Build and Deploy IoT Honeypots with Python and Docker

pyistanbul - Birkan Kolcu - 07.07.2020

About Me

- Graduated from University of Arizona (UoA) with Ms. Sc. Degree in ECE.
    - Worked as grad. research assistant in UoA for about 2 years. Reserch in Cybersecurity, IoT and data visualization.
- Graduated from Ozyegin University with Computer Science Bachelor Degree.
    - Personal projects/internships/research experience in embedded Linux systems, cloud, IoT, robotics, High Performance Computing.
    - Co-founded dusuncembu.com for helping businesses collect customer feedback in physical places.
- Github: https://github.com/ResearcherOne

Overview

1. Building a Simple Honeypot with Python
2. Dockerizing the Honeypot written in Python
3. Deployment of Dockerized Honeypot on a Raspberry Pi
4. Honeypot in action!

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2. Where did honeypot came from?
3. Real world honeypot examples.
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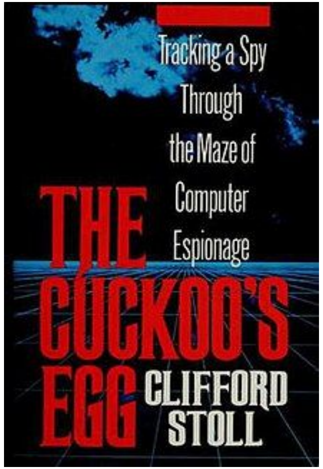

The Cuckoo’s Egg

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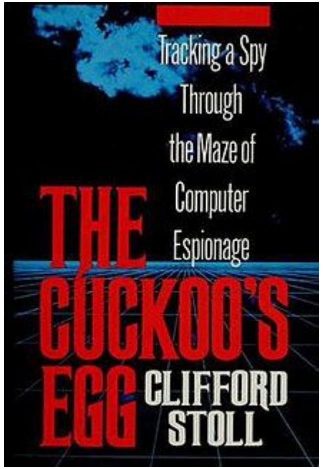

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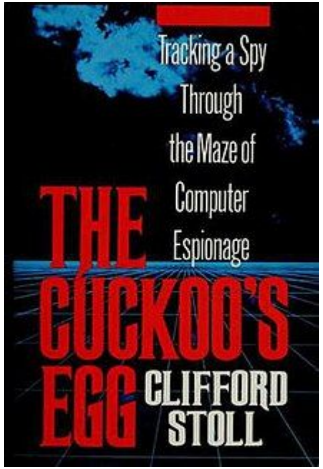

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1.4- Building honeypot with Python

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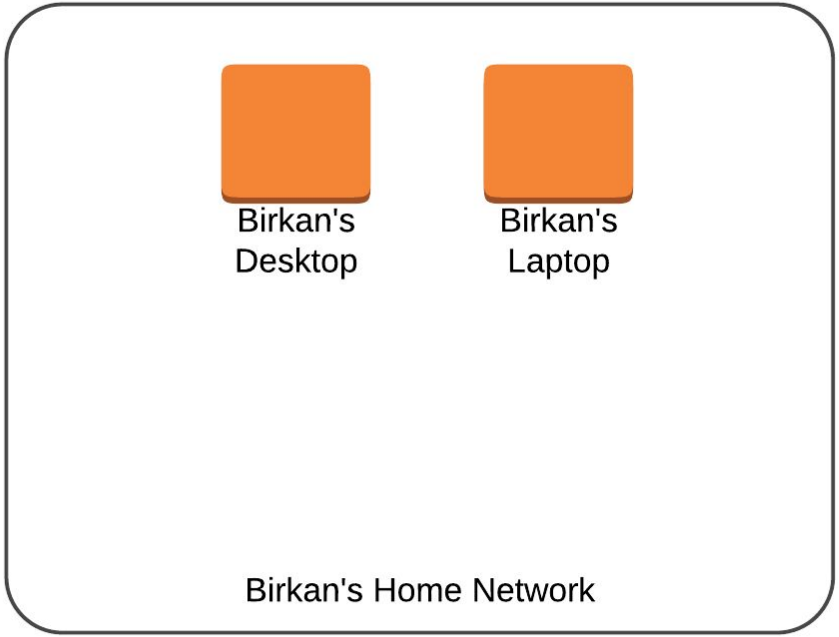

