Detecting In-Flight Page Changes with Web Tripwires

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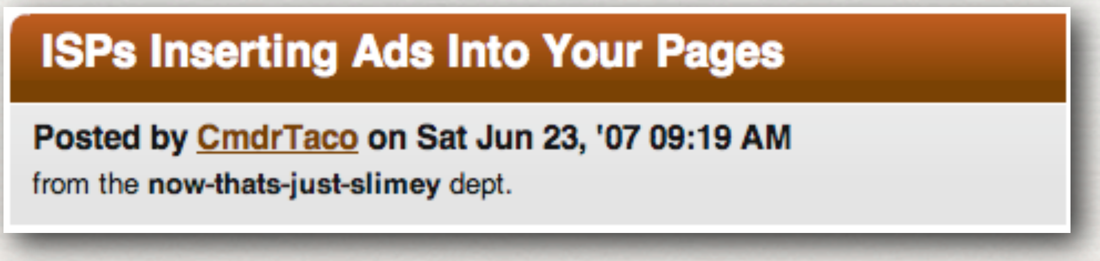
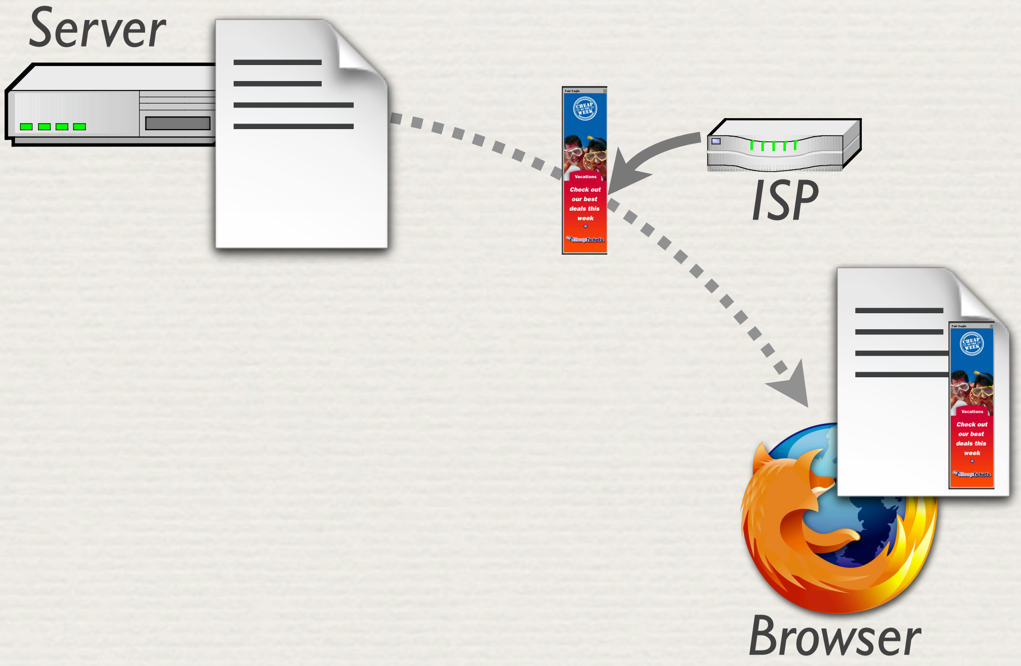
ISP-Injected Ads



ISPs Inserting Ads Into Your Pages

Posted by **CmdrTaco** **on Sat Jun 23, '07 09:19 AM**

from the **now-thats-just-slimey** dept.



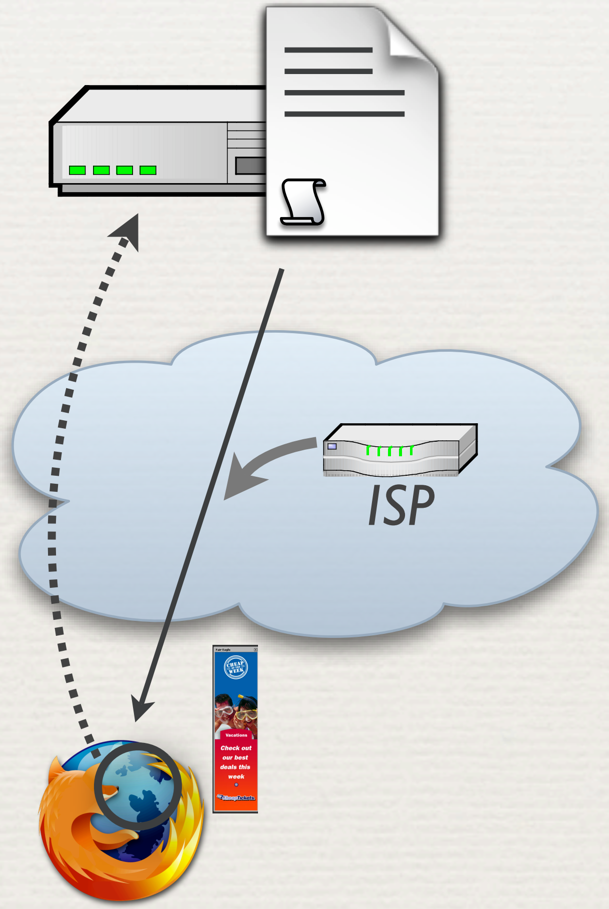
- Surprising reports of web page modifications
- How often does this occur?

Outline

- Detecting In-Flight Changes
- Measurement Results
- Dangerous Consequences
- Web Tripwires for Publishers

Detecting Page Changes

- Can detect with JavaScript
- Built a **Web Tripwire:**
    - Runs in client's browser
    - Finds most changes to HTML
    - Reports to user & server



