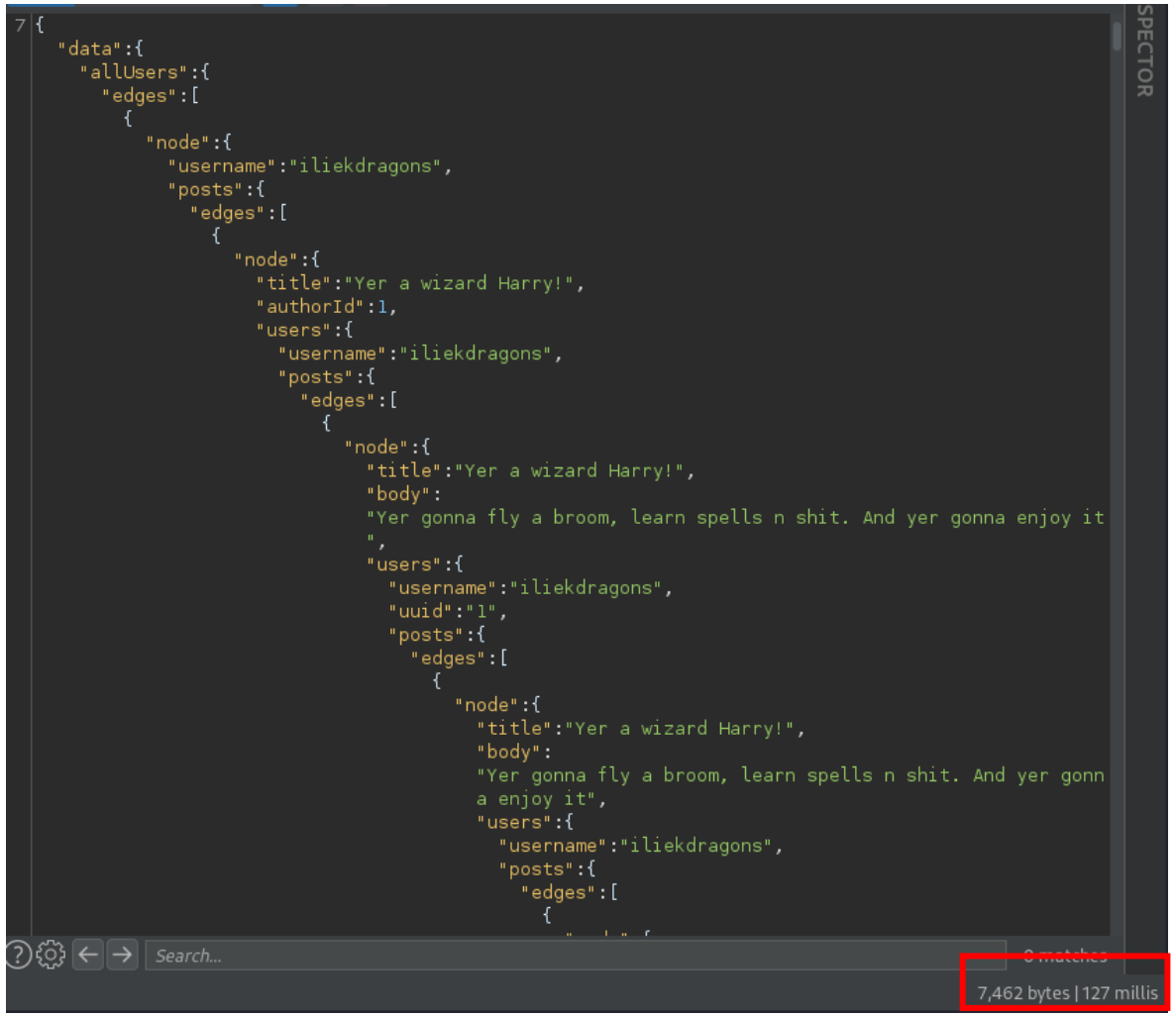
- As queries can be very complex - you can nest them and call them recursively
- E.g In a blog, you will have Users and Posts. A user can have multiple posts and each post will have a user.
- We can call this recursively.

