Distributed Trust Management and Rogue AV Software

Angelos D. Keromytis
Columbia University
DTM – Motivation

• Distributed system defenses built as “islands”
  – Forced to make assumptions re: topology, other defenses …
    • Locally correct, globally incorrect security enforcement
  – Assumptions fail or are exploited by attackers!

• Our work is motivated by real security incidents experienced first hand
  – “Pushing Boulders Uphill: The Difficulty of Network Intrusion Recovery”

• DTM forces these assumptions in the open, allowing systems to verify them continuously
Overall Approach

• Define policies that take into consideration system-wide context
  – Extend security mechanisms to emit contextual information (continuous or event-based)
  – Distribute information to interested components

• Integrate IDS/ADS, access control, reaction

• Challenges:
  – Accuracy (extracting data from noise)
  – Complexity (defining policies)
  – Performance (scale with users, system, events)
**Arachne**

- **ARACHNE** is a system for the coordinated distribution and evaluation of a system-wide policy on different nodes
  - Several prototype systems for enterprise-level security have been developed
- **GOAL:** Integrate a variety of different, diverse security mechanisms and policy expression methods
  - Achieve enhanced protection over any individual method
  - Allow exchange of information between different mechanisms (Eliminate the possibility of “locally correct” but globally wrong decisions)
  - Capture trade-offs between amount of global context, scalability, etc.
Specific Tasks (Years 1-3)

- Develop language for expressing DTM policies
  - "Arachne: Integrated Enterprise Security Management"

- Design DTM architecture
  - "Asynchronous Policy Evaluation and Enforcement"

- Collaborative/Distributed policy enforcement
  - "F3ildCrypt: End-to-End Protection of Sensitive Information in Web Services"
  - "Path-based Access Control for Enterprise Networks"
Contributions

- Framework for integrating all types of defenses
- Proof of feasibility
  - Prototype, preliminary performance, security analysis
- Initial exploration of design options
- Education (GRA training, coursework integration)
- Outreach
  - Tech transition to the government (operations)
Future Directions

- Continue work on refining architecture and system
  - Explore performance/scalability, effectiveness, overhead tradeoffs

- Integrate with QTM
  - Particularly important in federated systems (e.g., dynamically composable SOAs)

- Investigate the use of reactive mechanisms
  - Global coordination of dynamic defenses
Expected Contributions in Years 4 & 5

• Proof of feasibility
  – Experimentation in real environment
• Exploration of design and implementation space
• Use of active defenses and deceit
  – Can we challenge attackers’ (trust) assumptions?
Outreach and Education

- Integrated material into COMS W4180 course
- 2 invited talks (beyond conference talks) and 1 panel
- Main Ph.D. GRA now working for NSA (R23)
Work on Rogue AV Campaigns

• Working with Symantec to determine modus operandi of rogue AV sites (and why users trust them)

"Gone Rogue: An Analysis of Rogue Security Software Campaigns"

“An Analysis of Rogue AV Campaigns”
Kerik Pleads Guilty, and Faces 27 to 33 Months in Jail
By SAM DOLNICK 38 minutes ago
Bernard B. Kerik, the former New York police commissioner, will be sentenced in February for tax fraud and making false statements.

Insider Trading Charges for 14, Some Tied to Galleon
By ALEX BERENSON 28 minutes ago
Federal prosecutors charged 14 hedge fund employees, lawyers and other investors in criminal complaints that all appear to be connected to charges already filed against Raj Rajaratnam.

On the Hill, Protesters Chant ‘Kill the Bill’
By DAVID HERZENHORN 23 minutes ago
Thousands of demonstrators surfaced on Capitol Hill in opposition to the Democrats’ health care legislation.

Bait

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Hijack

[JavaScript Application]

Warning!!! You should install security software! Cyber Security is a good solution for your security, virus protection and spyware remover.

[OK] [Cancel]
Scare Tactics

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Payment

Software Secured Order

- WIN PC® Defender 6 Months License
  Subscription includes new version updates, definition updates, standard customer support for 6 Months. For only $49.99.

- WIN PC® Defender 1 Year License (Recommended)
  Subscription includes new version updates, definition updates, standard customer support for 1 year. Only today limited offer with special discount $239.21 $69.99.

