Malware Detection using Advanced Behavior Analysis

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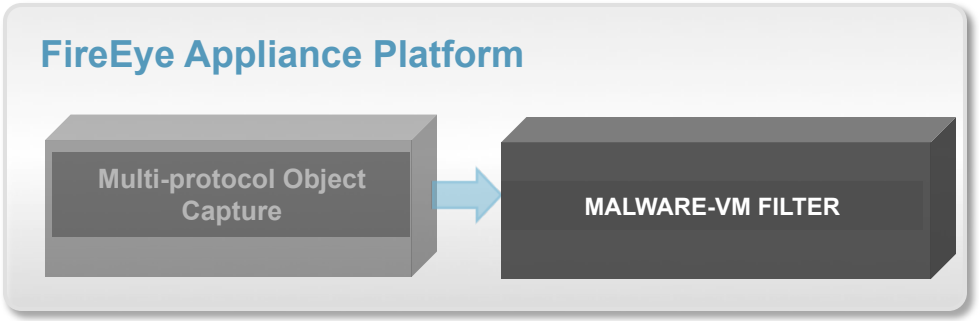
Multi-Protocol, Real-Time VX Engine



Phase 1 – Web MPS
- Aggressive Capture
- Web Object Filter

Phase 1 – Email MPS
- Email Attachments
- URL Submission

Phase 1 – MAS appliance
- User submissions
- Batch mode processing

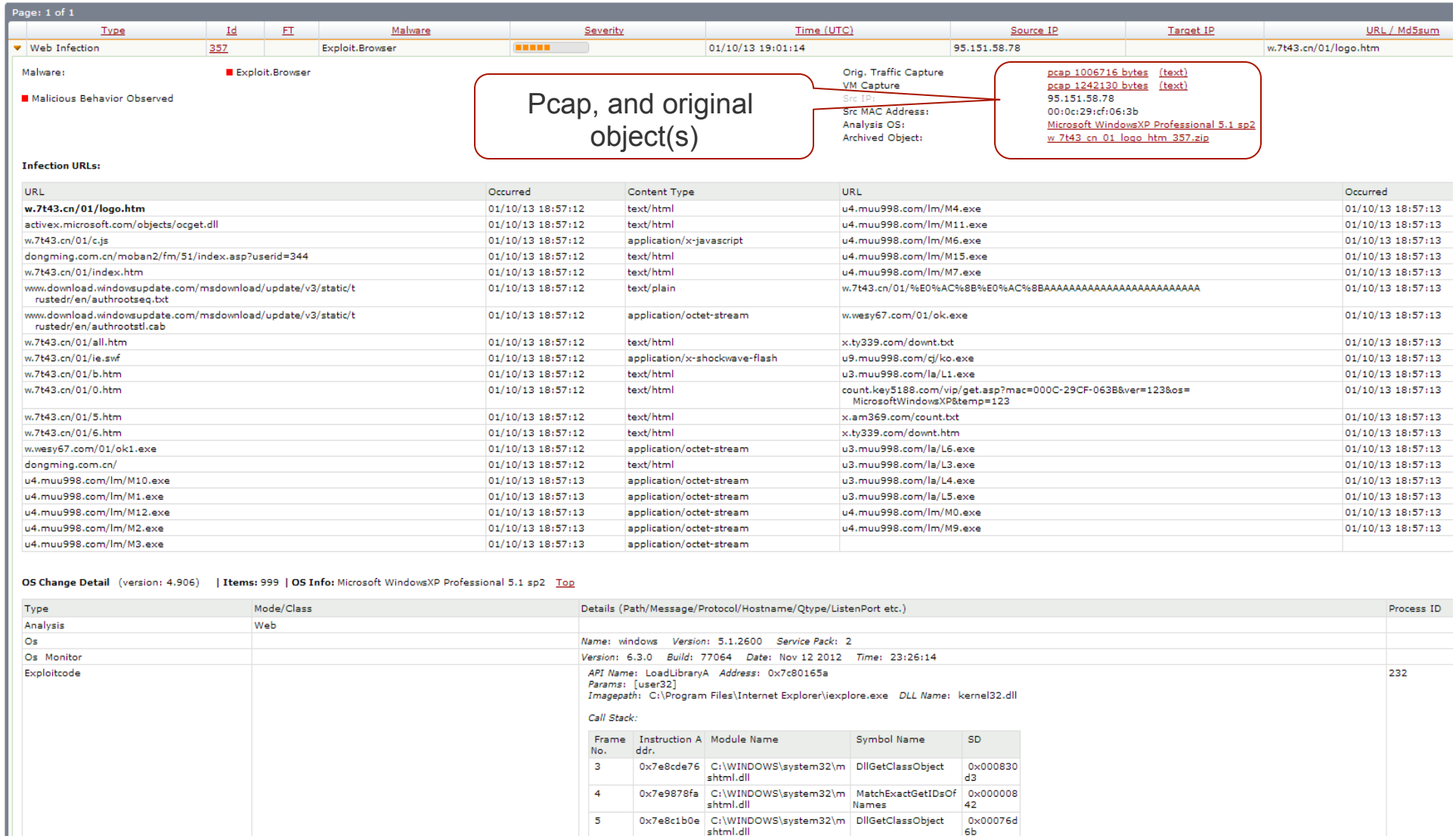
Map To Target OS&Apps

Virtual Execution Environments
Phase 2

Dynamic, real-time analysis
- Presence Of Malware
- Malware Binary
- Attack Profile
- Originating URL
- Subsequent URLs
- Obfuscation Techniques
- Host Modification Rpt
- Malware Identification
- C&C Profile
- C&C PCAP
- C&C Block List
- C&C Encryption Profile
- Management Reports
- Beaconing Volume
- Call Back Volume
- Infected Hosts
- Malware Type Reports

FireEye

Sample Web Exploit



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Type	Id	FT	Malware	Severity	Time (UTC)	Source IP	Target IP	URL / Md5sum
Web Infection	357		Exploit.Browser		01/10/13 19:01:14	95.151.58.78		w.7t43.cn/01/logo.htm

Malware: ■ Exploit.Browser

■ Malicious Behavior Observed

Pcap, and original object(s)

Orig. Traffic Capture: pcap 1006716 bytes (text)
VM Capture: pcap 1242130 bytes (text)
Src IP: 95.151.58.78
Src MAC Address: 00:0c:29:cf:06:3b
Analysis OS: Microsoft WindowsXP Professional 5.1 sp2
Archived Object: w_7t43_cn_01_logo_htm_357.zip

Infection URLs:

