



Adversary Simulation with MITRE CALDERA

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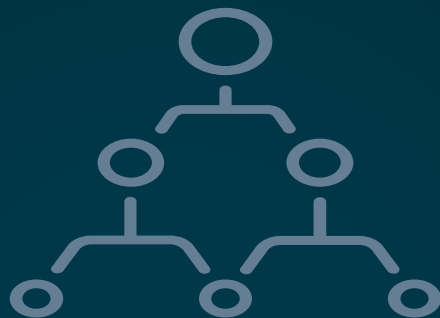
Kreiranje napada na entraprise okruženje za projekt

04

Threat hunter/Analitičar

Analiza ponašanje napada kroz sve faze te procijeniti učinkovitost detekcije i obrane



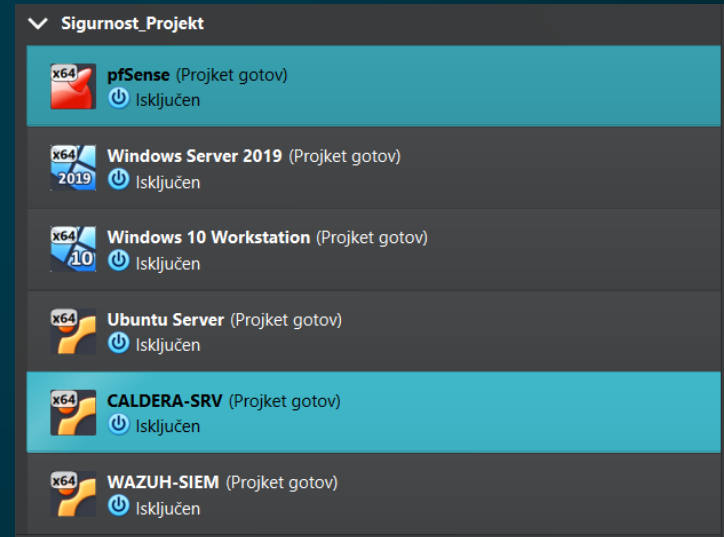
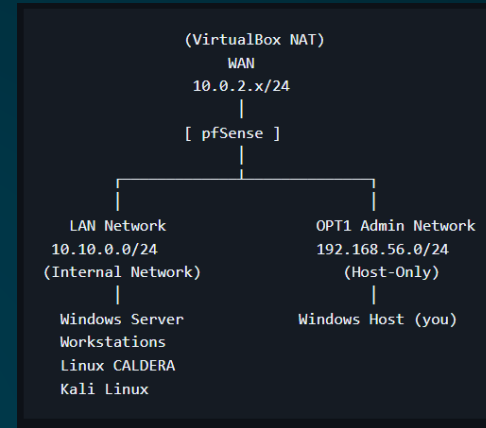


01

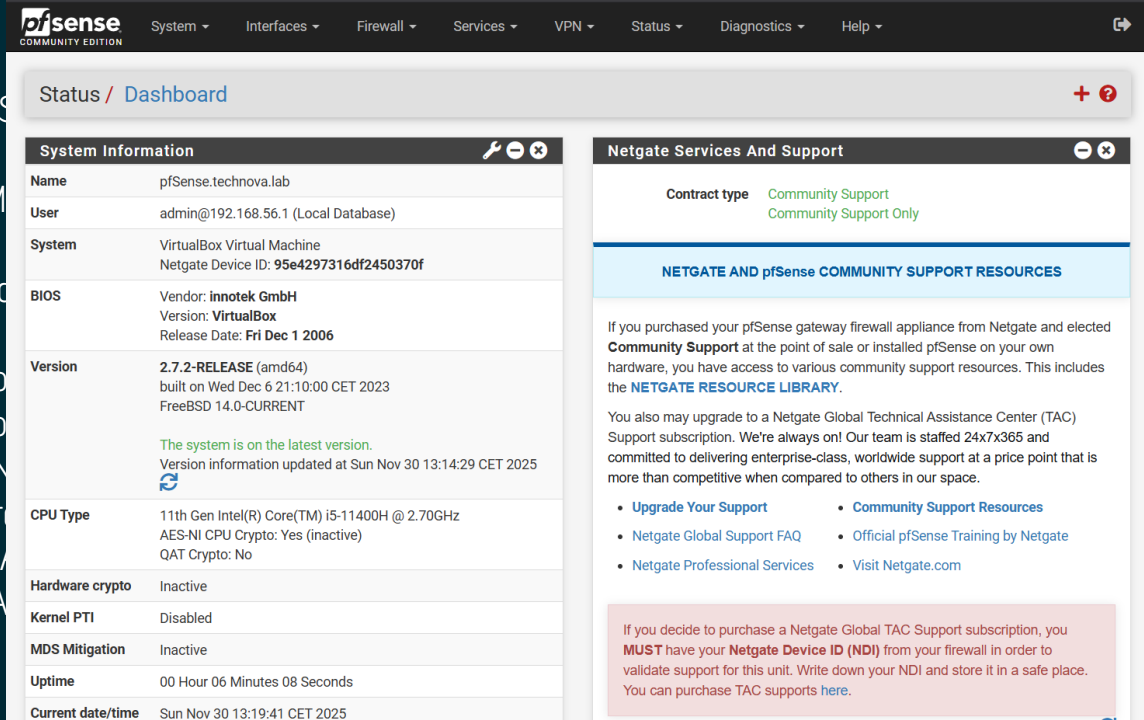
Infrastrukturni Inženjer

Misija

- 6 međusobno povezanih virtualnih strojeva
- -Realistična enterprise mreža (TechNovaNet 10.10.0.0/24)
- Namjerno ranjiva za Red Team
- U potpunosti nadzirana za Blue Team



Mrežna osnova - pfSense



The screenshot displays the pfSense Community Edition web interface. The top navigation bar includes links for System, Interfaces, Firewall, Services, VPN, Status, Diagnostics, and Help. The main content area is titled 'Status / Dashboard' and is divided into two panels.

