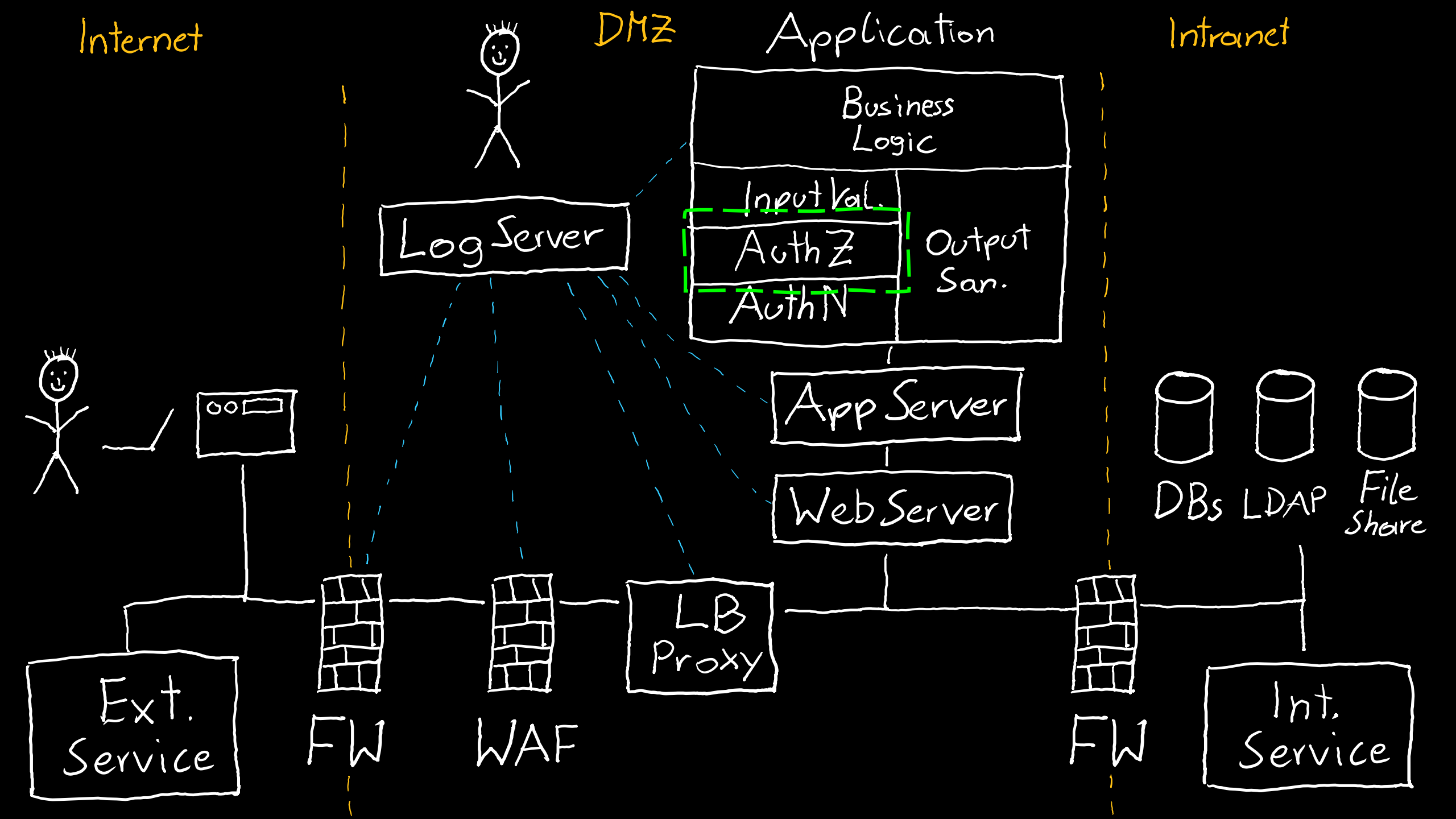
Authorization

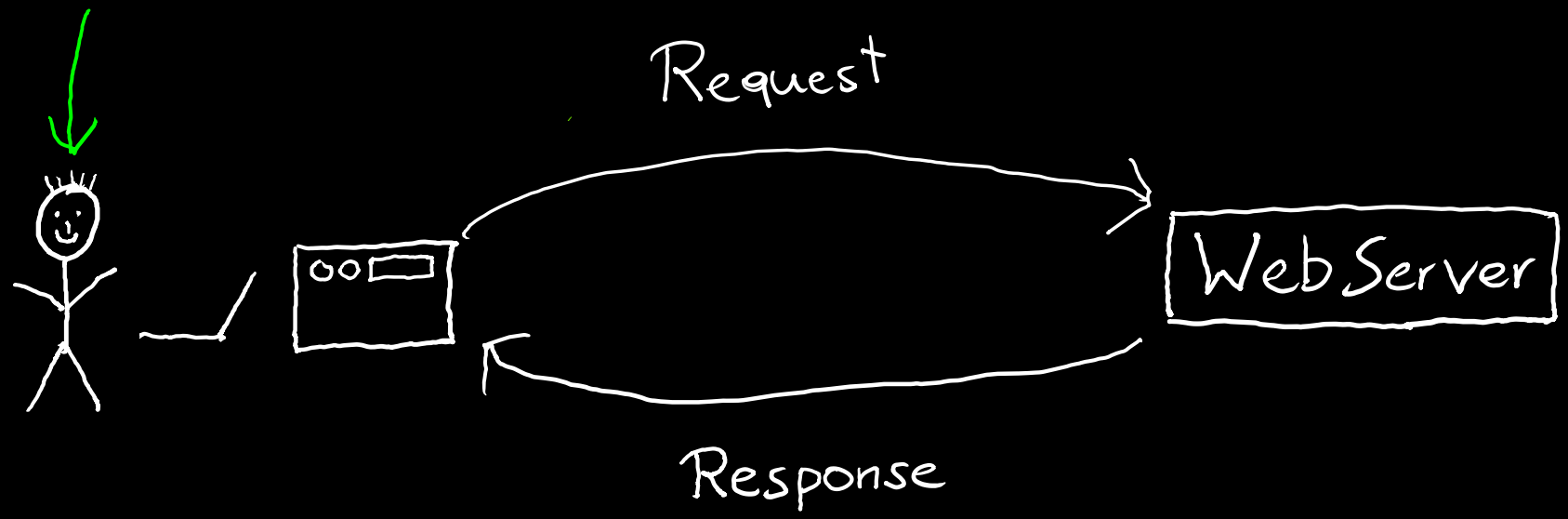
Forceful Browsing, IDOR, Path Traversal, TOCTOU

