Catching the silent whisper: Understanding the Derusbi family tree

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Virus Bulletin 2015

Agenda

- What is Derusbi
- Background
- Variants of Derusbi
- Technical Analysis

What is Derusbi

What is Derusbi

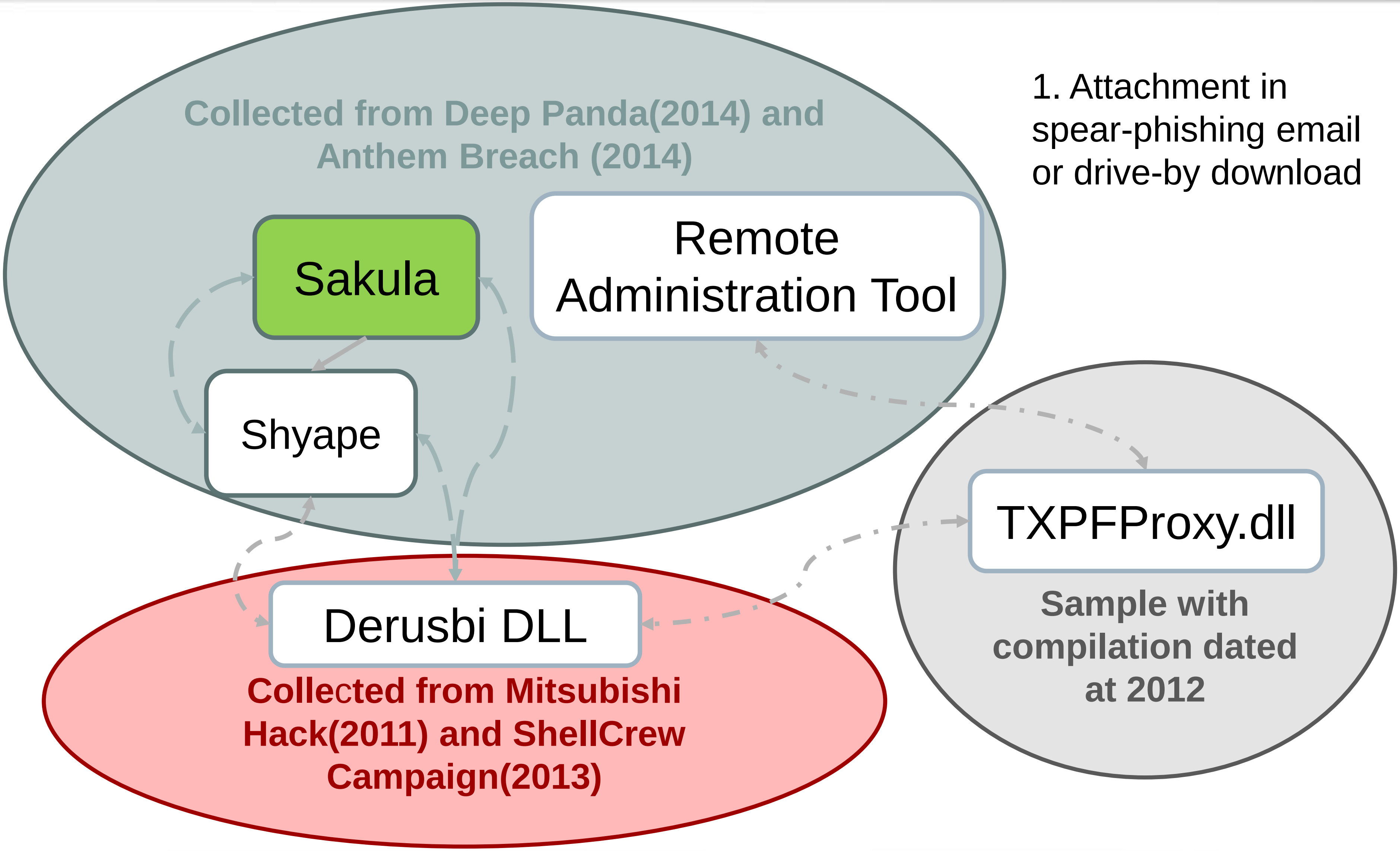
- DLL
- Remote Access Trojan
- Relies on other malware to load or plant on a system
- Resides on a system by imitating legitimate software DLLs (OfficeUt32.dll, Office32.dll, Update.dll…etc) during static file header scanning
- Limited amount of samples (The number of samples since 2008 till today are still in the hundreds)

Background

Background

- Timeline
- 2008 – Earliest sample with compile time Aug 3, 2008
  - » (md5: 338e4deb0be7769ef2c9d7080fb56154)
- 2011 – Mitsubishi Heavy Industries hack (discovered Oct, 2011)
  - » (md5: 1cd7835b9ac253a72f8cd94405100d62) (Ref: ixoxiブログ)(compile time Apr 15,2011)
- 2014 – CareFirst BlueCross BlueShield hack (by the work of Sakula)
  - » Revealed In May 2015
  - » 1.1 millions customer information breached
  - » Actual took place at June 2014 (Ref: CareFirstAnswers)
- 2015 – Anthem hack (by the work of Sakula)
  - » Revealed in Mar 2015
  - » 78.8 million people information breached (Ref : AnthemFacts)
  - » Data is stolen around Dec 2014 (Ref: AnthemFacts)
  - » Part of the Deep Panda Campaign

Possible Infection Routine

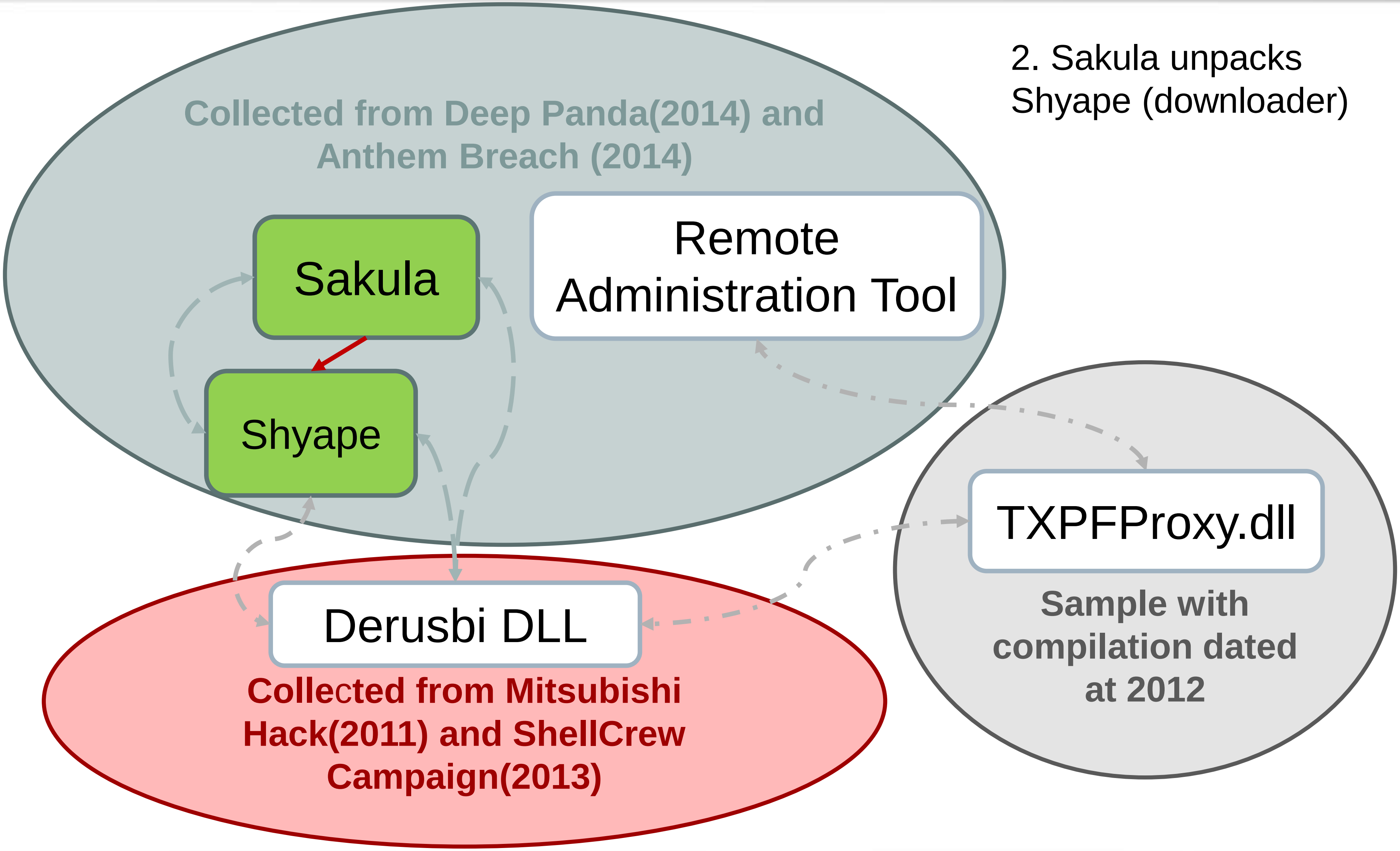


Collected from Deep Panda(2014) and Anthem Breach (2014)
Sakula
Remote Administration Tool
Shyape
TXPFProxy.dll
Sample with compilation dated at 2012
Derusbi DLL
Collected from Mitsubishi Hack(2011) and ShellCrew Campaign(2013)

1. Attachment in spear-phishing email or drive-by download

Possible Infection Routine

2. Sakula unpacks Shyape (downloader)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Sample with compilation dated at 2012
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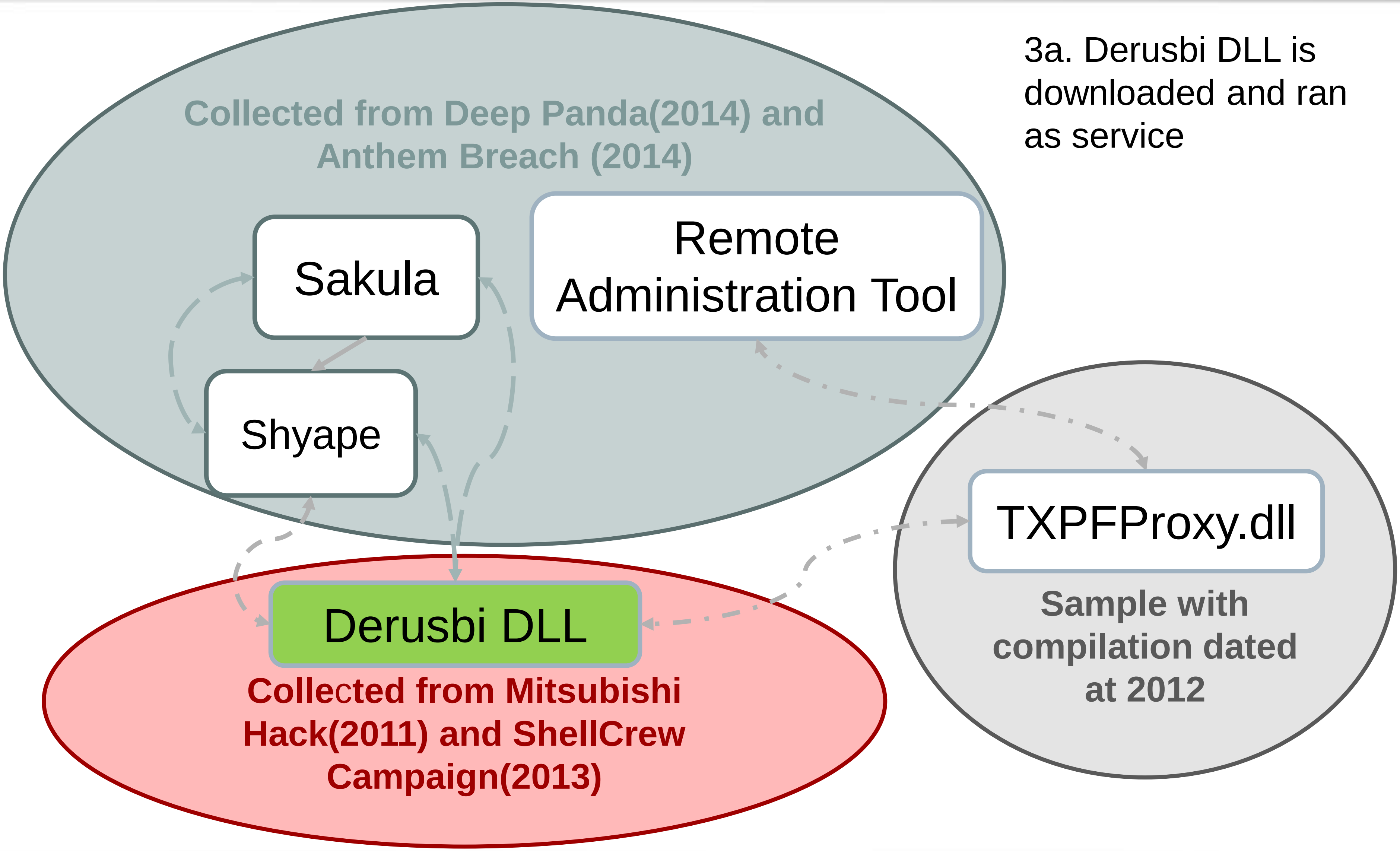
Possible Infection Routine

