FWDSEC

We Taught Burp How to Speak GraphQL

Jared Meit

2024-5-27 | v0.2

About Me

Jared Meit

- Senior Application Security Consultant
- 16 years of web API design and development
- 7 years in security professionally + decades unprofessionally
- Designations & Certifications: OSWE, Azure Security Engineer

Quick Poll:

1. Who has heard of GraphQL?
2. Who uses Burp Suite?
3. Who has pentested GraphQL?
4. Who has pentested GraphQL with Burp?

Overview

- Intro (Already done)
- What is GraphQL
- GraphQL weaknesses + attacks
- Current security tools landscape
- Overview of my tool
- Demo
- Q&A

What even, like, is GraphQL?

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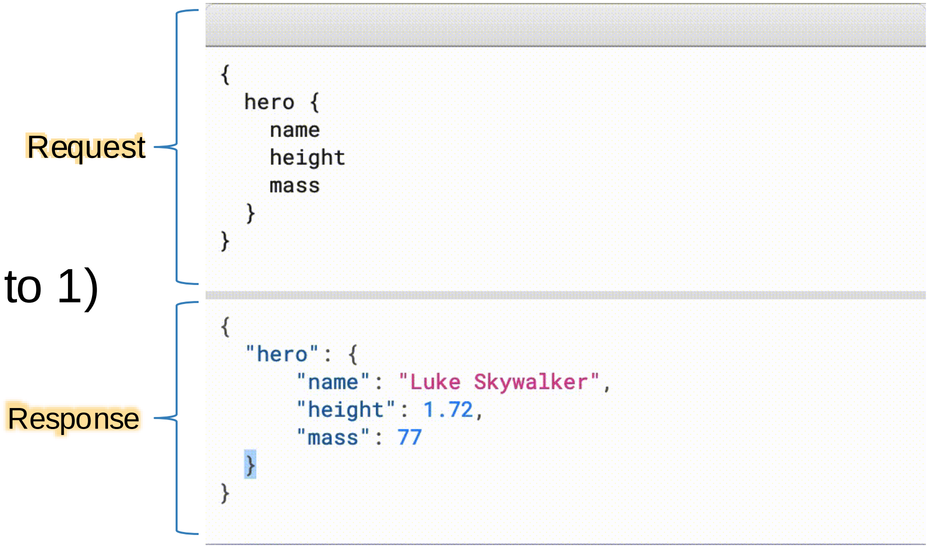
GraphQL

“A query language for your API"

- ✓ Body format
- ✓ Reduces calls to API
- ✓ Reduces endpoints (sometimes to 1)



```
{
  hero {
    name
    height
    mass
  }
}
```

```
{
  "hero": {
      "name": "Luke Skywalker",
      "height": 1.72,
      "mass": 77
  }
}
```

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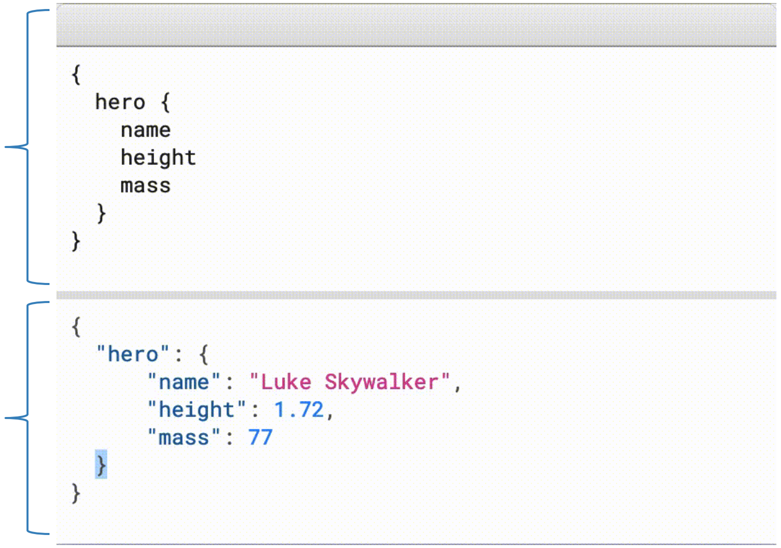
GraphQL

"A query language for your API"

- ✓ Body format
- ✓ Reduces calls to API
- ✓ Reduces endpoints (sometimes to 1)
- ✓ Just as vulnerable as regular REST
- ✓ Bonus DoS vulns
- ✓ It self-documents (Introspection)



Request

```
{
  hero {
    name
    height
    mass
  }
}
```

Response

```
{
  "hero": {
      "name": "Luke Skywalker",
      "height": 1.72,
      "mass": 77
  }
}
```

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What is GraphQL?

GraphQL

In your application code:

1. Import GraphQL library
2. Define GraphQL schema
3. Define “resolvers” that respond to the queries

Request Types:

- Query
- Mutation
- Subscription

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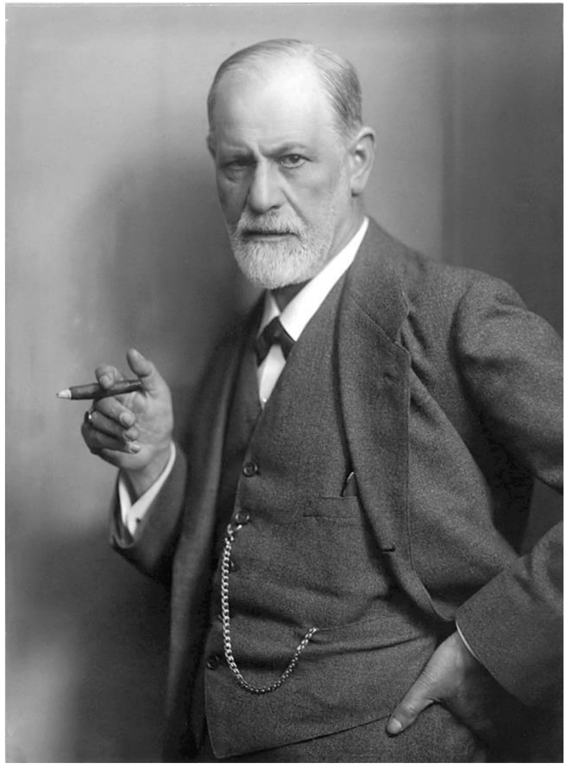
GraphQL

Introspection

- Special query
- Fetches entire schema
- Useful for frontend
- Vulnerability?



