(S//REL) Open Source Multi-Hop Networks

- (S//REL) Tor
- (S//REL) Very widely used worldwide
- (S//REL) Open Source
  - (S//REL) Active Development
  - (S//REL) Mitigates Threats
- (S//REL) Very Secure
- (S//REL) Low enough latency for most TCP uses
- (S//REL) Still the King of high secure, low latency Internet Anonymity
  - (S//REL) There are no contenders for the throne in waiting
How Tor Works: 1

Step 1: Alice’s Tor client obtains a list of Tor nodes from a directory server.

- Alice
- Dave
- Jane
- Bob

Tor node
- unencrypted link
- encrypted link
(S//REL) Tor Operation (2)

How Tor Works: 2

Step 2: Alice’s Tor client picks a random path to destination server. Green links are encrypted, red links are in the clear.
(S//SI//REL) Passive Tor Traffic Analysis

- (S//SI//REL) For Normal SIGINT flow, need to identify Tor traffic!
  - (S//SI//REL) Only outer TLS layer visible → How to Distinguish?
  - (S//SI//REL) Tor developers attempt to remain anonymous by blending in with myriad other TLS traffic
  - (S//SI//REL) Tor TLS has changed over the years
  - (S//SI//REL) There ARE some server → client features which are recognizable
    - (S//SI//REL) Certificate: always 2 hour lifetime – ASN.1 parsing, more computation
    - (S//SI) Multiple XKS fingerprints from multiple parties deployed
(S//REL) Tor Project Censorship Driven Activity

- (S//REL) Driven by Censorship Circumvention, Hide Signature
  - (S//REL) China and Iran still main adversaries
  - (S//REL) Researching better bridge distribution strategies
    - (S//REL) Claim by Tor Project is 8000 requests/day for <1000 total
  - (S//REL) Around Feb 2011, changed the TLS handshake
    - (S//REL) Signature more like Apache web-server
      - (S//REL) Different DH Modulus
      - (S//SI//REL) New XKS Signatures address this
  - (TS//SI//REL) Proposed eventual change will kill identification!
    - (S//REL) Each Tor node will generate random-ish signatures in a volatile way specifically designed to look like normal website TLS traffic!
(S//REL) Extreme Censorship blocking: Common encrypted protocols
- (S//REL) In the case of Psiphon 3: SSH
- (S//REL) In the case of Tor: TLS
- (S//REL) Make deep packet inspection (XKS :-) ) work harder
- (S//REL) Both use work of a open source project (brl/obfuscated-openssl)

(S//REL) Idea is both sides transmit random seed and verifier information
- (S//REL) Verifier is hash of seed and other data
- (S//REL) If verifier passes data used from both side seeds to generate key
- (S//REL) Key used in symmetric cipher to encrypt native SSH or SSL protocol
- (S//REL) So for random stream, need to de-obfuscate and test for SSH / SSL

(S//REL) Details for Psiphon 3
- (S//REL) Hash used for verifier, key generation: 6000 iterations SHA-1
- (S//REL) Symmetric cipher is RC-4

(S//REL) Details for Tor Obsfproxy
- (S//REL) Hash used for verifier, key generation: 100K iterations SHA-256
- (S//REL) Symmetric cipher is AES-CTR-128
- (S//REL) Key uses seed from both sides!
(S//REL) Tor Project and friends Recent Activity

- (S//REL) Tor on non-traditional platforms
  - (S//REL) ORBOT, Tor for Android smartphones – Associated browser, easy to use!
  - (S//REL) Tor Router Project – Modified Linksys Router (everything over Tor)
  - (S//REL) Hide-My-IP-Address
    - (S//REL) Proprietary replacement for Tor Browser Bundle
    - (S//REL) From “WCCL Network” not part of Tor Project
    - (S//SI//REL) Looked at based on reference by CT target
  - (S//REL) Tor Project working on improving support for circumvention
    » (S//REL) Handshake obfuscation (discussed)
    » (S//REL) Better bridge proliferation / distribution
  - (S//REL) Tails: Complete Bootable OS on CD for anonymity – includes Tor
    • (S//REL) Adds Severe CNE misery to equation
    • (S//SI//REL) Has been discussed by CT targets
(S//REL) Tor Project and friends Recent Activity

- (S//REL) Advanced Tor “Obfuscation” Project: SkypeMorph
  - (S//REL) Another option for pluggable transport
  - (S//REL) More sophisticated concept than Obfsproxy
  - (S//REL) Open connection to Skype server with “bridge Skype ID”
  - (S//REL) Encapsulate Tor in encrypted data mimicking Skype Video Traffic
  - (S//REL) Sort of traffic flow steganography vice content steganography
  - (S//REL) True Public Key cryptography vice obfuscation with known key
  - (S//REL) Product of University research – Non-trivial to deploy

- (TS//SI//REL) Most Recent SIGINT Work on Exploiting Tor
  - (TS//SI//REL) REMATION II Workshop (US/UK) at MHS spring 2012
  - (S//SI//REL) Unleashed Networking/CNE legions...
  - (S//REL) See later talk by [redacted] for the scoop
(S//REL) Online Feud between 2 IAT Products: Ultrasurf and Tor

- (S//REL) “Technical Analysis of the Ultrasurf proxying software” (Applebaum)
  - (S//REL) Analysis (including some SRE) – highly critical
  - (S//REL) Single hop, controlled by one authority
  - (S//REL) Security by obscurity
  - (S//REL) No perfect forward secrecy (forensic traces exploitable)
- (S//REL) “Tor’s critique of Ultrasurf: A reply from the Ultrasurf developers”
  » (S//REL) Posted on Ultrasurf site days after Tor published critique
  » (S//REL) All talk and no show
  » (S//REL) Not fully analyzed
  » (S//REL) One Approach to IAT: Tor – higher anonymity, smaller scale
  » (S//REL) One Approach to IAT: Ultrasurf – focus on circumvention, massive scale