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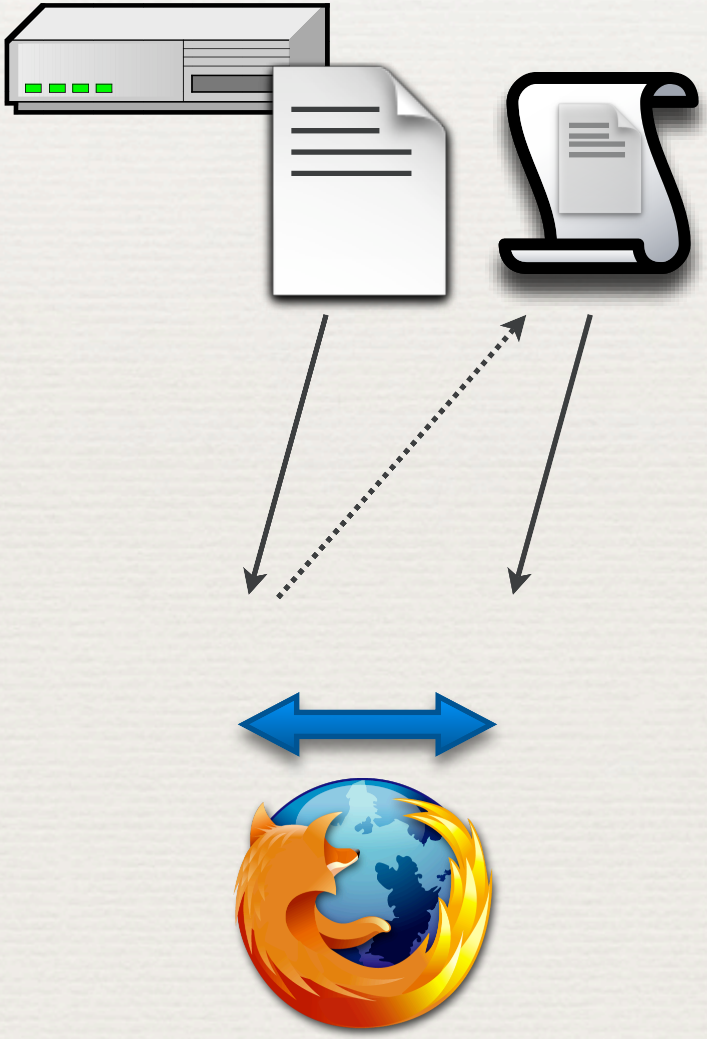
How it Works



- Fetch and render original page
- Fetch JavaScript code in background
    - Second, encoded copy of page
- Compare against page's source code

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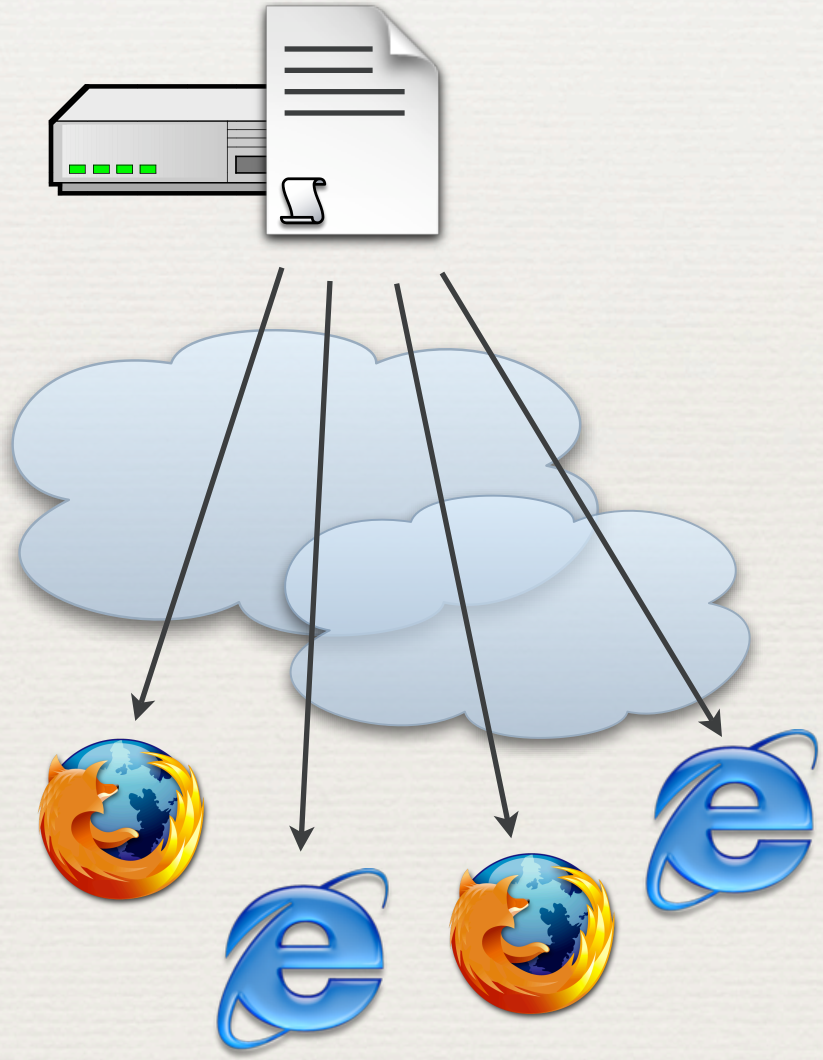
Attracting Visitors

- Wanted view of many clients on many networks
- Posted to **Slashdot**, **Digg**, etc.
  - Visits from over 50,000 unique IP addresses



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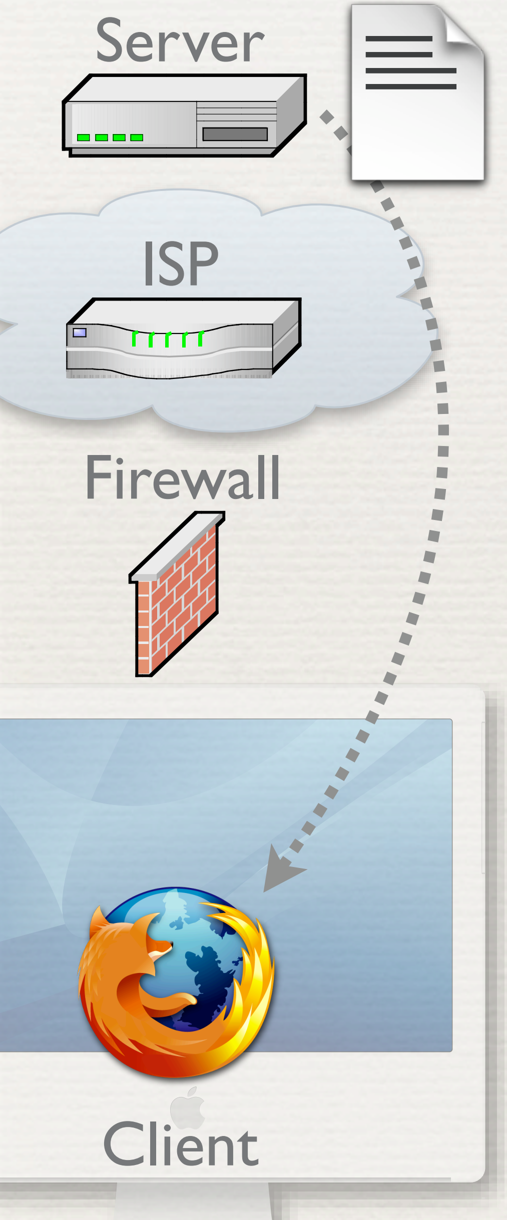
Many Users Affected