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
LB Proxy
Ext. Service
FW
WAF
FW
Int. Service

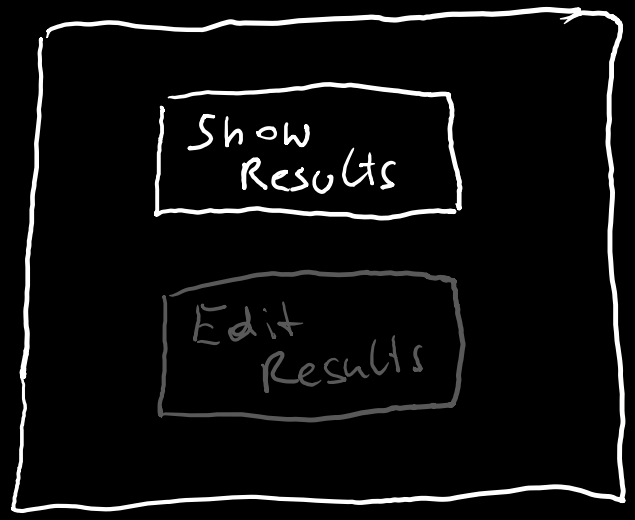
ok, we now really know who this guy is…



… 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?

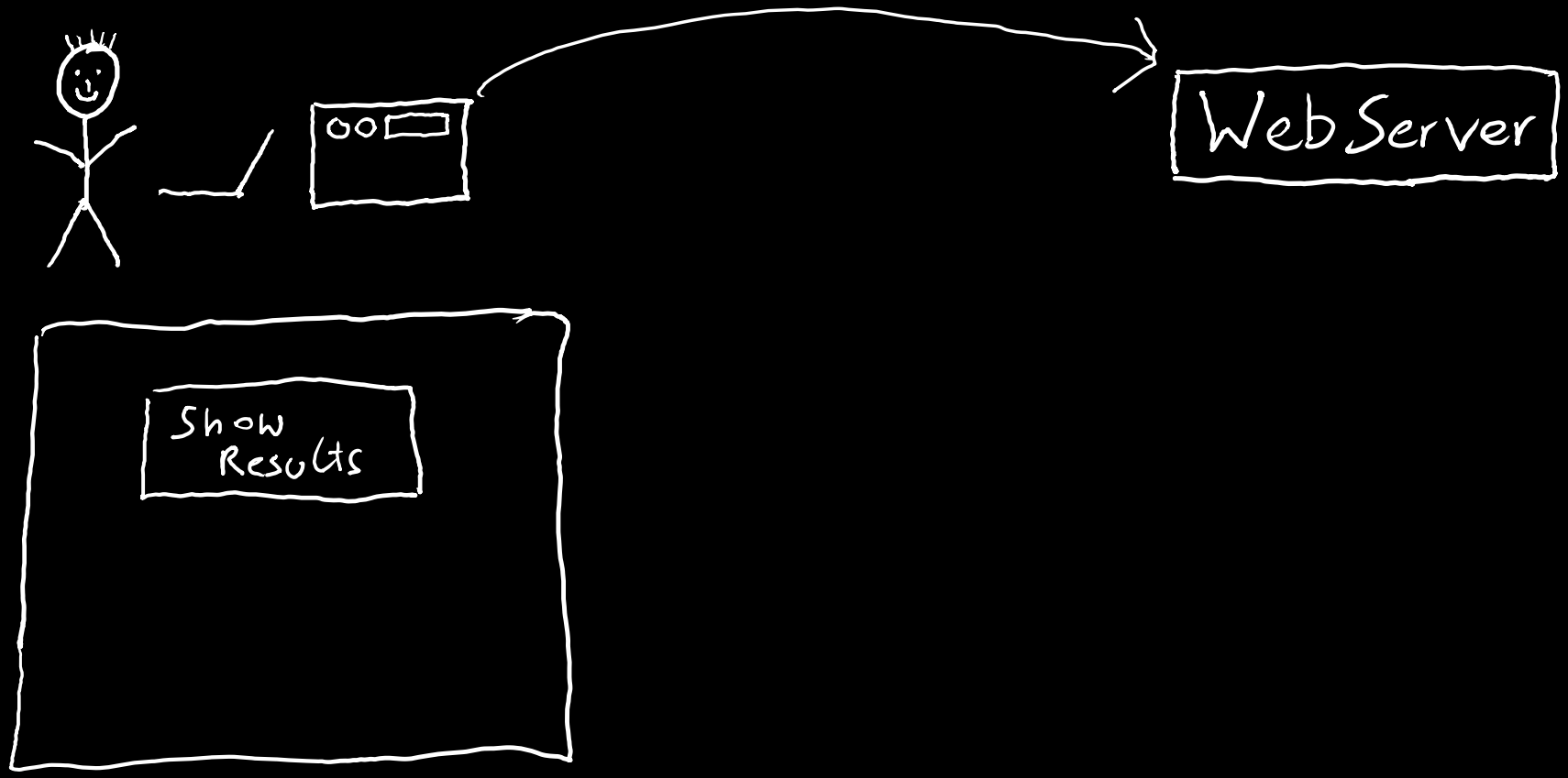



```
<button disabled>Edit Results</button>
```

