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Research on methods of detecting defacement attack based on deep learning

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CONTENT

1. Motivation
2. Building model Machine Learning
3. Alert system development
4. Experiment and evaluation

1 Motivation

2 Building model Machine Learning

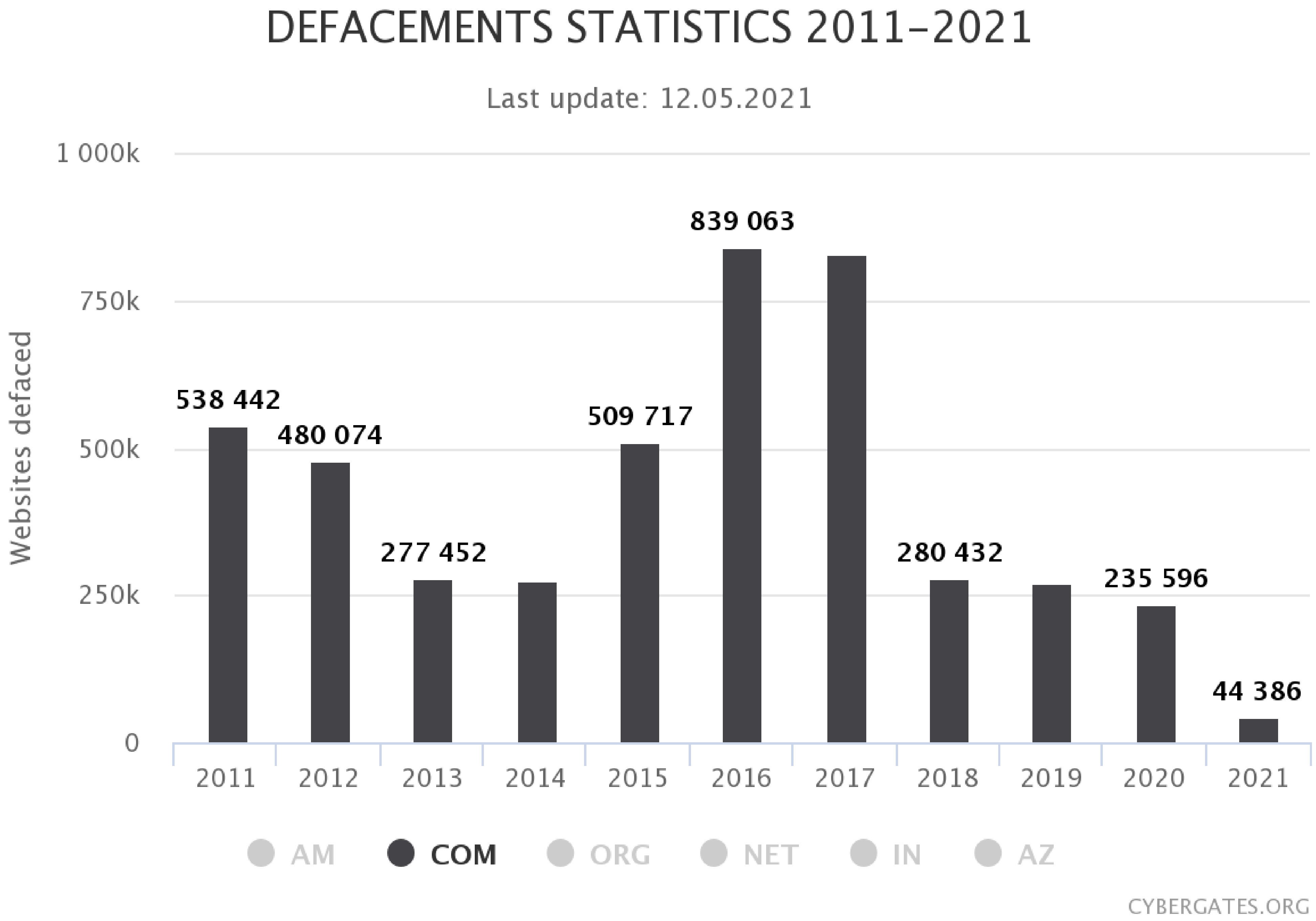
3 Alert system development

4 Experiment and evaluation

MOTIVATION

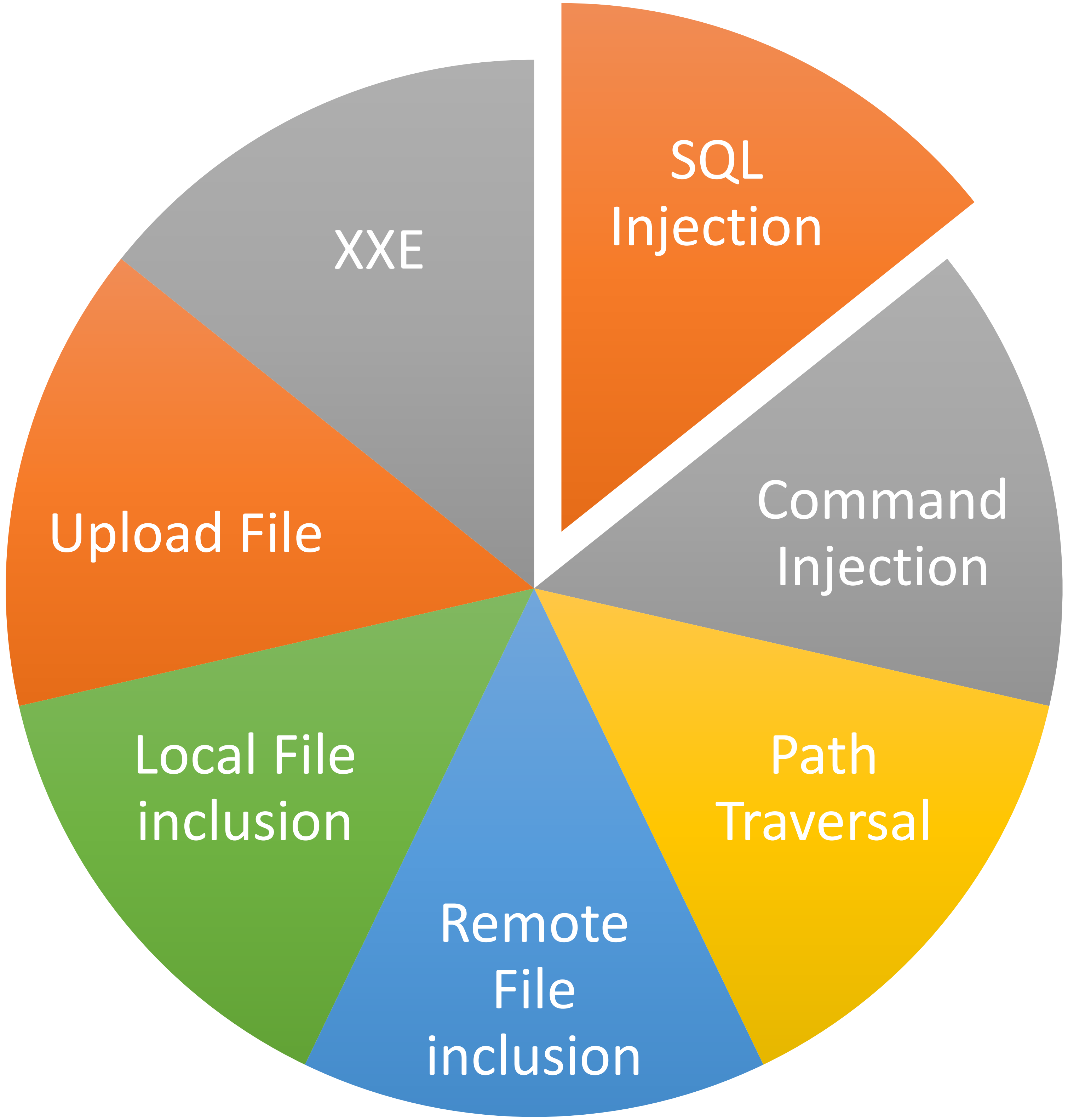
❖ Goals:

- Cause political conflict
- To show off
- Warn the system administrator



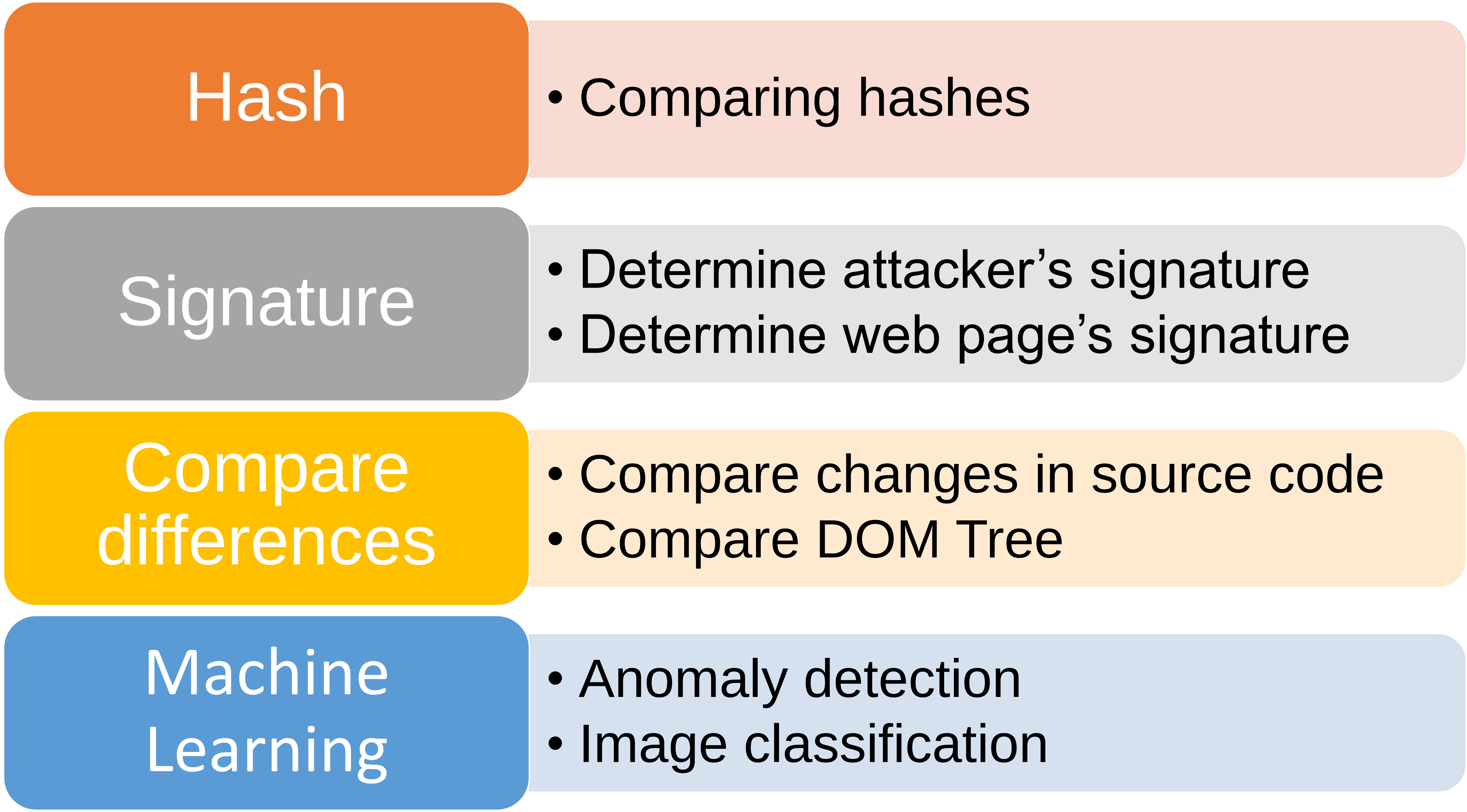
The amount of websites under the .com domain that faced defacement attacks from 2011 to 2021