3a. Derusbi DLL is downloaded and ran as service



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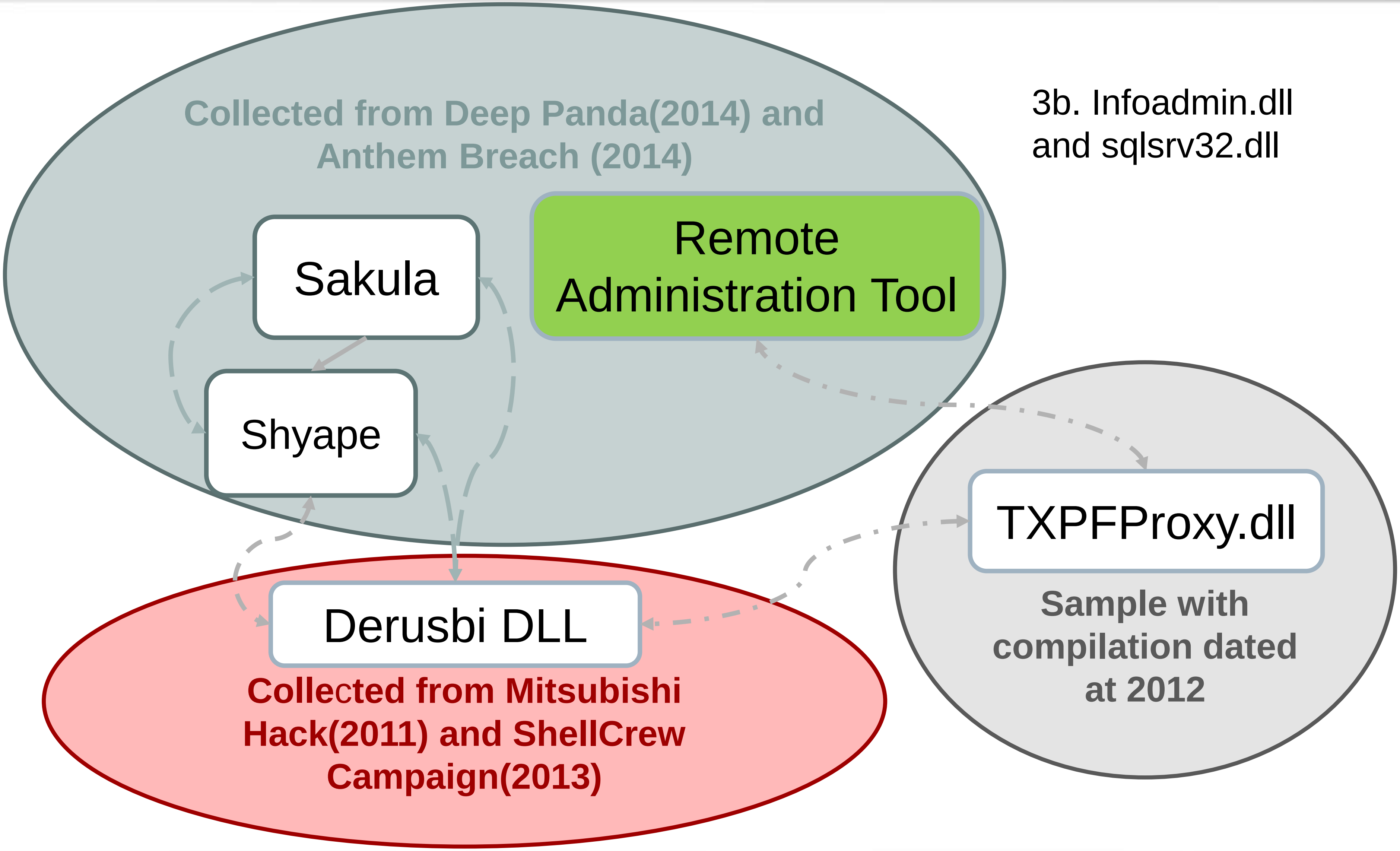
Possible Infection Routine



Collected from Deep Panda(2014) and Anthem Breach (2014)

Sakula

Shyape

Remote Administration Tool

3b. Infoadmin.dll
and sqlsrv32.dll

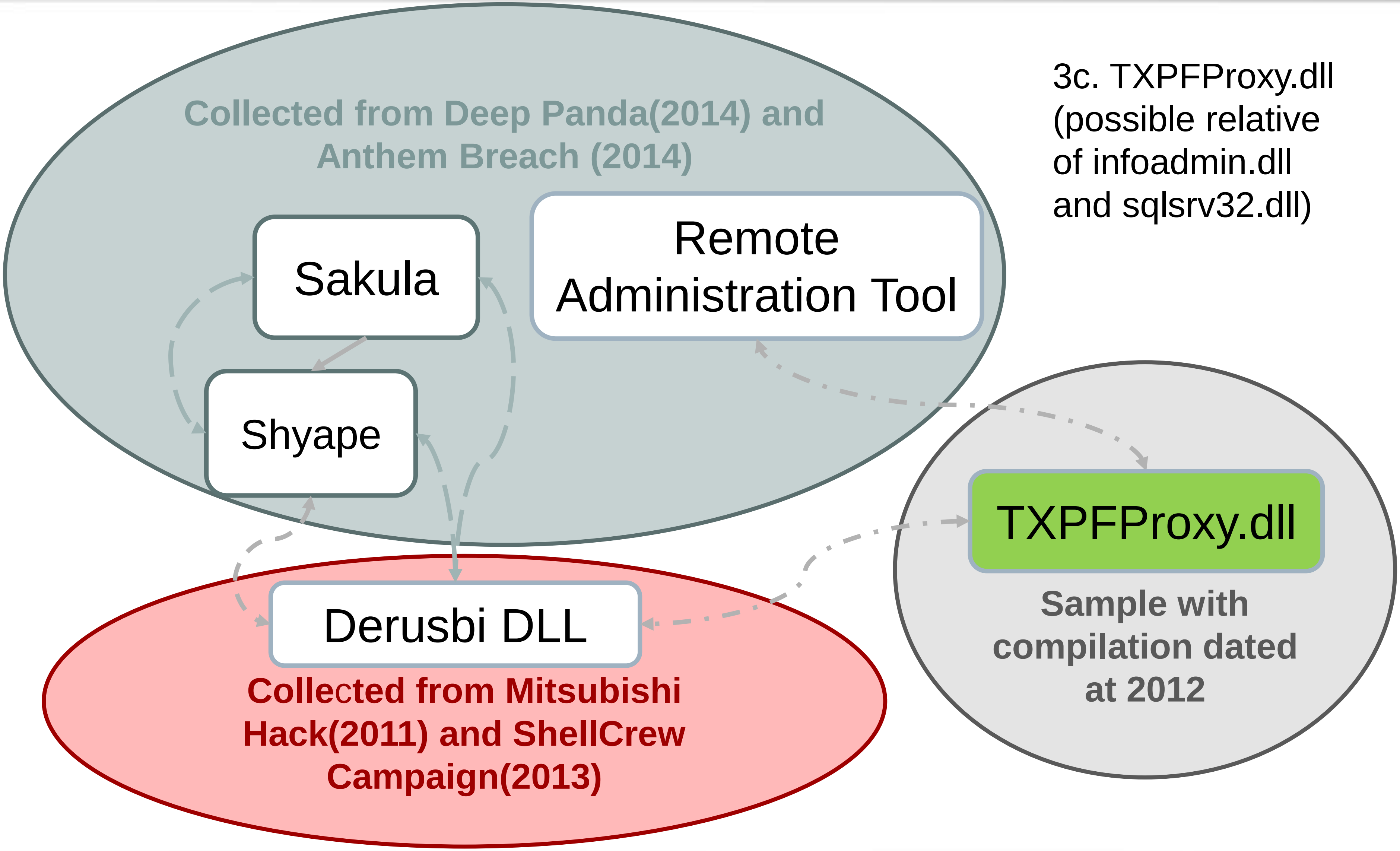
TXPFProxy.dll

Sample with compilation dated at 2012

Derusbi DLL

Collected from Mitsubishi Hack(2011) and ShellCrew Campaign(2013)

Possible Infection Routine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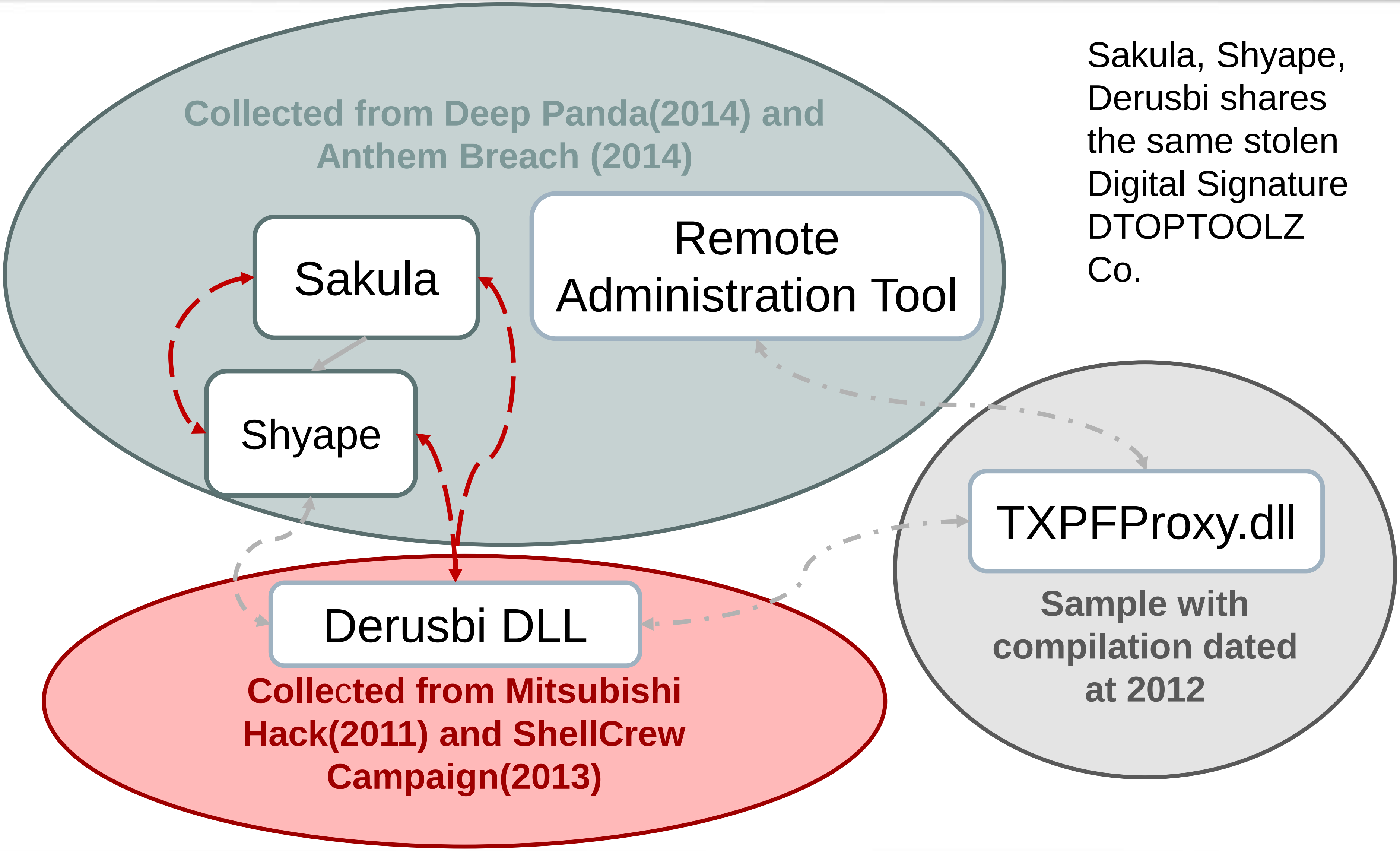
TXPFProxy.dll
Sample with compilation dated at 2012