System Information

Name	pfSense.technova.lab
User	admin@192.168.56.1 (Local Database)
System	VirtualBox Virtual Machine Netgate Device ID: 95e4297316df2450370f
BIOS	Vendor: innotek GmbH Version: VirtualBox Release Date: Fri Dec 1 2006
Version	2.7.2-RELEASE (amd64) built on Wed Dec 6 21:10:00 CET 2023 FreeBSD 14.0-CURRENT The system is on the latest version. Version information updated at Sun Nov 30 13:14:29 CET 2025
CPU Type	11th Gen Intel(R) Core(TM) i5-11400H @ 2.70GHz AES-NI CPU Crypto: Yes (inactive) QAT Crypto: No
Hardware crypto	Inactive
Kernel PTI	Disabled
MDS Mitigation	Inactive
Uptime	00 Hour 06 Minutes 08 Seconds
Current date/time	Sun Nov 30 13:19:41 CET 2025

Netgate Services And Support

Contract type: Community Support
Community Support Only

NETGATE AND pfSense COMMUNITY SUPPORT RESOURCES

If you purchased your pfSense gateway firewall appliance from Netgate and elected **Community Support** at the point of sale or installed pfSense on your own hardware, you have access to various community support resources. This includes the [NETGATE RESOURCE LIBRARY](#).

You also may upgrade to a Netgate Global Technical Assistance Center (TAC) Support subscription. We're always on! Our team is staffed 24x7x365 and committed to delivering enterprise-class, worldwide support at a price point that is more than competitive when compared to others in our space.

- [Upgrade Your Support](#)
- [Community Support Resources](#)
- [Netgate Global Support FAQ](#)
- [Official pfSense Training by Netgate](#)
- [Netgate Professional Services](#)
- [Visit Netgate.com](#)

If you decide to purchase a Netgate Global TAC Support subscription, you **MUST** have your **Netgate Device ID (NDI)** from your firewall in order to validate support for this unit. Write down your NDI and store it in a safe place. You can purchase TAC supports [here](#).

Active Directory okruženje

- Windows Server 2019 Core
Controller
- TechNovaNet domena
- Integrirane DNS usluge
- Ranjivi korisnik employee (sl)
- Wind

```
C:\Users\vboxuser>ipconfig/all
```

```
Windows IP Configuration
```

```
Host Name . . . . . : DC-SERVER
```

```
PS C:\Users\vboxuser> Get-ADUser -Filter * | Select SamAccountName
```

```
SamAccountName
```

```
-----
```

```
Administrator
```

```
Guest
```

```
vboxuser
```

```
krbtgt
```

```
admin
```

```
admin_lab
```

```
read_team
```

```
blue_team
```

```
-----
```

```
IPv4 Address. . . . . : 10.10.0.10(Preferred)
```

```
Subnet Mask . . . . . : 255.255.0.0
```

```
Default Gateway . . . . . : 10.10.0.1
```

```
DNS Servers . . . . . : ::1
```

```
NetBIOS over Tcpip. . . . . : Enabled
```

```
Set-ADAccountPassword -Identity employee -Reset  
-NewPassword (ConvertTo-SecureString "employee123" -AsPlainText -Force)
```

Ranjivi Linux server

- Ubuntu 24.04 LTS (10.10.0.51)
- Ranjivi korisnik: webadmin/Webadmin123!
- sudo NOPASSWD:ALL pogrešna konfiguracija
- Apache web server na portu 80
- SSH pristup omogućen sa password autentifikacijom

```
vbubuntu@ubuntu-srv:~$ grep webadmin /etc/passwd
webadmin:x:1001:1001:,,,:/home/webadmin:/bin/bash
vbubuntu@ubuntu-srv:~$ groups webadmin
webadmin : webadmin sudo users
vbubuntu@ubuntu-srv:~$ id webadmin
uid=1001(webadmin) gid=1001(webadmin) groups=1001(webadmin),27(sudo),100(users)
vbubuntu@ubuntu-srv:~$
```

```
# User privilege specification
root    ALL=(ALL:ALL) ALL

# Members of the admin group may gain root privileges
%admin   ALL=(ALL) ALL

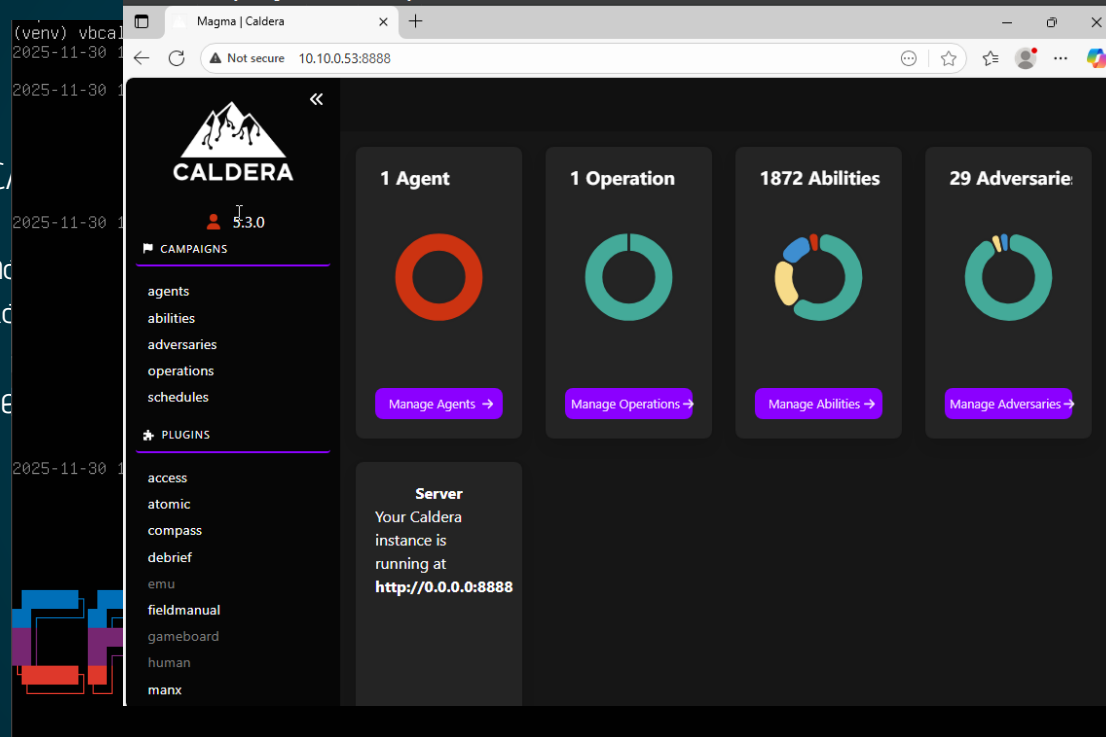
# Allow members of group sudo to execute any command
%sudo   ALL=(ALL:ALL) ALL

# See sudoers(5) for more information on "@include" directives:
@include /etc/sudoers.d

webadmin ALL=(ALL) NOPASSWD:ALL
```

