CSE 127: Introduction to Security

Lecture 15: Privacy and Anonymity / Policy and Ethics

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UCSD

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Some material from Nadia Heninger

Lecture outline

- Foundations of privacy
- Privacy-enhancing technologies
  - PGP and modern encrypted messaging
  - Tor and anonymous communication
  - Privacy-respecting browsers (Tor, Firefox, Brave)
- Ethical principles
- Laws relevant to security research and practice

What is privacy and why do we care?

Various definitions of privacy:

- Secrecy
- Anonymity
- Solitude

Human rights and values:

- Human dignity
- Mental health
- Intimacy/relationships

Political and democratic values:

- Liberty of action
- Moral autonomy

The “crypto wars”: privacy vs. wiretapping

- Crypto wars 1.0
  - Late 1970s,
  - US government threatened legal sanctions on researchers who published papers about cryptography.
  - Threats to retroactively classify cryptography research.

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  - Main issues: Export control and key escrow
  - Several legal challenges

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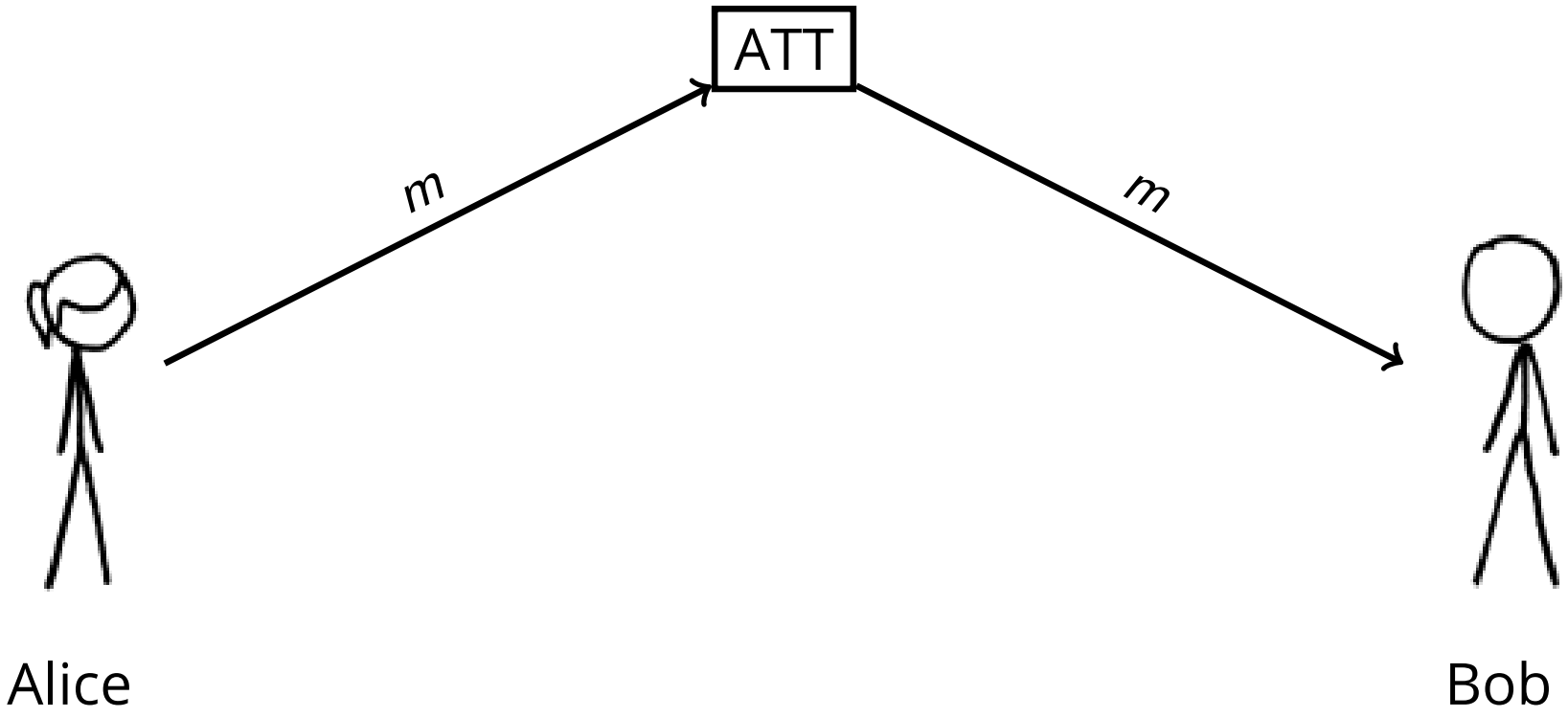
- Crypto wars 3.0
  - Now
  - Snowden
  - Apple v. FBI
  - …?
  - Calls for “balance”

Why is anonymous communication hard?



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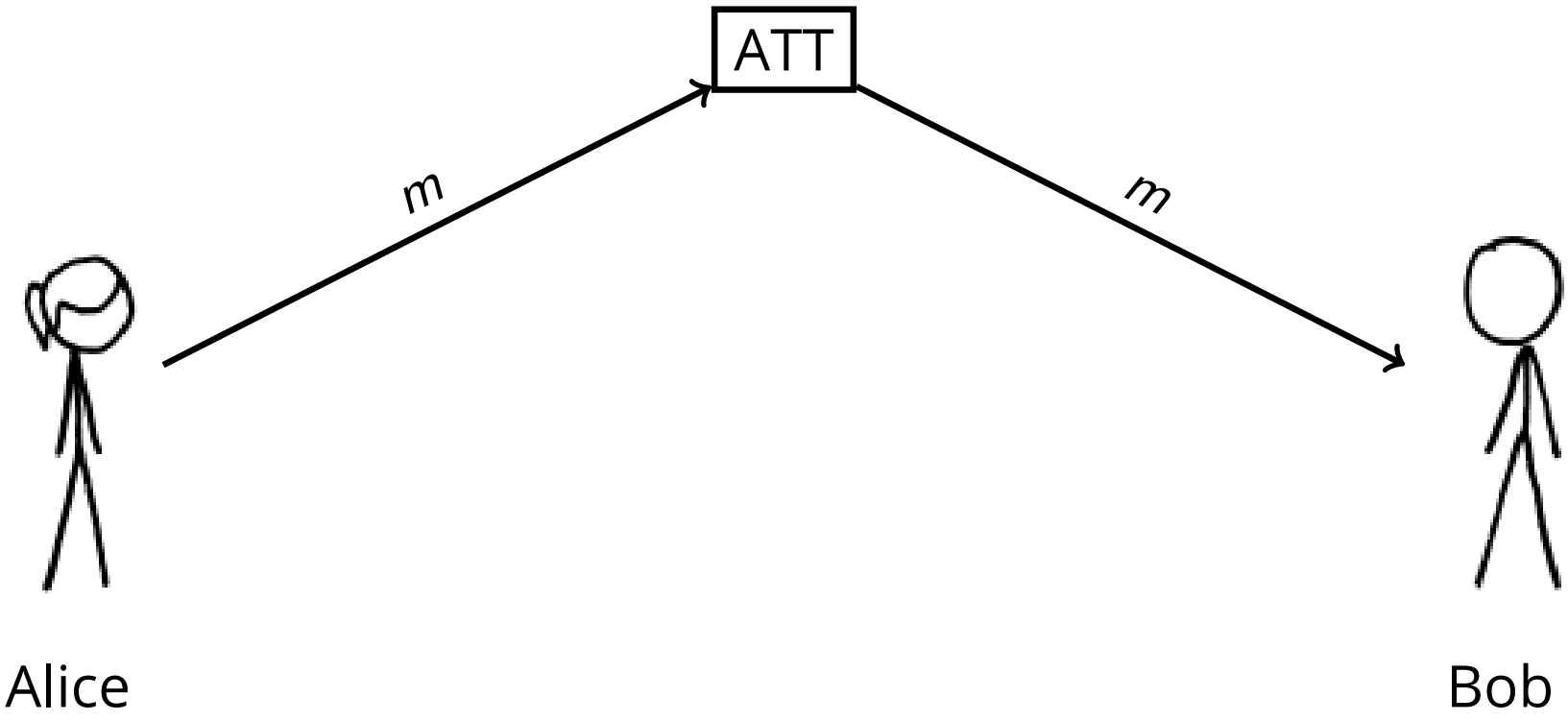
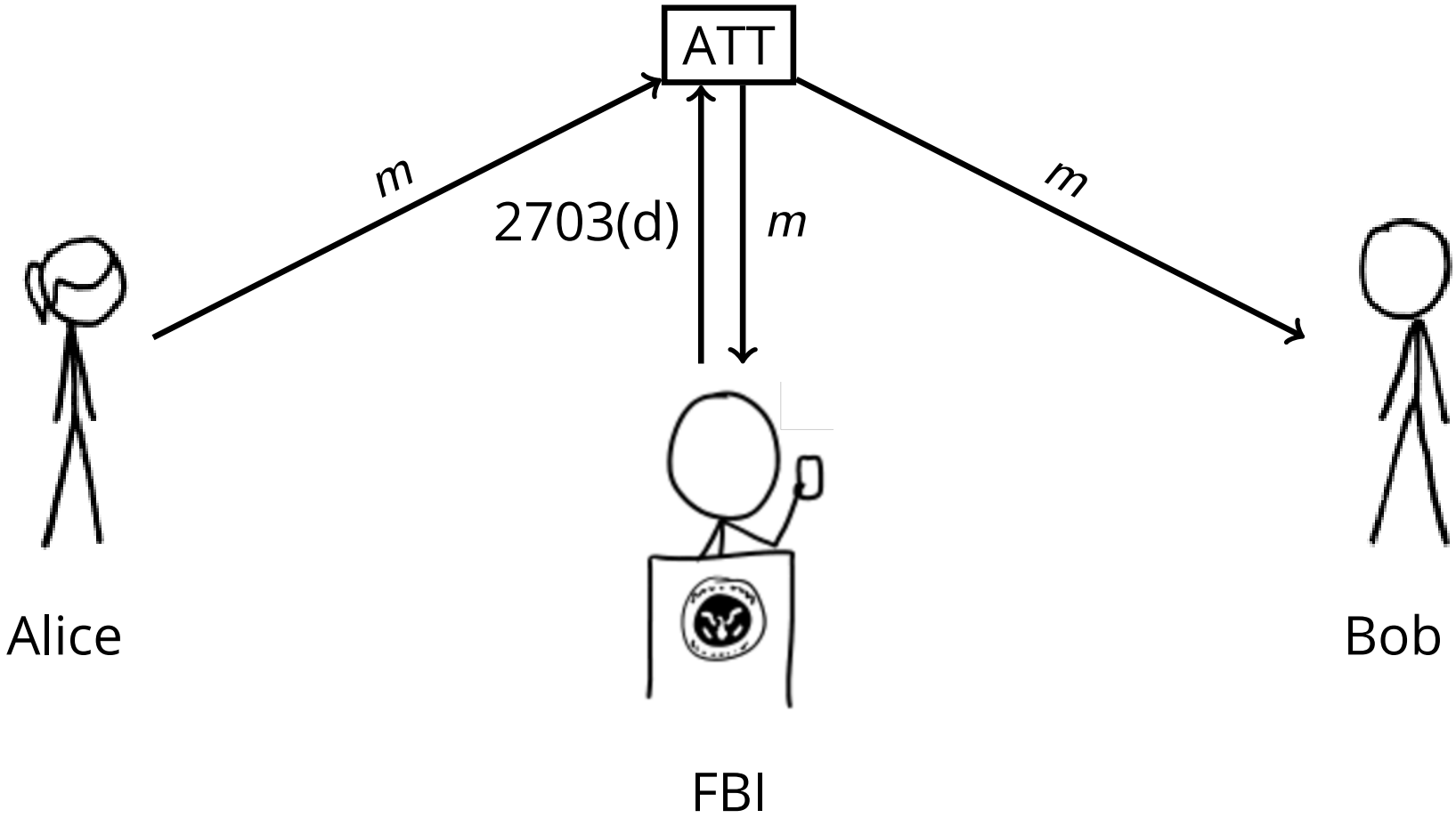


Communications/network service providers (ISPs, Google, Facebook, etc.) can generally see all traffic or communications they handle.

Why is anonymous communication hard?



Under the Stored Communications Act (1986), the US government can compel service providers to turn over customer communications. Only requires a subpoena for “storage” or communications held longer than 180 days.

Canary
Contact
Newsletters
Donate
Policy
Political Principles
Press
Projects

Search

□□ Español English
Português Русский
Deutsch Français Italiano
Polski Ελληνικά Català
Hindi

Support Riseup!

Bavarian raids

4 Jul, 2018

On June 20th, in order to gather data on a Riseup user, our fiscal sponsor in the EU was raided by the Bavarian police. This extreme overreach included raids on several homes, a hackerspace, a social center, and a lawyer's office. The police took all the computers, cell phones, disks, and records that they could. Several people were arrested and are now out and safe. However, as a consequence of these raids, the police have filed a number of unrelated charges.

What caused the police-state to raise up its ugly head? In this case, the justification was a website created to organize against a rally of an extreme right political party. It seems in Bavaria, you cannot make a website that tries to get people to come protest neo-fascists without also offending the police. The website had a riseup.net email address listed for a contact, and knowing they cannot get information from Riseup, the police looked at Riseup's donate page and found we accept donations in Europe through a non-profit organization ("Verein") based in Germany called Zwiebelfreunde. They decided this meant that Riseup was run by this organization (it is not), and so aggressively targeted this organization.

What does this mean for you, dear Riseup user?

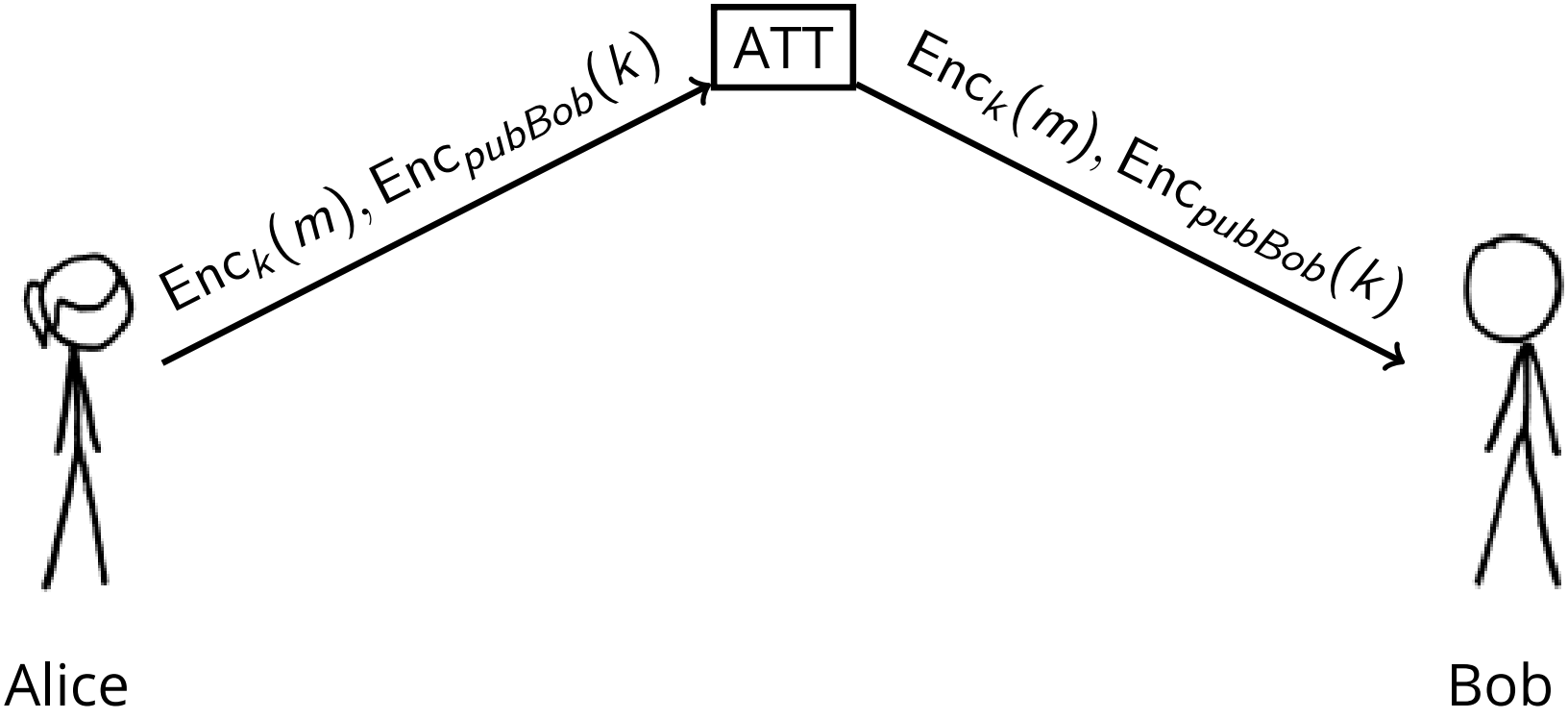
First, don't panic. All your data stored by Riseup is still secure.

