No Loitering: Exploiting Lingering Vulnerabilities in Default COM Objects

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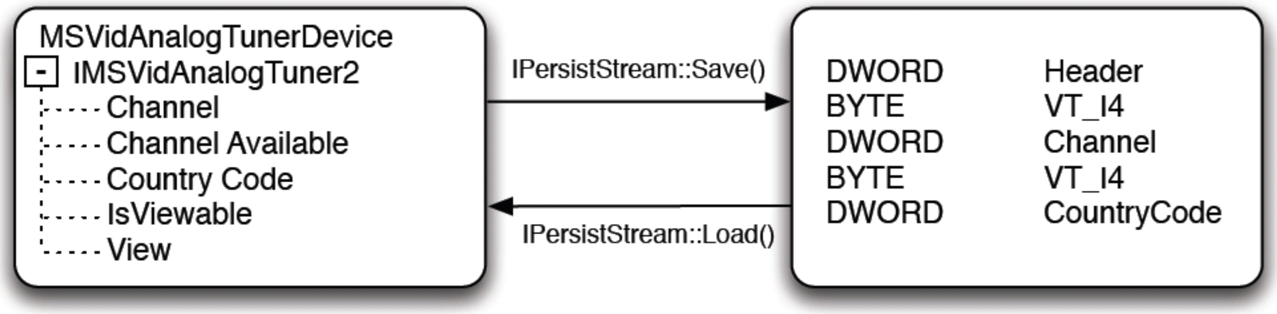
Introduction

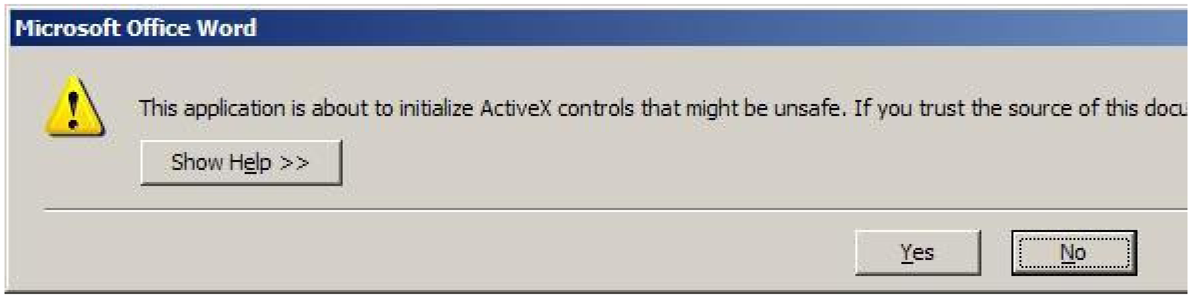
COM Background – Introduction

- **Language-neutral design philosophy for the creation of components for MS Windows**
- **Defines a base framework for creating plugins and components for myriad MS products**
- **Plugins are identified by a GUID or class id (CLSID) stored in the Windows Registry**
- **Allows for the persistence of object state between instantiations**



COM Background – Security

- Enforcing the instantiation of third-party objects is a significant security concern
- Currently, few discrete applications enforce a black list
- CLSID's are checked at instantiation time against a list in the Windows Registry
- As vulnerabilities are discovered in COM objects, they are often just listed in the killbit list – not actually fixed


Microsoft Office Word

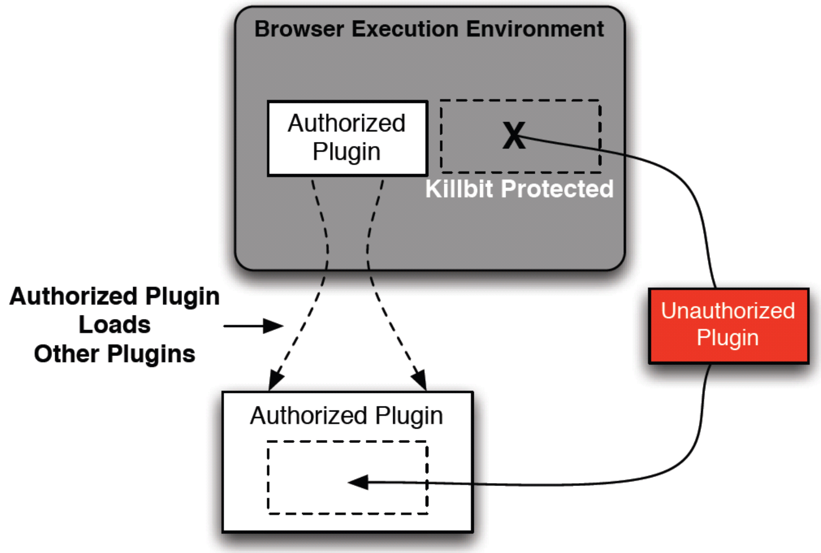
This application is about to initialize ActiveX controls that might be unsafe. If you trust the source of this docu