3c. TXPFProxy.dll (possible relative of infoadmin.dll and sqlsrv32.dll)

Similarities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Sakula
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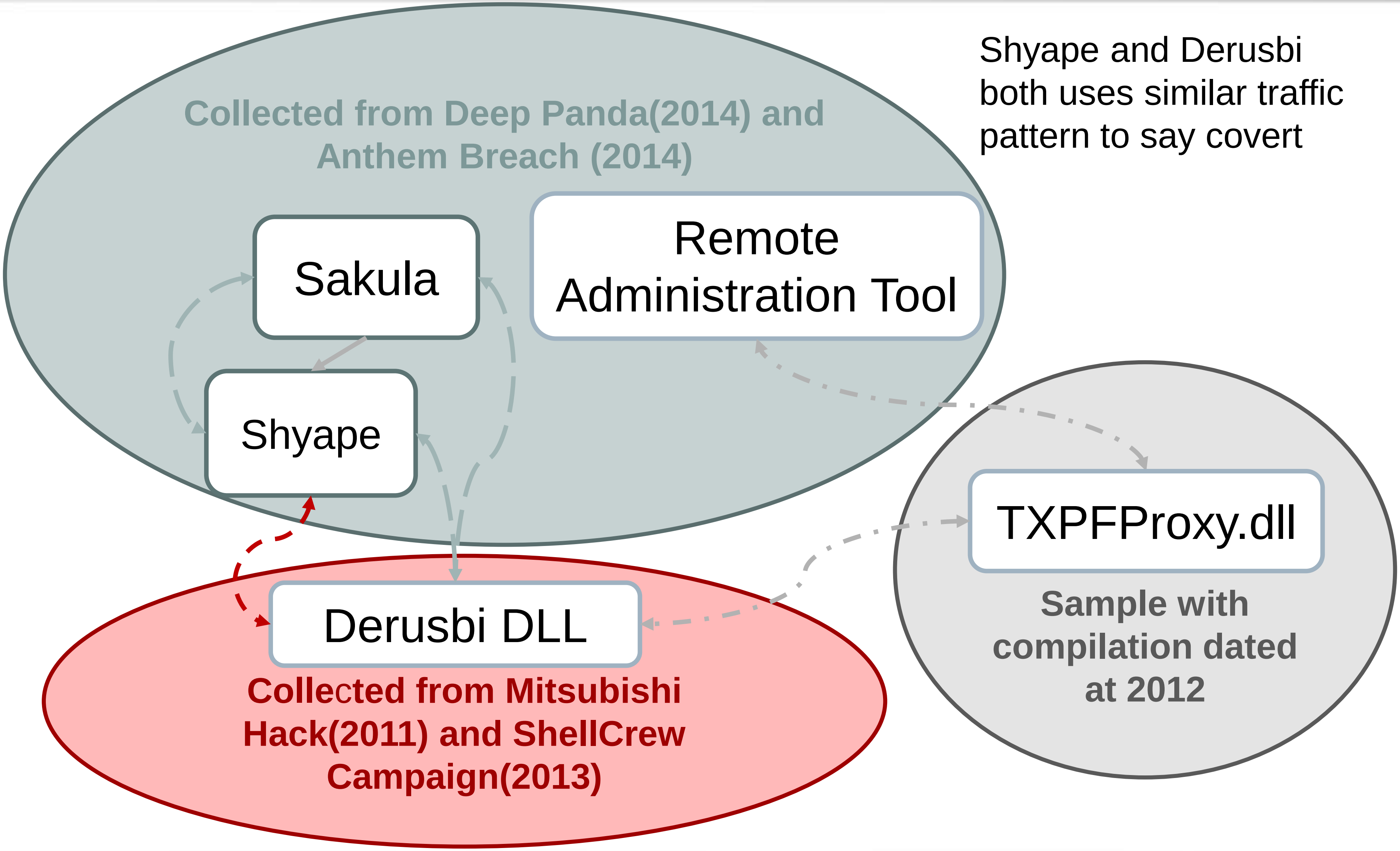
Shyape
TXPFProxy.dll
Derusbi DLL
Sample with compilation dated at 2012
Collected from Mitsubishi Hack(2011) and ShellCrew Campaign(2013)

Sakula, Shyape, Derusbi shares the same stolen Digital Signature DTOPTOOLZ Co.

Similarities



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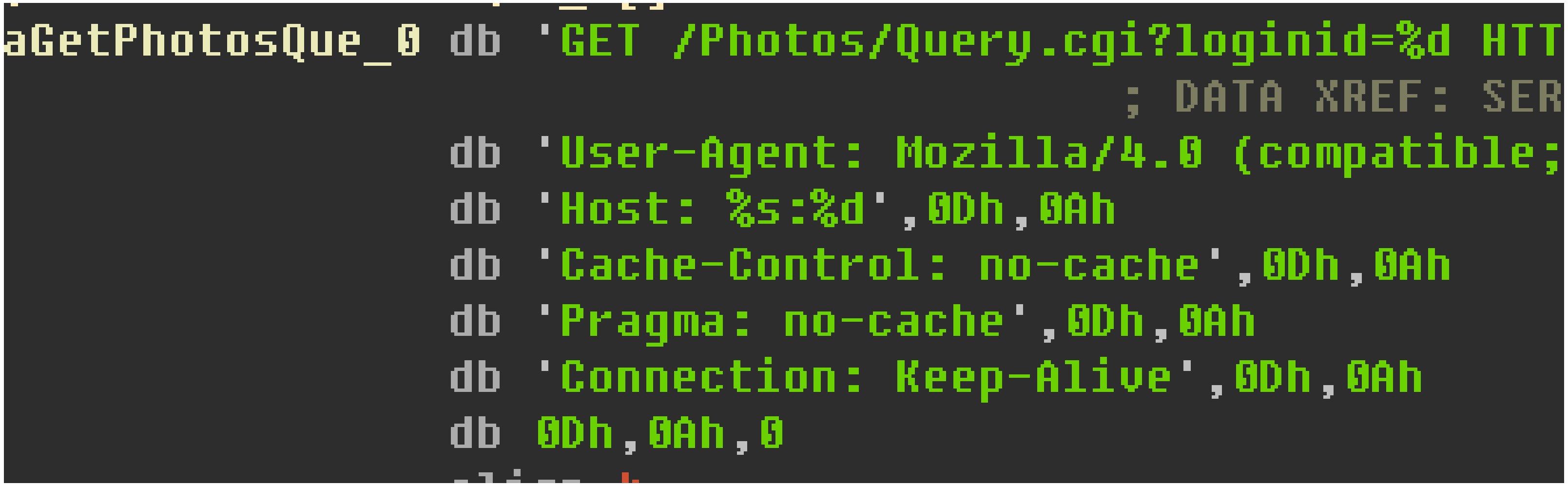
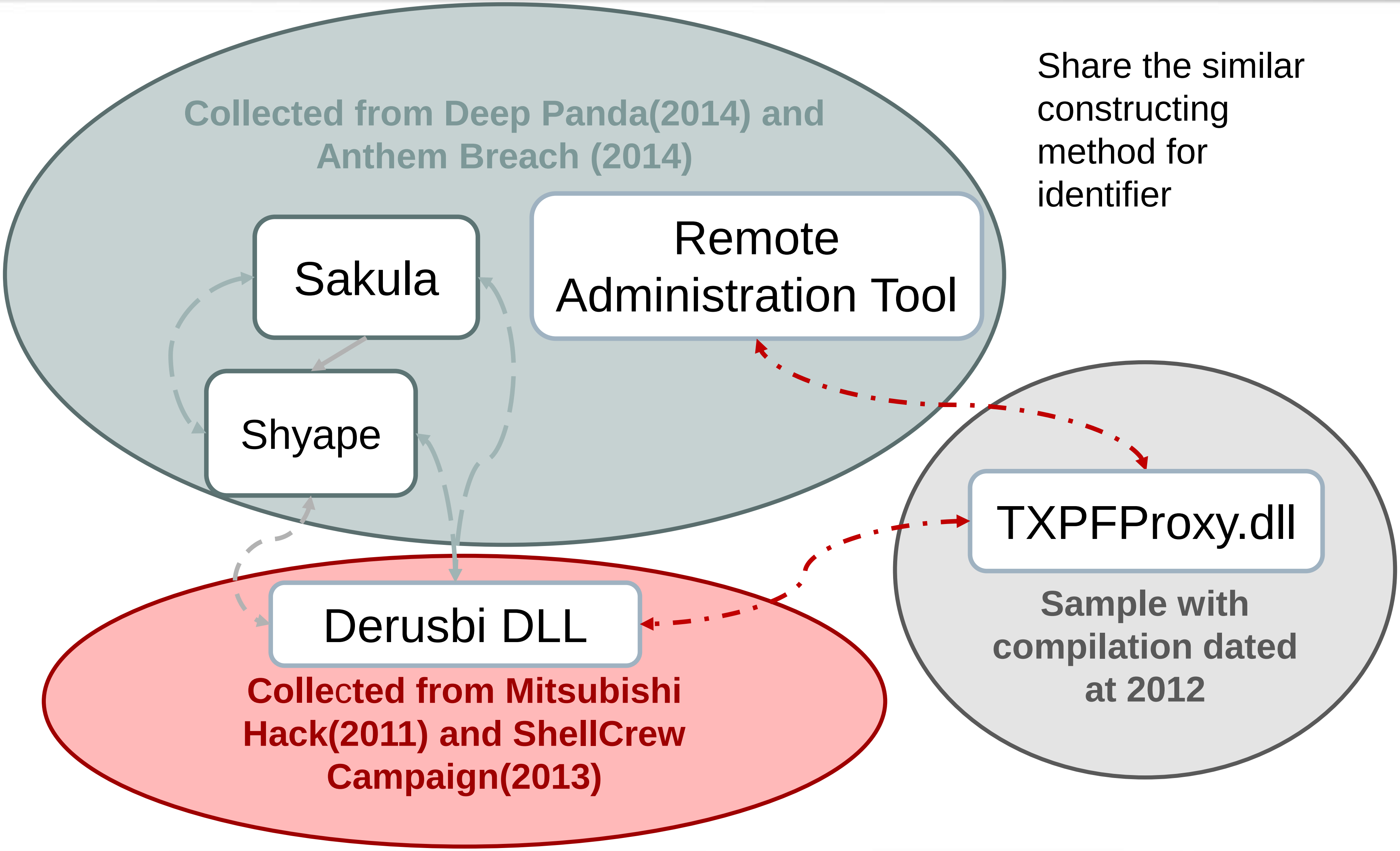
Shyape and Derusbi both uses similar traffic pattern to say covert

Similarities



```
aGetPhotosQue_0 db 'GET /Photos/Query.cgi?loginid=%d HTT
                                          ; DATA XREF: SER
                db 'User-Agent: Mozilla/4.0 (compatible;
                db 'Host: %s:%d',0Dh,0Ah
                db 'Cache-Control: no-cache',0Dh,0Ah
                db 'Pragma: no-cache',0Dh,0Ah
                db 'Connection: Keep-Alive',0Dh,0Ah
                db 0Dh,0Ah,0
```

Similarities



Collected from Deep Panda(2014) and Anthem Breach (2014)

Sakula

Shyape

Remote Administration Tool

Derusbi DLL

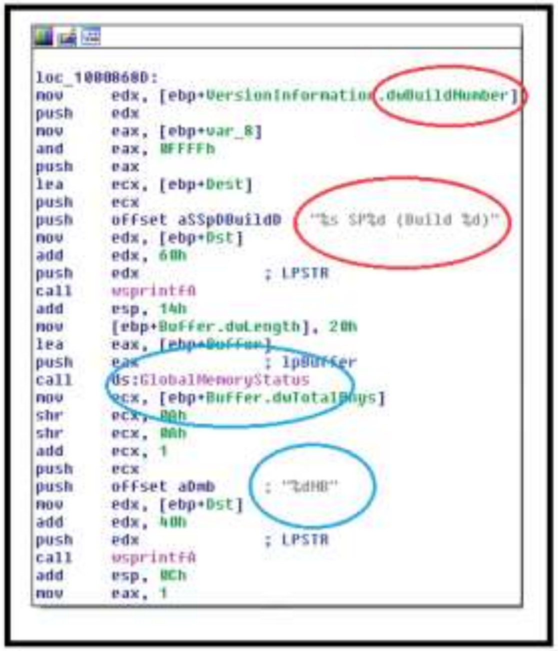
Collected from Mitsubishi Hack(2011) and ShellCrew Campaign(2013)

