# Internet Explorer 11 Exploit Cheat Sheets

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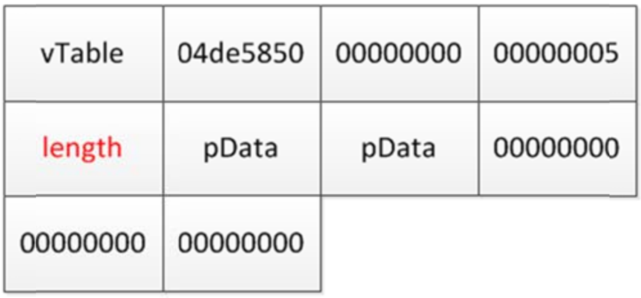
## 1. Javascript Array

### 1.1 PoC

All PoCs are at https://github.com/demi6od
Array Spray.html

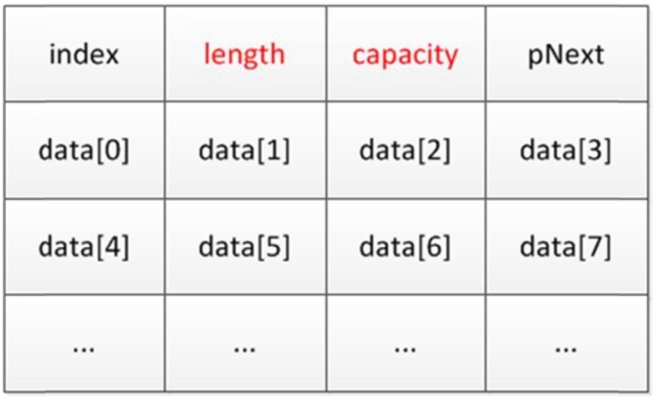
### 1.2 Data Struct

jscript9!Js::JavascriptArray



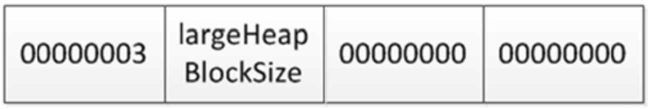
| | | | |
|---|---|---|---|
| vTable | 04de5850 | 00000000 | 00000005 |
| length | pData | pData | 00000000 |
| 00000000 | 00000000 | | |

ArrayData



| | | | |
|---|---|---|---|
| index | length | capacity | pNext |
| data[0] | data[1] | data[2] | data[3] |
| data[4] | data[5] | data[6] | data[7] |
| ... | ... | ... | ... |

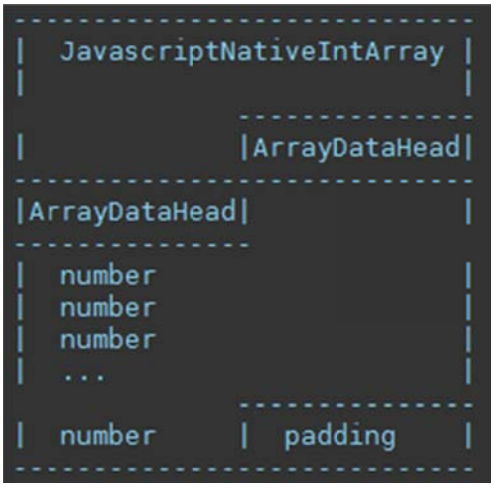
jscript9!LargeHeapBlock Entry



| | | | |
|---|---|---|---|
| 00000003 | largeHeap BlockSize | 00000000 | 00000000 |

## 1.3 Adjacent JavascriptNativeIntArray Spray

If size <= 0x100, allocate adjacent JavascriptNativeIntArray and ArrayData.



```
-----------------------------
|  JavascriptNativeIntArray |
|                           |
               --------------
|             |ArrayDataHead|
-----------------------------
|ArrayDataHead|             |
--------------
|  number                   |
|  number                   |
|  number                   |
|  ...                      |
               --------------
|  number     |  padding    |
-----------------------------
```

```
0:007> dd    02d0d000 l40
02d0d000   68662f54 02d362a0 00000000 00000005
02d0d010   00000030 02d0d028 02d0d028 00000000
02d0d020   00000001 02ab5e50 00000000 00000030
02d0d030   00000030 00000000 00adc0df 44444444
02d0d040   44444444 44444444 44444444 44444444
02d0d050   44444444 44444444 44444444 44444444
02d0d060   44444444 44444444 44444444 44444444
02d0d070   44444444 44444444 44444444 44444444
02d0d080   44444444 44444444 44444444 44444444
02d0d090   44444444 44444444 44444444 44444444
02d0d0a0   44444444 44444444 44444444 44444444
02d0d0b0   44444444 44444444 44444444 44444444
02d0d0c0   44444444 44444444 44444444 44444444
02d0d0d0   44444444 44444444 44444444 44444444
02d0d0e0   44444444 44444444 44444444 44444444
02d0d0f0   44444444 00adc0df 00000000 00000000
```