COM Background – Management

- **Average Windows install will have 1000’s of COM Objects**
- **Current killbit list has over 600 entries**
- **Many libraries contain multiple COM objects**

Vulnerability Characterization – Architectural Weakness

- **Black lists are only enforced on controls loaded by the base executable itself**
- **Trusted COM objects may load any other object – without security verification**
- **By creating a specially crafted persistence stream, one COM object can be coerced into loading another**



Vulnerability Characterization – Attack Requirements

An attacker must have the following:

1)An application that will render adversary-controlled content

Internet Explorer, MS Word, MS Excel, Adobe Reader, etc.

2)An application that will load COM objects

Internet Explorer, MS Word, MS Excel, Adobe Reader, etc.

3)A COM object that will in turn load other COM objects

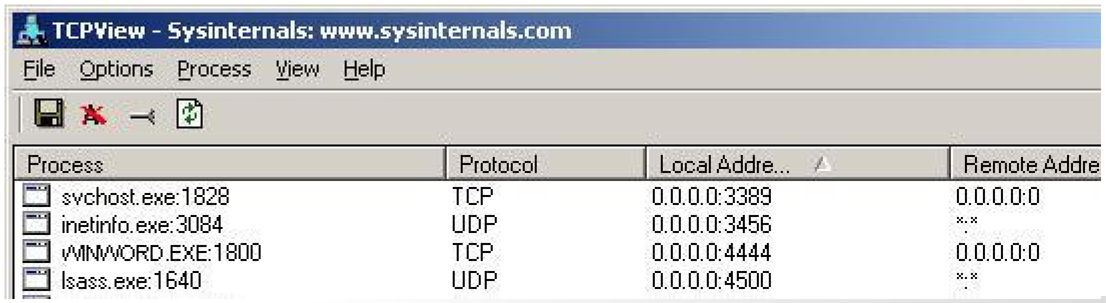
Many objects that are based on the MS ATL

4)A vulnerable object that can be exploited

Killbit list is has over 600 entries

Vulnerability Characterization – Proof of Concept

1) **Create a MS Word Document – can be emailed, rendered by browser, etc.**
2) **COM objects can be embedding in Word right through the GUI**
3) **Load MS Date and Time picker control**
4) **Have the control above load Microsoft Helper Object for Java**
5) **Exploit vulnerability in Helper Object for Java**


TCPView - Sysinternals: www.sysinternals.com
File Options Process View Help

Process	Protocol	Local Addre...	Remote Addre
svchost.exe:1828	TCP	0.0.0.0:3389	0.0.0.0:0
inetinfo.exe:3084	UDP	0.0.0.0:3456	*:*
WINWORD.EXE:1800	TCP	0.0.0.0:4444	0.0.0.0:0
lsass.exe:1640	UDP	0.0.0.0:4500	*:*

Vulnerability Characterization – Breadth of Attack

- **Many applications allow instantiation of COM objects**
  - MS Office, Adobe Reader, Internet Explorer, Flash, etc.
- **A new application could be created today**
- **Trying to secure each application individually is a fool’s errand**

