Low Cost, High Performance, Strong Security: Pick Any Three

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Why Listen to This Guy?

- Experienced web developer
- Experienced web application security consultant
  - I see lots of web apps of all types
  - Large companies, startups, all different types of risk/threat profiles
  - All different skill levels of developers
  - All different technical needs

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My Goal

- Find ways to improve site performance so that you can consider HTTPS deployment.

Security Guarantees of HTTP

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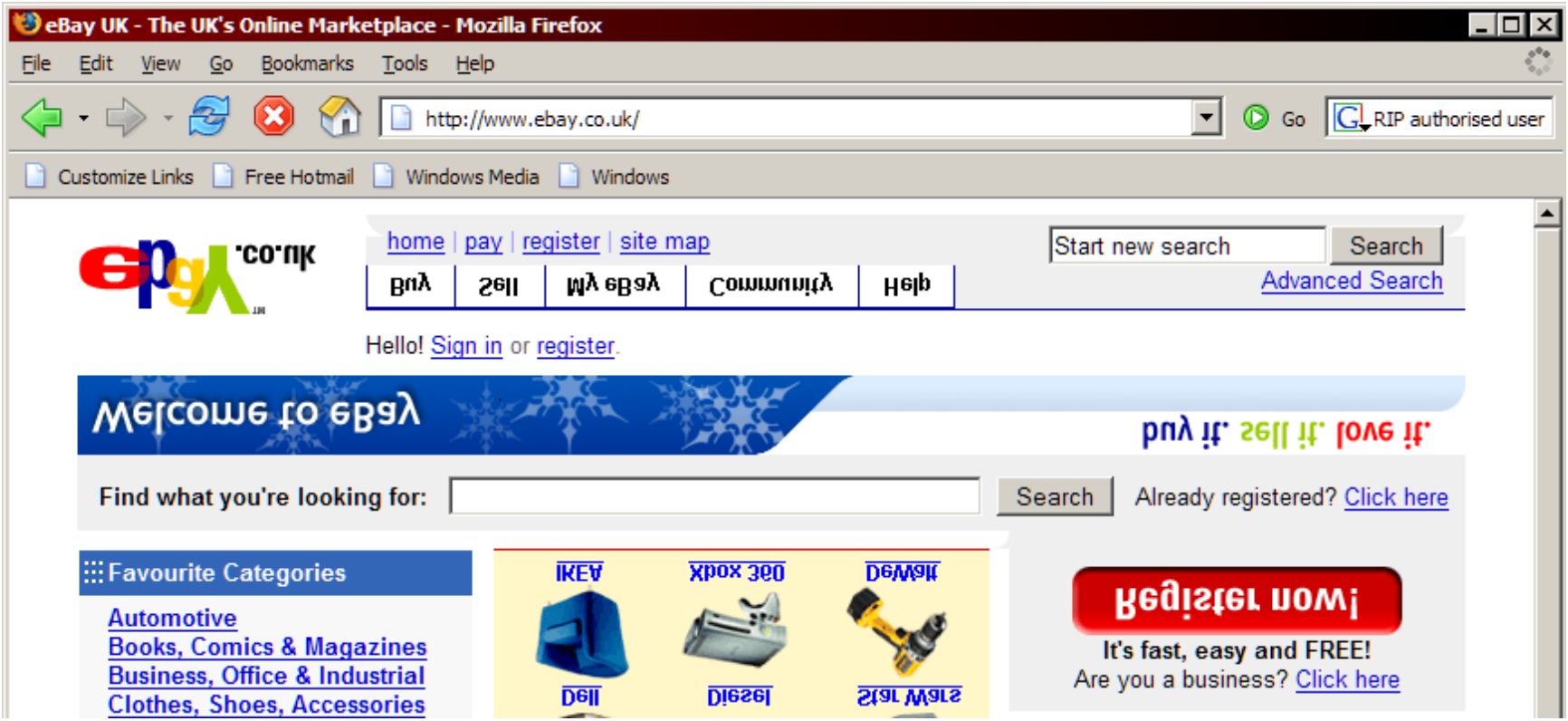
How Is This Possible?