TXPFProxy.dll

Sample with compilation dated at 2012

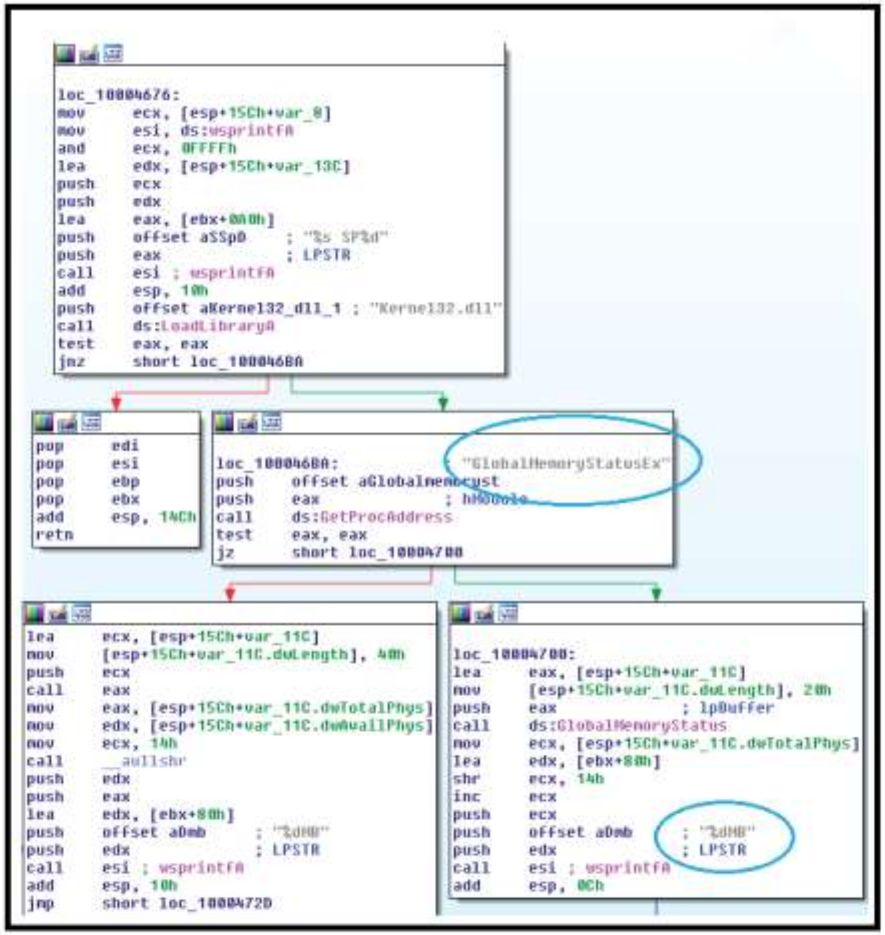
Share the similar constructing method for identifier

Similarities



```
loc_1000068D:
mov     edx, [ebp+VersionInformation.dwBuildNumber]
push    edx
mov     eax, [ebp+var_8]
and     eax, 0FFFFh
push    eax
lea     ecx, [ebp+Dest]
push    ecx
push    offset aSSpDBuildD ; "%s SP%d (Build %d)"
mov     edx, [ebp+Dst]
add     edx, 60h
push    edx             ; LPSTR
call    wsprintfA
add     esp, 14h
mov     [ebp+Buffer.dwLength], 20h
lea     eax, [ebp+Buffer]
push    eax             ; lpBuffer
call    ds:GlobalMemoryStatus
mov     ecx, [ebp+Buffer.dwTotalPhys]
shr     ecx, 0Ah
shr     ecx, 0Ah
add     ecx, 1
push    ecx
push    offset aDmb     ; "%dMB"
mov     edx, [ebp+Dst]
add     edx, 40h
push    edx             ; LPSTR
call    wsprintfA
add     esp, 0Ch
mov     eax, 1
```

TXPFProxy.dll



```
loc_10004676:
mov     ecx, [esp+15Ch+var_8]
mov     esi, ds:wsprintfA
and     ecx, 0FFFFh
lea     edx, [esp+15Ch+var_13C]
push    ecx
push    edx
lea     eax, [ebx+0A0h]
push    offset aSSpD    ; "%s SP%d"
push    eax             ; LPSTR
call    esi ; wsprintfA
add     esp, 10h
push    offset aKernel32_dll_1 ; "Kernel32.dll"
call    ds:LoadLibraryA
test    eax, eax
jnz     short loc_100046BA
```

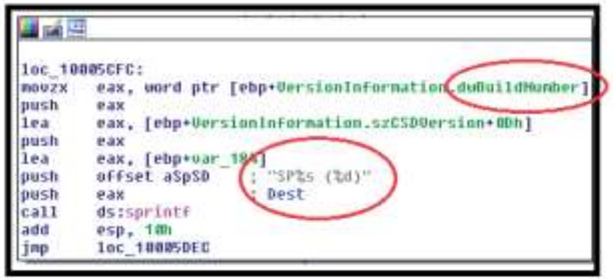
```
pop     edi
pop     esi
pop     ebp
pop     ebx
add     esp, 14Ch
retn
```

```
loc_100046BA:           ; "GlobalMemoryStatusEx"
push    offset aGlobalmemoryst
push    eax             ; hModule
call    ds:GetProcAddress
test    eax, eax
jz      short loc_10004700
```

```
lea     ecx, [esp+15Ch+var_11C]
mov     [esp+15Ch+var_11C.dwLength], 40h
push    ecx
call    eax
mov     eax, [esp+15Ch+var_11C.dwTotalPhys]
mov     edx, [esp+15Ch+var_11C.dwAvailPhys]
mov     ecx, 14h
call    __aullshr
push    edx
push    eax
lea     edx, [ebx+80h]
push    offset aDmb     ; "%dMB"
push    edx             ; LPSTR
call    esi ; wsprintfA
add     esp, 10h
jmp     short loc_1000472D
```

```
loc_10004700:
lea     eax, [esp+15Ch+var_11C]
mov     [esp+15Ch+var_11C.dwLength], 20h
push    eax             ; lpBuffer
call    ds:GlobalMemoryStatus
mov     ecx, [esp+15Ch+var_11C.dwTotalPhys]
lea     edx, [ebx+80h]
shr     ecx, 14h
inc     ecx
push    ecx
push    offset aDmb     ; "%dMB"
push    edx             ; LPSTR
call    esi ; wsprintfA
add     esp, 0Ch
```

Derusbi Collected from ShellCrew Campaign

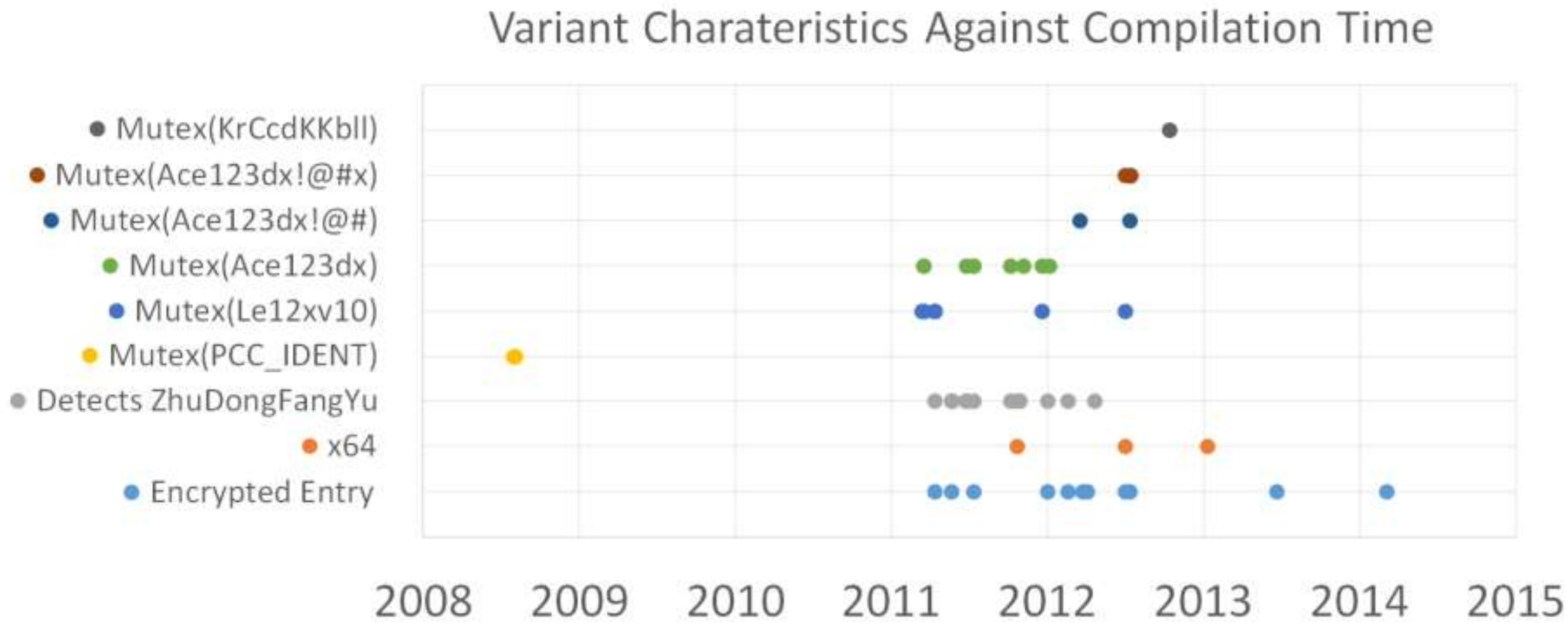


```
loc_10005CFC:
movzx   eax, word ptr [ebp+VersionInformation.dwBuildNumber]
push    eax
lea     eax, [ebp+VersionInformation.szCSDVersion+0Dh]
push    eax
lea     eax, [ebp+var_184]
push    offset aSpSD    ; "SP%s (%d)"
push    eax             ; Dest
call    ds:sprintf
add     esp, 10h
jmp     loc_10005DEC
```

Remote Adminstration Tool (sqlsrv32.dll)

Variants of Derusbi

Variants of Derusbi



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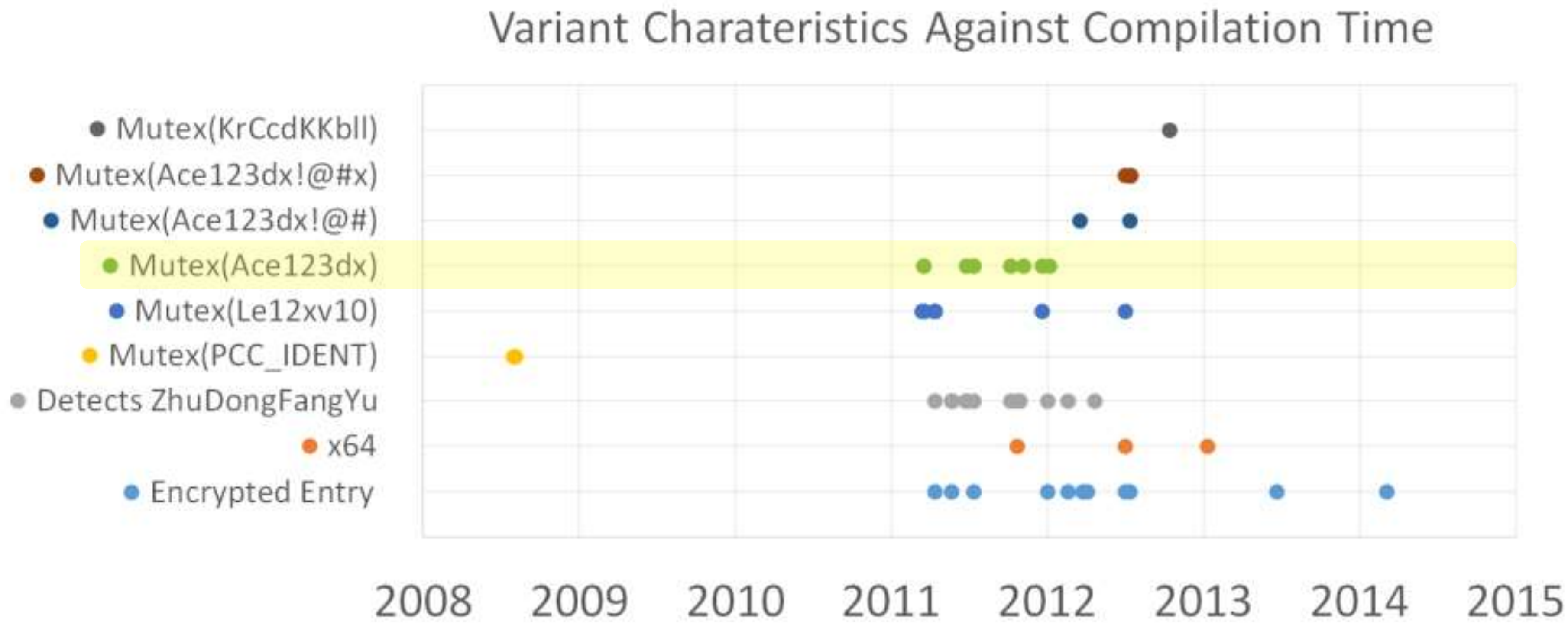