URL	Occurred	Content Type	URL	Occurred
w.7t43.cn/01/logo.htm	01/10/13 18:57:12	text/html	u4.muu998.com/lm/M4.exe	01/10/13 18:57:13
activex.microsoft.com/objects/ocget.dll	01/10/13 18:57:12	text/html	u4.muu998.com/lm/M11.exe	01/10/13 18:57:13
w.7t43.cn/01/c.js	01/10/13 18:57:12	application/x-javascript	u4.muu998.com/lm/M6.exe	01/10/13 18:57:13
dongming.com.cn/moban2/fm/51/index.asp?userid=344	01/10/13 18:57:12	text/html	u4.muu998.com/lm/M15.exe	01/10/13 18:57:13
w.7t43.cn/01/index.htm	01/10/13 18:57:12	text/html	u4.muu998.com/lm/M7.exe	01/10/13 18:57:13
www.download.windowsupdate.com/msdownload/update/v3/static/trustedr/en/authrootseq.txt	01/10/13 18:57:12	text/plain	w.7t43.cn/01/%E0%AC%8B%E0%AC%8BAAAAAAAAAAAAAAAAAAAAAAAA	01/10/13 18:57:13
www.download.windowsupdate.com/msdownload/update/v3/static/trustedr/en/authrootstl.cab	01/10/13 18:57:12	application/octet-stream	w.wesy67.com/01/ok.exe	01/10/13 18:57:13
w.7t43.cn/01/all.htm	01/10/13 18:57:12	text/html	x.ty339.com/downt.txt	01/10/13 18:57:13
w.7t43.cn/01/ie.swf	01/10/13 18:57:12	application/x-shockwave-flash	u9.muu998.com/cj/ko.exe	01/10/13 18:57:13
w.7t43.cn/01/b.htm	01/10/13 18:57:12	text/html	u3.muu998.com/la/L1.exe	01/10/13 18:57:13
w.7t43.cn/01/0.htm	01/10/13 18:57:12	text/html	count.key5188.com/vip/get.asp?mac=000C-29CF-063B&ver=123&os=MicrosoftWindowsXP&temp=123	01/10/13 18:57:13
w.7t43.cn/01/5.htm	01/10/13 18:57:12	text/html	x.am369.com/count.txt	01/10/13 18:57:13
w.7t43.cn/01/6.htm	01/10/13 18:57:12	text/html	x.ty339.com/downt.htm	01/10/13 18:57:13
w.wesy67.com/01/ok1.exe	01/10/13 18:57:12	application/octet-stream	u3.muu998.com/la/L6.exe	01/10/13 18:57:13
dongming.com.cn/	01/10/13 18:57:12	text/html	u3.muu998.com/la/L3.exe	01/10/13 18:57:13
u4.muu998.com/lm/M10.exe	01/10/13 18:57:13	application/octet-stream	u3.muu998.com/la/L4.exe	01/10/13 18:57:13
u4.muu998.com/lm/M1.exe	01/10/13 18:57:13	application/octet-stream	u3.muu998.com/la/L5.exe	01/10/13 18:57:13
u4.muu998.com/lm/M12.exe	01/10/13 18:57:13	application/octet-stream	u4.muu998.com/lm/M0.exe	01/10/13 18:57:13
u4.muu998.com/lm/M2.exe	01/10/13 18:57:13	application/octet-stream	u4.muu998.com/lm/M9.exe	01/10/13 18:57:13
u4.muu998.com/lm/M3.exe	01/10/13 18:57:13	application/octet-stream		

OS Change Detail (version: 4.906) | **Items:** 999 | **OS Info:** Microsoft WindowsXP Professional 5.1 sp2 Top

Type	Mode/Class	Details (Path/Message/Protocol/Hostname/Qtype/ListenPort etc.)	Process ID
Analysis	Web		
Os		*Name*: windows *Version*: 5.1.2600 *Service Pack*: 2	
Os Monitor		*Version*: 6.3.0 *Build*: 77064 *Date*: Nov 12 2012 *Time*: 23:26:14	
Exploitcode		*API Name*: LoadLibraryA *Address*: 0x7c80165a *Params*: [user32] *Imagepath*: C:\Program Files\Internet Explorer\iexplore.exe *DLL Name*: kernel32.dll *Call Stack:*	232

Frame No.	Instruction Addr.	Module Name	Symbol Name	SD
3	0x7e8cde76	C:\WINDOWS\system32\mshtml.dll	DllGetClassObject	0x000830d3
4	0x7e9878fa	C:\WINDOWS\system32\mshtml.dll	MatchExactGetIDsOfNames	0x0000842
5	0x7e8c1b0e	C:\WINDOWS\system32\mshtml.dll	DllGetClassObject	0x00076d6b