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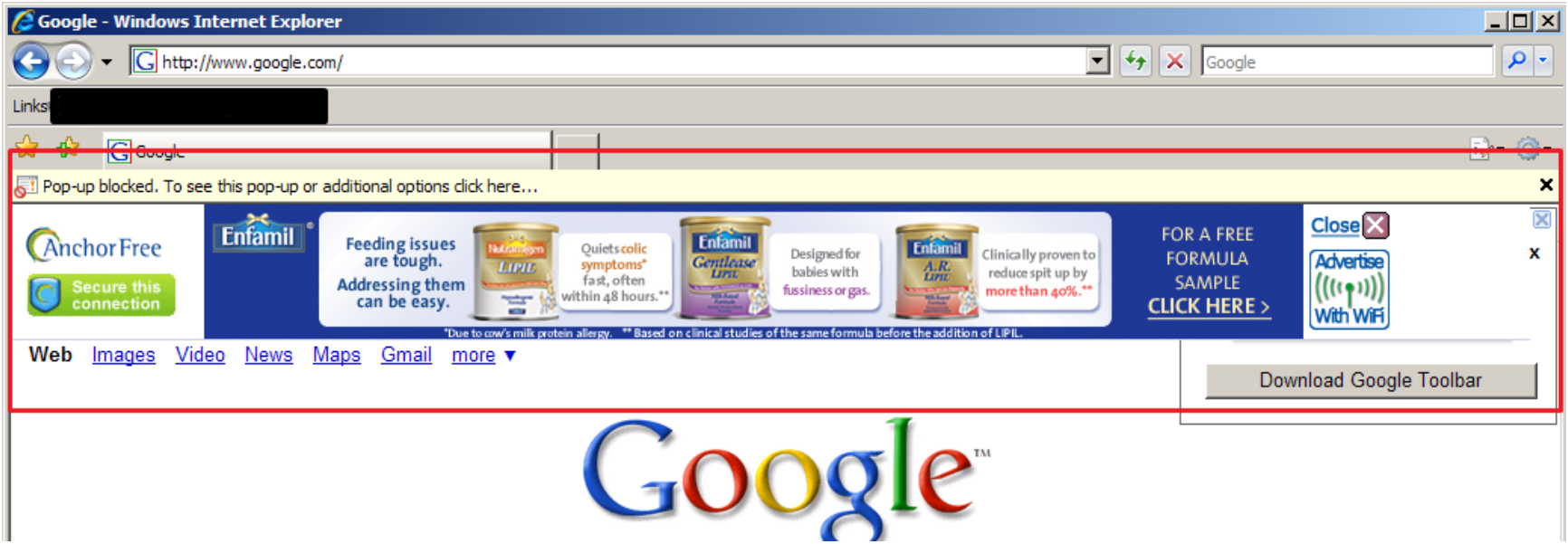
The Upside-down-ternet

- http://www.ex-parrot.com/~pete/upside-down-ternet.html
- Simple router configuration and HTTP proxy that runs a script to invert any image.
- See also: Wifi hotspots paid for by injecting advertising into the pages users view.

Network Attacks: A Business Model



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Security Guarantees of HTTPS

- Server authentication
  - You are talking to the true example.com
- Data integrity
  - You got the true page back from example.com
- Data confidentiality
  - Nobody can decrypt your sensitive example.com information

So Why Not Use HTTPS Exclusively?

- “It’s too slow.”
- Okay, what’s your performance target?
- “I don’t know.”
- Then HTTPS is not too slow.

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So Why Not Use HTTPS Exclusively?

- “It’s too slow.”
- Okay, what’s your performance target?
- “98% of responses in < 5 seconds.”
- Okay, have you profiled your application to find the slowest parts?
- “No.”
- Then HTTPS is not too slow.

Performance Ueber Alles?

- The proposition is that, since performance is so important, we must disable all security since it's "too slow".
- In effect, HTTP is considered an optimization of HTTPS.
- But is it an effective optimization?

Is Turning Off All Security an Effective Optimization?

- For most of my clients, and most web sites I see, there is much low-hanging fruit for optimization — orders of magnitude more effective than disabling security.
- Usually, the equation is reversed: You should have a really compelling performance requirement (e.g. 99% of responses in < 400ms!) to disable security.

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People With Such Severe SLAs Include:

- Probably not you

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What Does HTTPS Actually Cost?

- 3+ RTT handshake. Yeah, I know.
  - So use HTTP/1.1 persistent connections, and reduce the number of requests/responses.
  - Definitely turn on TLS session resumption!
- Asymmetric (public key) cryptography.
  - Amortizable with session resumption.
- Symmetric cryptography.
  - Very cheap (Moore's Law).
  - Reduce the size of your messages.

What Does HTTPS Actually Cost?

- The handshake latency is the real cost.
- You amortize it by making the best use of your TCP connection and TLS session.
- The more effective optimizations discussed below are:
  - Orders of magnitude more effective than disabling security.
  - Very effective, *and rarely applied*, even for insecure sites. Even for high-traffic sites!