- 657 clients saw changes (1.3%)
  - Many made by client software
  - Some made by agents in network
- Diverse incentives
- Often concerning for publishers

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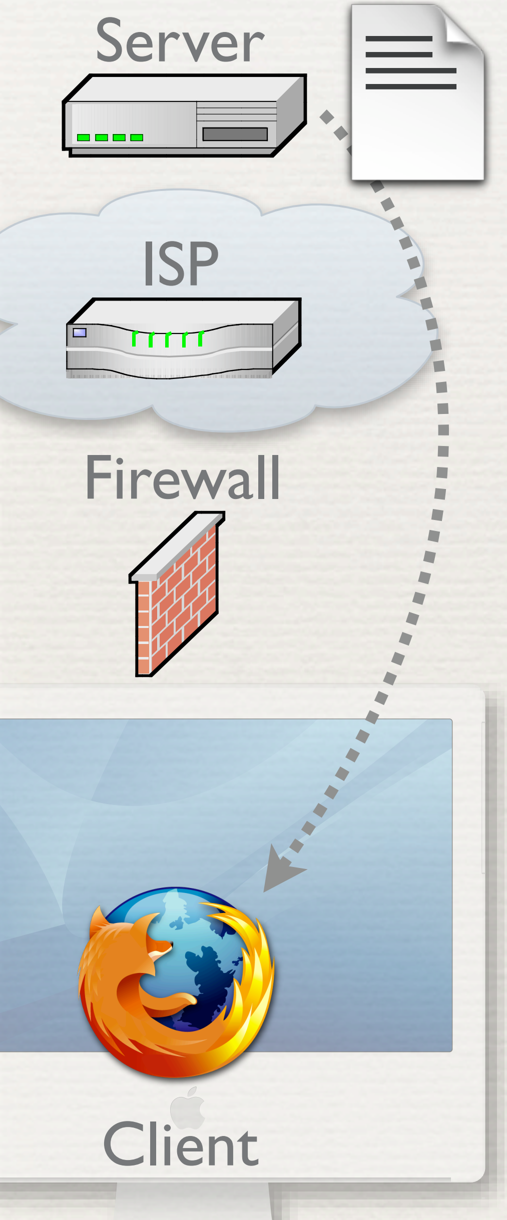
Many Types of Changes



Internet Service Providers

Enterprise Firewalls

Client Proxies

Malware

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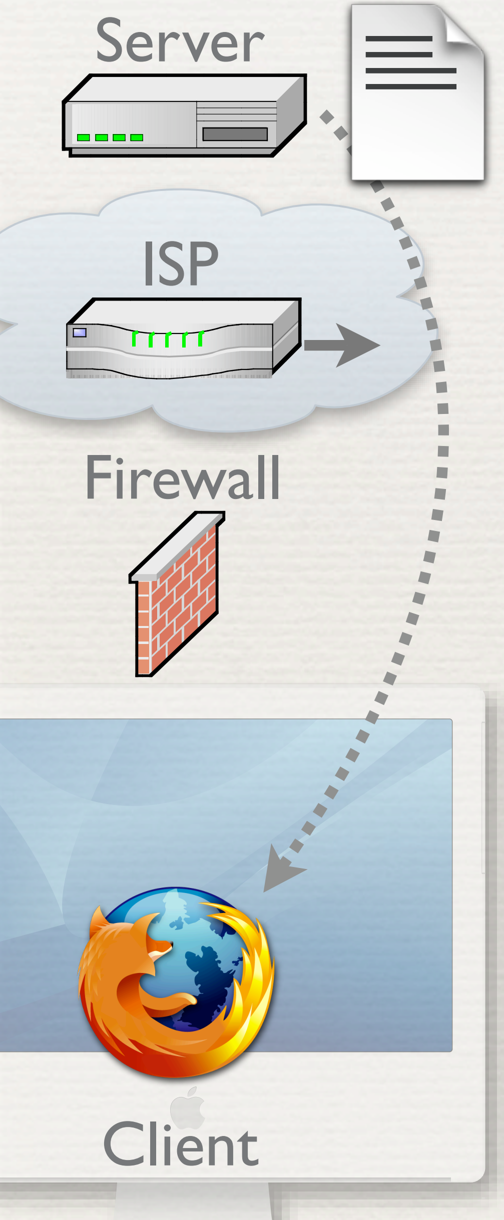
Changes by ISPs



- **Injected Advertisements** (2.4%)
  - NebuAd, MetroFi, LokBox, ...

Revenue for ISP; annoy users

Growing Trend?

PerfTech, Front Porch, Adzilla, Phorm

- **Compression** (4.6%)

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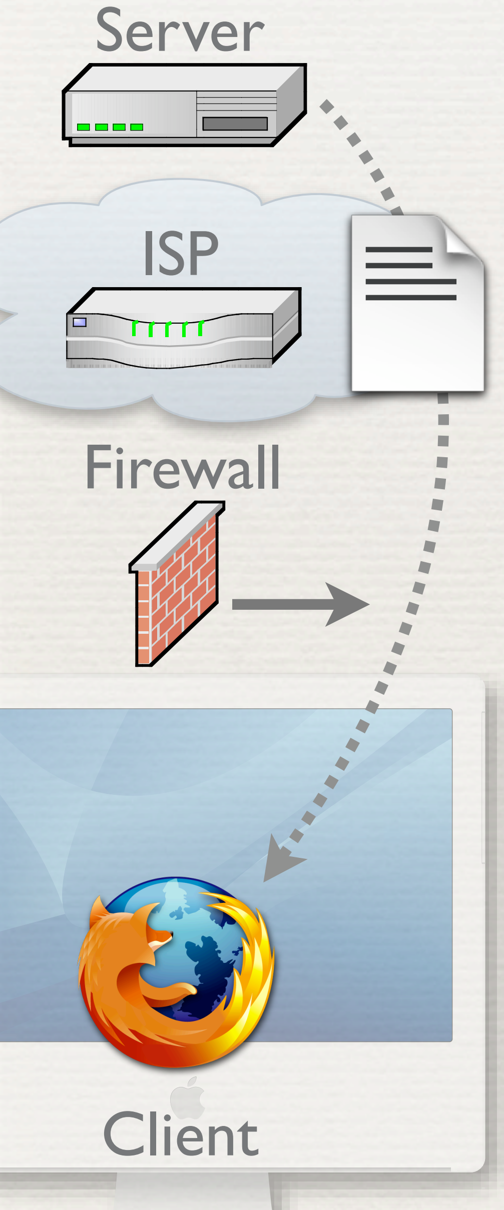
Changes by Enterprises