DLL Entry Points

File	Close	C:\WINDOWS\system\DVL MD5: d41d8cd98f00b204e9800998ecf8427e SHA1: da39a3ee5e6b4b0d3255bfef95601890afd80709
Regkey	Setval	\REGISTRY\MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run\"Rsskplm" = rundll32.exe C:\WINDOWS\system32\ngnvkf97.dll,Start
Malicious Alert	Misc Anomaly	*Message*: Startup services added *Detail*: Malware adding itself to windows startup areas
File	Created	C:\WINDOWS\system32\ngnvkf97.dllmmc.pkm
File	Close	C:\WINDOWS\system32\ngnvkf97.dllmmc.pkm MD5: 8d9c307cb7f3c4a32822a51922d1ceaa SHA1: b51a60734da64be0e618bacbea2865a8a7dcd669
Folder	Open	C:\Documents and Settings\Administrator\Cookies
File	Open	C:\Documents and Settings\Administrator\Cookies\index.dat
Mutex		*Imagepath*: C:\WINDOWS\system32\rundll32.exe
Regkey	Setval	\REGISTRY\USER\S-1-5-21-527237240-1580818891-725345543-500\Software\Microsoft\Windows\CurrentVersion\Internet Settings\"ProxyEnable" = 0x00000000
Regkey	Setval	\REGISTRY\USER\S-1-5-21-527237240-1580818891-725345543-500\Software\Microsoft\Windows\CurrentVersion\Internet Settings\Connections\"SavedLegacySettings" = 46 00 00 00 e6 03 00 00 01 00 00 00 0d 00 00 00 31 30 2e 30 2e 30 2e 32 3a 38 30 38 30 00 00 0 0 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 0
Driver	Loaded	*Registrypath*: \Registry\Machine\System\CurrentControlSet\Services\ngnvkf97 *Driverimage*: \??\C:\WINDOWS\system32\drivers\ngnvkf97.sys *Method*: NtLoadDriver *Imagepath*: C:\WINDOWS\system32\services.exe
Malicious Alert	Misc Anomaly	*Message*: Malware is loading a driver
Regkey	Deleteval	\REGISTRY\MACHINE\SOFTWARE\Microsoft\Windows\CurrentVersion\Run\"Rsskplm"
Malicious Alert	Misc Anomaly	*Message*: Startup services deleted *Detail*: Malware deleting entries in windows startup areas

Entry point passed to driver by malware in user mode

Kernel mode driver

File	Created	C:\WINDOWS\system32\cobox.dll
Malicious Alert	Misc Anomaly	*Message*: System services modified *Detail*: New exe/dll/sys file created under WINDOWS or SYSTEM32 directories
Process	Started	C:\WINDOWS\system32\rundll32.exe *Packed*: no *GUI*: no *Parentname*: C:\malware.exe *Command Line*: Rundll32 C:\WINDOWS\system32\cobox.dll Exucute
Mutex		\BaseNamedObjects\SHIMLIB_LOG_MUTEX

