Cross-Domain Theft and the Future of Browser Security

Chris Evans and Ian Fette
Google Inc
{cevans,ifette}@google.com

OWASP

23. Jun 2010

The OWASP Foundation
http://www.owasp.org

Introduction

- Browser ecosystem is at the forefront of the war
- How is the browser ecosystem adapting?

Overview

1. Browser ecosystem threat overview
2. Past and recent developments
3. Plug-ins detour
4. Looking to the future / malware trends
5. Blacklists as a defense-in-depth measure
6. New attack areas exposed by browsers

Browser ecosystem

Browser ecosystem: threats

1. Arbitrary code execution
   - Domain-isolated
   - Sandboxed
   - Unsandboxed
2. Cross-origin data theft
3. Web-app based leaks

Recent changes

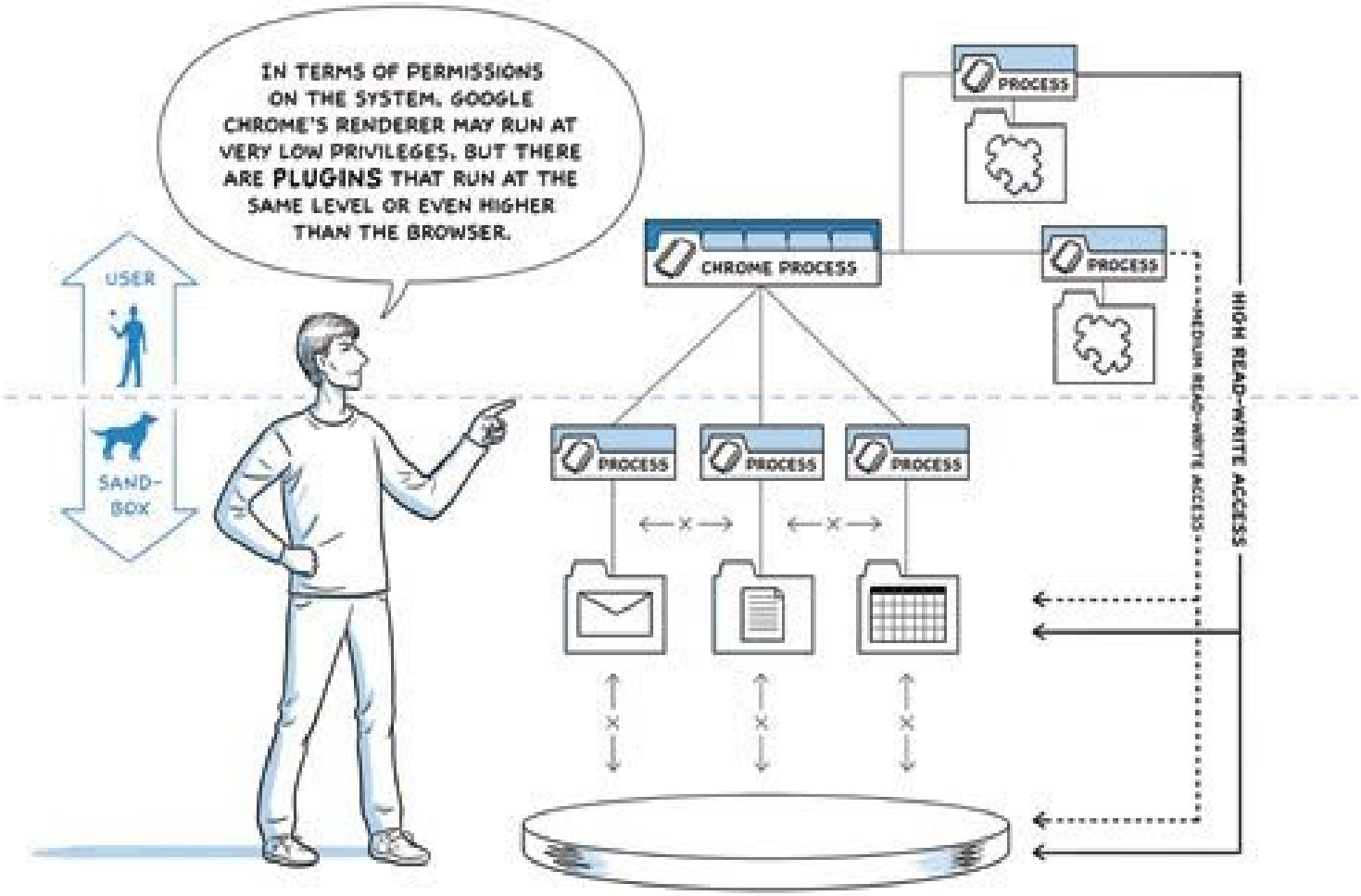
- Increased file download security
  - E-mail clients
  - Warning dialogs
  - Protected mode execution
  - Admin controls
  - Anti-virus enhancements
  - Whitelist-based security