- **Security Checking Scripts** (2.3%)
  - BlueCoat Web Filter

Safer for clients; reduce risk

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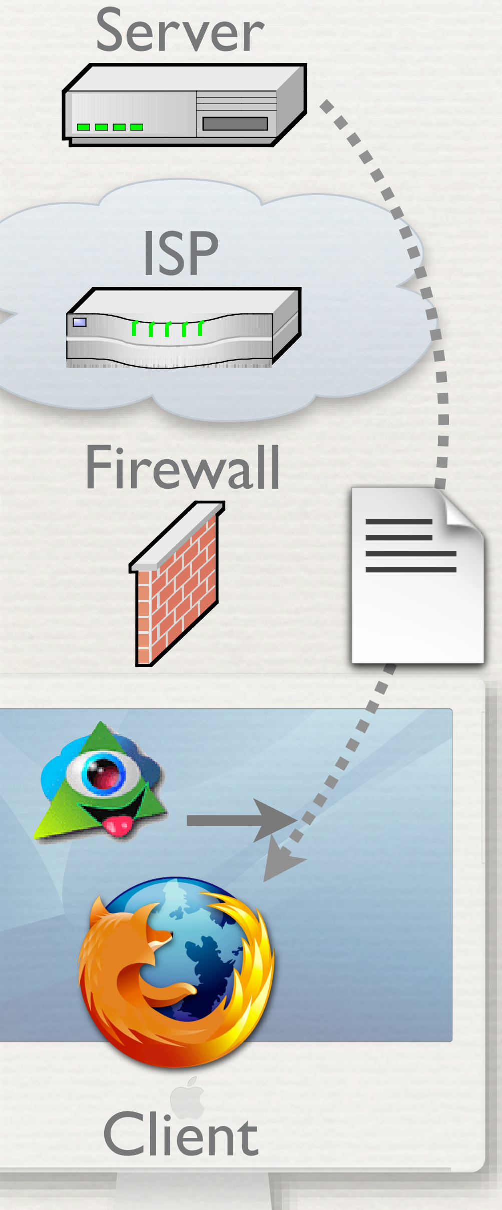
Changes by Client Proxies



- **Popup & Ad Blockers** (71%)
  - Zone Alarm, Ad Muncher, ...

Less annoying; impact revenue

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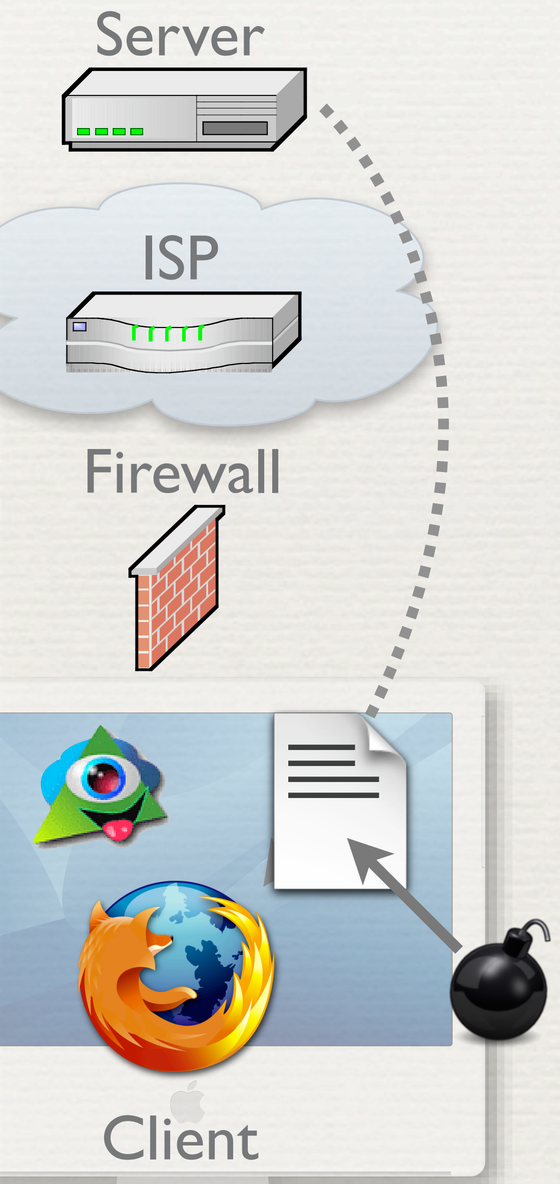
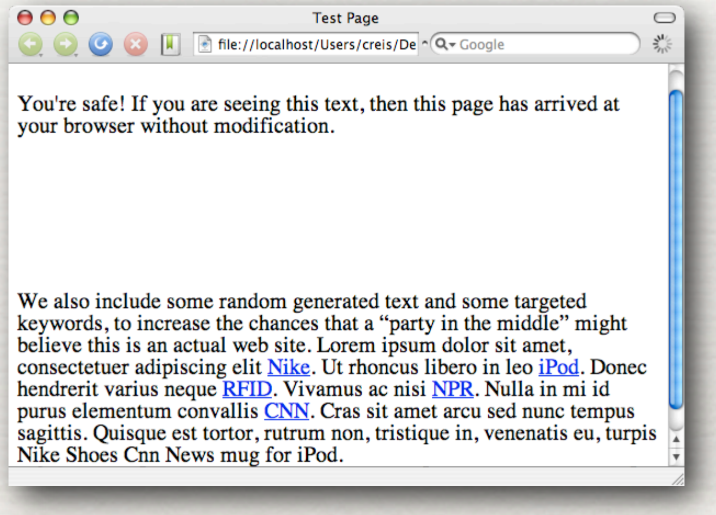
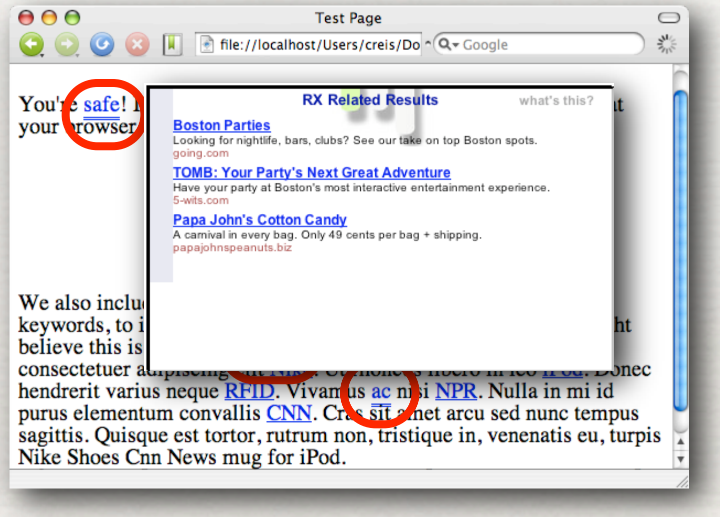
Changes by Malware





You're safe! If you are seeing this text, then this page has arrived at your browser without modification.