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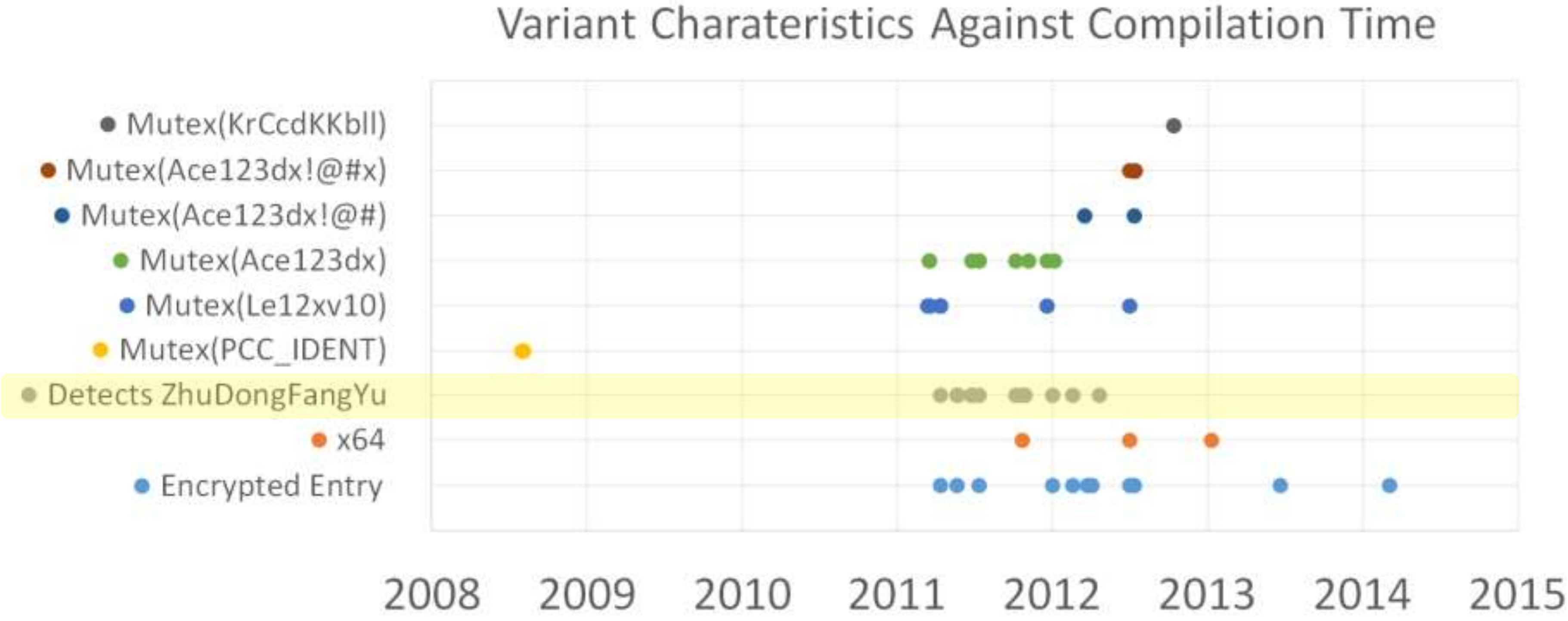

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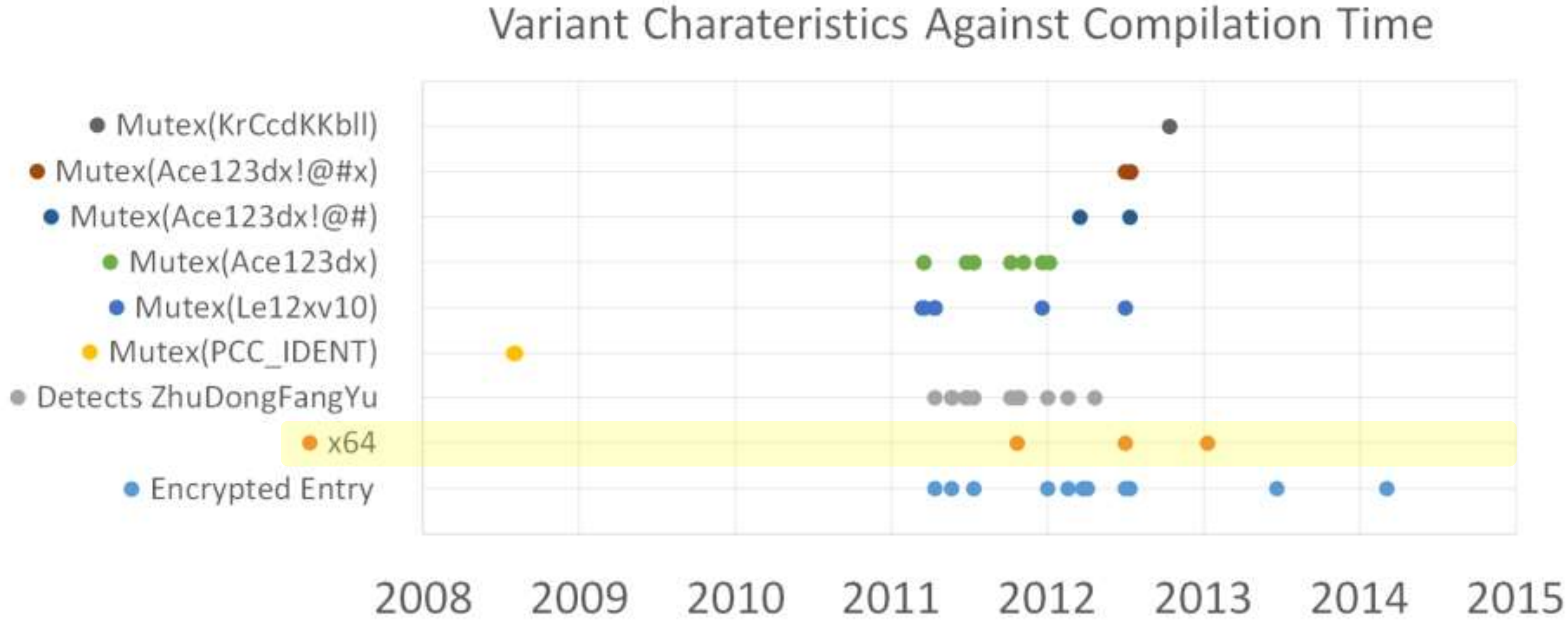

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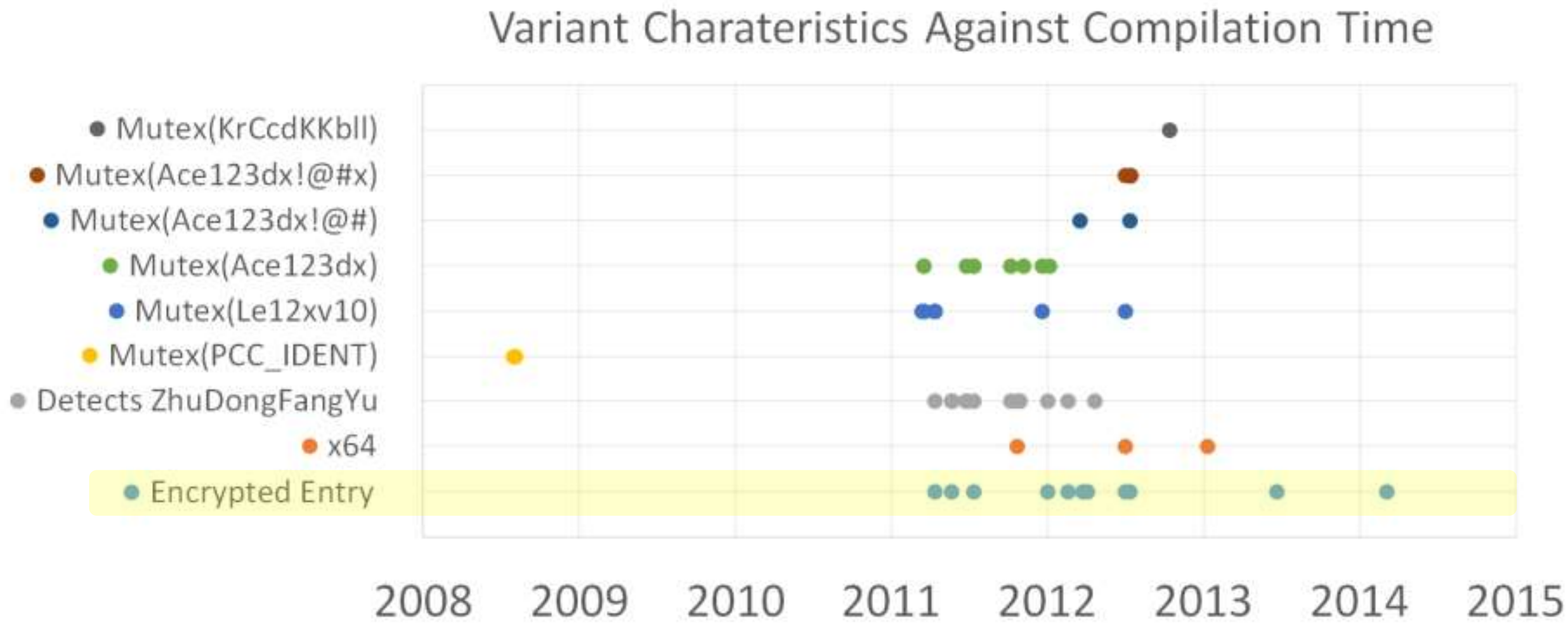


Variants of Derusbi

- Some notes:
  - 64-bit version first seen in 2011 – somewhat rare
  - Newer samples don’t necessarily use the newest version of a specific class
  - Much more features in samples from 2013/2014 versus 2008