Recent changes

- Sandboxing in browsers
  - IE7 on Vista: protected mode sandbox
  - Chromium on XP: filesystem sandbox
  - Chromium on Vista: filesystem + protected mode sandbox
  - Chromium on Linux: chroot() sandbox
  - Chromium on Mac: seatbelt sandbox

Recent changes

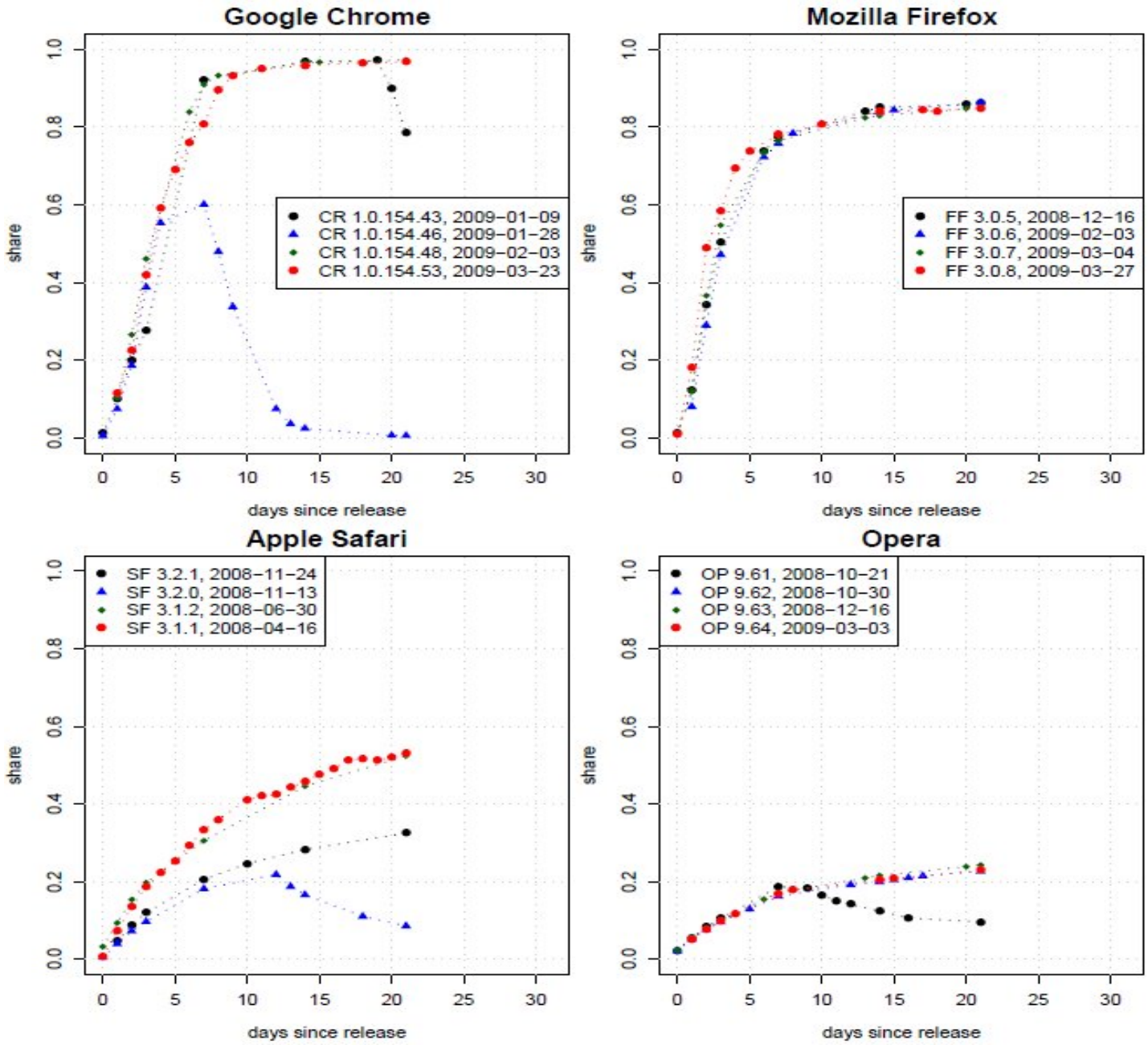
- Sandboxing in browsers



Recent changes

- Auto-updating users
  - Now widely accepted as required for security
  - On board: Windows, Google Chrome, Firefox, ...
  - Recent: Apr 2010, Adobe Reader auto-updater out of beta
- Interesting auto-update paper
  - http://www.techzoom.net/publications/silent-updates/

Auto-update



OWASP

Recent changes

- Attacker focus on plug-ins
- Plug-in stats (Google Chrome v4.1):
  - 97%: Shockwave Flash
  - 86%: Adobe Acrobat
  - 66%: Java(TM) Platform SE 6
    - Only 14% fully uptodate
  - 53%: Windows Media Player
  - 49%: Silverlight Plug-In
  - 39%: QuickTime Plug-In

Recent changes

- Attacker focus on plug-ins
- SANS Top Cyber Security Risks 2009

"Priority One... vulnerabilities in commonly used programs such as Adobe PDF Reader, QuickTime, Adobe Flash and Microsoft Office"

- News articles on theregister.co.uk
  - June 2010, "Adobe lines up emergency Flash fix"
  - April 2010, "Java code-execution vuln exploited in drive-by attack"
  - April 2010, "PDF security hole opens can of worms"
  - July 2009, "New attacks exploit vuln in (fully-patched) Adobe Flash"

Plug-in detour

Plug-ins

about:plugins

Plug-ins

Plug-ins (17) Details

Google Gears 0.5.33.0 - Version: 0.5.33.0 (Disabled)
Description: These are the Gears that power the tubes! :-)
Location: C:\Documents and Settings\cevans\Local Settings\Application Data\Google\Chrome\Application\5.0.375.70\gears.dll