SOME ATTACK TECHNIQUES



Some critical web vulnerabilities

DETECTION TECHNIQUES



Hash

- Comparing hashes

Signature

- Determine attacker’s signature
- Determine web page’s signature

Compare differences

- Compare changes in source code
- Compare DOM Tree

Machine Learning

- Anomaly detection
- Image classification

INTRODUCTION

"RESEARCH ON METHODS OF DETECTING DEFACEMENT ATTACKS BASED ON DEEP LEARNING"

1. Motivation
2. Building model Machine Learning
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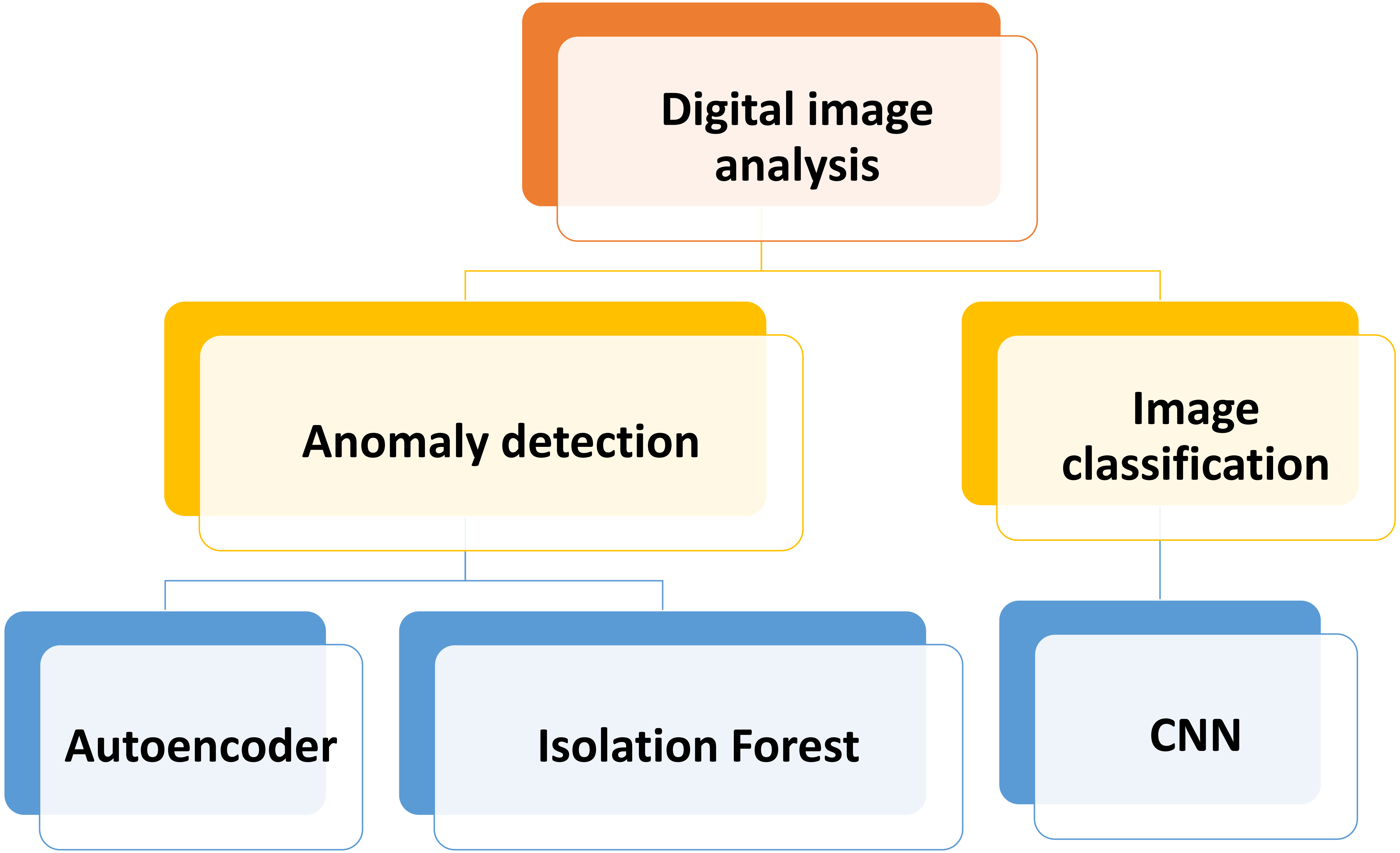
APPROACH