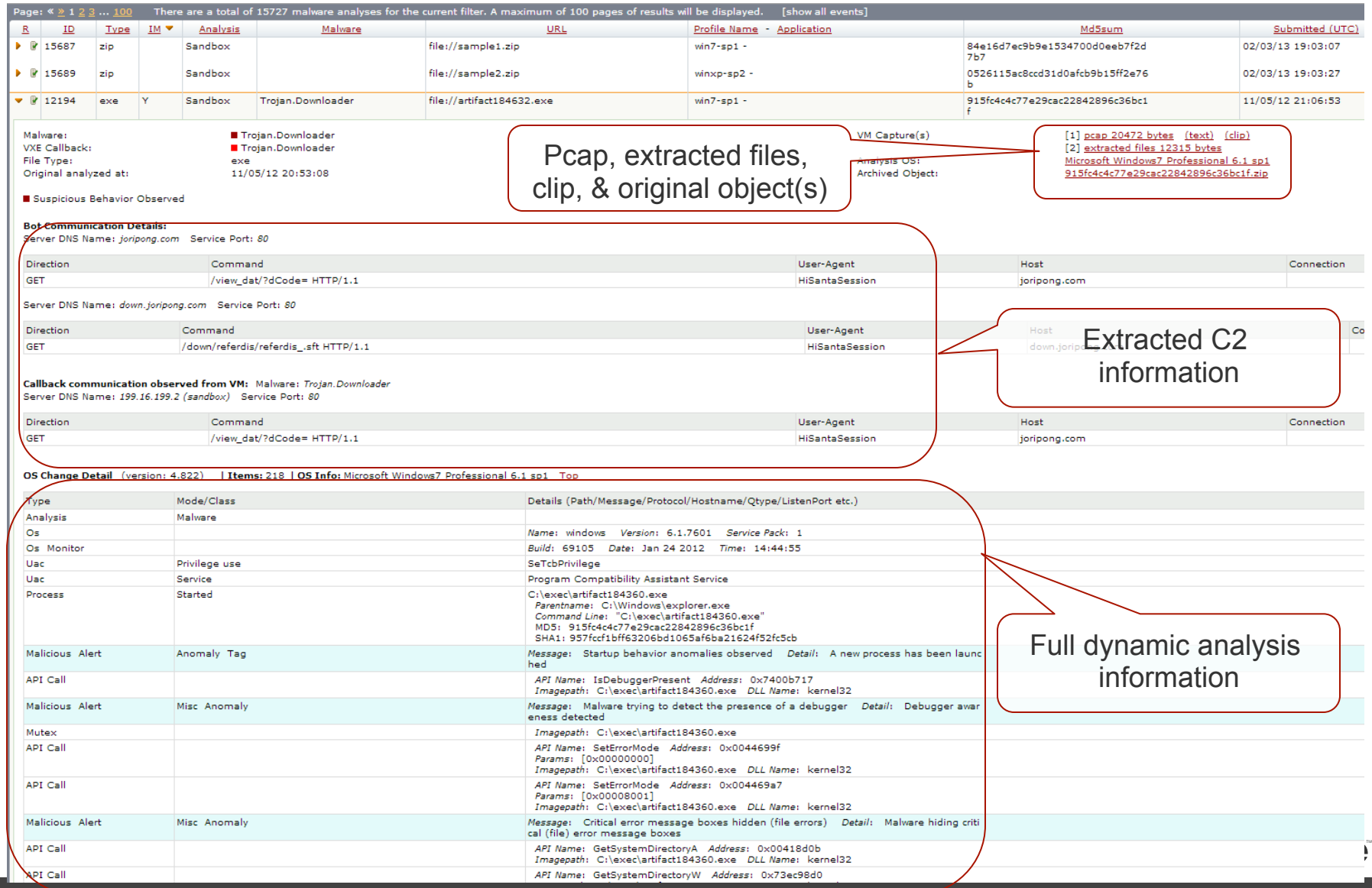
Recent PDF Zero-Day Sleep Example

OS Change Detail (version: 4.975) | **Items:** 1020 | **OS Info:** Microsoft WindowsXP Professional 5.1 sp2 Top