- Lifetime UNLIMITED License, Best Choice!
  WIN PC® Defender - protection software with new generation engine, protect yourself and never worry about your PC with our unlimited package with free VIP Support. Today with special discount for only $439.21 $99.99!

[Payment form with fields for Card Number, Expiration Date, CVV2, First Last Name, Email, Country, State, Address, City, Zip, Phone]

*Your order is 100% risk free with our 30 Day Money Back Guarantee*

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Aftermath

Report: Antivirus 2009 Professional
Category: Internet Fraud

Antivirus 2009 Professional This not only a scam..IT IS A VIRUS !! Windows Security had to clean the system, took 18 hrs to remove the virus. DO NOT INSTALL THIS PROGRAM, REGARDLESS OF WHAT THE "POP-UPS" TELL YOU !! Internet

Antivirus 2009 Professional

Submitted: Thursday, August 21, 2008
Posted: Thursday, August 21, 2008

Antivirus 2009 IS a virus. It appears on your log in page and will continue as "pop up" giving you dire warnings about your computer's vulnerabilities. Don't believe it! Go back to your start menu and contact your system's security center. It took Windows almost 2 days to determine the source, then resolve it.

I also will now have to go to the bank and cancel my card. There are hidden charges, and will appear as $109.82. And you cannot print the confirmation, it freezes your system completely!

Don't be tricked into this as many of us have....contact Windows, Microsoft, BEFORE you install anything. They are already aware of this scam.

(And the overlaps and ads from this virus are lude and offensive, so be sure you have your kids check with you if they see the original "warning" that your computer is infected!)

Kate
Poplar Branch, North Carolina
U.S.A.

(Courtesy of http://www.ripoffreport.com/)
Rogue AV

- Misleading application
- Pretends to be legitimate security software, such as an anti-virus scanner
- Offers little or no protection
- Often facilitates installation of same malware it pretends to protect from
How “little” is too little?

• False alerts only
  – Tens of alerts on freshly installed machine
• “Selective” alerts
  – IE Defender spreads via Zlob malware
  – After installation, it correctly detects Zlob
• “1980-style” alerts
  – Filename, registry path checks
• Sometimes come with EULA…
Have no idea about Spyware?

Spyware, like a virus, is a malicious software planted on your PC by a third party in order to secretly monitor what you do online.

Once your browsing habits are analyzed, you are flooded with endless commercials, popups and spam from inside your PC!

Spyware also dramatically slows down your computer and Internet connection speeds.

Spyware collects your private information and steals your identity, passwords, credit card details and other.

100% remove of malicious software, viruses, spyware, malware etc.

Removes suspicious files, Facebook and MySpace account stealers.

Protect personal information from phishing.

Environment care program: $2 dollars from every sale will be sent on saving green forests in Amazonia.

Have more questions? You can contact us easy via Online Support.

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Green AV an award winning spyware removal utility will help you fighting all kinds of spyware and adware including keyloggers, trojan horses, password thieves.
Free Video Nude
Anjelina Jolie

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Microsoft Corporation, One Microsoft Way, Redmond, WA 98052

(Courtesy of www.m86security.com)
Distribution: Skype

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**Online Notification**

```
View earlier messages: 1 Day | 1 Week | 2 Weeks | 1 Month | 3 Months | 6 Months | 1 Year | All

Online Notification 6/10/09 3:23 PM

*****************************************************************
URGENT SYSTEM SCAN NOTIFICATION! PLEASE READ CAREFULLY!!

http://www.securonline.net/

For the link to become active, please click on 'Add to contacts' skype button or type it in manually into your web browser!

FULL DETAILS OF SCAN RESULT BELOW
*****************************************************************

WINDOWS REQUIRES IMMEDIATE ATTENTION

ATTENTION! Security Center has detected malware on your computer!

Affected Software:

Microsoft Windows Vista
Microsoft Windows XP
Microsoft Windows 2000
Microsoft Windows Server 2003

Impact of Vulnerability: Remote Code Execution / Virus Infection / Unexpected shutdowns

Recommendation: Users running vulnerable version should install a repair utility immediately

Your system is affected, download the patch from the address below! Failure to do so may result in severe computer malfunction.
```