F12

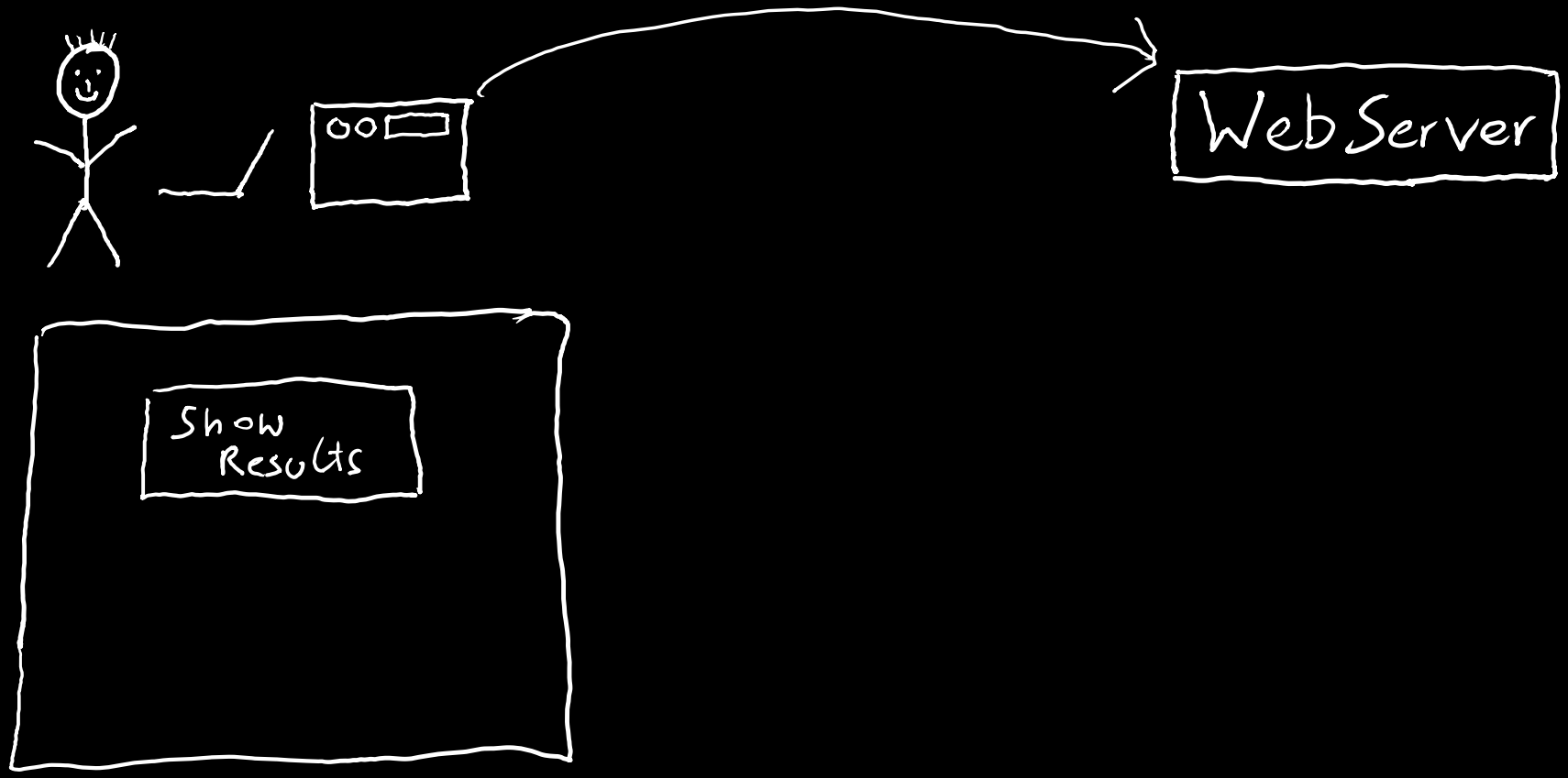
what would an attacker do now?