Second, if you donated to Riseup via our European IBAN mechanism then there is a good chance the German police now have a record of your bank account number, name, amount you donated, and the date of the donation.

Third, please join us in supporting our friends and allies at Zwiebelfreunde[0]. They are amazing and need your support. In the coming weeks, information will be posted to their website detailing ways that you can help.

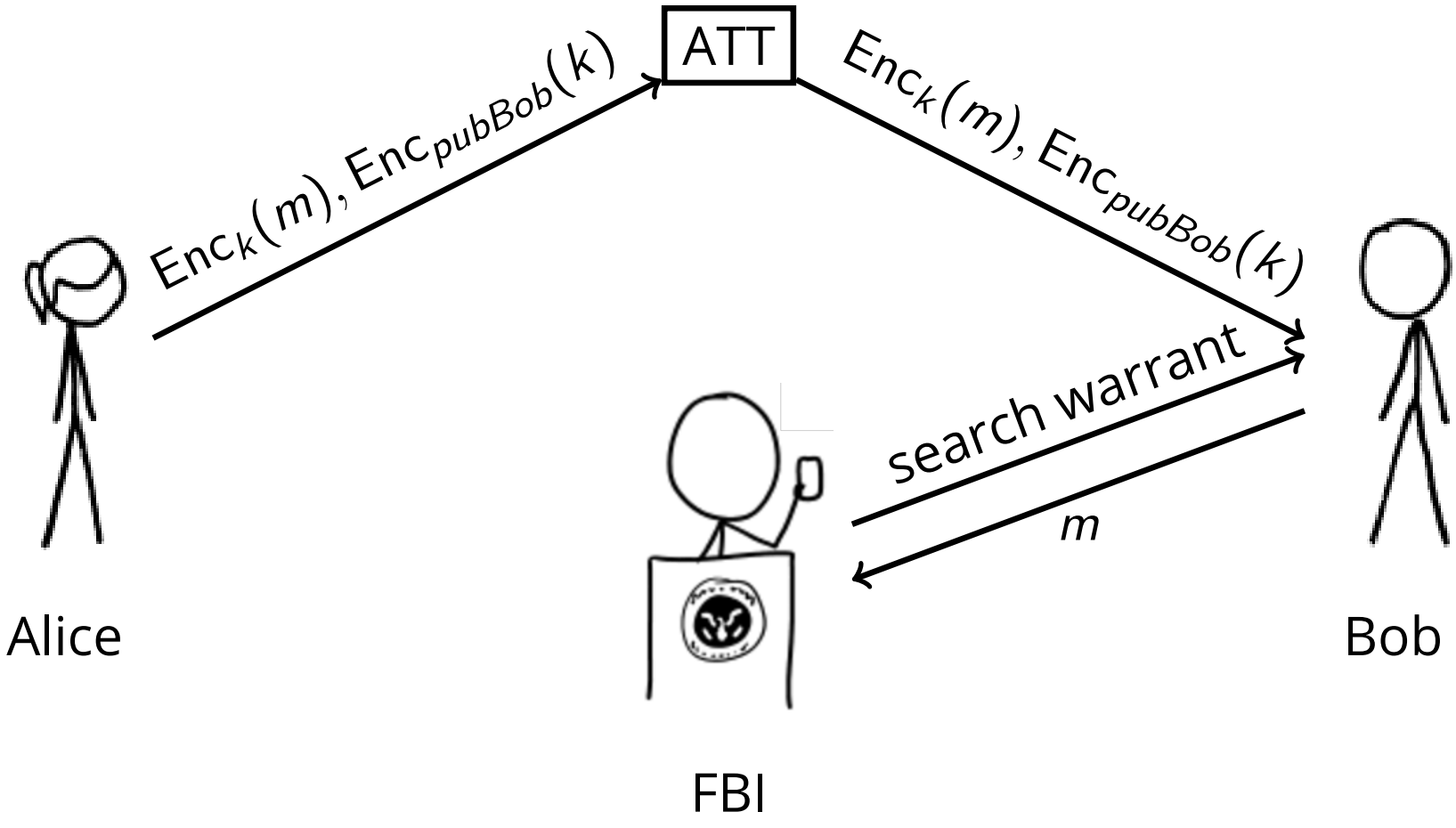
In solidarity,
The Riseup Birds

End-to-end encryption and service providers



If a message is end-to-end encrypted, the service provider may not have the plaintext.

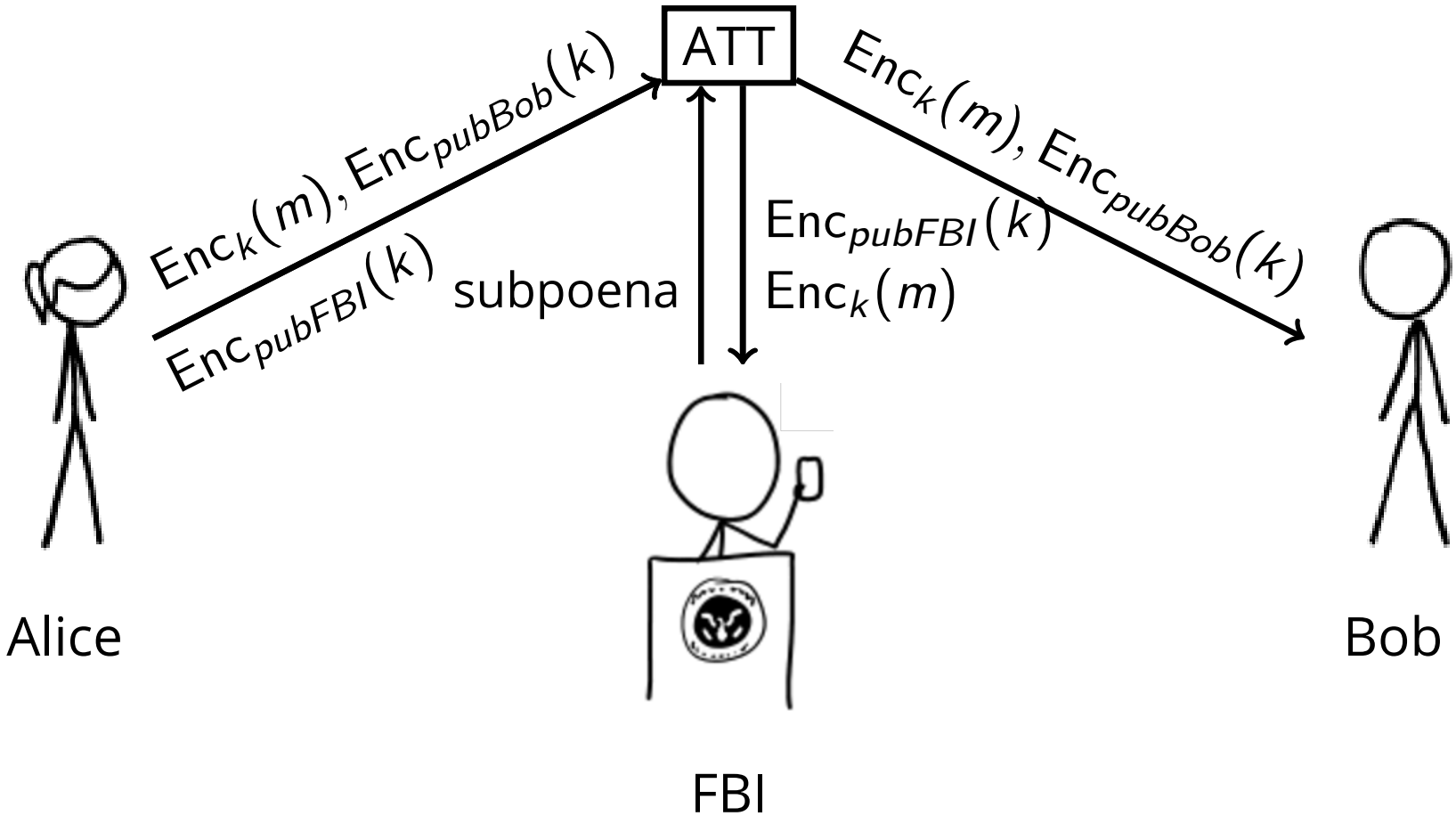
End-to-end encryption and service providers



Law enforcement can always serve the customer with a search warrant for the decrypted communications.

End-to-end encryption and service providers

"Key escrow" or "backdoored encryption"



The US government has been asking service providers to design ways to overcome encryption for decades. Most reasonable proposals work something like this.

Pretty Good Privacy (PGP)

- Written by Phil Zimmermann in 1991
  - Response to US Senate bill requiring crypto backdoors (didn't pass)
- Public key email encryption "for the masses"
  - Signatures, public key encryption, or sign+encrypt
- Key management
  - Public keyservers
  - Web of trust: users sign other users' keys
- Grand jury investigated Zimmermann 1993–1996
  - No indictment issued, but was a subject for violating export controls
- Fundamental insight: Knowledge about cryptography is public. In theory citizens can circumvent government-mandated key escrow by implementing cryptography themselves.

PGP in the modern era

- PGP was built before modern cryptographic protocol design was properly understood.
- Numerous vulnerabilities
  - Outdated cipher choices
  - Doesn’t authenticate encryption with a MAC or authenticated encryption mode
- Commercialized in the 90s, most recently developed by Symantec
- GnuPGP and libgcrypt open source and quite widely used
- 2005 paper on usability issues: “Why Johnny Can’t Encrypt: A Usability Evaluation of PGP 5.0” by Whitten and Tygar
  - Most experts unable to use PGP properly

https://xkcd.com/1181/

“If you want to be extra safe, check that there’s a big block of jumbled characters at the bottom.”

Message Encryption since PGP

- For messaging, Signal, WhatsApp, or iMessage offer modern end-to-end encryption.
- Modern protocols typically:
  - Use Diffie-Hellman to negotiate ephemeral keys
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  - Offer “deniability”:
    - Message recipient can verify message integrity without a third party being able to “cryptographically prove” that sender sent the message.
    - Cryptographically interesting, but likely legally irrelevant.

Crypto Wars 2.0

In the current debates about government-mandated weakening of cryptography, there are two scenarios of interest:

- Message encryption.
  - This is what we've talked about so far in lecture.

- Storage encryption.
  - For example, unlocking iPhones.
  - This is what the Apple v. FBI case was about.

In Apple v. FBI, the question was whether the government could compel Apple to break their own encryption mechanism with the All Writs Act. The government backed down and reportedly used a specialty consulting firm to unlock the phone.

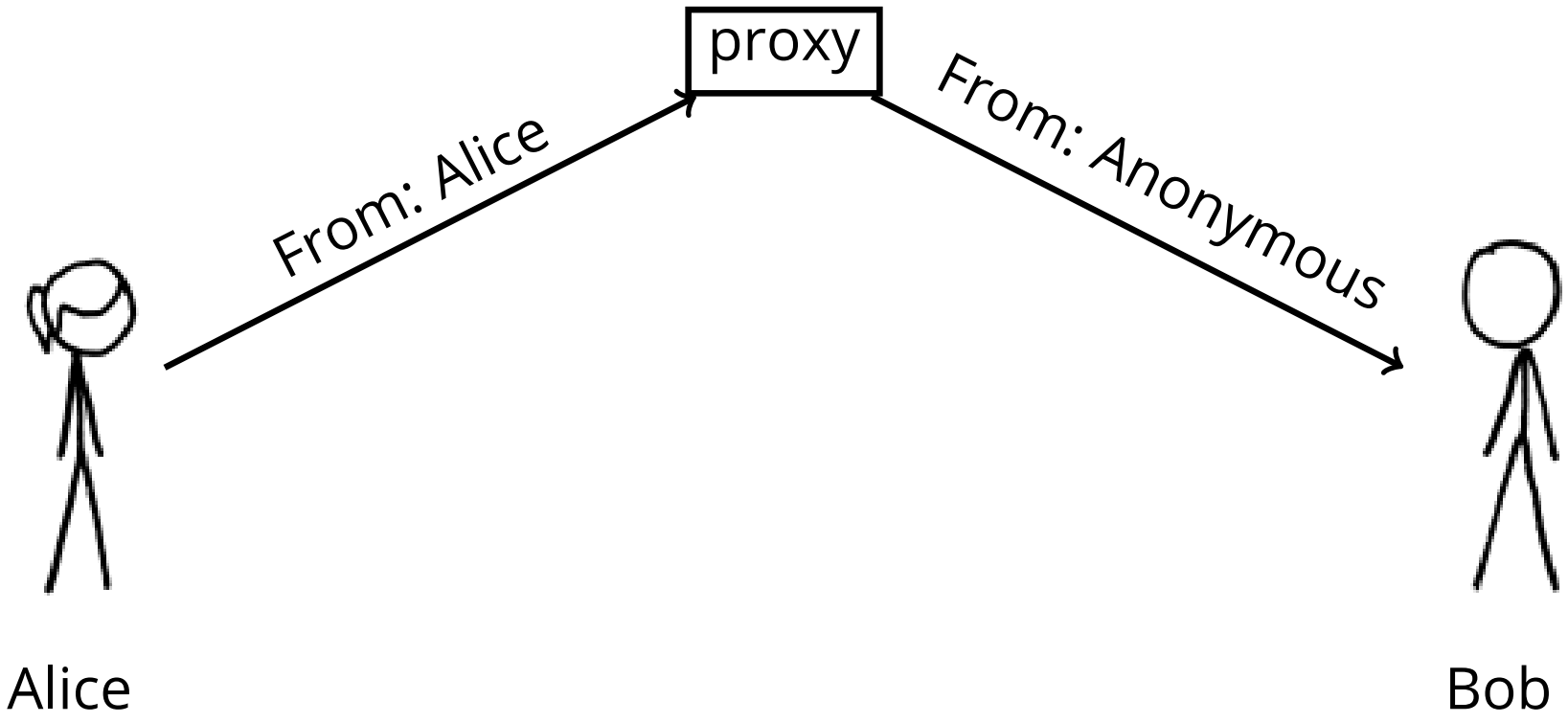
Anonymity

Michael Hayden, former NSA director: “We kill people based on metadata."

- Long history of anonymous communication in US democracy
- e.g. Revolutionary war anonymous political pamphlets

Technical question: Is anonymous communication still feasible on the internet?