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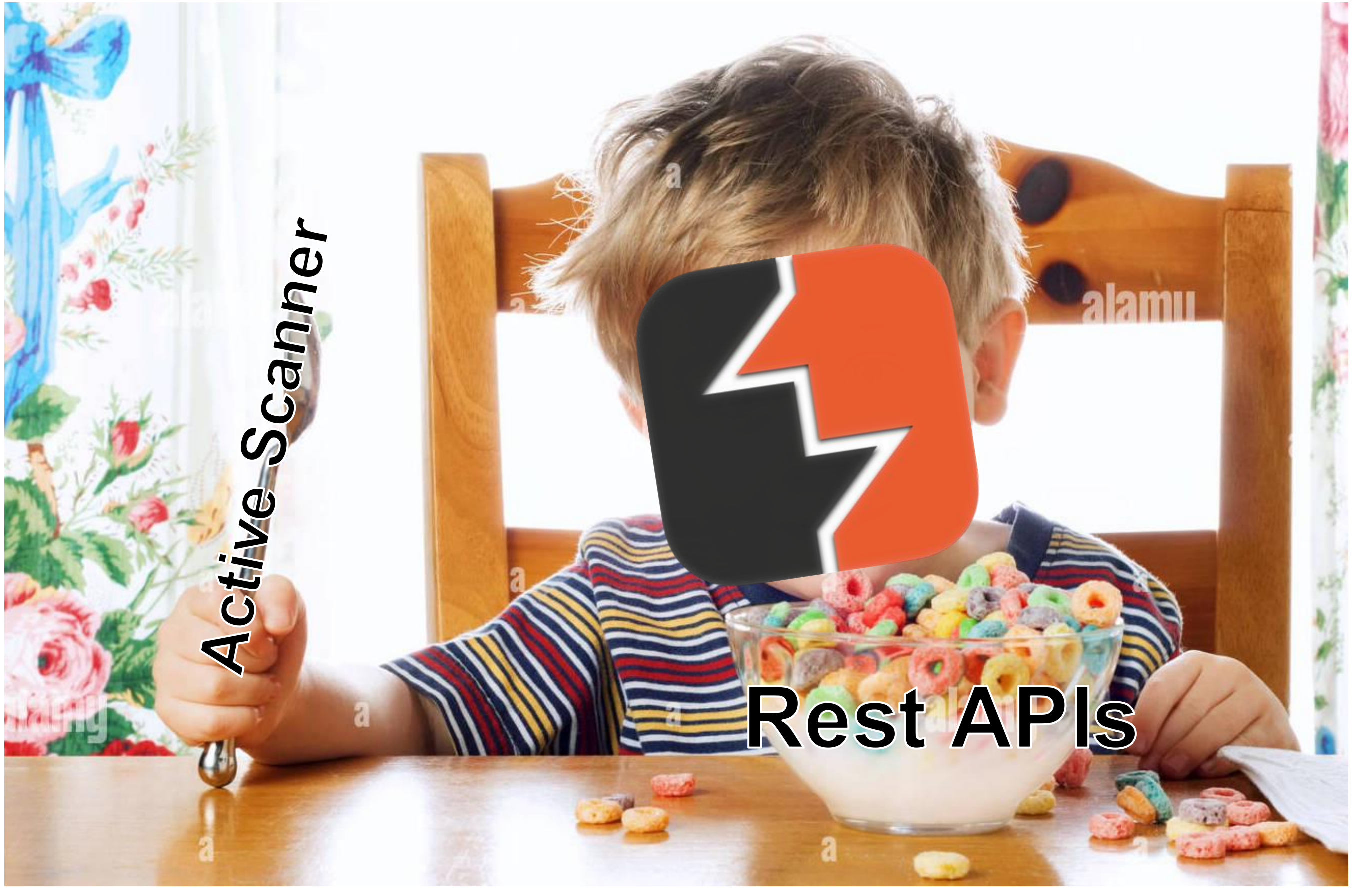
What is GraphQL?



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Safe Injection Sites

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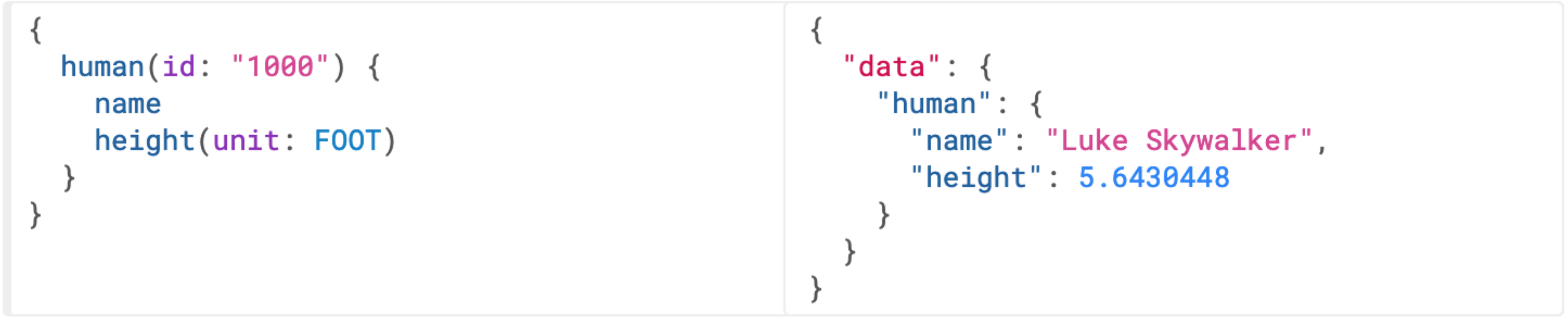
Ohhhhhhhhh… It takes params.

- Standard and custom data types



```
{
  human(id: "1000") {
    name
    height(unit: FOOT)
  }
}
```

```
{
  "data": {
    "human": {
      "name": "Luke Skywalker",
      "height": 5.6430448
    }
  }
}
```