Digital image analysis

Anomaly detection

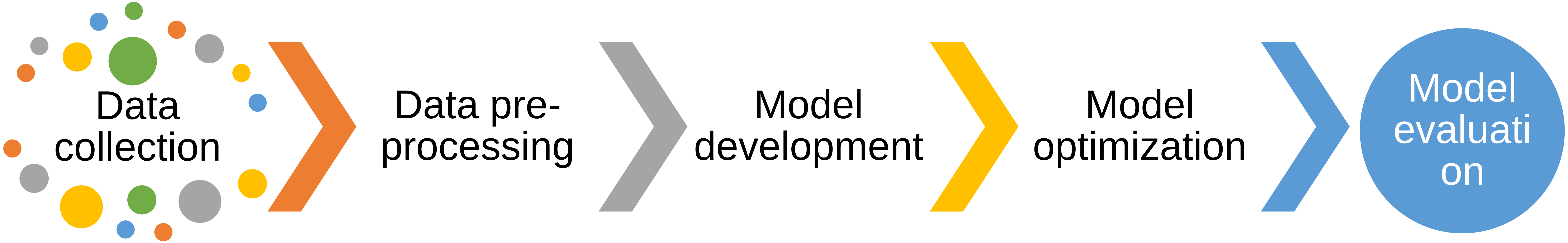
Image classification

Autoencoder

Isolation Forest

CNN

APPROACH



Data collection

Data pre-processing

Model development

Model optimization

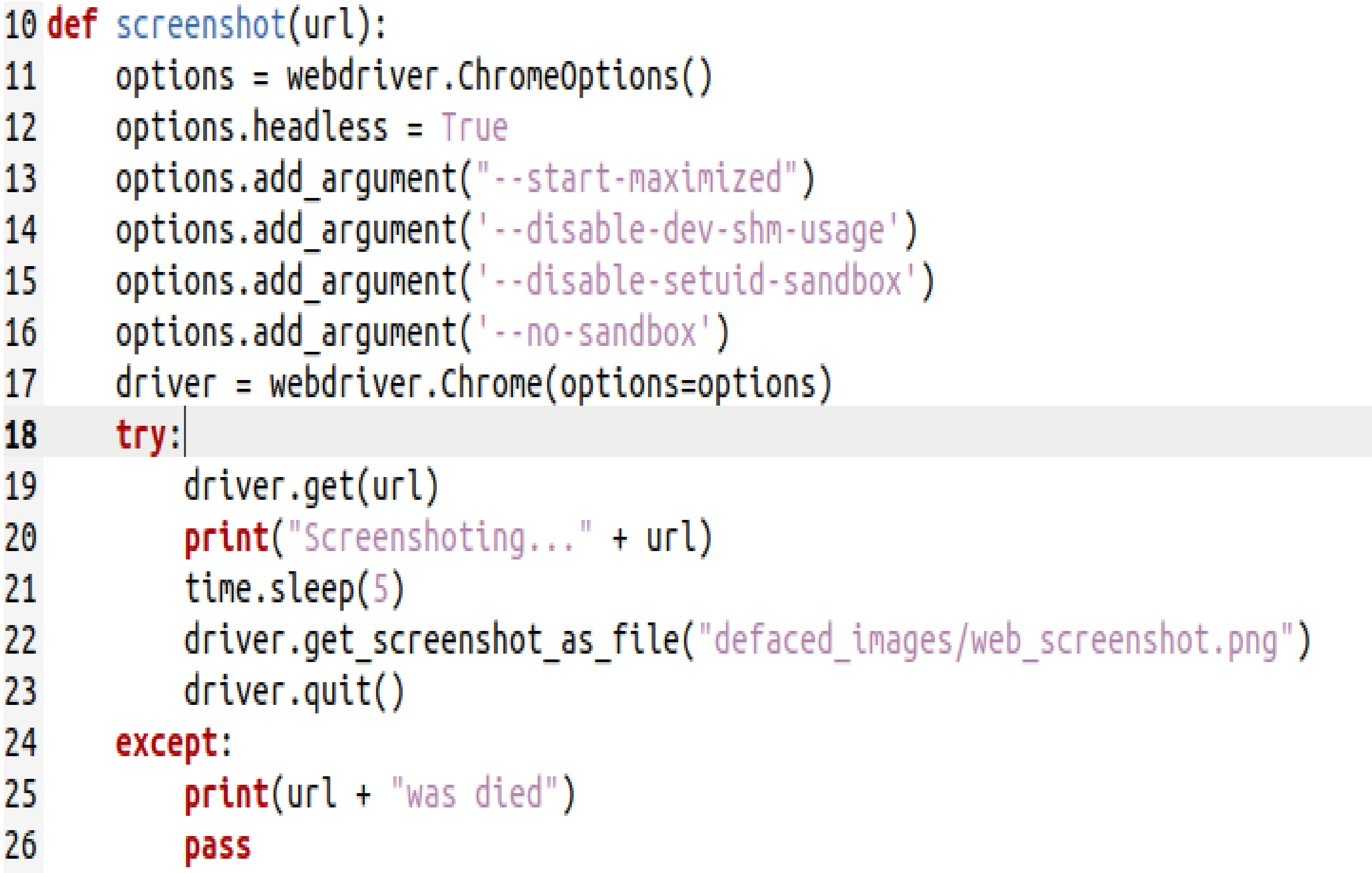
Model evaluati on

INPUT DATA COLLECTION

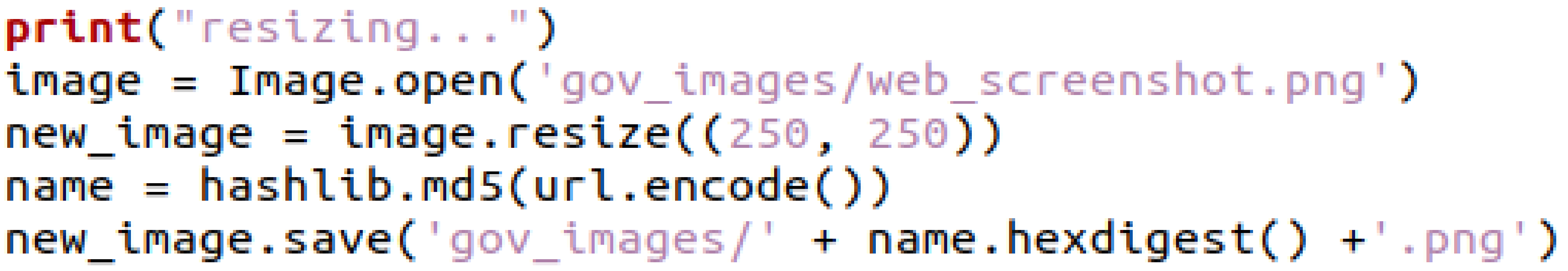
- ❖ Normal website data
  - moz.com/top500
  - github.com/GSA/govt-urls

- ❖ Defaced website data
  - mirror-h.org
  - zone.kurd-h.org
  - www.zone-h.org
  - www.xatrix.org/defac.php

Screenshot: Python-selenium & Chromium



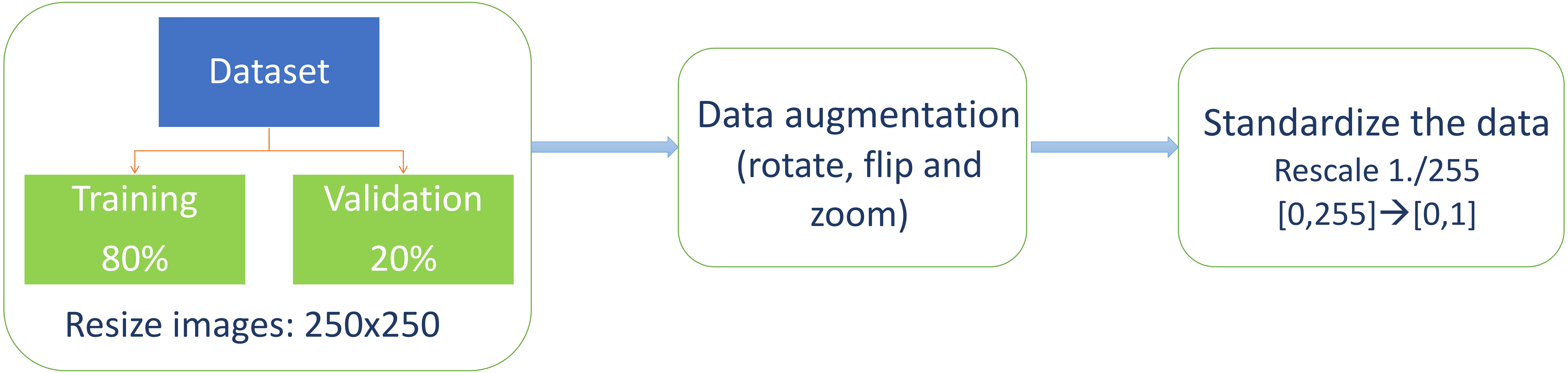
```python
def screenshot(url):
    options = webdriver.ChromeOptions()
    options.headless = True
    options.add_argument("--start-maximized")
    options.add_argument('--disable-dev-shm-usage')
    options.add_argument('--disable-setuid-sandbox')
    options.add_argument('--no-sandbox')
    driver = webdriver.Chrome(options=options)
    try:
        driver.get(url)
        print("Screenshoting..." + url)
        time.sleep(5)
        driver.get_screenshot_as_file("defaced_images/web_screenshot.png")
        driver.quit()
    except:
        print(url + "was died")
        pass
```



```python
print("resizing...")
image = Image.open('gov_images/web_screenshot.png')
new_image = image.resize((250, 250))
name = hashlib.md5(url.encode())
new_image.save('gov_images/' + name.hexdigest() +'.png')
```

DATA PRE-PROCESSING

- Dataset
  - Clean: 6,796 pics
  - Deface: 4,917 pics



Dataset

Training

80%

Validation

20%

Resize images: 250x250

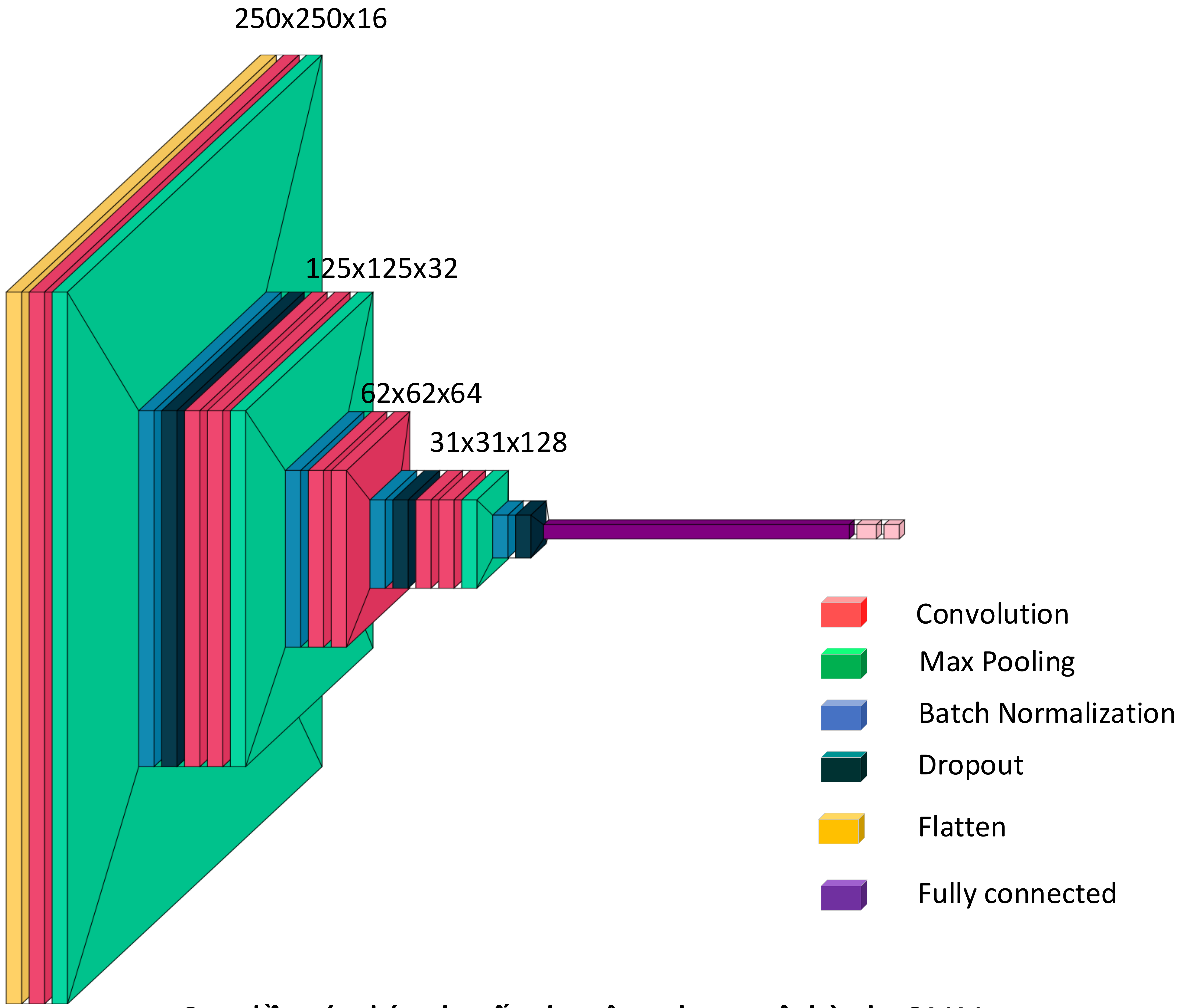
Data augmentation (rotate, flip and zoom)