Automatizacija napada - CALDERA

- MITRE CALDERA
- Platforma protivnika
- Sandcat agent



to failed impor
more functional

Sigurnosni nadzor - Wazuh SIEM

- Mini-Wazuh SIEM (10.10.0.70) - optimiziran

```
vbubuntu@ubuntu-srv:~$ sudo systemctl daemon-reload
vbubuntu@ubuntu-srv:~$ sudo systemctl enable wazuh-agent
Created symlink /etc/systemd/system/multi-user.target.wants/wazuh-agent.service → /usr/lib/systemd/system/wazuh-agent.service.
vbubuntu@ubuntu-srv:~$ sudo systemctl start wazuh-agent
vbubuntu@ubuntu-srv:~$ systemctl status wazuh-agent
● wazuh-agent.service - Wazuh
   Loaded: loaded (/usr/lib/systemd/system/wazuh-agent.service; vendor preset: enabled)
   Active: active (running) since Mon 2023-10-02 14:42:25 CEST; 1min 4s ago
     Process: 1172 ExecStart=/usr/bin/wazuh-agent (code=exited, status=0/SUCCESS)
    Tasks: 34 (limit: 2267)
   Memory: 425.0M (peak: 425.0M)
      CPU: 4.272s
   CGroup: /system.slice/wazuh-agent.service
           └─1204 /usr/bin/wazuh-agent
              1212 /usr/bin/wazuh-agent
              1226 /usr/bin/wazuh-agent
              1236 /usr/bin/wazuh-agent
              1253 /usr/bin/wazuh-agent
              1447 sh -c -- "/bin/ps -p 235 > /dev/null 2>&1"
              1448 /bin/ps -p 235
```

```
^Cvbubuntu@ubuntu-srv:~$ sudo /var/ossec/bin/wazuh-control status
wazuh-clusterd not running...
wazuh-modulesd is running...
wazuh-monitord is running...
wazuh-logcollector is running...
wazuh-remoted is running...
wazuh-syscheckd is running...
wazuh-analysisd is running...
```

```
vbubuntu@ubuntu-srv:~$ sudo /var/ossec/bin/agent_control -l
```

Wazuh agent_control. List of available agents:

```
ID: 000, Name: WAZUH-SIEM (server), IP: 127.0.0.1, Active/Local
ID: 004, Name: WIN10, IP: any, Active
ID: 005, Name: ubuntu-srv, IP: any, Active
```








List of agentless devices:

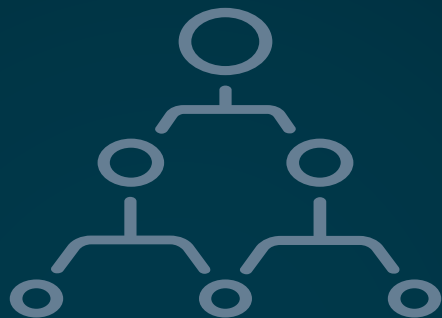
```
1204 /var/ossec/bin/wazuh-agent
1212 /var/ossec/bin/wazuh-agent
1226 /var/ossec/bin/wazuh-agent
1236 /var/ossec/bin/wazuh-agent
1253 /var/ossec/bin/wazuh-agent
1447 sh -c -- "/bin/ps -p 235 > /dev/null 2>&1"
1448 /bin/ps -p 235
```

Status	Name	DisplayName
Running	WazuhSvc	Wazuh

PS C:\Windows\system32>

Tailscale VPN

MACHINE	ADDRESSES 	VERSION	LAST SEEN
caldera-srv <small>tag:lab</small> SSH	100.118.97.74 	1.90.9 Linux 6.8.0-88-generic	● 11:34 AM SSH... Share... ...
dc-server <small>tag:lab</small>	100.67.42.81 	1.90.9 Windows Server 2019	● 2:23 PM GMT+1 ...
desktop-lbf7a9d <small>tag:lab</small>	100.73.38.37 	1.90.9 Windows 10 21H2	● 1:00 PM GMT+1 ...
pfsense <small>tag:lab</small> SSH	100.108.74.68 	1.54.0 FreeBSD 14.0-CURRENT	● 1:29 PM GMT+1 ...
ubuntu-srv <small>tag:lab</small> SSH	100.106.9.109 	1.90.9 Linux 6.8.0-88-generic	● 11:34 AM GMT+1 ...
wazuh-siem <small>tag:lab</small> SSH	100.67.231.16 	1.90.9 Linux 6.8.0-71-generic	● 11:34 AM GMT+1 ...



02

Blue team Inženjer

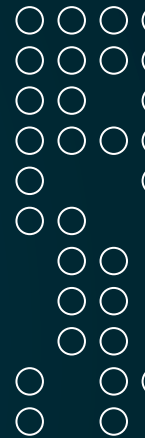


Sigurnosni Nadzor i Instrumentacija (Blue Team)

Cilj: Uspostava proaktivnog nadzora nad infrastrukturom.

Fokus: Praćenje procesa, mrežne aktivnosti i integriteta sustava.

Pristup: Osiguravanje potpune vidljivosti svih kritičnih točaka u realnom vremenu.



Remote Logging Options

Enable Remote Logging ☒ Send log messages to remote syslog server

Source Address

Default (any) ▼

This option will allow the logging daemon to bind to a single IP address, rather than all IP addresses. If a single IP is picked, remote syslog servers must all be of that IP type. To mix IPv4 and IPv6 remote syslog servers, bind to all interfaces.

NOTE: If an IP address cannot be located on the chosen interface, the daemon will bind to all addresses.

IP Protocol

IPv4 ▼

This option is only used when a non-default address is chosen as the source above. This option only expresses a preference; If an IP address of the selected type is not found on the chosen interface, the other type will be tried.