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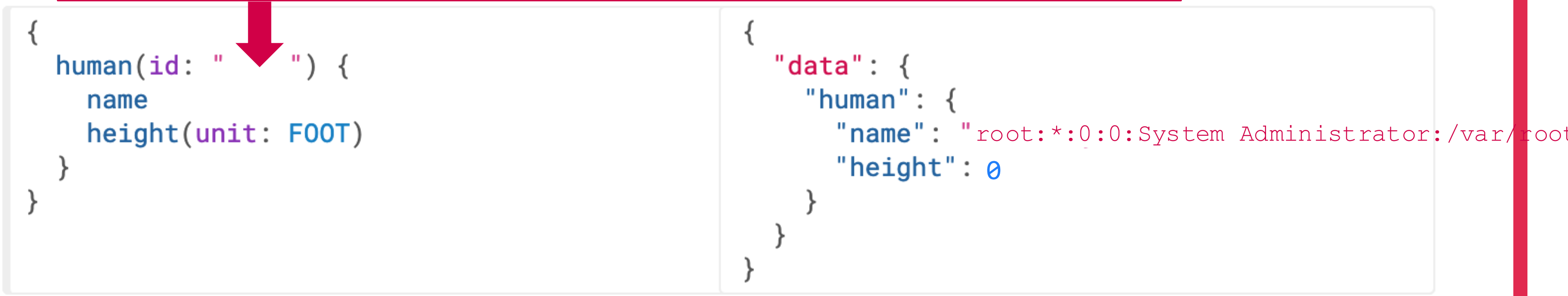
Old payloads
New locations

```
' UNION ALL SELECT LOAD_FILE('/etc/passwd') --
```



```
{
  human(id: "      ") {
    name
    height(unit: FOOT)
  }
}
```

```
{
  "data": {
    "human": {
      "name": "root:*:0:0:System Administrator:/var/root
      "height": 0
    }
  }
}
```

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Beautified:

```
{
  human(id: "1000") {
    name
    height(unit: FOOT)
  }
}
```

```
{
  "data": {
    "human": {
      "name": "Luke Skywalker",
      "height": 5.6430448
    }
  }
}
```

Actual request body:

```
1. {"query": "query {\n\thuman(id:\"1000\")
   {\n\t\tname\n\t\theight(unit:FOOT)\n}"}
```

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Burp is like:

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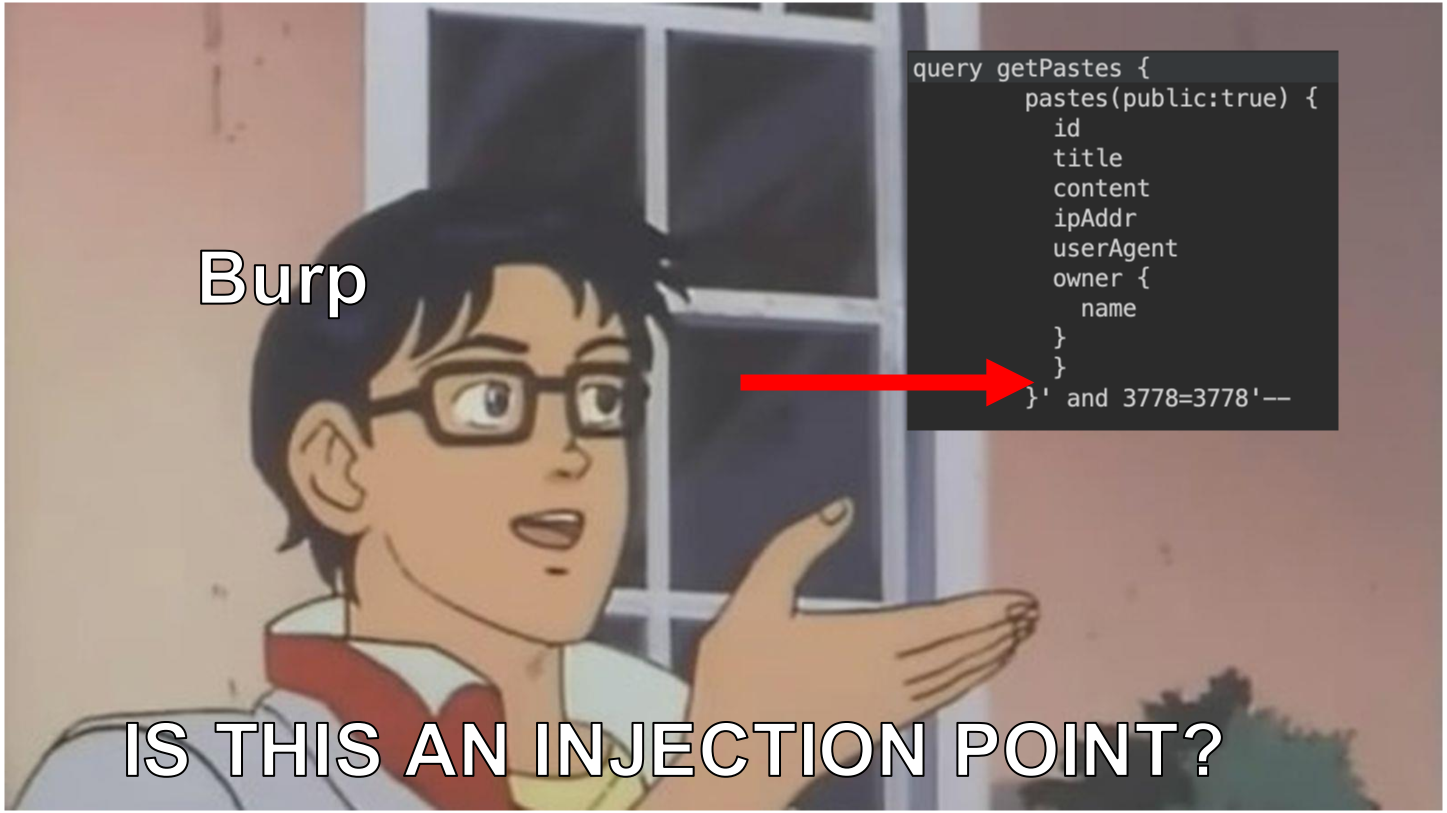

```
query getPastes {
        pastes(public:true) {
          id
          title
          content
          ipAddr
          userAgent
          owner {
            name
          }
          }
        }' and 3778=3778'--
```

Gently coaching Burp without being condescending

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Goals:

- Burp extension
- Auto find every possible request
- Leverage Active Scan

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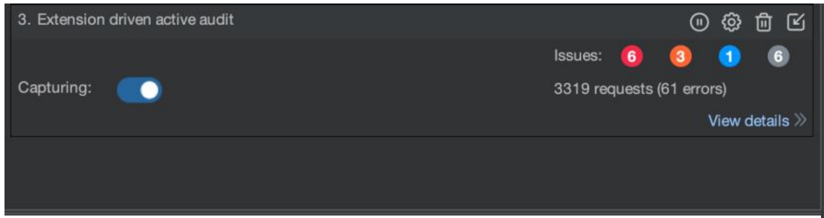
Solution