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Distribution: Fake Codec

(Courtesy of threatinfo.trendmicro.com)
Distribution: Malvertisement

eWeek Web Site Leads Users to Rogue Anti-Virus (AV) Application
Date: 02.24.2009

April 15th, 2009
Scareware pops-up at FoxNews
Posted by Dancho Danchev @ 6:41 am

USAToday.com Ads Redirect to Rogue AV
Posted by Paul Royal on Thu, May 07, 2009

Home > News > New York Times serves up rogue ads to readers
New York Times serves up rogue ads to readers
Angela Moscaritolo  September 14, 2009

Gizmodo victimized by malicious advertising scam
by Steve Ragan – Oct 28 2009, 16:00

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Distribution: Drive-by Downloads

- Victim visits a legitimate web site, which has been compromised (say, via SQL injection)
- Hidden iframe redirects victim to malicious site
- Malicious site launches a number of browser and plugin exploits
- If successful, exploits download and run rogue AV on the victim’s machine
Distribution: Piggyback Trojan

- 9 April, 2009, Confiker awakens, and
- Downloads a Waledac malware,
- Which installs SpywareProtect2009,
- Which asks for $49.95 to remove “threats”
“Google recommends you to activate Antivirus 2009 to protect your PC from malicious intrusions from the Internet”
### Products

<table>
<thead>
<tr>
<th>Rank</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Spyware Guard 2008</td>
</tr>
<tr>
<td>2</td>
<td>AntiVirus 2008</td>
</tr>
<tr>
<td>3</td>
<td>AntiVirus 2009</td>
</tr>
<tr>
<td>4</td>
<td>Spyware Secure</td>
</tr>
<tr>
<td>5</td>
<td>XPAntivirus</td>
</tr>
<tr>
<td>6</td>
<td>WinFixer</td>
</tr>
<tr>
<td>7</td>
<td>SafeStrip</td>
</tr>
<tr>
<td>8</td>
<td>ErrorRepair</td>
</tr>
<tr>
<td>9</td>
<td>Internet Antivirus</td>
</tr>
<tr>
<td>10</td>
<td>DriveCleaner</td>
</tr>
</tbody>
</table>

Over 250 rogue AV programs, according to Symantec.

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Spot the Difference

(Courtesy of http://rogueantispyware.blogspot.com/)
Rebranding

• Changes in the name, logos, pictures of a rogue AV
• Helps evade detection if original version of the rogue AV has been discovered
• Minimizes the impact of credit card chargebacks and payment reversals
Basic Business Model

- Rogue AV basic: $0
- Rogue AV full: $30-$100
- Multi-year licensing: ~$20 more
- Bundling other applications: ~$20 more
- Fraudulent credit card transactions: $$$
“Click this message to purchase recommended antivirus software”

“Regular updating is needed”
Affiliate-based Business Model

- Affiliates are given a range of links and JavaScript snippets
- Links and scripts embedded in shady or compromised sites
- Victim visits affiliate-controlled web site and pays for full version of rogue AV
- Affiliate responsible for generating installation is paid 60% of installation revenue
- In economic lingo: “Affiliate-based, pay-per-sale model”
TrafficConverter.biz

• Web site used to manage affiliate
  – Provides support (files, links, etc.)
  – Tracks installation and sales

• Bonus programs
  – VIP points
  – Contests for top-selling affiliates (win a Mercedes)

• Database snatched by security researchers before its shutdown in November 2008
Affiliate earnings

- 500 active affiliates
- Per-sale price: $30
- Top affiliate purportedly earning $332K in one month (!)
- Top-10 affiliates purportedly earning $23K/week

Per-installation price

<table>
<thead>
<tr>
<th>Country</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>$0.55</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>$0.52</td>
</tr>
<tr>
<td>Canada</td>
<td>$0.52</td>
</tr>
<tr>
<td>Australia</td>
<td>$0.50</td>
</tr>
<tr>
<td>Spain</td>
<td>$0.16</td>
</tr>
<tr>
<td>Ireland</td>
<td>$0.16</td>
</tr>
<tr>
<td>France</td>
<td>$0.16</td>
</tr>
<tr>
<td>Italy</td>
<td>$0.16</td>
</tr>
<tr>
<td>Germany</td>
<td>$0.12</td>
</tr>
<tr>
<td>Belgium</td>
<td>$0.12</td>
</tr>
</tbody>
</table>
Rogue AV Campaigns