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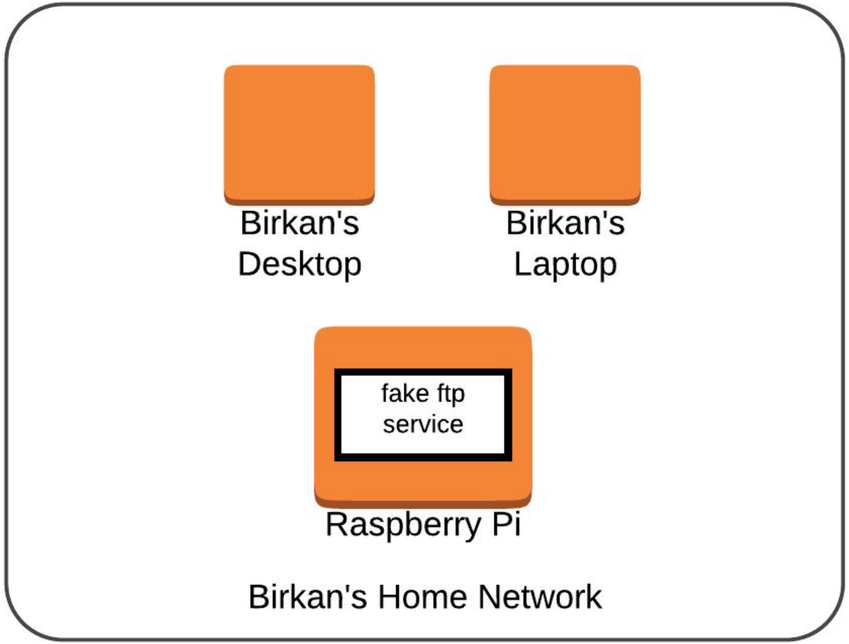

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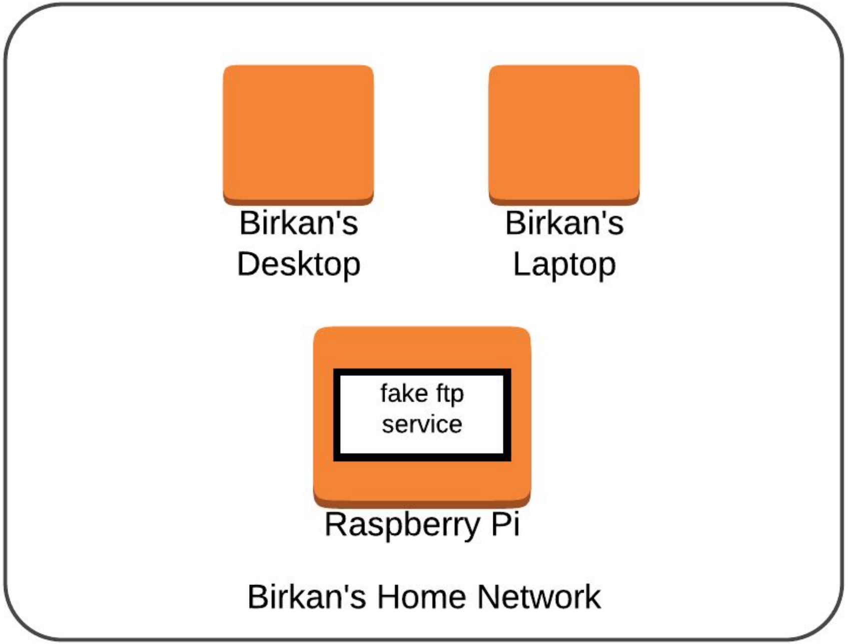

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THIS IS AN EXPERIMENTAL HONEYPOT. DO NOT USE IN PRODUCTION ENVIRONMENTS.