Technical Analysis

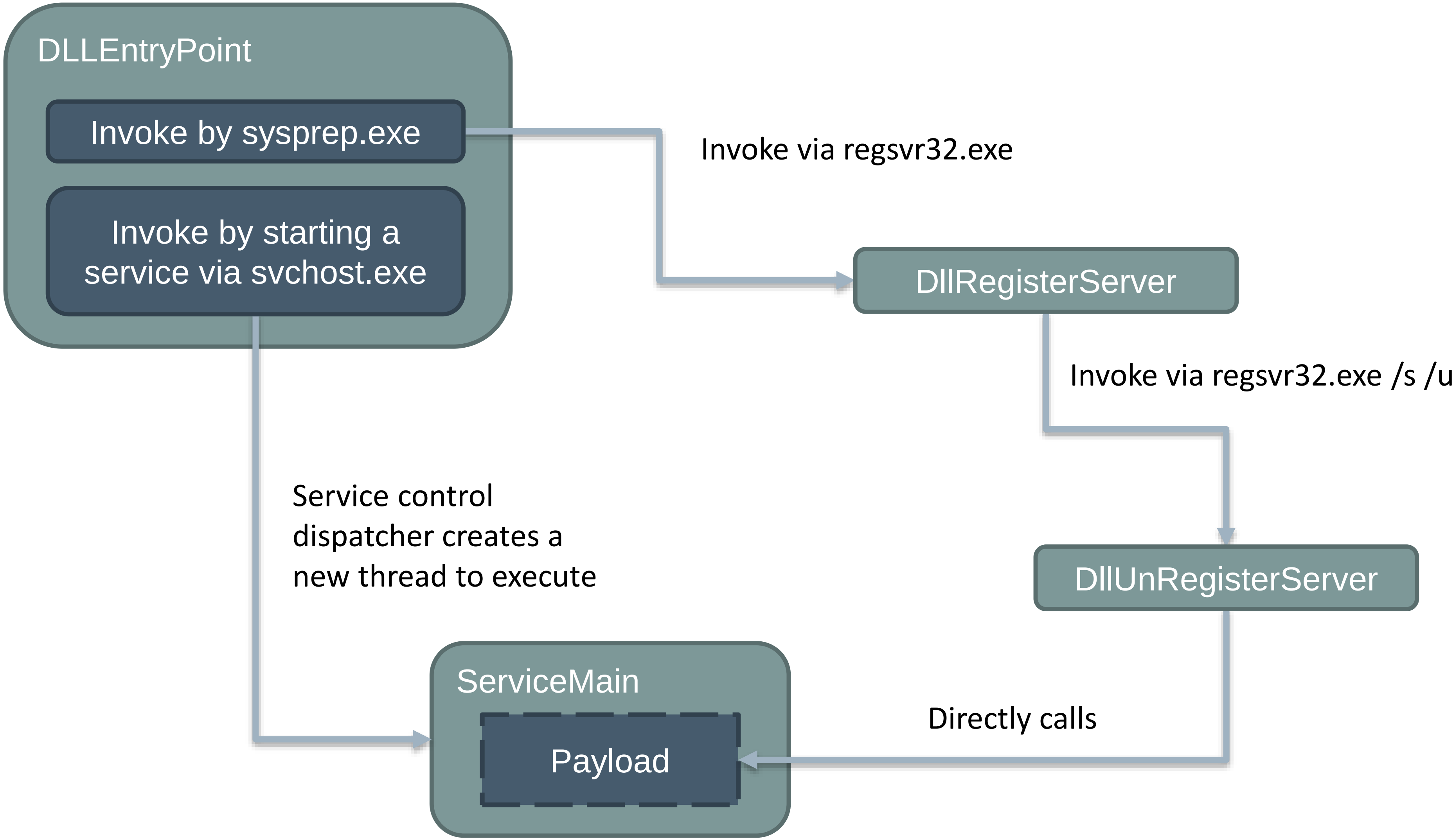
DLL Export Functions

- DllEntryPoint
  - Initialization
  - Calls regsvr32.exe
  - If sample is packed, unpack the export functions
- DllRegisterServer
  - Persistence Management
- DllUnregisterServer
  - Invoke Payload/BDSocket Thread
- ServiceMain
  - Main code
  - Contains the Payload/BDSocket Thread

Technical Analysis

Persistence Management

Derusbi Loading Sequence

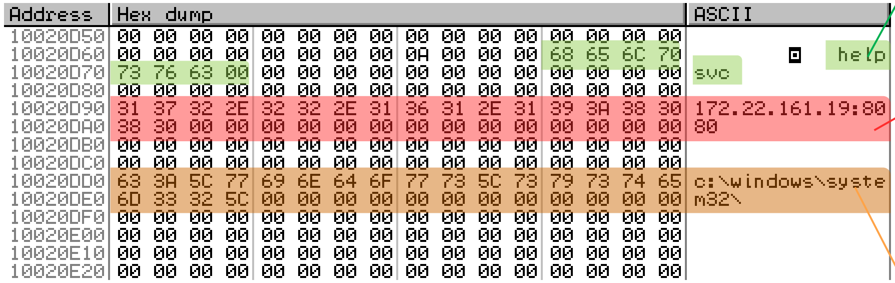


DLLEntryPoint
Invoke by sysprep.exe
Invoke by starting a service via svchost.exe
Invoke via regsvr32.exe
DllRegisterServer
Invoke via regsvr32.exe /s /u
Service control dispatcher creates a new thread to execute
DllUnRegisterServer
ServiceMain
Payload
Directly calls

Persistence Management - DllRegisterServer

- Decrypt and store built-in configuration at
  - Key: HK_Local_Machine\Software\Microsoft\RPC
  - Subkey: Security
  - Data: xor(not(one-byte key))[Decrypted Configuration]
- Backup the current file to %SystemFolder% with filename
  - [hardcoded-prefix]{randomstring}.[hardcoded-extension]
- Store the persistent DLL path in
  - Key: HK_LOCAL_MACHINE\System\CurrentControlSet\Service\{Persistent Service Name}\Parameter
  - Subkey: ServiceDLL

Built-in Configuration



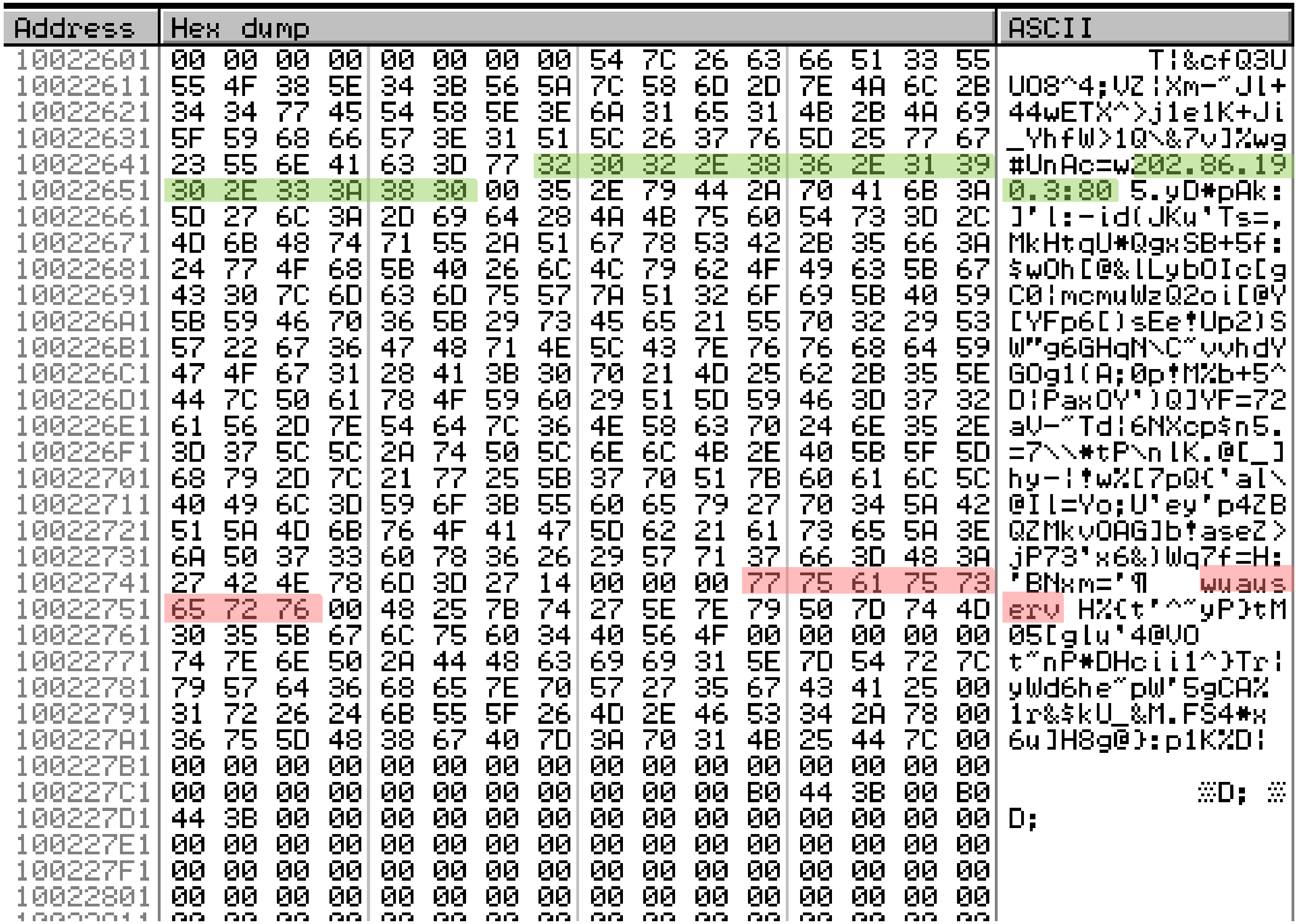
```
Address | Hex dump                                        | ASCII
10020D50| 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |
10020D60| 00 00 00 00 00 00 00 00 0A 00 00 00 68 65 6C 70 |         ◘   help
10020D70| 73 76 63 00 00 00 00 00 00 00 00 00 00 00 00 00 | svc
10020D80| 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |
10020D90| 31 37 32 2E 32 32 2E 31 36 31 2E 31 39 3A 38 30 | 172.22.161.19:80
10020DA0| 38 30 00 00 00 00 00 00 00 00 00 00 00 00 00 00 | 80
10020DB0| 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |
10020DC0| 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |
10020DD0| 63 3A 5C 77 69 6E 64 6F 77 73 5C 73 79 73 74 65 | c:\windows\syste
10020DE0| 6D 33 32 5C 00 00 00 00 00 00 00 00 00 00 00 00 | m32\
10020DF0| 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |
10020E00| 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |
10020E10| 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |
10020E20| 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 |
```

Persistent service name

Beacon URL

File path where the Derusbi client is stored on the computer under a different name