• Coordinated effort by cyber-criminals to distribute and profit from a rogue AV

• Components:
  – Malware code
  – Infrastructure used to distribute it
  – Victims that fall for it
Campaign Analysis

Data:
• 2 months in summer 2009
• 4,305 rogue AV-hosting servers (IP addresses)
• 6,500 domains

Goals:
• Infrastructure
  – How created and managed
  – Identify related sites
• How it affects clients
Whac-a-mole?
Identifying Campaigns

- Assumption: campaign is managed by a group of people, who are likely to reuse, at various stages of the campaign, the same techniques, strategies, and tools
- Approach: look for emerging patterns in infrastructure components (web sites)
Features

- IP address
- DNS domain names
- Geolocation
- Server identification name and version
- ISP
- ASN
- DNS registrar
- DNS registrant
- Uptime
Multicriteria Clustering

- **TRIAGE**
  - atTRIbution of Attack phenomena using Graph-based Event clustering

- Multicriteria clustering method
TRIAGE: a “simple” example

310 domains registered over a few days

registrants

IP networks

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A slightly more complex example

750 domains registered over a span of 8 months

Email addr. hidden by privacy protection services

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A slightly more complex example
Cluster Results

- 39 clusters with at least 10 domains
- They account for ~70% dataset
Server Geolocation
Server IPs
Activating Sites

In one-day interval:
• Moved 3 sites from GoDaddy’s parking servers to active servers
• Consolidated 4th site
Rogue AV Registrants

<table>
<thead>
<tr>
<th>Registrant’s email domain</th>
<th># Sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>gmail.com</td>
<td>1,238 (30%)</td>
</tr>
<tr>
<td>id-private.com</td>
<td>574 (14%)</td>
</tr>
<tr>
<td>whoisprivacyprotect.com</td>
<td>533 (13%)</td>
</tr>
<tr>
<td>privacyprotect.org</td>
<td>125 (3%)</td>
</tr>
<tr>
<td>mas2009.com</td>
<td>101 (2%)</td>
</tr>
</tbody>
</table>

Registrants seem to value their privacy...

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Beyond the Graphs

• Automate the identification of campaigns
• Insights into how cyber criminals operate
  – Registration strategy (time)
  – Name schemes
• Attack attribution/understanding
• Future work: early warning system
Clients

- 6 of the rogue AV-hosting servers leaked information about their clients
  - Site name
  - Client IP
  - Client Request
- No access to content of communication
- 45-day monitoring
- 372,096 distinct client IP addresses
(Potential) Victim Geolocation

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Request Types

- Scan
- Download
- Update
- Payment form
- Payment confirmation
- Report
Rogue AV Effectiveness

On sites we monitored:
- 1.26% of users visit payment page
- 0.03% attempt to complete purchase
Interaction Duration

![Graph showing observed Class C Networks vs. Days of Observation]

- **X-axis**: Days of Observation
  - 0-10
  - 10-20
  - 20-30
  - 30-40
  - 40-50

- **Y-axis**: Observed Class C Networks (#)
  - 1
  - 10
  - 100
  - 1,000
  - 10,000
  - 100,000
  - 1,000,000

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Conclusions

• Rogue AV significant threat
  – “Products”
  – Distribution mechanisms
  – Developed economy

• Our contributions
  – Understanding infrastructure
  – Identifying related sites
  – Insights into modus operandi criminals
  – Inside look at victims (potential and actual)
Some Legal Victories

• Washington State’s Attorney General obtained a $1 million settlement from Secure Computer LLC, of White Plains, NY (December 2006), distributor of Spyware Cleaner
• Microsoft and Washington State’s Attorney General filed lawsuits against Branch Software, distributor of Registry Cleaner XP
• FTC obtained $1.9 million settlement from distributors of WinFixer, WinAntivirus, DriveCleaner, ErrorSafe, and XP Antivirus