Enable

Adobe Acrobat - Version: 9.3.2.163 (Disabled)
Description: Adobe PDF Plug-In For Firefox and Netscape "9.3.2"
Location: C:\Program Files\Adobe\Reader 9.0\Reader\Browser\nppdf32.dll
Enable

Java Deployment Toolkit 6.0.180.7 - Version: 6.0.180.7 (Disabled)
Description: NPRuntime Script Plug-in Library for Java(TM) Deploy
Location: C:\Program Files\Java\jre6\bin\new_plugin\npdeploytk.dll
Enable

Java(TM) Platform SE 6 U18 - Version: 6.0.180.7 (Disabled)
Description: Next Generation Java Plug-in 1.6.0_18 for Mozilla browsers
Location: C:\Program Files\Java\jre6\bin\new_plugin\npjp2.dll
Enable

Oracle JInitiator - Version: 1, 3, 1, 28 (Disabled)
Description: JInitiator 1.3.1.28 for Netscape Navigator (DLL Helper)
Location: C:\Program Files\Mozilla Firefox\plugins\NPJinit13128.dll
Enable

Microsoft® DRM - Version: 9.00.00.4503 (Disabled)
Description: DRM Netscape Network Object
Location: C:\Program Files\Windows Media Player\npdrmv2.dll
Enable

Windows Media Player Plug-in Dynamic Link Library - Version: 3.0.2.629 (Disabled)
Description: Npdsplay dll

Plug-in detour

Plug-ins

about:plugins

Plug-ins

Plug-ins (17) Details

Google Gears 0.5.33.0 - Version: 0.5.33.0 (Disabled)
Description: These are the Gears that power the tubes! :-)
Location: C:\Documents and Settings\cevans\Local Settings\Application Data\Google\Chrome\Application\5.0.375.70\gears.dll
MIME types:

MIME type	Description	File extensions
application/x-googlegears		

Enable

Adobe Acrobat - Version: 9.3.2.163 (Disabled)
Description: Adobe PDF Plug-In For Firefox and Netscape "9.3.2"
Location: C:\Program Files\Adobe\Reader 9.0\Reader\Browser\nppdf32.dll
MIME types:

MIME type	Description	File extensions
application/pdf	Acrobat Portable Document Format	.pdf
application/vnd.adobe.pdfxml	Adobe PDF in XML Format	.pdfxml
application/vnd.adobe.x-mars	Adobe PDF in XML Format	.mars
application/vnd.fdf	Acrobat Forms Data Format	.fdf
application/vnd.adobe.xfdf	XML Version of Acrobat Forms Data Format	.xfdf
application/vnd.adobe.xdp+xml	Acrobat XML Data Package	.xdp
application/vnd.adobe.xfd+xml	Adobe FormFlow99 Data File	.xfd

Enable

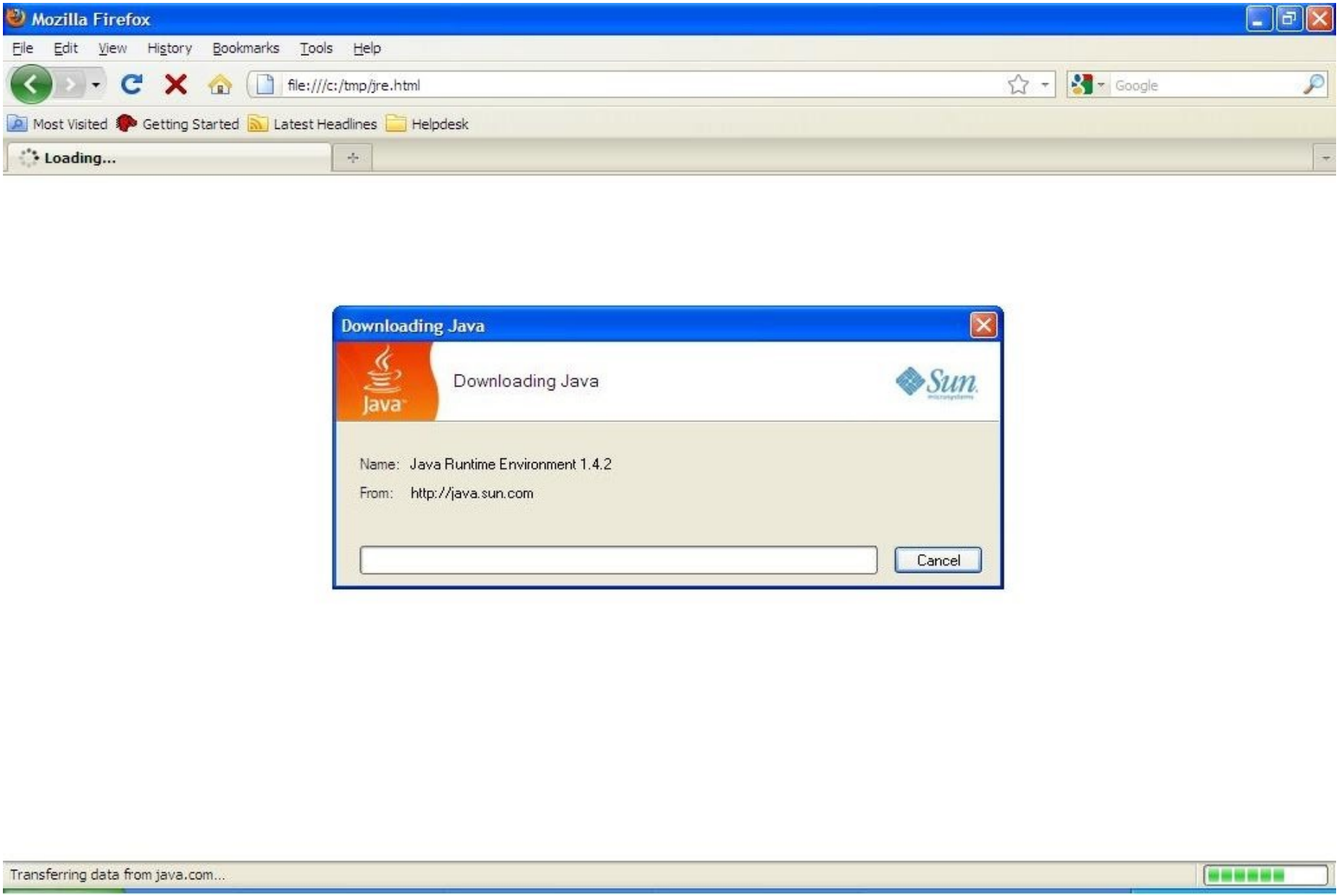
Java Deployment Toolkit 6.0.180.7 - Version: 6.0.180.7 (Disabled)
Description: NPRuntime Script Plug-in Library for Java(TM) Deploy
Location: C:\Program Files\Java\jre6\bin\new_plugin\npdeploytk.dll
MIME types:

MIME type	Description	File extensions
application/java-deployment-toolkit		

Enable

Java(TM) Platform SE 6 U18 - Version: 6.0.180.7 (Disabled)
Description: Next Generation Java Plug-in 1.6.0_18 for Mozilla browsers
Location: C:\Program Files\Java\jre6\bin\new_plugin\npjp2.dll

Plug-in detour



Future: sandboxing

- Safari
  - April 2010: WebKit2

"Webkit2 is designed from the ground up to support a split process model..."

- Firefox
  - April 2010: Firefox 3.6.4 dev release
    - Plug-ins in separate process
  - July 2009: "Electrolysis" announced
    - Security as a long-term goal
- Plug-ins
  - Hard!
  - Browser as O/S specific

Future: plug-ins

- As browsers get more secure, less tolerance for poor plug-in security
- Internet Explorer: warns upon leaving protected mode
- Firefox: warns on out-of-date plug-ins
- Chromium: plug-ins inside auto-update umbrella; sandboxed PDF viewer

Future: soft spots

- Java plug-in
  - Very powerful => hard to sandbox
  - High potential for reliable exploits
    - April 2010, Ormandy: command-line error
    - May 2009 / April 2010, Koivu & Tinnes: deserialization bugs
- Operating system kernels
- Extension systems

Future: soft spots

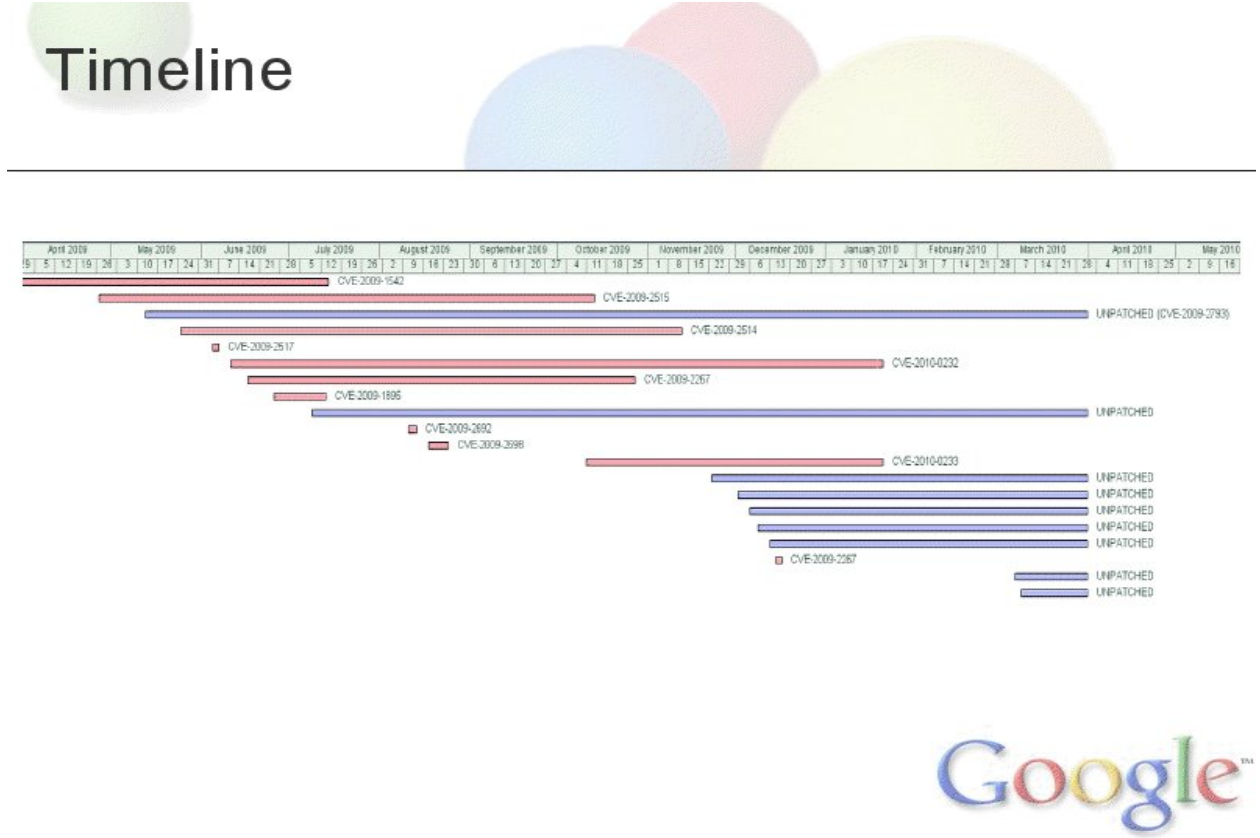
- Operating system kernels
  - Big attack surface to escape sandboxes
  - Linux: ~300 syscalls
  - Mac: ??
  - Windows: ~1400 more complicated syscalls
  - Under-researched area (except Linux)
- Kernel bug samples
  - Jan 2010, Ormandy; Windows #GP Trap handler
  - Aug 2009, Tinnes & Ormandy; Linux UDP-related NULL pointer
  - Pending disclosures in this space

