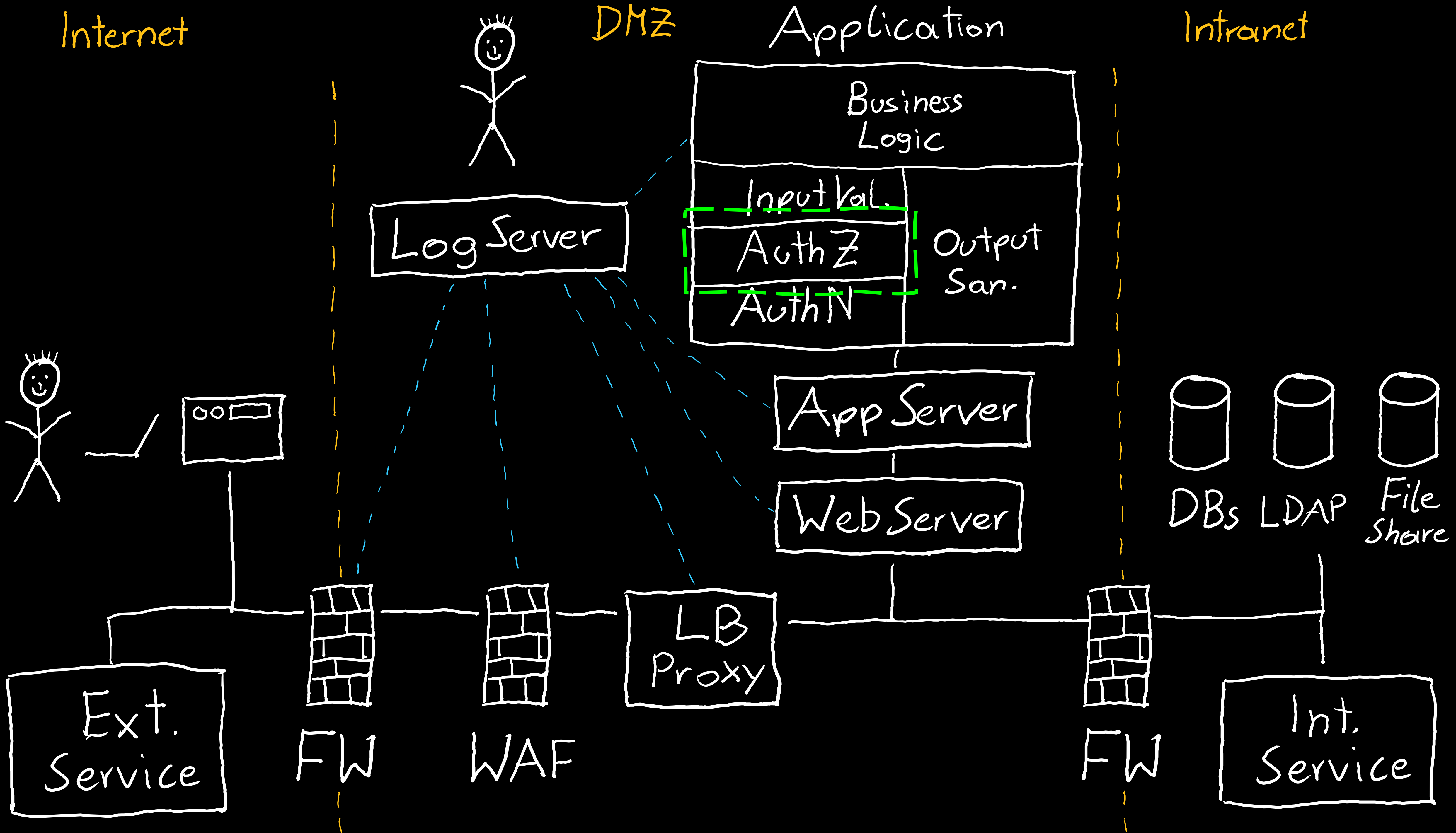
Authorization

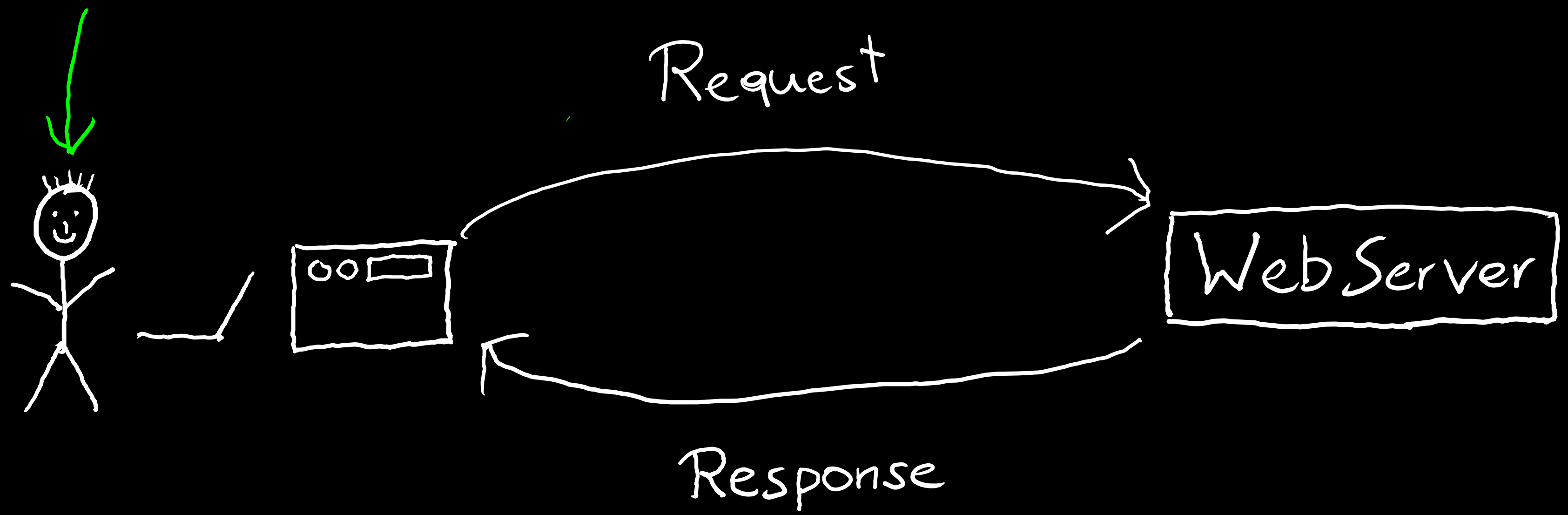
Forceful Browsing, Path Traversal, TOCTOU

Rough Overview

1. Introduction
2. Basic Principles and Resources
3. Architecture & Basic Web Procedure
4. Authentication and Session Management
5. >> Authorization <<
6. Server and Backend Attacks
7. Remaining Client Attacks
8. General Topics
9. Conclusions


Internet
DMZ
Application
Intranet
Business Logic
Input Val.
AuthZ
AuthN
Output San.
Log Server
App Server
Web Server
DBs
LDAP
File Share
Ext. Service
FW
WAF
LB Proxy
FW
Int. Service