**Sensitive length**

**JavascriptNativeIntArray**

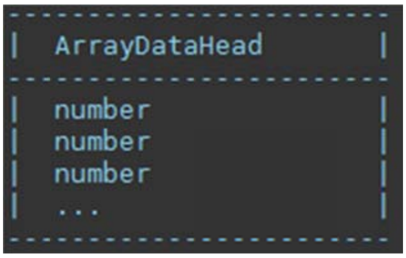
**ArrayDataHead**

**Padding**

**Data**

## 1.4 Separate small JavascriptNativeIntArray Spray

If 0x100 <= size <= 0x 300, allocate separate ArrayData.



```
 -----------------------
|  ArrayDataHead        |
 -----------------------
|  number               |
|  number               |
|  number               |
|  ...                  |
 -----------------------
```

```
0:007> dd 02820600
02820600   00000000 000000bc 000000bc 00000000
02820610   00adc0df 44444444 44444444 44444444
02820620   44444444 44444444 44444444 44444444
02820630   44444444 44444444 44444444 44444444
02820640   44444444 44444444 44444444 44444444
02820650   44444444 44444444 44444444 44444444
02820660   44444444 44444444 44444444 44444444
02820670   44444444 44444444 44444444 44444444
```

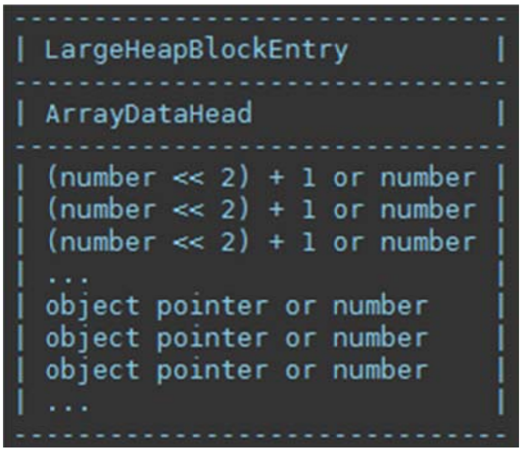
Sensitive length

ArrayDataHead

Data

## 1.5 Separate large JavascriptNativeIntArray or JavascriptArray Spray

If size >= 0x300, allocate separate ArrayData and put into LargeHeapBlock.



```
 -----------------------------
| LargeHeapBlockEntry         |
 -----------------------------
| ArrayDataHead               |
 -----------------------------
| (number << 2) + 1 or number |
| (number << 2) + 1 or number |
| (number << 2) + 1 or number |
| ...                         |
| object pointer or number    |
| object pointer or number    |
| object pointer or number    |
| ...                         |
 -----------------------------
```

```
0:007> dd 0d0d0000
0d0d0000   00000000 0000fff0 00000000 00000000
0d0d0010   00000000 00003ff8 00003ff8 00000000
0d0d0020   0eadc0df 41410011 41410021 41410031
0d0d0030   41410041 41410051 41410061 41410071
0d0d0040   41410081 41410091 414100a1 414100b1
0d0d0050   414100c1 414100d1 414100e1 414100f1
0d0d0060   41410101 41410111 41410121 41410131
0d0d0070   41410141 41410151 41410161 41410171
```