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



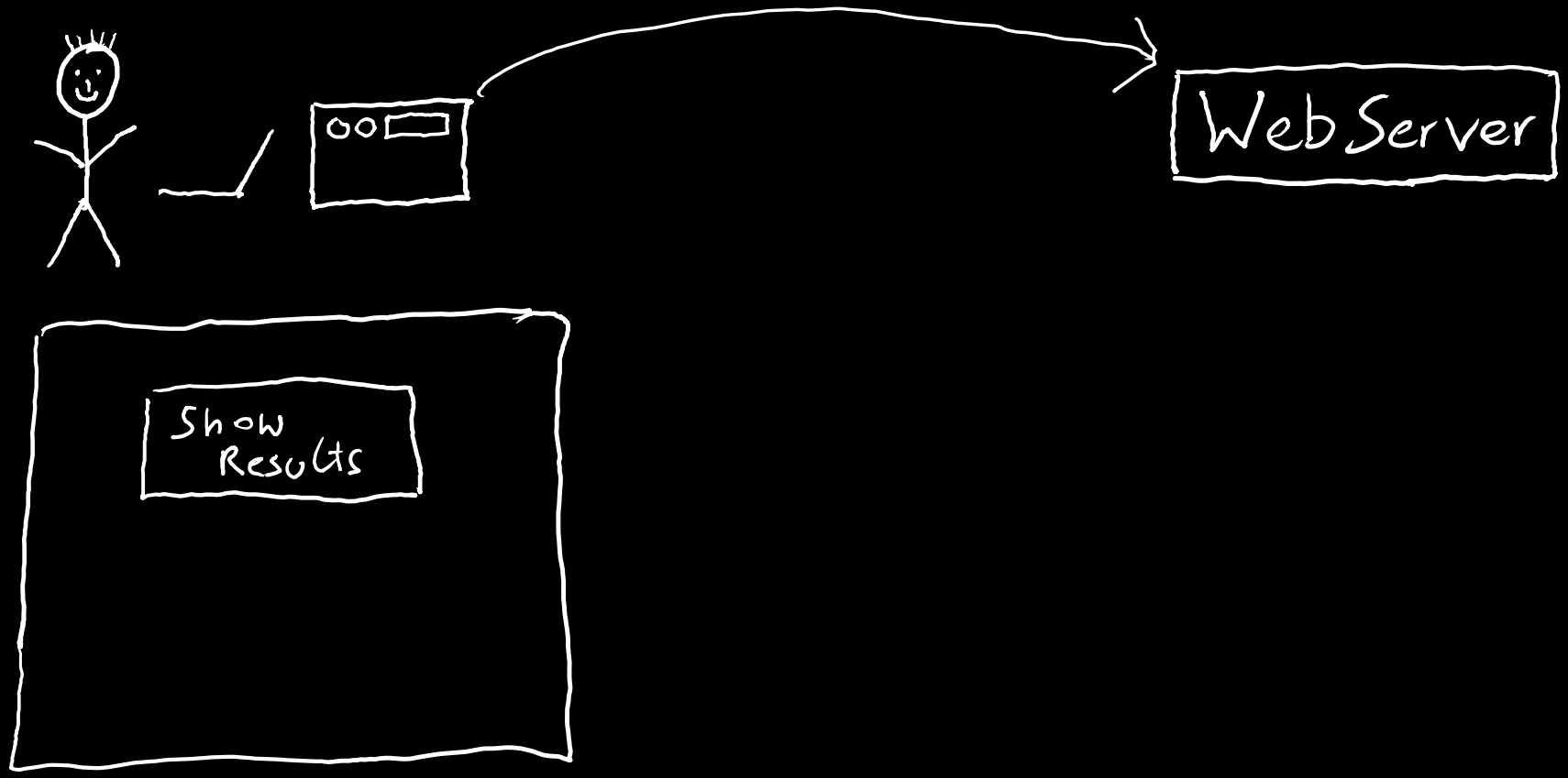
what would an attacker do now?

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

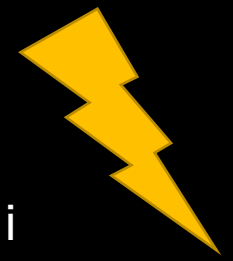


what would an attacker do now?

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



Forceful Browsing



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How	
Solution	
OWASP Top 10	
(Primary) Violated Principle	

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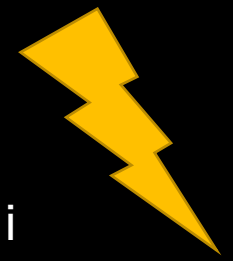

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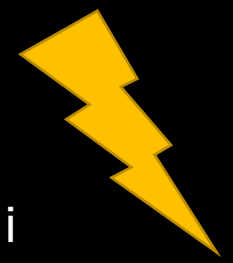

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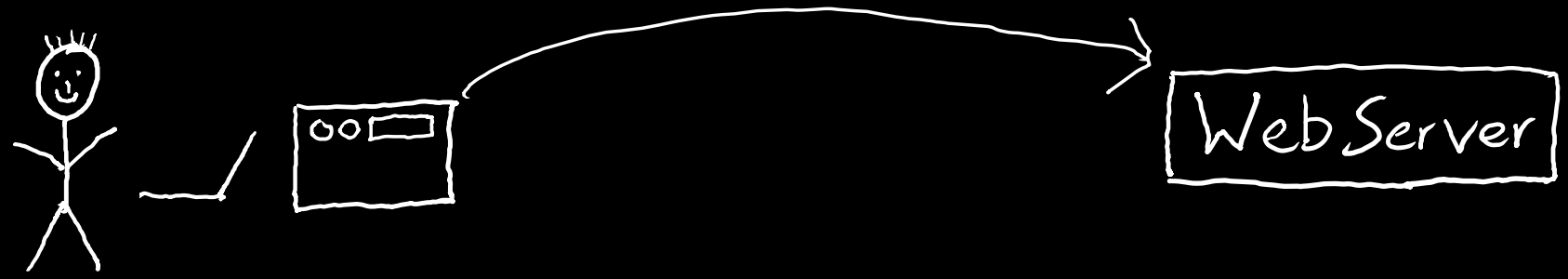
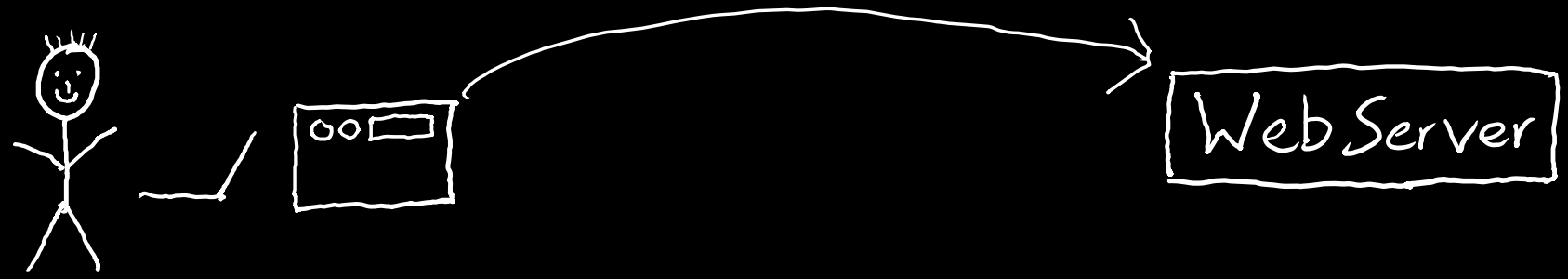
OWASP Top 10	A5:2017-Broken Access Control
(Primary) Violated Principle	„Earn or give, but never assume, trust.“ „Authorize after you authenticate“

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

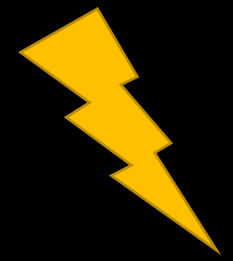


what would an attacker do?