Remote log servers

10.10.0.70:514

IP[:port]

IP[:port]

Remote Syslog Contents

- ☐ Everything
- ☐ System Events
- ☒ Firewall Events
- ☐ DNS Events (Resolver/unbound, Forwarder/dnsmasq, filterdns)
- ☐ DHCP Events (DHCP Daemon, DHCP Relay, DHCP Client)
- ☐ PPP Events (PPPoE WAN Client, L2TP WAN Client, PPTP WAN Client)
- ☐ General Authentication Events
- ☐ Captive Portal Events
- ☐ VPN Events (IPsec, OpenVPN, L2TP, PPPoE Server)
- ☐ Gateway Monitor Events
- ☐ Routing Daemon Events (RADVD, UPnP, RIP, OSPF, BGP)
- ☐ Network Time Protocol Events (NTP Daemon, NTP Client)
- ☐ Wireless Events (hostapd)

Syslog sends UDP datagrams to port 514 on the specified remote syslog server, unless another port is specified. Be sure to set syslogd on the remote server to accept syslog messages from pfSense.

 Save

PS C:\Sysmon> Get-WinEvent -LogName "Microsoft-Windows-Sysmon/Operational" -MaxEvents 3 | Format-List TimeCreated, Id, Message

TimeCreated : 12/5/2025 1:12:47 PM
Id : 22
Message : Dns query:
RuleName: -

vbwazuh@WAZUH-SIEM:~\$ sudo tail -20 /var/ossec/logs/alerts/alerts.log

Rule: 5402 (level 3) -> 'Successful sudo to ROOT executed.'

User: root

2025-12-05T12:47:37.813547+00:00 ubuntu-srv sudo: vbubuntu : TTY=pts/0 ; PWD=/home/vbubuntu ; USER=root ; COMMAND=/usr/bin/rm /etc/cron.d/test_fim

tty: pts/0

pwd: /home/vbubuntu

command: /usr/bin/rm /etc/cron.d/test_fim

** Alert 1764938857.1538596: - pam,syslog,authentication_success,pci_dss_10.2.5,gpg13_7.8,gpg13_7.9,gdpr_IV_32.2,hipaa_164.312.b,nist_800_53_AU.14,nist_800_53_AC.7,tsc_CC6.8,tsc_CC7.2,tsc_CC7.3,

2025 Dec 05 12:47:37 (ubuntu-srv) any->/var/log/auth.log

Rule: 5501 (level 3) -> 'PAM: Login session opened.'

User: root

2025-12-05T12:47:37.814193+00:00 ubuntu-srv sudo: pam_unix(sudo:session): session opened for user root(uid=0) by vbubuntu(uid=1000)

uid: 1000

** Alert 1764938857.1539055: - pam,syslog,pci_dss_10.2.5,gpg13_7.8,gpg13_7.9,gdpr_IV_32.2,hipaa_164.312.b,nist_800_53_AU.14,nist_800_53_AC.7,tsc_CC6.8,tsc_CC7.2,tsc_CC7.3,

2025 Dec 05 12:47:37 (ubuntu-srv) any->/var/log/auth.log

Rule: 5502 (level 3) -> 'PAM: Login session closed.'

User: root

2025-12-05T12:47:37.816433+00:00 ubuntu-srv sudo: pam_unix(sudo:session): session closed for user root

vbwazuh@WAZUH-SIEM:~\$

ProcessGuid: {002abfc1-cab5-6932-c702-000000001600}
ProcessId: 6340
QueryName: signaler-pa.clients6.google.com
QueryStatus: 0
QueryResults: ::ffff:142.251.38.202;
Image: C:\Program Files (x86)\Microsoft\Edge\Application\msedge.exe
User: TECHNOVA\blue_team

PS C:\Sysmon>

RuleName: -

UtcTime: 2025-12-05 12:46:00.258

```
vbwazuh@WAZUH-SIEM:~$ sudo tail -20 /var/ossec/logs/alerts/alerts.log
```

```
Rule: 5402 (level 3) -> 'Successful sudo to ROOT executed.'
```

```
User: root
```

```
2025-12-05T12:47:37.813547+00:00 ubuntu-srv sudo: vbubuntu : TTY=pts/0 ; PWD=/home/vbubuntu ; USER=root ; COMMAND=/usr/bin/rm /etc/cron.d/test_fim
```

```
tty: pts/0
```

```
pwd: /home/vbubuntu
```

```
command: /usr/bin/rm /etc/cron.d/test_fim
```

```
** Alert 1764938857.1538596: - pam,syslog,authentication_success,pci_dss_10.2.5,gpg13_7.8,gpg13_7.9,gdpr_IV_32.2,hipaa_164.312.b,nist_800_53_AU.14,nist_800_53_AC.7,tsc_CC6.8,tsc_CC7.2,tsc_CC7.3,
```

```
2025 Dec 05 12:47:37 (ubuntu-srv) any->/var/log/auth.log
```

```
Rule: 5501 (level 3) -> 'PAM: Login session opened.'
```

```
User: root
```

```
2025-12-05T12:47:37.814193+00:00 ubuntu-srv sudo: pam_unix(sudo:session): session opened for user root(uid=0) by vbubuntu(uid=1000)
```

```
uid: 1000
```

```
** Alert 1764938857.1539055: - pam,syslog,pci_dss_10.2.5,gpg13_7.8,gpg13_7.9,gdpr_IV_32.2,hipaa_164.312.b,nist_800_53_AU.14,nist_800_53_AC.7,tsc_CC6.8,tsc_CC7.2,tsc_CC7.3,
```

```
2025 Dec 05 12:47:37 (ubuntu-srv) any->/var/log/auth.log
```

```
Rule: 5502 (level 3) -> 'PAM: Login session closed.'
```

```
User: root
```

```
2025-12-05T12:47:37.816433+00:00 ubuntu-srv sudo: pam_unix(sudo:session): session closed for user root
```

```
vbwazuh@WAZUH-SIEM:~$
```

```
<desc> 088B0,IMPHASH=272245E2988E1E430500B852C4FB5E18
</desc> win.eventdata.parentProcessGuid: {002abfc1-d3de-6932-2d04-000000001600}
win.eventdata.parentProcessId: 3376
<mit> win.eventdata.parentImage: C:\\Windows\\System32\\WindowsPowerShell\\v1.0\\powershell.exe
win.eventdata.parentCommandLine: \"C:\\Windows\\System32\\WindowsPowerShell\\v1.0\\powershell.exe\"
<gro> win.eventdata.parentUser: TECHNOVA\\admin_lab
</rule> ^C
vbwazuh@WAZUH-SIEM:~$
```

Edit Firewall Rule

Action

Block

Choose what to do with packets that match the criteria specified below.

