



Securing
Your Digital
World

infoGuard
SWISS CYBER SECURITY

Initial Access Reloaded – Perimeter Breaches Beyond the Mainstream

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- The **professional** and **ethical** hacker team
- **We protect our clients by attacking them!**
- Identify vulnerabilities before criminals can exploit them
- Assess and prioritize vulnerabilities (risk-based)
- Evaluate remediation measures

- **20 professional hackers**
- From apprentices to PhDs
- Ages ranging from 18 to 40+ years



We test:

- (Web-) applications
- Products
- IT-systems & networks
- Power plants, control systems...

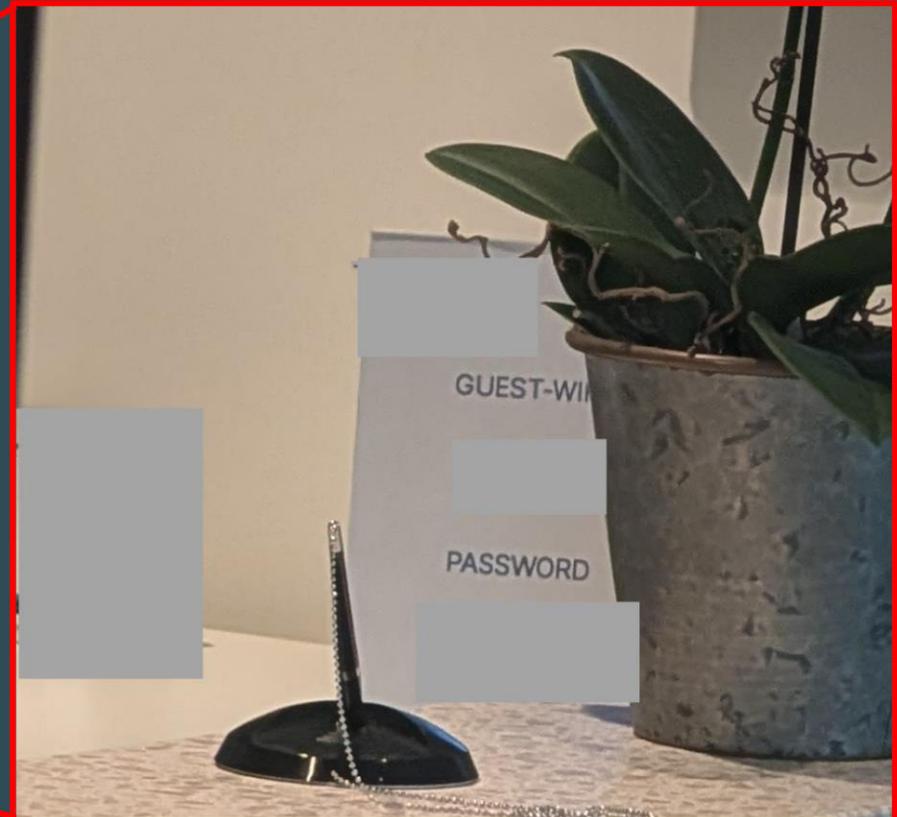
We have:

- Own research laboratory, dedicated infrastructure & self-developed tools
- 100 billion passwords / per second





Guest WiFi – What could go wrong?



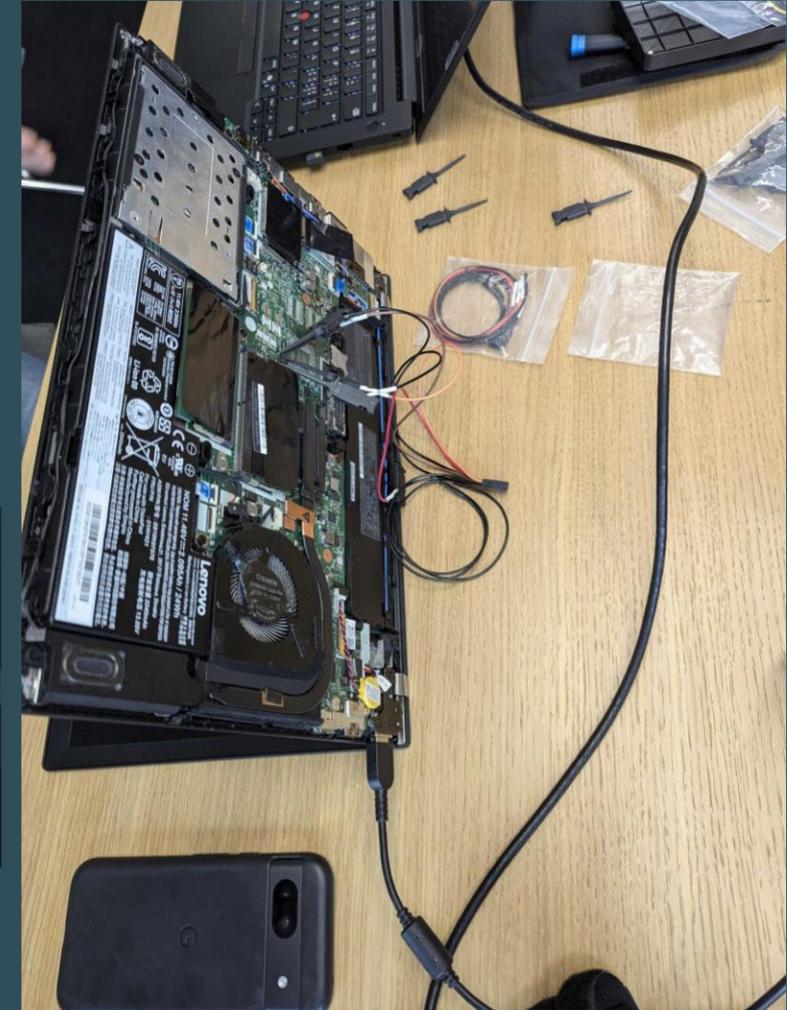
Guest WiFi – What could go wrong?

- Open shares
- Credentials guessed
- Domain controller reachable
- Standard user was granted too much privileges in the domain which led to domain administrator privileges



What can happen if a device gets stolen?

- BitLocker enabled
- How does BitLocker work?
- TPM sniffing



Conclusion

Physical attack vectors are often underestimated





IoT Devices

IoT Device 1: Smart Sensor

- Webserver running
- Device name leaked in server header
- Smart sensor
- Used at construction sites, tunnels, railways, critical infrastructure, etc.

Sign in

http

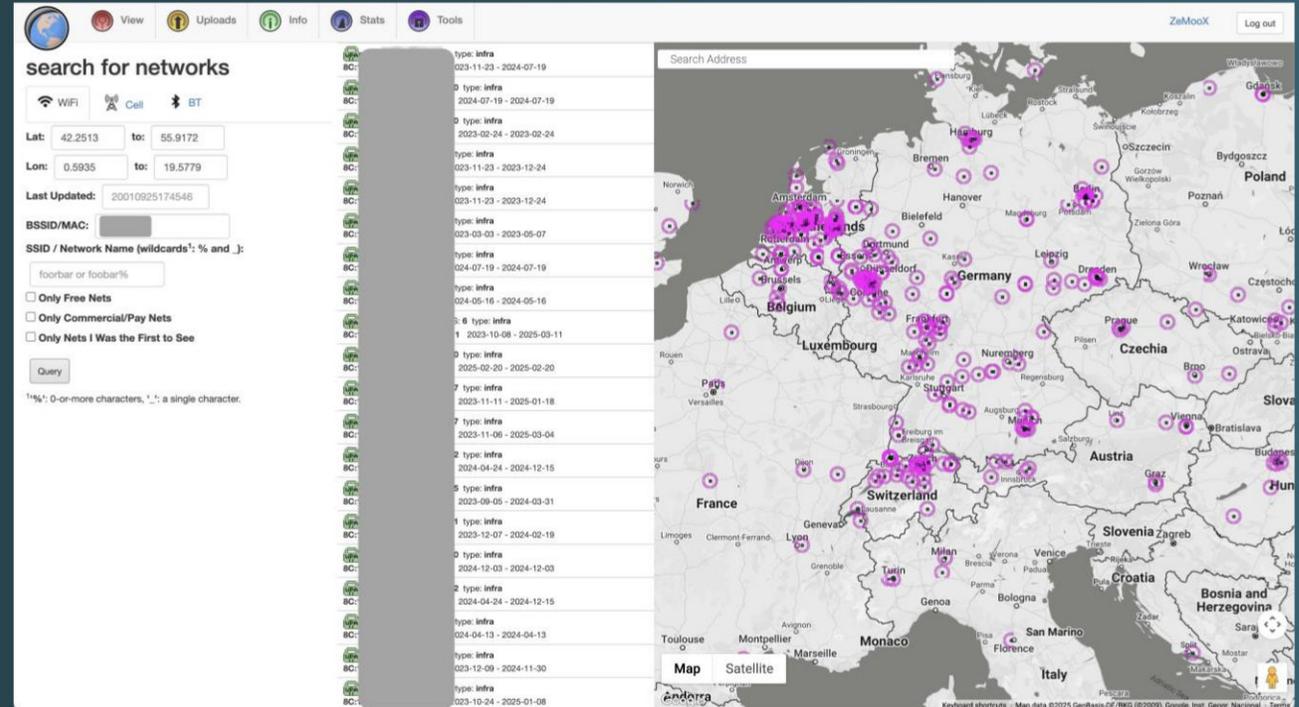
Username

Password

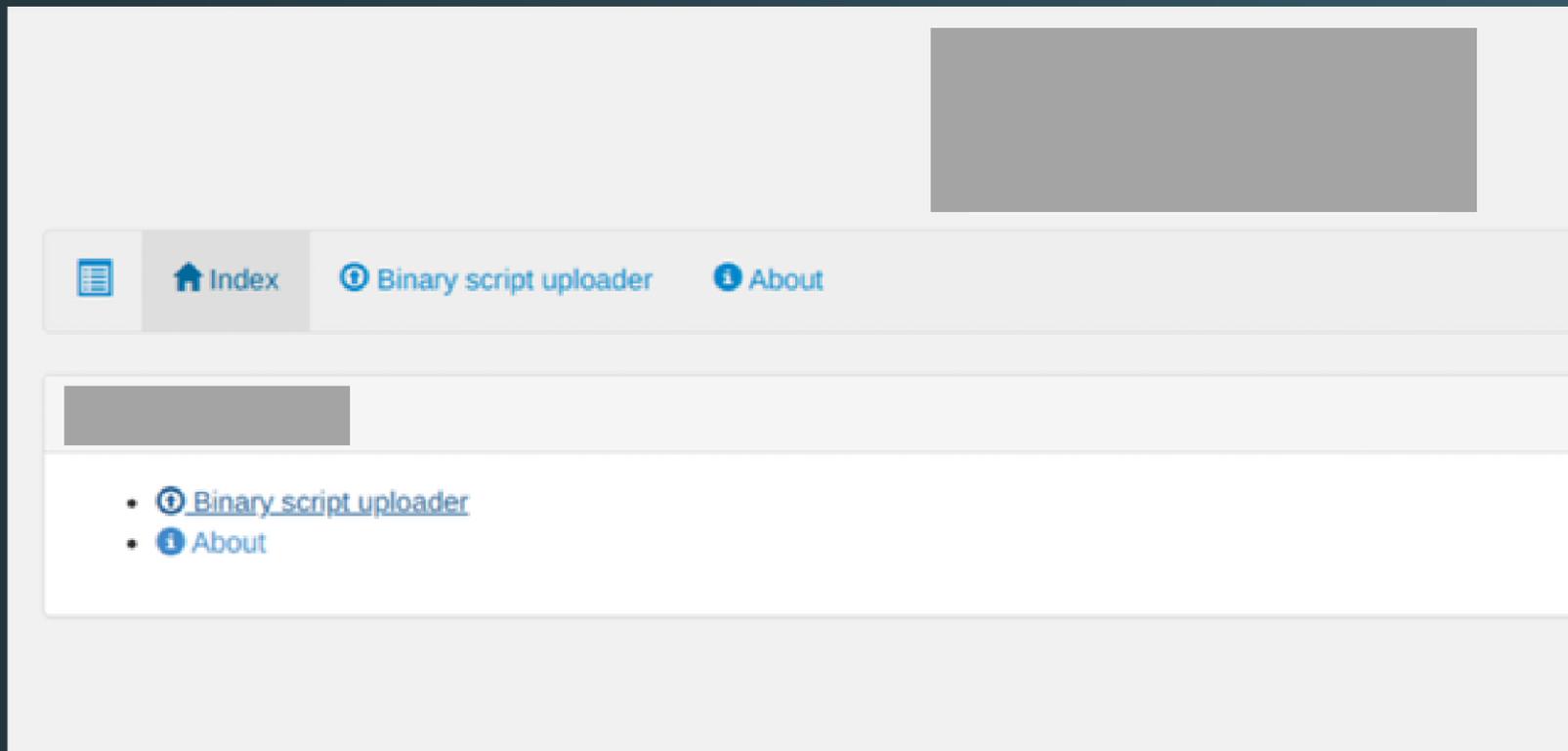
Cancel Sign In

OSINT

- Default password = serial number
- Default WiFi name contains serial number
- Let's look at war driving data!