Malware: trends?

- Attackers follow path of least resistance
- Multi-bug payloads
  1. Gain code execution
  2. Escape sandbox
- Two bugs harder than one =>
  - Less 0-day?
  - Increasing black-market exploit value?
- More direct-to-kernel bugs?
  - MS09-065: EOT font parsing
  - MS10-032: TrueType font parsing
  - 3D APIs

Malware: kernel attacks

- Further reading:
  - Party at ring0



Beyond the Sandbox

- Sandboxing is great, but leaves gaps:
  - Sandbox bugs
  - User bugs
  - New APIs poking holes
- Blacklist approaches as defense in depth
  - Mitigate against zero-days
  - Mitigate against phishing, social engineering

Beyond the Sandbox

ian fette - Google Search

www.google.com/search?rlz=1C1GGLS_enUS336US336&sourceid=chrome&ie=UTF-8&q=ian+fette

Feb 19, 2010 ... Posted by **Ian Fette**, Gears Team. If you've wondered why there haven't been many Gears releases or posts on the Gears blog lately, ...
gearsblog.blogspot.com/2010/02/hello-html5.html - Cached - Similar

Ian Fette | Facebook
Friends: Christiana Diehr, Christian Happy, Andre C Bouldin, Tracey Porter, Kevin Boehnke
Ian Fette is on Facebook. Join Facebook to connect with **Ian Fette** and others you may know. Facebook gives people the power to share and makes the world more ...
www.facebook.com/**ifette** - Cached

Techmeme: Hello HTML5 (**Ian Fette**/Gears API Blog)
Feb 20, 2010 ... The web's technology news site of record, Techmeme spotlights the hottest tech stories from all around the web on a single page.
techmeme.com/100220/p11 - Cached

DBLP: **Ian Fette**
Andrew Carlson, **Ian Fette**: Memory-based context-sensitive spelling correction at web scale. ICMLA 2007: 166-171. 1, Electronic Edition · pubzone.org ...
www.informatik.uni-trier.de/~ley/db/indices/.../**Fette**:**Ian**.html - Cached - Similar

ianfette.net
This site may harm your computer.
Not up yet.
https://**ianfette**.org/