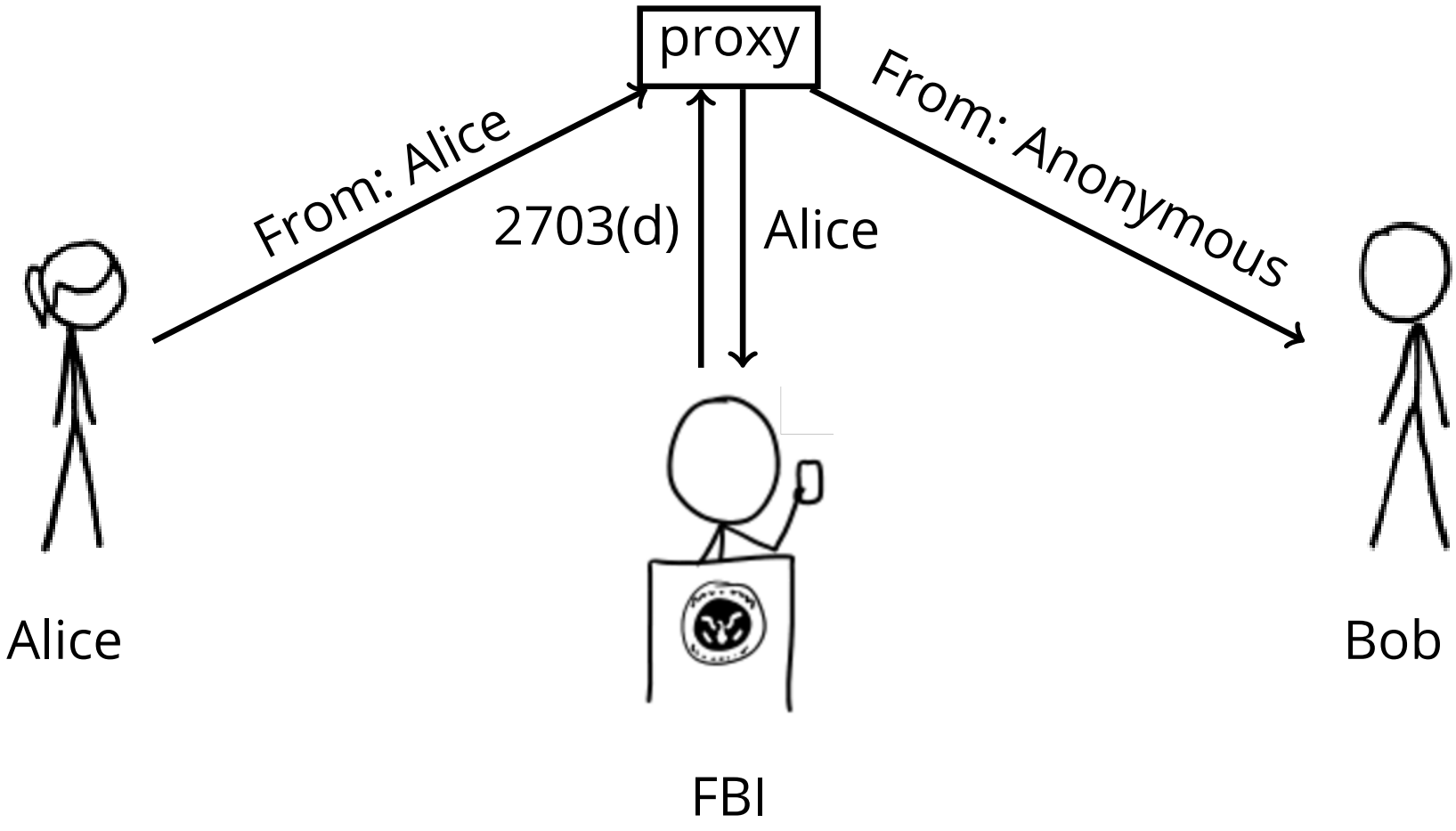
“Anonymity” via tunneling or proxies



A proxy can rewrite metadata. Examples:

- Early “anonymous remailers” forwarded email.
- VPN services allow users to tunnel traffic

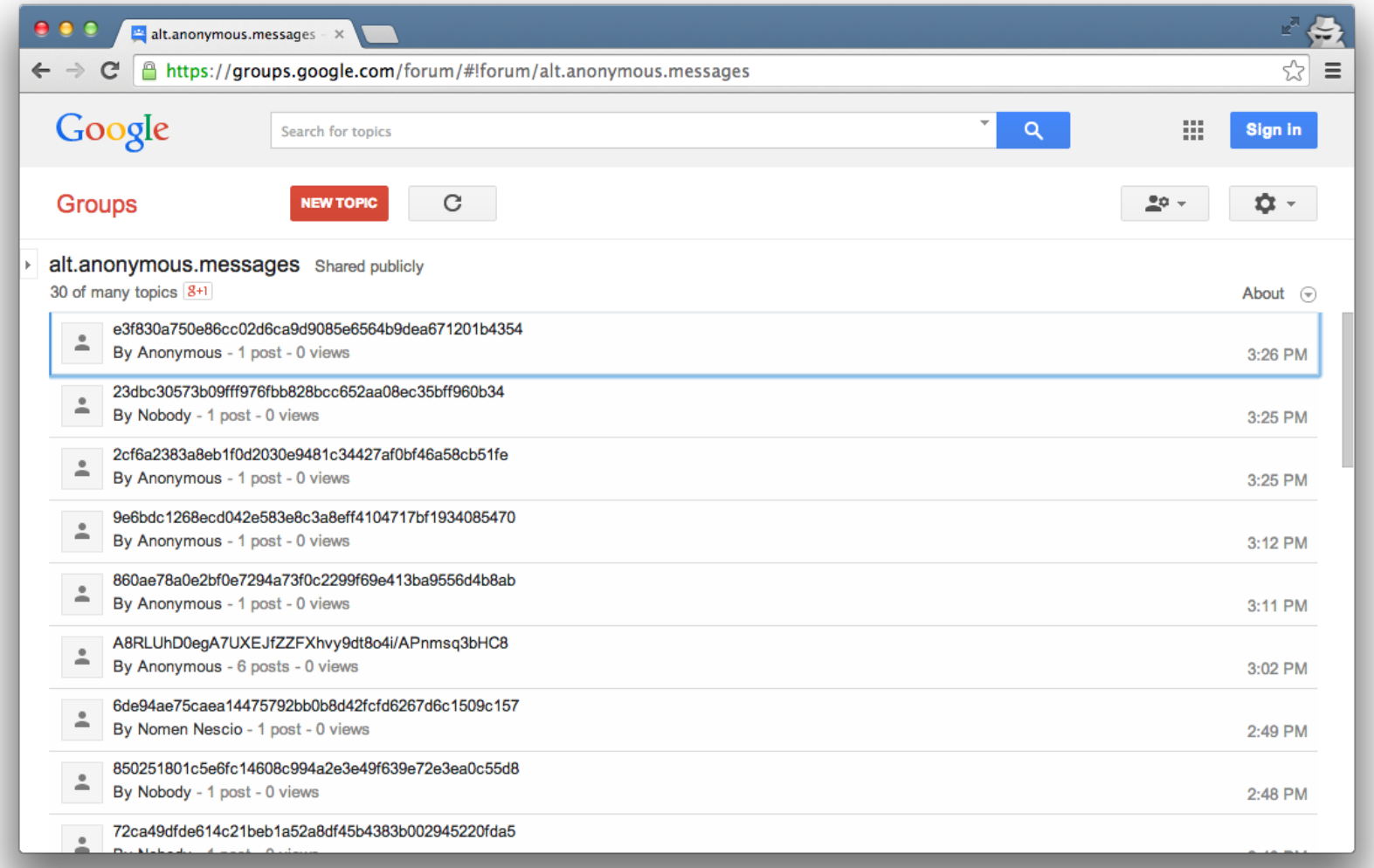
“Anonymity” via tunneling or proxies



One-hop proxies have a single point of failure, must see both sides of communication.

Attempt to fix: Anonymous bulletin boards

Post message encrypted to recipient in public; recipient tries to decrypt all messages.



Bulletin board host still has metadata from visitors.

Tor: Anonymous communication for TCP sessions

Desired properties:

- Network attacker watching client traffic can't see destination.
- Destination server does not see client IP address.
- Network nodes can't link client and server.
- Fast enough to support TCP streams and network applications.

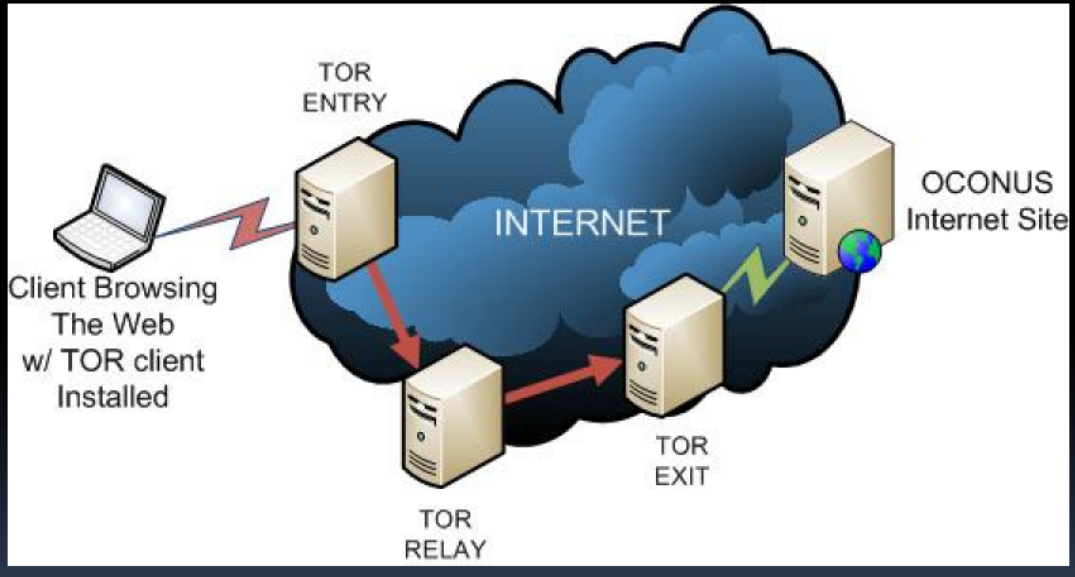
Current state: A nonprofit organization, active academic research, deployed around the world.

Not perfect, but a building block.

(U) What is TOR?

- (U) "The Onion Router"
- (U) Enables anonymous internet activity
  - General privacy
  - Non-attribution
  - Circumvention of nation state internet policies
- (U) Hundreds of thousands of users
  - Dissidents (Iran, China, etc)
  - (S//SI//REL) **Terrorists!**
  - (S//SI//REL) Other targets too!

(U) What is TOR?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OCONUS
Internet Site
Client Browsing
The Web
w/ TOR client
Installed
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EXIT
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RELAY

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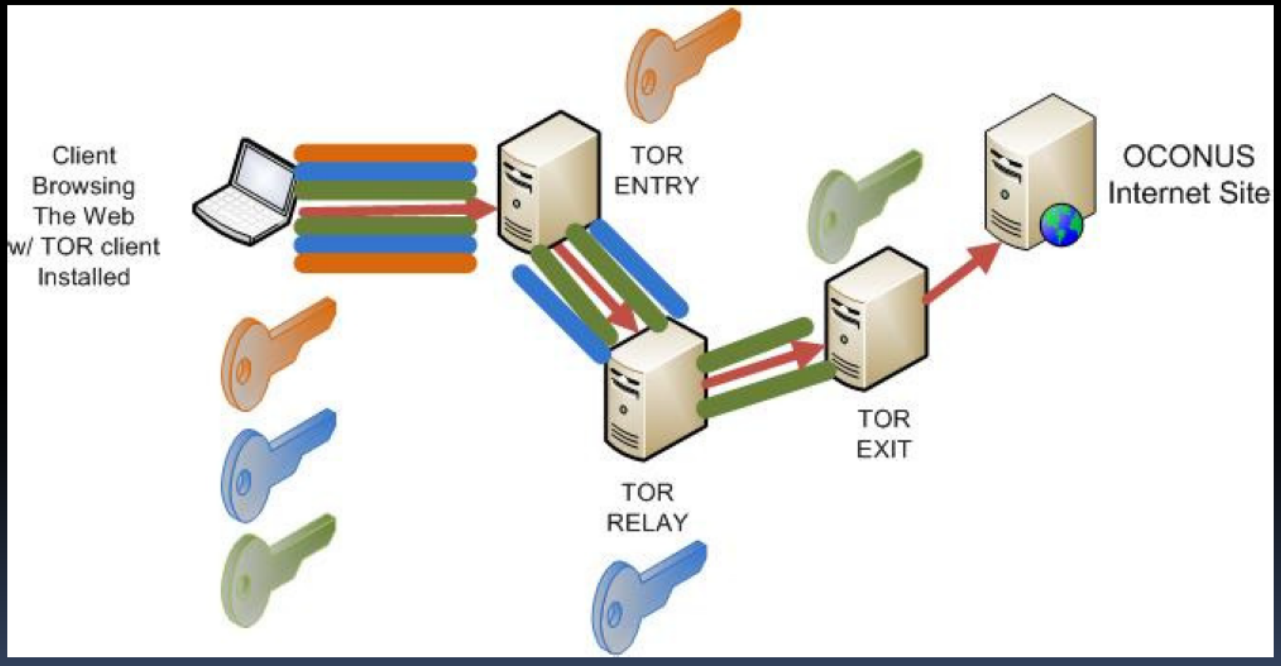
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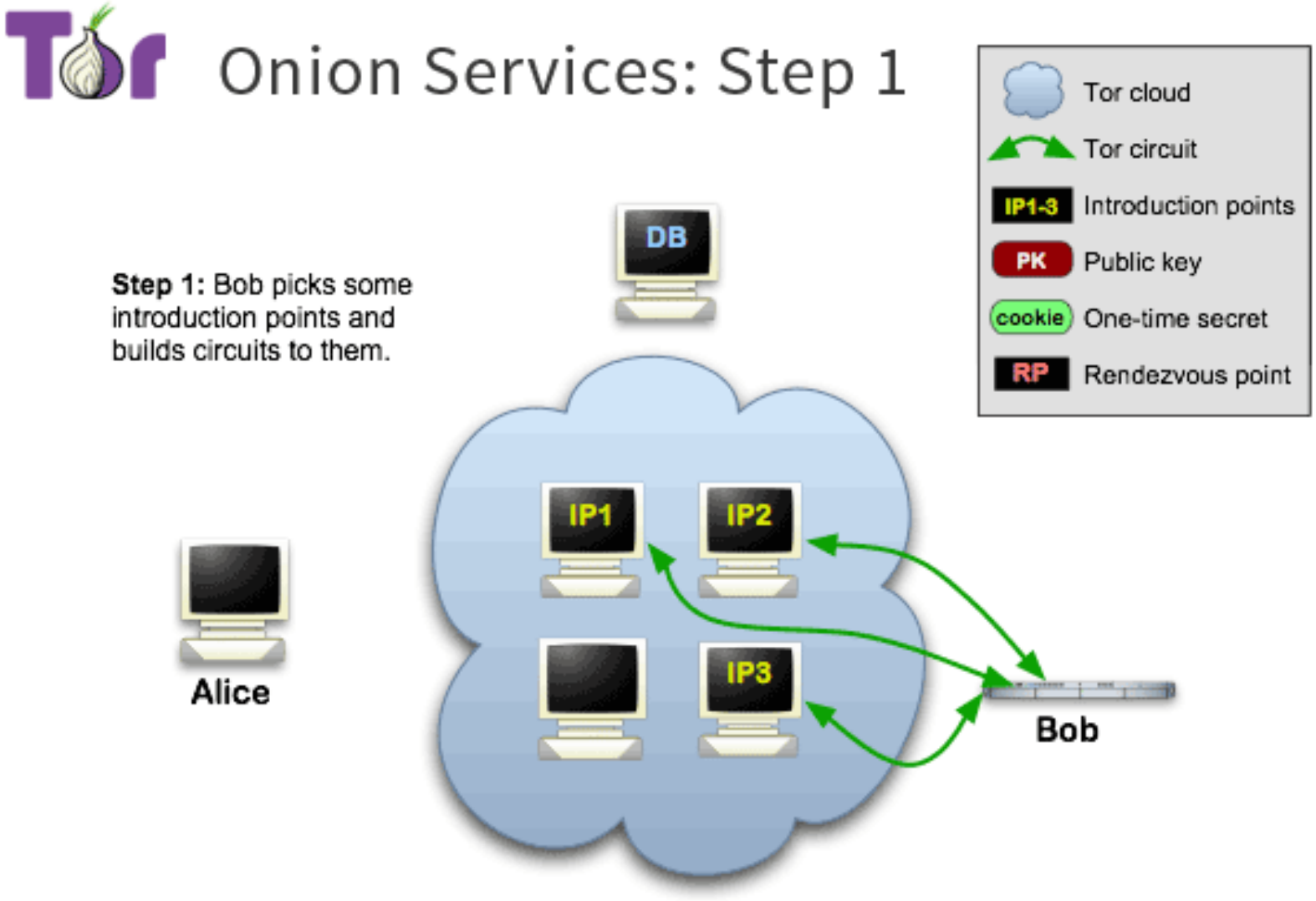
(U) What is TOR?