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



Insec. Direct Object References



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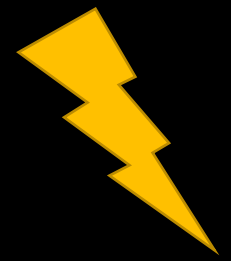

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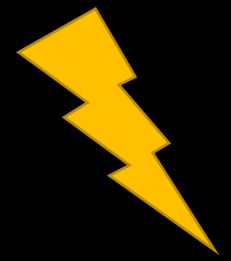

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Direct vs. Indirect Object Reference

ID	Object	Owner
1336	inv_202010_luke.pdf	Luke
1337	inv_202010_lea.pdf	Lea
1338	inv_202011_luke.pdf	Luke
1339	inv_202011_lea.pdf	Lea
1340	inv_202011_vader.pdf	Vader

Session	RID	ID	Object
Luke	1	1336	inv_202010_luke.pdf
	2	1338	inv_202011_luke.pdf

Session	RID	ID	Object
Lea	1	1337	inv_202010_lea.pdf
	2	1339	inv_202011_lea.pdf

Session	RID	ID	Object
Vader	1	1340	inv_202011_vader.pdf

Using random values (e.g. UUID)

ID	Object	Owner
14b7bdea-e58d-46ec-bfd7-e175022f32ce	inv_202010_luke.pdf	Luke
b113479b-46ad-42e6-a3f3-0d5f80847d38	inv_202010_lea.pdf	Lea
11dfa49e-f585-4e93-8a76-2a1843b7d118	inv_202011_luke.pdf	Luke
7255e1bd-417a-425b-ba88-98c3fe2405b2	inv_202011_lea.pdf	Lea
6a08f5e6-4fa8-44e6-92bb-db0d7b38a393	inv_202011_vader.pdf	Vader

still needs a mapping table…

Salted Hashes

ID	Salt	Object	Owner
6cc433f2803080c9a633b2d110a745e264baca6c9e4455ea4d02f9ae41efe146	MYSALT	inv_202010_luke.pdf	Luke
bd4fbb2af573895ab6f239b2ba9f60f651098a1f6c357a7ca7d018f1c46432f6	MYSALT	inv_202010_lea.pdf	Lea
b0a85076b44450cab45b507c8c0ddb0b36e46402204ca593bcc9a8db8119edb6	MYSALT	inv_202011_luke.pdf	Luke
ff33b6dfdddcd14ed700d19dcca736b3b6015f2badab5b9e740988e1ab70cc1b	MYSALT	inv_202011_lea.pdf	Lea
1bf50583d983a9981a86761daae7c1b6c136bb932f9f921bd6cf20c01e6271b1	MYSALT	inv_202011_vader.pdf	Vader

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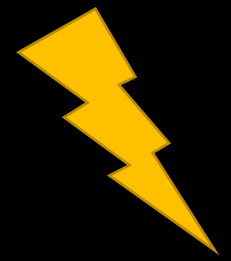

Goal	Directly access a resource which you‘re not supposed to by the ui
How	information gathering by http parameters client source code logs error messages other users with higher privileges hacker instinct / guessing ;-)
Solution	NEVER rely on (client-side) frontend check user’s authorization to access resources on server-side use indirect object references, unguessable IDs (e.g. UUIDs) or salted hashes
OWASP Top 10	
(Primary) Violated Principle	

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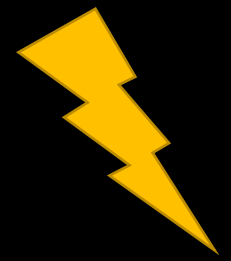

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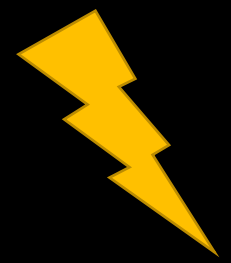