We also include some random generated text and some targeted keywords, to increase the chances that a "party in the middle" might believe this is an actual web site. Lorem ipsum dolor sit amet, consectetuer adipiscing elit Nike. Ut rhoncus libero in leo iPod. Donec hendrerit varius neque RFID. Vivamus ac nisi NPR. Nulla in mi id purus elementum convallis CNN. Cras sit amet arcu sed nunc tempus sagittis. Quisque est tortor, rutrum non, tristique in, venenatis eu, turpis Nike Shoes Cnn News mug for iPod.



You're safe!
your browser

RX Related Results

what's this?

Boston Parties
Looking for nightlife, bars, clubs? See our take on top Boston spots.
going.com

TOMB: Your Party's Next Great Adventure
Have your party at Boston's most interactive entertainment experience.
5-wits.com

Papa John's Cotton Candy
A carnival in every bag. Only 49 cents per bag + shipping.
papajohnspeanuts.biz

We also inclu
keywords, to i
believe this is
consectetuer
hendrerit varius neque RFID. Vivamus ac nisi NPR. Nulla in mi id purus elementum convallis CNN. Cras sit amet arcu sed nunc tempus sagittis. Quisque est tortor, rutrum non, tristique in, venenatis eu, turpis Nike Shoes Cnn News mug for iPod.

- **Adware** (1 client)

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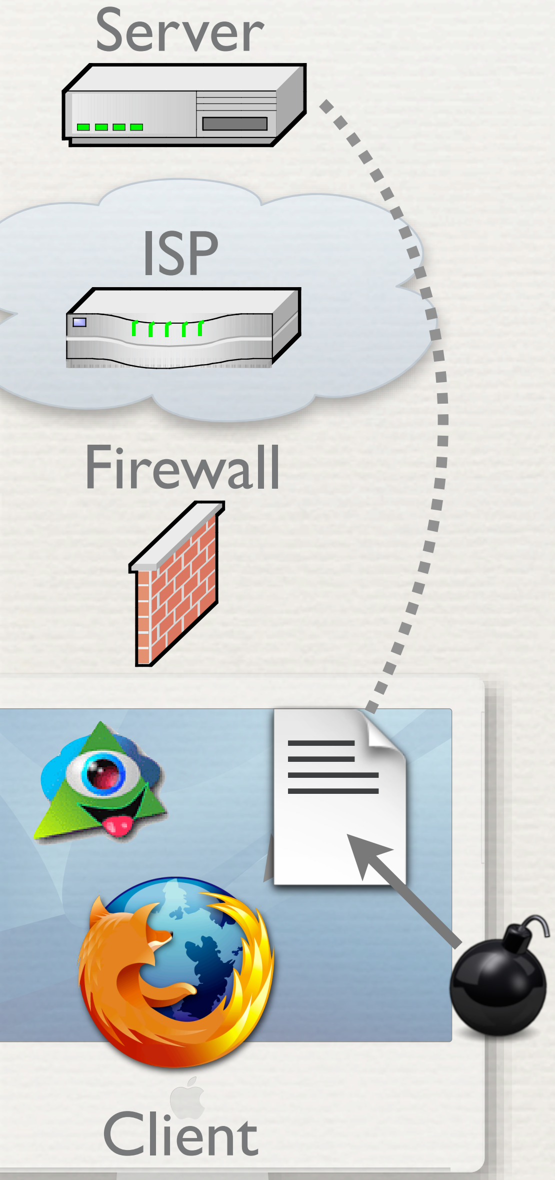
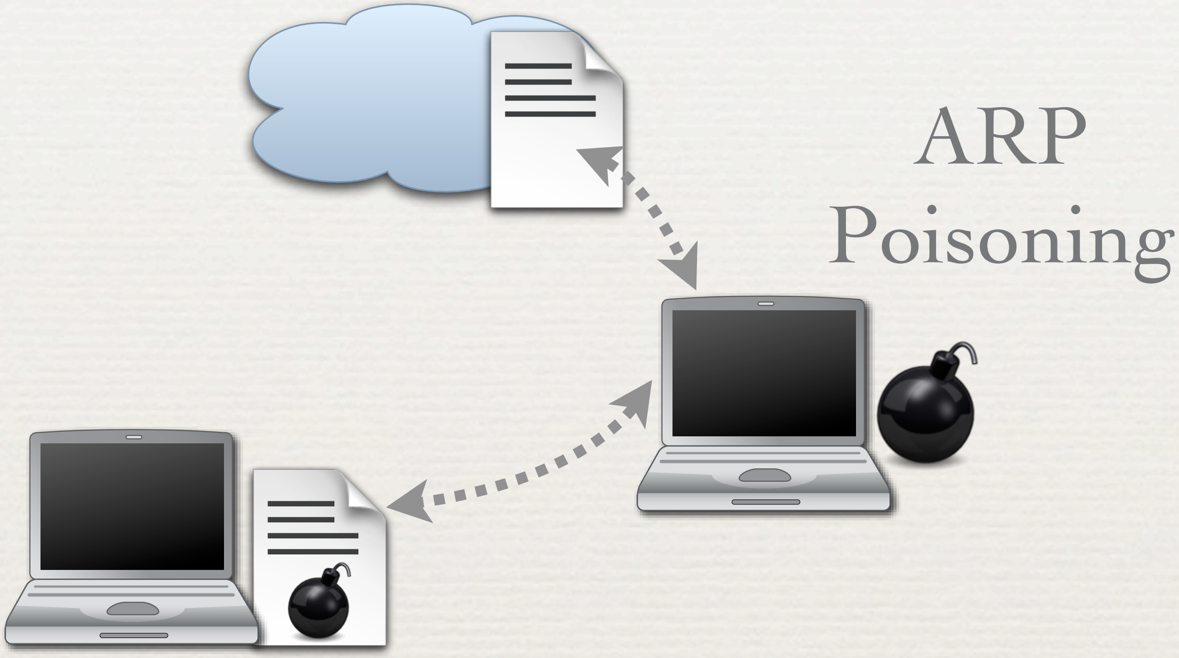
Changes by Malware