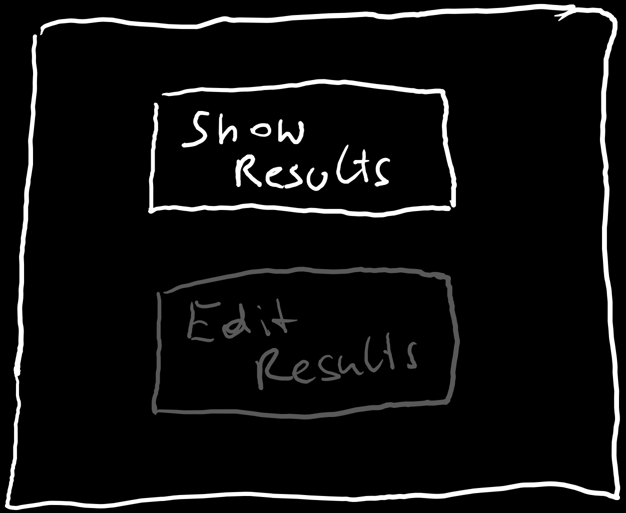
ok, we now really know who this guy is…



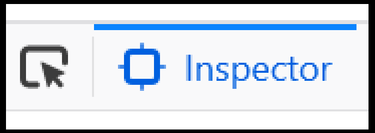
… and we also know how session management works

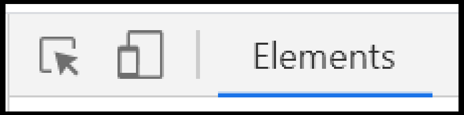
but what is he actually allowed to do?

what is the first thing ~~you~~ an attacker would do?



```
<button disabled>Edit Results</button>
```

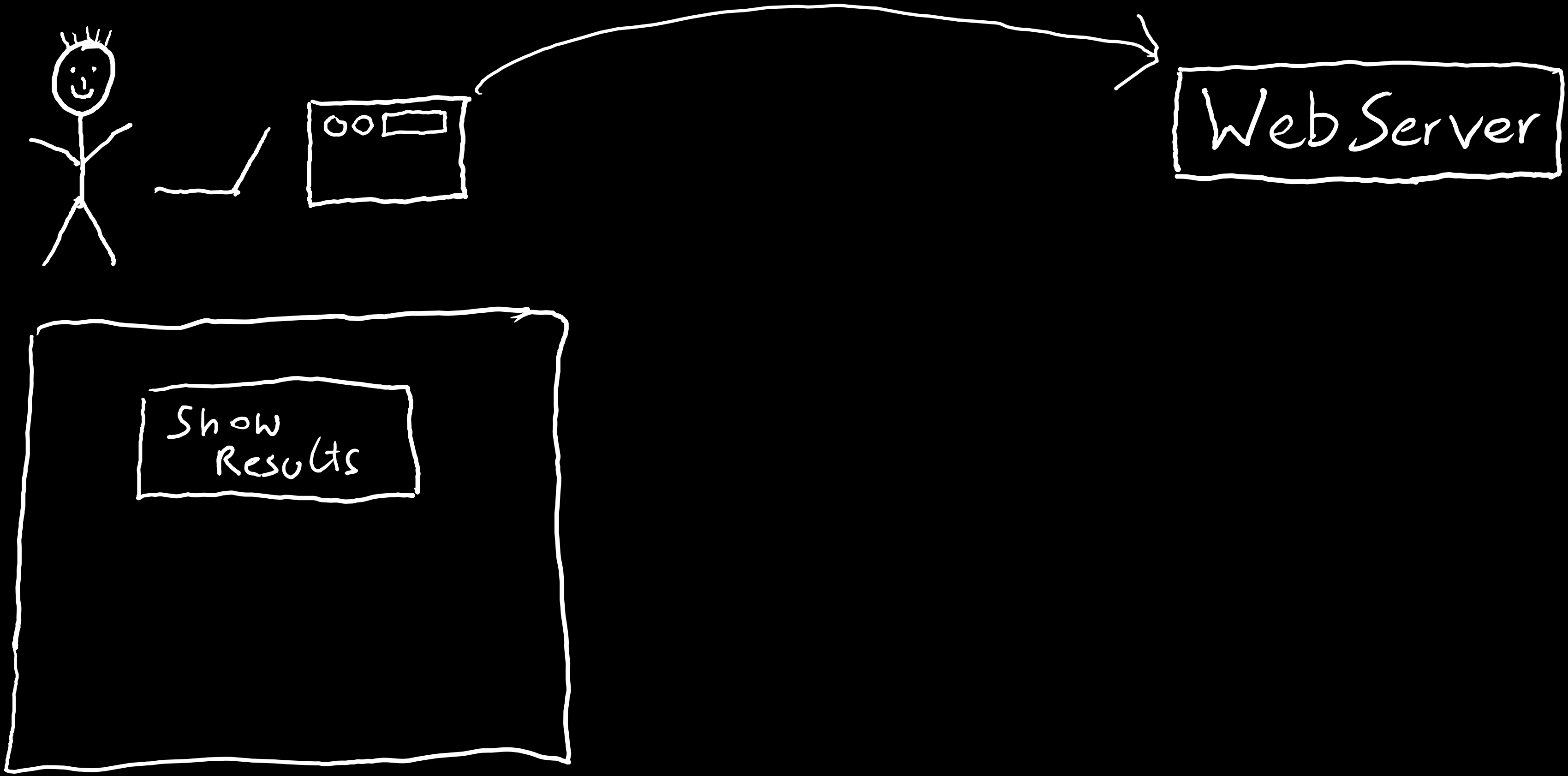




$\boxed{\text{F12}}$

what would an attacker do now?

```
GET /show-results HTTP/1.1
Host: lightside.me
```