2- Dockerizing the Honeypot written in Python

1. What is Docker and why are we using it?
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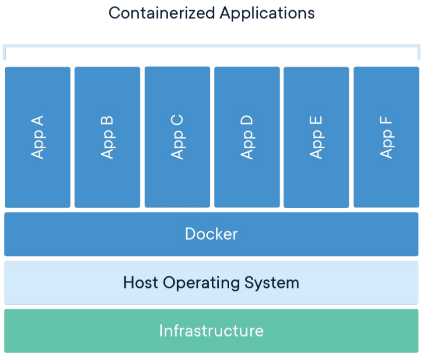

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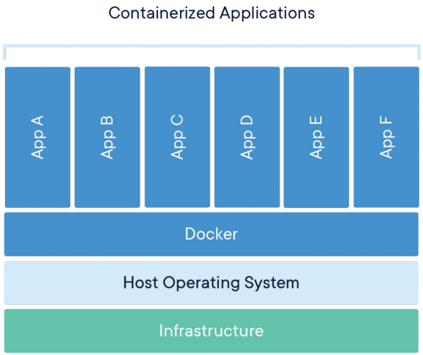

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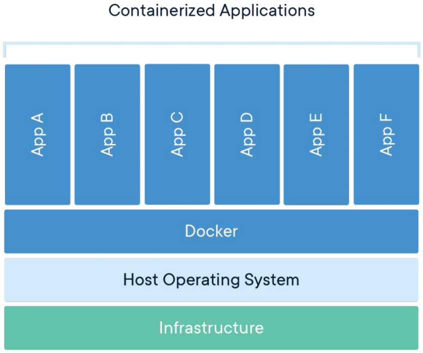

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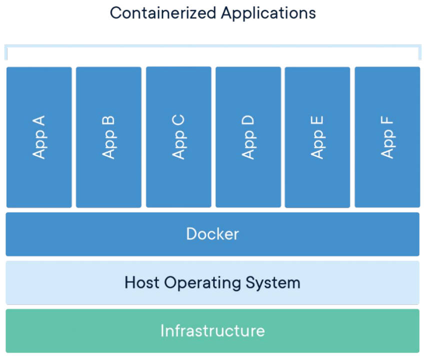

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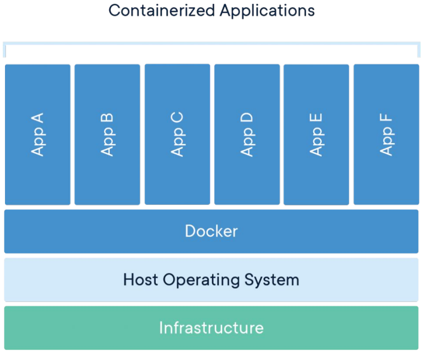

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  c. `RUN pip install sendgrid`

  d. `CMD ["python", "./ftp-honeypot.py"]`

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- sudo docker build -t ftp-honeypot .
- sudo docker run -p 21:21 -e "SENDGRID_API_KEY=your-top-secret-sendgrid-api-key" -e "more_env_variables_here" ftp-honeypot

3- Deployment of Dockerized Honeypot on a Raspberry Pi

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- wget https://github.com/hypriot/image-builder-rpi/releases/download/v1.11.0/hypriotos-rpi-v1.11.0.img.zip

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- flash -u wifi.yml ./hypriotos-rpi-v1.11.0.img.zip