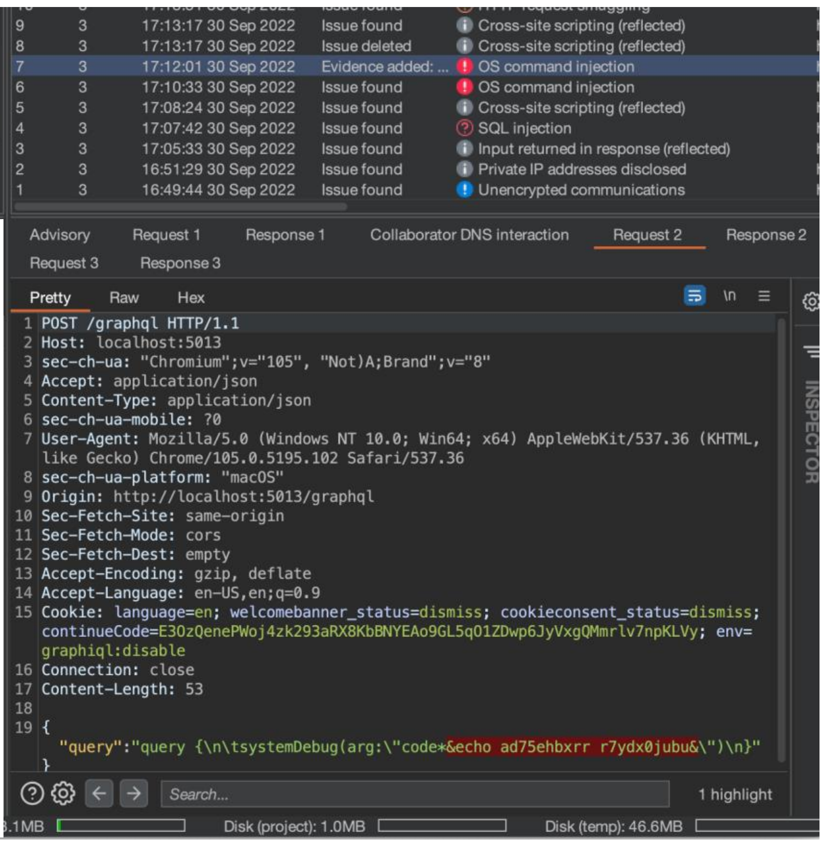
3. Extension driven active audit

Issues: 6 3 1 6

Capturing:

3319 requests (61 errors)

View details



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1   3   16:49:44 30 Sep 2022   Issue found         Unencrypted communications
```

```
POST /graphql HTTP/1.1
Host: localhost:5013
sec-ch-ua: "Chromium";v="105", "Not)A;Brand";v="8"
Accept: application/json
Content-Type: application/json
sec-ch-ua-mobile: ?0
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/105.0.5195.102 Safari/537.36
sec-ch-ua-platform: "macOS"
Origin: http://localhost:5013/graphql
Sec-Fetch-Site: same-origin
Sec-Fetch-Mode: cors
Sec-Fetch-Dest: empty
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9
Cookie: language=en; welcomebanner_status=dismiss; cookieconsent_status=dismiss;
continueCode=E3OzQenePWoj4zk293aRX8KbBNYEAo9GL5q01ZDwp6JyVxgQMmrlv7npKLVy; env=
graphiql:disable
Connection: close
Content-Length: 53

{
  "query":"query {\n\tsystemDebug(arg:\"code*&echo ad75ehbxrr r7ydx0jubu&\")\n}"
}
```

Goals:

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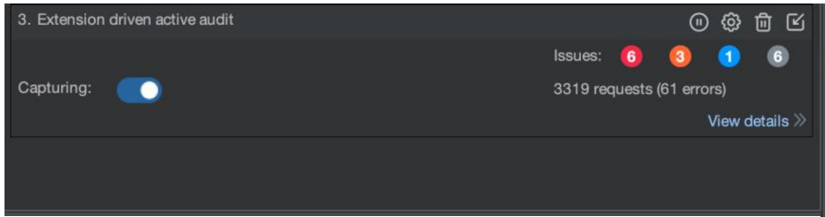
Solution



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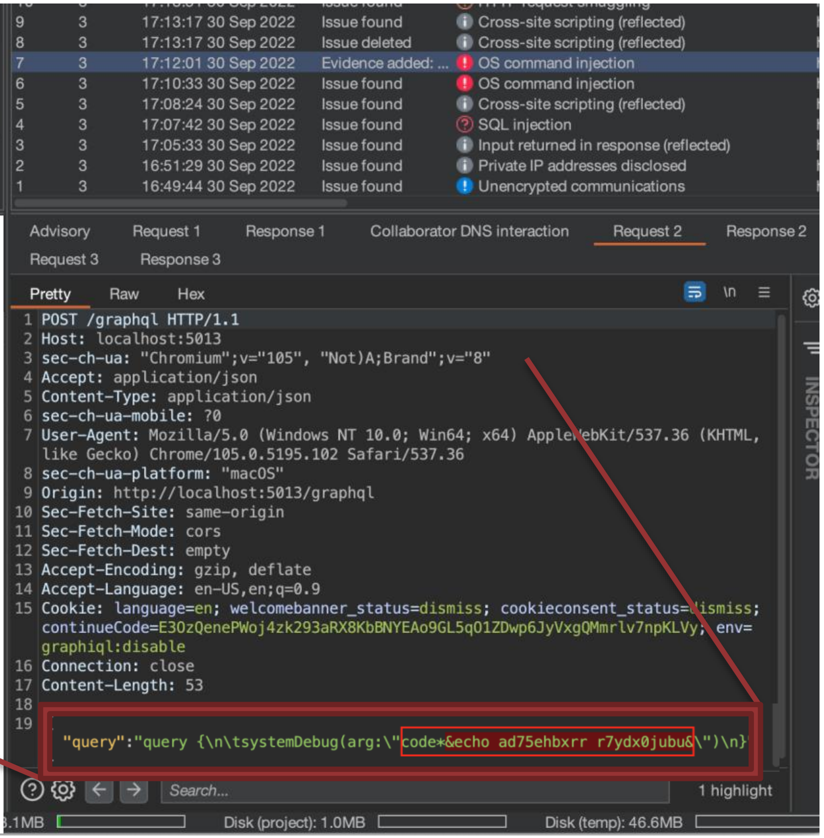

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Accept: application/json
Content-Type: application/json
sec-ch-ua-mobile: ?0
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/105.0.5195.102 Safari/537.36
sec-ch-ua-platform: "macOS"
Origin: http://localhost:5013/graphql
Sec-Fetch-Site: same-origin
Sec-Fetch-Mode: cors
Sec-Fetch-Dest: empty
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9
Cookie: language=en; welcomebanner_status=dismiss; cookieconsent_status=dismiss;
continueCode=E3OzQenePWoj4zk293aRX8KbBNYEAo9GL5q01ZDwp6JyVxgQMmrlv7npKLVy; env=
graphiql:disable
Connection: close
Content-Length: 53


 "query":"query {\n\tsystemDebug(arg:\"code*&echo ad75ehbxrr r7ydx0jubu&\")\n}
```

```
Search...                                   1 highlight
.1MB     Disk (project): 1.0MB     Disk (temp): 46.6MB
```