Query Variables Injection Points

```
{
  allUsers {
    edges {
      node {
        username
        posts {
          edges {
            node {
              title
              authorId
              users {
                username
                posts {
                  edges {
                    node {
                      title
                      body
                      users {
                        username
                        uuid
                        username
                        uuid
                        posts {
                          edges {
                            node {
                              title
                              body
                              users {
                                username
                                posts {
                                  edges {
                                    node {
                                      title
                                      body
```

DoS



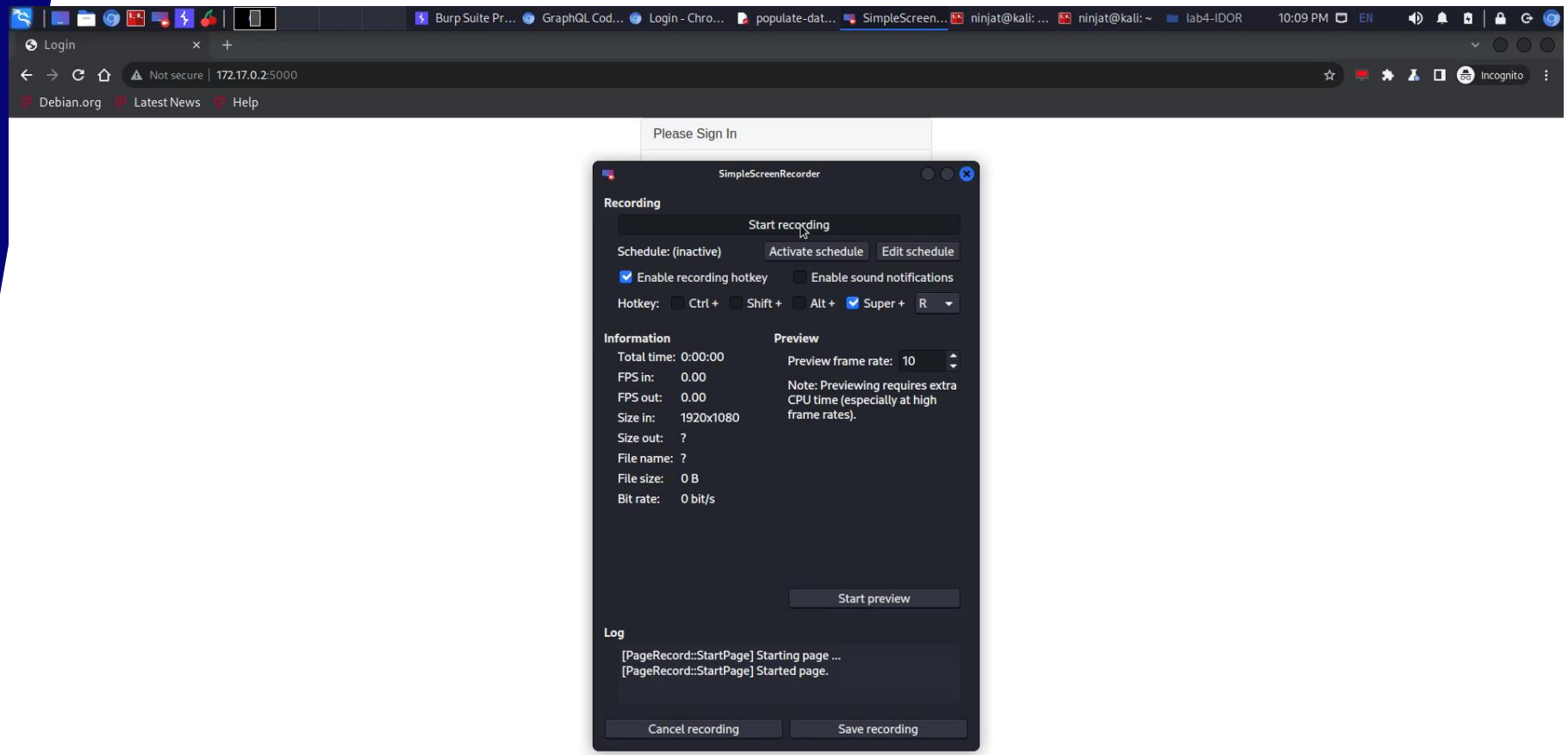


DoS Mitigation?

