



(TS//SI//REL) Peeling Back the Layers of TOR with

# EGOTISTICALGIRAFFE



Derived From: NSA/CSSM 1-82  
Dated: 2007/01/08  
Declassify On: 20371101



# Overall Classification



This briefing is classified  
TOP SECRET//COMINT//REL USA, FVEY



## (U) Overview



- (U) What is TOR?
- (S//SI//REL) The TOR Problem
- (TS//SI//REL) EGOTISTICALGOAT
- (TS//SI//REL) EGOTISTICALGIRAFFE
- (U) Future Development



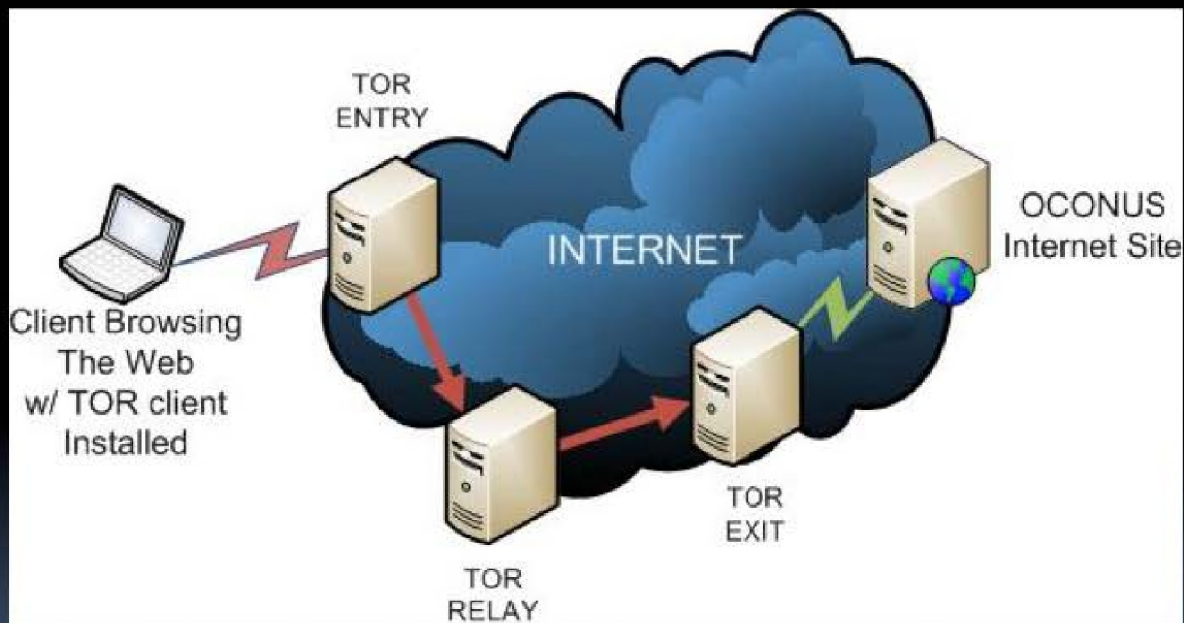
## (U) What is TOR?



- (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!