Standardize the data

Rescale 1./255

[0,255]→[0,1]

BUILDING MODEL



Sơ đồ các lớp huấn luyện cho mô hình CNN

MODEL OPTIMIZATION

- Reduce overfitting
  - Add Dropout layers
  - Data augmentation
  - Add Batch Normalization layers

MODEL EVALUATION

- Evaluation criteria:

Accuracy

$$Accuracy = \frac{TP+TN}{TP+TN+FP+FN} = 98.01$$

True positive rate

$$TPR = \frac{TP}{TP+FN} = 98.12$$

False positive rate

$$FPR = \frac{FP}{FP+TN} = 3.73$$

False negative rate

$$FNR = \frac{FN}{FN+TP} = 1 - TPR = 1.88$$

Positive predictive value

$$PPV = \frac{TP}{TP+FP} = 94.00$$

F1 Score

$$F1 = 2 \times \frac{PPV \ \times TPR}{PPV + TPR} = 96.02$$

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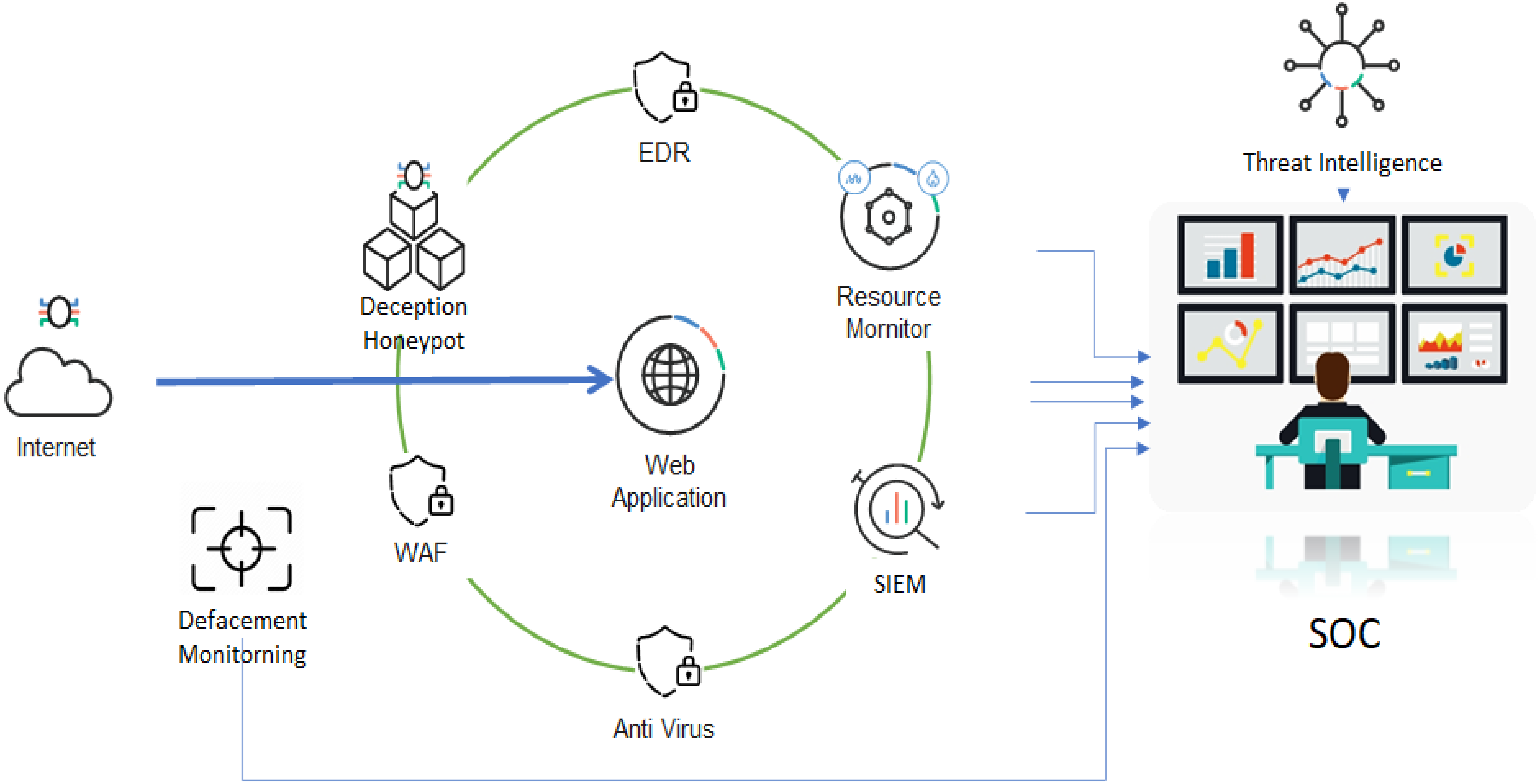
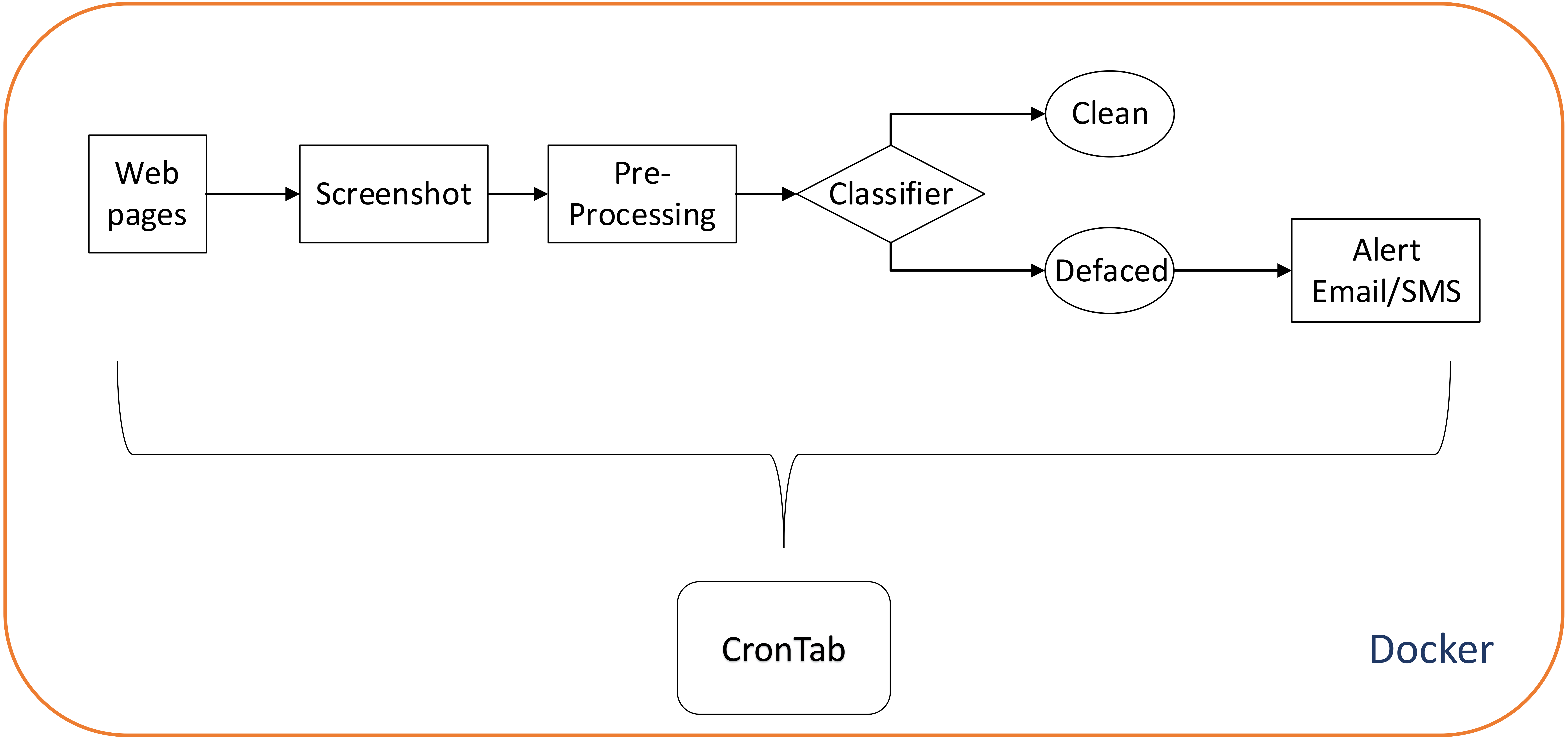
MOTIVATION