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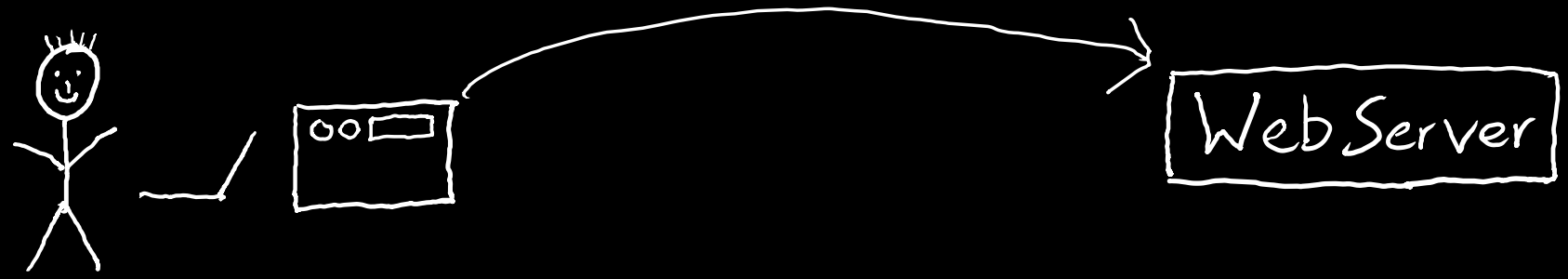
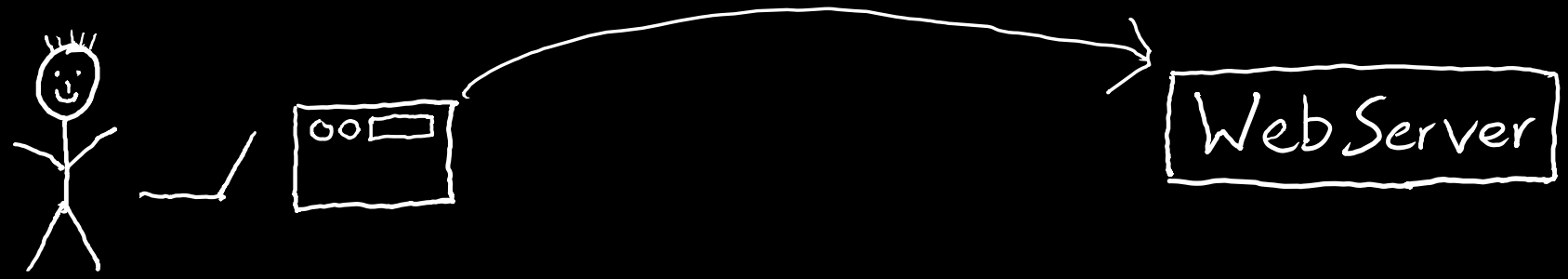
OWASP Top 10	A5:2017-Broken Access Control
(Primary) Violated Principle	„Authorize after you authenticate“

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



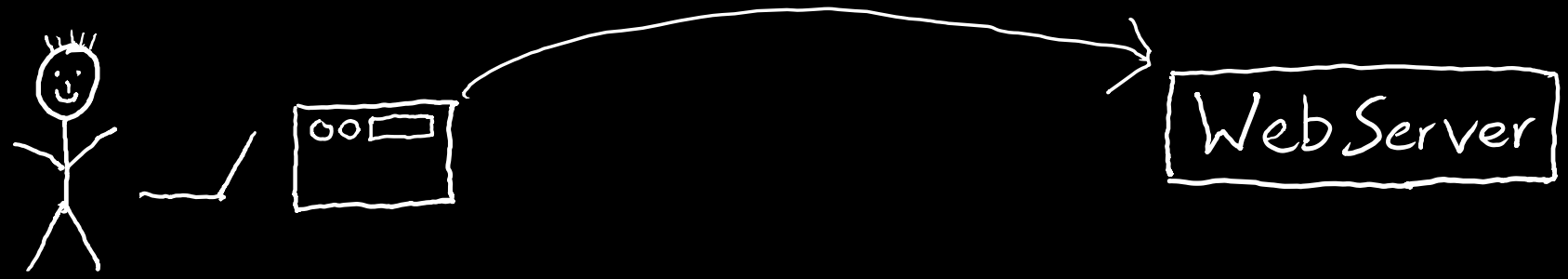
what would an attacker do?

```
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
```

invoice.php

```php
<?php
    $filename = $_GET['f'];
    $dir = "./202010/";
    header('Content-disposition: attachment; filename='.$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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OWASP Top 10	
(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
Solution	
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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
Solution	Don’t use user input in filesystem APIs If you have to validate it (explicit allowlist) check the canonicalized path
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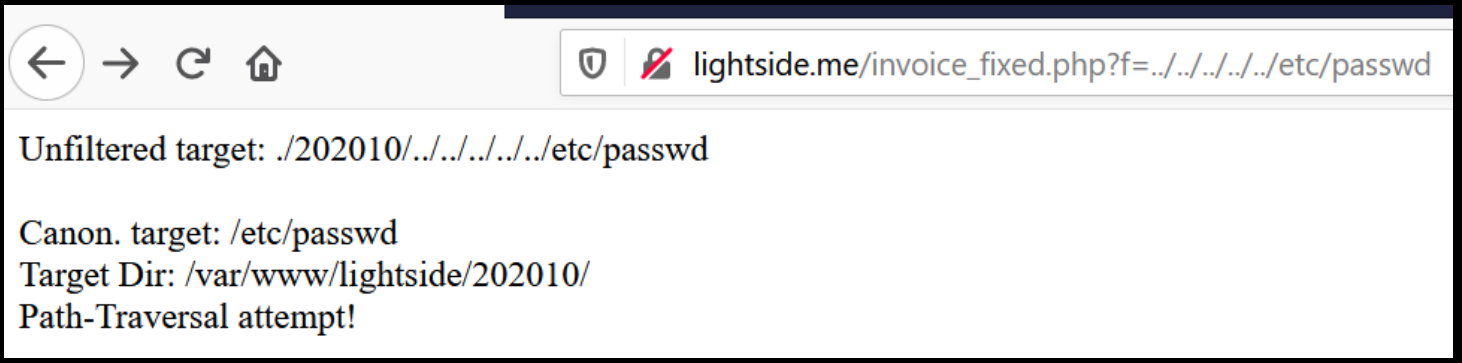
```php
<?php
    function startsWith ($string, $startString)
    {
        //https://www.geeksforgeeks.org/php-startswith-and-endswith-functions/
        $len = strlen($startString);
        return (substr($string, 0, $len) === $startString);
    }