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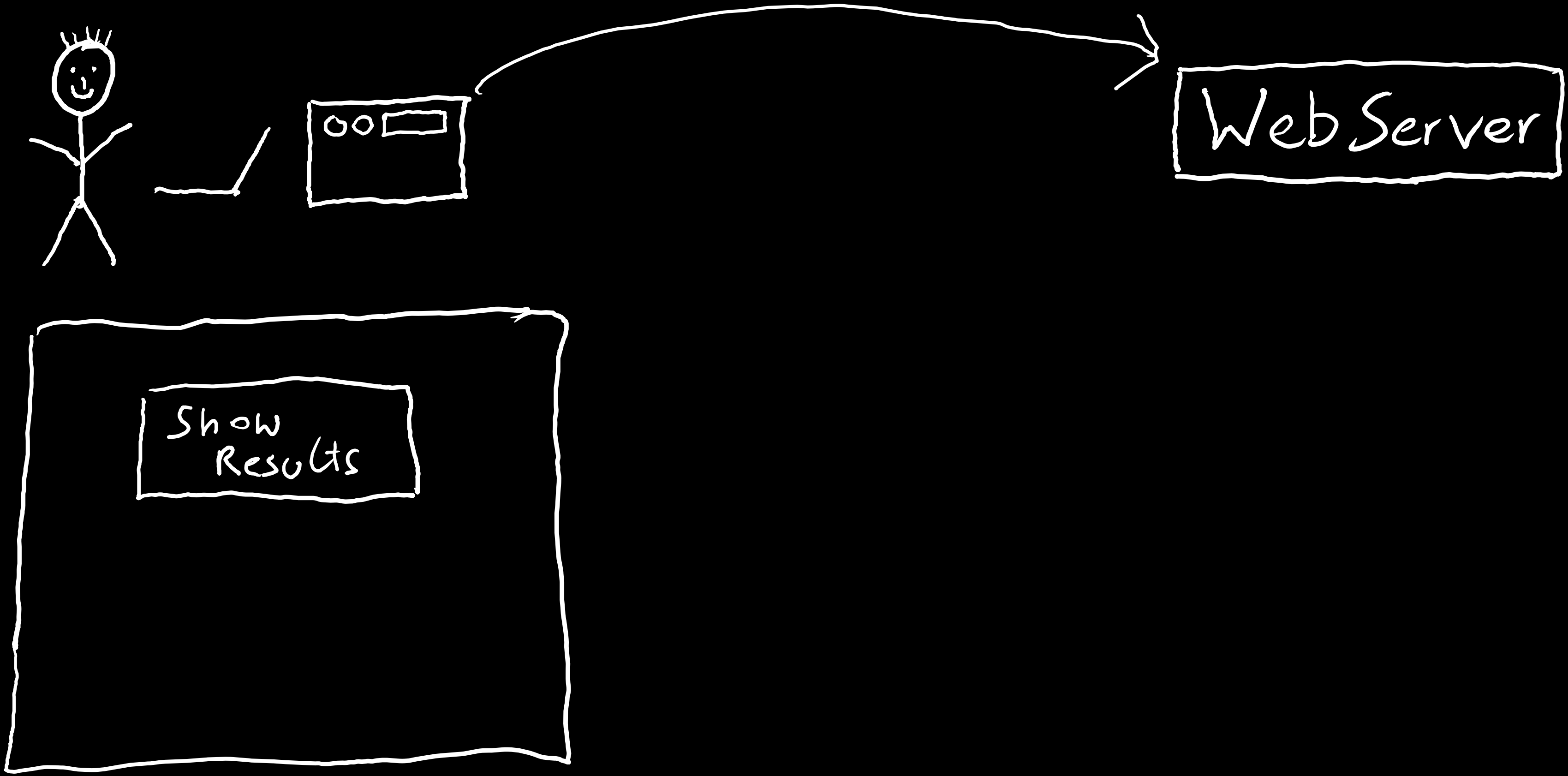
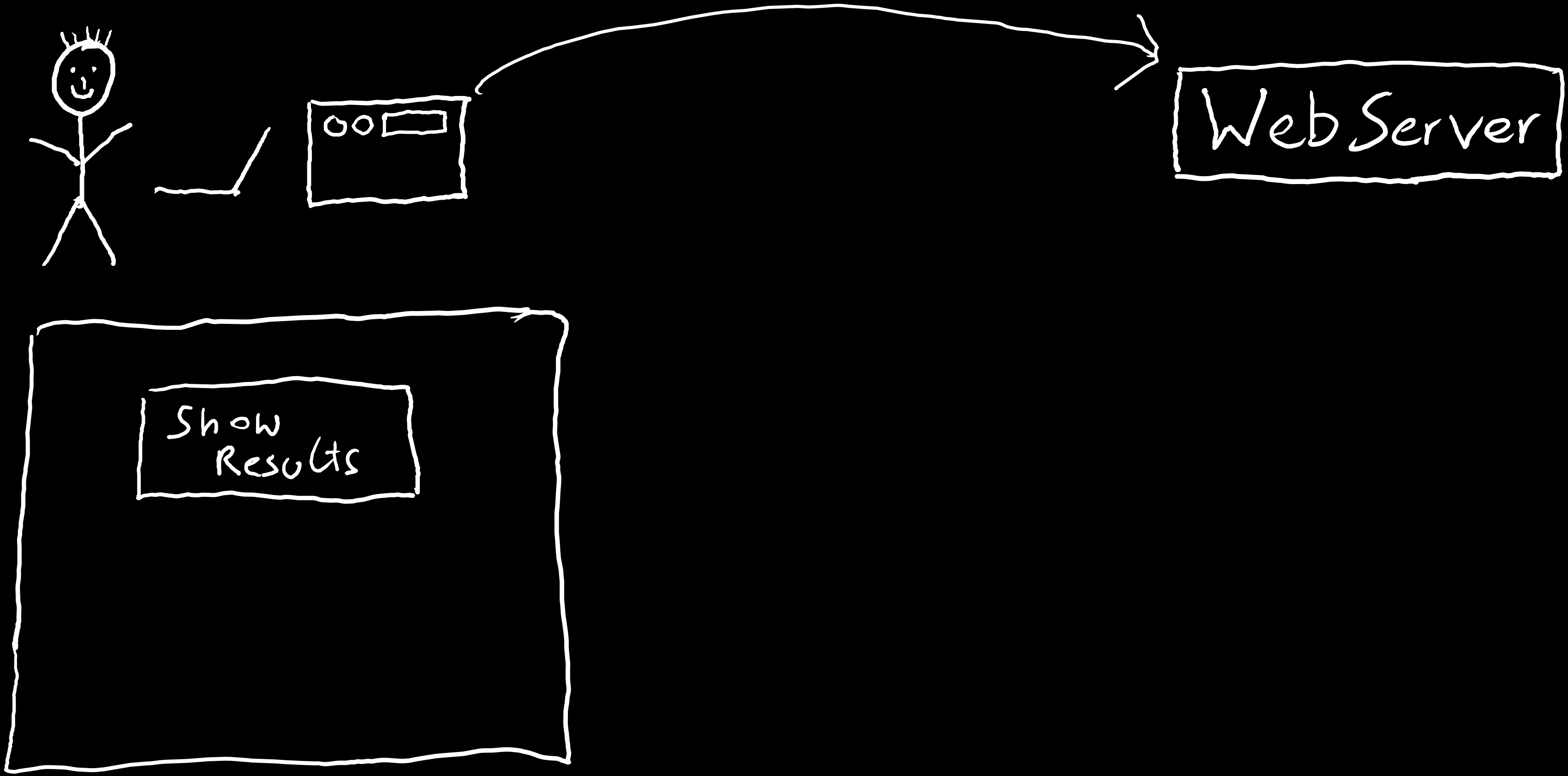