Hint: the difference between block and reject is that with reject, a packet (TCP RST or ICMP port unreachable for UDP) is returned to the sender, whereas with block the packet is dropped silently. In either case, the original packet is discarded.

Disabled

☐ Disable this rule

Set this option to disable this rule without removing it from the list.

SSH Host

Privileged

Network

Micro-s

```
PS C:\Windows\system32> Set-NetFirewallProfile -Profile Domain,Public,Private -Enabled True
PS C:\Windows\system32> Get-NetFirewallProfile | Select-Object Name, Enabled
```

```
Name      Enabled
-----
Domain    True
Private   True
Public    True
```

```
PS C:\Windows\system32>
```

Windows Defender Firewall with Advanced Security

File Action View Help



Windows Defender Firewall with Advanced Security

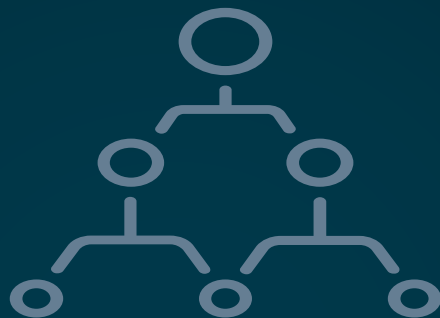
- Inbound Rules
- Outbound Rules
- Connection Security Rules
- Monitoring

Inbound Rules

Name	Group	Profile	Enabled	Action	Override	Program	Local Address	Remote Address
✓ Allow RDP 3389 over Tailscale		All	Yes	Allow	No	Any	Any	Any
✓ Allow RDP 3389 TS		All	Yes	Allow	No	Any	Any	Any
✗ Block CALDERA Attacker Inbound		All	Yes	Block	No	Any	Any	10.10.0.53
✗ Block RPC from Ubuntu Server		All	Yes	Block	No	Any	Any	10.10.0.51
✗ Block SMB from Ubuntu Server		All	Yes	Block	No	Any	Any	10.10.0.51
✗ Block WMI from External		All	Yes	Block	No	Any	Any	10.10.0.51, 10.10...

Since the memory has limited recording space, don't turn on logging for everything. If doing a lot of logging, consider using a remote logging server (see the Status: System Logs: Settings page).

100.73.38.37



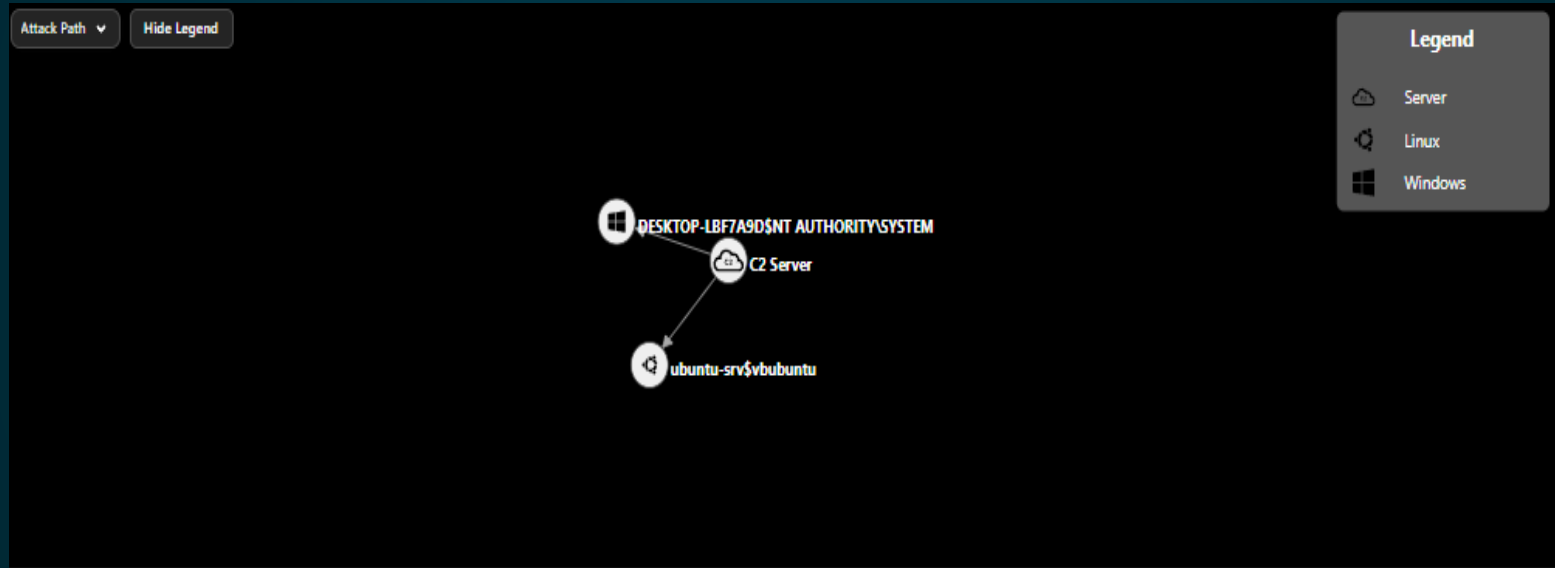
03

Red Team Inženjer


Red Team: Strategija Napada

- **Cilj:** Simulacija APT napada (Advanced Persistent Threat).
- **Alati:** MITRE CALDERA (Sandcat Agents) + Impacket (Python scripts).
- **Lanac Napada (Kill Chain):**
 1. **Initial Access (T1078):** Compromised Credentials (SSH).
 2. **Persistence (T1053):** Cron Jobs / Systemd Services.
 3. **Lateral Movement (T1021.002):** SMB/PsExec (Linux → Windows).
 4. **Exfiltration (T1041):** HTTP POST (Data Theft).