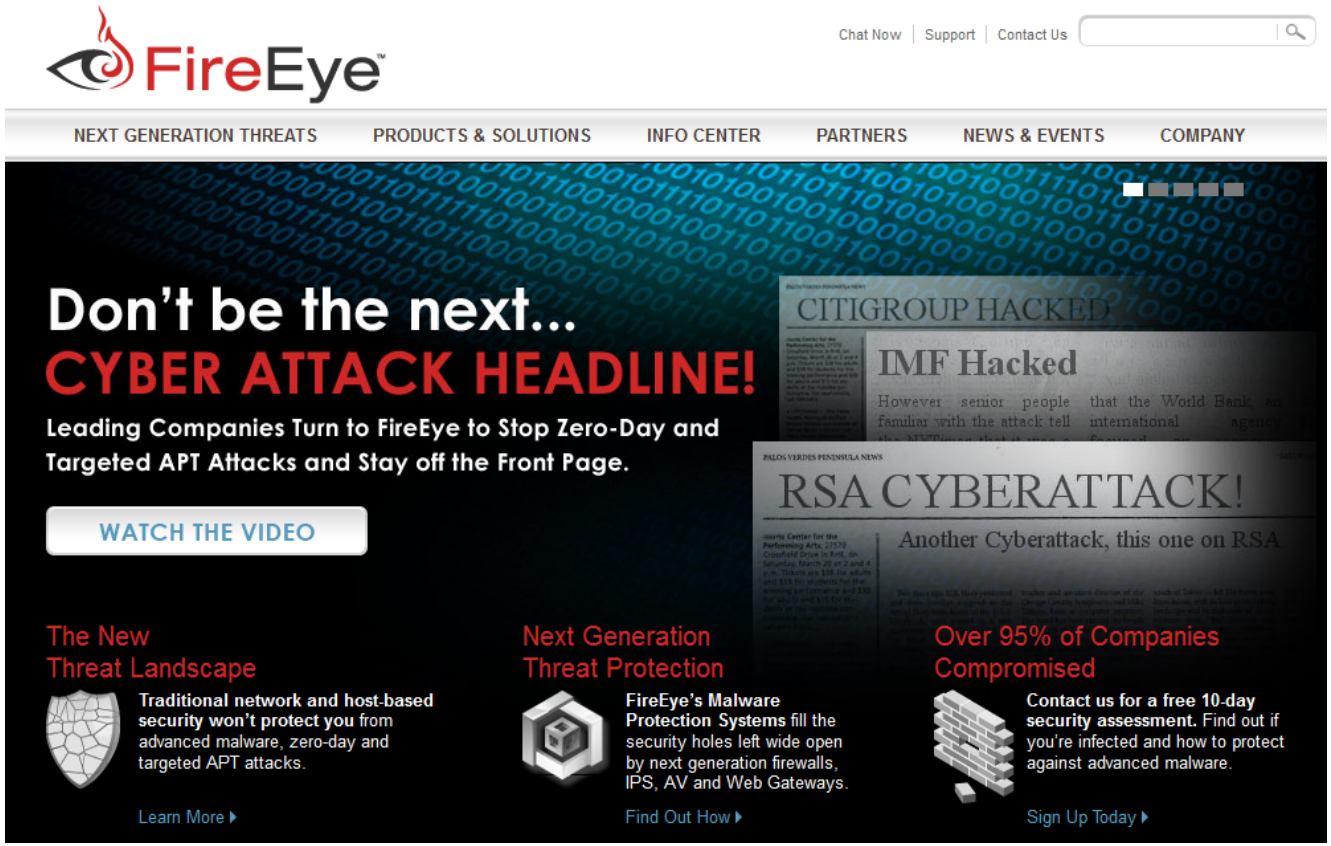
Type	Mode/Class	Details (Path/Message/Protocol/Hostname/Qtype/ListenPort etc.)	Process ID	Parent ID	File Size
Analysis	Malware				
Os		*Name*: windows *Version*: 5.1.2600 *Service Pack*: 2			
Os Monitor		[redacted]			
Process	Started	C:\WINDOWS\system32\rundll.exe *Parentname*: C:\WINDOWS\system32\cmd.exe *Command Line*: "c:\windows\system32\rundll.exe" "c:\[redacted].dll" MD5: [redacted] SHA1: [redacted]	400	644	720896
Malicious Alert	Anomaly Tag	*Message*: Startup behavior anomalies observed *Detail*: A new process has been launched			
API Call		*API Name*: SystemTimeToFileTime *Address*: 0x7c833ece *Params*: [0x12f0a4, 0x12eef8] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
API Call		*API Name*: SystemTimeToFileTime *Address*: 0x0045f9ff *Params*: [0x12f094, 0x12f08c] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
API Call		*API Name*: SystemTimeToFileTime *Address*: 0x7c833ece *Params*: [0x12f9d8, 0x12f82c] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
API Call		*API Name*: SystemTimeToFileTime *Address*: 0x0045f9ff *Params*: [0x12f9c8, 0x12f9c0] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
API Call		*API Name*: SystemTimeToFileTime *Address*: 0x7c833ece *Params*: [0x12f8f4, 0x12f748] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
API Call		*API Name*: SystemTimeToFileTime *Address*: 0x0045f9ff *Params*: [0x12f8e4, 0x12f8dc] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
3 Repeated items skipped					
API Call		*API Name*: SetErrorMode *Address*: 0x7c8219fb *Params*: [32769] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
