Anonymity Tor Overview

Andrew Lewman
andrew@torproject.org

April 21, 2011

TorProject.org
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?

Andrew Lewman  andrew@torproject.org
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...

- "You can’t prove it was me!"
Anonymity isn’t just wishful thinking...

- "You can’t prove it was me!"
- "Promise you won’t look"
Anonymity isn’t just wishful thinking...

- "You can’t prove it was me!"
- "Promise you won’t look"
- "Promise you won’t remember"
Anonymity isn’t just wishful thinking...

- "You can’t prove it was me!"
- "Promise you won’t look"
- "Promise you won’t remember"
- "Promise you won’t tell"
Anonymity isn’t just wishful thinking...

- "You can’t prove it was me!"
- "Promise you won’t look”
- "Promise you won’t remember”
- "Promise you won’t tell”
- "I didn’t write my name on it!"
Anonymity isn’t just wishful thinking...

- "You can’t prove it was me!"
- "Promise you won’t look”
- "Promise you won’t remember”
- "Promise you won’t tell”
- "I didn’t write my name on it!”
- "Isn’t the Internet already anonymous?”
..since "weak" isn't anonymity.

- "You can\'{t prove it was me!" Proof is a very strong word. Statistical analysis allows suspicion to become certainty.
..since "weak" isn't anonymity.

- "You can't prove it was me!" Proof is a very strong word. Statistical analysis allows suspicion to become certainty.
- "Promise you won't look/remember/tell" Will other parties have the abilities and incentives to keep these promises?
"You can’t prove it was me!” Proof is a very strong word. Statistical analysis allows suspicion to become certainty. 

"Promise you won’t look/remember/tell” Will other parties have the abilities and incentives to keep these promises?

"I didn’t write my name on it!” Not what we’re talking about.
since ”weak” isn’t anonymity.

- ”You can’t prove it was me!” Proof is a very strong word. Statistical analysis allows suspicion to become certainty.
- ”Promise you won’t look/remember/tell” Will other parties have the abilities and incentives to keep these promises?
- ”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?)
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?)
  - And if anonymity loves company...
What is Tor?

- online anonymity software and network
What is Tor?

- online anonymity software and network
- open source, freely available (3-clause BSD license)
What is Tor?

- online anonymity software and network
- open source, freely available (3-clause BSD license)
- active research environment:
  Rice, UMN, NSF, NRL, Drexel, Waterloo, Cambridge UK, Bamberg Germany, Boston Univ, Harvard, MIT, RPI, Georgia Tech
What is Tor?

- online anonymity software and network
- open source, freely available (3-clause BSD license)
- active research environment:
  Rice, UMN, NSF, NRL, Drexel, Waterloo, Cambridge UK, Bamberg Germany, Boston Univ, Harvard, MIT, RPI, Georgia Tech
- increasingly diverse toolset:
  Tor, Torbutton, Tor Browser Bundle, TA(I)LS LiveCD, Tor Weather, Tor auto-responder, Secure Updater, Orbot, Torora, Tor Check, Arm, Nymble, Tor Control, Tor Wall, TorVM
How is Tor different from other systems?
How is Tor different from other systems?
How is Tor different from other systems?

![Diagram showing Tor's network structure](image)
Twitter in Iran: Good.

Iran Protests: Twitter, the Medium of the Movement
By LEV GROSSMAN  Wednesday, Jun. 17, 2009

Related Photos

Behind the Scenes with Mousavi

Stories
- In Iran, Rival Regime Factions Play a High-Stakes Game of Chicken
- Latest Tweets on Fallout from Iran's

Share

The U.S. State Department doesn't usually take an interest in the maintenance schedules of dotcom start-ups. But over the weekend, officials there reached out to Twitter and asked them to delay a network upgrade that was scheduled for Monday night. The reason? To protect the interests of

From http://www.time.com/time/world/article/0,8599,1905125,00.html
Twitter in USA: Bad.

FBI Raids Queens Home in G20 Protest Twitter Crackdown

That's right, a Twitter crackdown. A lawyer for Jackson Heights social worker Elliot Madison, 41, says that the feds searched his client's house for 16 hours on Thursday after Madison was arrested on September 24th at a Pittsburgh hotel room with another man. What were they up to? Sitting at laptops sending Twitter messages advising G20 demonstrators about riot police activity in the streets. And yet real Twitter threats like Lindsay Lohan and Courtney Love remain at large.

Madison, a self-described anarchist, was in Pittsburgh volunteering for the Tin Can Comms Collective, a group that uses Twitter to send mass text messages during protests describing events observed on the streets or over police scanners; stuff like "SWAT teams rolling down 5th Ave." Tin Can was active during the St. Paul RNC protests, and the authorities are now on to them. Madison was charged with hindering apprehension or prosecution, criminal use of a communication facility and possession of instruments of crime; he's currently out on bail.

from http://gothamist.com/2009/10/05/fbi_raids_queens_home_in_g20_protes.php
Who uses Tor?

- Normal people
- Law Enforcement
- Human Rights Activists
- Business Execs
- Militaries
- Abuse Victims
estimated 300k to 800k daily users
Tor hides communication patterns by relaying data through volunteer servers
Tor hides communication patterns by relaying data through volunteer servers
Tor hides communication patterns by relaying data through volunteer servers
Tor hides communication patterns by relaying data through volunteer servers

Diagram: Robert Watson
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 a 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 edition used a variety of special typographical symbols for superscripts, we use numerals. Editors's footnotes are in original typography used for emphasis, such as all caps or italics, has been used here. We have tried to identify the name
dot onion you say?

Global

Pointers  Nicknames

No names land

Unique  Petnames

Memorable
Hidden services, in text

- Distributed Hash Table (DHT) Directory
Hidden services, in text

- Distributed Hash Table (DHT) Directory
- Rendezvous points
Hidden services, in text

- Distributed Hash Table (DHT) Directory
- Rendezvous points
- Anonymity for both the server and client
Hidden Services, in graphics

Step 1: Bob picks some introduction points and builds circuits to them.
Step 2: Bob advertises his hidden service -- XYZ.onion -- at the database.
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.

- **IP1-3:** Introduction points
- **PK:** Public key
- **cookie:** One-time secret
- **RP:** Rendezvous point

**Alice**

**Bob**
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.
Hidden Services, in graphics

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....
Operating Systems leak info like a sieve

- Applications, network stacks, plugins, oh my.... some call this "sharing"
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?
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?
- www.decloak.net is a fine test
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 CE, 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.
Credits & Thanks

- 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.