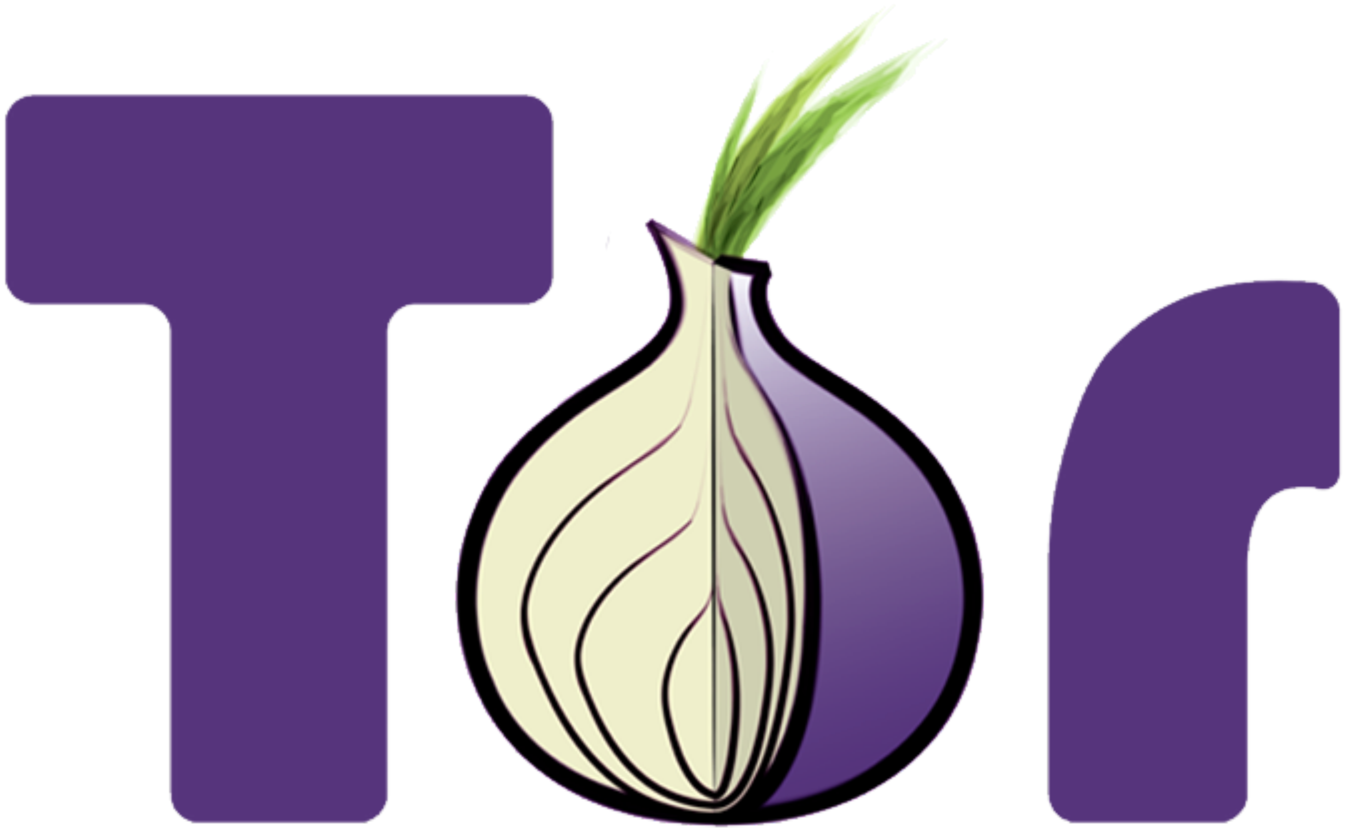

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What *does* TOR do?

- TOR is just an additional layer of obscurity. No more, no less.

- Provides unlisted, bridge relays to solve problems in reaching the first relay
  - e.g. ISP filtering connections to any known TOR relays
  - Bridges can’t be easily identified, so can’t be blocked

- Without TOR, everything one does online can be watched by one’s ISP
  - Anything passing through a tapped internet exchange point can be stored and analyzed by intelligence agencies

What *doesn’t* TOR do?