Goals:

- Burp extension
- Auto find every possible request
- Leverage Active Scan

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Auto GQL™ (aka Burp GraphQL Auto Scanner)

- Give it a URL
- Customize headers (optional)
- Click “Go”

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- Give it a URL
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- Click “Go”

    1. Runs Introspection Query
    2. Determines every possible request
    3. Finds insertion/injection points
    4. Sends them all to Active Scanner
    5. You: profit

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Demo Time

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Auto GQL™ (aka Burp GraphQL Auto Scanner)

- Give it a URL or schema file
- Customize headers (optional)
- Click “Go”

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3. Finds insertion/injection points
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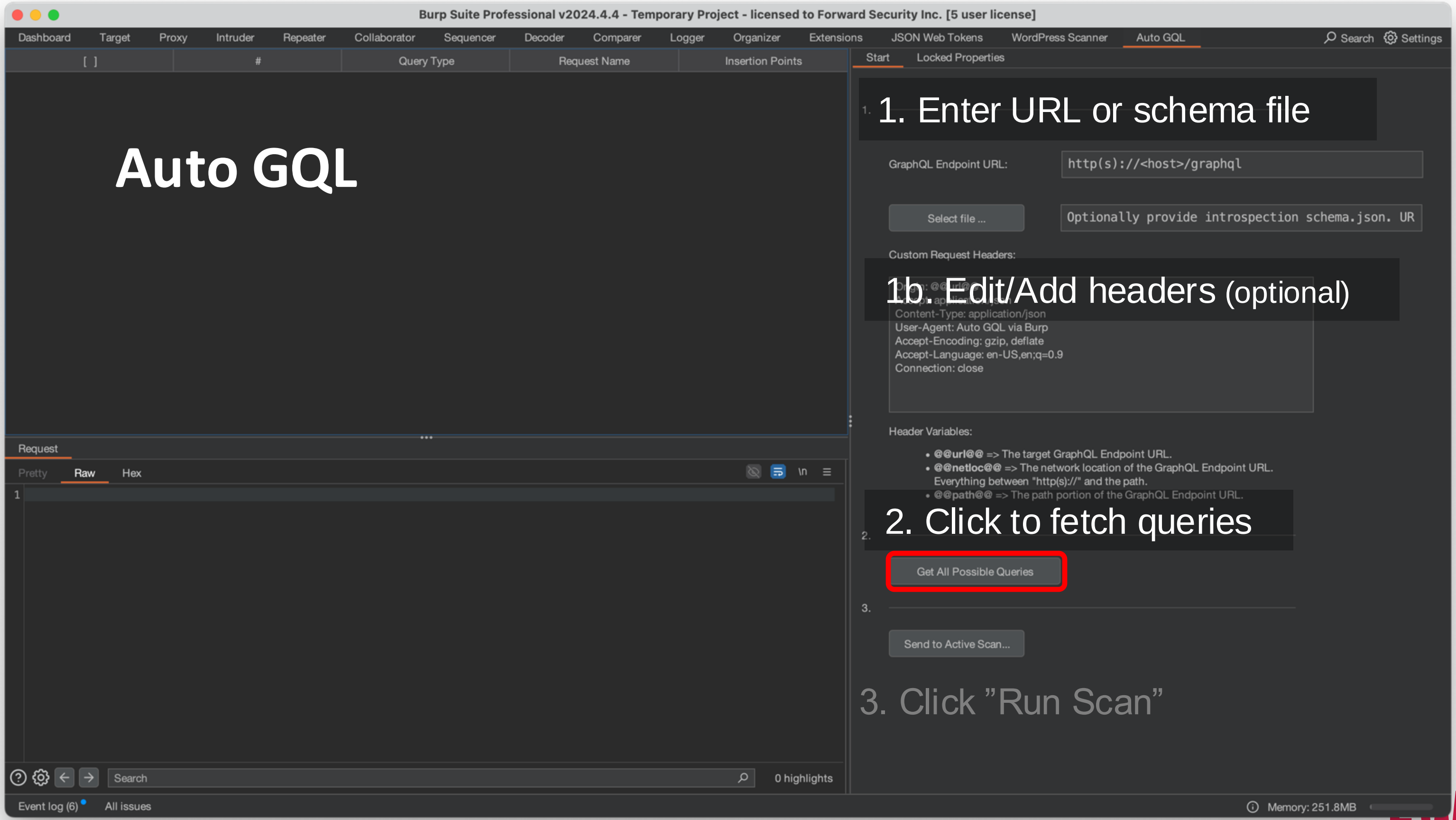

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Auto GQL

1. Enter URL or schema file

GraphQL Endpoint URL: http(s)://<host>/graphql

Optionally provide introspection schema.json. UR

Custom Request Headers:

1b. Edit/Add headers (optional)

```
Content-Type: application/json
User-Agent: Auto GQL via Burp
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9
Connection: close
```