Binary script uploader

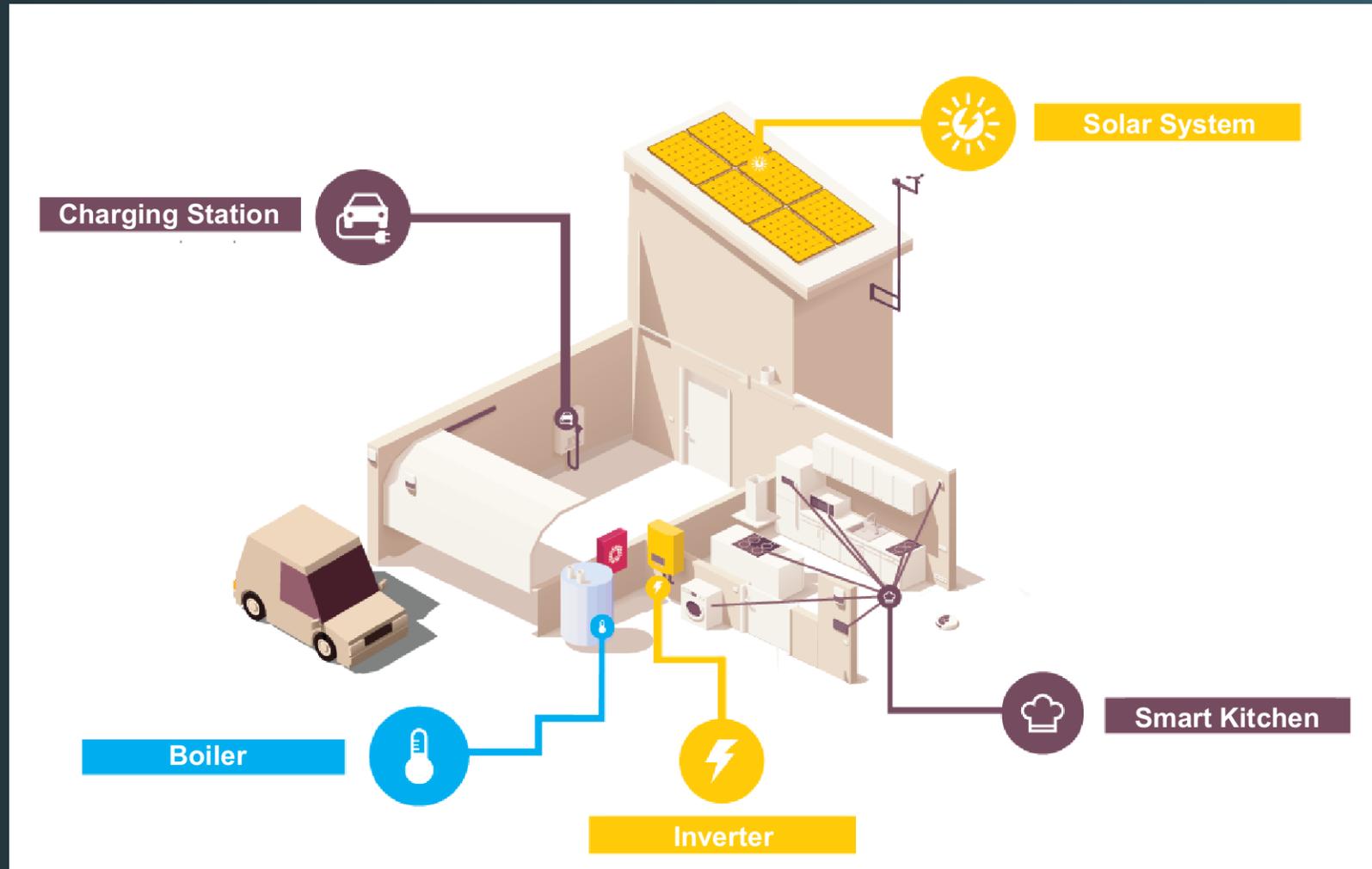


Exploitation

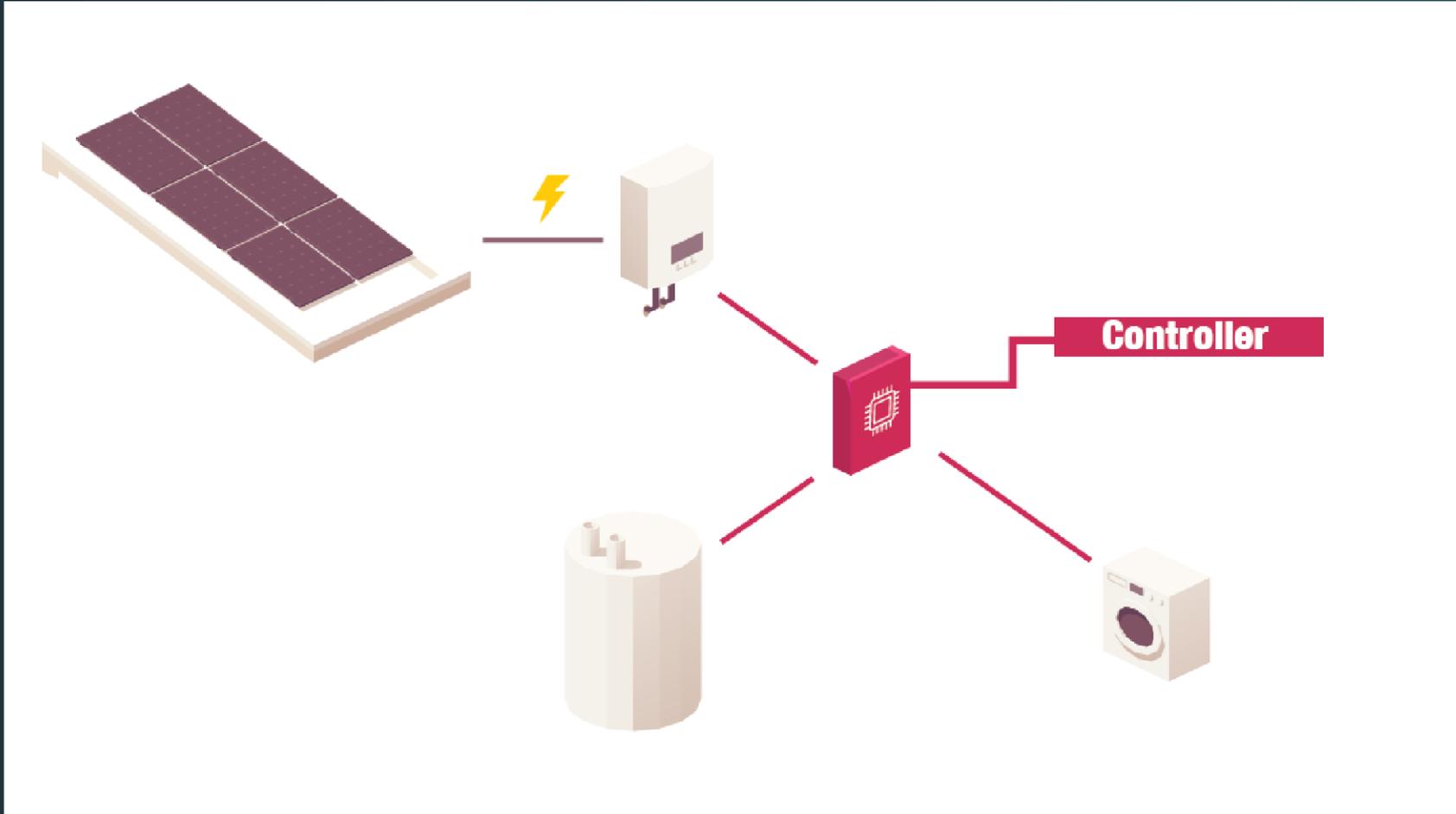
- We have access to the webserver
- We can upload a script
- ➔ Create a script containing a reverse shell and upload it to the device

```
Connection from [REDACTED]  
whoami  
root
```