Red Team: Strategija Napada



Faza 1: Uspješna Eksploatacija

- **Status:**  **POTPUNI USPJEH**
- **Ključni Vektori Napada:**
 1. **SSH Proboj / Slaba Lozinka** (webadmin).
 2. **Eskalacija Privilegija:** sudo NOPASSWD exploit (Shadow file dump).
 3. **Lateralno Kretanje:** Pronađene hardkodirane Admin vjerodajnice u /tmp.
 4. **Rezultat:** Kompromitiran Domain Admin i instaliran agent na Windowsima.

Faza 1: Dokaz Uspjeha

Project_Demo_Run

Download Graph SVG

+ Manual Command

+ Potential Link

Operation Details

Filters

running

||

▶





1

Obfuscator: plain-text

Autonomous

Time Ran	Status	Ability Name	Tactic	Agent	Host	pid	Link Command	Link Output
12/21/2025, 3:31:39 PM GMT+1	success	Identify active user	discovery	xframo	ubuntu-srv	1277	View Command	View Output
12/21/2025, 3:32:24 PM GMT+1	success	Simple File Discovery	discovery	xframo	ubuntu-srv	1286	View Command	View Output
12/21/2025, 3:33:09 PM GMT+1	success	Port Scan Target	discovery	xframo	ubuntu-srv	1288	View Command	View Output
12/21/2025, 3:33:49 PM GMT+1	failed	Lateral Movement Attempt - Standard User	lateral-movement	xframo	ubuntu-srv	1295	View Command	View Output
12/21/2025, 3:34:54 PM GMT+1	success	Credential Hunting in Config Files	credential-access	xframo	ubuntu-srv	1315	View Command	View Output
12/21/2025, 3:35:54 PM GMT+1	timeout	Lateral Movement - Admin Compromise	lateral-movement	xframo	ubuntu-srv	1322	View Command	View Output
12/21/2025, 3:37:34 PM GMT+1	success	Identify active user	discovery	itlfxp	DESKTOP-LBF7A9D	184	View Command	View Output
12/21/2025, 3:38:09 PM GMT+1	success	System Information Discovery	discovery	itlfxp	DESKTOP-LBF7A9D	8144	View Command	View Output
12/21/2025, 3:39:04 PM GMT+1	success	Security Software Discovery - AV Discovery via WMI	discovery	itlfxp	DESKTOP-LBF7A9D	8380	View Command	View Output
12/21/2025, 3:39:49 PM GMT+1	failed	Account Discovery (all)	discovery	itlfxp	DESKTOP-LBF7A9D	6932	View Command	View Output
12/21/2025, 3:40:24 PM GMT+1	success	Custom Exfiltration (Generate & Steal)	exfiltration	itlfxp	DESKTOP-LBF7A9D	10828	View Command	View Output

Faza 2: Potvrda Zaštite

- **Status:**  **NAPAD BLOKIRAN**
- **Rezultati Validacije :**
 1. **Eskalacija Privilegija:**  FAILED (Sudo password required).
 2. **Krađa Vjerodajnica:**  FAILED (File removed).
 3. **Lateralno Kretanje:**  FAILED (Network Timeout / Firewall Block).
- **Zaključak:** Attack chain broken at Network & Host level.

Faza 2: Potvrda Zaštite

Phase2_Webadmin_Verify

Download Graph SVG

+ Manual Command

+ Potential Link

Operation Details

Filters

running

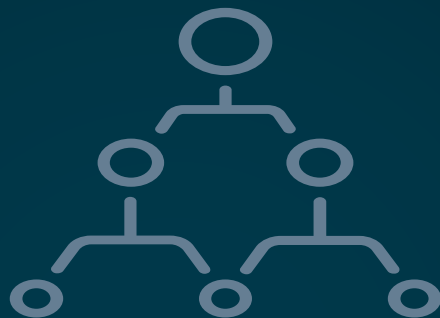
Obfuscator: plain-text

Autonomous

Time Ran	Status	Ability Name	Tactic	Agent	Host	pid	Link Command	Link Output
1/2/2026, 5:34:15 PM GMT+1	success	Automated SSH Noise Generator	credential-access	pbojns	ubuntu-srv	3525	View Command	View Output
1/2/2026, 5:34:55 PM GMT+1	success	Identify active user	discovery	pbojns	ubuntu-srv	3539	View Command	View Output
1/2/2026, 5:35:45 PM GMT+1	timeout	Dump Shadow File (Sudo)	credential-access	pbojns	ubuntu-srv	3547	View Command	View Output
1/2/2026, 5:37:25 PM GMT+1	timeout	Noisy Service Creation	persistence	pbojns	ubuntu-srv	3558	View Command	View Output
1/2/2026, 5:39:11 PM GMT+1	failed	Simple File Discovery	discovery	pbojns	ubuntu-srv	3564	View Command	View Output
1/2/2026, 5:39:41 PM GMT+1	failed	Port Scan Target	discovery	pbojns	ubuntu-srv	3583	View Command	View Output
1/2/2026, 5:40:41 PM GMT+1	failed	Lateral Movement Attempt - Standard User	lateral-movement	pbojns	ubuntu-srv	3590	View Command	View Output
1/2/2026, 5:41:51 PM GMT+1	failed	Credential Hunting in Config Files	credential-access	pbojns	ubuntu-srv	3598	View Command	View Output
1/2/2026, 5:42:26 PM GMT+1	failed	Lateral Movement - Admin Compromise	lateral-movement	pbojns	ubuntu-srv	3604	View Command	View Output

Zaključak i Nalazi

- **Kritični Rizik:** Ravna mrežna topologija omogućila je brzo širenje napada.
- **Ljudska Pogreška:** Tvrdo kodirane (hardcoded) vjerodajnice uzrokovale su kompromitaciju domene.
- **Alati:** Bilo je potrebno koristiti prilagođene alate (Python/Impacket) kako bi se zaobišla zadana ograničenja.
- **Konačni Status:** Sustav je sada siguran od osnovnih TTP-ova (Tactics, Techniques, and Procedures).