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More Effective Optimizations

- In addition to profiling and optimizing the client, server, and backend code (how chubby is your AJAX library?),
- you can find lots of optimization opportunities in the network traffic profile.
- After all, it's a *web* app, right? Let's check the web part.

Previous Work

- Gmail: http://gmailblog.blogspot.com/2008/05/need-for-speed-path-to-faster-loading.html
- Yahoo: http://developer.yahoo.com/performance/rules.html

Gmail: Major Improvements

- “““…we found that there were between fourteen and twenty-four HTTP requests required to load an inbox… it now takes as few as four requests from the click of the “Sign in” button to the display of your inbox.””””

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Gmail: Major Improvements

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Gmail: Some Bad Advice

- http://mail.google.com/support/bin/answer.py?hl=en&ctx=mail&answer=74765
- “If you trust the security of your network, you can turn this feature off at any time.”
- If you trust the security of your parking garage, you can unlock your car door at any time. – Nathan Wilcox
- The Internet is not a secure network.

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Yahoo UI Blog

- http://yuiblog.com/blog/2006/11/28/performance-research-part-1/
- “You may be wondering why you’re reading a performance article on the YUI Blog. It turns out that most of web page performance is affected by front-end engineering, that is, the user interface design and development.”

Yahoo UI Blog

- “Reducing the number of HTTP requests has the biggest impact on reducing response time and is often the easiest performance improvement to make.”

Reduce Network Traffic

- DON’T have giant cookies, giant request parameters (e.g. .NET ViewState).
- DO compress responses (gzip, deflate).
- DO minify HTML, CSS, and JS.
- DO use sprites. DO compress images at the right compression level, and DO use the right compression algorithm for the job.
- DO maximize caching.

Reduce Network Traffic

- DO enable TLS session resumption on the TLS server.
  - http://rdist.root.org/2009/03/10/note-to-wordpress-on-ssl/

Reduce Network Traffic

- Do you find yourself serving images from 6 different hostnames to get the browser to maximally parallelize your 40 image loads?
- Perhaps the problem is the 40 images.
- eBay.com: 370KiB, 57 request/response pairs, 20+ TCP connections, 7 DNS resolutions.
  - > 4s to load, then 17s later, does > 5s more loading.

Reduce Network Traffic

- Is your front page 1MiB?
- Gap.com (977,657 bytes), nytimes.com (741,148 bytes, > 8 seconds)
- Even if the page really presented that much information (500 pages of ASCII text), people don't sit there and read 500 pages in one go.
- Sure, a lot of it is images… Can people process that much visual information at once? No.

Design and Usability

- As much as that 1MiB page is flooding the network,
- it’s flooding people’s brains even more.

Pick Any Three

- Reducing the size and frequency of network communications allows you to:
  - Get faster page loads—which often means more sales!
  - Suddenly be able to afford the relatively small cost of HTTPS.
  - Save money — lower ISP bills.
    - Give a DoS attacker less of a multiplier…

“But the Site Must Be Visually Rich!”

- Tell that to Larry and Sergey.
- Google made more money than the Beatles with little 3-line text ads.
- Look at their home page, a search results page, and then their stock price and market capitalization.

“But the Site Must Be Visually Rich!”

- Sure, okay. But have you optimized the network traffic as much as possible, given this requirement?
- Visually noisy sites in my experience usually pay a higher network cost than they have to.

A Unifying Principle

- Good security, good performance, good usability, good design all agree on the same basic principle:
- Present people relevant information, allowing them to make good choices at the right time without distractions.

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Tools to Get the Job Done

- Shameless plug: httprof
  - http://code.google.com/p/httprof
- YSlow and HTTPFox (Firefox plugins)
- WebScarab: https://www.owasp.org/index.php/Category:OWASP_WebScarab_Project
- Wireshark

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Demonstrating That the Internet Is Not Secure

- The Upside-Down-Ternet
- Cain and Abel
- Metasploit: http://blog.metasploit.com/2008/07/bailiwicked.html
- Ettercap
- Wireshark, tcpdump
- BGP forgeries: http://iar.cs.unm.edu/

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Conclusion

- Usability, design, security, and performance are all friends — not enemies.
- If you can't afford HTTPS, you can't afford to be in business.
- Luckily, you *can* afford HTTPS!

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Future Work

- Improve the security UI of browsers.
  - Usability is our biggest security problem right now!
  - And vice-versa!
- Improve the quality of browsers' treatment of TLS/SSL and PKI.

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Thank You

Questions?

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