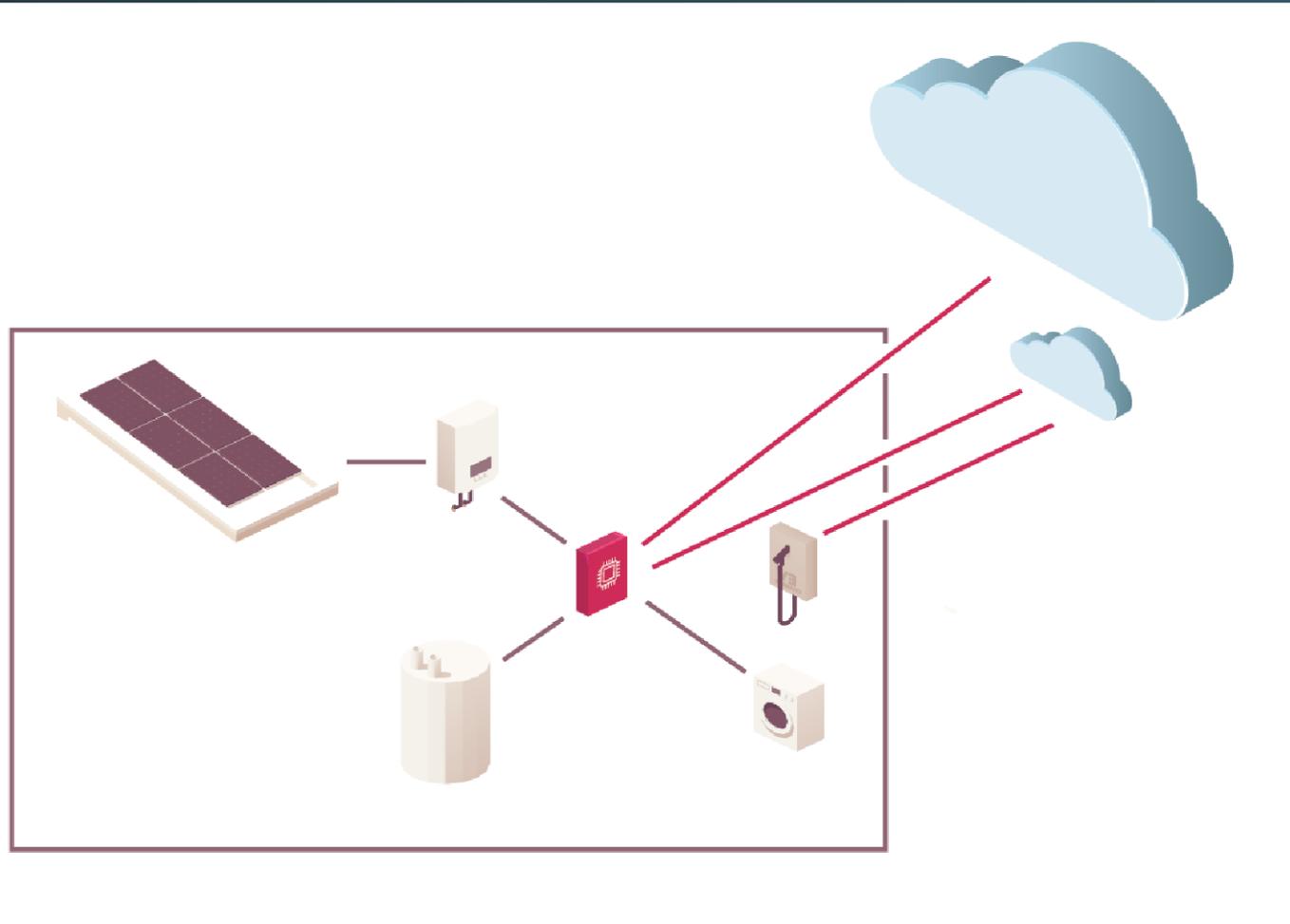
IoT Device 2: Solar Controller



Solar Controller



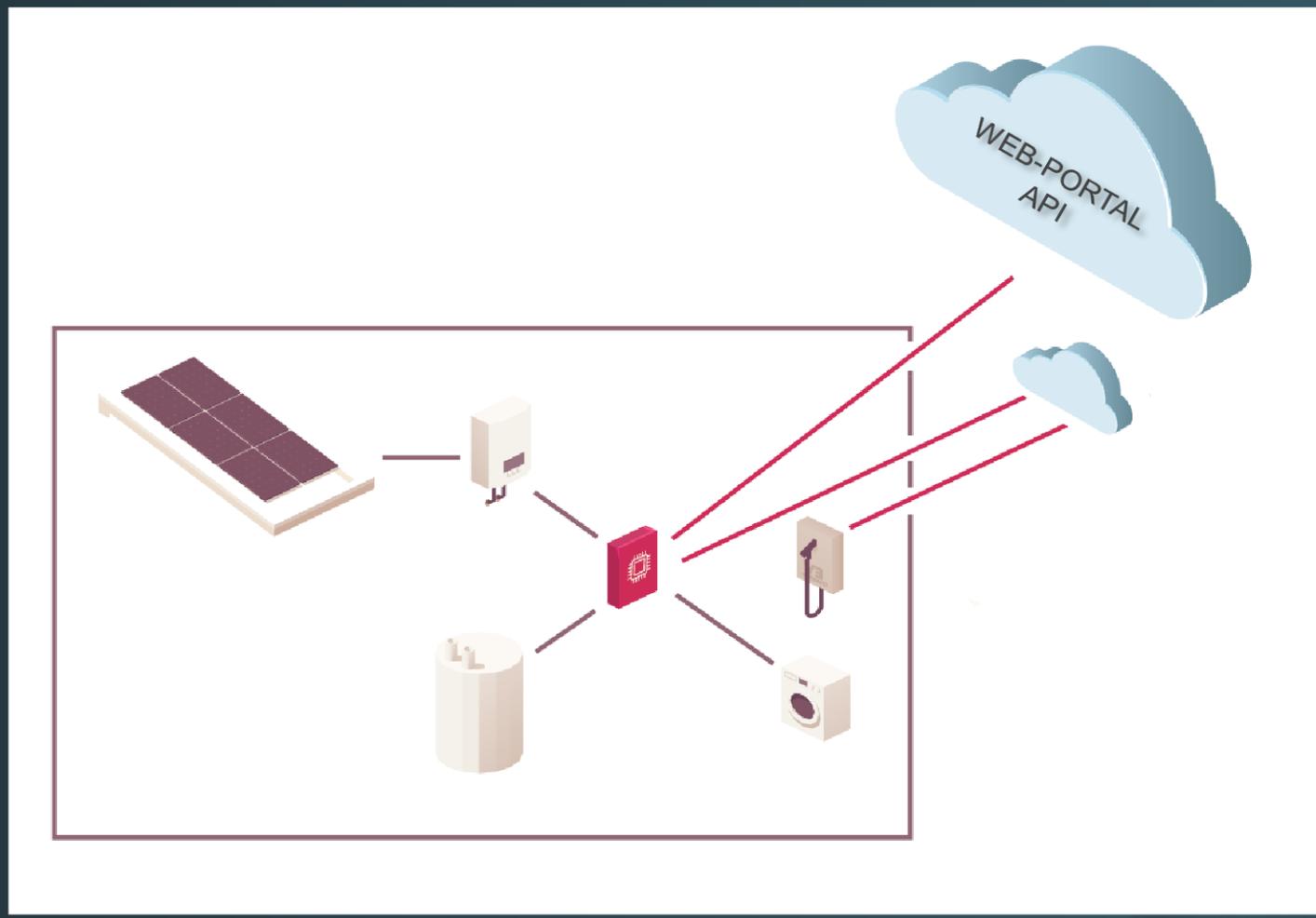
Solar Controller



What could go wrong?



Solar Controller

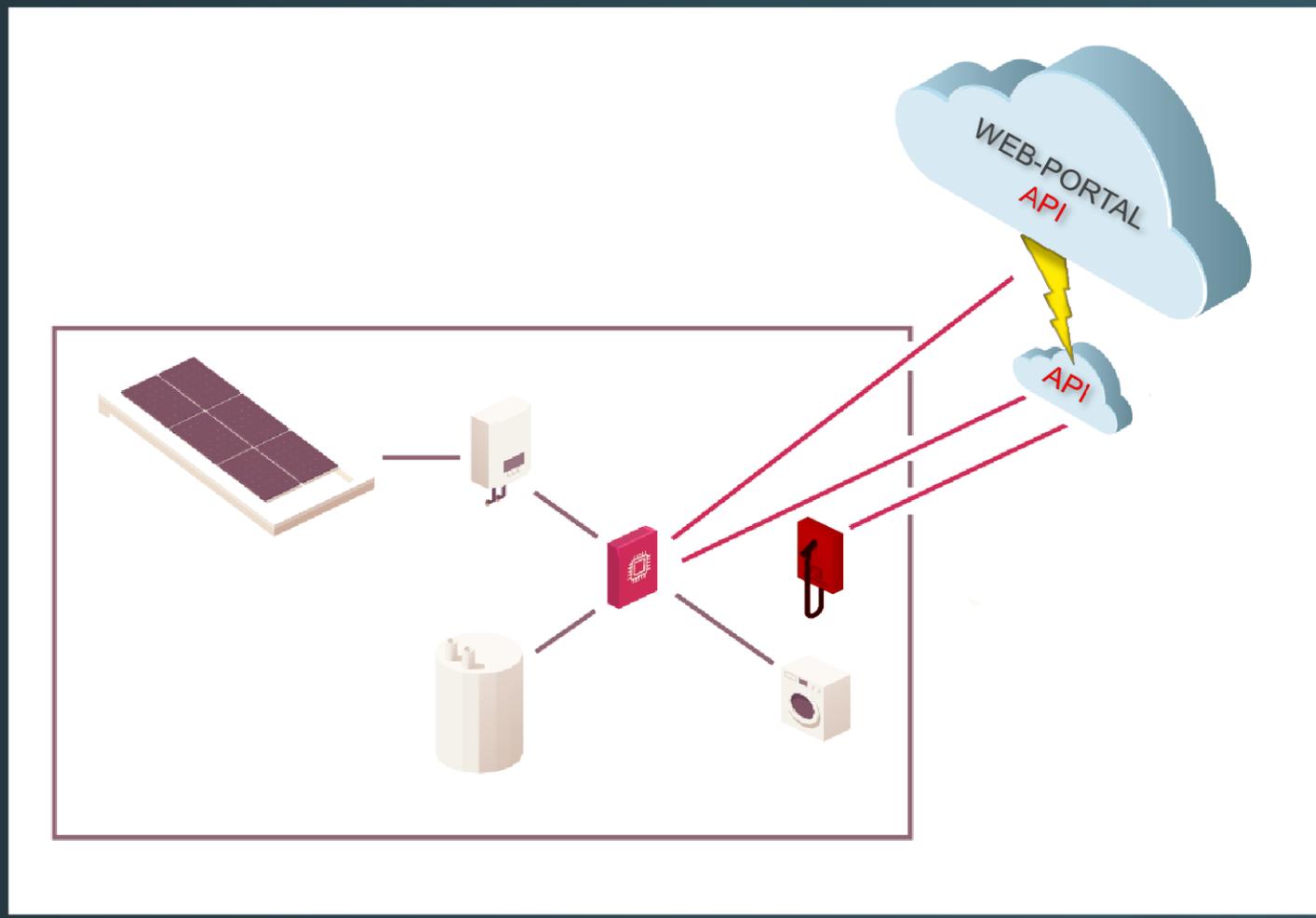


Solar Controller

- **Unauthenticated Public API**
 - exposes configurations of controllers
 - **private credentials** for external IoT-devices
 - Car charging stations etc.
- ➔ Attackers gain access to these IoT-devices over cloud



Solar Controller



Solar Controller

invertMeasurement:
User:
Password:
SerialNumber:

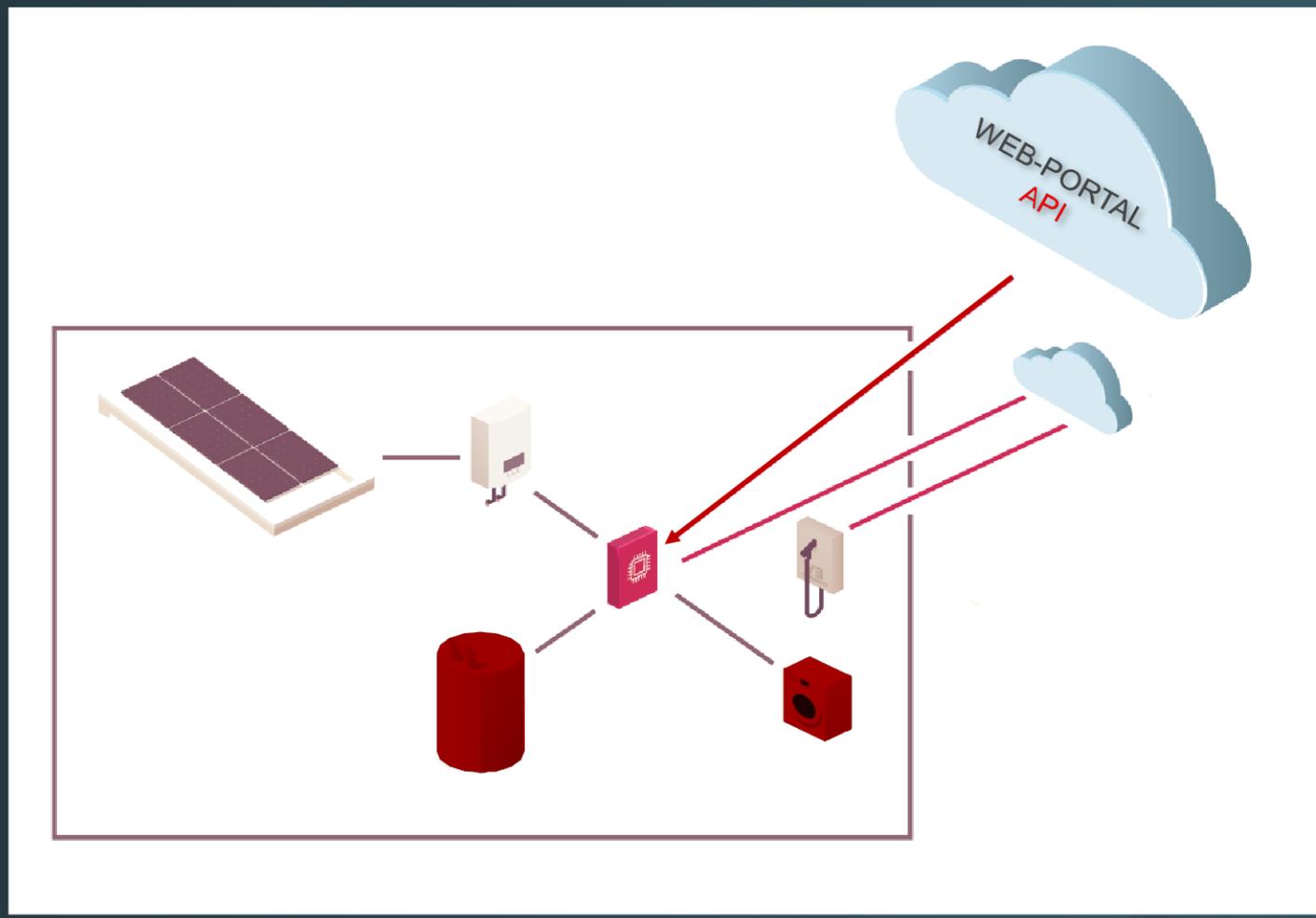
```
https://api...
JSON Raw Data Headers
Save Copy Collapse All Expand All Filter JSON
name:
ip: "192.168.1.48"
mac:
signal: "connected"
device:
installer:
  _id:
  name:
devices:
  0:
    _id:
    data:
      port: 1502
      Device_ID: "1"
      Device_ID old: "1"
      updateRequestIntervalTime: 5000
      name: "SolarEdge SE"
      ip: "192.168.1.46"
      mac: "84:d6:c5:17:33:05"
      signal: "connected"
      type: "Inverter"
      device type: "inverter"
      descriptionTag: null
    1:
      _id:
      data:
        SmartMeterPosition:
        invertMeasurement: false
        User:
        Password:
        SerialNumber:
      updateRequestIntervalTime: 5000
      name: "Cloud"
      signal: "connected"
      type: "Smart Meter"
      device type: "smart-meter"
      descriptionTag: null
```

Solar Controller

- **Web-portal for device configuration**
- JW Token for authentication
 - Tokens signed by server
 - Publicly known secret used for signing
- ➔ Impersonation of user- and installer-accounts
- ➔ Control configuration of all devices