- (U) TOR Browser Bundle
  - Portable Firefox 10 ESR (tbb-firefox.exe)
  - Vidalia
  - Polipo
  - TorButton
  - TOR
  - "Idiot-proof"

Tor also allows “anonymous” servers



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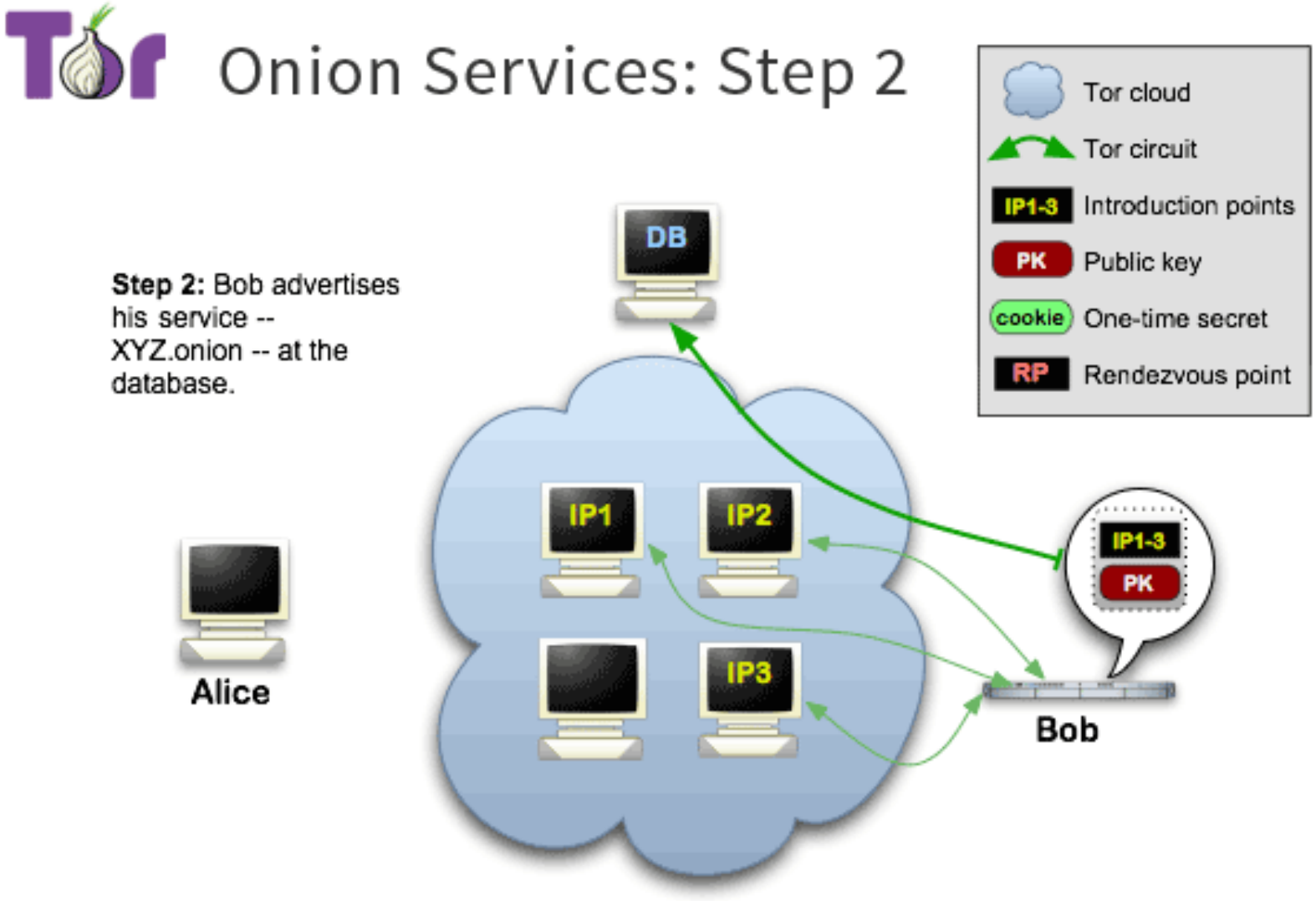

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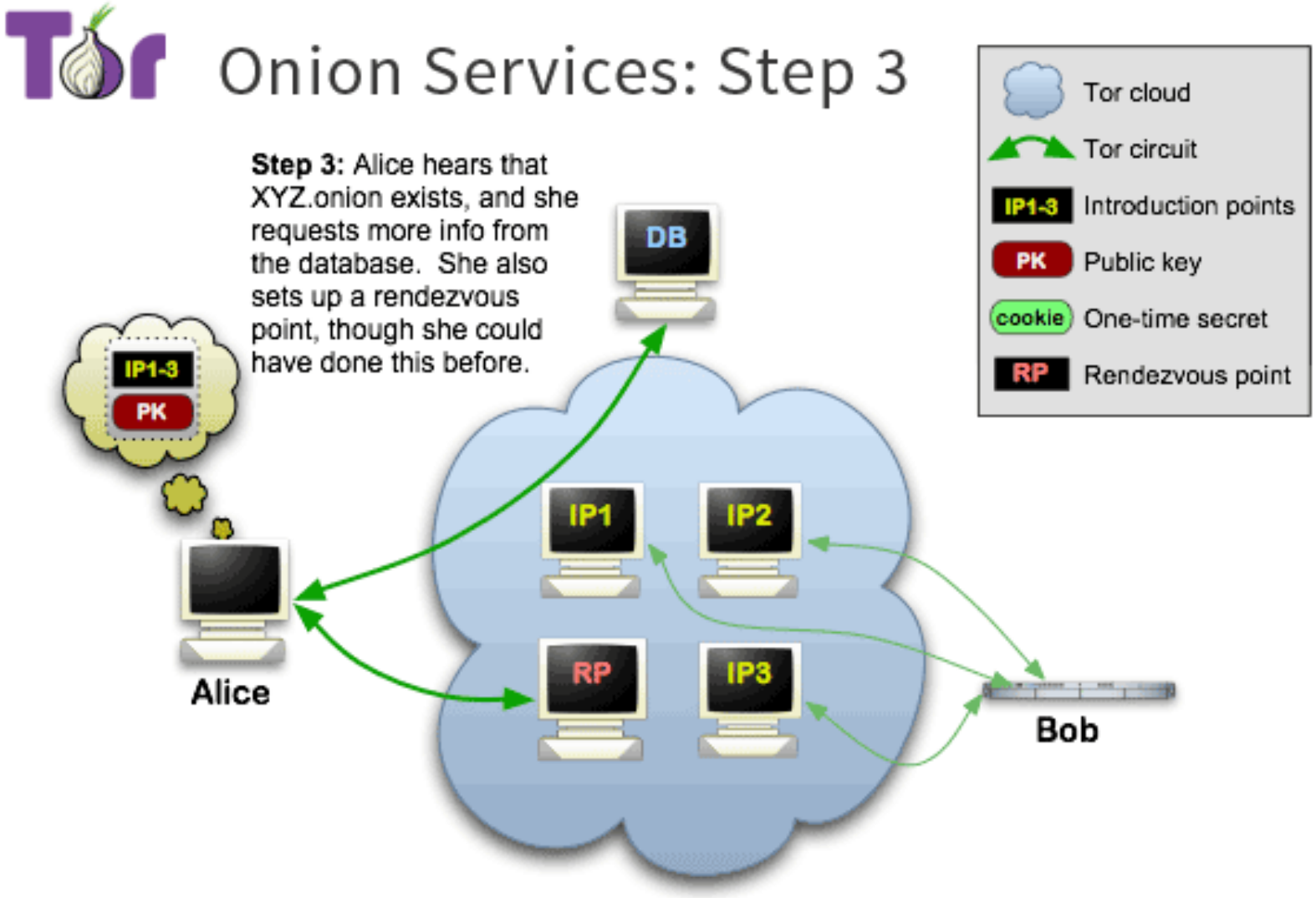

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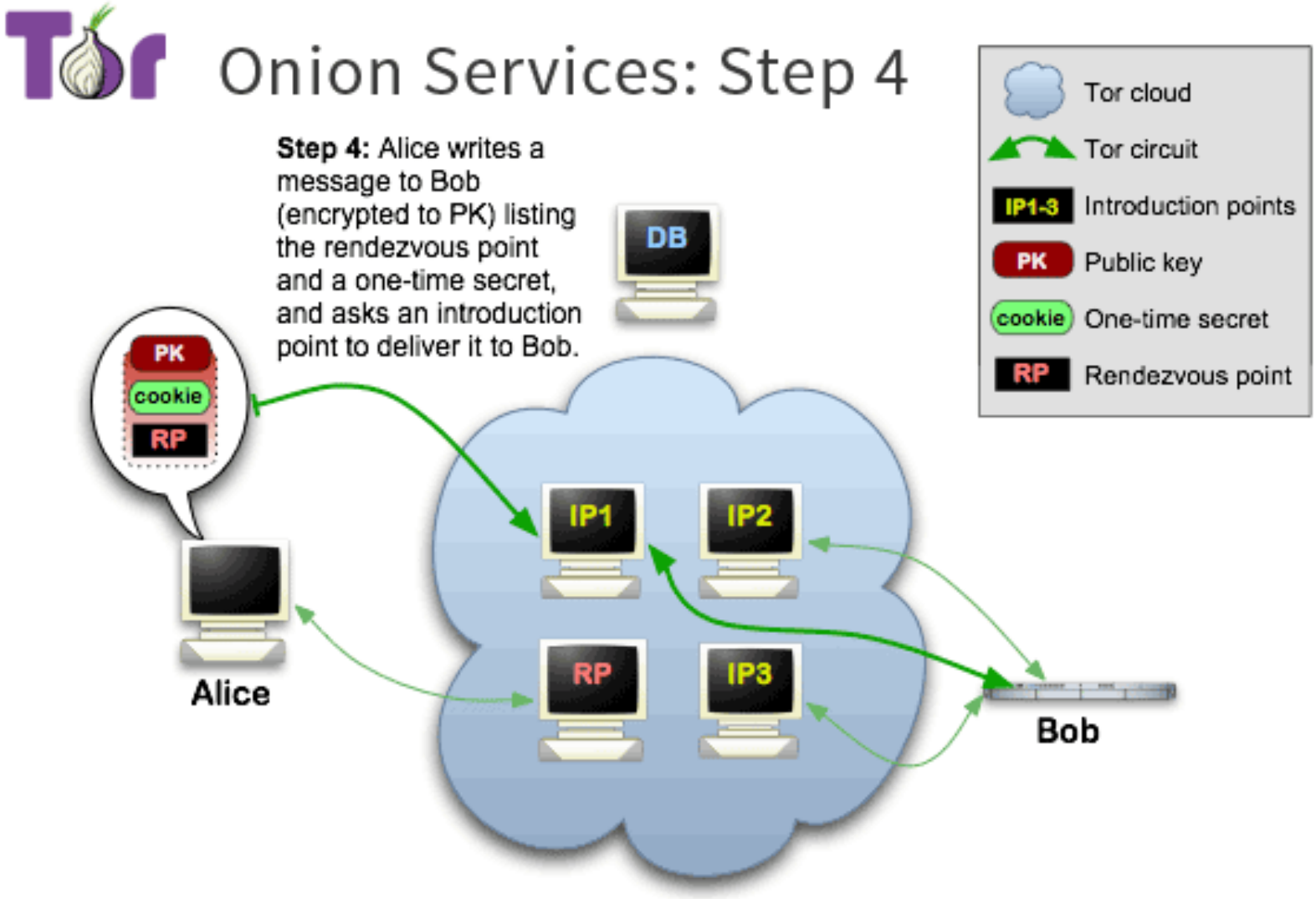

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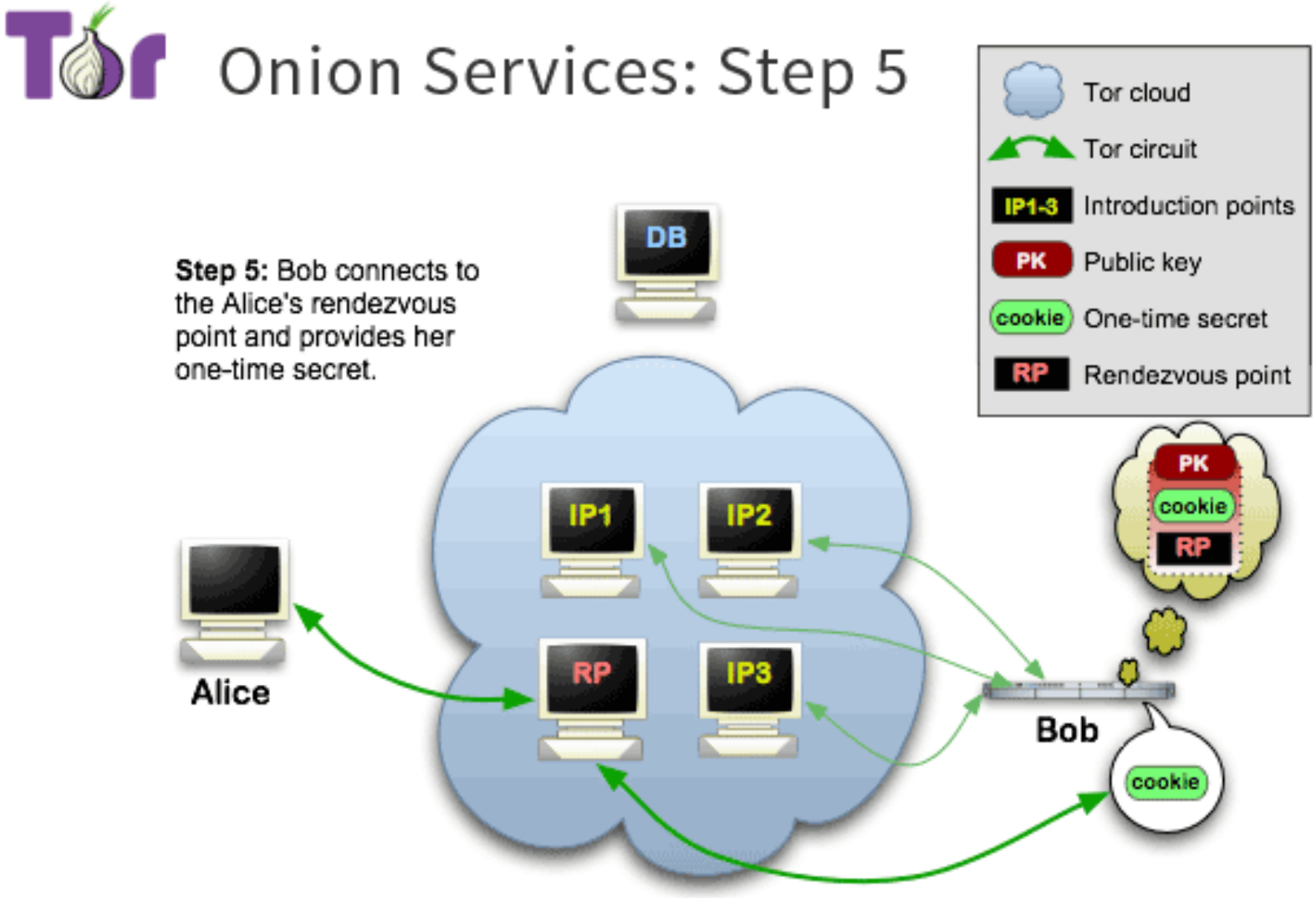