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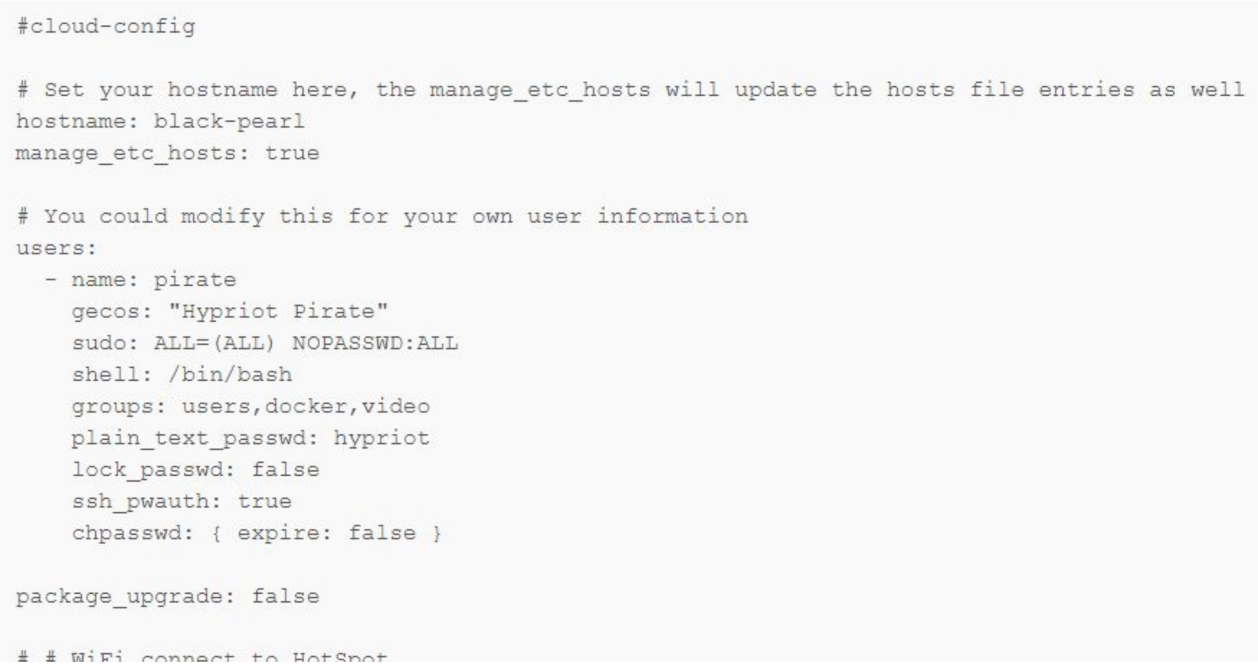
wifi.yml



```
#cloud-config

# Set your hostname here, the manage_etc_hosts will update the hosts file entries as well
hostname: black-pearl
manage_etc_hosts: true

# You could modify this for your own user information
users:
  - name: pirate
    gecos: "Hypriot Pirate"
    sudo: ALL=(ALL) NOPASSWD:ALL
    shell: /bin/bash
    groups: users,docker,video
    plain_text_passwd: hypriot
    lock_passwd: false
    ssh_pwauth: true
    chpasswd: { expire: false }

package_upgrade: false

# # WiFi connect to HotSpot
```

3.2- How to install Docker Pirates on a Raspberry Pi?

- ssh pirate@black-pearl.local
- date -s '2014-12-25 12:34:56' && echo “The date should be current time”

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4- Honeypot in Action!

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    a. Attacker compromised wireless home network.

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    a. Attacker compromised wireless home network.
    b. Performing network scanning to figure out devices and services.
    c. Realize that an ftp service is running on a host.
    d. Login to ftp and exploit the machine (through brute-force etc.)

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1. Attacker figures out his/her ip address in home network.
    a. ifconfig

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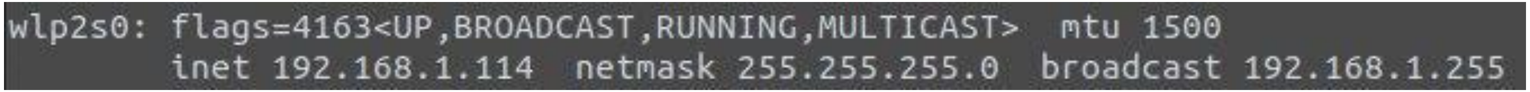

```
wlp2s0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST>  mtu 1500
        inet 192.168.1.114  netmask 255.255.255.0  broadcast 192.168.1.255
```

4- Honeypot in Action!