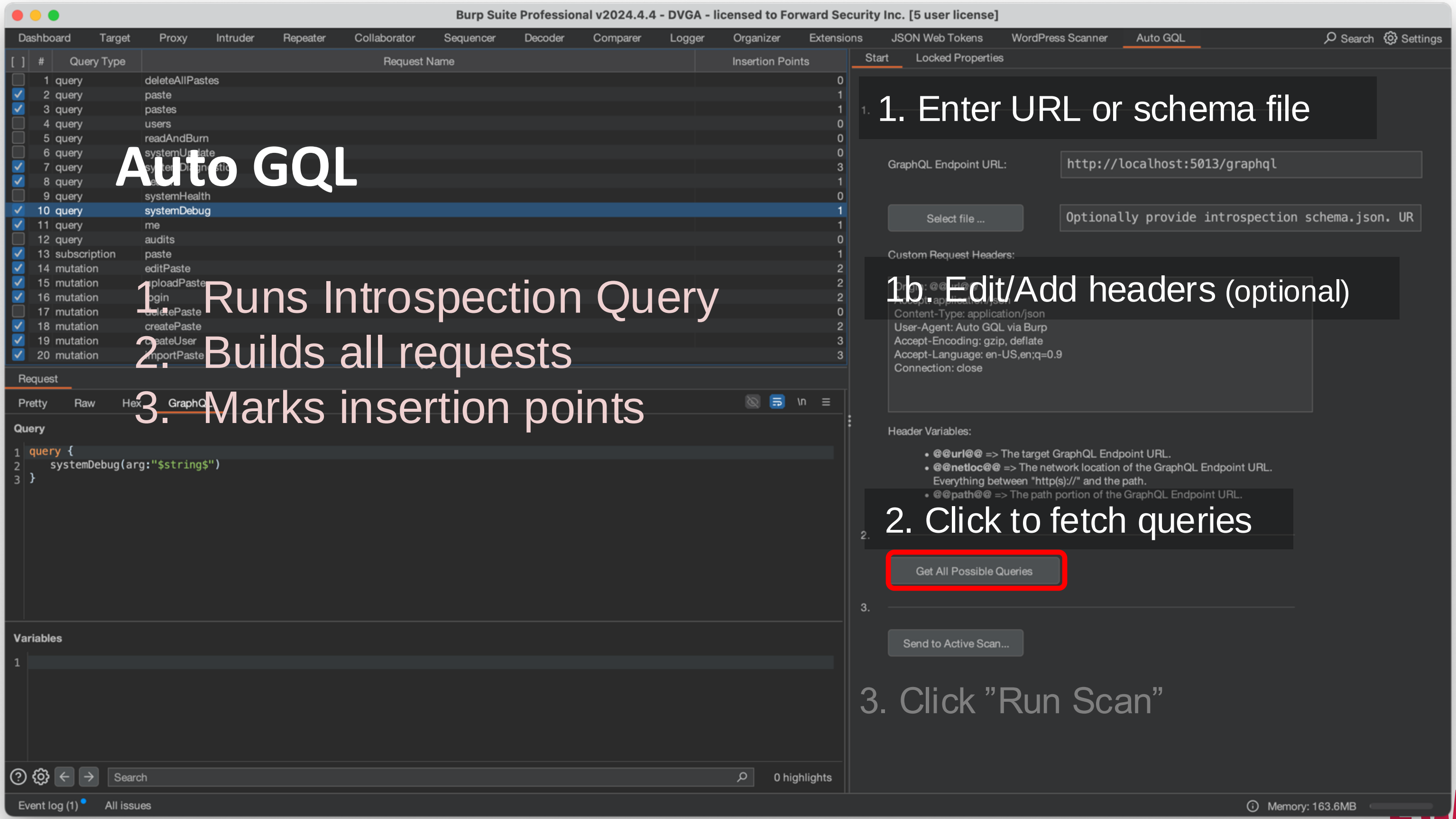
Header Variables:

- @@url@@ => The target GraphQL Endpoint URL.
- @@netloc@@ => The network location of the GraphQL Endpoint URL. Everything between "http(s)://" and the path.
- @@path@@ => The path portion of the GraphQL Endpoint URL.

2. Click to fetch queries

3. Click "Run Scan"

Solution



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Dashboard Target Proxy Intruder Repeater Collaborator Sequencer Decoder Comparer Logger Organizer Extensions JSON Web Tokens WordPress Scanner Auto GQL
Search Settings
Start Locked Properties

[ ]	#	Query Type	Request Name	Insertion Points
☐	1	query	deleteAllPastes	0
✓	2	query	paste	1
✓	3	query	pastes	1
☐	4	query	users	0
☐	5	query	readAndBurn	0
☐	6	query	systemUpdate	0
✓	7	query	systemDiagnostics	3
✓	8	query	[illegible]	1
☐	9	query	systemHealth	0
✓	10	query	systemDebug	1
✓	11	query	me	1
☐	12	query	audits	0
✓	13	subscription	paste	1
✓	14	mutation	editPaste	2
✓	15	mutation	uploadPaste	2
✓	16	mutation	login	2
☐	17	mutation	deletePaste	0
✓	18	mutation	createPaste	2
✓	19	mutation	createUser	3
✓	20	mutation	importPaste	3

Query

```
query {
  systemDebug(arg:"$string$")
}
```

Variables

Auto GQL

1. Runs Introspection Query
2. Builds all requests
3. Marks insertion points

1. Enter URL or schema file

GraphQL Endpoint URL: http://localhost:5013/graphql

Select file ... Optionally provide introspection schema.json. UR

Custom Request Headers:

1b. Edit/Add headers (optional)

```
Content-Type: application/json
User-Agent: Auto GQL via Burp
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9
Connection: close
```

Header Variables:

- @@url@@ => The target GraphQL Endpoint URL.
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Get All Possible Queries

Send to Active Scan...

3. Click "Run Scan"

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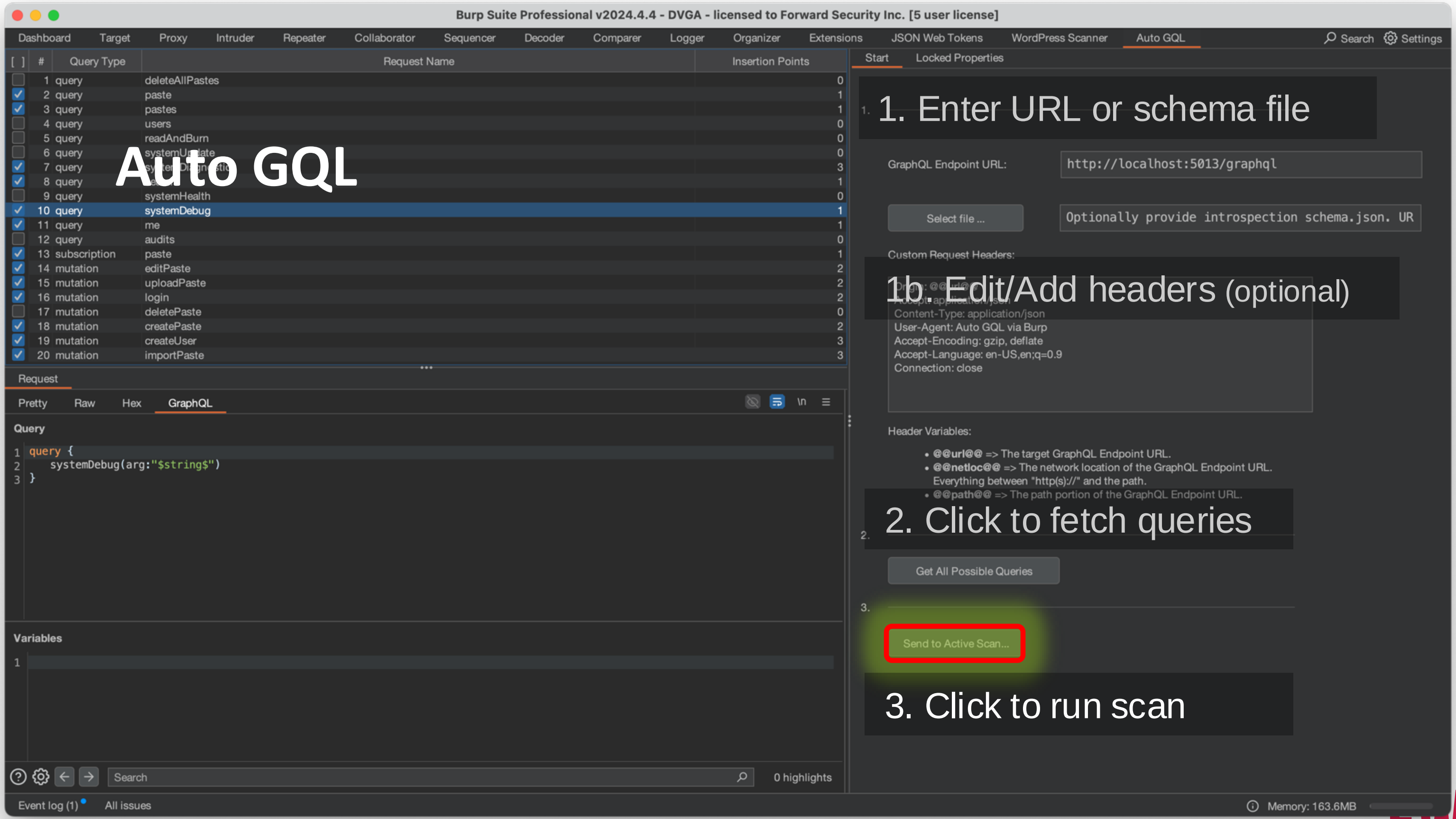
Solution