Solar Controller



Solar Controller

Request

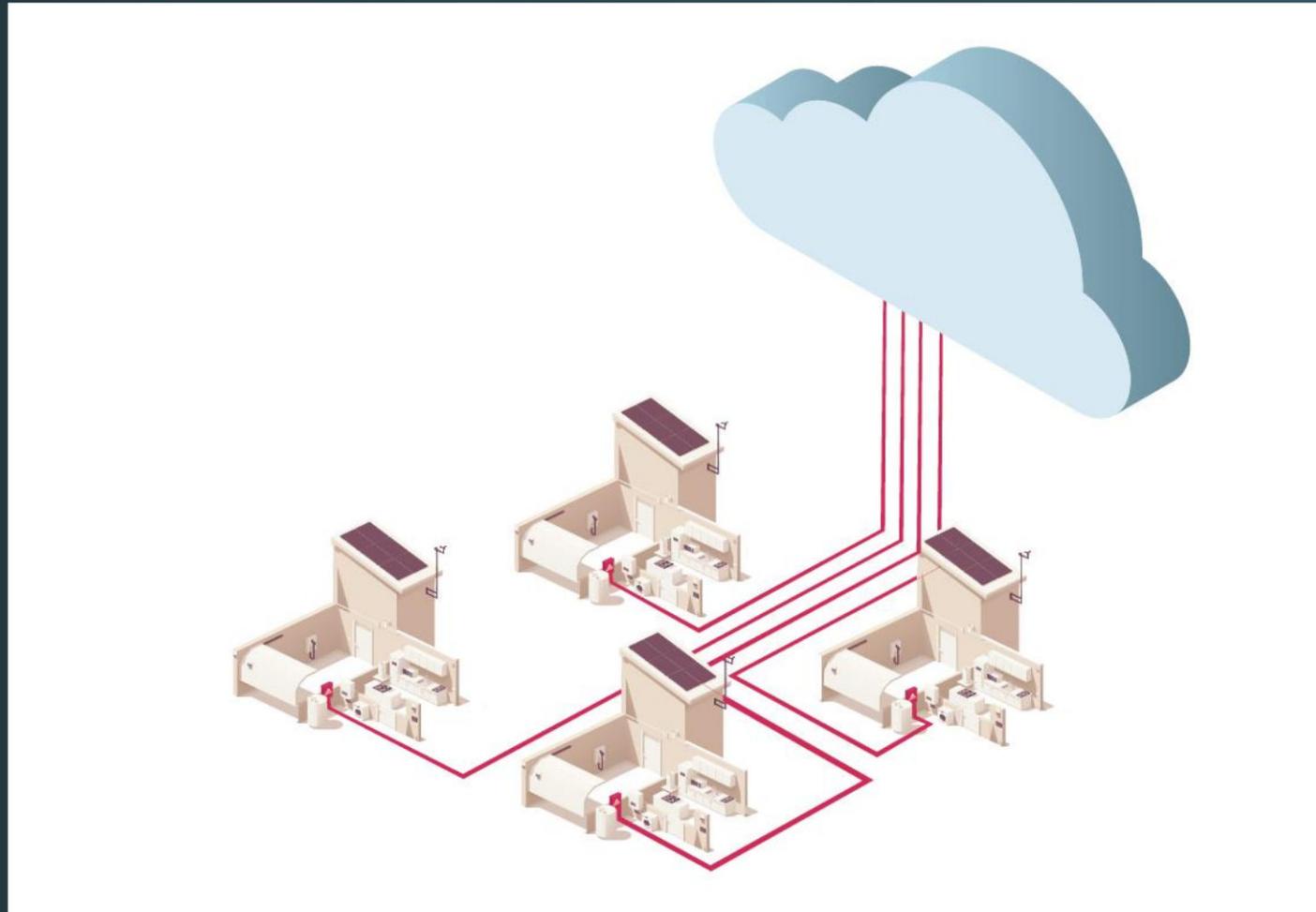
```
1 GET /user/me?app= HTTP/2
2 Host:
3 User-Agent: Mozilla/5.0 (Macintosh; Intel Mac OS X 10.15; rv:109.0) Gecko/20100101 Firefox/111.0
4 Accept: application/json, text/plain, */*
5 Accept-Language: de,en-US;q=0.7,en;q=0.3
6 Accept-Encoding: gzip, deflate
7 Referer: https:// /
8 Authorization: Bearer
9 Origin: https:// .ch
10 Sec-Fetch-Dest: empty
11 Sec-Fetch-Mode: cors
12 Sec-Fetch-Site: same-site
13 Te: trailers
14
15
```

Response

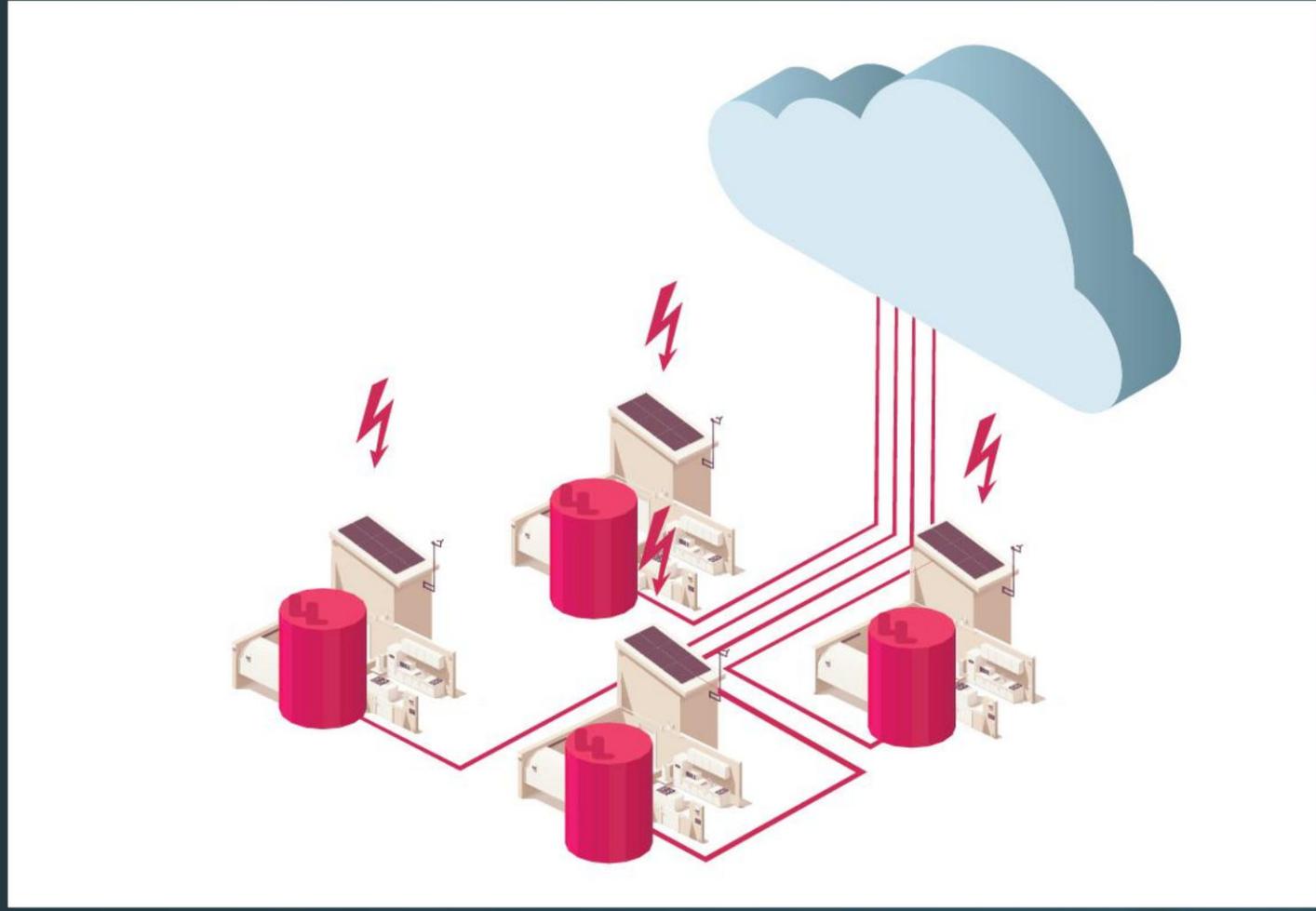
```
1 HTTP/2 200 OK
2 Date: Tue, 02 May 2023 15:02:14 GMT
3 Content-Type: application/json; charset=utf-8
4 Content-Length: 1260
5 Vary: Origin
6 Access-Control-Allow-Origin: *
7 Access-Control-Allow-Credentials: true
8 Access-Control-Expose-Headers: WWW-Authenticate,Server-Authorization
9 X-Powered-By:
10
11 {
  "_id": " ",
  "language": "Deutsch",
  "status": "active",
  "email": " ",
  "first_name": " ",
  "last_name": " ",
  "createdAt": "2018-10-20T09:56:57.125Z",
  "updatedAt": "2023-05-02T09:13:55.410Z",
  "my_company": {
    "_id": " ",
    "name": " ",
    "createdAt": "2018-10-20T09:56:57.011Z",
    "updatedAt": "2022-07-28T10:00:55.789Z",
    "_v": 0,
    "admin": " ",
    "visible_web": true,
    "visible_installer_app": true,
    "visible_end_user_app": true
  },
  "role": {
    "_id": " ",
    "name": "PV Installer",
    "description": "PV Installer",
    "type": "pv_installer",
    "v": 0
  },
  "city": " ",
  "phone": " ",
  "street": " "
}
```

```
"role":{
  "_id": " ",
  "name": "PV Installer",
  "description": "PV Installer",
  "type": "pv_installer",
  "v": 0
}
```

Solar Controller



Solar Controller



Solar Controller - Risks

- Simultaneous on/off switching of external devices (e.g., boilers)

➔ Destabilization of the power grid

- Lowering boiler water temperature

➔ Disabling legionella protection



Solar Controller - Conclusion

The same old story: IoT and connectivity **bring both opportunities and risks**

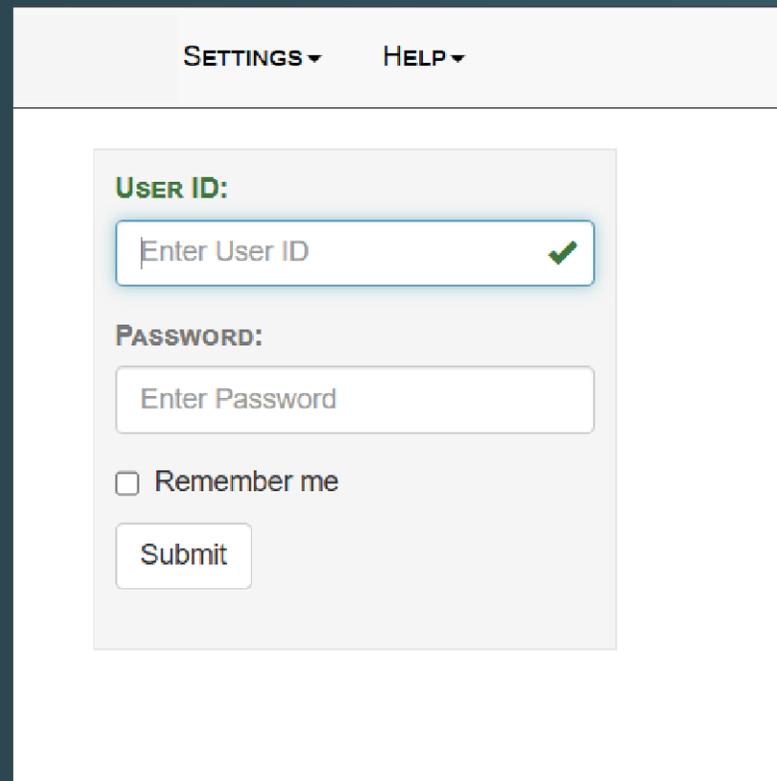
- But: **centralization massively amplifies the risk**
 - ➔ **Single point of failure**: the entire system stands or falls with one single component

Web Applications



Starting Point

- External penetration test
- Small attack surface
- 2 web applications
- No credentials



SETTINGS ▾ HELP ▾

USER ID:

Enter User ID ✓

PASSWORD:

Enter Password

Remember me

Submit

Static Code Analysis

```
if (username.toUpperCase() == "ADMINISTRATOR") {  
    role = "Admin"  
}
```

SETTINGS ▾ HELP ▾

USER ID:

ADMINISTRATOR ✓

ADMINISTRATOR CONSOLE

General

[Redacted]

Licensed To:
[Redacted]

Serial Number:
[Redacted]

Module Details: [Redacted]

Static Code Analysis

```
$(document).on('keydown', function (e)
{
  //ctrl + space
  if (e.ctrlKey && e.which === 32)
  {
    if ($('#code').css('display') != 'inline')
    {
```

SETTINGS ▾

HELP ▾

submit

Request

...