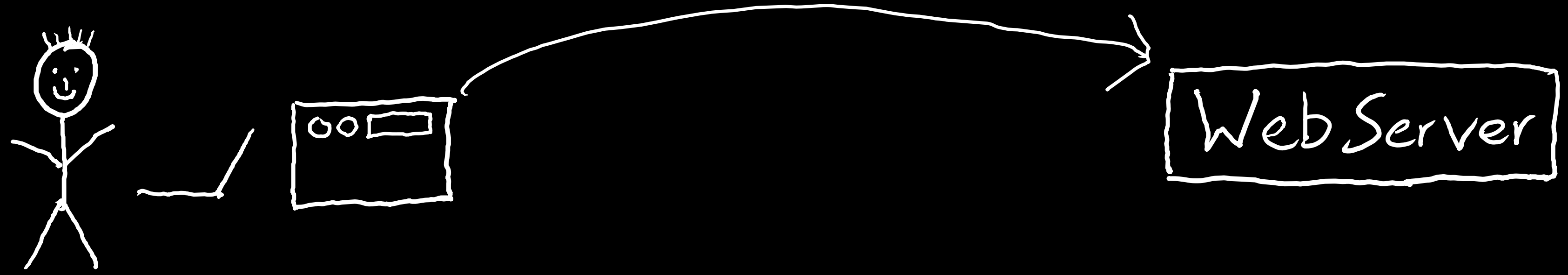
```
GET /edit-results HTTP/1.1
Host: lightside.me
```

what would an attacker do now?

```
POST /edit-results HTTP/1.1
Host: lightside.me
```

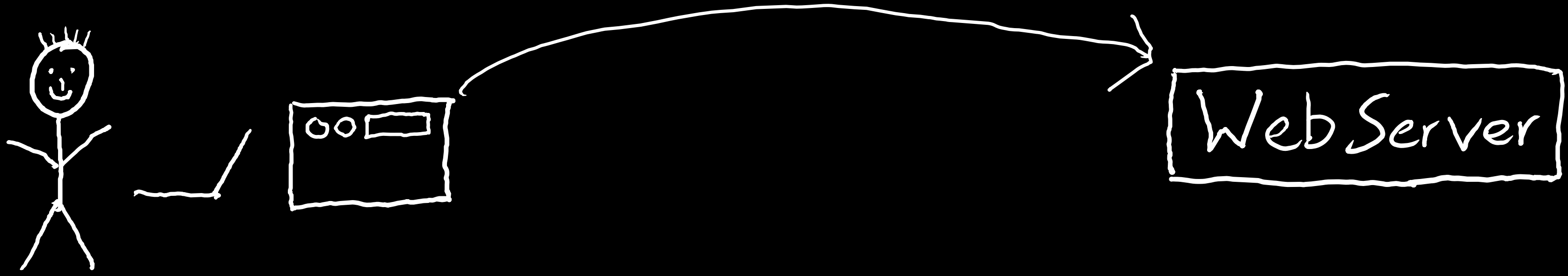


```
GET /invoice?id=1337 HTTP/1.1
Host: lightside.me
```



what would an attacker do?

```
GET /invoice?id=1338 HTTP/1.1
Host: lightside.me
```



Forceful Browsing

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How	
Solution	
OWASP Top 10	
(Primary) Violated Principle	

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client-side authorization checks yay or nay?

- not relevant for security
    - security needs server side authorization checks
- as an addition good for
    - usability – faster feedback
    - alerting
        - if server-side checks are mirrored at the frontend, every negative authorization decision at the backend is a strong indicator for an attack

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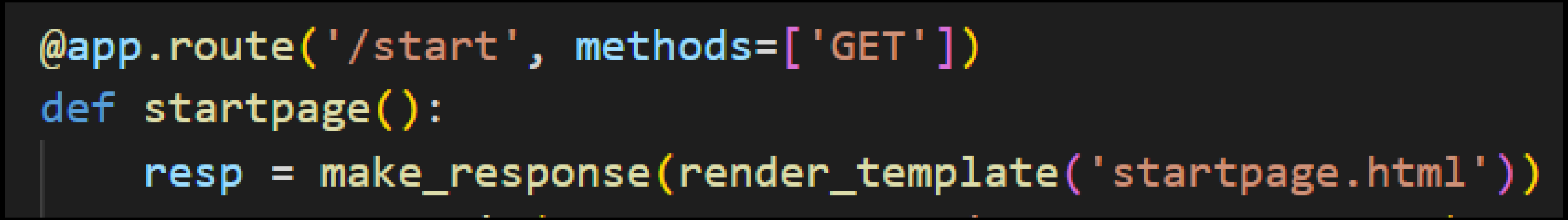
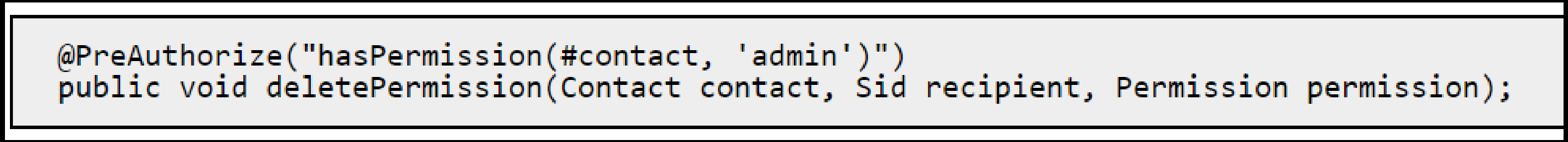
Access Control Levels

- define allowed http method for every url/function



```
@app.route('/start', methods=['GET'])
def startpage():
    resp = make_response(render_template('startpage.html'))
```

- check if user is allowed to
  - call url/function
  - interact with the object/resource



```
@PreAuthorize("hasPermission(#contact, 'admin')")
public void deletePermission(Contact contact, Sid recipient, Permission permission);
```

https://docs.spring.io/spring-security/site/docs/3.0.x/reference/el-access.html

Centralization for better auditability

try to centralize authorization decisions

- own class / library in your own code
- dedicated authorization service
  - e.g. https://www.openpolicyagent.org/