- Anonymize users; it only anonymizes that computer
  - No security if a user provides personal information to another service
  - VPN’s with logs subject to subpoena also a concern
- Provide protection against end-to-end timing attacks
  - Watching the traffic at both ends of communication can result in a compromised link
- Allow users to indulge in unsafe behavior
  - Maybe don’t use your legal name? More on this…

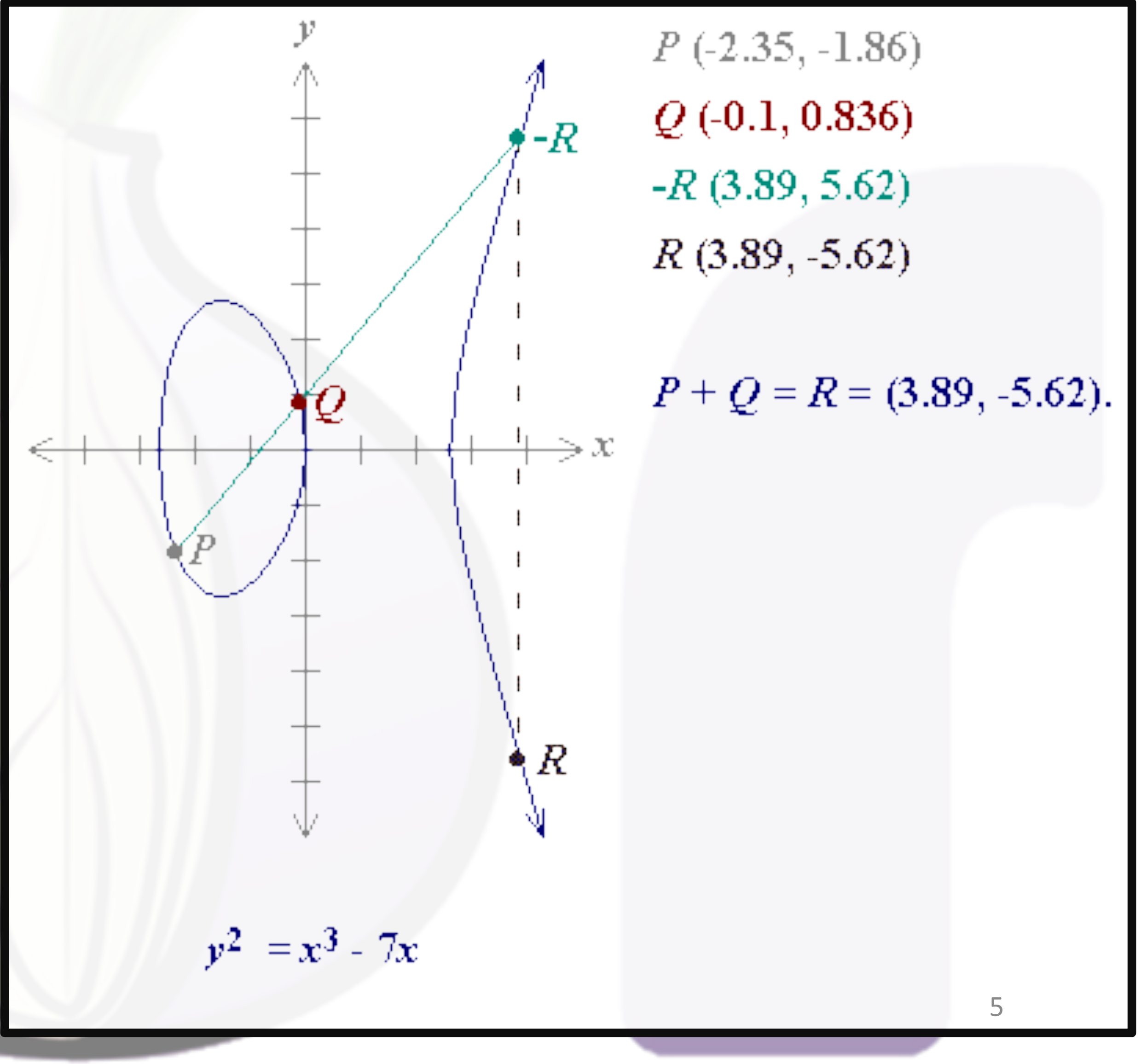
How Safe is TOR?

- Strong crypto systems are one of the few things you can rely on
- Version 2.3.25-13 most common
  - Uses 1024 RSA/Diffie-Hellman crypto
- Version 2.4.17-beta-2 also available
  - Uses Elliptical Curve Diffie-Hellman (ECDH)
  - Can yield same level of security with 164 bits as RSA/DH can with 1024 bits

How Safe is TOR?