API Call		*API Name*: SetErrorMode *Address*: 0x7c821ce6 *Params*: [1] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
DLL Exports		*DLL Name*: c:\97777F~1.DLL *Exports*: [Call32W, Call32W@16, CallW, CallW@16, ClearPropVariantArray, ClearVariantArray, DllCanUnloadNow, DllGetClassObject, DllMain, DllMain@12, DllRegisterServer, DllUnregisterServer, GetProxyDllInfo, InitPropVariantFromBooleanVector, InitPropVariantFromBuffer, InitPropVariantFromCLSID, InitPropVariantFromDoubleVector, InitPropVariantFromFileTime, InitPropVariantFromFileTimeVector, InitPropVariantFromGUIDAsString, InitPropVariantFromInt16Vector, InitPropVariantFromInt32Vector, InitPropVariantFromInt64Vector, InitPropVariantFromPropVariantVectorElem, InitPropVariantFromResource, InitPropVariantFromStrRet, InitPropVariantFromStringAsVector, InitPropVariantFromStringVector, InitPropVariantFromUInt16Vector, InitPropVariantFromUInt32Vector, InitPropVariantFromUInt64Vector]			
DLL Loaded		*Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Path*: C:\[redacted].dll MD5: [redacted] SHA1: [redacted]	400		
API Call		*API Name*: WaitForMultipleObjectsEx *Address*: 0x77df9b26 *Params*: [2, 0xe7ff6c, 0, 300000, 1] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		
Regkey	Added	\REGISTRY\USER\S-1-5-21-1409082233-688789844-725345543-1003\SOFTWARE\Microsoft\Windows\CurrentVersion\Internet Settings	400		
API Call		*API Name*: Sleep *Address*: 0x666c3689 *Params*: [15000] *Imagepath*: C:\WINDOWS\system32\rundll.exe *DLL Name*: kernel32.dll	400		