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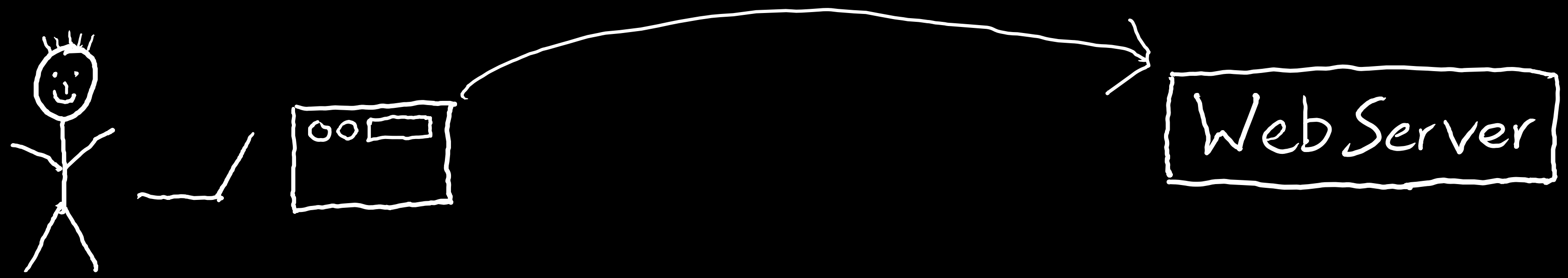
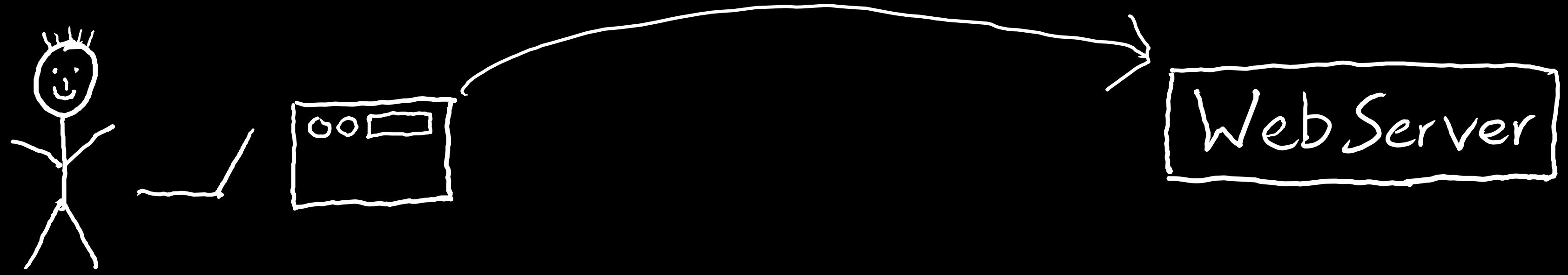
OWASP Top 10	A01:2021-Broken Access Control
(Primary) Violated Principle	„Earn or give, but never assume, trust.“ „Authorize after you authenticate“

```
GET /invoice?f=inv_202010_luke.pdf HTTP/1.1
Host: lightside.me
```



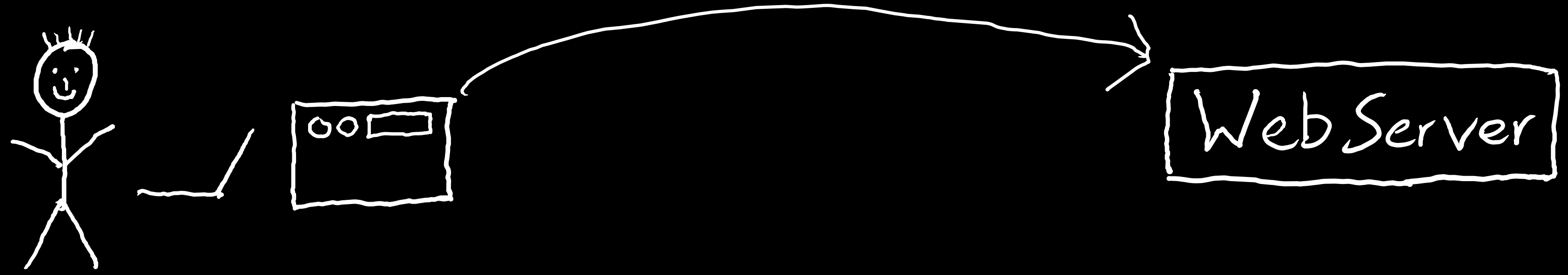
what would an attacker do?

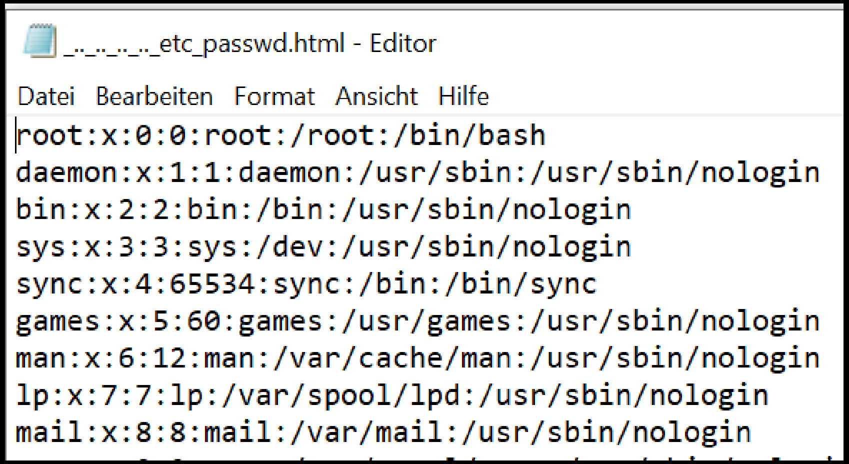
```
GET /invoice?f=inv_202010_lea.pdf HTTP/1.1
Host: lightside.me
```



of course… can you think of something else?

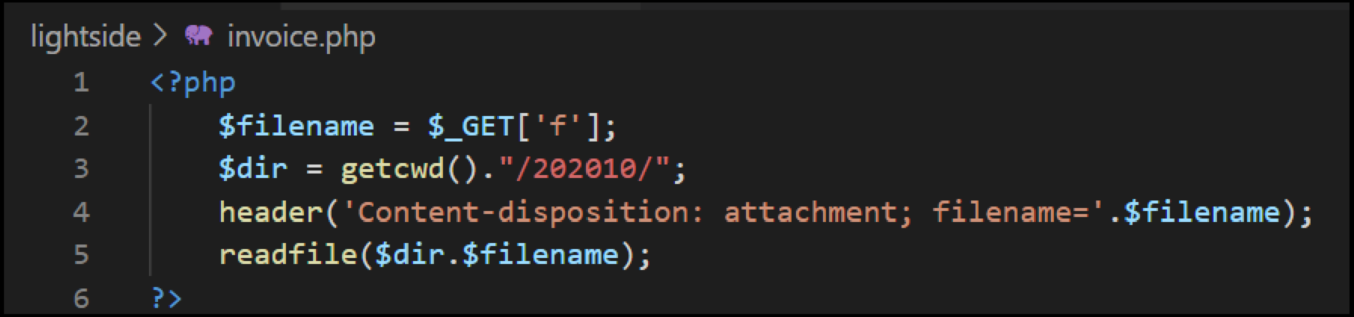
```
GET /invoice?f=../../../../../etc/passwd HTTP/1.1
Host: lightside.me
```




_.._.._.._.._etc_passwd.html - Editor

Datei Bearbeiten Format Ansicht Hilfe

```
root:x:0:0:root:/root:/bin/bash
daemon:x:1:1:daemon:/usr/sbin:/usr/sbin/nologin
bin:x:2:2:bin:/bin:/usr/sbin/nologin
sys:x:3:3:sys:/dev:/usr/sbin/nologin
sync:x:4:65534:sync:/bin:/bin/sync
games:x:5:60:games:/usr/games:/usr/sbin/nologin
man:x:6:12:man:/var/cache/man:/usr/sbin/nologin
lp:x:7:7:lp:/var/spool/lpd:/usr/sbin/nologin
mail:x:8:8:mail:/var/mail:/usr/sbin/nologin
```


lightside > invoice.php

```php
<?php
    $filename = $_GET['f'];
    $dir = getcwd()."/202010/";
    header('Content-disposition: attachment; filename='.$filename);
    readfile($dir.$filename);
?>
```