- **Adware** (1 client)
- **Worms** (2 clients)

Helps malware author; risk to user

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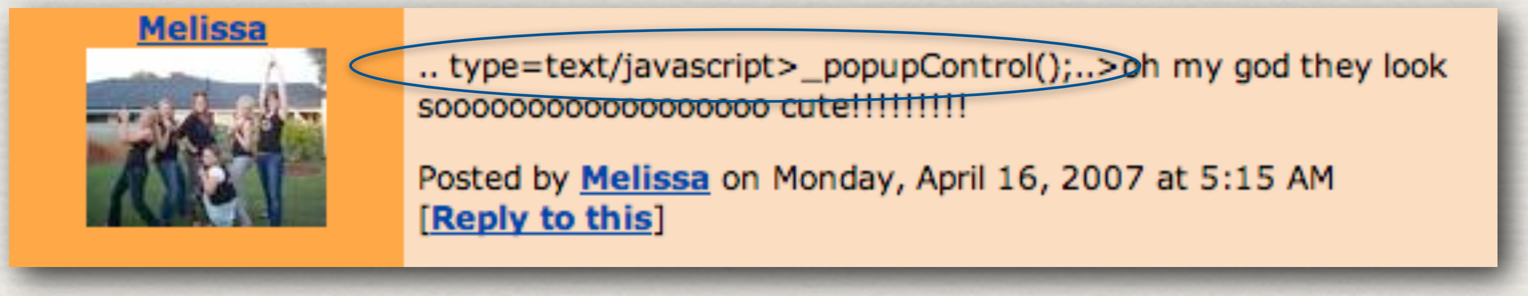
Unanticipated Impact

- Some changes **inadvertently** broke pages
  - JavaScript errors
  - Interfered with MySpace / forum posts



Melissa

.. type=text/javascript>_popupControl();..>oh my god they look sooooooooooooooooooo cute!!!!!!!!!

Posted by Melissa on Monday, April 16, 2007 at 5:15 AM
[Reply to this]

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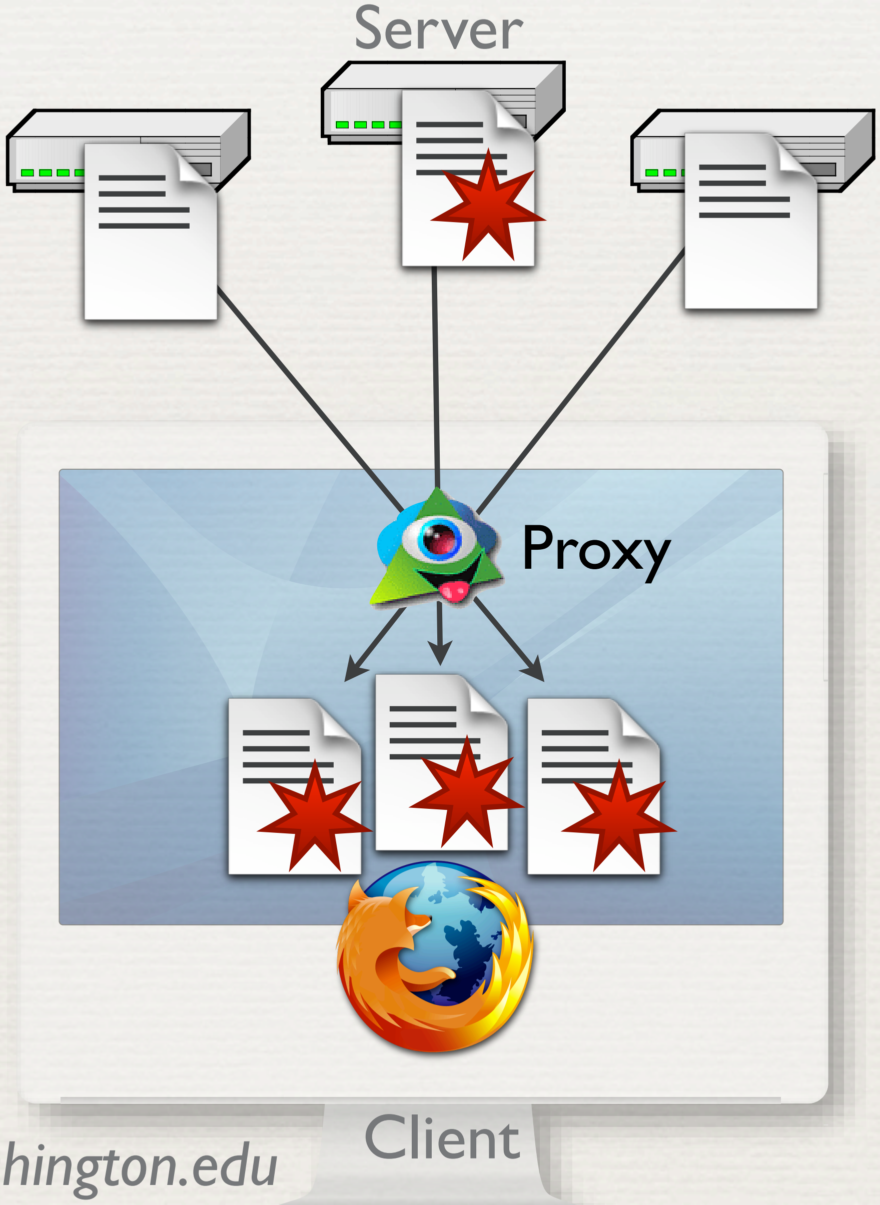
Introduced Vulnerabilities

- **XSS** allows script injection
    - Usually fixed at server
- Some proxies made otherwise safe pages vulnerable
    - Ad Muncher, Proxomitron
- Affected most HTTP pages
    - Like a **root exploit**