1. Performing network scanning
    a. nmap 192.168.1.0/24

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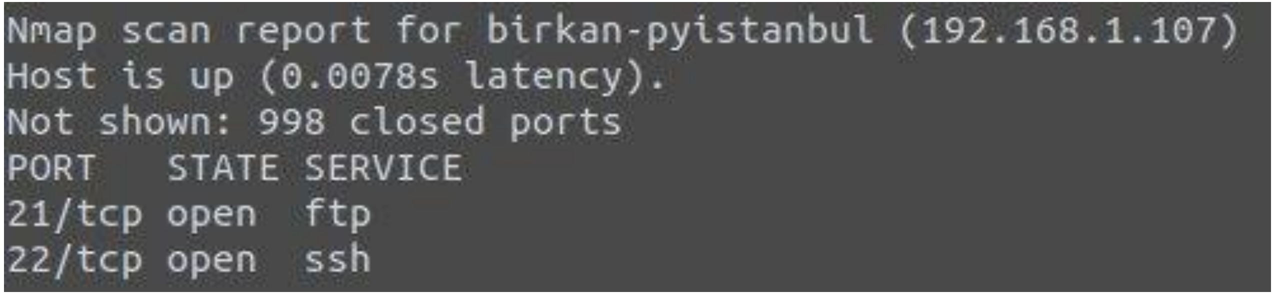
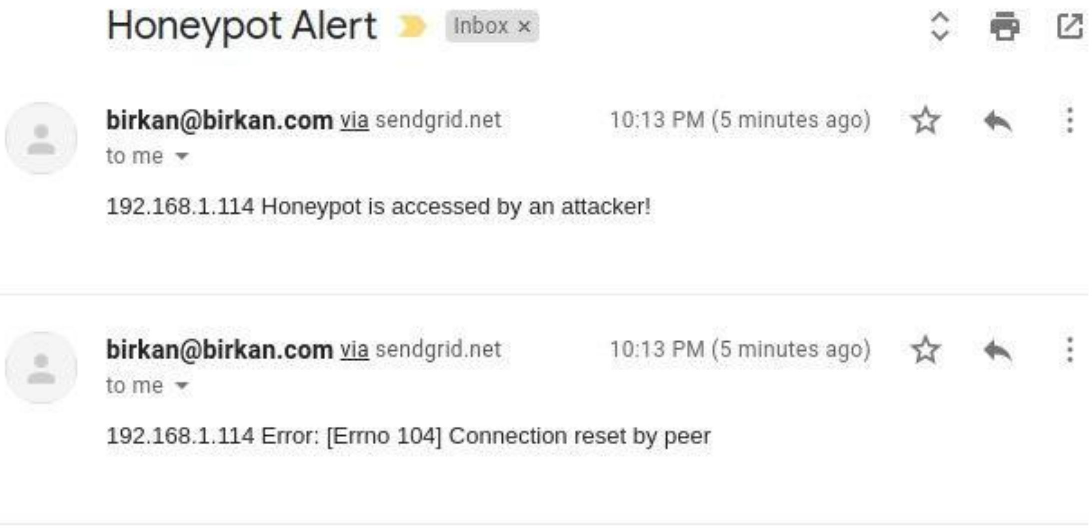


```
Nmap scan report for birkan-pyistanbul (192.168.1.107)
Host is up (0.0078s latency).
Not shown: 998 closed ports
PORT   STATE SERVICE
21/tcp open  ftp
22/tcp open  ssh
```

4- Honeypot in Action!

1. This action triggered alert on the honeypot:



Honeypot Alert

birkan@birkan.com via sendgrid.net 10:13 PM (5 minutes ago)
to me

192.168.1.114 Honeypot is accessed by an attacker!

birkan@birkan.com via sendgrid.net 10:13 PM (5 minutes ago)
to me

192.168.1.114 Error: [Errno 104] Connection reset by peer

4- Honeypot in Action!