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Auto GQL

[ ]	#	Query Type	Request Name	Insertion Points
☐	1	query	deleteAllPastes	0
✓	2	query	paste	1
✓	3	query	pastes	1
☐	4	query	users	0
☐	5	query	readAndBurn	0
☐	6	query	systemUpdate	0
✓	7	query	[illegible]	3
✓	8	query	[illegible]	1
☐	9	query	systemHealth	0
✓	10	query	systemDebug	1
✓	11	query	me	1
☐	12	query	audits	0
✓	13	subscription	paste	1
✓	14	mutation	editPaste	2
✓	15	mutation	uploadPaste	2
✓	16	mutation	login	2
☐	17	mutation	deletePaste	0
✓	18	mutation	createPaste	2
✓	19	mutation	createUser	3
✓	20	mutation	importPaste	3

Request

Query

```
query {
  systemDebug(arg:"$string$")
}
```

Variables

1. Enter URL or schema file

GraphQL Endpoint URL: `http://localhost:5013/graphql`

Select file ... `Optionally provide introspection schema.json. UR`

Custom Request Headers:

1b. Edit/Add headers (optional)

```
Content-Type: application/json
User-Agent: Auto GQL via Burp
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9
Connection: close
```

Header Variables:

- @@url@@ => The target GraphQL Endpoint URL.
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2. Click to fetch queries

Get All Possible Queries

3. Send to Active Scan...

3. Click to run scan

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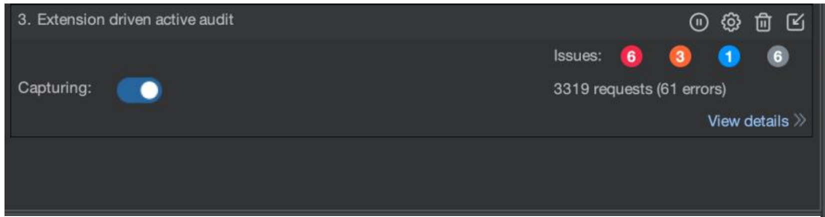
Solution



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Issues: 6 3 1 6

Capturing:

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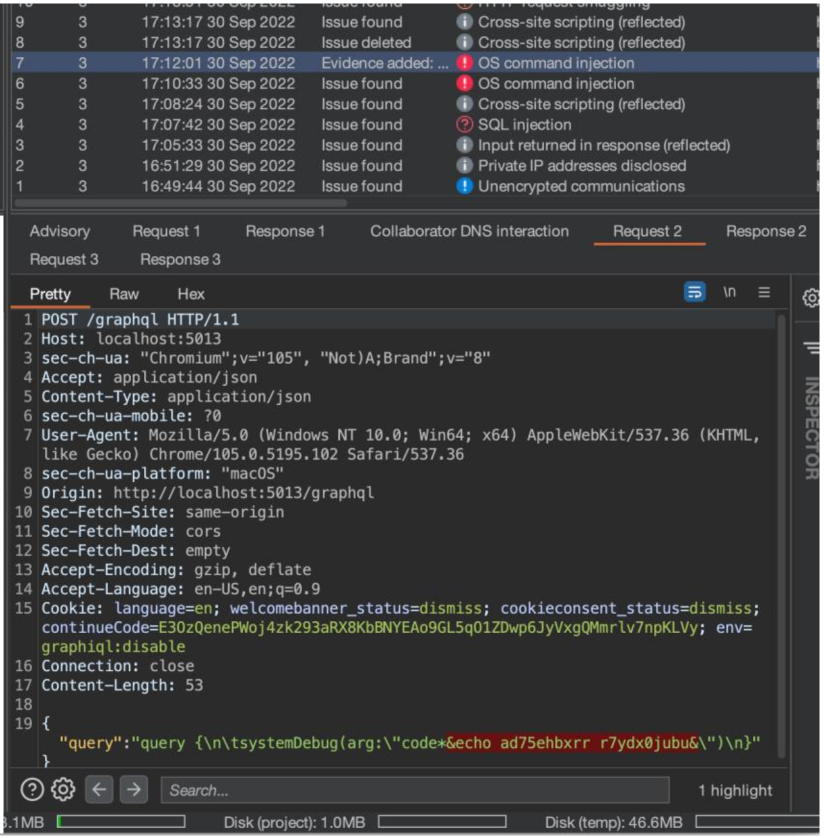
View details »



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```
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Host: localhost:5013
sec-ch-ua: "Chromium";v="105", "Not)A;Brand";v="8"
Accept: application/json
Content-Type: application/json
sec-ch-ua-mobile: ?0
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/105.0.5195.102 Safari/537.36
sec-ch-ua-platform: "macOS"
Origin: http://localhost:5013/graphql
Sec-Fetch-Site: same-origin
Sec-Fetch-Mode: cors
Sec-Fetch-Dest: empty
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9
Cookie: language=en; welcomebanner_status=dismiss; cookieconsent_status=dismiss;
continueCode=E3OzQenePWoj4zk293aRX8KbBNYEAo9GL5qO1ZDwp6JyVxgQMmrlv7npKLVy; env=
graphiql:disable
Connection: close
Content-Length: 53