- Tor 2.4 based on the elliptic curve discrete logarithm problem
  - Finding the discrete logarithm of a random elliptic curve element with respect to a publicly known base point
  - Currently assumed to be infeasible

- Very easy to do, very hard to reverse
  - Perfect for crpto



What are the risks?

- Vast majority (~90%) of TOR users still use version 2.3, and its 1024 bit DH crypto
  - NSA can break this in a few hours using brute force attacks
    - Not in real-time, only possible on targeted, archived offline data
    - Needs custom-built chips
  - Has publicly known contracts with IBM

- Version 2.4 and ECDH might still be within NSA's, and others', scope
  - Less popular, so likely less money/time/effort put into breaking ECDH

- A hidden service website that made mistakes in configuration or maintenance could compromise anonymity independent of TOR

ESIEA “broke” TOR?

- École Supérieure d‘Informatique, Électronique, Automatique
  - French ‘Grande École’ for private engineers
- Performed inventory of the TOR network and developed a script to identify the TOR Bridges
  - Found 6,000 relays and 181 Bridges
  - Claimed to have a “complete picture of the topography of TOR”
- Research claims that one third of TOR nodes are vulnerable

ESIEA “broke” TOR?

- Engineered a virus in a lab setting aimed at infecting and obtaining system privileges of TOR nodes
  - Infected nodes are cloned to create a local network in the lab

- Traffic is directed to infected nodes by a double attack on the network
  - Denial of Service attack on clean nodes
  - Packet spinning, creating a loop within TOR servers to lead the packet to an infected node

- An infected node as a second relay would be a big problem

How the Silk Road was shut down

- Evolution of law-enforcement problems:
  - Dread Pirate Roberts vs. Al Capone
  - Problem with identification, not incrimination
  - Silk Road only accessible through TOR, only used BitCoins

- Two year long investigation led by Christopher Tarbell and “Agent-1”
  - Agent-1 ironically anonymous
  - Theories that Agent-1 is Hector Xavier Monsegur, also known as **Sabu**
  - Sabu was a leader of the group *Anonymous*, and was arrest by Tarbell in June 2011

How the Silk Road was shut down

- January 27, 2011
  - Username ***altoid*** found on a discussion forum discussing psychedelic mushrooms
  - ***altoid*** found again on a BitCoin discussion forum on January 29
- Eight months later
  - ***altoid*** posts to a BitCoin forum again, looking to hire an IT pro
  - Includes contact information (personal email address) : Ross Ubricht
- Dread Pirate Roberts and Ubricht had strongly overlapping online activity (same videos, links, timezone, etc…)
  - Silk Road was run through a private, unique access VPN
  - Tarbell and Agent-1 traced it to an IP-address
  - Traced IP and Ubricht’s Comacst IP were within 500 feet

Points to Ponder

- Silk Road bust had nothing to do with breaking TOR. Most successful raids have been through subpoenaed banks, VPN's, etc…

- ESIEA's attempt to break TOR is still in its infancy; it has too small a reach on the Internet given the sheer number of TOR relays. But if French, British and American intelligence traded their data, could TOR be broken?

- If TOR is broken, would we find out? If so, how quickly?

Sources

- TOR’s weakness to brute-force attacks
    - “Majority of Tor crypto keys could be broken by NSA, researcher says”, by Dan Goodlin

    http://arstechnica.com/security/2013/09/majority-of-tor-crypto-keys-could-be-broken-by-nsa-researcher-says/

    - “90 percent of Tor keys can be broken by NSA: what does it mean?”, by Cory Doctorow

    http://boingboing.net/2013/09/07/90-percent-of-tor-keys-can-be.html

    - “NSA works with security vendors to thwart encryption, according to 'Bullrun' docs leaked by Snowden”, by Xeni Jardin
    - http://boingboing.net/2013/09/05/report-nsa-slices-through-mos.html

Sources

- Elliptical Curves in TOR 2.4
  - “Elliptical curve cryptography (ECC)”, by Margaret Rouse
    http://searchsecurity.techtarget.com/definition/elliptical-curve-cryptography

- ESIEA’s Map of TOR
  - “Tor anonymizing network Compromised by French researchers”, by Mohit Kumar
    http://thehackernews.com/2011/10/tor-anonymizing-network-compromised-by.html