1. Attacker connects to ftp service on target machine.
   a. ftp 192.168.1.107

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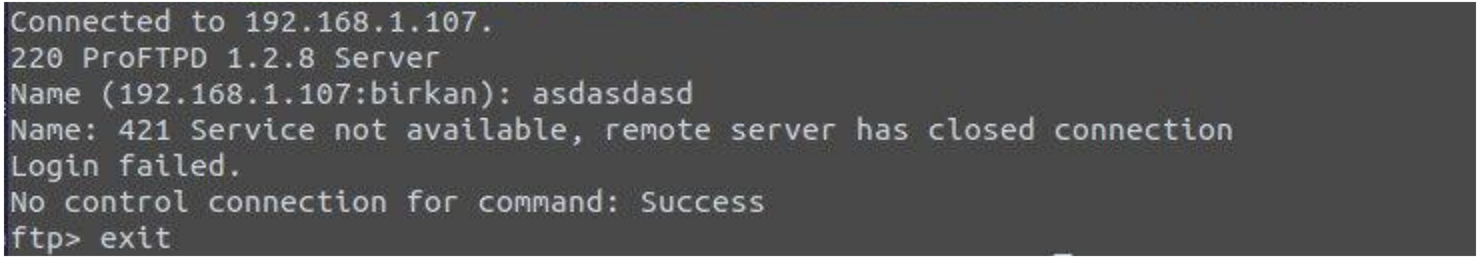
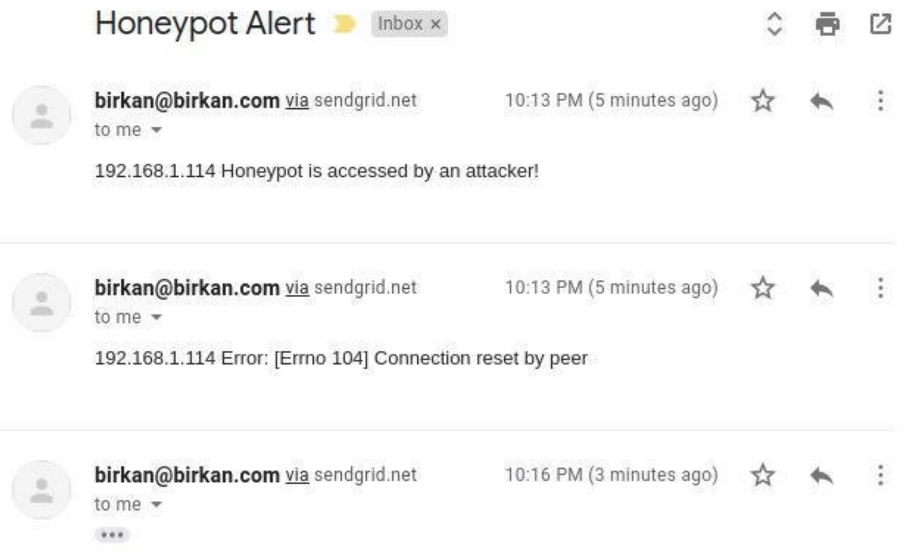


```
Connected to 192.168.1.107.
220 ProFTPD 1.2.8 Server
Name (192.168.1.107:birkan): asdasdasd
Name: 421 Service not available, remote server has closed connection
Login failed.
No control connection for command: Success
ftp> exit
```

4- Honeypot in Action!

1. This action also triggered alert on the honeypot:



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birkan@birkan.com via sendgrid.net 10:16 PM (3 minutes ago)
to me

References

- https://searchsecurity.techtarget.com/definition/honey-pot
- https://en.wikipedia.org/wiki/The_Cuckoo%27s_Egg
- sshesame - https://github.com/jaksi/sshesame
- Mert Sarıca “Tuzak Sistem ile Hacker Avı” -

  https://www.mertsarica.com/tuzak-sistem-ile-hacker-avi/
- https://www.docker.com/resources/what-container
- https://www.linode.com/docs/applications/containers/when-and-why-to-use-docker/