{
  "query":"query {\n\tsystemDebug(arg:\"code*&echo ad75ehbxrr r7ydx0jubu&\")\n}"
}
```

Goals:

- ❏ Burp extension
- ❏ Auto find every possible request
- ❏ Leverage Active Scan

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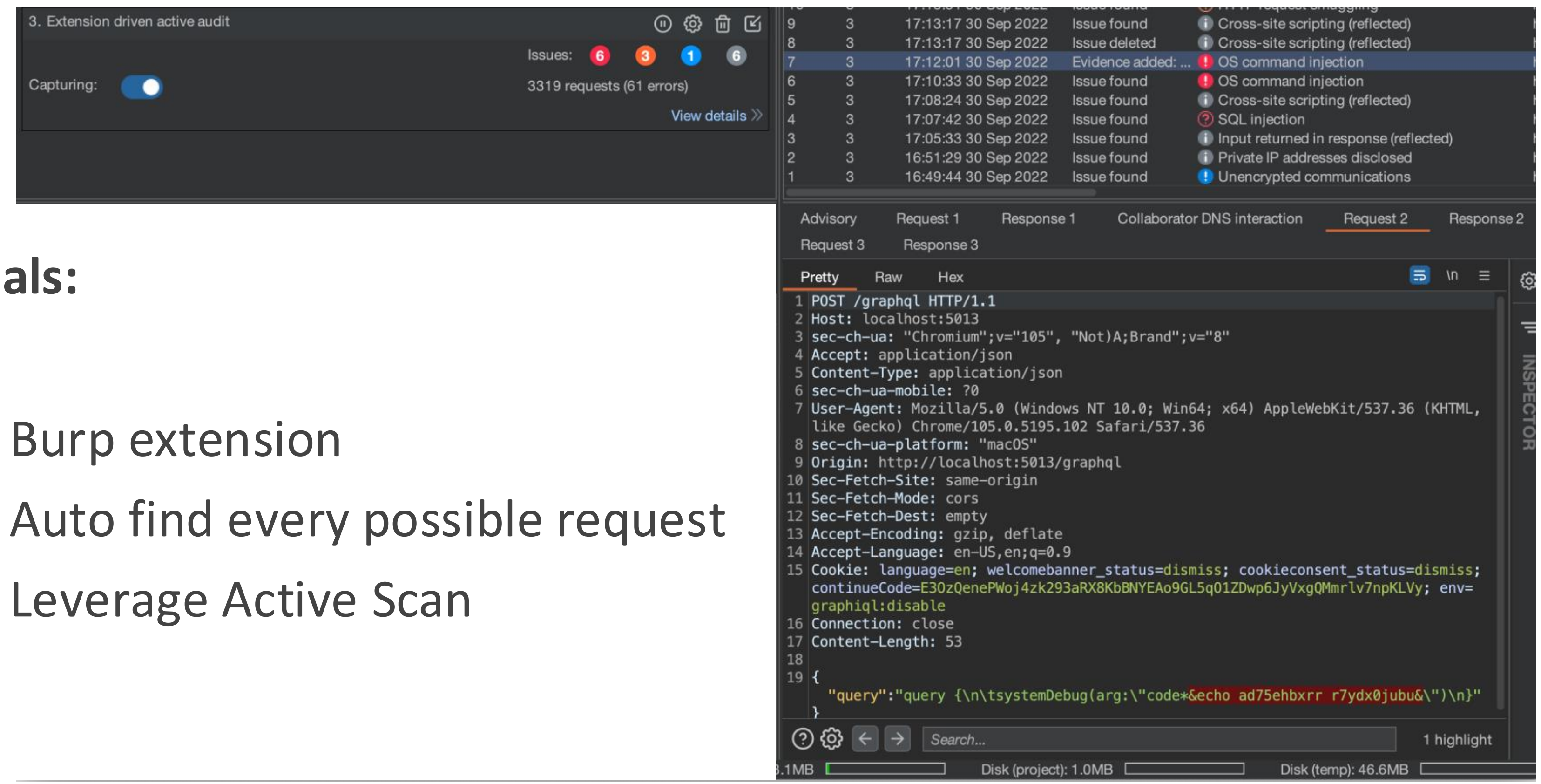

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Host: localhost:5013
sec-ch-ua: "Chromium";v="105", "Not)A;Brand";v="8"
Accept: application/json
Content-Type: application/json
sec-ch-ua-mobile: ?0
User-Agent: Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML,
like Gecko) Chrome/105.0.5195.102 Safari/537.36
sec-ch-ua-platform: "macOS"
Origin: http://localhost:5013/graphql
Sec-Fetch-Site: same-origin
Sec-Fetch-Mode: cors
Sec-Fetch-Dest: empty
Accept-Encoding: gzip, deflate
Accept-Language: en-US,en;q=0.9
Cookie: language=en; welcomebanner_status=dismiss; cookieconsent_status=dismiss;
continueCode=E3OzQenePWoj4zk293aRX8KbBNYEAo9GL5qO1ZDwp6JyVxgQMmrlv7npKLVy; env=
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.1MB        Disk (project): 1.0MB        Disk (temp): 46.6MB
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Goals:

- ✓ Burp extension
- ✓ Auto find every possible request
- ✓ Leverage Active Scan

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Take-away Considerations

- GraphQL is new and security is often lacking
- Burp’s Active Scanner automates vulnerability hunting
- Auto GQL extends Active Scanner to find GraphQL insertion points ***and*** automatically grabs all possible requests.
- Get it here: https://github.com/FWDSEC/burp-auto-gql
- Save massive amounts of time

Workshop Prerequisites

- Burp Suite (Community Edition is fine)
  - https://portswigger.net/burp/communitydownload
  - Click Go straight to downloads -->

- AutoGQL Burp Extension
  - https://github.com/FWDSEC/burp-auto-gql/

- Docker
  - https://www.docker.com/get-started/

- DVGA docker image
  - Pull image:

```
$ docker pull dolevf/dvga:latest
```

  - Run image:

```
$ docker run -t -p 5013:5013 -e WEB_HOST=0.0.0.0 dolevf/dvga
```

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Q&A

Contact Me:

Jared Meit

Email: j.meit@fwdsec.com

https://github.com/FWDSEC/burp-auto-gql

Contact FWDSEC:

Twitter: @FWD_SEC

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