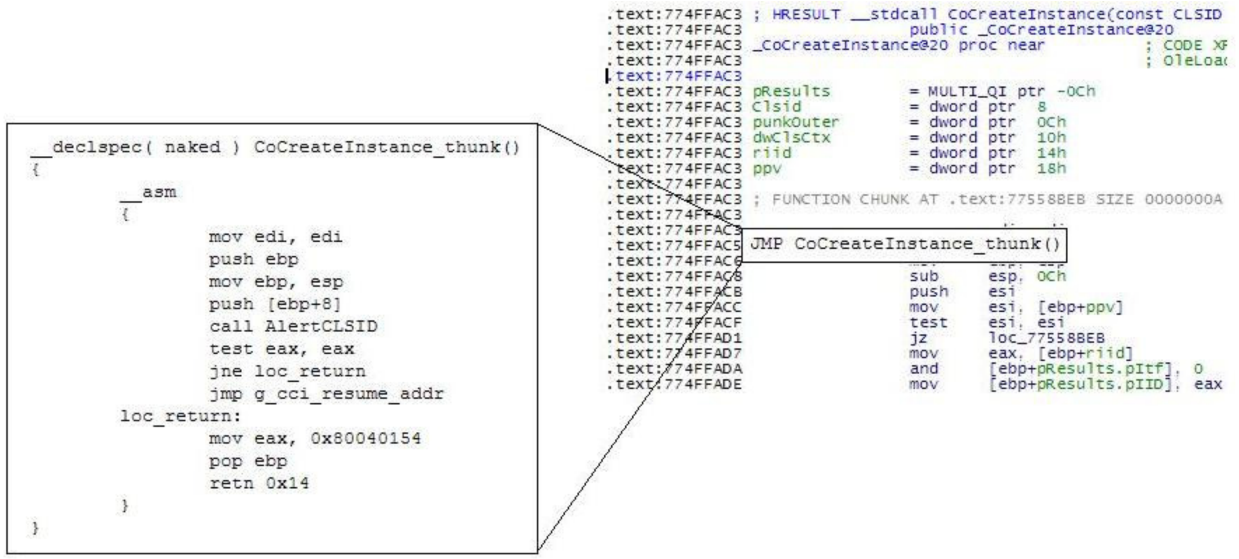
Mitigation Architecture – Assumptions

- **Our goal is to prevent the exploitation of this vulnerability on a *clean system***
- **We intend to adhere to Microsoft's design model**
- **We do not intend to protect infected systems**
- **We do not intend to protect against the instantiation of COM objects by malicious COM containers**

- **BOTTOM LINE: We intend to stop the initial attack**

Mitigation Architecture – High-Level Architecture

- **Hook every COM instantiation API**
- **Look up the CLSID in a pre-defined black list**
- **Terminate the instantiation as necessary**

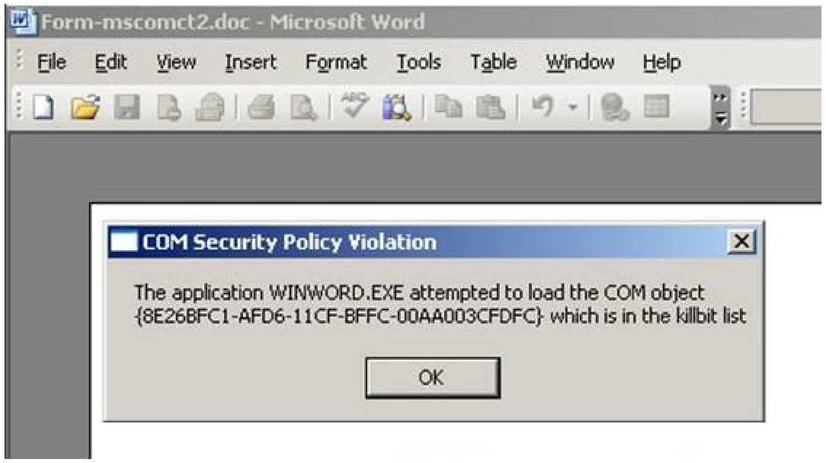


```
__declspec( naked ) CoCreateInstance_thunk()
{
        __asm
        {
                mov edi, edi
                push ebp
                mov ebp, esp
                push [ebp+8]
                call AlertCLSID
                test eax, eax
                jne loc_return
                jmp g_cci_resume_addr
        loc_return:
                mov eax, 0x80040154
                pop ebp
                retn 0x14
        }
}
```

```
.text:774FFAC3 ; HRESULT __stdcall CoCreateInstance(const CLSID
.text:774FFAC3                 public _CoCreateInstance@20
.text:774FFAC3 _CoCreateInstance@20 proc near          ; CODE XF
.text:774FFAC3                                         ; OleLoa
.text:774FFAC3
.text:774FFAC3 pResults        = MULTI_QI ptr -0Ch
.text:774FFAC3 Clsid           = dword ptr  8
.text:774FFAC3 punkOuter       = dword ptr  0Ch
.text:774FFAC3 dwClsCtx        = dword ptr  10h
.text:774FFAC3 riid            = dword ptr  14h
.text:774FFAC3 ppv             = dword ptr  18h
.text:774FFAC3
.text:774FFAC3 ; FUNCTION CHUNK AT .text:77558BEB SIZE 0000000A
.text:774FFAC3
.text:774FFAC3
.text:774FFAC5 JMP CoCreateInstance_thunk()
.text:774FFAC6
.text:774FFAC8                 sub     esp, 0Ch
.text:774FFACB                 push    esi
.text:774FFACC                 mov     esi, [ebp+ppv]
.text:774FFACF                 test    esi, esi
.text:774FFAD1                 jz      loc_77558BEB
.text:774FFAD7                 mov     eax, [ebp+riid]
.text:774FFADA                 and     [ebp+pResults.pItf], 0
.text:774FFADE                 mov     [ebp+pResults.pIID], eax
```