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

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

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

?>
```



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    }

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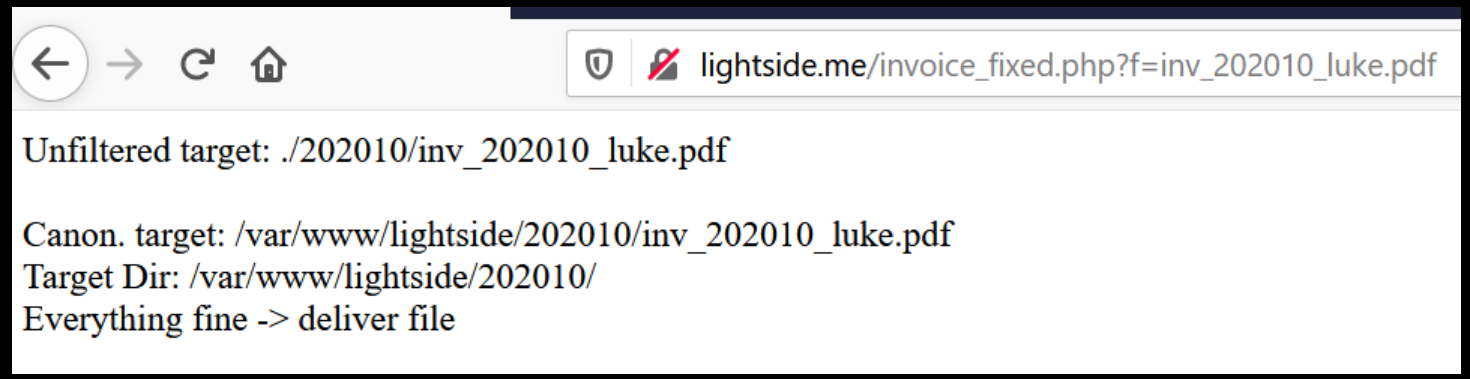

Path Traversal

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
Solution	Don’t use user input in filesystem APIs If you have to validate it (Whitelist) check the canonicalized path
OWASP Top 10	A5:2017-Broken Access Control
(Primary) Violated Principle	

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Goal	Directly access files (outside the webroot) which you‘re not supposed to by the application
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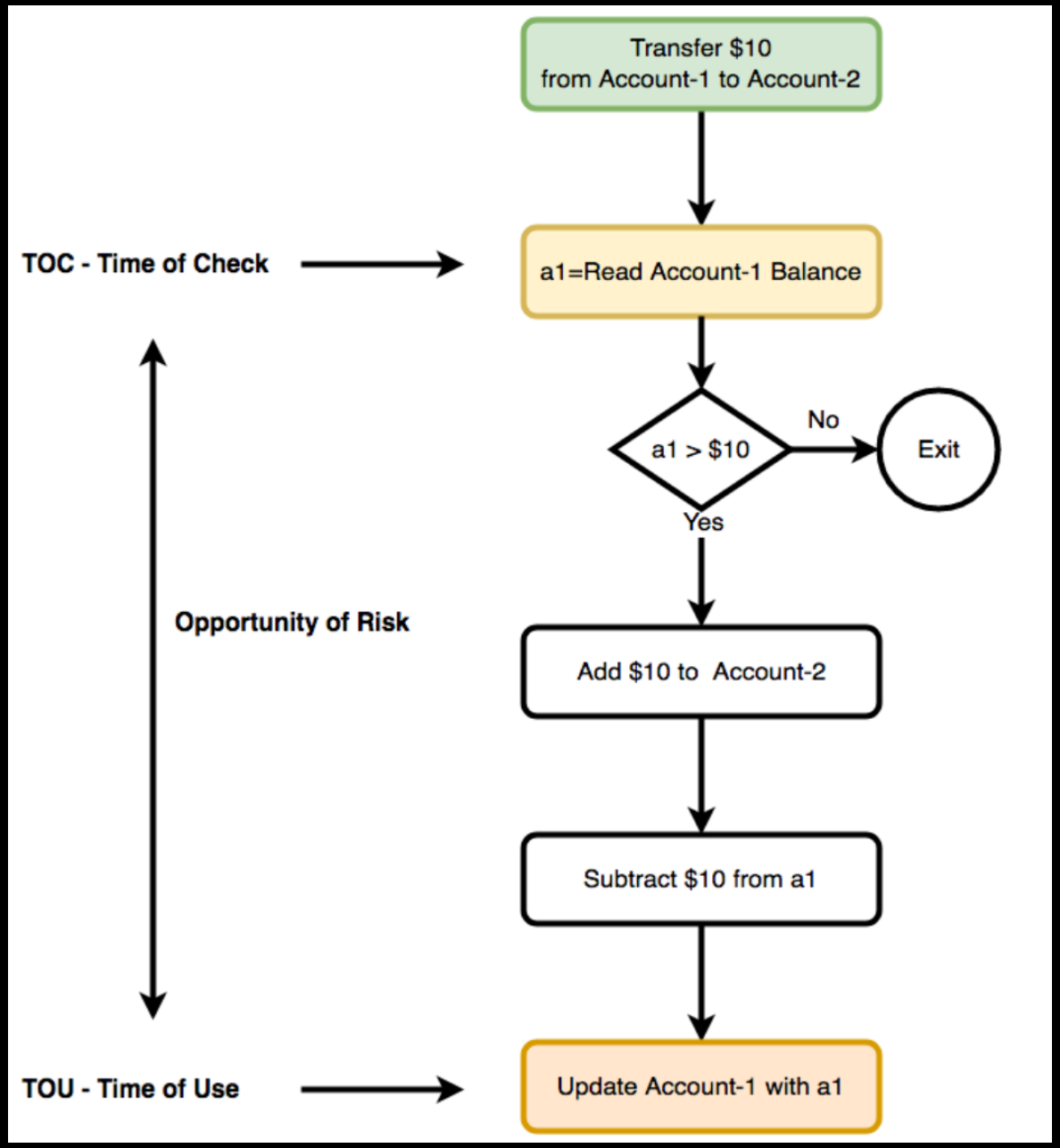
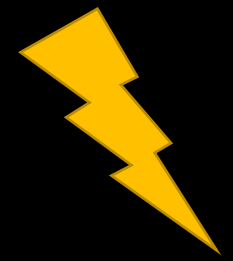
(Primary) Violated Principle	“Define an approach that ensures all data are explicitly validated.”

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
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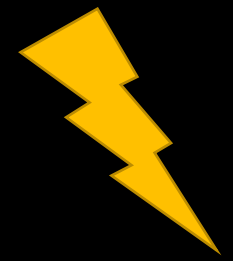

Goal	Execute an operation you are actually not allowed to
How	Take advantage of a time-window between a security check and the actual action this check should protect