Tracking sleep call

MAS Object and Info Availability



FireEye Security Assessment



http://www.fireeye.com/stopapts

FireEye

How to Detect Advanced Malware

- Implement automated behavior analysis of inbound network traffic using virtual analysis techniques
  - Analyze multiple version of Adobe files and Microsoft Office files
  - Java exploits
  - DLL injects
  - Heap spray attacks
- Implement automated mechanisms to discover Call-back Channels via behavioral analysis
- Implement automated dynamic behavior analysis mechanism to evaluate email attachments and URLs to identify and protect against targeted spear phishing attacks

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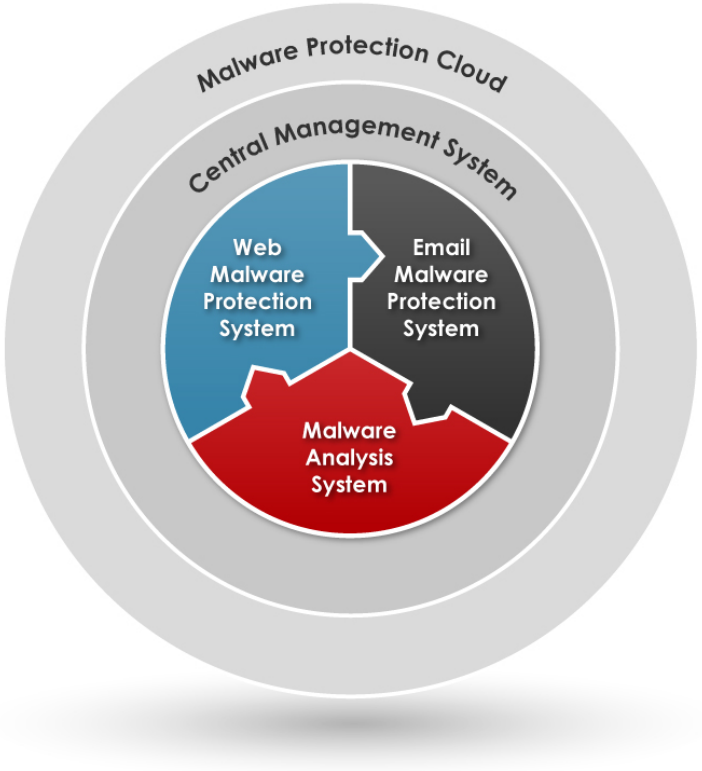
FireEye Advanced Malware Protection

Complete Protection Against Advanced Malware



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