What are we talking about?

- Crash course on anonymous communications
- Quick overview of Tor
- Quick overview of Tor Hidden Services
- Future directions
The Tor Project, Inc.

501(c)(3) non-profit organization dedicated to the research and development of technologies for online anonymity and privacy
What is anonymity?
Anonymity isn’t cryptography

- Cryptography protects the contents in transit
- You still know who is talking to whom, how often, and how much data is sent.
Anonymity isn’t steganography

Attacker can tell Alice is talking to someone, how often, and how much data is sent.
Anonymity isn’t just wishful thinking...

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- ”You can’t prove it was me!”
- ”Promise you won’t look”
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- ”I didn’t write my name on it!” Not what we’re talking about.
- ”Isn’t the Internet already anonymous?” Nope!
Anonymous communication

- People have to hide in a crowd of other people ("anonymity loves company")
- The goal of the system is to make all users look as similar as possible, to give a bigger crowd
- Hide who is communicating with whom
- Layered encryption and random delays hide correlation between input traffic and output traffic
Low versus High-latency anonymous communication systems

- Tor is not the first system; ZKS, mixmaster, single-hop proxies, Crowds, Java Anon Proxy.
- Low-latency systems are vulnerable to end-to-end correlation attacks.
- High-latency systems are more resistant to end-to-end correlation attacks, but by definition, less interactive.
Low-latency systems are generally more attractive to today’s user

- Interactive apps: web, instant messaging, VOIP, ssh, X11, cifs/nfs, video streaming (millions of users)
- Multi-hour delays: email, nntp, blog posting? (tens of thousands of users?)
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- Multi-hour delays: email, nntp, blog posting? (tens of thousands of users?)
  - And if anonymity loves company...
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- increasingly diverse toolset:
  Tor, Tor Browser Bundle, Tails LiveCD, Tor Weather, Tor auto-responder, Secure Updater, Orbot, Torora, Tor Check, Arm, Nymble, Tor Control, and so on.
Other Systems

- **VPN** - Virtual Private Network, 1 to 1 connection, can redirect all traffic, generally encrypted

- **Proxy** - 1 to 1 connection, per application traffic redirection, sometimes encrypted

- **I2P** - Garlic routing, closed network, anonymity and reputation

- **Freenet** - closed network, anonymity, distributed file storage and sharing

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How is Tor different from other systems?
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Who uses Tor?

- Normal people
- Law Enforcement
- Human Rights Activists
- Business Execs
- Militaries
- Abuse Victims
Who uses Tor?

- Normal users
  linking sensitive information to their current identities, online advertising networks, search engines, censorship circumvention

- Law enforcement
  accidental disclosure to targets, family and friend concerns, separating work from home life

- Rights Activists
  personal safety, family safety, narrowly defined publicity, censorship circumvention

- Business Execs
  separating work from home life, competitor research, censorship circumvention

- Abuse Victims and Survivors
  complete separation of past abuse and current life, finding help and safety, need to help others anonymously

- Militaries
  intelligence gathering, separating work from home life, other activities
Who uses Tor?

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You missed a use case
estimated 400k to 800k daily users

Source: zscaler research, Dec 2011
Tor hides communication patterns by relaying data through volunteer servers

Diagram: Robert Watson
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Vidalia Network Map

Connection | Status
--- | ---
FordModelA,sprockets,maumau2 | Open
FordModelA,maumau,chaoscomputerclub3 | Open

Uptime: 18 days 17 hours 17 mins 13 secs
Last Updated: 2011-05-15 06:30:02 GMT

maumau2 (Online)
Location: Romania
IP Address: 195.60.76.239
Platform: Tor 0.2.2.25-alpha (git-fa48973a53191469) on
Bandwidth: 5.54 MB/s
Uptime: 12 days 17 hours 16 mins 56 secs
Last Updated: 2011-05-14 21:25:17 GMT
Metrics

- Measuring metrics anonymously
- NSF grant to find out
- Archive of hourly consensus, ExoneraTor, VisiTor
- Metrics portal:
  https://metrics.torproject.org/
Tor hidden services allow privacy enhanced hosting of services

The text of this version is primarily taken from the first collected 1788 "McLean edition", but spelling and punctuation errors -- mainly printer's lapses -- have been corrected. The main heads have also been taken from that edition and all something like "The Same Subject Continued" we have repeated the previous heading and appended "(continued)", so have been guided by the excellent edition by Jacob E. Cooke, Wesleyan University Press, 1961. The footnotes are the original typography used for emphasis, such as all caps or italics, has been used here. We have tried to identify the authors. All references are to the Federalist Papers.
dot onion you say?

http://duskgytldkxiuqc6.onion/fedpapers/federa00.htm
Hidden Services, in graphics

Step 1: Bob picks some introduction points and builds circuits to them.
Hidden Services, in graphics

Step 2: Bob advertises his hidden service -- XYZ.onion -- at the database.

Alice

IP1

IP2

IP3

Bob

DB

Tor cloud

Tor circuit

IP1-3

Introduction points

PK

Public key

cookie

One-time secret

RP

Rendezvous point
Hidden Services, in graphics

Step 3: Alice hears that XYZ.onion exists, and she requests more info from the database. She also sets up a rendezvous point, though she could have done this before.
Hidden Services, in graphics

Step 4: Alice writes a message to Bob (encrypted to PK) listing the rendezvous point and a one-time secret, and asks an introduction point to deliver it to Bob.
Step 5: Bob connects to the Alice’s rendezvous point and provides her one-time secret.
Hidden Services, in graphics

Step 6: Bob and Alice proceed to use their Tor circuits like normal.
Operating Systems leak info like a sieve

- Applications, network stacks, plugins, oh my....
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Operating Systems leak info like a sieve

- Applications, network stacks, plugins, oh my.... some call this ”sharing”
- Did you know Microsoft Word and OpenOffice Writer are browsers?
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- Did you know Microsoft Word and OpenOffice Writer are browsers?
- www.decloak.net is a fine test
Mobile Operating Systems

- Entirely new set of challenges for something designed to know where you are at all times.
- Orbot: Tor on Android. https://guardianproject.info/apps/
- Tor on iphone, maemo/meego, symbian, etc
- Tor on Windows Mobile, http://www.gsmk.de as an example.
- Guardian Project, https://guardianproject.info/
Next steps

Visit https://www.torproject.org/ for more information, links, and ideas.
who uses tor?
http://www.flickr.com/photos/mattw/2336507468/sizes/o/, Matt Westervelt, CC-BY-SA.

danger!, http://flickr.com/photos/hmvh/58185411/sizes/o/, hmvh, CC-BY-SA.

500k, http:
//www.flickr.com/photos/lukaskracic/334850378/sizes/l/, Luka Skracic, used with permission.