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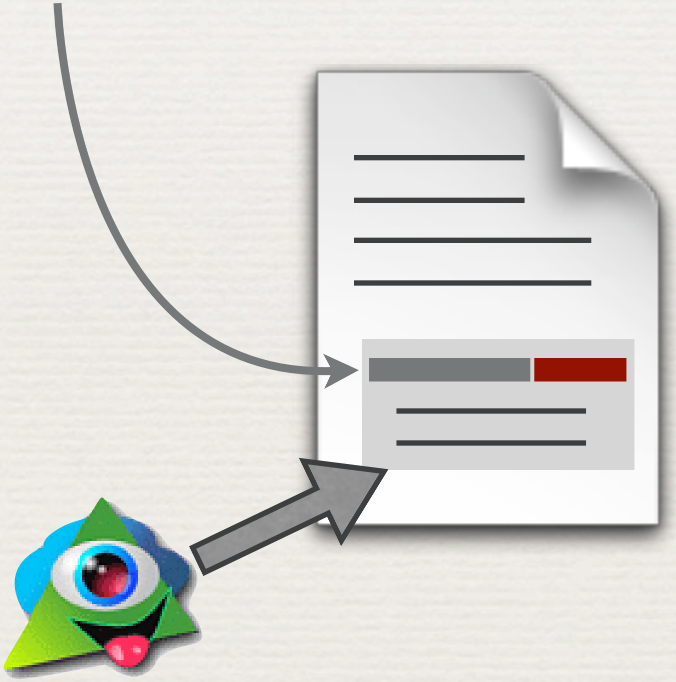
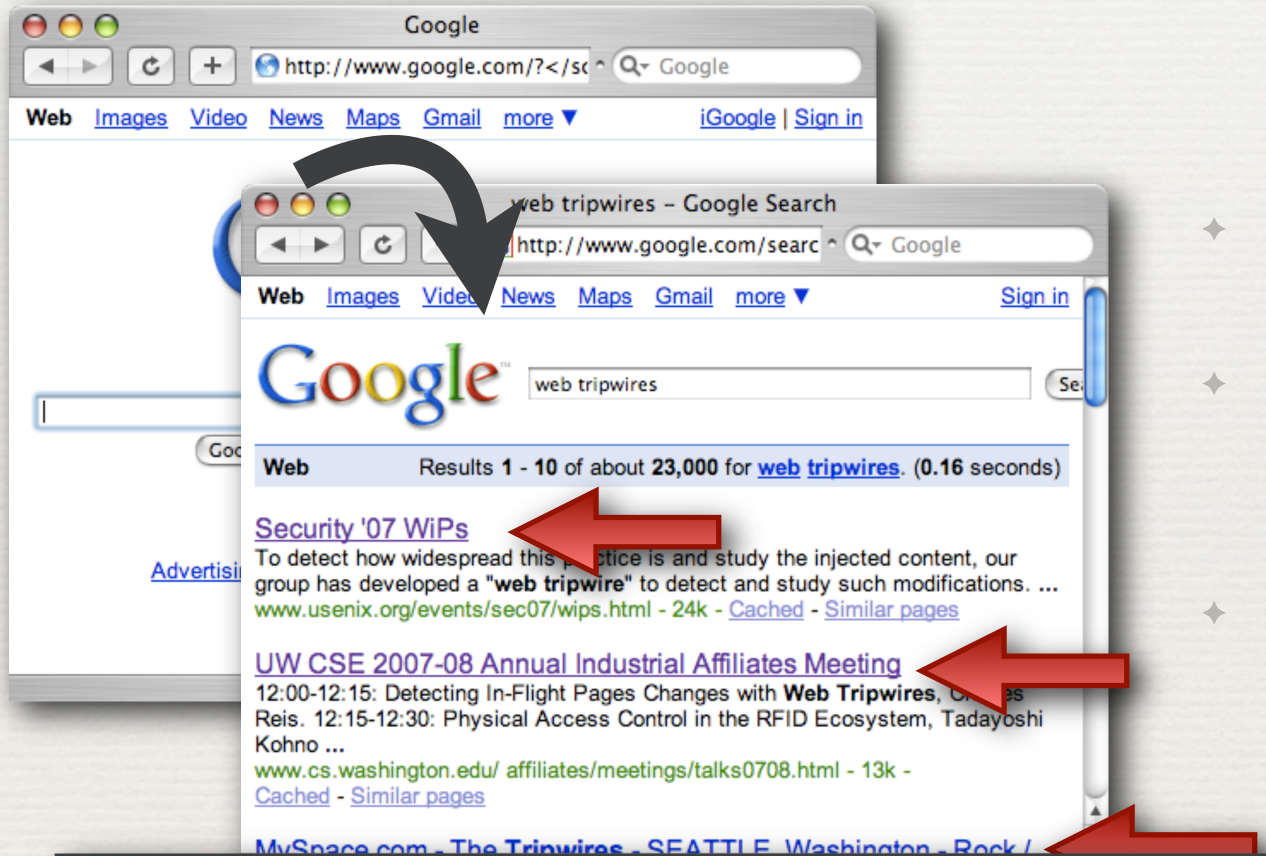
XSS via Proxy

http://usbank.com/?</script><script>attackCode...



- Proxy injected script code
- **Page URL** was included in code
- Attacker could place script code in a valid URL
- Users who follow the URL run injected code

Example Exploit



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Web Results **1** - **10** of about **23,000** for **web tripwires**. (**0.16** seconds)

Security '07 WiPs
To detect how widespread this practice is and study the injected content, our group has developed a "**web tripwire**" to detect and study such modifications. ...
www.usenix.org/events/sec07/wips.html - 24k - Cached - Similar pages

UW CSE 2007-08 Annual Industrial Affiliates Meeting
12:00-12:15: Detecting In-Flight Pages Changes with **Web Tripwires**, Charles Reis. 12:15-12:30: Physical Access Control in the RFID Ecosystem, Tadayoshi Kohno ...
www.cs.washington.edu/ affiliates/meetings/talks0708.html - 13k -
Cached - Similar pages

MySpace.com - The Tripwires - SEATTLE, Washington - Rock /

www.usenix.org/events/sec07/wips.html?</script><script>attackCode...