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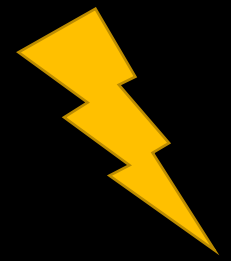
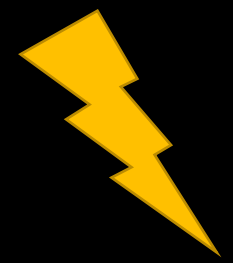


Goal	Execute an operation you are actually not allowed to
How	Take advantage of a time-window between a security check and the actual action this check should protect
Solution	Apply security checks as close to the actual action as possible
OWASP Top 10	
(Primary) Violated Principle	

TOCTOU (Race Condition)



Goal	Execute an operation you are actually not allowed to
How	Take advantage of a time-window between a security check and the actual action this check should protect
Solution	Apply security checks as close to the actual action as possible Use locking mechanisms, e.g. locking / semaphores database transactions etc.
OWASP Top 10	
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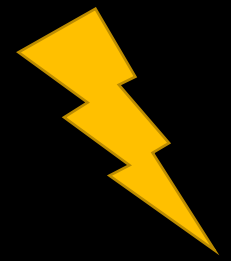

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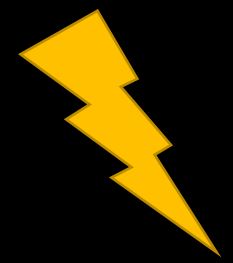

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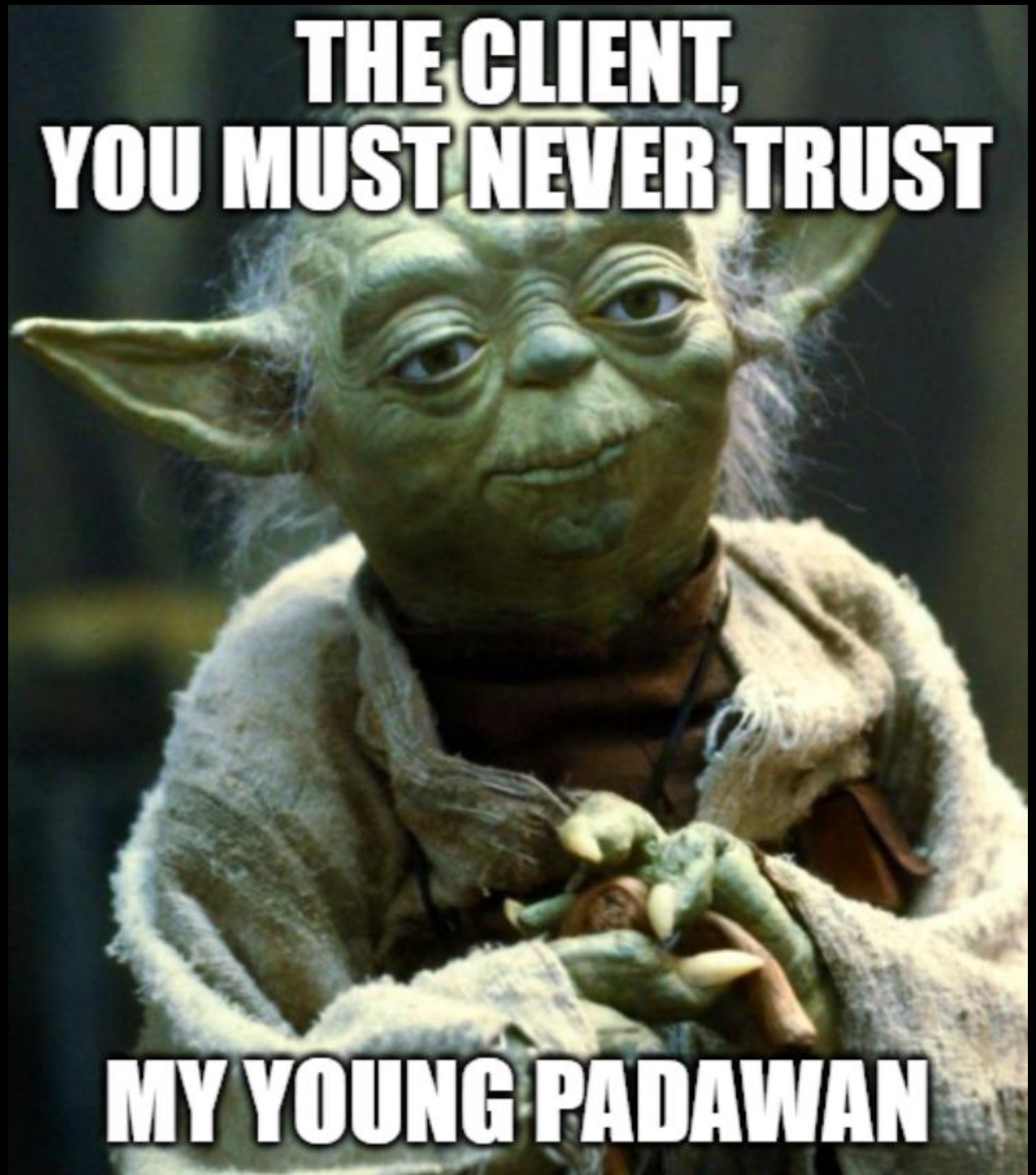
OWASP Top 10	A5:2017-Broken Access Control
(Primary) Violated Principle	“Authorize after you authenticate”

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