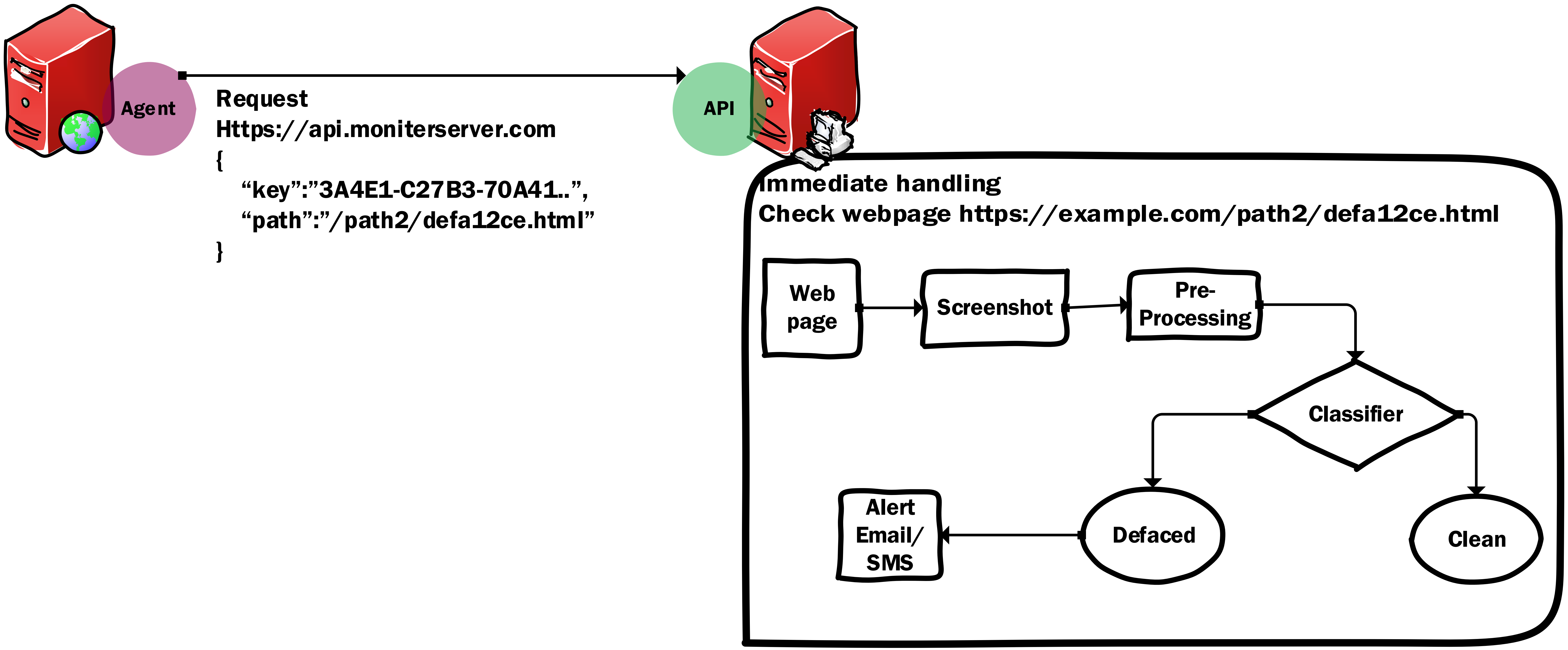
Some security solutions for a web application

ALERT SYSTEM DEVELOPMENT



Detection and warning diagram

AGENT DEPLOYMENT



Request
Https://api.moniterserver.com

```
{
   “key”:”3A4E1-C27B3-70A41..”,
   “path”:”/path2/defa12ce.html”
}
```

Immediate handling
Check webpage https://example.com/path2/defa12ce.html

Event handling flow

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INSTALLATION

Cloning the repository

```
git clone https://github.com/J4FSec/In0ri.git
cd In0ri
```

Configuring email credentials to send notifications and agent keys from

Edit the file FlaskApp/sendEmail.py

```
EMAIL_ADDRESS = "foo@gmail.com"
EMAIL_PASSWORD = "$uper$ecurePa$$word"
```

Configure Telegram notification

Edit the file chatbot.py

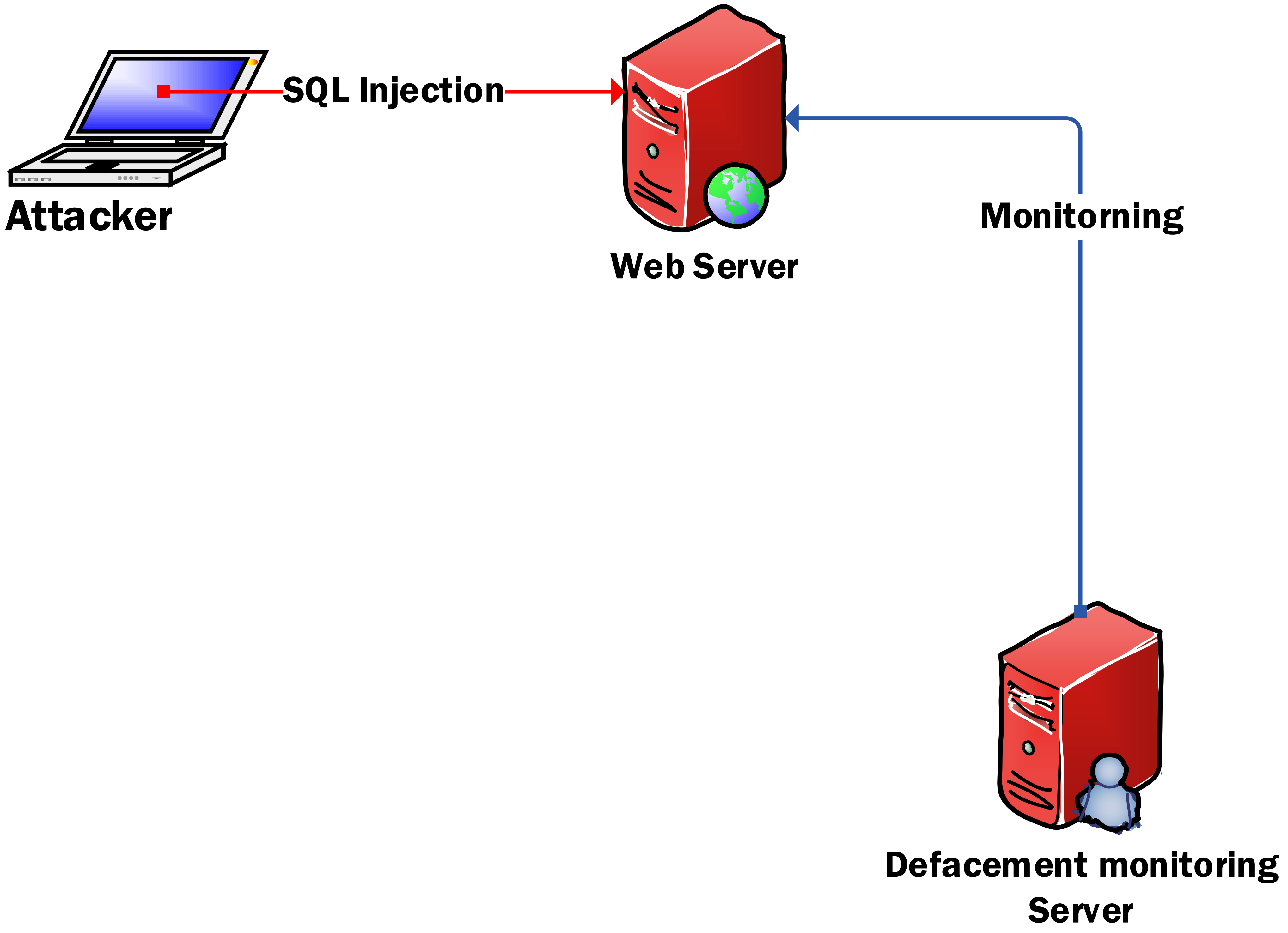
```
CHAT_ID= 'foo' // Channel ID to send notifications to
TOKEN = 'bar' // Bot token retrieved from @BotFather
```