- Redirect user to Google
- Inject script code into search form
- Append exploit code to all outgoing links

Vulnerability Aftermath

- Reported vulnerabilities; now fixed
- Web tripwires can help find vulnerabilities
  - Search for URL in page changes

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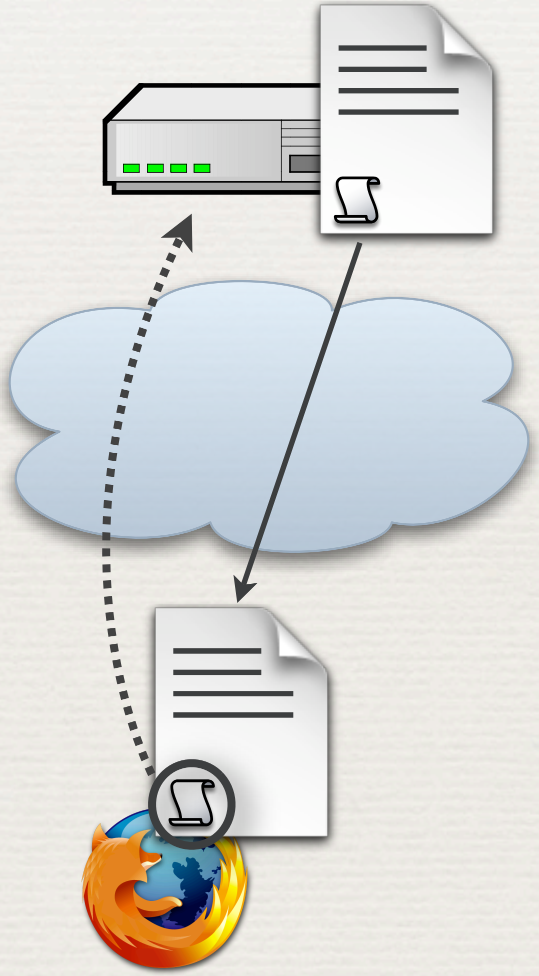
How to React?

- Option 1: **Use HTTPS**
  - Encryption prevents in-flight changes
- But... costly and rigid
  - Can't allow security checks, caching, etc.

Web Tripwires

- JavaScript code to detect changes
- Easy for publishers to deploy
  - **Configurable toolkit**
  - **Web tripwire service**
- But... not cryptographically secure
- Can be robust in practice



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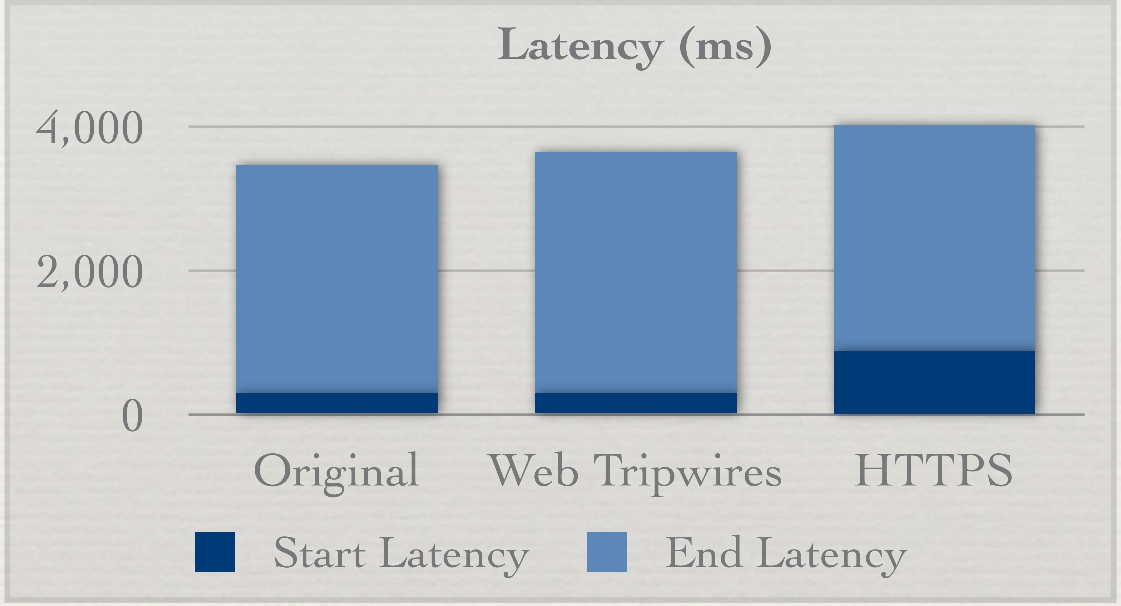
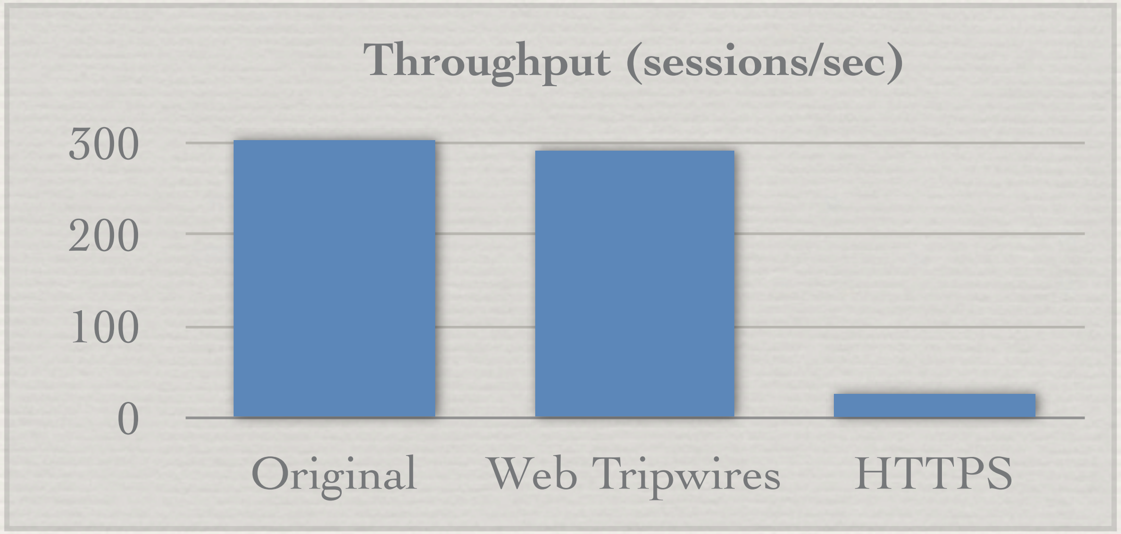
Tradeoffs

HTTPS	Web Tripwires
✦ Prevents most changes, as well as some useful services	✦ Detects most in-flight changes
✦ Cryptographically robust	✦ Could face an arms race ✦ Obfuscation can challenge adversaries
✦ Expensive: certificates, computation, extra RTTs	✦ Inexpensive to deploy

Performance Impact

- Relative to HTTPS, web tripwires have:
    - Low latency
    - High throughput





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Conclusion

- HTTP web pages are being **changed in flight**
  - Real negative impact for publishers & users
  - Page rewriters have dangerous power
- **Web tripwires** can help publishers react

This work partially
supported by NSF.