04

Threat hunter/Analitičar

Cilj i fokus analize

- **Cilj:** Analizirati ponašanje napada kroz sve faze (Baseline → Phase 1 → Phase 2)
- **Fokus:** Korelacija host, mrežnih i SIEM podataka
- **Pristup:** Threat hunting temeljen na stvarnim artefaktima, a ne samo alertima
- **Ishod:** Procjena učinkovitosti detekcije, vidljivosti i hardening mjera

Baseline kao temelj analize

- **Baseline = referentna točka za threat hunting**
- Definira normalno ponašanje sustava i korisnika
- Omogućuje razlikovanje:
 - legitimne aktivnosti
 - pozadinske buke
 - stvarnih napada
- Ključan za pouzdanu interpretaciju alerta i logova

```
vbwazuh@WAZUH-SIEM:~$ sudo /var/ossec/bin/agent_control -l

Wazuh agent_control. List of available agents:
  ID: 000, Name: WAZUH-SIEM (server), IP: 127.0.0.1, Active/Local
  ID: 004, Name: WIN10, IP: any, Active
  ID: 005, Name: ubuntu-srv, IP: any, Active

List of agentless devices:

vbwazuh@WAZUH-SIEM:~$
```

Što je definirano kao baseline

- **Linux:** legitimni SSH logini i uobičajeno sudo korištenje
- **Windows:** normalne prijave, procesi i RDP aktivnosti
- **Mreža (pfSense):** očekivani promet (HTTPS, DNS, NTP)
- **SIEM (Wazuh):** logovi sustava bez kritičnih upozorenja

```
vbwazuh@WAZUH-SIEM:~$ sudo /var/ossec/bin/wazuh-control status
[sudo] password for vbwazuh:
Sorry, try again.
[sudo] password for vbwazuh:
wazuh-clusterd not running...
wazuh-modulesd is running...
wazuh-monitord is running...
wazuh-logcollector is running...
wazuh-remoted is running...
wazuh-syscheckd is running...
wazuh-analysisd is running...
wazuh-maild not running...
wazuh-execd is running...
wazuh-db is running...
wazuh-authd is running...
wazuh-agentlessd not running...
wazuh-integratord not running...
wazuh-dbd not running...
wazuh-csyslogd not running...
wazuh-apid is running...
vbwazuh@WAZUH-SIEM:~$
```

```
2025-12-10T13:34:01.445217+00:00 ubuntu-srv CRON[2136]: pam_unix(cron:session): session closed for user root
2025-12-10T13:34:13.767162+00:00 ubuntu-srv sudo: pam_unix(sudo:auth): authentication failure; logname=vbubuntu uid=1000 euid=0 tty=/dev/pts/0 ruser=vbubuntu rhost= use
r=vbubuntu
2025-12-10T13:35:01.447555+00:00 ubuntu-srv CRON[2141]: pam_unix(cron:session): session opened for user root(uid=0) by root(uid=0)
2025-12-10T13:35:01.447769+00:00 ubuntu-srv CRON[2140]: pam_unix(cron:session): session opened for user root(uid=0) by root(uid=0)
2025-12-10T13:35:01.450004+00:00 ubuntu-srv CRON[2140]: pam_unix(cron:session): session closed for user root
2025-12-10T13:35:01.450132+00:00 ubuntu-srv CRON[2141]: pam_unix(cron:session): session closed for user root
2025-12-10T13:35:07.897508+00:00 ubuntu-srv sudo: vbubuntu : 3 incorrect password attempts ; TTY=pts/0 ; PWD=/home/vbubuntu ; USER=root ; COMMAND=/usr/bin/tail -n 50 /va
r/log/auth.log
2025-12-10T13:36:01.453896+00:00 ubuntu-srv CRON[2160]: pam_unix(cron:session): session opened for user root(uid=0) by root(uid=0)
2025-12-10T13:36:01.456804+00:00 ubuntu-srv CRON[2160]: pam_unix(cron:session): session closed for user root
2025-12-10T13:36:46.806943+00:00 ubuntu-srv sudo: vbubuntu : TTY=pts/0 ; PWD=/home/vbubuntu ; USER=root ; COMMAND=/usr/bin/tail -n 50 /var/log/auth.log
2025-12-10T13:36:46.807788+00:00 ubuntu-srv sudo: pam_unix(sudo:session): session opened for user root(uid=0) by vbubuntu(uid=1000)
vbubuntu@ubuntu-srv:~$
```