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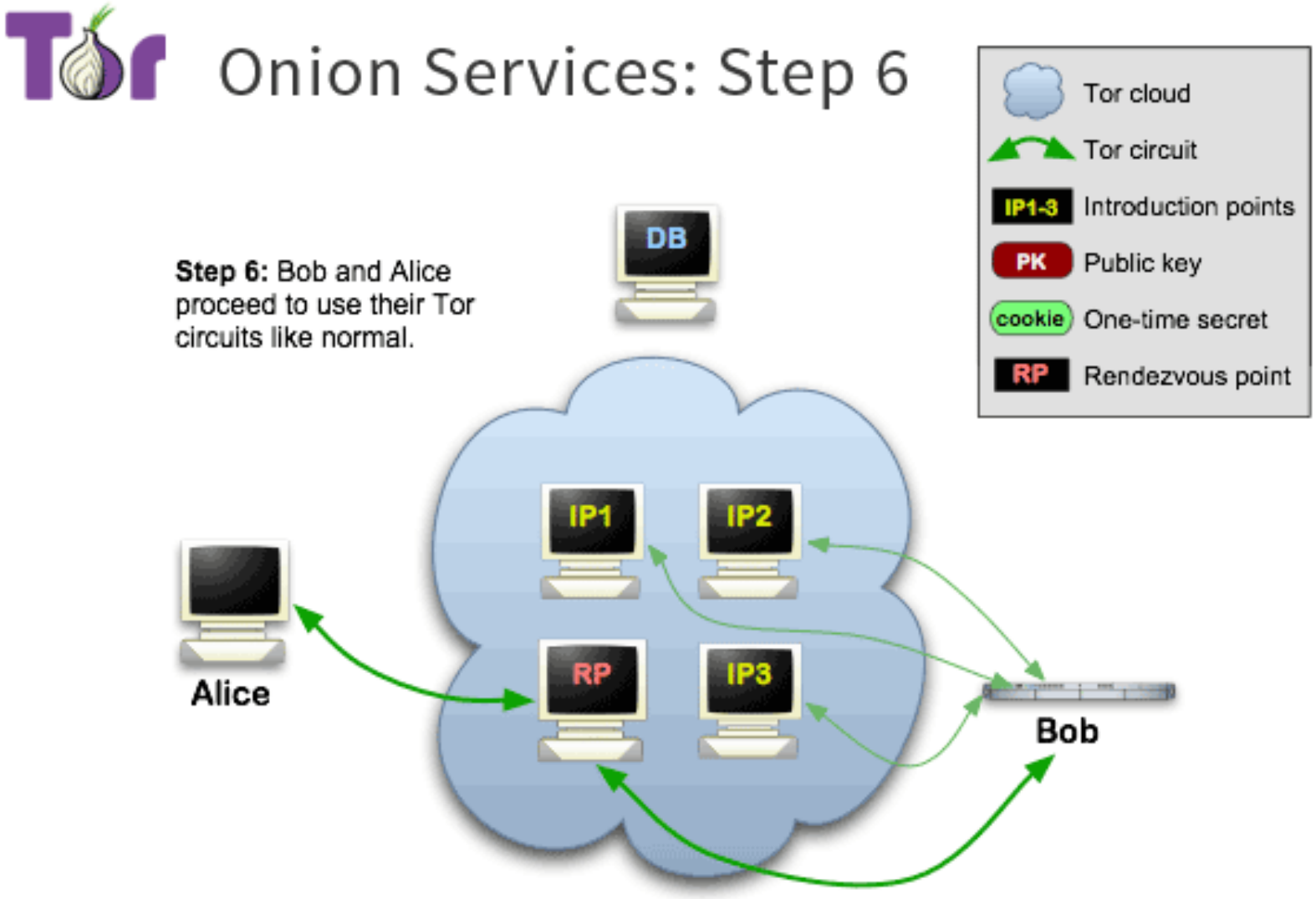

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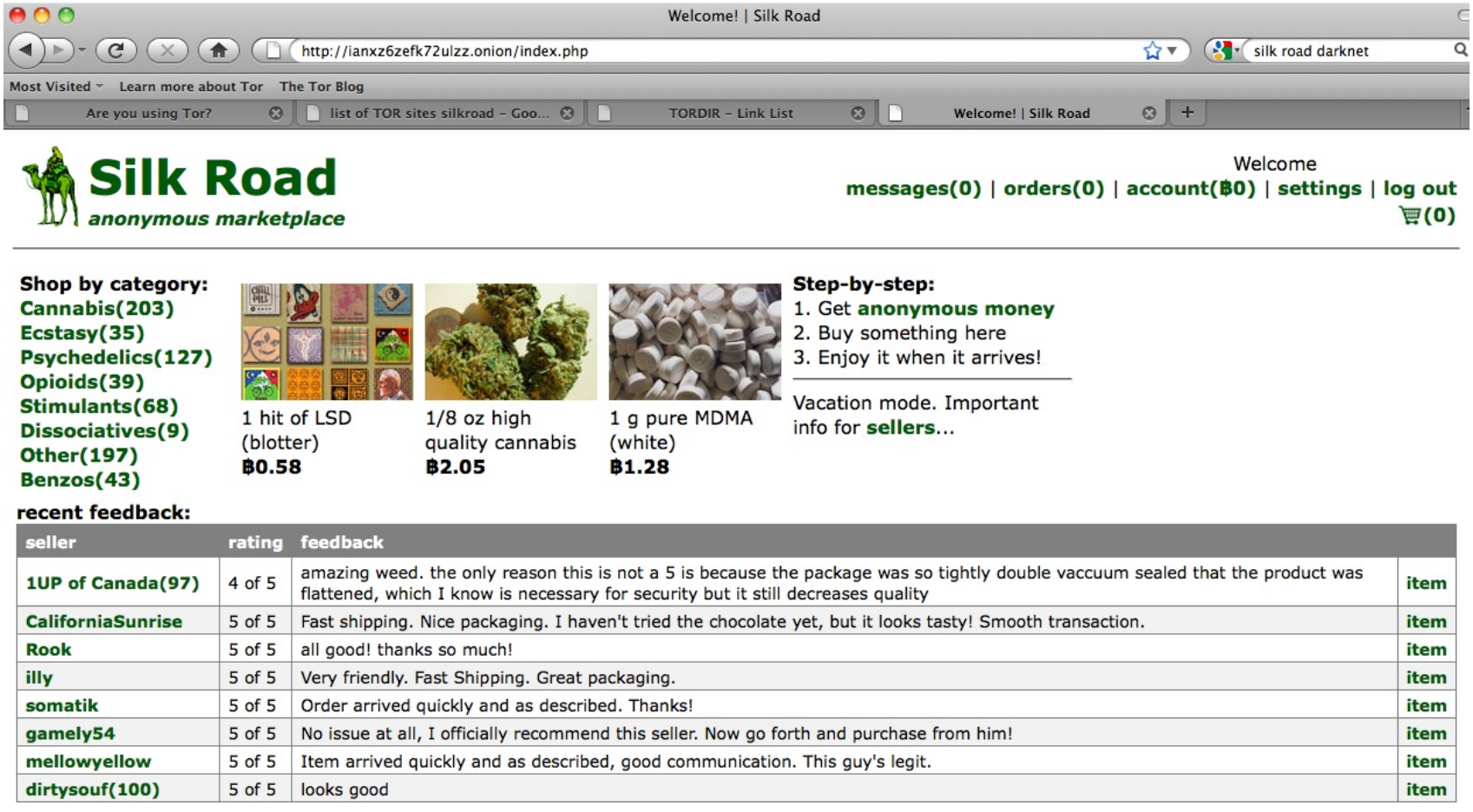

vice.com

In practice, prominent “hidden services” deanonymized through real-world metadata, browser 0days, misconfigured servers.

Stinks (U)

[redacted]

CT SIGDEV

[redacted]

JUN 2012

Tor Stinks… (U)

- We will never be able to de-anonymize all Tor users all the time.
- With manual analysis we can de-anonymize a **very small fraction** of Tor users, however, **no** success de-anonymizing a user in response to a TOPI request/on demand.

[redacted]

b. On March 1, 2012, at approximately 5:03 p.m. CST, HAMMOND was seen leaving the CHICAGO RESIDENCE. Almost immediately after, CW-1 (in New York) contacted me to report that the defendant was offline. Pen/Trap data also reflected that TOR network activity and Internet activity from the CHICAGO RESIDENCE stopped at approximately the same time.

c. Later, also on March 1, 2012, at approximately 6:23 p.m. CST, HAMMOND was observed returning to the CHICAGO RESIDENCE. TOR network traffic resumed from the CHICAGO RESIDENCE approximately a minute or so later. Moreover, CW-1 reported to me that the defendant, using the online alias "yohoho," was back online at approximately the same time as physical surveillance in Chicago showed HAMMOND had returned to the CHICAGO RESIDENCE. New York FBI, through a program that remotely monitors the Internet activity of the buddy list on CW-1's jabber program, including when a "buddy" signs on and off, corroborated CW-1's report that the defendant, using "yohoho," was back online. Pen/Trap data reflected extensive TOR-related activity through the night.

8. In the course of this investigation, I have learned that the person who sent the e-mail messages described above took steps to disguise his identity. Specifically, Harvard received the e-mail messages from a service called Guerrilla Mail, an Internet application that creates temporary and anonymous e-mail addresses available free of charge. Further investigation yielded information that the person who sent the e-mail messages accessed Guerrilla Mail by using a product called TOR, which is also available free of charge on the Internet and which automatically assigns an anonymous Internet Protocol ("IP") address that can be used for a limited period of time. Every computer attached to the Internet uses an IP address, which is a unique numerical identifier, to identify itself to other computers on the Internet and direct the orderly flow of electronic information between them. IP addresses typically consist of four numbers between 0 and 255 separated by periods (*e.g.*, 216.239.51.99). Both TOR and Guerilla Mail are commonly used by Internet users seeking to communicate anonymously and in a manner that makes it difficult to trace the IP address of the computer being used.

9. Harvard University was able to determine that, in the several hours leading up to the receipt of the e-mail messages described above, ELDO KIM accessed TOR using Harvard's wireless network.

Anonymity on the web

- Companies like Google, Facebook, Twitter, Microsoft, Amazon, Target, Walmart, . . . make a lot of money from tracking users.
- For some of these companies you are the product. So tracking you is their business.

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- How do websites track users?

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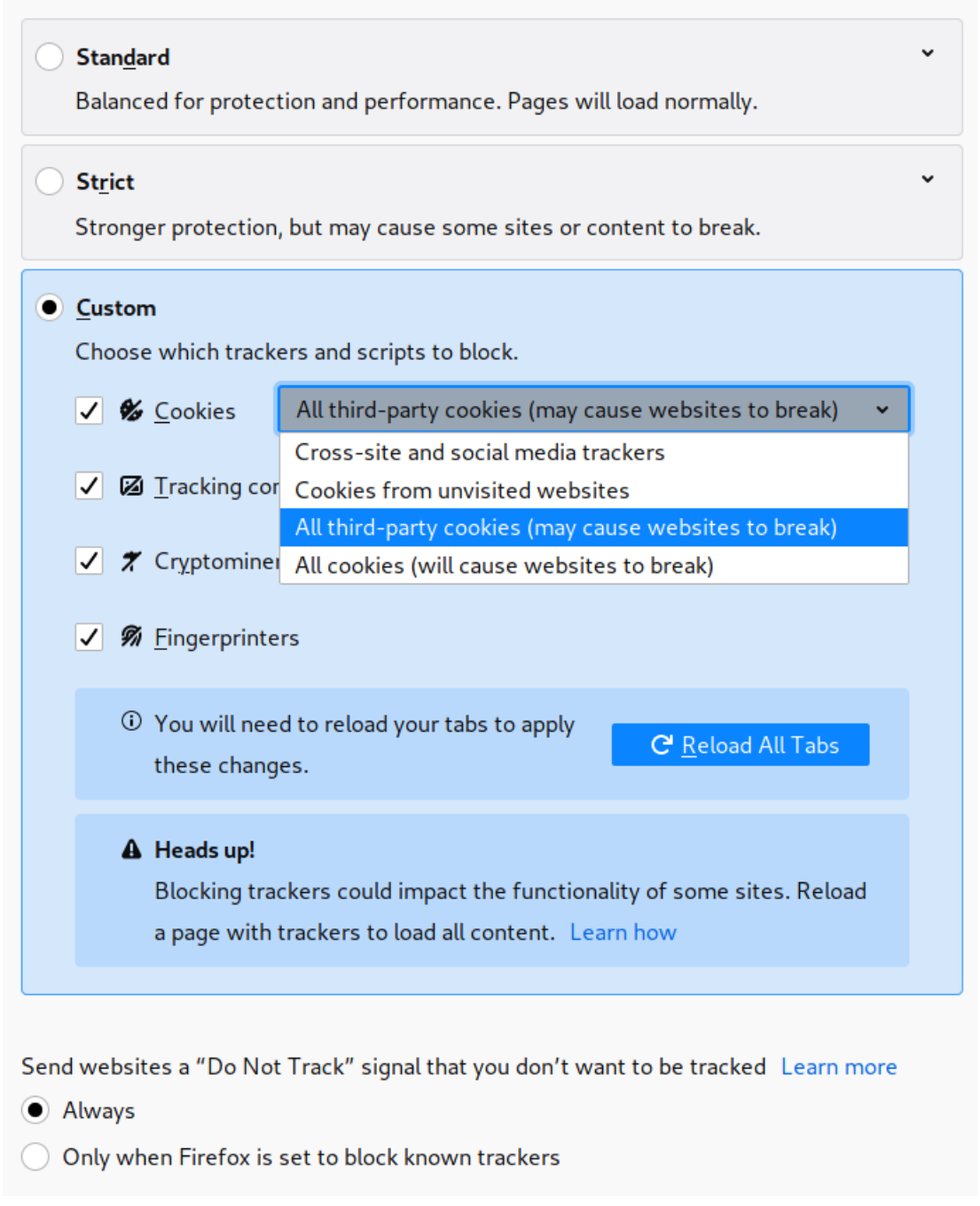
  - Tracking content: Sites include tracking code into URLs (e.g., advertisements, videos, marketing emails, etc.)
  - Fingerprinting: sites profile your browser, extensions, OS, hardware, screen resolution, fonts you have installed, etc.

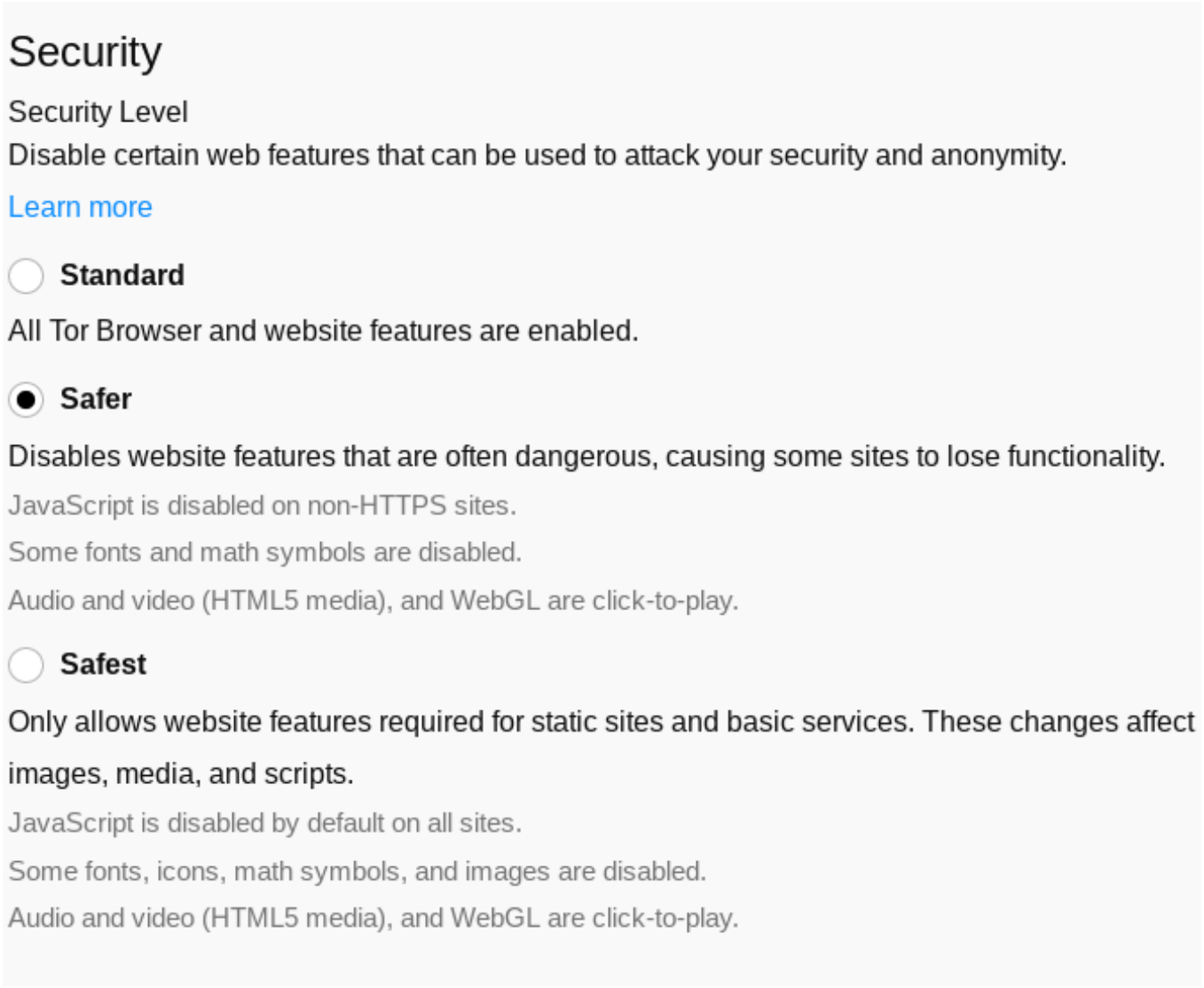
What can you do about this?