Sensitive length

LargeHeapBlockEntry

ArrayDataHead

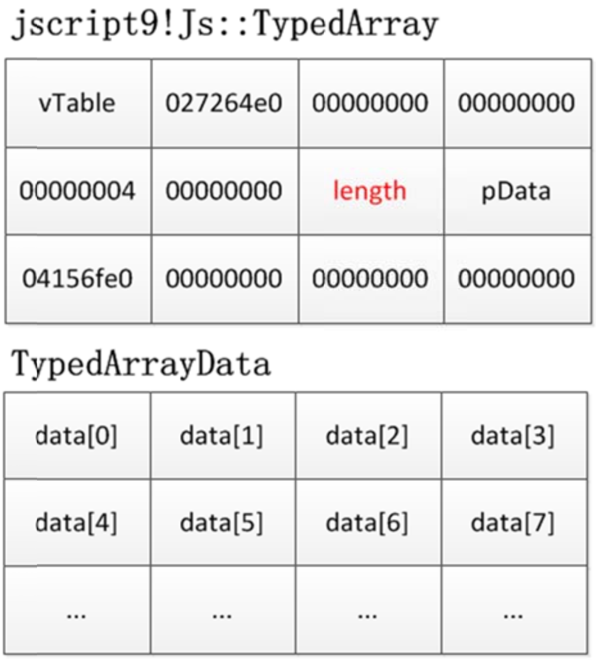
**Data**

# 2. Javascript Typed Array

## 2.1 PoC

VarArr+TypedArr Spray.html

## 2.2 Data Struct



jscript9!Js::TypedArray

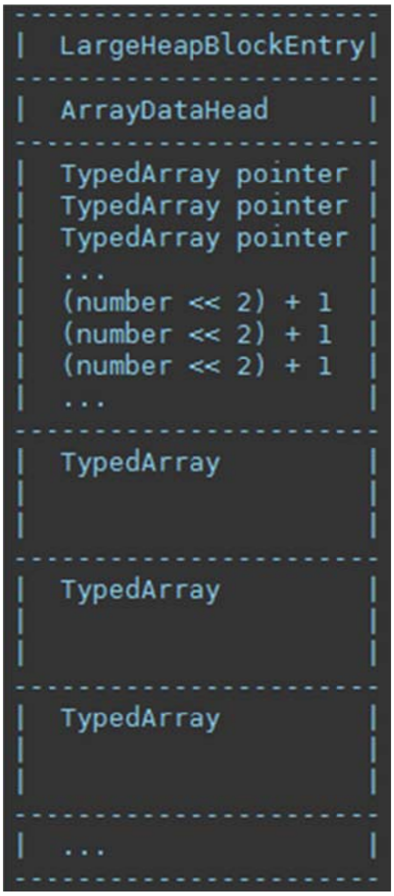
| | | | |
|---|---|---|---|
| vTable | 027264e0 | 00000000 | 00000000 |
| 00000004 | 00000000 | length | pData |
| 04156fe0 | 00000000 | 00000000 | 00000000 |

TypedArrayData

| | | | |
|---|---|---|---|
| data[0] | data[1] | data[2] | data[3] |
| data[4] | data[5] | data[6] | data[7] |
| ... | ... | ... | ... |

## 2.3 VarArray & TypedArray Spray

Heap fengshui to allocate adjacent VarArrayData and TypedArray



```
-----------------------
|  LargeHeapBlockEntry|
-----------------------
|  ArrayDataHead      |
-----------------------
|  TypedArray pointer |
|  TypedArray pointer |
|  TypedArray pointer |
|  ...                |
|  (number << 2) + 1  |
|  (number << 2) + 1  |
|  (number << 2) + 1  |
|  ...                |
-----------------------
|  TypedArray         |
|                     |
|                     |
-----------------------
|  TypedArray         |
|                     |
|                     |
-----------------------
|  TypedArray         |
|                     |
|                     |
-----------------------
|  ...                |
-----------------------
```

```
0:016> dd 0d0d0000
0d0d0000   00000000 0000eff0 00000000 00000000
0d0d0010   00000000 00003bf8 00003bf8 00000000
0d0d0020   0d0cff60 0d0cff90 0d0cffc0 0d0df000
0d0d0030   0d0df030 0d0df060 0d0df090 0d0df0c0
0d0d0040   0d0df0f0 0d0df120 0d0df150 0d0df180
0d0d0050   0d0df1b0 0d0df1e0 0d0df210 0d0df240
0d0d0060   0d0df270 0d0df2a0 0d0df2d0 0d0df300
0d0d0070   0d0df330 0d0df360 0d0df390 0d0df3c0
0:016> dd 0d0df000 - 10
0d0deff0   41410341 41410351 41410361 00adc0dd
0d0df000   686eb238 03bc6480 00000000 00000000
0d0df010   00000004 00000000 0000001a 01063648
0d0df020   03ee6fe0 00000000 00000000 00000000
0d0df030   686eb238 03bc6480 00000000 00000000
0d0df040   00000004 00000000 0000001a 01063648
0d0df050   03ee6fe0 00000000 00000000 00000000
```

Sensitive length

LargeHeapBlockEntry

ArrayDataHead

Data

# 3. HTML Element Property String

## 3.1 PoC

ElemProp Spray.html

## 3.2 HTML Element Property String Spray

If blockSize > 0x80000, allocate virtual memory directly instead of windows heap management.

```
0:016> dd 0d0a0000
0d0a0000    0d2b0000 0ce90000 00000000 00000000
0d0a0010    00100000 00100000 55f4959c 04000000
0d0a0020    deadc0de 3d0d0320 3d0d1320 ff0d2320
0d0a0030    ffffffff 3d0d43ff 3d0d5320 3d0d6320
0d0a0040    00200020 3d0d8300 0d0df300 3d0da320
0d0a0050    3d0db320 3d0dc320 3d0dd320 0d618820
0d0a0060    3d0df30d 3d1d0308 3d1d1320 3d1d2320
0d0a0070    3d1d3320 3d1d4320 3d0d0d64 3d1d6320
```

**VirtualMemoryHead**

# 4. Reference

[1] The Art of Leaks (@ga1ois)
https://cansecwest.com/slides/2014/The%20Art%20of%20Leaks%20-%20read%20version%20-%20Yoyo.pdf

[2] hacking ie11 32-bit: write once, bypass all (@bluerust)
http://hi.baidu.com/bluerust/item/8fffe0e5e60a623c86d9deff

[3] Windows 8.1 + IE 11 Exploit (@exp-sky)
http://www.exp-sky.org/windows-81-ie-11-exploit.html

[4] Exploiting Internet Explorer 11 64-bit on Windows 8.1 Preview (Ivan Fratric)
http://ifsec.blogspot.jp/2013/11/exploiting-internet-explorer-11-64-bit.html