Starting In0ri

```
docker-compose up -d
```

SCENARIO 1

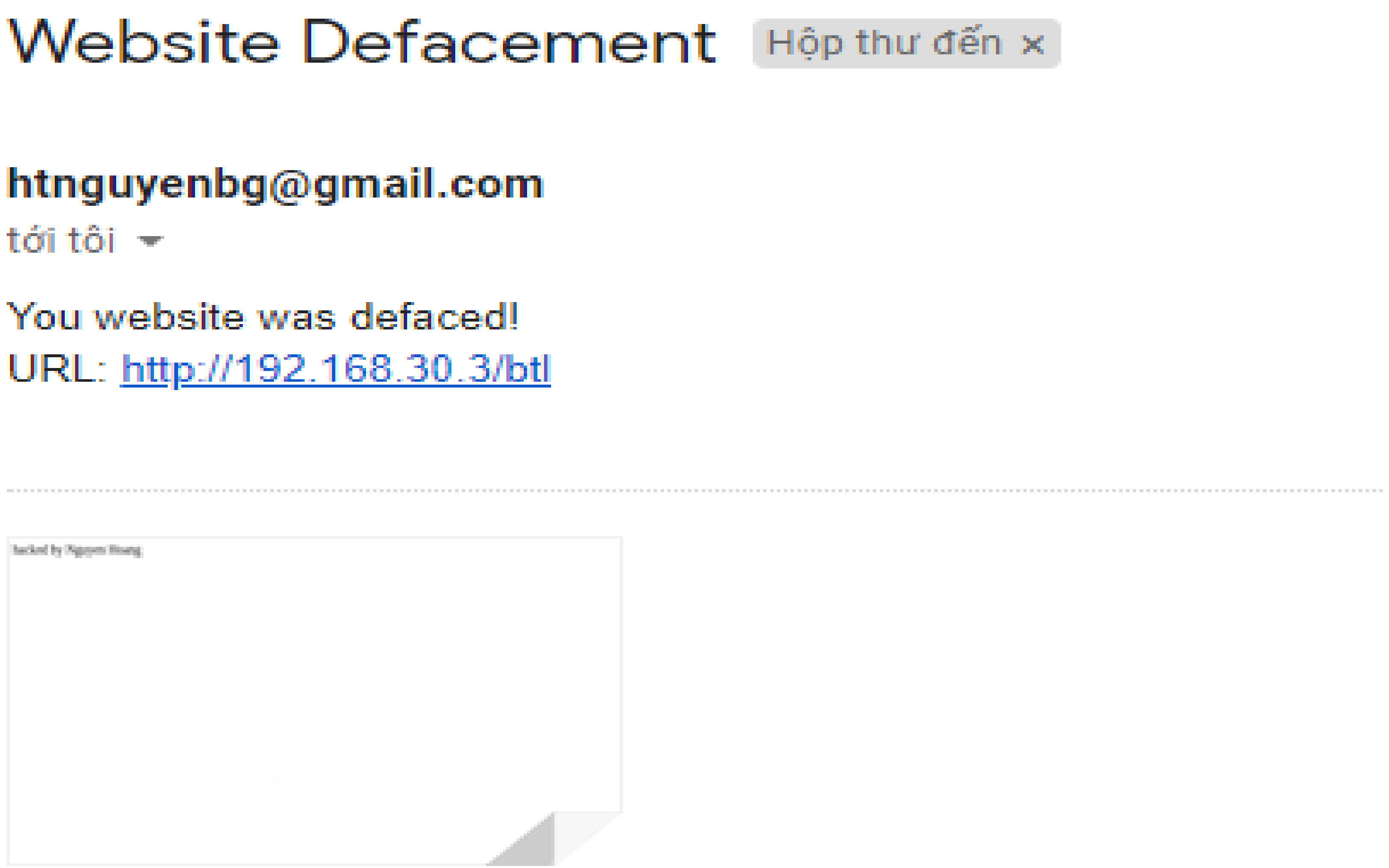
Scenario content



Scenario 1 diagram

SCENARIO 1

Result



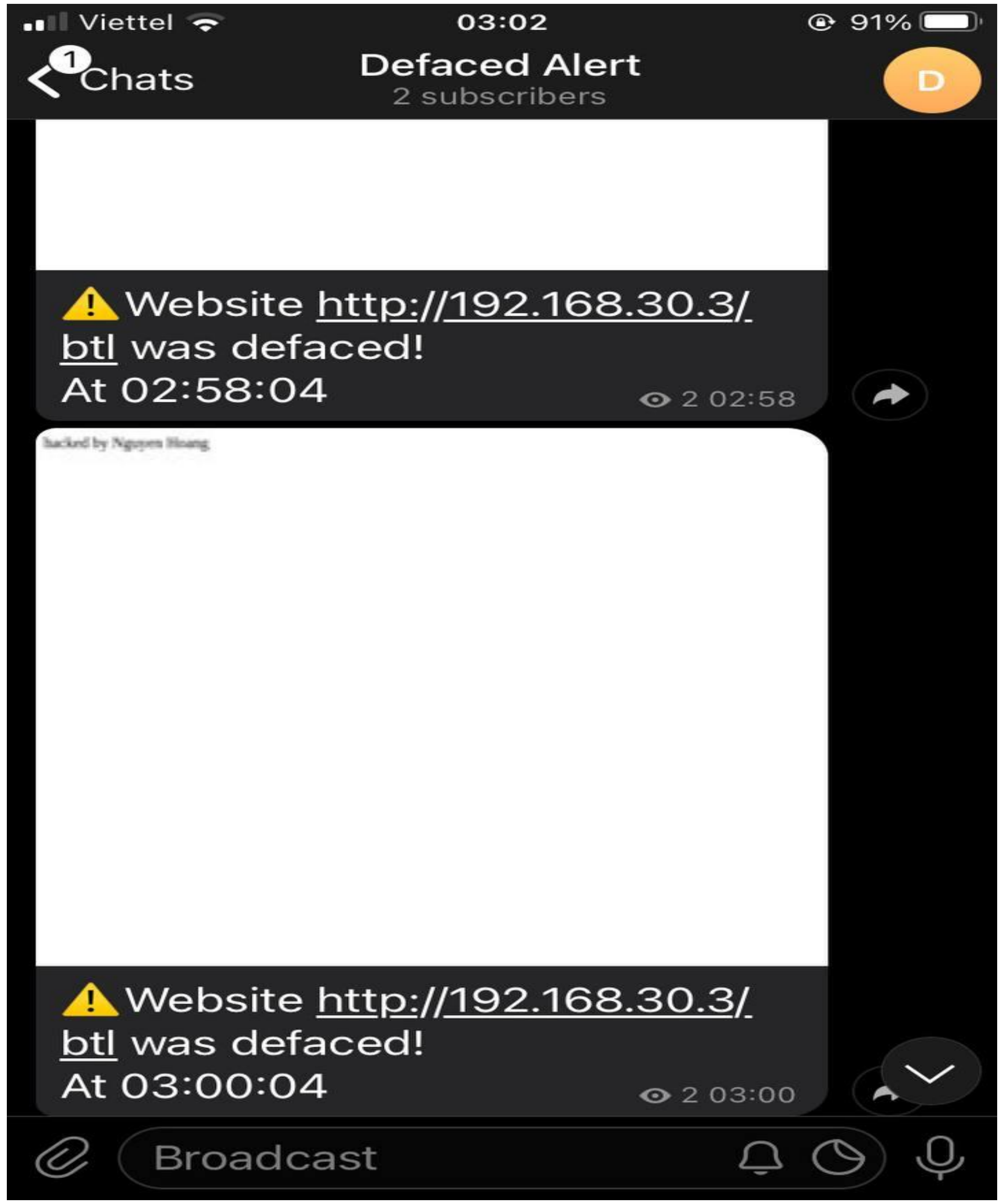
Website Defacement

htngmuyenbg@gmail.com

tới tôi

You website was defaced!
URL: http://192.168.30.3/btl

Email Alert



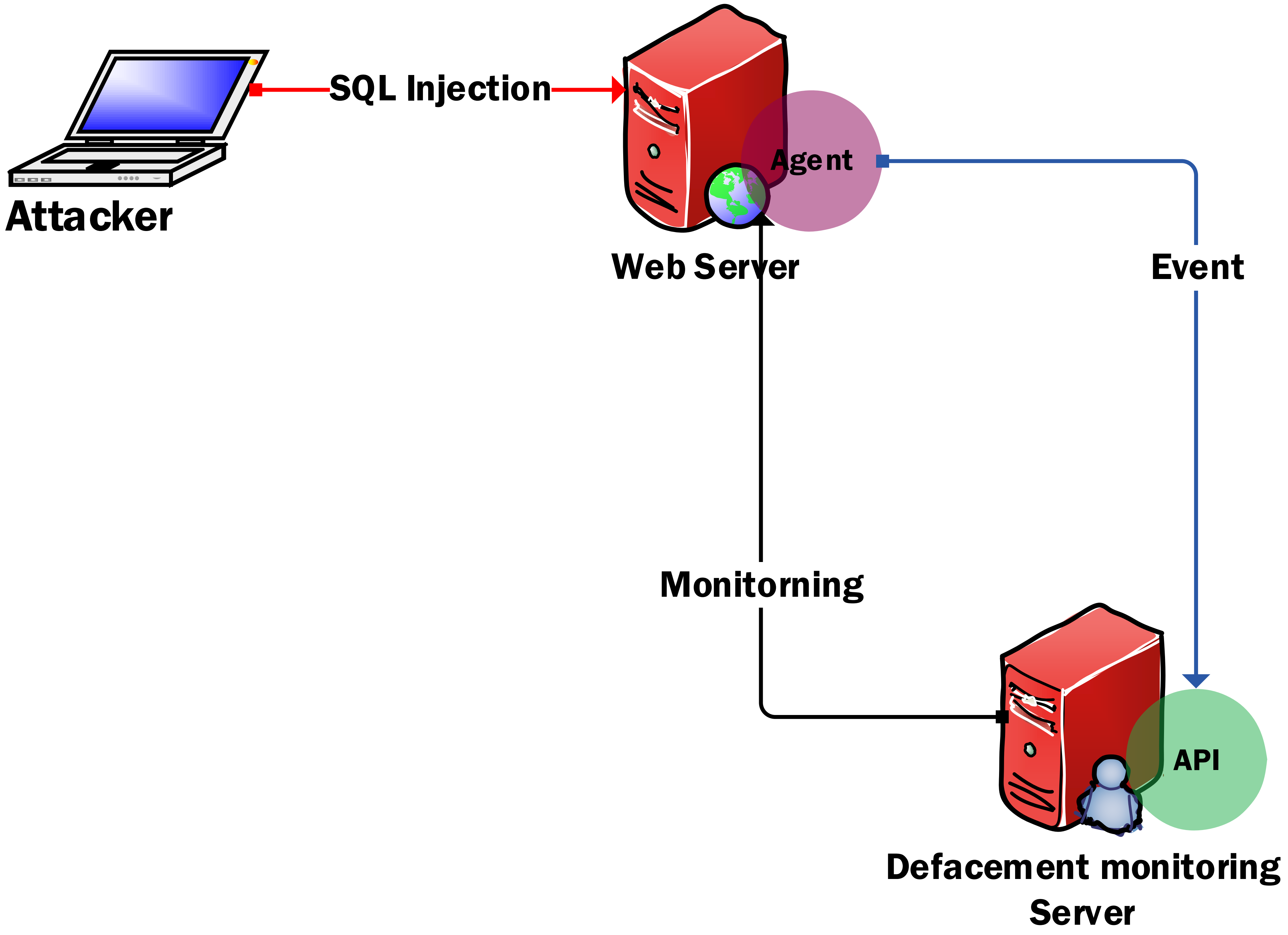
⚠Website http://192.168.30.3/btl was defaced!
At 02:58:04 2 02:58