Path Traversal

Goal	Directly access files (outside the webroot) which you‘re not supposed to by the application
How	
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(Primary) Violated Principle	

Path Traversal

Goal	Directly access files (outside the webroot) which you‘re not supposed to by the application
How	whenever an application handles path’s incorrectly, try to iterate through it
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Goal	Directly access files (outside the webroot) which you‘re not supposed to by the application
How	whenever an application handles path’s incorrectly, try to iterate through it
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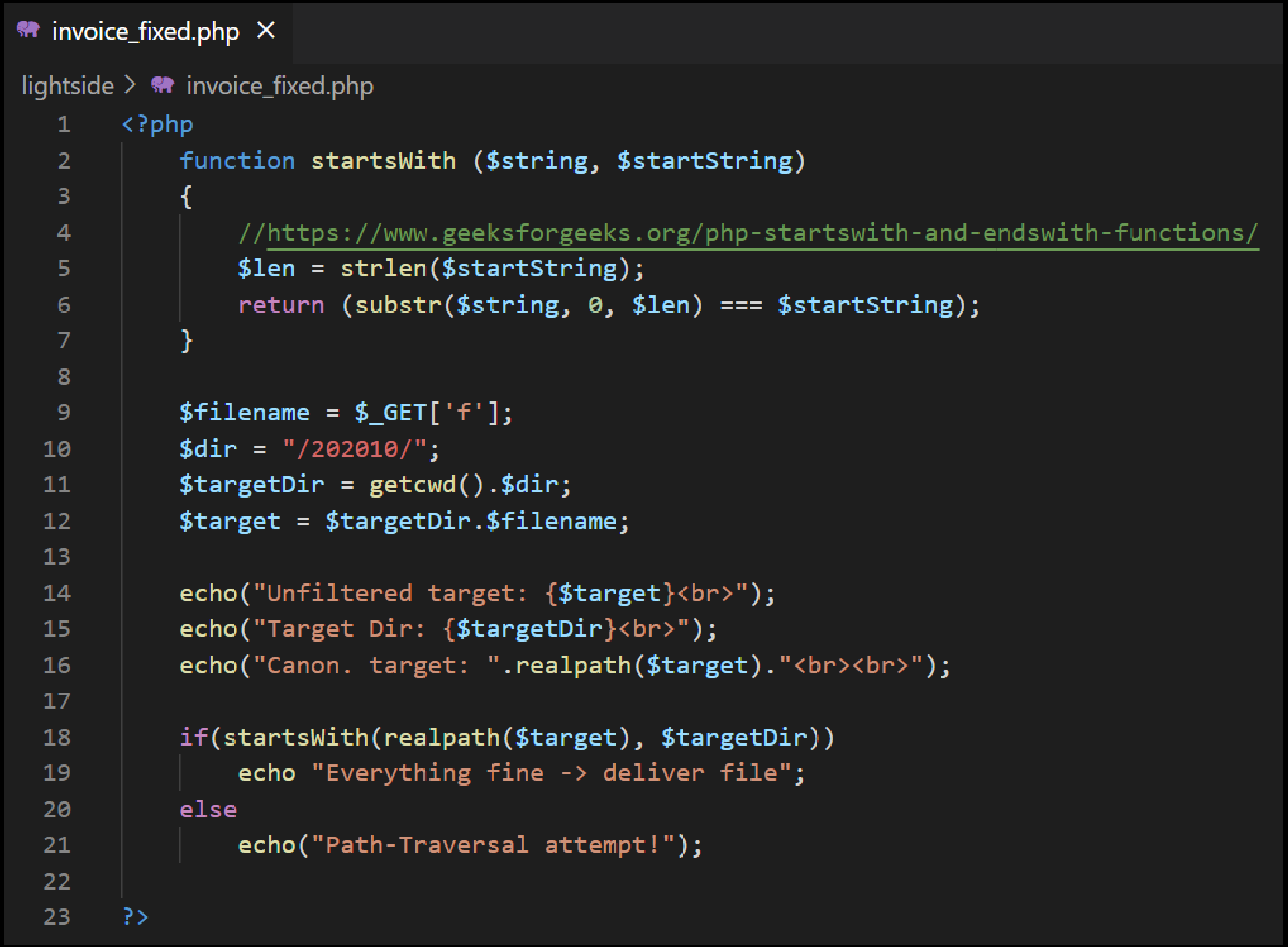
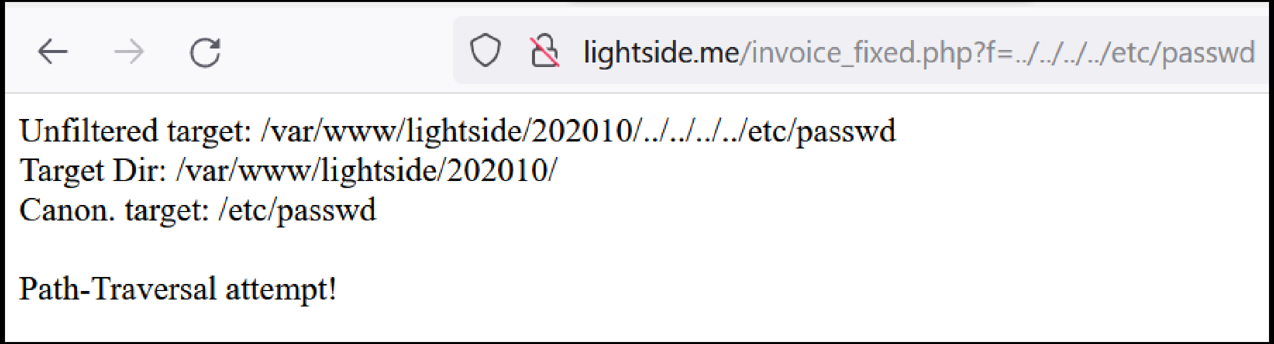
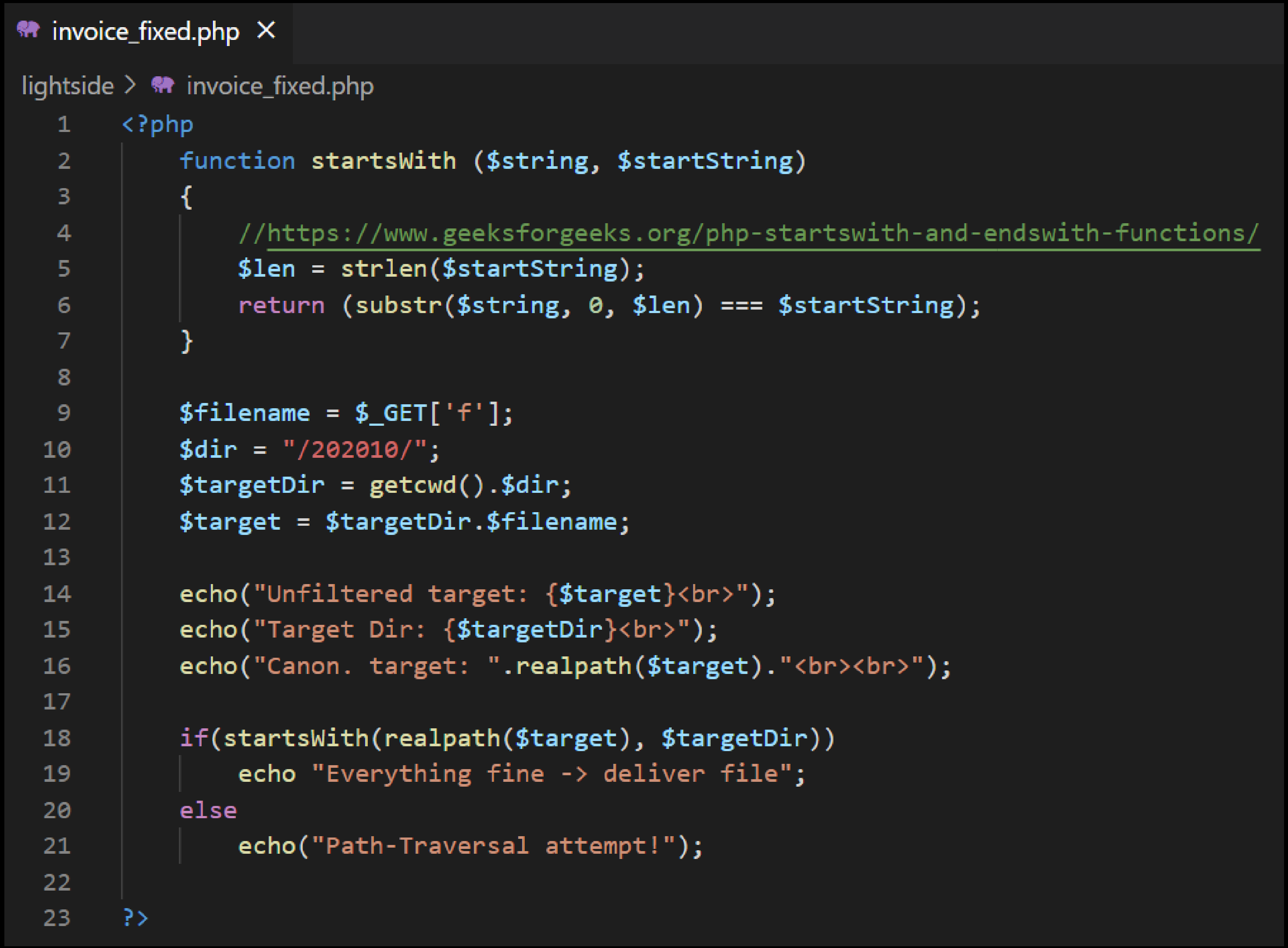


```php
<?php
    function startsWith ($string, $startString)
    {
        //https://www.geeksforgeeks.org/php-startswith-and-endswith-functions/
        $len = strlen($startString);
        return (substr($string, 0, $len) === $startString);
    }

    $filename = $_GET['f'];
    $dir = "/202010/";
    $targetDir = getcwd().$dir;
    $target = $targetDir.$filename;

    echo("Unfiltered target: {$target}<br>");
    echo("Target Dir: {$targetDir}<br>");
    echo("Canon. target: ".realpath($target)."<br><br>");

    if(startsWith(realpath($target), $targetDir))
        echo "Everything fine -> deliver file";
    else
        echo("Path-Traversal attempt!");

?>
```



```
Unfiltered target: /var/www/lightside/202010/../../../../etc/passwd
Target Dir: /var/www/lightside/202010/
Canon. target: /etc/passwd

Path-Traversal attempt!
```