Searches related to **ian fette**

google ian fette

tracker summary ian fette

Goooooooooogle ▶

1 2 3 4 5 6 7 8 9 10 **Next**

ian fette | Search

Search within results | Search Help | Give us feedback

Google Home | Advertising Programs | Business Solutions | Privacy | About Google

Beyond the Sandbox

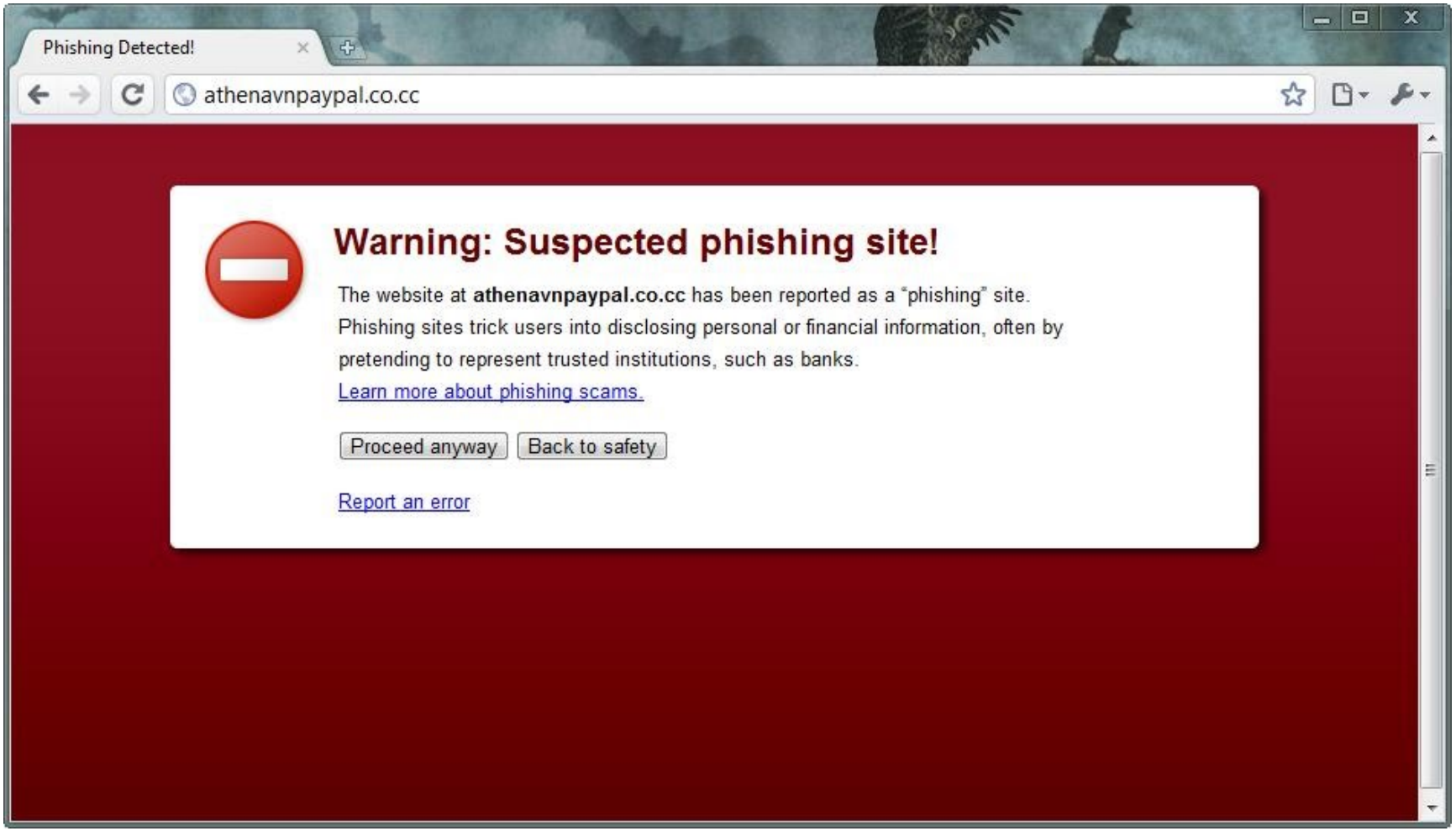
- Key metrics for blacklist approach
  - Freshness of data
  - Coverage
  - Accuracy

Beyond the Sandbox

- Building a blacklist
  - URL discovery
  - Classification
  - Information dissemination
  - Broadening scope (phishing, malware, social engineering)
- Approach varies for phishing, malware

Beyond the Sandbox

- Let's talk about phishing



Beyond the Sandbox

- As we harden the browser + authentication mechanisms, humans remain the weak link
- Phishers obtain compromised credentials, potentially easier than compromising the computer
- Use gmail spam + user submissions to build up list of URLs, machine learning to classify
- go from millions of URLs to a few hundred thousand known patterns at any time

Beyond the Sandbox

- Malware may require a bit more skill, but a zero day can get incredible reach compared to phishing
- Start with billions of URLs (our copy of the web)
- Machine learning to come up with candidate malware sites
- Visit in virtual machine to confirm

Beyond the Sandbox

- Where will the next zero-days lie?
- Many new APIs being added to browser (HTML5++).
- Some APIs expose new devices to the web -- 3d graphics, filesystems, fonts
- May see attacks on drivers now that they are exposed to untrusted web data
- Blacklist based approaches won't save us, but can help mitigate against these new threats