- Can’t really avoid these platforms (e.g., Facebook profiles you even if you don’t have an account).
- Use a browser that cares about your privacy (e.g., Firefox, The Tor Browser, Brave, Safari)
- Use privacy-enhancing browser extensions

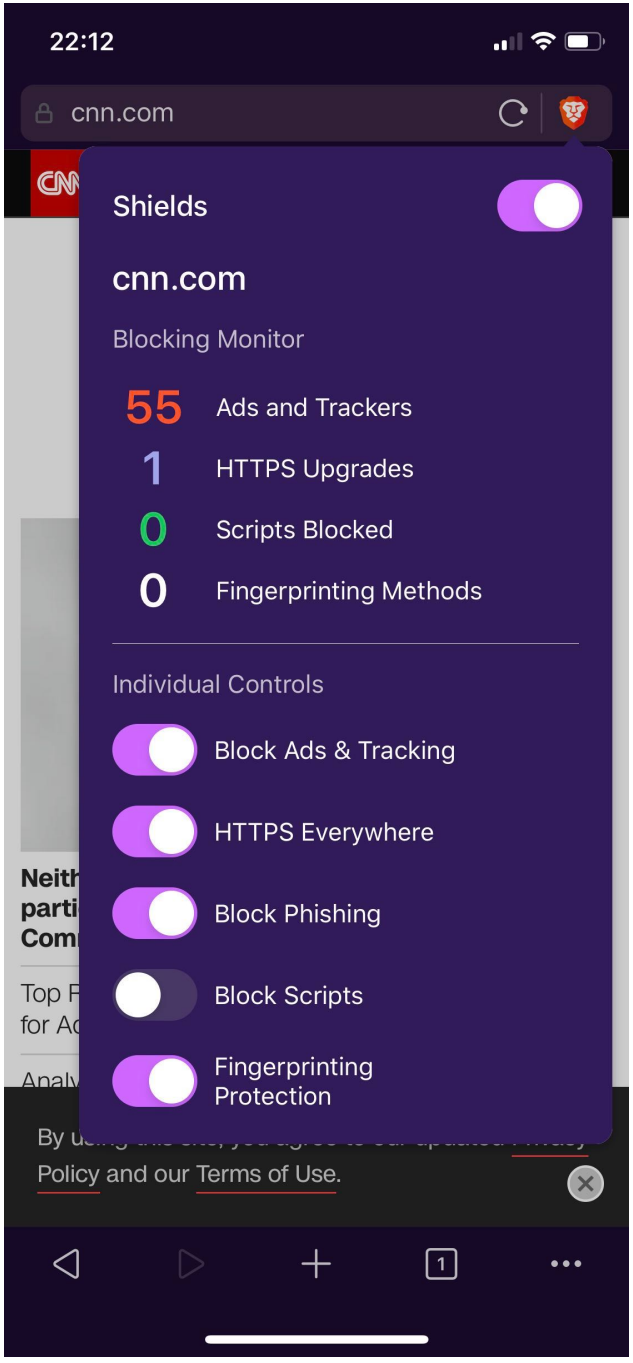
Privacy-enhanced browsing (Firefox)

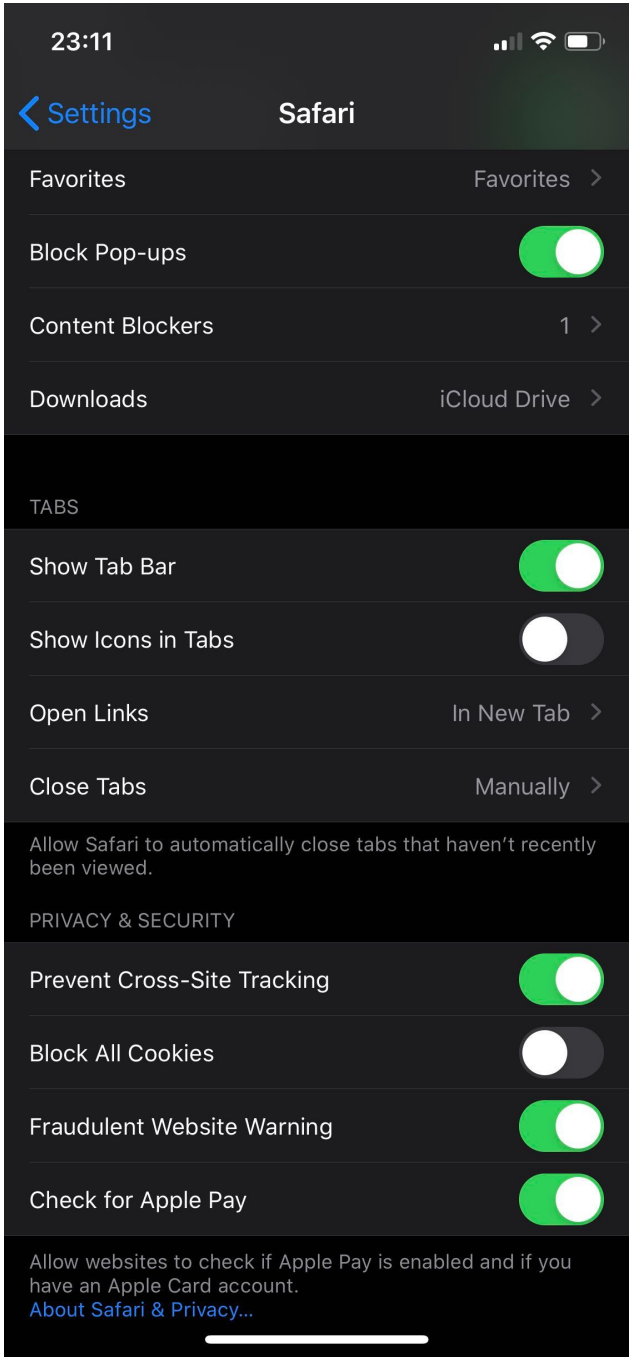


Privacy-enhanced browsing (Tor)



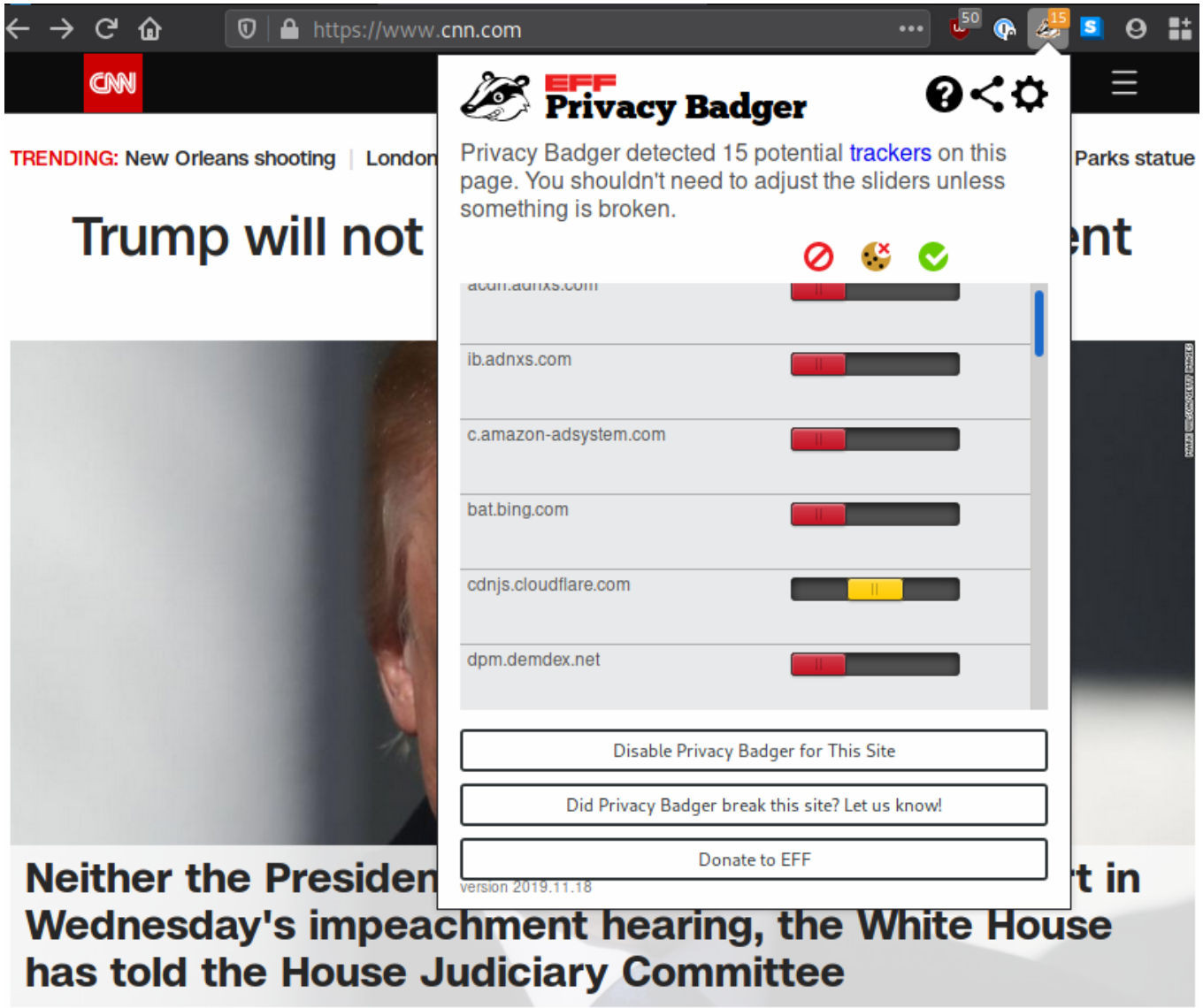
Privacy-enhanced browsing (Brave & Safari)





Privacy-enchaning extensions

- Privacy Badger blocks trackers; uBlock Origin blocks ads; many others



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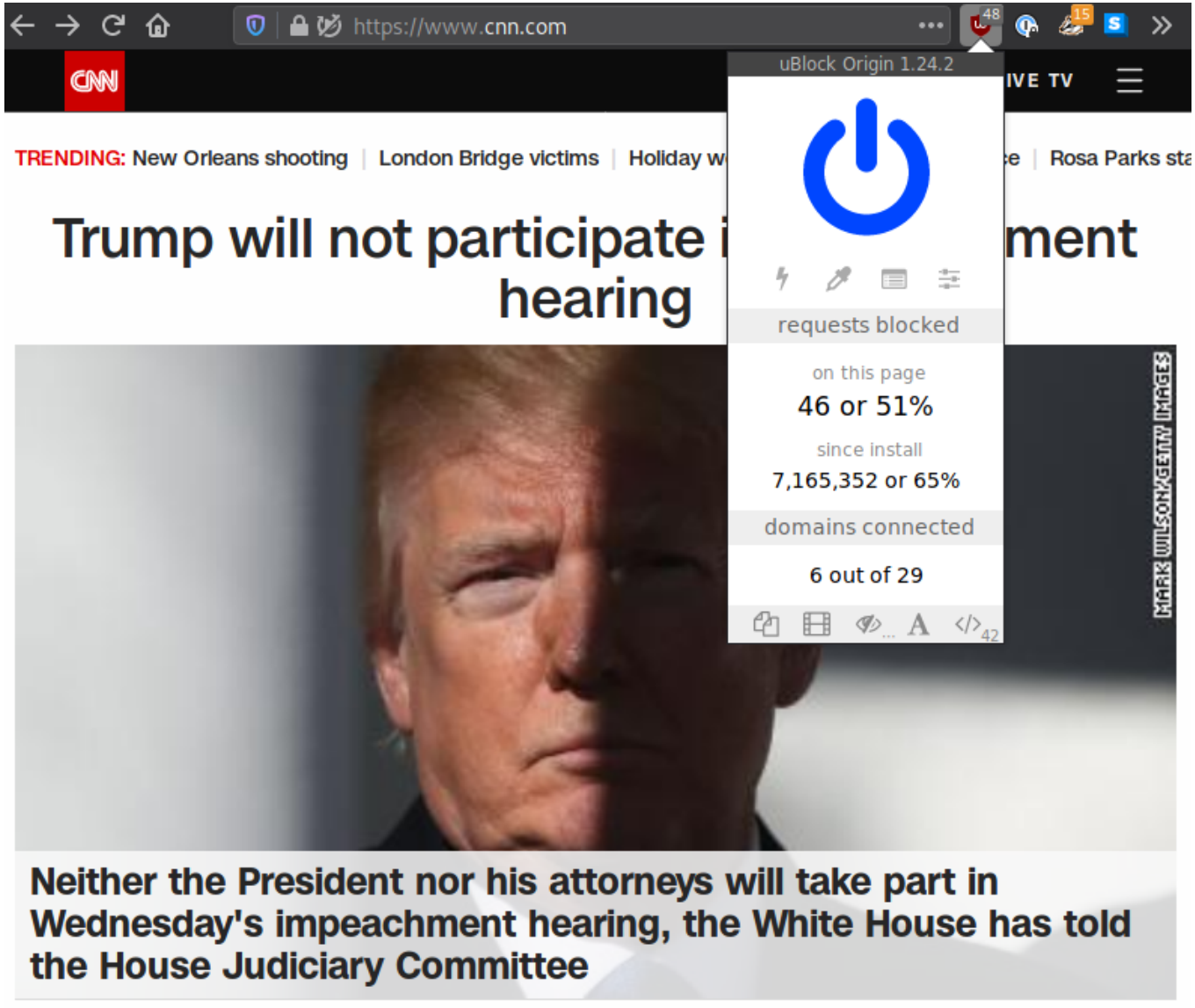

Lecture outline

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  - Privacy-respecting browsers (Tor, Firefox, Brave)
- Ethical principles
- Laws relevant to security research and practice

Overarching principles/lessons

- Ethics: Try to be a good person. Be thoughtful about your actions and their effects on yourself and others.
- Legal issues: Don’t violate laws.
- If lawyers or law enforcement are involved, you have already lost. It doesn’t matter if you could in theory win the case in the end.

Legal/ethical principle: Property rights

Respect other people's property.

Example: Hacking your own password.

- On your own machine: Probably ok. (Possible exception: DMCA.)
- On someone else's machine: Get permission or else it's probably not ok. (Might be CFAA violation under Terms of Service interpretation.)

Computer Fraud and Abuse Act (CFAA)

18 U.S. CODE §1030 - FRAUD AND RELATED ACTIVITY IN CONNECTION WITH COMPUTERS

Whoever intentionally accesses a computer without authorization or exceeds authorized access, and thereby obtains information from any protected computer...