{

"Auth": "test"

}

Response

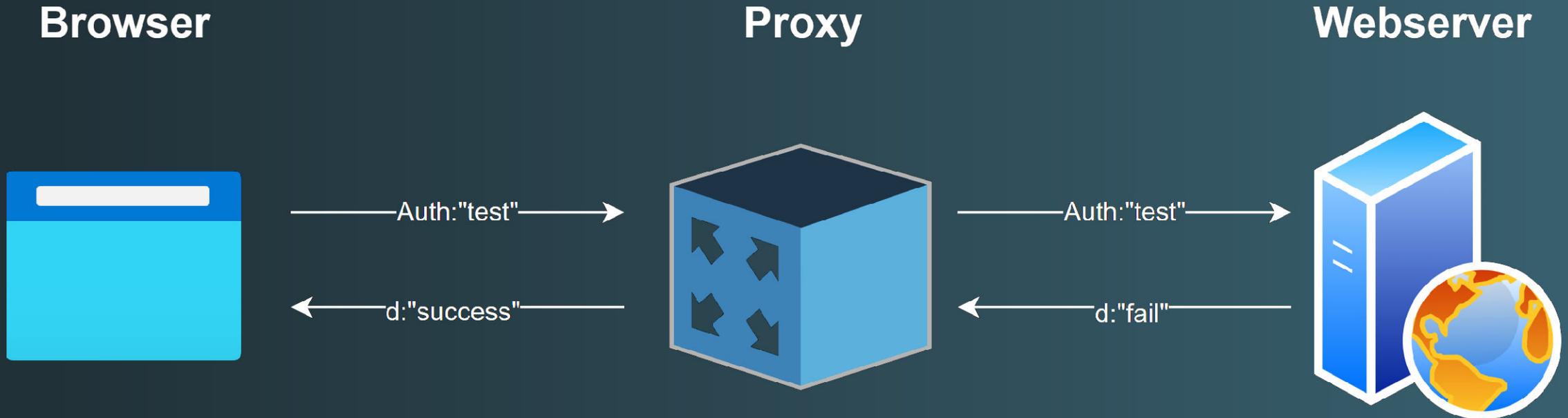
...

{

"d": "fail"

}

Man-in-the-Middle Proxy



Static Code Analysis

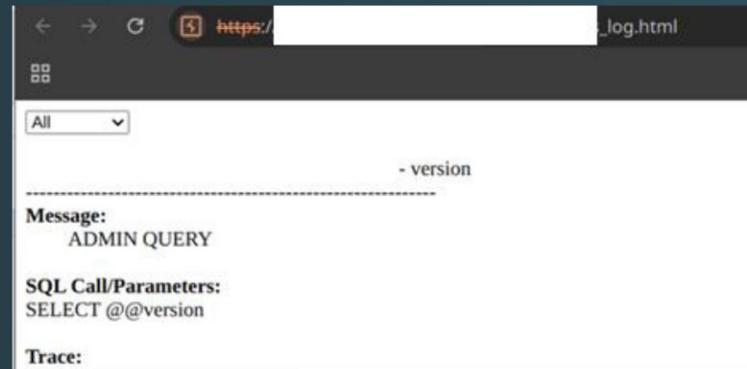
The screenshot shows a web interface for executing SQL queries. At the top, there is a navigation bar with buttons for 'SQL', 'Config', 'Logs', 'Sync', 'Files', and 'Import'. Below this, there are tabs for 'Query' and 'File'. A large text area is provided for entering the SQL query. Below the text area, there is a 'SAVED QUERIES:' dropdown menu, an 'EXPORT:' dropdown menu set to 'CSV', and a 'Go!' button. At the bottom, there is a 'Run Query' button.

Response

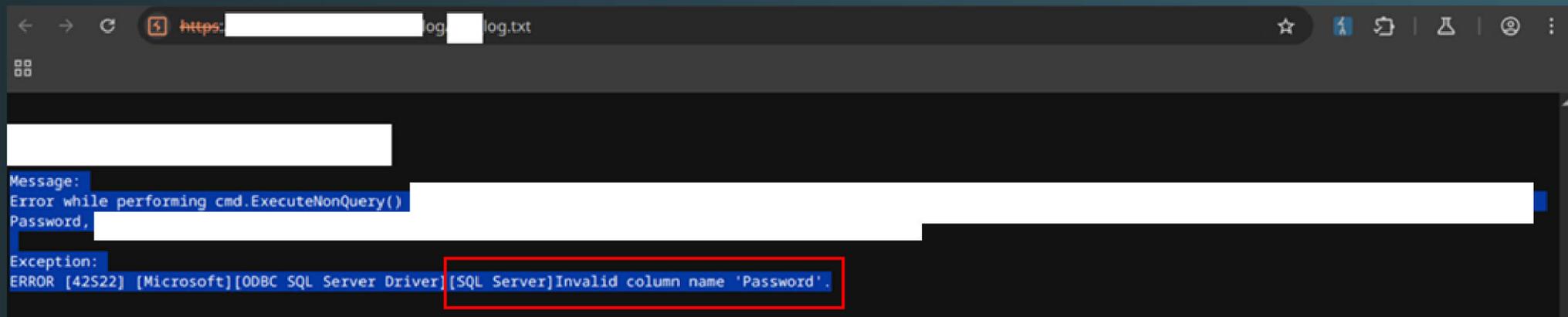
Pretty Raw Hex Render JSON

```
Uid=dba;Pwd=sql\"
```

Emergency Update



```
< https://[redacted]_log.html
All
- version
-----
Message:
  ADMIN QUERY
SQL Call/Parameters:
  SELECT @@version
Trace:
```



```
< https://[redacted]log.txt
Message:
Error while performing cmd.ExecuteNonQuery()
Password, [redacted]
Exception:
ERROR [42S22] [Microsoft][ODBC SQL Server Driver][SQL Server]Invalid column name 'Password'.
```