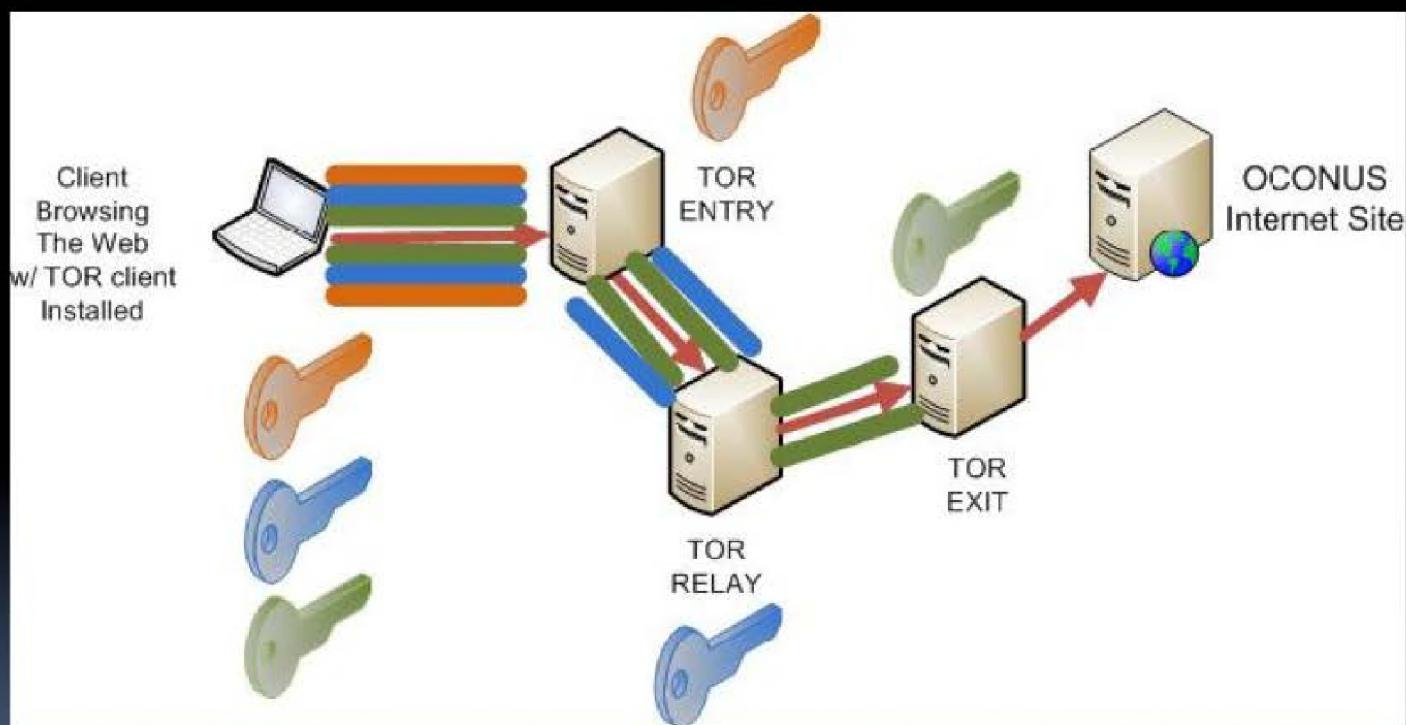


# (U) What is TOR?





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# (U) What is TOR?



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



# (S//SI//REL) The TOR Problem



- (TS//SI//REL) Fingerprinting TOR
- (TS//SI//REL) Exploiting TOR
- (TS//SI//REL) Callbacks from TOR





# (TS//SI//REL) Fingerprinting TOR



## Windows XP

### Firefox 10.0.5 ESR?

- 32-bit Windows 7
- Firefox/10.0

## 64-bit Mac OS X

### Firefox 10.0.4 ESR?

- 32-bit Windows 7
- Firefox/10.0

## Ubuntu 11.10

### Firefox 10.0.7 ESR?

- 32-bit Windows 7
- Firefox/10.0

## 64-bit Windows 7

### Firefox 10.0.10 ESR?

- 32-bit Windows 7
- Firefox/10.0

## Windows 7

### Firefox 10.0, not running TOR?

- 32-bit Windows 7
- Firefox/10.0



# (TS//SI//REL) Fingerprinting TOR



(TS//SI//REL) BuildID gives a timestamp for when the Firefox release was built

20121024073032

Year Month Day Hour Min Sec

(TS//SI//REL) tbb-firefox's BuildID:

0



## (TS//SI//REL) Fingerprinting TOR



- (TS//SI//REL) TorButton cares about TOR users being indistinguishable from TOR users
- (TS//SI//REL) We only care about TOR users versus non-TOR users
- (TS//SI//REL) Thanks to TorButton, it's easy!



# (S//SI//REL) The TOR Problem



- ~~(TS//SI//REL) Fingerprinting TOR~~
- (TS//SI//REL) Exploiting TOR
- (TS//SI//REL) Callbacks from TOR



# (TS//SI//REL) Exploiting TOR



- (TS//SI//REL) tbb-firefox is barebones
  - Flash is a no-no
  - NoScript add-on pre-installed...  
...but not enabled by default!
  - TOR explicitly advises against using any add-ons or extensions other than TorButton and NoScript
- (TS//SI//REL) Need a native Firefox exploit



# (TS//SI//REL) Exploiting TOR



- (TS//SI//REL) ERRONEOUSINGENUITY
  - Commonly known as ERIN
  - First native Firefox exploit in a long time
  - Only works against 13.0-16.0.2
- (TS//SI//REL) EGOTISTICALGOAT
  - Commonly known as EGGO
  - Configured for 11.0-16.0.2...  
...but the vulnerability also exists in 10.0!



# (U) EGOTISTICALGOAT



- (TS//SI//REL) Type confusion vulnerability in E<sub>4</sub>X
- (TS//SI//REL) Enables arbitrary read/write access to the process memory
- (TS//SI//REL) Remote code execution via the CTypes module



# (TS//SI//REL) Exploiting TOR



- (TS//SI//REL) Can't distinguish OS until on box
  - That's okay
- (TS//SI//REL) Can't distinguish Firefox version until on box
  - That's also okay
- (TS//SI//REL) Can't distinguish 64-bit from 32-bit until on box
  - I think you see where this is going





# (S//SI//REL) The TOR Problem



- ~~(TS//SI//REL) Fingerprinting TOR~~
- ~~(TS//SI//REL) Exploiting TOR~~
- (TS//SI//REL) Callbacks from TOR



## (TS//SI//REL) Callbacks from TOR



- (TS//SI//REL) Tests on Firefox 10 ESR worked
- (TS//SI//REL) Tests on tbb-firefox did not
  - Gained execution
  - Didn't receive FINKDIFFERENT
- (TS//SI//REL) Defeated by Prefilter Hash!
  - Requests EGGI: Hash(tor\_exit\_ip || session\_id)
  - Requests FIDI: Hash(target\_ip || session\_id)



# (TS//SI//REL) Callbacks from TOR



- (TS//SI//REL) Easy fix
  - Turn off prefilter hashing
  - FUNNELOUT
- (TS//SI//REL) OPSEC Concerns
  - Pre-play attacks
    - PSPs
    - Adversarial Actors
  - Targets worth it?



# (S//SI//REL) The TOR Problem



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