⚠Website http://192.168.30.3/btl was defaced!
At 03:00:04 2 03:00

Telegram Alert

SCENARIO 2

Scenario content

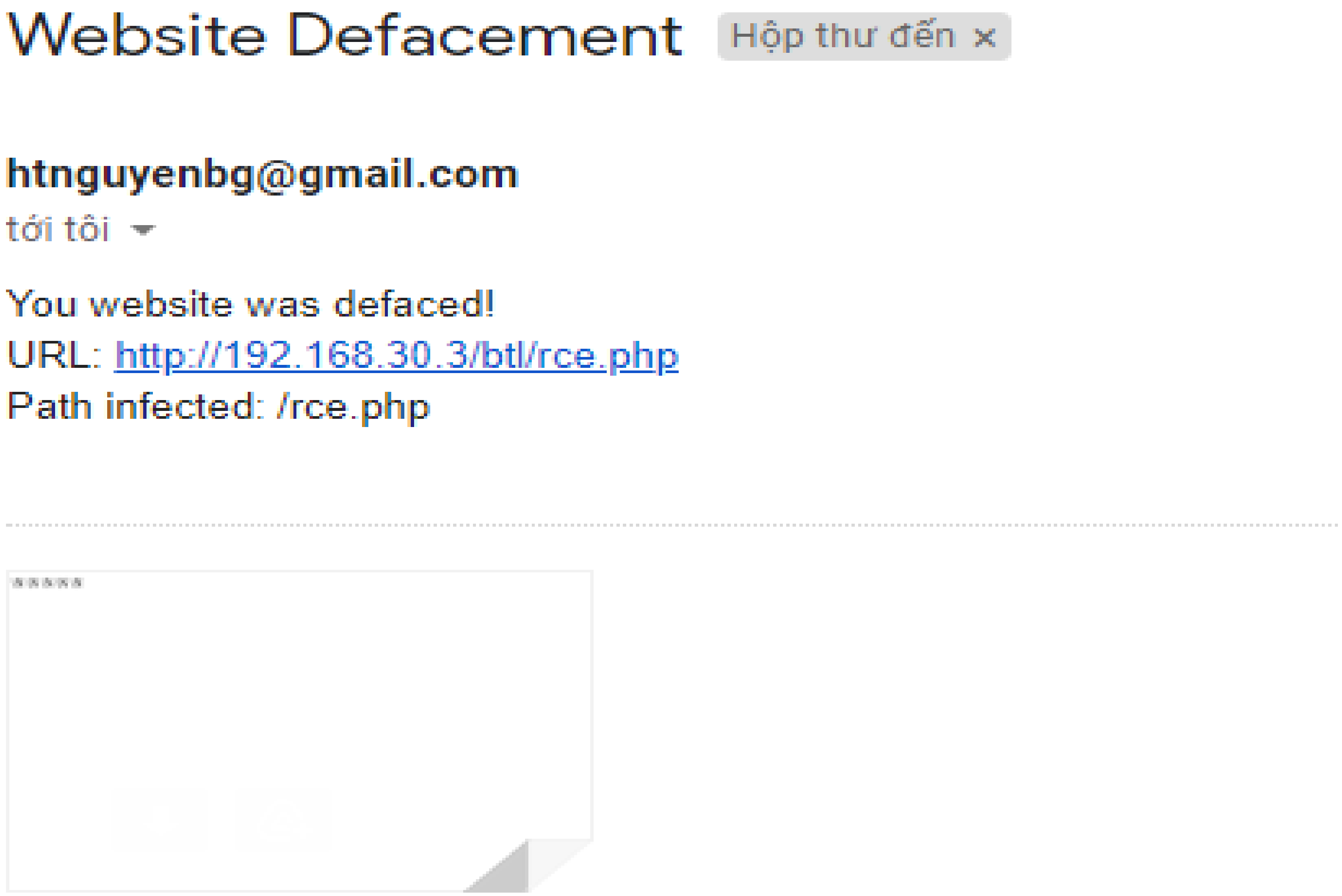


Scenario 2 diagram

SCENARIO 2

Result 1

- The system detected that an suspicious file has been created on the server and send out a warning



Website Defacement

htnguyenbg@gmail.com

tới tôi

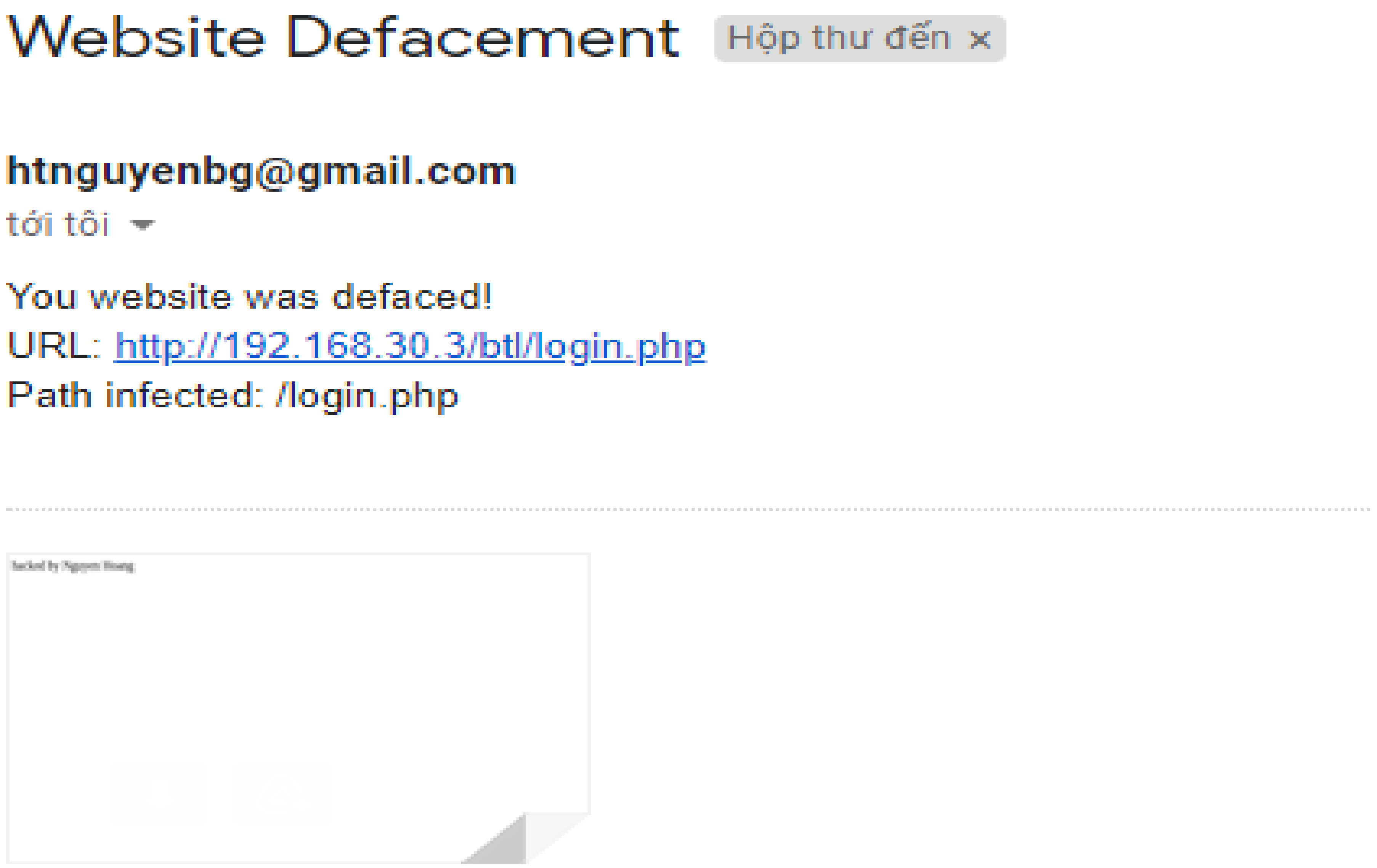
You website was defaced!
URL: http://192.168.30.3/btl/rce.php
Path infected: /rce.php

Email Alert

SCENARIO 2

Result 2

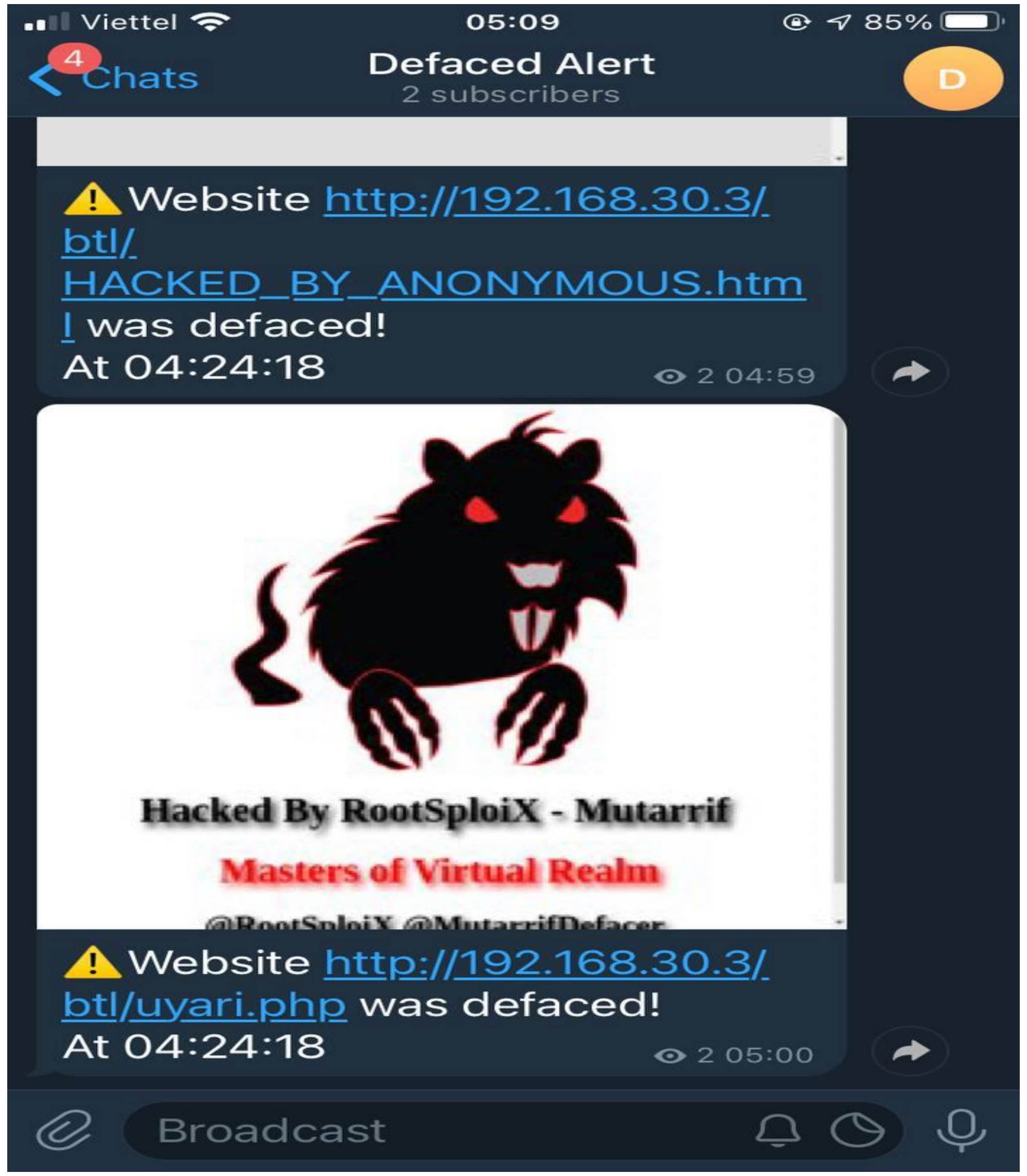
- Detect any file without registering them previously



htnguyenbg@gmail.com

You website was defaced!
URL: http://192.168.30.3/btl/login.php
Path infected: /login.php