The punishment for an offense...

- a fine under this title or imprisonment for not more than one year, or both...,
- a fine under this title or imprisonment for not more than 5 years, or both... if—
  - (i) the offense was committed for purposes of commercial advantage or private financial gain;
  - (ii) the offense was committed in furtherance of any criminal or tortious act...; or
  - (iii) the value of the information obtained exceeds $5,000

Prominent CFAA cases: Aaron Swartz

- Scraped JStor from MIT's network and evaded numerous blocking attempts.
- Prosecuted for violating the Terms of Service of JStor even though JStor did not want to prosecute.
- Property owners: MIT, JStor, article authors
- Swartz had already been investigated for scraping public court records (PACER)

Ethical Principle: Minimizing harm

Ethical research involves trying to minimize harm.

Example: SYN scanning

- Scanning public hosts is legal, but generates many complaints.
- Depends on intended use: Used by attackers to find vulnerable hosts, used by researchers to measure networks.
- Doing research on open networks means understanding and following best practices:
  - Publicly identifying the purpose of the research
  - Providing an opt-out mechanism
  - Not launching attacks
  - Avoiding overwhelming your or others' networks or crashing hosts
  - Etc.

Ethical principle: Minimizing harm

Example: Botherding

- Botherding is taking over a botnet
- Is this ethical or not?
  - Interfering with a legal botnet is definitely illegal.
  - Marcus Hutchins was celebrated for activating a kill switch in WannaCry malware that halted infections.
  - Is taking over a botnet for research purposes ethical? It is pursuing illegal activity to study illegal activity.
  - What is harm minimization?

Your Botnet is My Botnet: Analysis of a Botnet Takeover

Brett Stone-Gross, Marco Cova, Lorenzo Cavallaro, Bob Gilbert, Martin Szydlowski,
Richard Kemmerer, Christopher Kruegel, and Giovanni Vigna

University of California, Santa Barbara
[bstone,marco,sullivan,rgilbert,msz,kemm,chris,vigna]@cs.ucsb.edu

ABSTRACT

Botnets, networks of malware-infected machines that are controlled by an adversary, are the root cause of a large number of security problems on the Internet. A particularly sophisticated and insidious type of bot is Torpig, a malware program that is designed to

One approach to study botnets is to perform *passive analysis* of secondary effects that are caused by the activity of compromised machines. For example, researchers have collected spam mails that were likely sent by bots [47]. Through this, they were able to make indirect observations about the sizes and activities of different spam

Digital Millennium Copyright Act (DMCA)

17 U.S. Code § 1201 - Circumvention of copyright protection systems

Current through Pub. L. 113–86, except 113–79. (See Public Laws for the current Congress.)

US Code | Notes | Updates

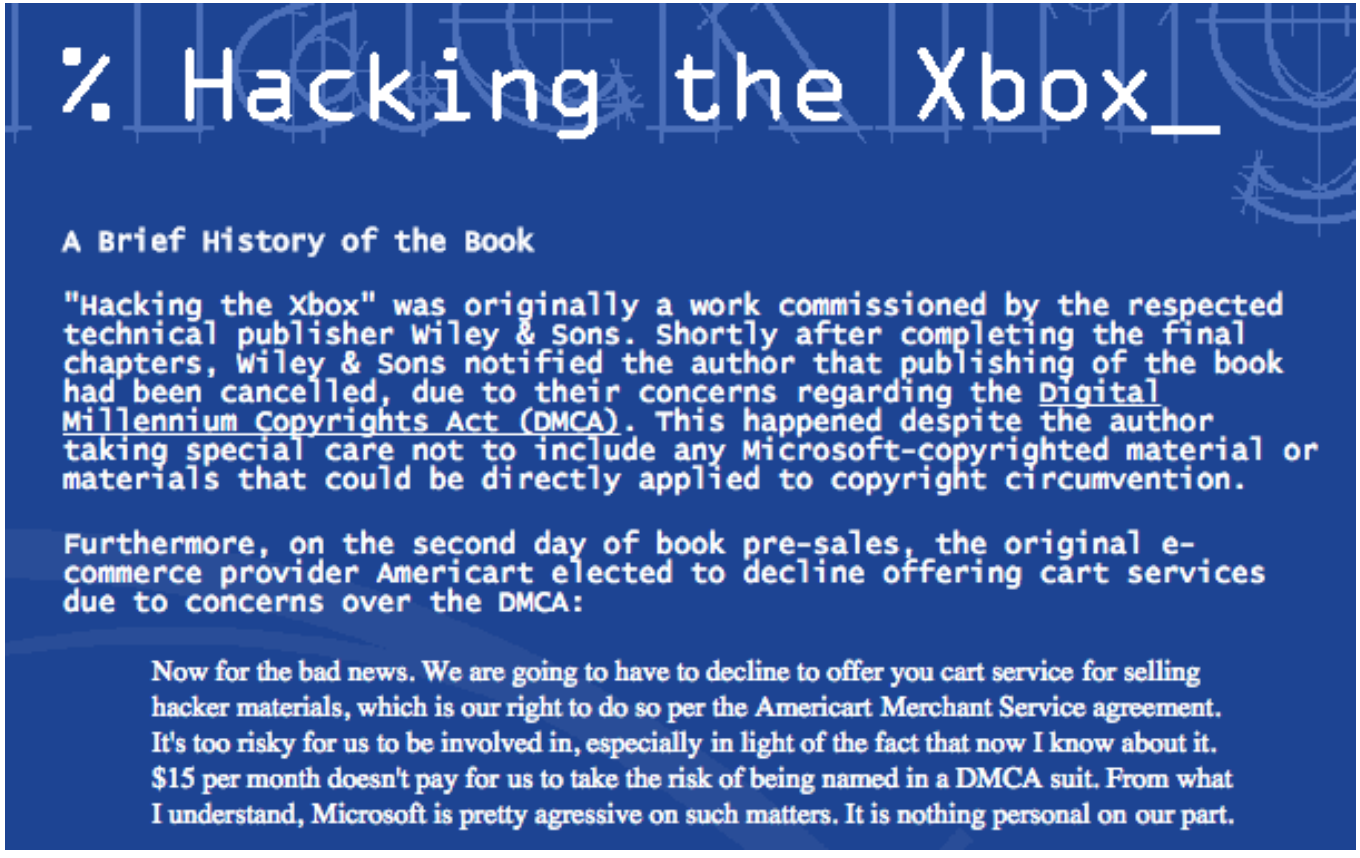
(a) Violations Regarding Circumvention of Technological Measures.—

(1)

(A) No person shall circumvent a technological measure that effectively controls access to a work protected under this title. The prohibition contained in the preceding sentence shall take effect at the end of the 2-year period beginning on the date of the enactment of this chapter.

DMCA cases

- 2010 US v. Crippen, rare criminal DMCA prosecution of Xbox modder
- 2002 Bunnie Huang Xbox key extraction
  - MIT did not support his work, AI Lab published his work and reached an agreement with Microsoft



DMCA Exemptions

Every three years, the Library of Congress considers exemptions to the DMCA.

- 2010: Phone jailbreaking
- 2016: Security research

Accordingly, based on the Register's recommendation, the Librarian adopts the following exemption:

(i) Computer programs, where the circumvention is undertaken on a lawfully acquired device or machine on which the computer program operates solely for the purpose of good-faith security research and does not violate any applicable law, including without limitation the Computer Fraud and Abuse Act of 1986, as amended and codified in title 18, United States Code; and provided, however, that, except as to voting machines, such circumvention is initiated no earlier than 12 months after the effective date of this regulation, and the device or machine is one of the following:

(2) Permissible acts of encryption research.— Notwithstanding the provisions of subsection (a)(1)(A), it is not a violation of that subsection for a person to circumvent a technological measure as applied to a copy, phonorecord, performance, or display of a published work in the course of an act of good faith encryption research if—

(A) the person lawfully obtained the encrypted copy, phonorecord, performance, or display of the published work;

(B) such act is necessary to conduct such encryption research;

(C) the person made a good faith effort to obtain authorization before the circumvention; and

(D) such act does not constitute infringement under this title or a violation of applicable law other than this section, including section 1030 of title 18 and those provisions of title 18 amended by the Computer Fraud and Abuse Act of 1986.

Personal and Privacy Rights

Principle: Informed consent

- Human subjects research should go through ethical review
  - At a university, this is done by IRB
  - Some companies now have review processes (Example: Facebook happiness research)
- Human subjects research includes any collection of Personally Identifiable Information

Judge Confirms Government Paid CMU Scientists to Hack Tor Users for FBI

February 25, 2016 Swati Khandelwal

Everything is now crystal clear:

The security researchers from Carnegie Mellon University (CMU) were hired by the federal officials to discover a technique that could help the FBI Unmask Tor users and **Reveal their IP addresses** as part of a criminal investigation.

Yes, a federal judge in Washington has recently confirmed that the computer scientists at CMU's Software Engineering Institute (SEI) were indeed behind a hack of the TOR project in 2014, according to court documents [PDF] filed Tuesday.

In November 2015, The Hacker News reported that Tor Project Director *Roger Dingledine* accused the Federal Bureau of Investigation (FBI) of paying the CMU, at least, $1 Million for providing information that led to the criminal suspects identification on the Dark Web.

After this news had broken, the FBI denied the claims, saying *"The allegation that we paid [CMU] $1 Million to hack into TOR is inaccurate."*

Informed consent

Example: Jason Fortuny posted fake sex ad on Craigslist as a woman in 2006

- Received hundreds of replies, posted them all online

Informed consent

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- Unethical? Yes.

Informed consent

Example: Jason Fortuny posted fake sex ad on Craigslist as a woman in 2006

- Received hundreds of replies, posted them all online
- Unethical? Yes.
- Illegal? Unclear.
    - Encyclopedia Dramatica received DMCA takedown notice.
    - Sued in Illinois by anonymous victim, default $75k judgement

Legal foundations of privacy

In US, 14th amendment: “nor shall any state deprive any person of life, liberty, or property without due process of law”

Interpreted as right to privacy by 20th century supreme court:

- Legality of contraception
- Roe v. Wade

Wiretapping

18 U.S. Code § 2511 - Interception and disclosure of wire, oral, or electronic communications prohibited

Current through Pub. L. 113-296, except 113-287, 113-291, 113-295. (See Public Laws for the current Congress.)

US Code | Notes

prev | next

(1) Except as otherwise specifically provided in this chapter any person who—

(a) intentionally intercepts, endeavors to intercept, or procures any other person to intercept or endeavor to intercept, any wire, oral, or electronic communication;

(b) intentionally uses, endeavors to use, or procures any other person to use or endeavor to use any electronic, mechanical, or other device to intercept any oral communication when—

(i) such device is affixed to, or otherwise transmits a signal through, a wire, cable, or other like connection used in wire communication; or

(ii) such device transmits communications by radio, or interferes with the transmission of such communication; or

(iii) such person knows, or has reason to know, that such device or any component thereof has been sent through the mail or transported in interstate or foreign commerce; or

(iv) such use or endeavor to use (A) takes place on the premises of any business or other commercial establishment the operations of which affect interstate or foreign commerce; or (B) obtains or is for the purpose of obtaining information relating to the operations of any business or other commercial establishment the operations of which affect interstate or foreign commerce; or

California is a “two-party consent” state. All parties in a conversation must consent for it to be recorded.

FISA background

1978 Foreign Intelligence Surveillance Act

- Passed in response to Church Committee investigation of COINTELPRO scandals
- Codified separation between domestic law enforcement activities and international intelligence activities
- FISA Court established to handle surveillance warrants for intelligence investigations in the US

After 2001, PATRIOT Act weakened some of these separations.

Snowden leaked FISA order for all Verizon Business customer information in 2013

IN RE APPLICATION OF THE
FEDERAL BUREAU OF INVESTIGATION
FOR AN ORDER REQUIRING THE
PRODUCTION OF TANGIBLE THINGS
FROM VERIZON BUSINESS NETWORK SERVICES,
INC. ON BEHALF OF MCI COMMUNICATION
SERVICES, INC. D/B/A VERIZON
BUSINESS SERVICES.

Docket Number: BR 13-80

SECONDARY ORDER

This Court having found that the Application of the Federal Bureau of Investigation (FBI) for an Order requiring the production of tangible things from **Verizon Business Network Services, Inc. on behalf of MCI Communication Services Inc., d/b/a Verizon Business Services (individually and collectively "Verizon")** satisfies the requirements of 50 U.S.C. § 1861,

IT IS HEREBY ORDERED that, the Custodian of Records shall produce to the National Security Agency (NSA) upon service of this Order, and continue production on an ongoing daily basis thereafter for the duration of this Order, unless otherwise ordered by the Court, an electronic copy of the following tangible things: all call detail records or "telephony metadata" created by Verizon for communications (i) between the United States and abroad; or (ii) wholly within the United States, including local telephone calls. This Order does not require Verizon to produce telephony metadata for communications wholly originating and terminating in foreign countries.

Telephony metadata includes comprehensive communications routing information, including but not limited to session identifying information (*e.g.*, originating and terminating telephone number, International Mobile Subscriber Identity (IMSI) number, International Mobile station Equipment Identity (IMEI) number, etc.), trunk identifier, telephone calling card numbers, and time and duration of call. Telephony metadata does not include the substantive content of any communication, as defined by 18 U.S.C. § 2510(8), or the name, address, or financial information of a subscriber or customer.

IT IS FURTHER ORDERED that no person shall disclose to any other person that the FBI or NSA has sought or obtained tangible things under this Order, other than to: (a) those persons to whom disclosure is necessary to comply with such Order; (b) an attorney to obtain legal advice or assistance with respect to the production of things in

TOP SECRET//SI//NOFORN

Derived from: Pleadings in the above-captioned docket
Declassify on: 12 April 2038

Updated FISA orders have continued to be approved.

Verizon Government Transparency Report

National security demands

The table below sets forth the number of national security demands we received in the applicable period. Under section 603 of the USA Freedom Act we are now able to report the number of demands in bands of 500.

	Jan 1, 2016 – Jun. 30, 2016	Jul. 1, 2016 – Dec. 31, 2016	Jan 1, 2017 – Jun. 30, 2017	July 1, 2017 – Dec. 31, 2017	Jan 1, 2018 – Jun. 30, 2018	Jul. 1, 2018 – Dec. 31, 2018	Jan 1, 2019 – Jun. 30, 2019
National Security Letters	1-499	5-499	1-499	501-999	1-499	0-499	0-499
Number of customer selectors	500-999	1000-1499	1500-1999	1500-1999	2000-2499	2000-2499	1500-1999
FISA Orders (Content)	0-499	0-499	0-499	0-499	0-499	0-499	*
Number of customer selectors	2000-1499	2000-2499	1500-1999	2000-2499	2000-2499	1500-1999	*
FISA Orders (Non-Content)	0-499	0-499	0-499	0-499	0-499	0-499	*
Number of customer selectors	0-499	0-499	0-499	0-499	0-499	0-499	*

* The government has imposed a six month delay for reporting this data.

“In the first half of 2019, we received between 0 and 499 NSLs from the FBI. Those NSLs sought information regarding between 1500 and 1999 ’selectors’ used to identify a Verizon customer. ”

September 2013: NSA Bullrun program

- (TS//SI//REL TO USA, FVEY) Insert vulnerabilities into commercial encryption systems, IT systems, networks, and endpoint communications devices used by targets.
- (TS//SI//REL TO USA, FVEY) Collect target network data and metadata via cooperative network carriers and/or increased control over core networks.
- (TS//SI//REL TO USA, FVEY) Leverage commercial capabilities to remotely deliver or receive information to and from target endpoints.
- (TS//SI//REL TO USA, FVEY) Exploit foreign trusted computing platforms and technologies.
- (TS//SI//REL TO USA, FVEY) Influence policies, standards and specification for commercial public key technologies.
- (TS//SI//REL TO USA, FVEY) Make specific and aggressive investments to facilitate the development of a robust exploitation capability against Next-Generation Wireless (NGW) communications.

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New York Times names US standardized random number generator as a target.

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New York Times names US standardized random number generator as a target.