Faza 1: Analiza napada

- Pojava **uspješnog SSH pristupa** s neuobičajenog izvora
- **Sudo eskalacija bez** lozinke (NOPASSWD)
- Pristup osjetljivim datotekama (/etc/shadow)
- Aktivnosti koje odstupaju od definiranog baselinea

```
vbwazuh@WAZUH-SIEM:~$ sudo tail -n 50 /var/ossec/logs/alerts/alerts.log
- Permissions: rw-rw-r--
- Date: Mon Dec 29 16:50:18 2025
- Inode: 262168
- User: webadmin (1001)
- Group: webadmin (1001)
- MD5: 163c1070c0a3ed320e3394ead17363de
- SHA1: c00707e96b90bd103583741f9d998f36816b1alf
- SHA256: 10e22a63465adcle98e7249f0ca1808bfb2788988170ef02368fec620d1f9573

** Alert 1767028013.42797: - pam.syslog,pci_dss_10.6.1,pgp13_4.3,gdpr_IV_35.7.d,hip
aa_164.312.b,nist_800_53_AU.6,tsc_CC7.2,tsc_CC7.3,
2025 Dec 29 17:06:53 WAZUH-SIEM->/var/log/auth.log
Rule: 5553 (level 4) -> 'PAM misconfiguration.'
2025-12-29T17:06:53.516893+00:00 WAZUH-SIEM login(4614): PAM unable to dlopen(pam_1
astlog.so): /usr/lib/security/pam_lastlog.so: cannot open shared object file: No su
ch file or directory

** Alert 1767028015.43218: - pam.syslog,authentication_success,pci_dss_10.2.5,pgp13
7.8,pgp13_7.9,gdpr_IV_32.2,hipaa_164.312.b,nist_800_53_AU.14,nist_800_53_AC.7,tsc
CC6.8,tsc_CC7.2,tsc_CC7.3,
2025 Dec 29 17:06:55 WAZUH-SIEM->/var/log/auth.log
Rule: 5501 (level 3) -> 'PAM: Login session opened.'
User: vbwazuh
2025-12-29T17:06:53.954166+00:00 WAZUH-SIEM login(4614): pam_unix(login:session): s
ession opened for user vbwazuh(uid=1000) by vbwazuh(uid=0)
uid: 0

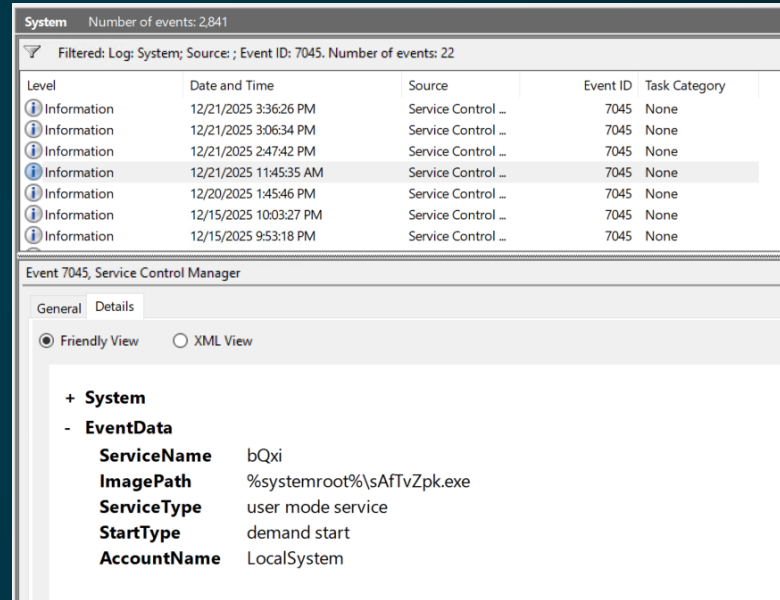
** Alert 1767028015.43679: - pam.syslog,authentication_success,pci_dss_10.2.5,pgp13
7.8,pgp13_7.9,gdpr_IV_32.2,hipaa_164.312.b,nist_800_53_AU.14,nist_800_53_AC.7,tsc
CC6.8,tsc_CC7.2,tsc_CC7.3,
2025 Dec 29 17:06:55 WAZUH-SIEM->/var/log/auth.log
Rule: 5501 (level 3) -> 'PAM: Login session opened.'
User: vbwazuh
2025-12-29T17:06:53.991511+00:00 WAZUH-SIEM (systemd): pam_unix(systemd-user:sessio
n): session opened for user vbwazuh(uid=1000) by vbwazuh(uid=0)
uid: 0

** Alert 1767028257.44145: - pam.syslog,authentication_success,pci_dss_10.2.5,pgp13
7.8,pgp13_7.9,gdpr_IV_32.2,hipaa_164.312.b,nist_800_53_AU.14,nist_800_53_AC.7,tsc
```

```
vbubuntu@ubuntu-srv:~$ sudo zgrep "Accepted password" /var/log/auth.log.2.gz
2025-12-17T19:52:47.391890+00:00 ubuntu-srv sshd[1881]: Accepted password for webad
min from 10.10.0.50 port 50213 ssh2
grep: /var/log/auth.log.2.gz: binary file matches
vbubuntu@ubuntu-srv:~$
```

Faza 1: Analiza napada

- Autentikacija na Windows s Linux kredencijalima
- Višestruki failed logoni → uspješan logon
- Service creation kao persistence indikator
- Korelacija Linux → Windows → SIEM



System Number of events: 2,841

Filtered: Log: System; Source: ; Event ID: 7045. Number of events: 22

Level	Date and Time	Source	Event ID	Task Category
Information	12/21/2025 3:36:26 PM	Service Control ...	7045	None
Information	12/21/2025 3:06:34 PM	Service Control ...	7045	None
Information	12/21/2025 2:47:42 PM	Service Control ...	7045	None
Information	12/21/2025 11:45:35 AM	Service Control ...	7045	None
Information	12/20/2025 1:45:46 PM	Service Control ...	7045	None
Information	12/15/2025 10:03:27 PM	Service Control ...	7045	None
Information	12/15/2025 9:53:18 PM	Service Control ...	7045	None

Event 7045, Service Control Manager

General Details

☒ Friendly View ☐ XML View

+ System

- EventData

ServiceName bQxi

ImagePath %systemroot%\sAftvZpk.exe

ServiceType user mode service

StartType demand start

AccountName LocalSystem

Faza 2: Analiza nakon hardeninga

- Neuspjeli SSH pokušaji prema Linux hostu
- Nema pristupa osjetljivim datotekama (/etc/shadow)
- Onemogućena sudo eskalacija privilegija
- Napad zaustavljen prije lateralnog kretanja

```
vbubuntu@ubuntu-srv:~$ sudo grep "sudo" /var/log/auth.log | grep webadmin | tail -30
2026-01-04T18:25:56.618017+00:00 ubuntu-srv sudo: pam_unix(sudo:auth): auth could not identify password for [webadmin]
2026-01-04T18:25:56.618032+00:00 ubuntu-srv sudo: pam_unix(sudo:auth): auth could not identify password for [webadmin]
vbubuntu@ubuntu-srv:~$

vbubuntu@ubuntu-srv:~$ sudo grep "Failed password" /var/log/auth.log | grep webadmin | tail -20
[sudo] password for vbubuntu:
2026-01-04T18:16:20.251365+00:00 ubuntu-srv sshd[2895]: Failed password for webadmin from 127.0.0.1 port 51472 ssh2
vbubuntu@ubuntu-srv:~$
```

Usporedba faza 1 i 2

Sigurnosni element	Faza 1	Faza 2
SSH pristup	Uspješan	Neuspješan
Privilege escalation	Dozvoljena	Blokirana
Pristup /etc/shadow	Ostvaren	Onemogućen
Lateral movement	Uspješan	Nije moguć
Windows kompromizacija	Da	Ne
Persistence	Uspostavljena	Spriječena

Zaključak

- Baseline je omogućio pouzdanu analizu i usporedbu
- Faza 1 je potvrdila realnu izloženost napadima
- Faza 2 je dokazala učinkovitost hardening mjera
- Napadni putovi su eliminirani, ne samo detektirani
- SIEM je pružio potvrdu, ne lažan osjećaj sigurnosti



Hvala na
pažnji!