SQL Injection



SQL Injection



SQL Injection – Remote Code Execution

```

0 Priority: u=0, i
1
2 {
3
4
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11
12
13 Date:
14 Content-Length: 15
15
16 {
17     "d": "success"
18 }
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Conclusion

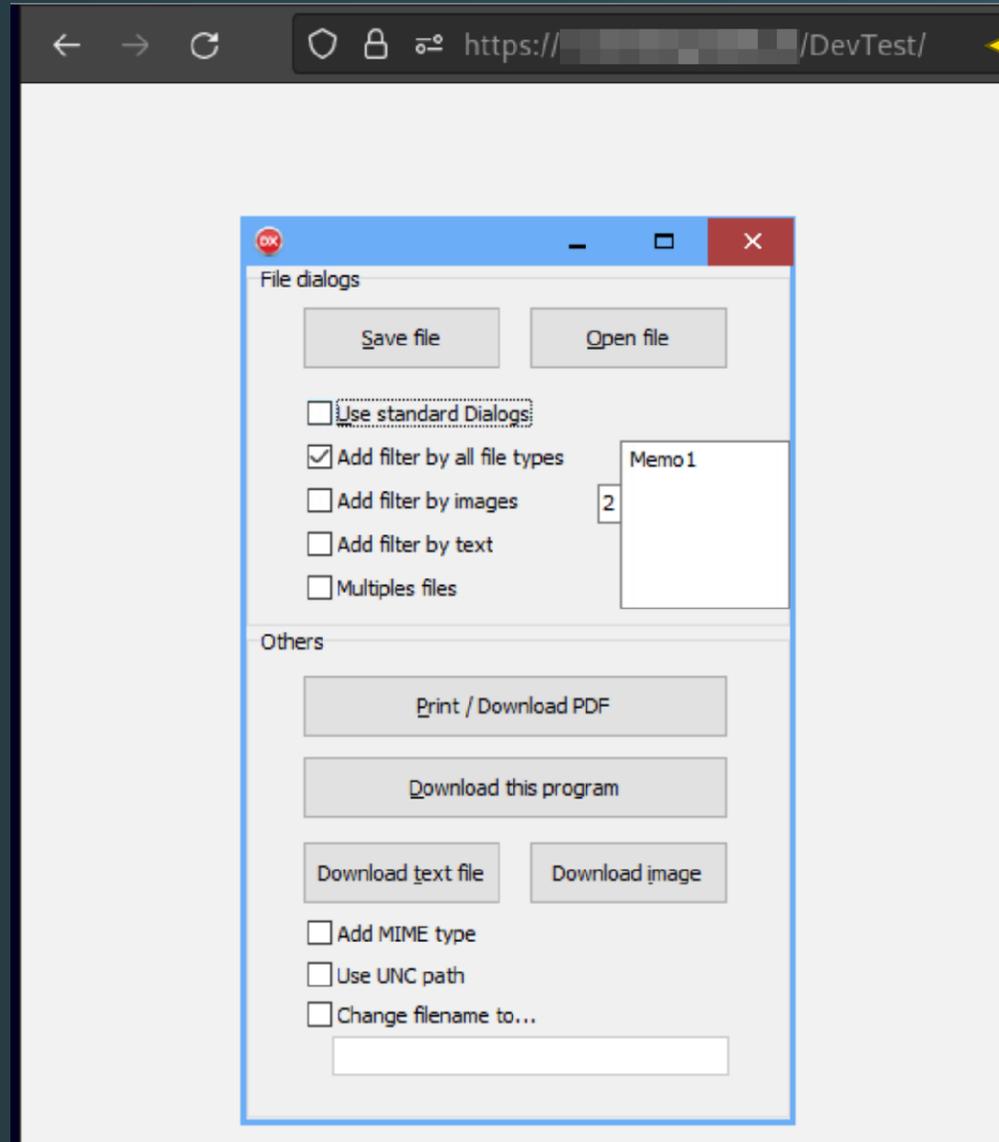
- ✓ Customer had a small attack surface
- ✓ Customer used MFA
- ✓ Automatic scans didn't find anything

✗ Perimeter breached

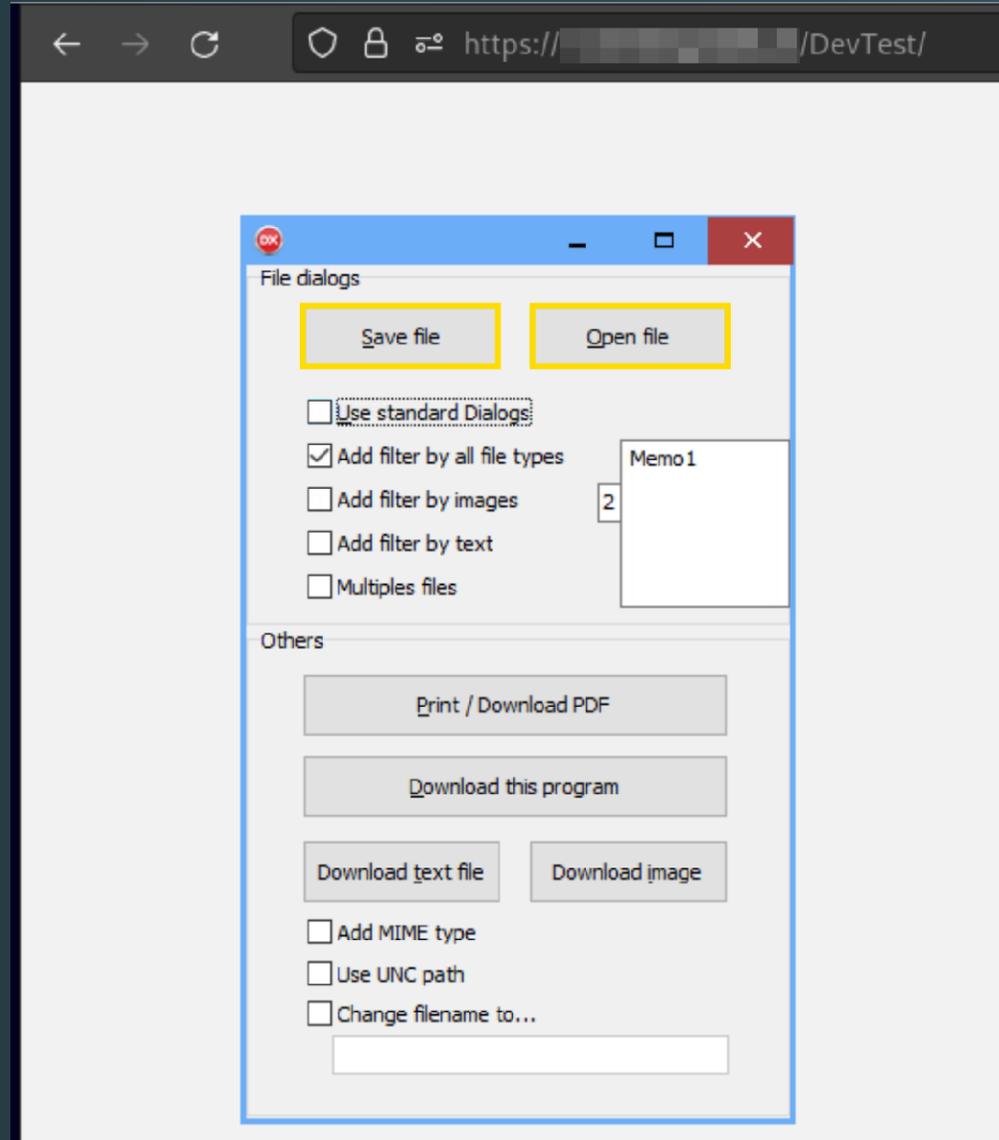
✓ EDR was triggered

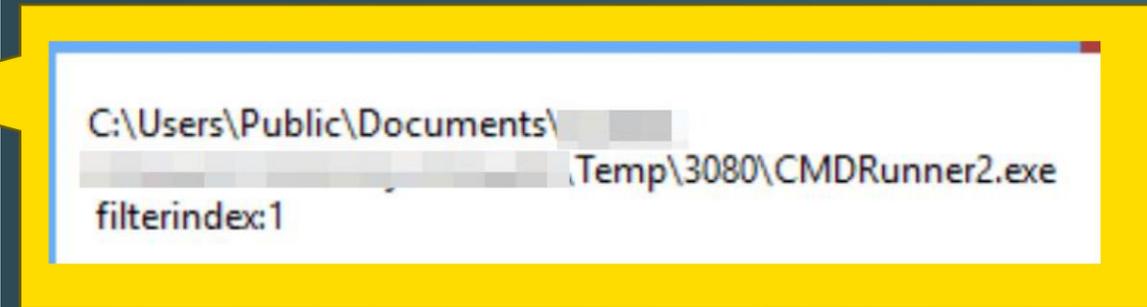
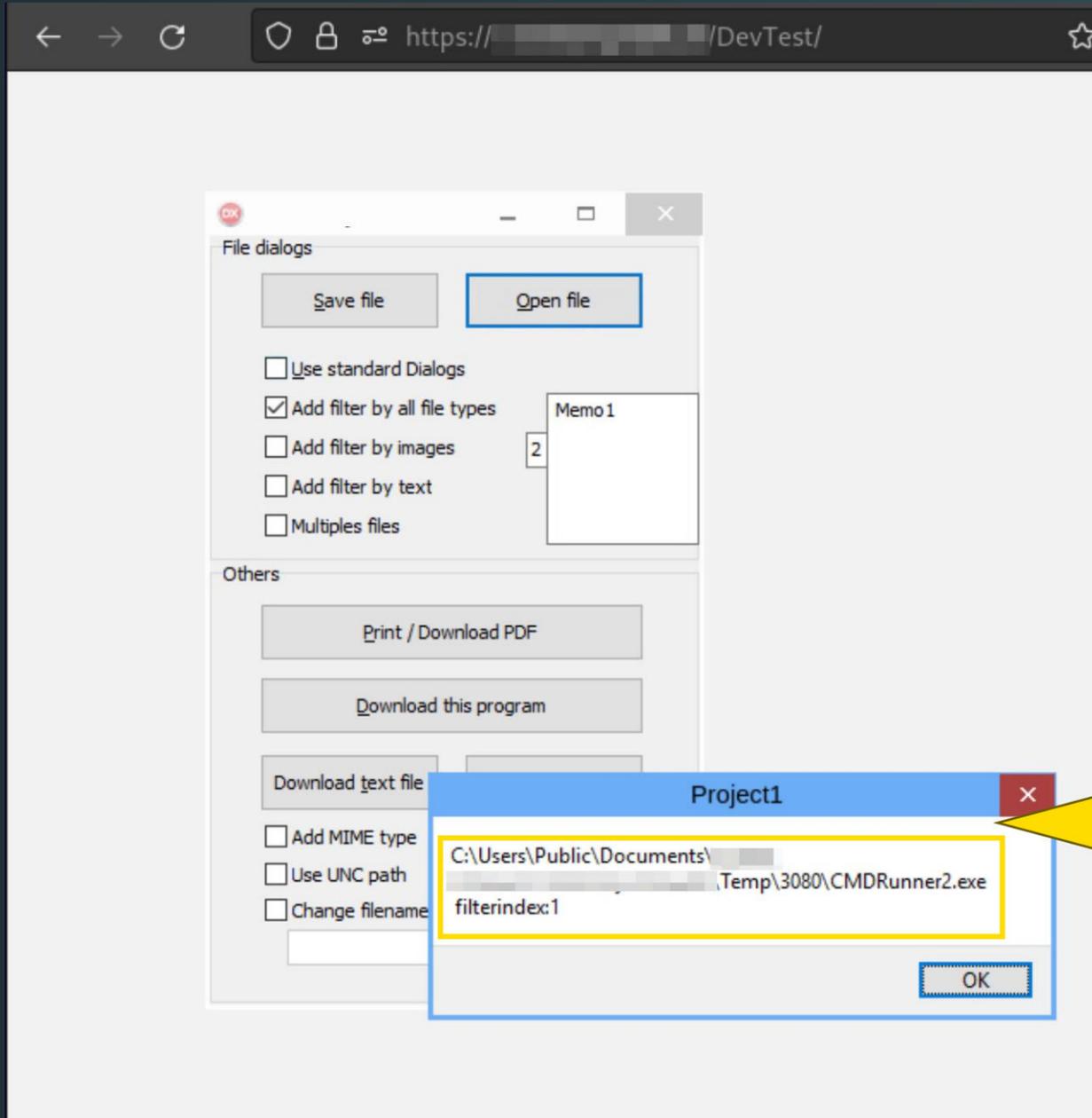