NIST re-opens discussions on SP800.90; recommmends against use.

RSA suggests changing default in BSAFE.

2015: Juniper discovers Dual EC DRBG backdoor in ScreenOS.

RELATED TOPICS

Politics »

Tech »

(Reuters) - Security industry pioneer RSA adopted not just one but two encryption tools developed by the U.S. National Security Agency, greatly increasing the spy agency's ability to eavesdrop on some Internet communications, according to a team of academic researchers.

Reuters reported in December that the NSA had paid RSA $10 million to make a now-discredited cryptography system the default in software used by a wide range of Internet and computer security programs. The system, called Dual Elliptic Curve, was a random number generator, but it had a deliberate flaw - or "back door" - that allowed the NSA to crack the encryption.

A group of professors from Johns Hopkins, the University of Wisconsin, the University of Illinois and elsewhere now say they have discovered that a second NSA tool exacerbated the RSA software's vulnerability.

The professors found that the tool, known as the "Extended Random" extension for secure websites, could help crack a version of RSA's Dual Elliptic Curve software tens of thousands of times faster, according to an advance copy of their research shared with Reuters.

While Extended Random was not widely adopted, the new research sheds light on how the NSA extended the reach of its surveillance under cover of advising companies on protection.

2015-12 Out of Cycle Security Bulletin: ScreenOS: Multiple Security issues with ScreenOS (CVE-2015-7755, CVE-2015-7756)

VPN Decryption (CVE-2015-7756) may allow a knowledgeable attacker who can monitor VPN traffic to decrypt that traffic. It is independent of the first issue.

This issue affects ScreenOS 6.2.0r15 through 6.2.0r18 and 6.3.0r12 through 6.3.0r20. **No other Juniper products or versions of ScreenOS are affected by this issue.**

There is no way to detect that this vulnerability was exploited.

This issue has been assigned CVE-2015-7756.

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A Systematic Analysis of the Juniper Dual EC Incident

Stephen Checkoway,[*] Shaanan Cohney,[**] Christina Garman[†] Matthew Green,[†] Nadia Heninger,[**]
Jacob Maskiewicz,[††] Eric Rescorla,[††] Hovav Shacham,[††] Ralf-Philipp Weinmann
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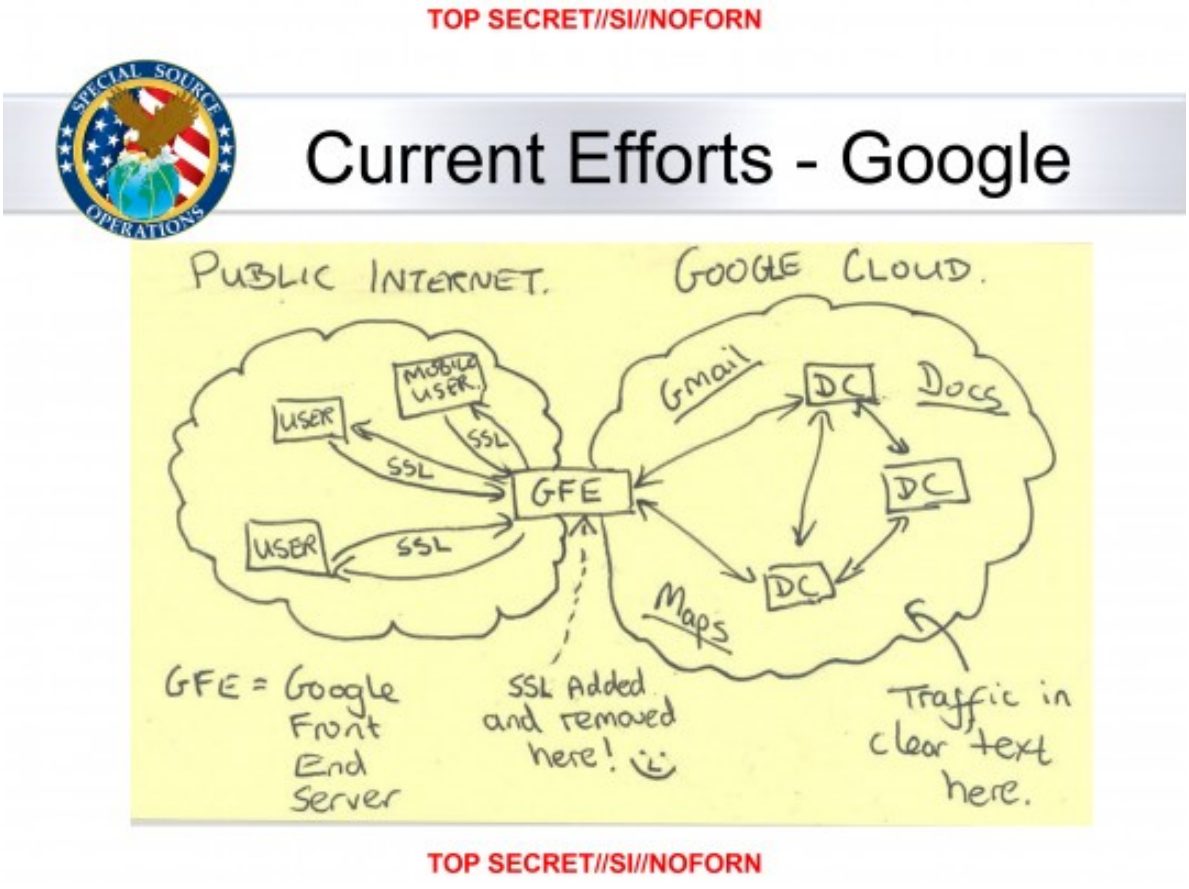
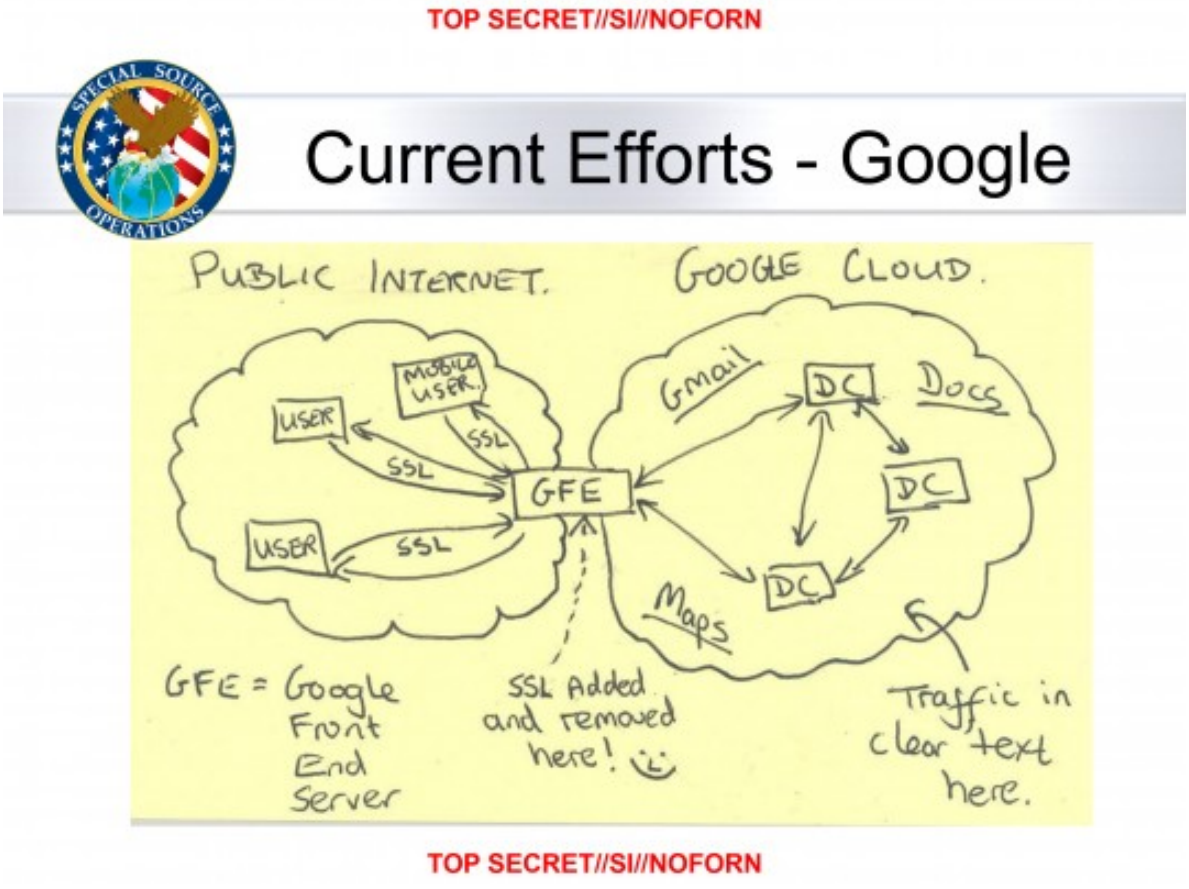
October 2013: MUSCULAR



Official Google statement:
“We are outraged”

October 2013: MUSCULAR



Official Google statement:
“We are outraged”

Unofficial Google statement: “Fuck these guys.”

Key Escrow and Law Enforcement Backdoors Redux

Recently, the head of the National Security Agency provided a rare hint of what some U.S. officials think might be a technical solution. Why not, suggested Adm. Michael S. Rogers, require technology companies to create a digital key that could open any smartphone or other locked device to obtain text messages or photos, but divide the key into pieces so that no one person or agency alone could decide to use it?

"I don't want a back door," Rogers, the director of the nation's top electronic spy agency, said during a speech at Princeton University, using a tech industry term for covert measures to bypass device security. "I want a front door. And I want the front door to have multiple locks. Big locks."

Law Enforcement Access Policy

Policy/ethics question: Is it preferable to have law enforcement/intelligence:

- Stockpile software vulnerabilities, write targeted malware, and hack into targets when desired
- Mandate encryption backdoors or otherwise enable mass surveillance

The FBI's Firefox Exploit

By **Nicholas Weaver** Thursday, April 7, 2016, 8:43 AM

Lawfare contributors are having an interesting debate (with dinners and drinks on the line) about whether and why the FBI might reveal the details of the exploit used to unlock the San Bernardino iPhone. My guess is that the FBI will inadvertently release so many details in aiding local law enforcement that the question becomes moot: we will at least learn whether the exploit uses the USB connection or attacks through the cellular "baseband," as well as whether the exploit works on current versions or has already been patched by Apple.

But another fight over vulnerability disclosure is far more interesting and getting far less attention. The FBI is apparently hoarding a Tor Browser exploit which it used to target visitors of the "Playpen" child porn site. I've previously discussed how the FBI wrote the warrant to hack over a thousand targets. Now the FBI is fighting defense efforts to examine the exploit itself despite an order requiring the FBI to reveal the exploit to the defense.

The Tor Browser is simply Firefox running in a hardened mode. While many Firefox exploits will not work against the Tor browser—particularly those relying on Flash—the converse is not necessarily true. To the contrary, any Tor browser exploit is almost certainly a Firefox exploit too.

Unintended Consequences of Law Enforcement Access

- 2004 Greek wiretapping scandal
  - Greek politicians wiretapped through law enforcement access system present on phone network
  - System was present because of US CALEA law, not used in Greece
- 2010 China Google hack
  - Came in through law enforcement access portal

Disclosure options for security flaws

- Develop fully weaponized malware and distribute on black market
- Tell no one
- Sell vulnerability to middleman and don’t report to vendor
- Report to vendor only
- Report to vendor and receive bug bounty
- Report to vendor, wait for fix, report to public (“responsible disclosure”)
- Report in full to public immediately (“full disclosure”)

The process of reporting vulnerabilities

- Some vendors have sensible reporting process
  - E.g., Firefox and Chrome teams respond and react quickly, easy to work with on fixing bugs, etc.
- Some vendors less so
  - E.g., Send email through an intermediary, receive ACK, no real conversation.
  - E.g., Send email, poke individual folks for replies, no replies. Give up.
- Some vendors are playing catch up
  - E.g., Reported OOB write vulnerability, security “team” replied with “not a security bug.” Later freaked out about public disclososure of OOB read vulnerability. Now there is a working group dedicated to security, slightly better definition of an attacker model, and reasonable reporting method: HackerOne.
- Some vendors are the worst: they will try to gag/sue you

Bug bounty programs

- Many vendors have bug bounty programs: $$ for bugs
  - Mozilla and Google will even run your checkers and pay you if the checkers find real bugs
- Our students made $3-10K on some papers!

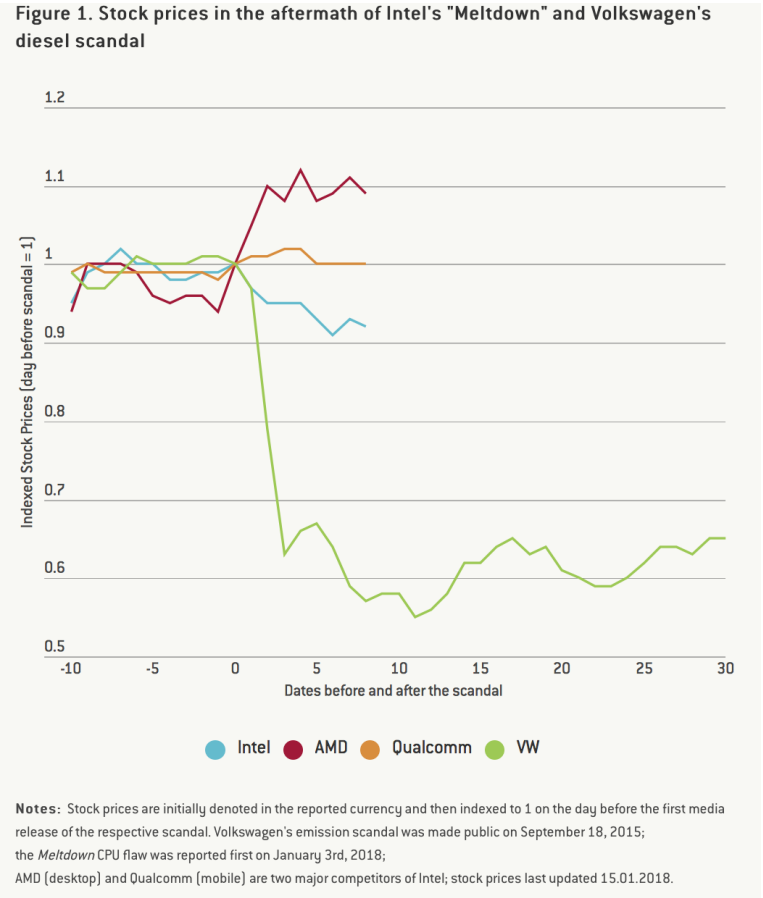
	High-quality report with functional exploit	High-quality report	Baseline
Sandbox escape / Memory corruption in a non-sandboxed process	$30,000	$20,000	$5,000 - $15,000
Universal Cross Site Scripting	$20,000	$15,000	$2,000 - $10,000
Renderer RCE / memory corruption in a sandboxed process	$10,000	$7,500	$2,000 - $5,000
Security UI Spoofing	$7,500	N/A [1]	$500 - $3,000
User information disclosure	$5,000 - $20,000	N/A [1]	$500 - $2,000
Web Platform Privilege Escalation	$5,000	$3,000	$500 - $1,000
Exploitation Mitigation Bypass	$5,000	$3,000	$500 - $1,000
Chrome OS	See below		
Chrome Fuzzer Bonus	$1,000		
Chrome Patch Bonus	$500 - $2,000		

Are companies liable for security flaws?

The FTC says yes.

- 2011 Facebook settlement for deceptive privacy policies
- 2013 HTC settlement for security flaws in phones
- 2016 LabMD liable for failure to institute reasonable security practices to protect consumer data

The stock market says not really:



nakedcapitalism.com

Policy questions around security research

- Should exploit sales be legal?
  - Code as speech principle says yes
  - Is publishing exploits ethical?
- How about mixed-use tools?
  - Privacy tools like Tor or encrypted messengers used by criminals, normal people, activists
  - Random darknet shopper art piece?

Have a great end of quarter!

Good luck on the final!