Results and Discussion – Effectiveness

- **Successfully stopped attacks against:**
  - MS Internet Explorer
  - MS Word
  - MS Excel
  - MS PowerPoint
  - “Homemade” COM Container
  - ActiveX Control Test Container


Form-mscomct2.doc - Microsoft Word
File
Edit
View
Insert
Format
Tools
Table
Window
Help
COM Security Policy Violation
OK

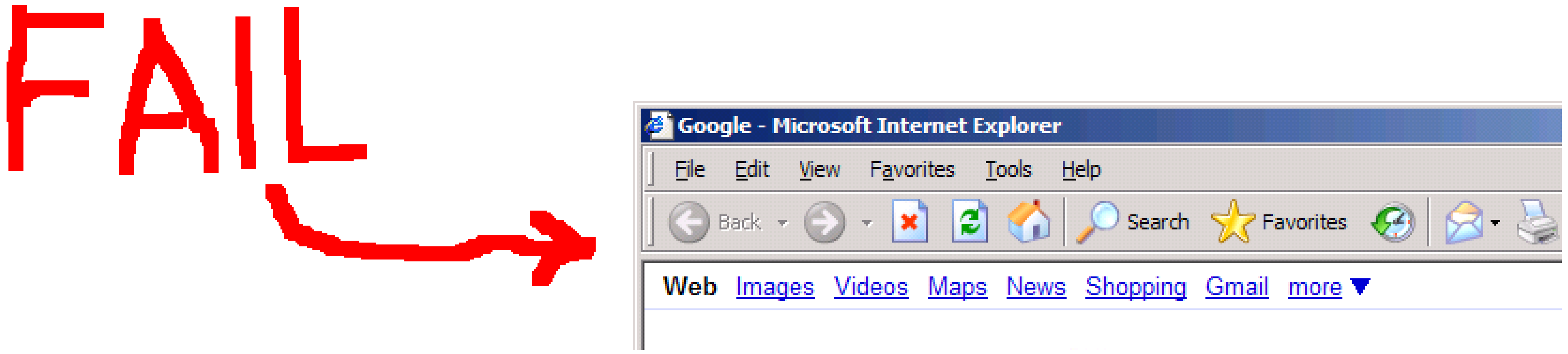
The application WINWORD.EXE attempted to load the COM object {8E26BFC1-AFD6-11CF-BFFC-00AA003CFDFC} which is in the killbit list

Results and Discussion – Performance

- **Average lookup time of 554µs**
  - 95% confidence interval of ±104µs
- **Using Microsoft API's to query registry**
  - Linear scan of registry
- **Could be improved with a more intelligent database**

Results and Discussion – Policy Creation

- Working from the killbit list is still difficult
- Experimented with creating per-application lists
- Experimented with deploying system-wide – interesting side effects


FAIL
Google - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites
Web Images Videos Maps News Shopping Gmail more

Results and Discussion – Practical Impact

- **Microsoft Security Vulnerabilities**
  - MS10-083
  - MS10-036
  - MS09-060
  - MS09-037
  - MS09-035

- **Disclosed through US-CERT VU #456745**
  - Adobe APSB09-10
  - Cisco-SA-20090728
  - F5 Networks FirePass Controls
  - SonicWALL XTSAC.cab
  - Sun Alert 264648

Conclusion

- How many gates do you have to put up?
- Standard COM architecture creates a transitive trust issue
- Many COM containers on the average Windows install
- Hundreds of vulnerable COM object lingering on the average Windows install
- Windows needs a centralized solution for the management of COM security

Questions?

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