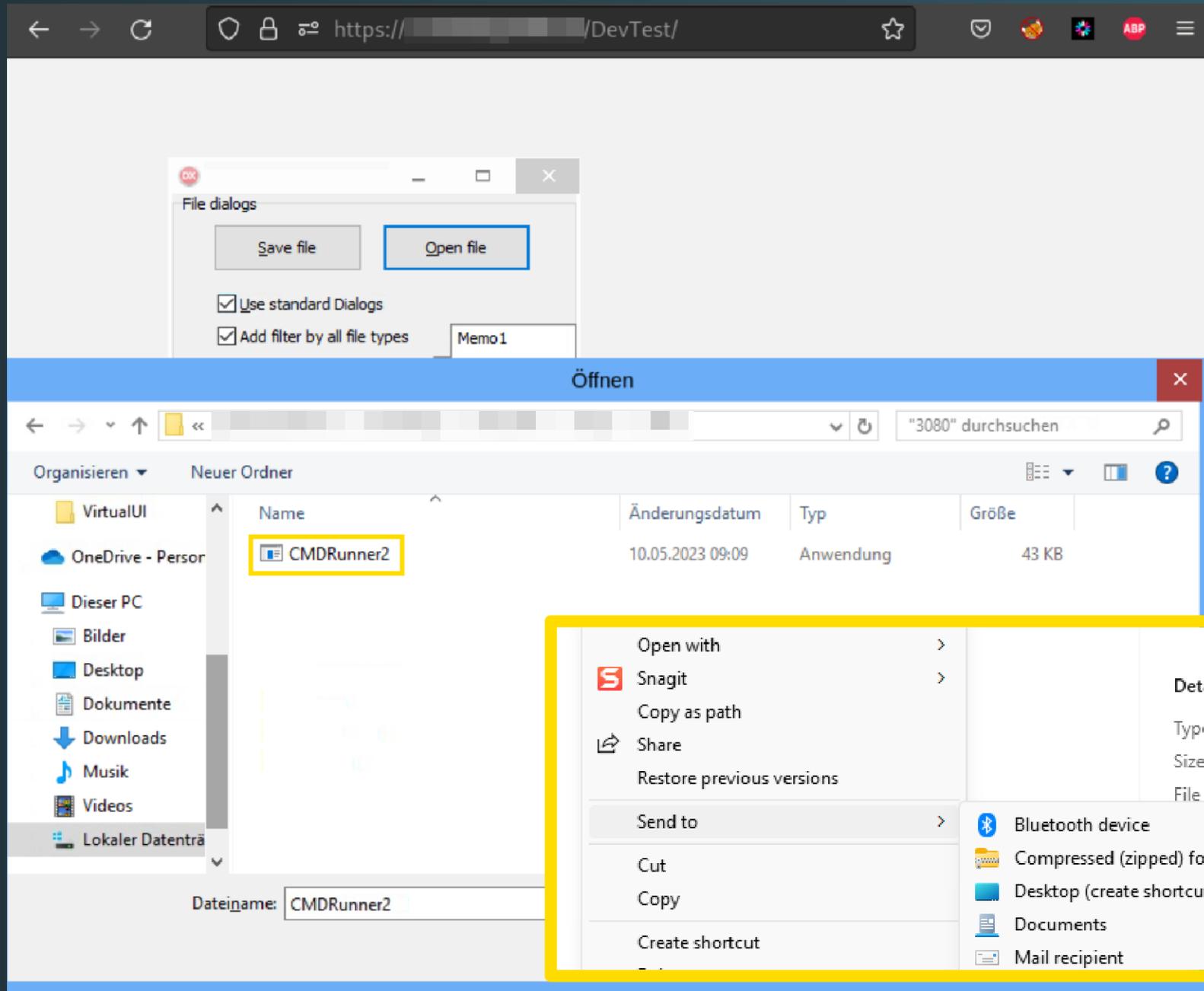
Case Study Web – Scenario & Analysis



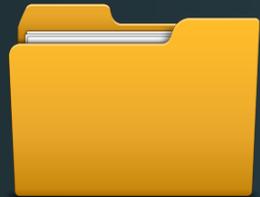
Case Study Web – Scenario & Analysis







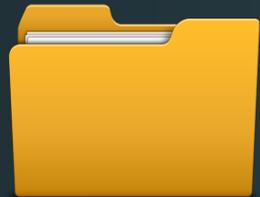
Case Study Web – Exploitation



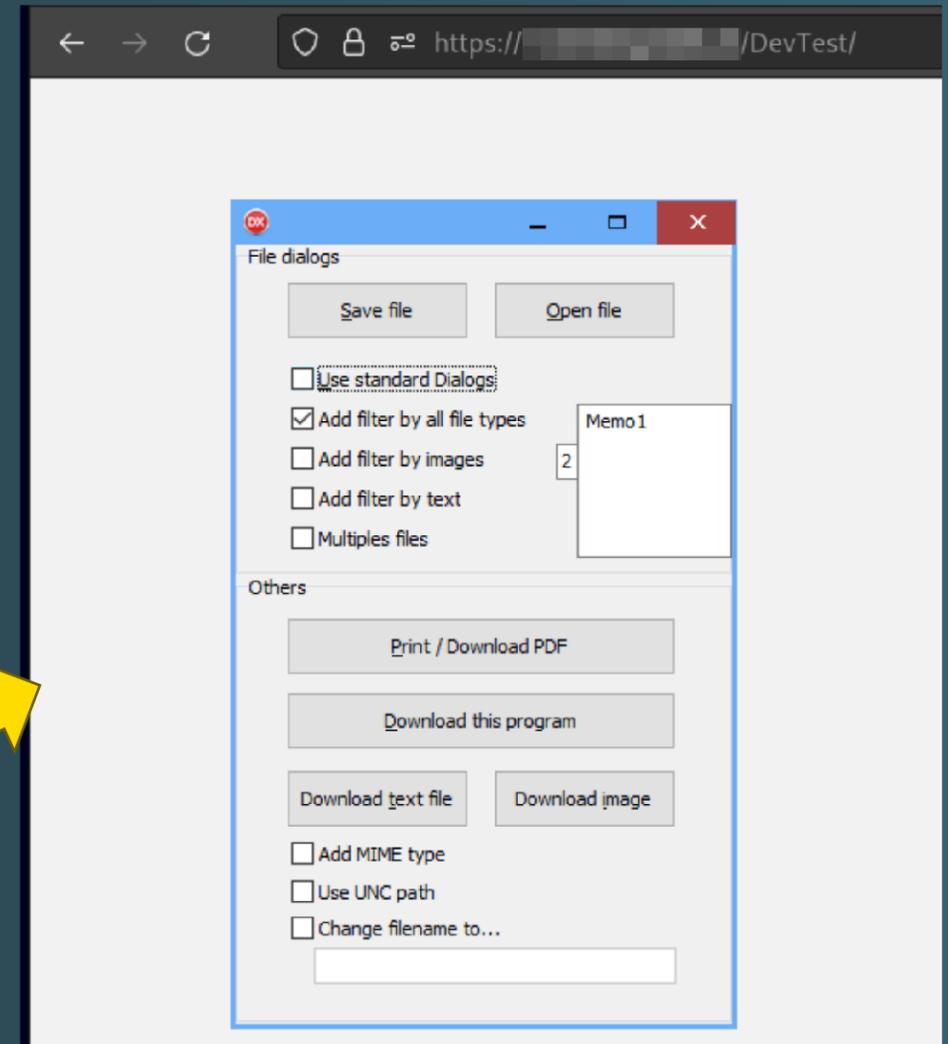
Application 1



Application 2



Application DevTest



Case Study Web – Exploitation



Application 1



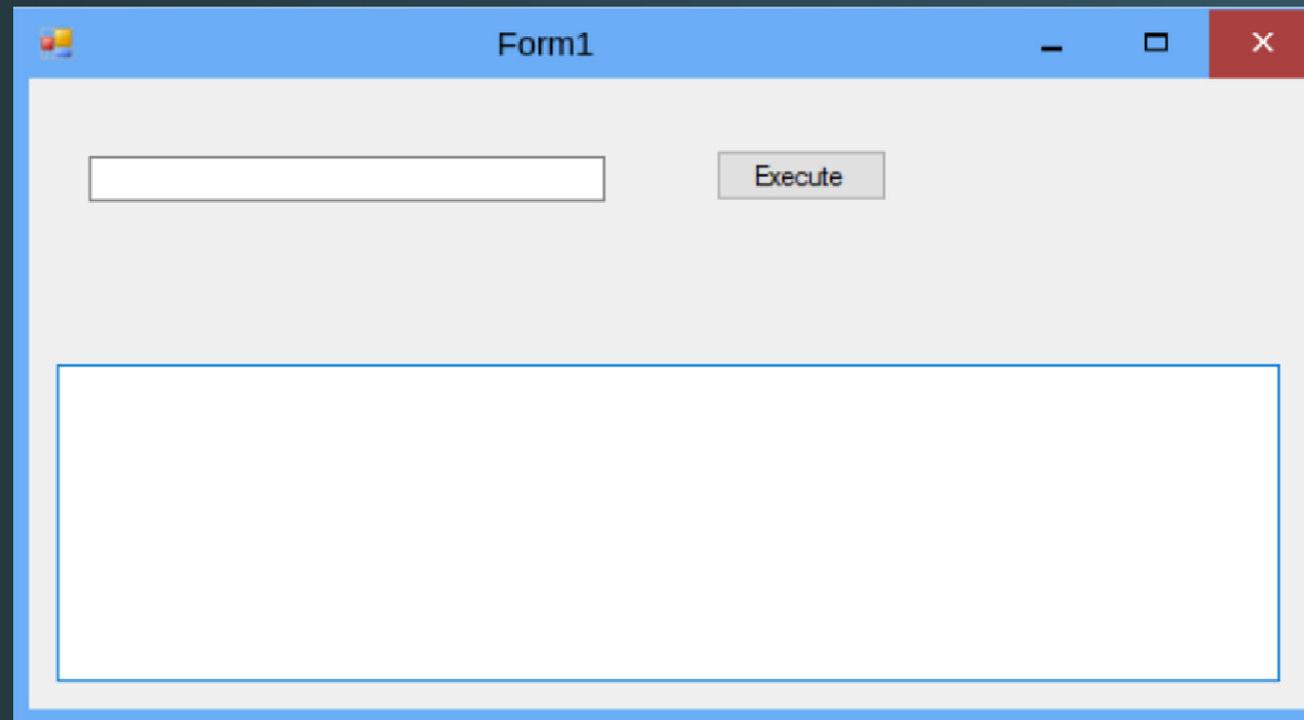
Application 2

Application InfoGuard

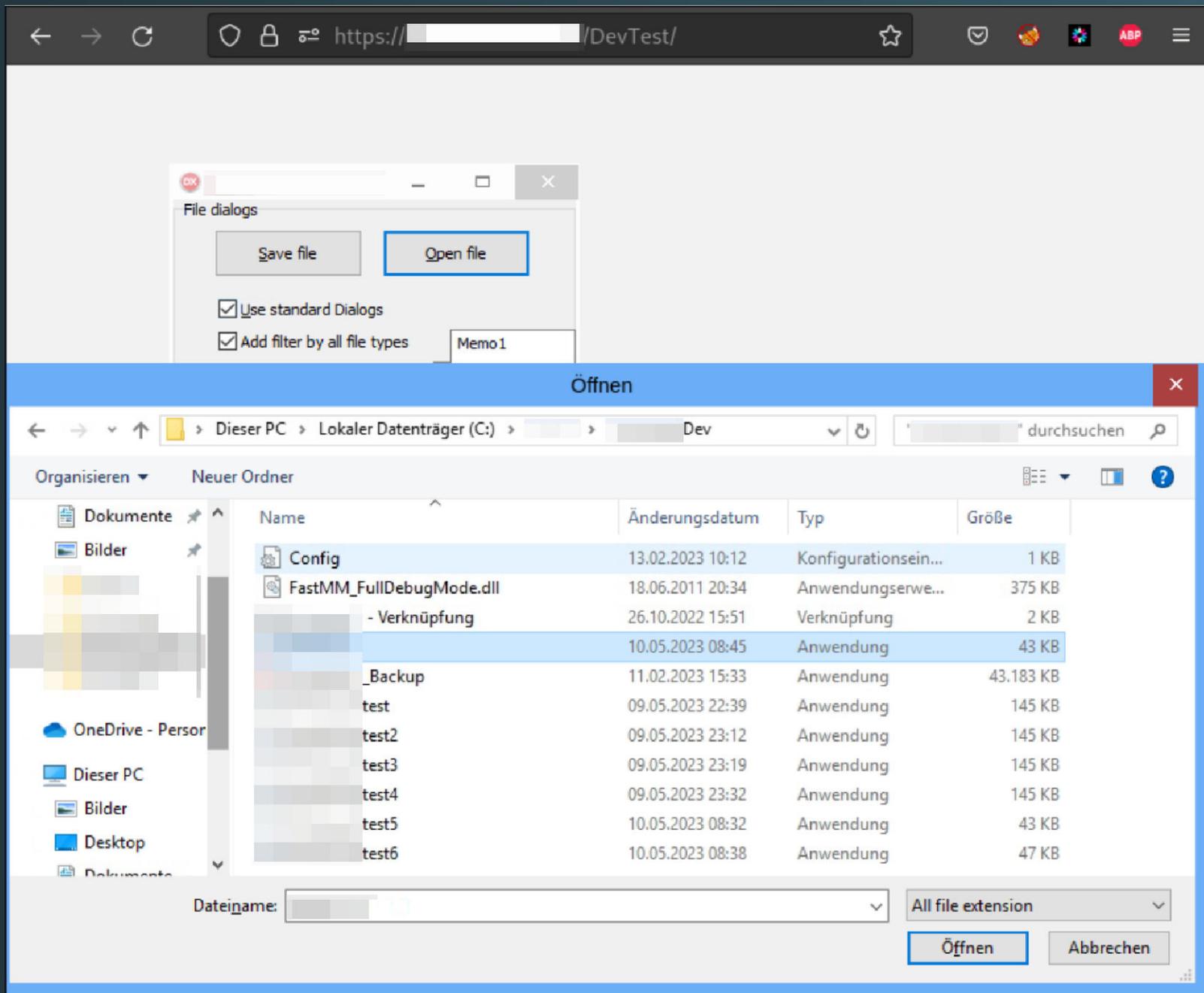


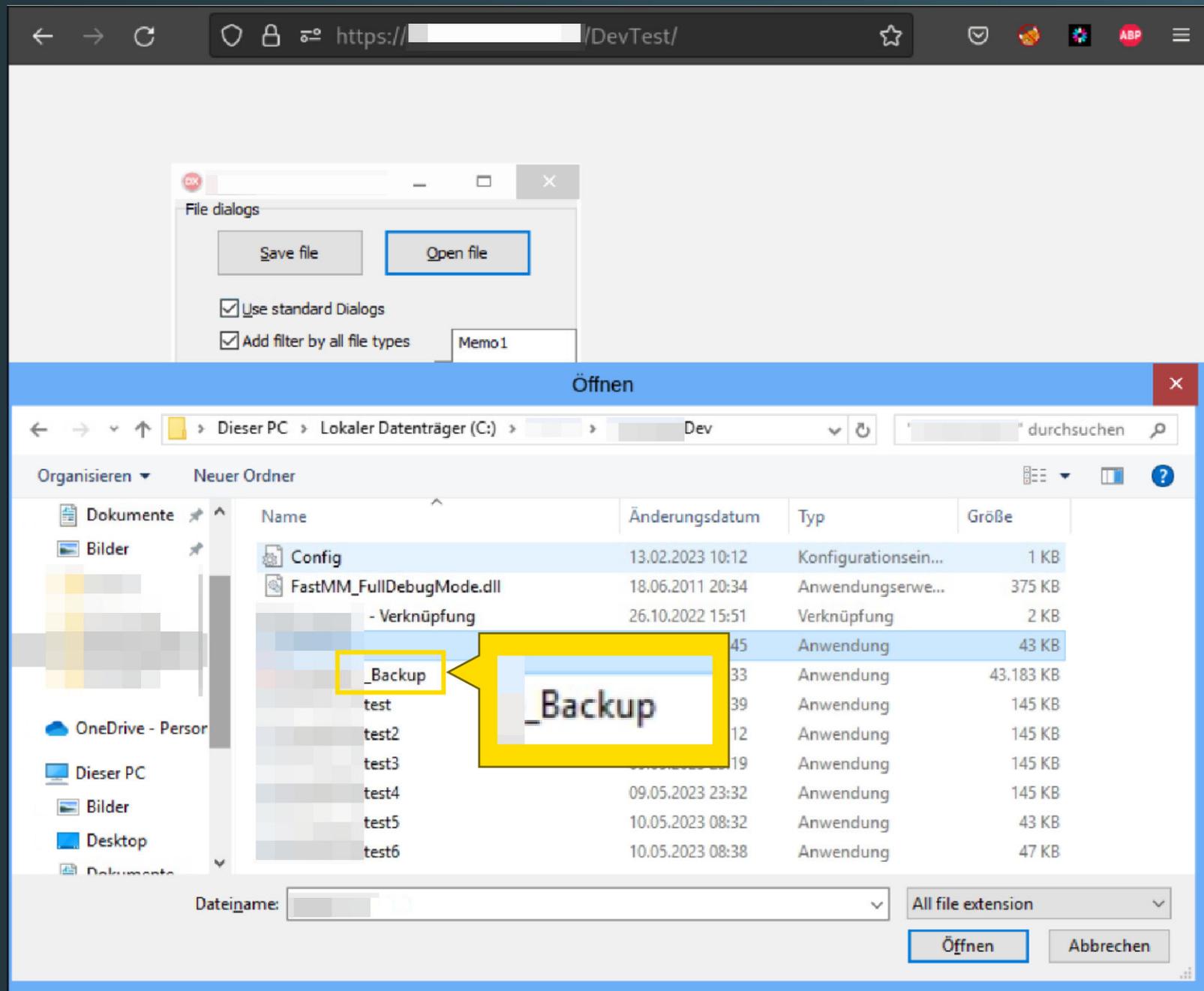
Application DevTest

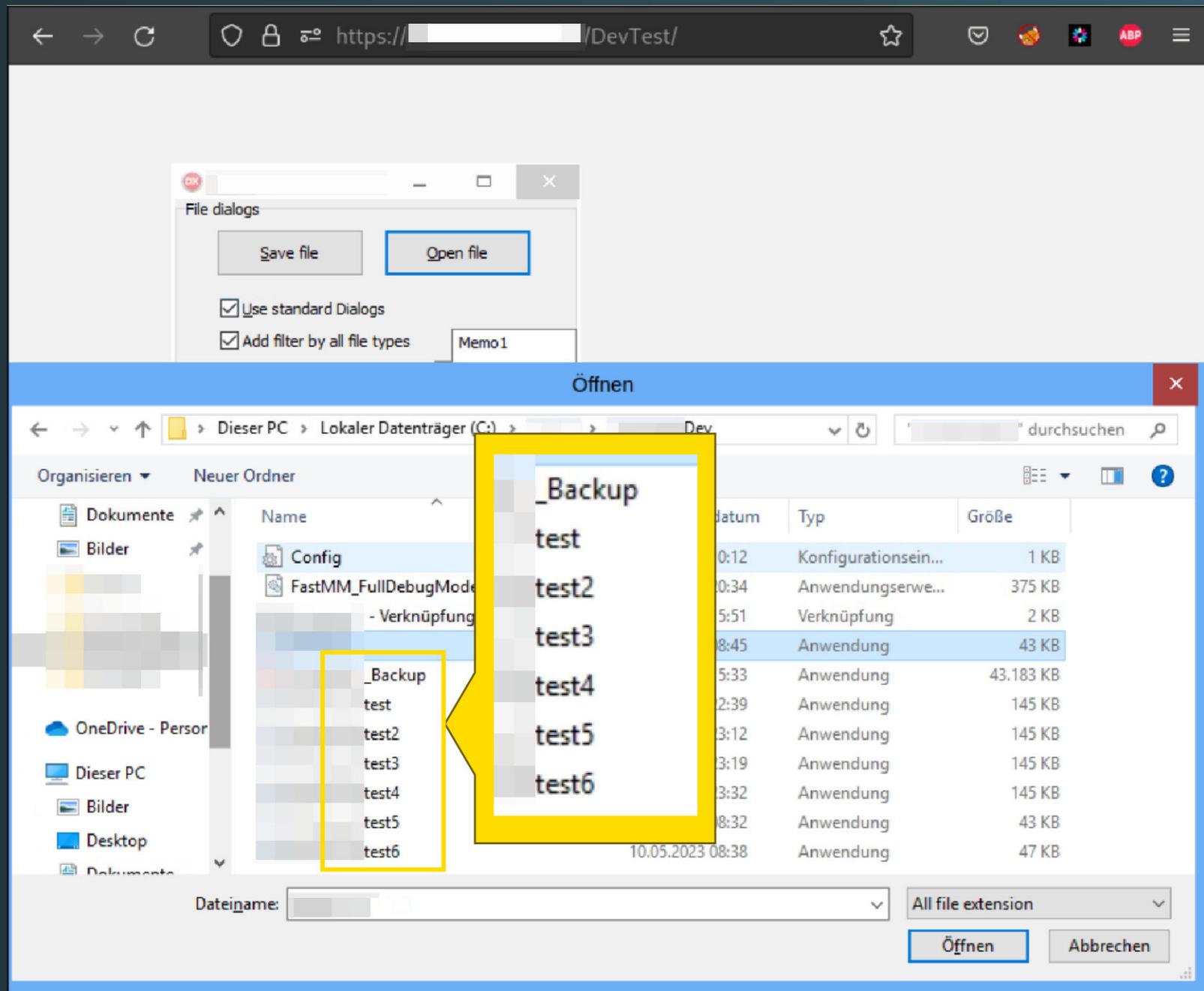