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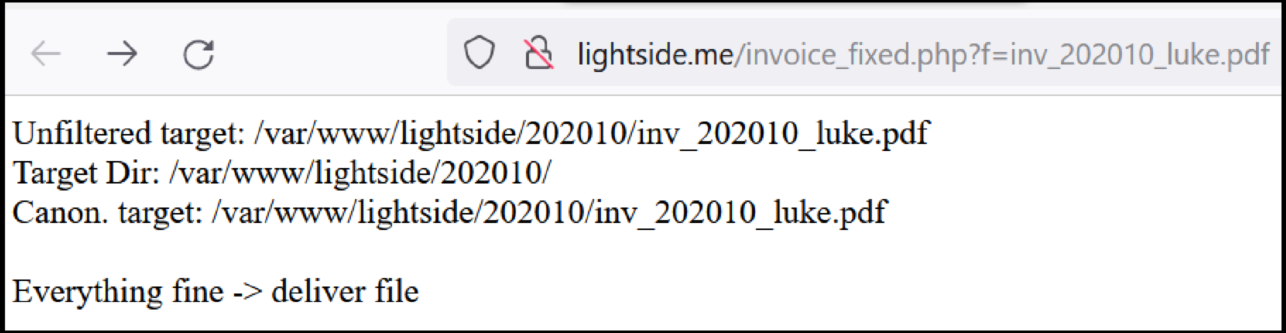