- Limit Maximum Query Depth
- Throttling Based on Server Time or Query Complexity
- Audit your query before production

- https://www.npmjs.com/package/graphql-validation-complexity
- https://github.com/4Catalyzer/graphql-validation-complexity
- https://github.com/slicknode/graphql-query-complexity

IDOR

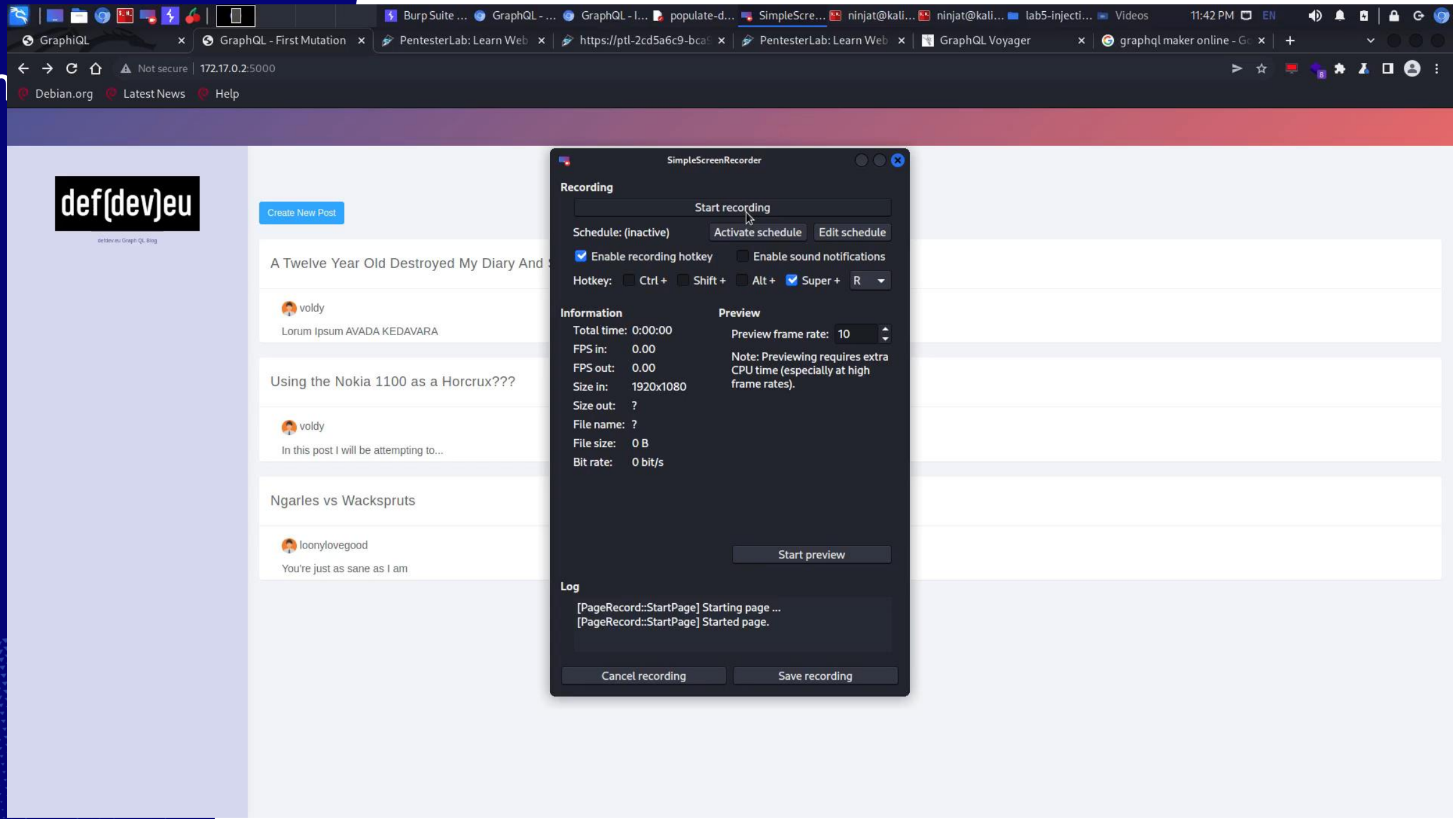


IDOR Mitigation?

- Use GUIDs instead of IDs
  - Increases complexity

- Implement Role Based Access Controls (RBACs)
  - Validate that the requested is authorised to perform the action

In



Injection Mitigation?

- Input Validation
  - Whitelist approach
- Use parameterised queries

Examples

- Testing a crowdfunding style app
- Access controls weren’t applied to GraphQL endpoint
- Allowed **unauthed** payments to funding requests, remove funding from one project to another and resetting user passwords
- Create your own project -> Move funding to your own project -> $$$$

Q&A

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