Email Alert



⚠️Website http://192.168.30.3/btl/HACKED_BY_ANONYMOUS.html was defaced!
At 04:24:18
2 04:59

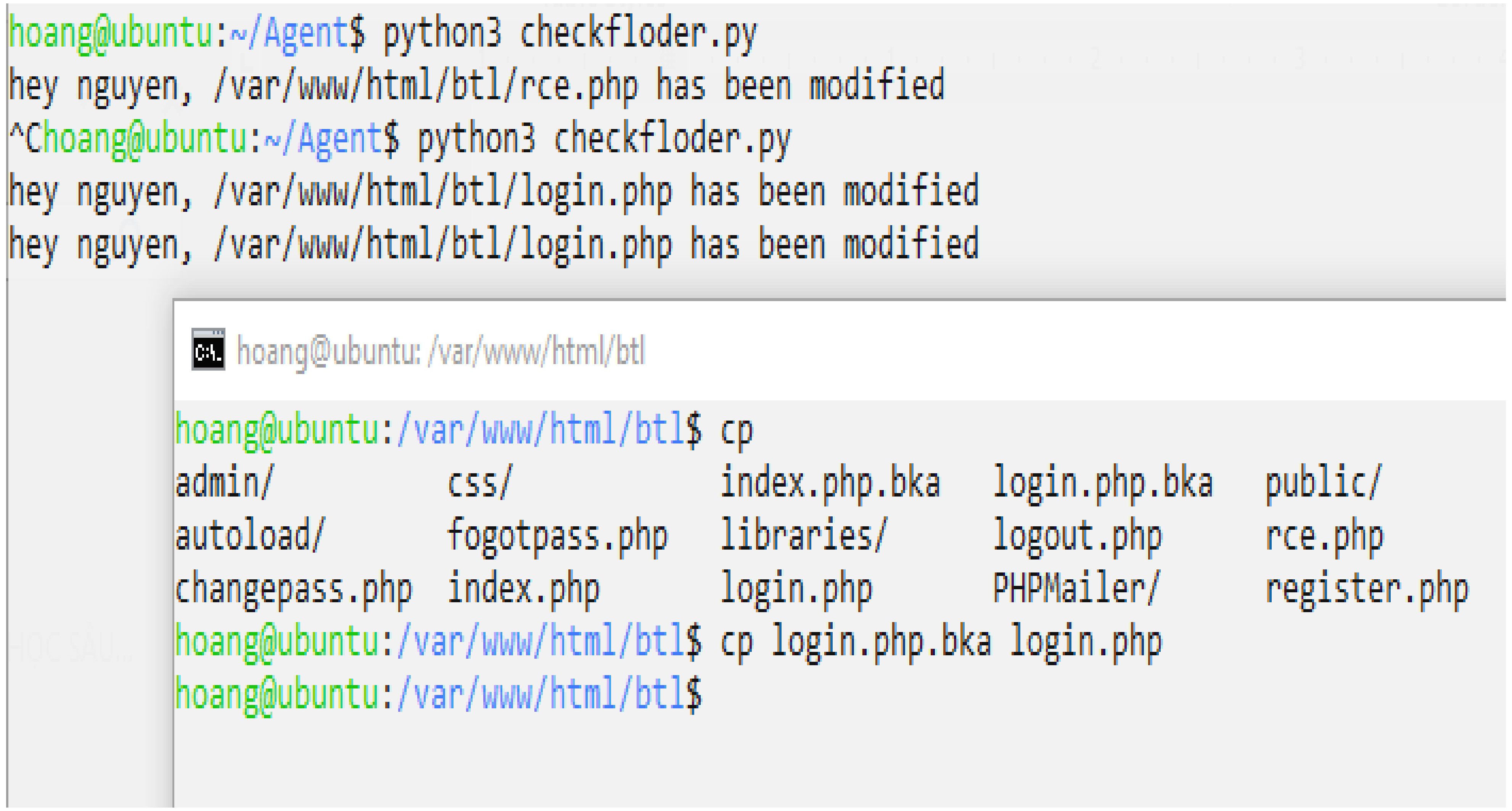
⚠️Website http://192.168.30.3/btl/uyari.php was defaced!
At 04:24:18
2 05:00

Telegram Alert

SCENARIO 2

Result 3

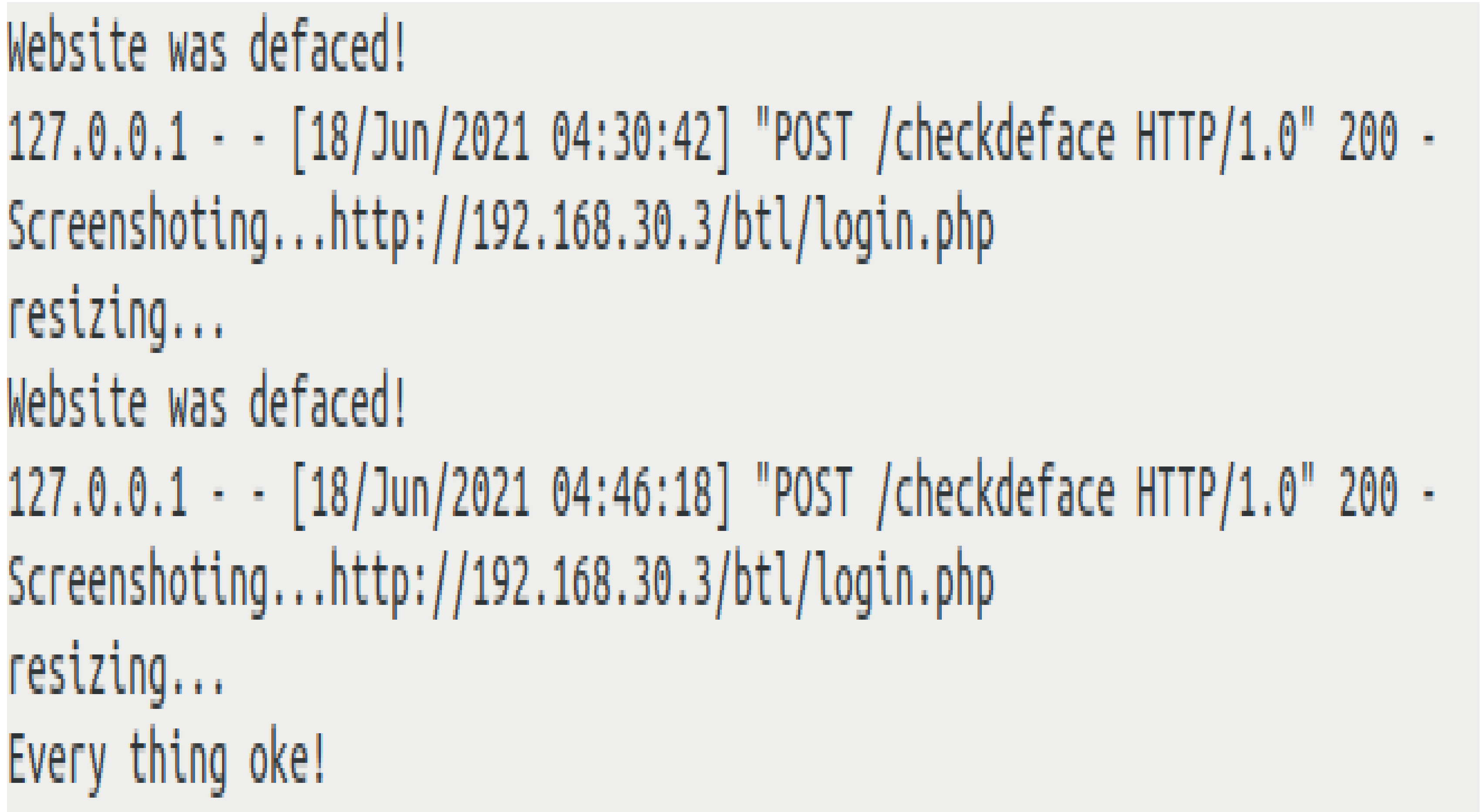
- The system does not alert when legitimate changes are made.



```
hoang@ubuntu:~/Agent$ python3 checkfloder.py
hey nguyen, /var/www/html/btl/rce.php has been modified
^Choang@ubuntu:~/Agent$ python3 checkfloder.py
hey nguyen, /var/www/html/btl/login.php has been modified
hey nguyen, /var/www/html/btl/login.php has been modified
```

```
hoang@ubuntu:/var/www/html/btl$ cp
admin/         css/           index.php.bka  login.php.bka  public/
autoload/      fogotpass.php  libraries/     logout.php     rce.php
changepass.php index.php      login.php      PHPMailer/     register.php
hoang@ubuntu:/var/www/html/btl$ cp login.php.bka login.php
hoang@ubuntu:/var/www/html/btl$
```

Backup to the original file



```
Website was defaced!
127.0.0.1 - - [18/Jun/2021 04:30:42] "POST /checkdeface HTTP/1.0" 200 -
Screenshoting...http://192.168.30.3/btl/login.php
resizing...
Website was defaced!
127.0.0.1 - - [18/Jun/2021 04:46:18] "POST /checkdeface HTTP/1.0" 200 -
Screenshoting...http://192.168.30.3/btl/login.php
resizing...
Every thing oke!
```

The server receives the event and run a check

QnA