Built-in Configuration

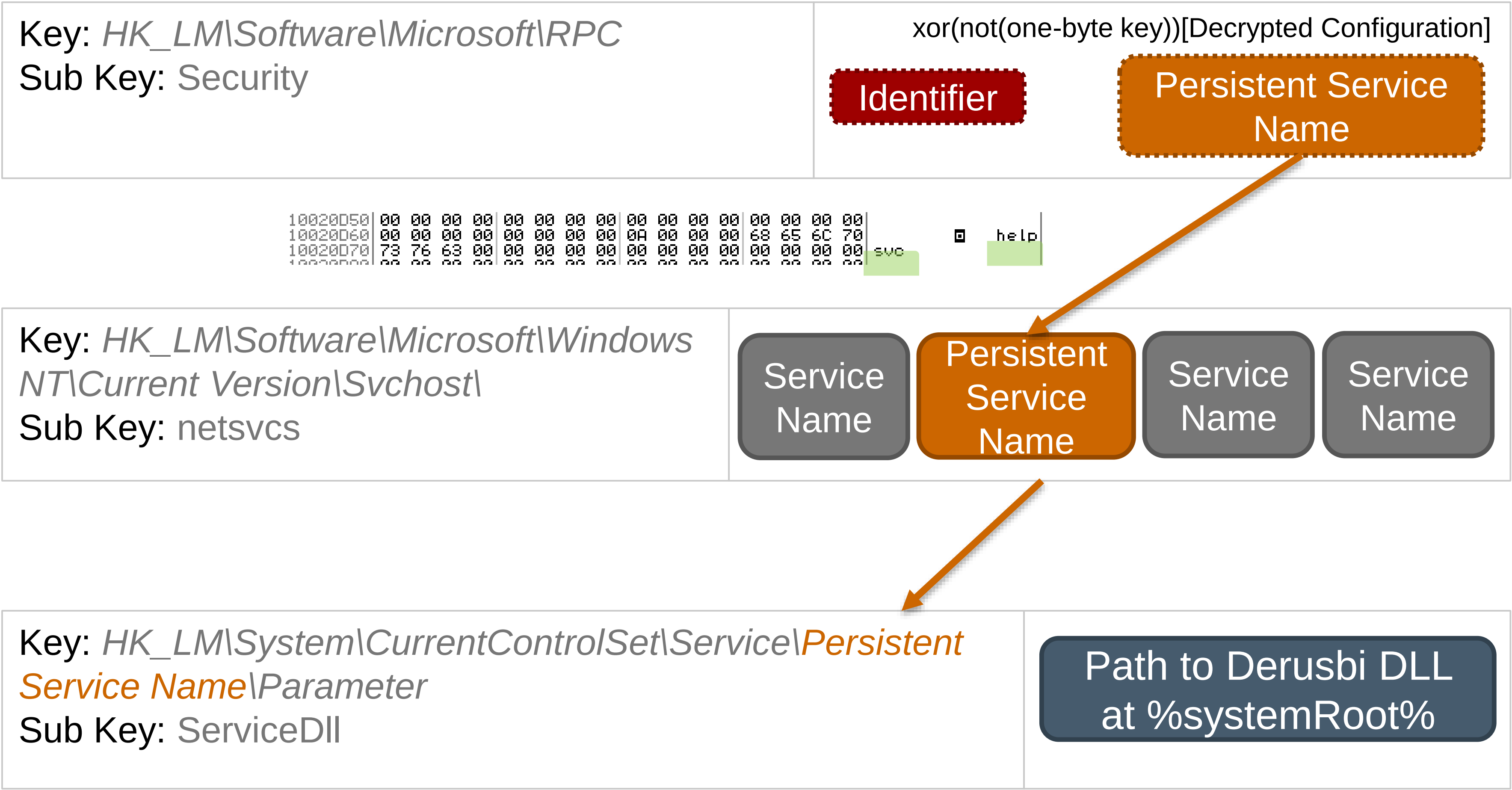


```
Address   Hex dump                                         ASCII
10022601  00 00 00 00 00 00 00 00 54 7C 26 63 66 51 33 55          T¦&cfQ3U
10022611  55 4F 38 5E 34 3B 56 5A 7C 58 6D 2D 7E 4A 6C 2B  UO8^4;VZ¦Xm-~Jl+
10022621  34 34 77 45 54 58 5E 3E 6A 31 65 31 4B 2B 4A 69  44wETX^>j1e1K+Ji
10022631  5F 59 68 66 57 3E 31 51 5C 26 37 76 5D 25 77 67  _YhfW>1Q\&7v]%wg
10022641  23 55 6E 41 63 3D 77 32 30 32 2E 38 36 2E 31 39  #UnAc=w202.86.19
10022651  30 2E 33 3A 38 30 00 35 2E 79 44 2A 70 41 6B 3A  0.3:80 5.yD*pAk:
10022661  5D 27 6C 3A 2D 69 64 28 4A 4B 75 60 54 73 3D 2C  ]'l:-id(JKu`Ts=,
10022671  4D 6B 48 74 71 55 2A 51 67 78 53 42 2B 35 66 3A  MkHtqU*QgxSB+5f:
10022681  24 77 4F 68 5B 40 26 6C 4C 79 62 4F 49 63 5B 67  $wOh[@&lLybOIc[g
10022691  43 30 7C 6D 63 6D 75 57 7A 51 32 6F 69 5B 40 59  C0¦mcmuWzQ2oi[@Y
100226A1  5B 59 46 70 36 5B 29 73 45 65 21 55 70 32 29 53  [YFp6[)sEe!Up2)S
100226B1  57 22 67 36 47 48 71 4E 5C 43 7E 76 76 68 64 59  W"g6GHqN\C~vvhdY
100226C1  47 4F 67 31 28 41 3B 30 70 21 4D 25 62 2B 35 5E  GOg1(A;0p!M%b+5^
100226D1  44 7C 50 61 78 4F 59 60 29 51 5D 59 46 3D 37 32  D¦PaxOY`)Q]YF=72
100226E1  61 56 2D 7E 54 64 7C 36 4E 58 63 70 24 6E 35 2E  aV-~Td¦6NXcp$n5.
100226F1  3D 37 5C 5C 2A 74 50 5C 6E 6C 4B 2E 40 5B 5F 5D  =7\\*tP\nlK.@[_]
10022701  68 79 2D 7C 21 77 25 5B 37 70 51 7B 60 61 6C 5C  hy-¦!w%[7pQ{`al\
10022711  40 49 6C 3D 59 6F 3B 55 60 65 79 27 70 34 5A 42  @Il=Yo;U`ey'p4ZB
10022721  51 5A 4D 6B 76 4F 41 47 5D 62 21 61 73 65 5A 3E  QZMkvOAG]b!aseZ>
10022731  6A 50 37 33 60 78 36 26 29 57 71 37 66 3D 48 3A  jP73`x6&)Wq7f=H:
10022741  27 42 4E 78 6D 3D 27 14 00 00 00 77 75 61 75 73  'BNxm='¶   wuaus
10022751  65 72 76 00 48 25 7B 74 27 5E 7E 79 50 7D 74 4D  erv H%{t'^~yP}tM
10022761  30 35 5B 67 6C 75 60 34 40 56 4F 00 00 00 00 00  05[glu`4@VO
10022771  74 7E 6E 50 2A 44 48 63 69 69 31 5E 7D 54 72 7C  t~nP*DHcii1^}Tr¦
10022781  79 57 64 36 68 65 7E 70 57 27 35 67 43 41 25 00  yWd6he~pW'5gCA%
10022791  31 72 26 24 6B 55 5F 26 4D 2E 46 53 34 2A 78 00  1r&$kU_&M.FS4*x
100227A1  36 75 5D 48 38 67 40 7D 3A 70 31 4B 25 44 7C 00  6u]H8g@}:p1K%D¦
100227B1  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
100227C1  00 00 00 00 00 00 00 00 00 00 00 B0 44 3B 00 B0             ░D; ░
100227D1  44 3B 00 00 00 00 00 00 00 00 00 00 00 00 00 00  D;
100227E1  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
100227F1  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
10022801  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Persistence Management - DllRegisterServer

- If McAfee's anti-virus service is detected, it would not use regsvr32.exe to invoke the DllUnregisterServer export function
- It will copy of regsvr32.exe to update.exe, run update.exe and then invoke the DllUnregisterServer export function

Persistence Management – Registry Setup



Key: *HK_LM\Software\Microsoft\RPC*
Sub Key: Security

xor(not(one-byte key))[Decrypted Configuration]

```
10020D50 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
10020D60 00 00 00 00 00 00 00 00 0A 00 00 00 68 65 6C 70        ◘    help
10020D70 73 76 63 00 00 00 00 00 00 00 00 00 00 00 00 00 svc
```

Key: *HK_LM\Software\Microsoft\Windows NT\Current Version\Svchost\*
Sub Key: netsvcs

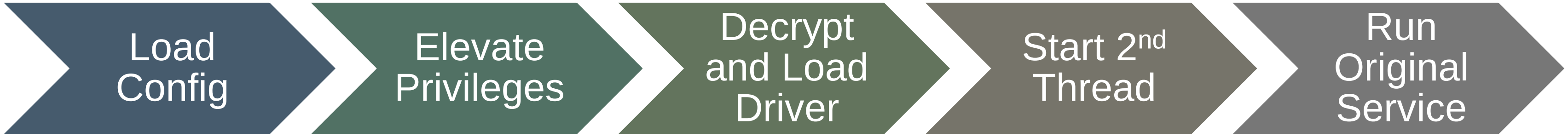
Key: *HK_LM\System\CurrentControlSet\Service\Persistent Service Name\Parameter*
Sub Key: ServiceDll

Technical Analysis

Payload

Inside ServiceMain

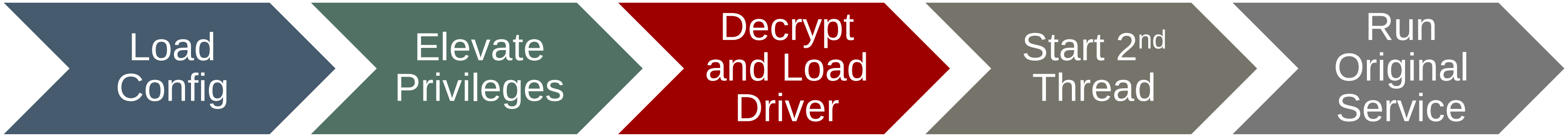
- Main Thread



- SeDebugPrivilege
- SeLoadDriverPrivilege
- SeShutdownPrivilege
- SeTcbPrivilege

Optional Embedded Driver

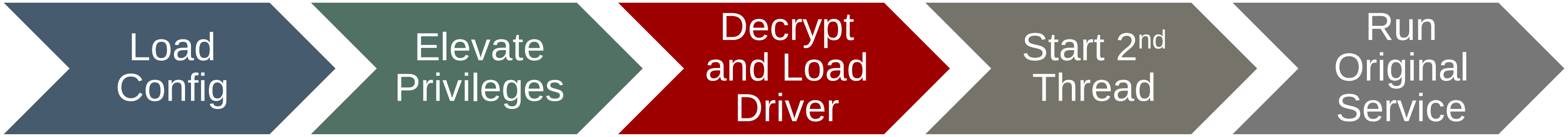
- Main Thread



- Not all samples contain an embedded driver
- XOR-encrypted, with 4-byte key
- Conditions for decrypting and loading driver
  - » 360’s ZhuDongFangYu.exe must not be running (optional)
  - » The username of the current process must be “system”

Embedded Driver

- Main Thread



- Example Drivers:
  - » Keylogger
  - » USB/Disk infector
  - » Network hooking driver

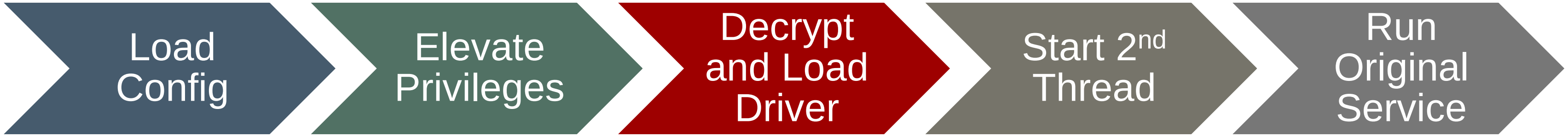
Embedded Driver – USB/Disk Infector

- Derusbi Sample (MD5: 92d18d1ca7e66539873be7f5366b04d1)

- Iterate all directories on the disk
- Drop Derusbi when service DLLs found
- Create autorun.inf to auto-register Derusbi when the infected drive is connected to a computer

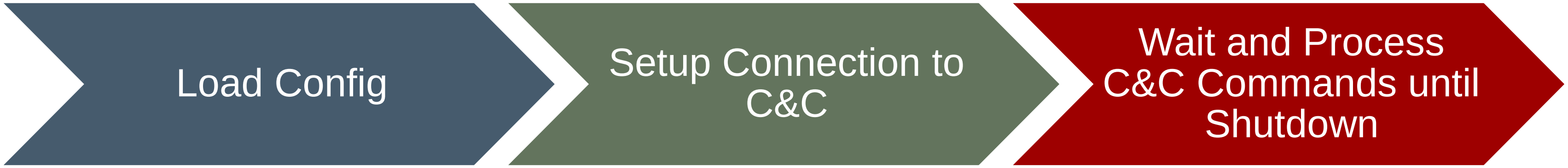
Inside ServiceMain

- Main Thread



Load Config → Elevate Privileges → Decrypt and Load Driver → Start 2nd Thread → Run Original Service

- Second Thread



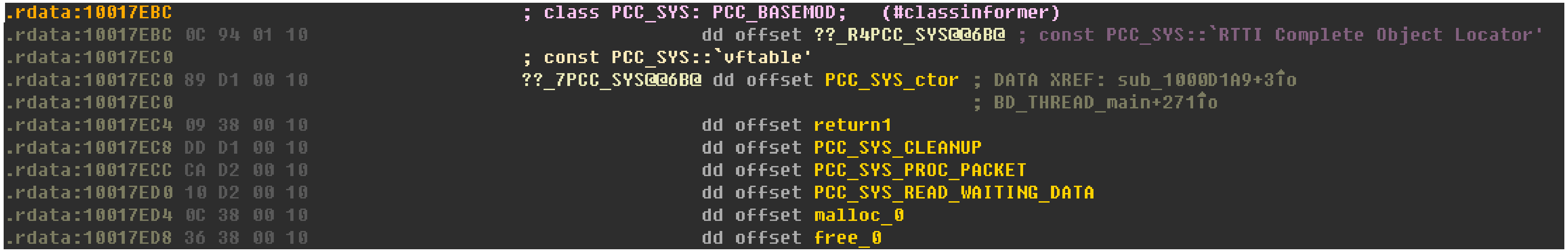
Load Config → Setup Connection to C&C → Wait and Process C&C Commands until Shutdown

Technical Analysis

Built-in modules

Built-in Classes

- Written in C++
- RTTI information!
  - » Thanks to IDA ClassInformer plugin