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Unfiltered target: /var/www/lightside/202010/inv_202010_luke.pdf
Target Dir: /var/www/lightside/202010/
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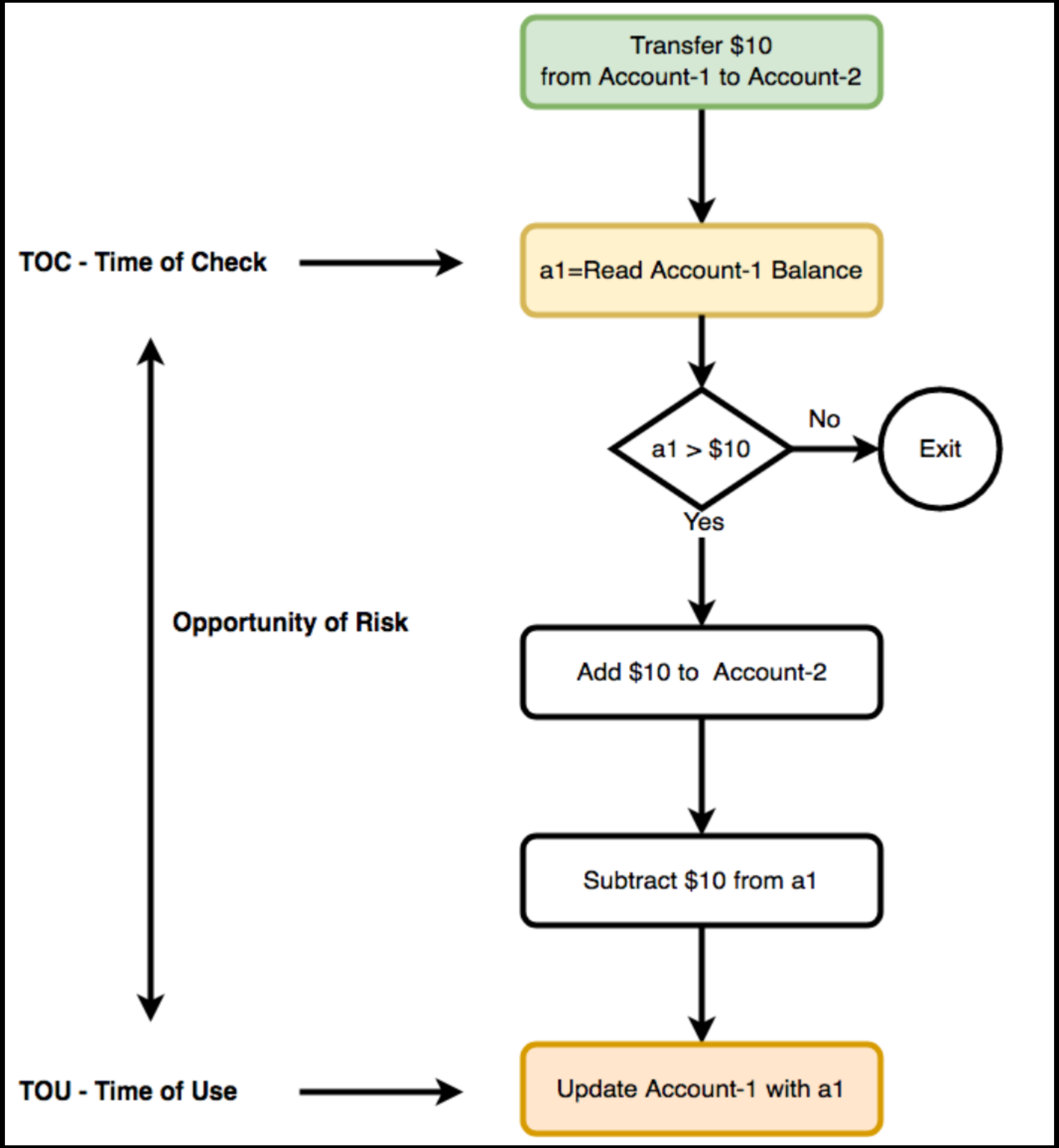
(Primary) Violated Principle	“Define an approach that ensures all data are explicitly validated.”

so one last thing about authorization…



https://medium.com/@schogini/toctou-time-of-check-and-time-of-use-a-demonstration-and-mitigation-609c999042cb

TOCTOU (Race Condition)

Goal	Execute an operation you are actually not allowed to
How	
Solution	
OWASP Top 10	
(Primary) Violated Principle	

TOCTOU (Race Condition)

Goal	Execute an operation you are actually not allowed to
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(Primary) Violated Principle	“Authorize after you authenticate”

Authorization pitfalls

- Worst: no authorization

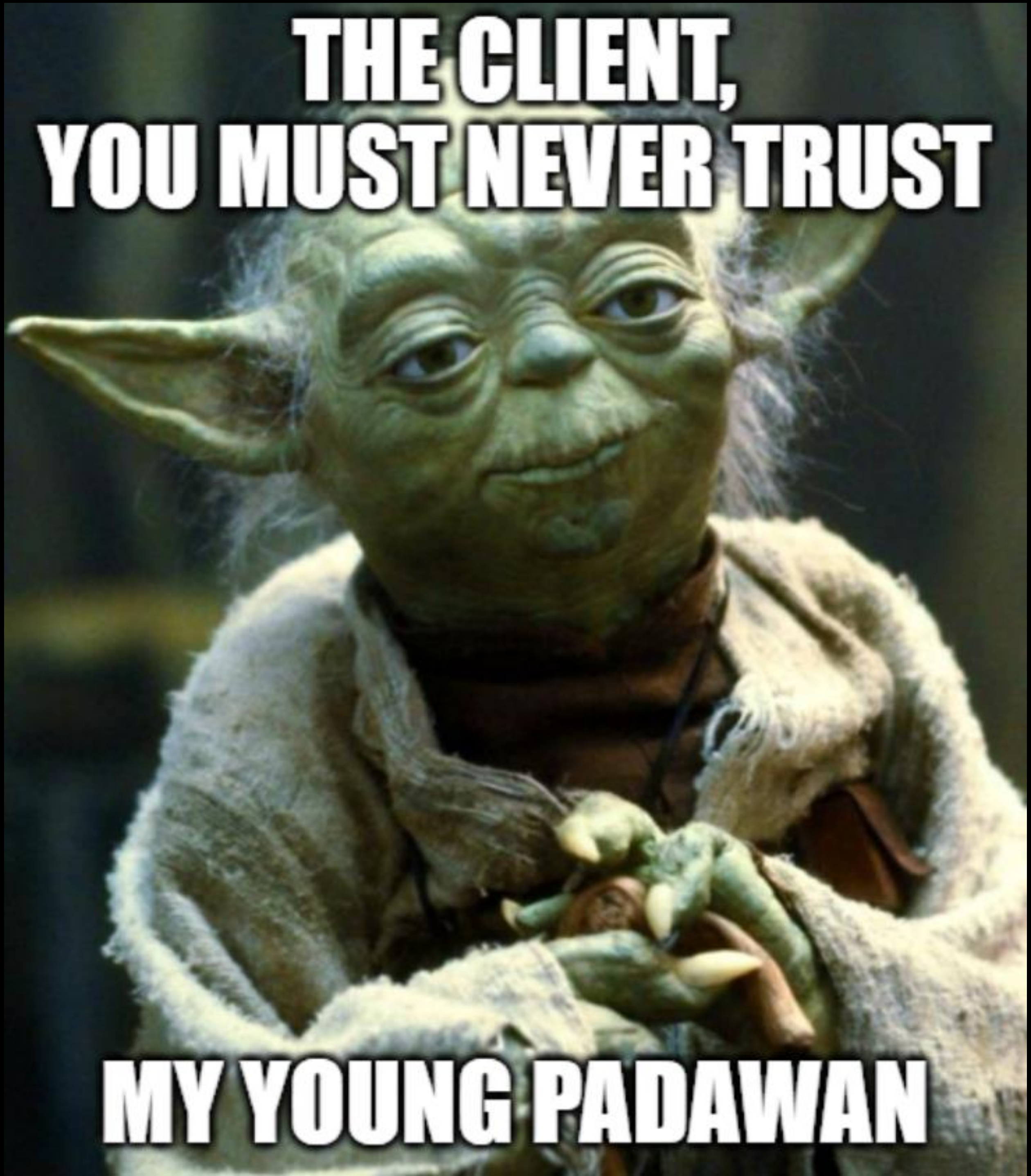
- Second: client-side authorization
    - actually, it‘s the same as „no authorization“

- Third: Inconsistent authorization, e.g.:
    - check GET, but not POST
    - check via direct web access but not via SOAP service

Golden Authorization Rules

- Always check everything for authorization
  - every request
  - every function call
  - every resource access
  - every everything

- NEVER ever trust the client!
  - always check authorization on server side


THE CLIENT,
YOU MUST NEVER TRUST
MY YOUNG PADAWAN