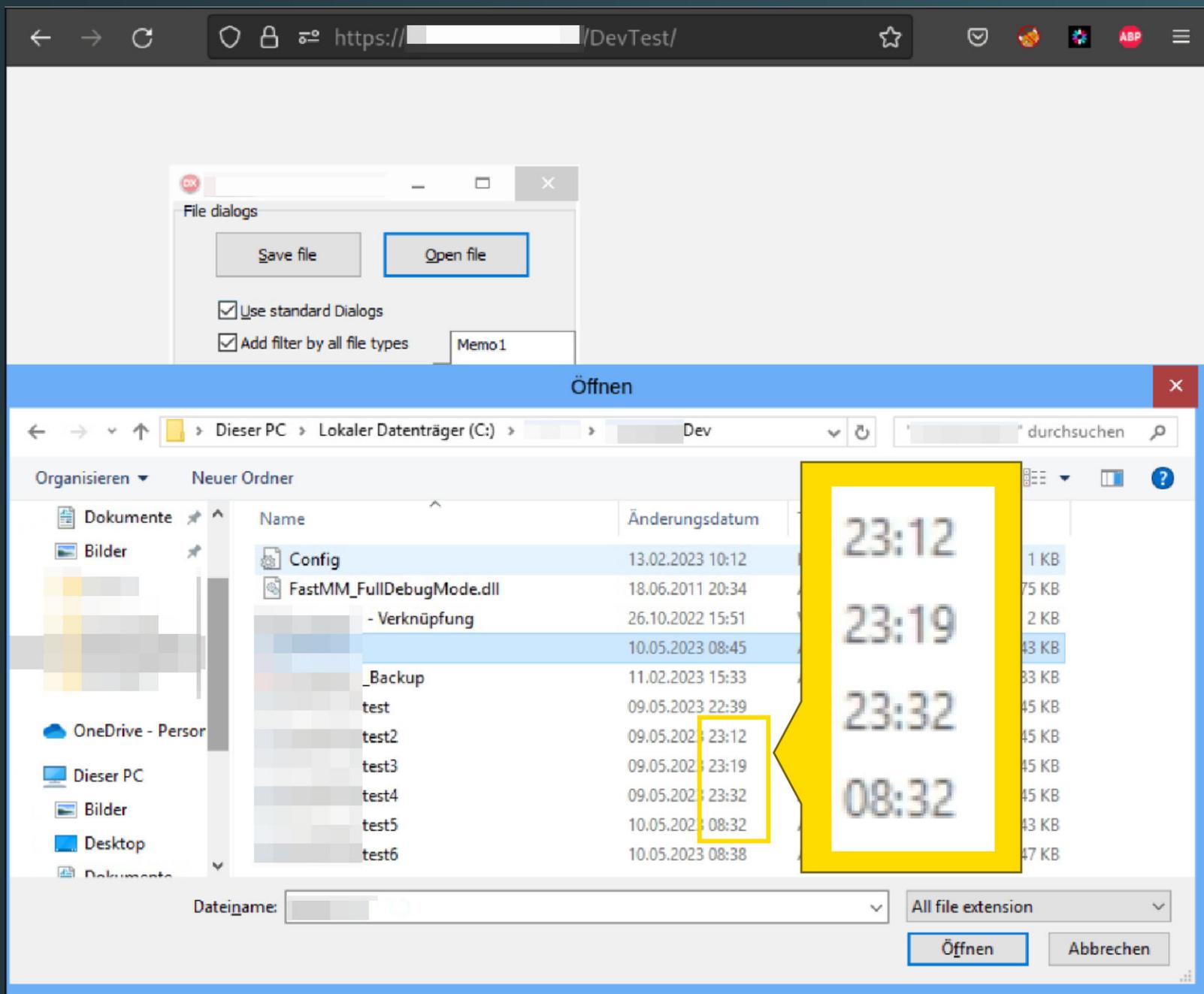


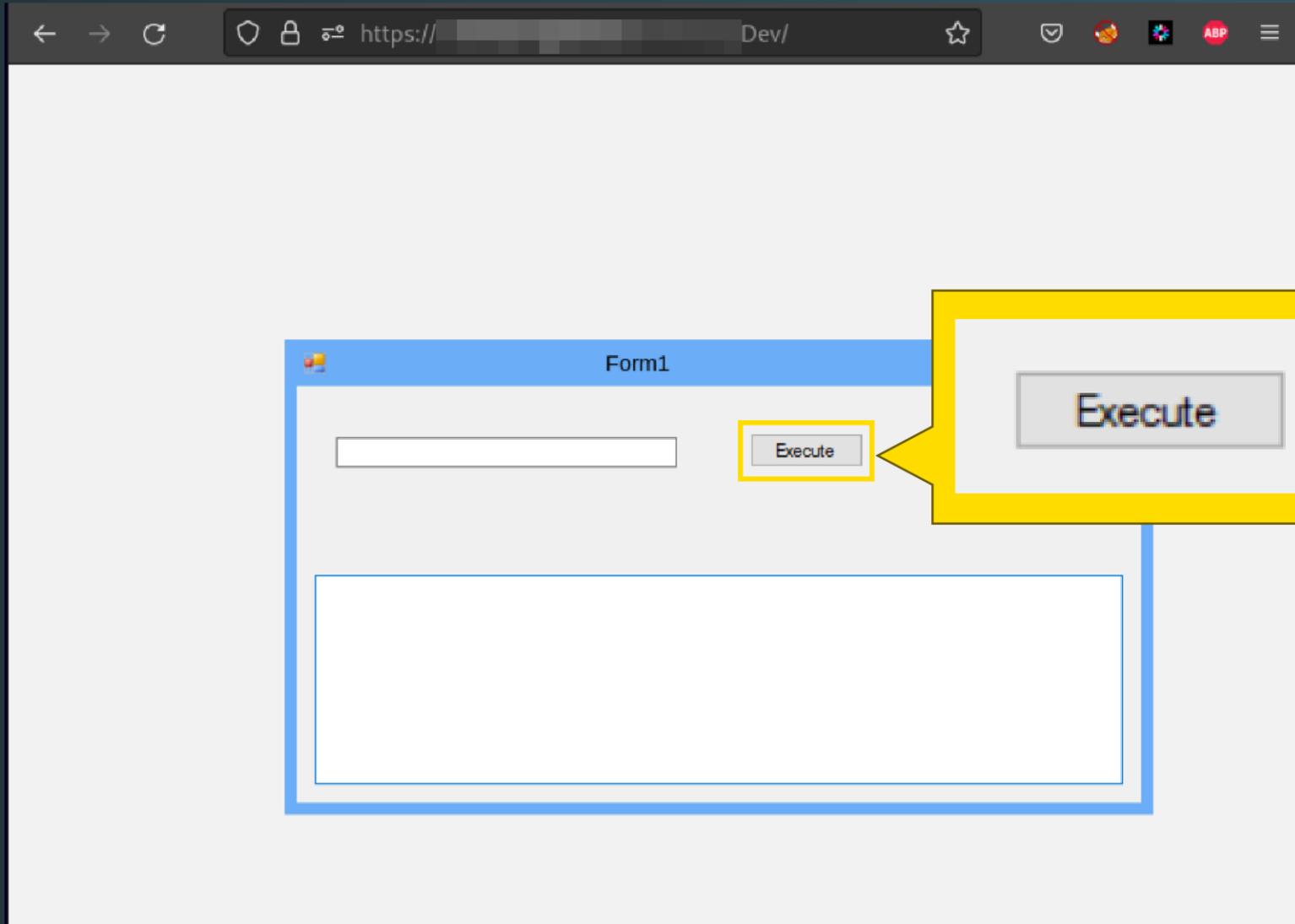
```
1 reference  
private void button1_Click(object sender, EventArgs e)  
{  
    string someText = "This is a test";  
    File.WriteAllText(@"C:\Users\Public\Documents\outputFile.txt", someText);  
}  
}
```

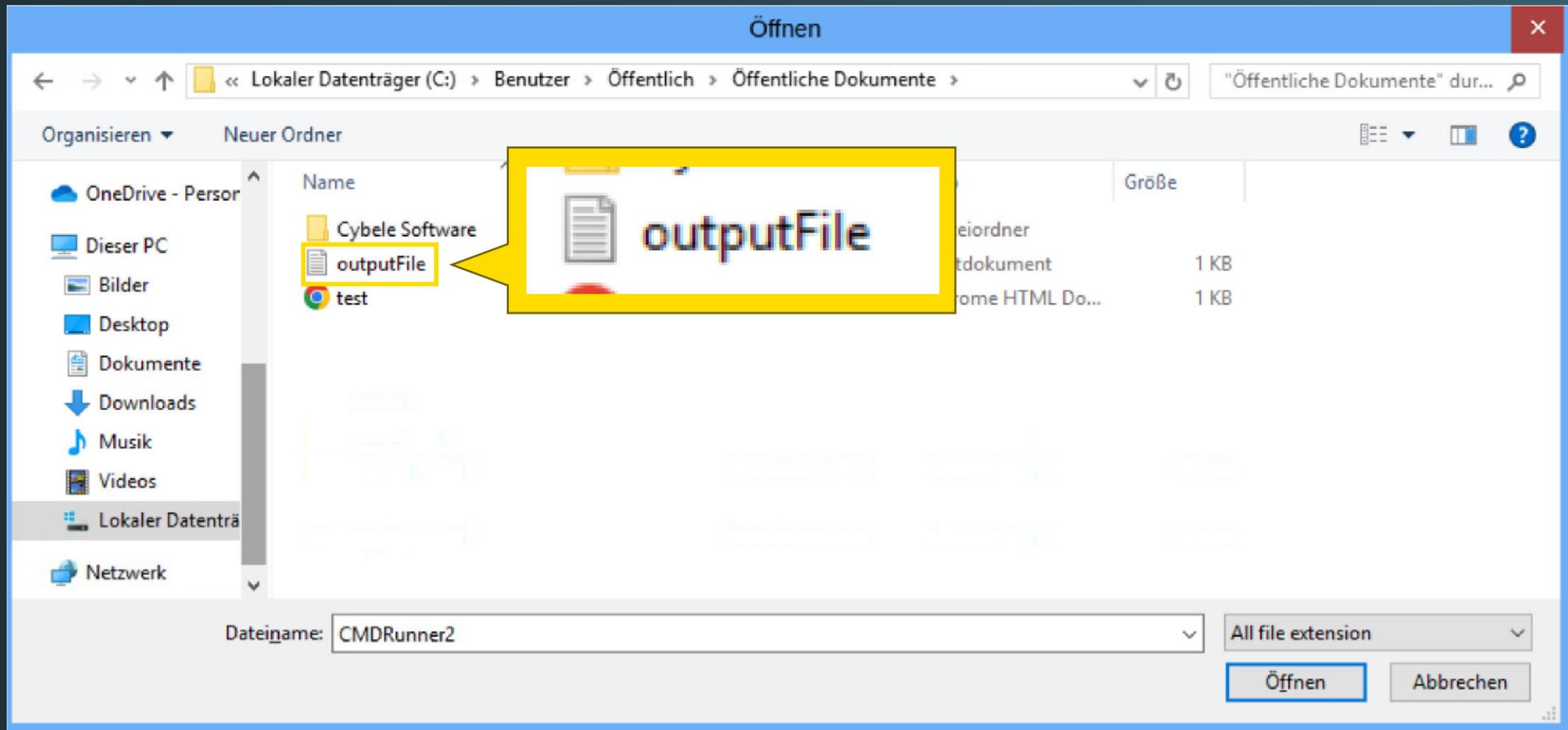












Case Study Web – Solution(?)



- **The Perimeter is Everywhere:**
Sensors, physical spaces, devices, third-party apps
- **Security Is More Than Tech:**
People, processes, and procurement
- **Continuous Testing is Essential:**
Go beyond mainstream testing