```
.rdata:10017EBC                               ; class PCC_SYS: PCC_BASEMOD;   (#classinformer)
.rdata:10017EBC 0C 94 01 10                                    dd offset ??_R4PCC_SYS@@6B@ ; const PCC_SYS::`RTTI Complete Object Locator'
.rdata:10017EC0                               ; const PCC_SYS::`vftable'
.rdata:10017EC0 89 D1 00 10                   ??_7PCC_SYS@@6B@ dd offset PCC_SYS_ctor ; DATA XREF: sub_1000D1A9+3↑o
.rdata:10017EC0                                                                       ; BD_THREAD_main+271↑o
.rdata:10017EC4 09 38 00 10                                    dd offset return1
.rdata:10017EC8 DD D1 00 10                                    dd offset PCC_SYS_CLEANUP
.rdata:10017ECC CA D2 00 10                                    dd offset PCC_SYS_PROC_PACKET
.rdata:10017ED0 10 D2 00 10                                    dd offset PCC_SYS_READ_WAITING_DATA
.rdata:10017ED4 0C 38 00 10                                    dd offset malloc_0
.rdata:10017ED8 36 38 00 10                                    dd offset free_0
```

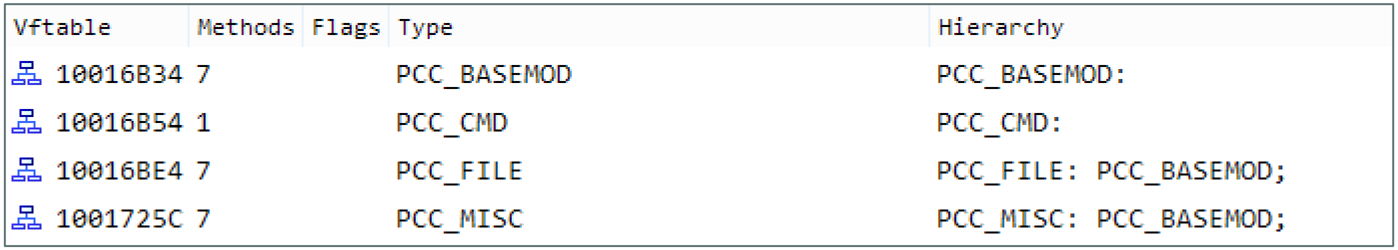
- Unfortunately, some 2014 samples uses updated classes

Some Built-in Class Names

- INTERNAL_CMD
- PCC_BASEMOD
- PCC_CMD
- PCC_FILE
- PCC_MISC
- PCC_PROXY
- PCC_SYS

Built-in Class Hierarchy

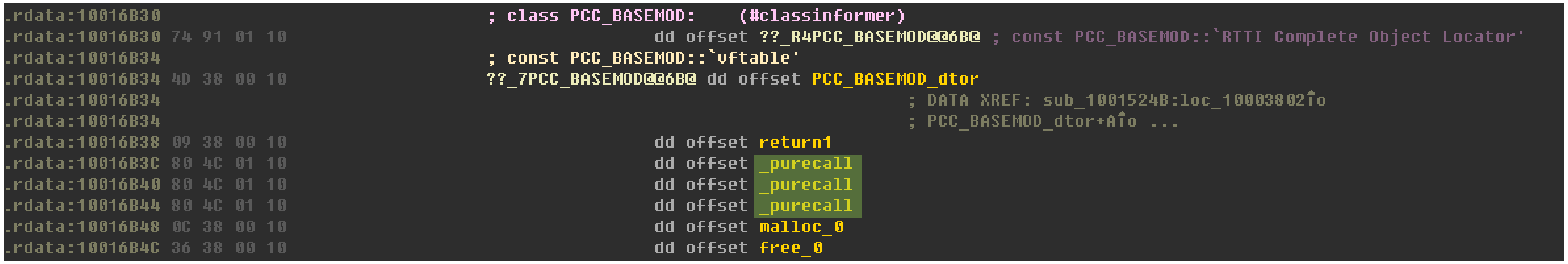
- All command classes are child classes of abstract class PCC_BASEMOD



Vftable	Methods	Flags	Type	Hierarchy
10016B34	7		PCC_BASEMOD	PCC_BASEMOD:
10016B54	1		PCC_CMD	PCC_CMD:
10016BE4	7		PCC_FILE	PCC_FILE: PCC_BASEMOD;
1001725C	7		PCC_MISC	PCC_MISC: PCC_BASEMOD;

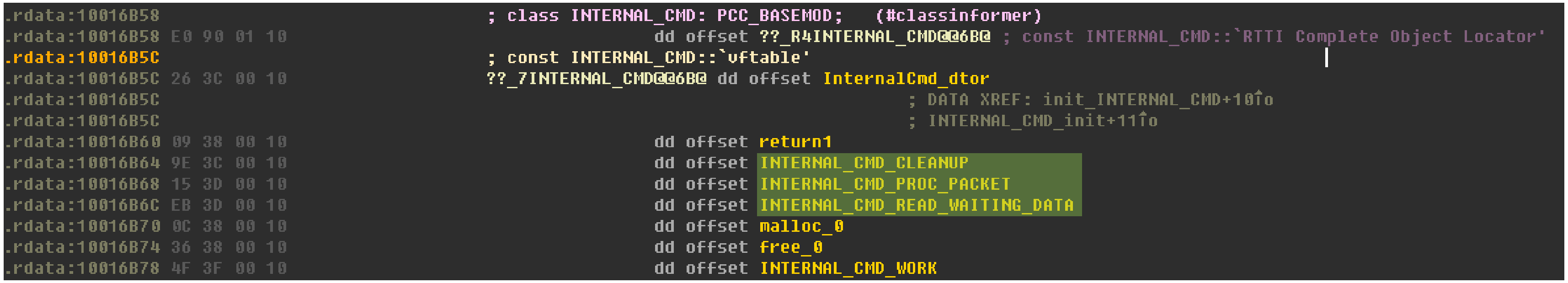
Built-in Command Class Functions

- PCC_BASEMOD



```
.rdata:10016B30                               ; class PCC_BASEMOD:    (#classinformer)
.rdata:10016B30 74 91 01 10                                   dd offset ??_R4PCC_BASEMOD@@6B@ ; const PCC_BASEMOD::`RTTI Complete Object Locator'
.rdata:10016B34                               ; const PCC_BASEMOD::`vftable'
.rdata:10016B34 4D 38 00 10                   ??_7PCC_BASEMOD@@6B@ dd offset PCC_BASEMOD_dtor
.rdata:10016B34                                                                       ; DATA XREF: sub_1001524B:loc_10003802↑o
.rdata:10016B34                                                                       ; PCC_BASEMOD_dtor+A↑o ...
.rdata:10016B38 09 38 00 10                                   dd offset return1
.rdata:10016B3C 80 4C 01 10                                   dd offset _purecall
.rdata:10016B40 80 4C 01 10                                   dd offset _purecall
.rdata:10016B44 80 4C 01 10                                   dd offset _purecall
.rdata:10016B48 0C 38 00 10                                   dd offset malloc_0
.rdata:10016B4C 36 38 00 10                                   dd offset free_0
```

- INTERNAL_CMD



```
.rdata:10016B58                               ; class INTERNAL_CMD: PCC_BASEMOD;   (#classinformer)
.rdata:10016B58 E0 90 01 10                                   dd offset ??_R4INTERNAL_CMD@@6B@ ; const INTERNAL_CMD::`RTTI Complete Object Locator'
.rdata:10016B5C                               ; const INTERNAL_CMD::`vftable'
.rdata:10016B5C 26 3C 00 10                   ??_7INTERNAL_CMD@@6B@ dd offset InternalCmd_dtor
.rdata:10016B5C                                                                       ; DATA XREF: init_INTERNAL_CMD+10↑o
.rdata:10016B5C                                                                       ; INTERNAL_CMD_init+11↑o
.rdata:10016B60 09 38 00 10                                   dd offset return1
.rdata:10016B64 9E 3C 00 10                                   dd offset INTERNAL_CMD_CLEANUP
.rdata:10016B68 15 3D 00 10                                   dd offset INTERNAL_CMD_PROC_PACKET
.rdata:10016B6C EB 3D 00 10                                   dd offset INTERNAL_CMD_READ_WAITING_DATA
.rdata:10016B70 0C 38 00 10                                   dd offset malloc_0
.rdata:10016B74 36 38 00 10                                   dd offset free_0
.rdata:10016B78 4F 3F 00 10                                   dd offset INTERNAL_CMD_WORK
```

- Novetta, 2014 describes some of these functions for an older Derusbi sample

Built-in Command Class Functions – Con’t

- There is also a default handler
  - packet_type/class_id: 100h
- Some of its functions:
  - Terminate current connection (deprecated)
  - Cleanup data stored in the different modules
  - Backup configuration to registry, set current file to be deleted on reboot, terminate current process immediately
  - Terminate after current jobs
  - Install a new DLL

Built-in Command Class Examples

- INTERNAL_CMD (supersedes PCC_CMD class)
  - » 2011 – Present
    - Some samples from 2012 do not have this class though
  - » Class ID: 5
  - » Interactive shell commands
  - » Has help/? functions!!!
  - » Common OS operations (v1.1)
    - cd, dir, md, rd, del, copy, ren, type, start
  - » Additional commands in v1.2
    - runas
    - reboot *[-f]*
    - shutdown *[-f]*
    - clearlog
    - wget *[httpurl]*

Built-in Command Class Examples – Con’t

- PCC_MISC
  - 2011 – Present
  - Most samples have this class
  - Class ID: 10
  - Mixture of numerical and text commands
  - Command IDs:
    - ID=1: save attached file to temp dir and load as DLL. Can remember up to 16 files.
    - ID=2: delete temp file. Attached filename must correspond to one of the 16 saved from command ID 1

Built-in Command Class Examples – Con’t

- PCC_MISC
  - 2011 – Present
  - Most samples have this class
  - Class ID: 10
  - Mixture of numerical and text commands
  - Text commands:
    - “pstore”: steals password information from IE and firefox and send to C2
    - “keylog": send keylog info to C2
    - “info”: gathers system information and send to C2
      - OS name and build number
      - Network adapter info
      - IE version
      - Proxy server info
      - AV info (Norton, 360, Kaspersky, Trend Micro, ESET, Avira)

Built-in Command Class Examples – Con’t

- PCC_SYS
  - » 2008 – Present
  - » Almost all samples have this class
  - » Class ID: 4 (80h in older samples)
  - » 4 types of numerical commands
    - Processes-related: enumerate and kill processes
    - Services-related: enumerate, start, stop, delete services
    - Registry-related: enumerate, create/delete keys, set/delete/replace values
    - Screenshot command
  - » Each type contains its own command IDs

Built-in Command Class Functions

- PCC_FILE
  - 2008 – Present
  - Almost all samples have this class
  - Class ID: 8 (84h in older samples)
  - Numerical commands
    - Cleanup
    - Enumerate all drives
    - Find/rename/delete/copy/move file
    - Save a file to system
    - Recursively enumerate directory
    - Start new process
    - Recursively enumerate all drives

Current generation (2014 – Present)

- Old code, just packed
  - Class structure and functions from 2011/2012
  - Compatibility/on-going attack?
- New version
  - Same payload delivery
  - Updated built-in classes

Updated Built-in Classes

- Still written in C++
- No RTTI information
- Updated/rewritten classes
  - » Custom code for creating new() objects
  - » New is_this_data_for_me() virtual function
  - » Dynamically decrypt embedded helper DLL during class initialization
    - Inject helper DLL into explorer.exe in class command handler function
    - Communicate with helper DLL using pipes
  - » Removed duplicate functionality in modules

Updated Built-in Classes – Con’t

- Command IDs changed
- No more verbose commands
- No interactive shell
- PCC_SYS, PCC_FILE, default_handler functionality still there
- Identify newer OS like Win8 (but no Win 8.1 or 10)
- Processor architecture detection(x86, x64, IA64, ARM)

Conclusion

Challenges and Remediation

- Samples circulating between vendors
  - » Limited number of samples
  - » Delayed discovery
  - » Corrupt files
- To improve detection
  - » Class/modular structure
  - » IPS
  - » Sakula/Shyape

Summary

- Modular
- Fully-featured for stealth and espionage
- Targeted attacks
- Operations could take up to 2 years

Any questions?

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