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# CS 4930/5930 Privacy and Censorship: Overview

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# Intro of Intro

- Yanyan Zhuang
  - [yzhuang@uccs.edu](mailto:yzhuang@uccs.edu)
  - I have a PhD...
  - I do research in networked systems, security and privacy, software engineering
- Office hours
  - M/W: 6:00 -- 6:45pm
  - Or by appointment
- Canvas
  - Announcements of assignment, project, etc.
  - Posting slides

# What will you learn??

- What is privacy and anonymity?
- What techniques/tools can protect anonymity?
- How tracking can be done on the Internet? And how can we protect online privacy?
  
- How do certain governments block “unwanted” traffic?
- What are the counter measures?

# Lectures, Assignments, Projects, etc.

- Lectures
  - M/W 4:45 -- 6:00 pm
  - ENGR 109
- Mix of lectures and readings...
  - Two people lead the discussion, one advocate, one skeptic
  - No slides necessary (100% assignment if slides)
  - -10% in assignment if no show
- No textbook (someone should write one)
- Assignments (45%+30%)
- Projects (25%)
- No exams

# Annnnd... The Overview



*"On the Internet, nobody knows you're a dog."*

# Privacy and Censorship

- **Privacy and Anonymity (first ~8 weeks)**
  - Two concepts are different (but sometimes used interchangeably)
  - Anonymity cares about obscuring the **metadata** but not the message
  - Privacy cares about obscuring the **message** but not necessarily the metadata



**Hey Bob, let's  
get together for  
coffee!**





**Hey Bob, let's  
get together for  
coffee!**

**Message (or content)  
is privacy**



**Hey Bob, let's  
get together for  
coffee!**

**Everything else is  
anonymity (pretty much)**



**At 2pm**

**Me, at home**



**Hey Bob, let's get together for coffee!**

**Bob**

**Everything else is anonymity (pretty much)**

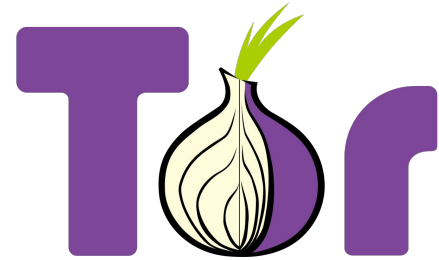
**Anonymity is about metadata**

# Privacy and Censorship

- **Privacy and Anonymity (first ~8 weeks)**
  - Two concepts are different (but sometimes used interchangeably)
  - Anonymity cares about obscuring the **metadata** but not the message
  - Privacy cares about obscuring the **message** but not necessarily the metadata
- **Censorship (last ~8 weeks)**
  - Non-democratic governments forbid citizens to view certain content
  - Various blocking/interrupting techniques
  - Various counter-measures: circumvention

# Schedule for Privacy/Anonymity

- Definitions, etc.
- Classic anonymity systems
  - Mix networks
  - Tor
- Web tracking (cookies, etc.)
- Problems with mobile systems
- Usability issues
- Cryptocurrencies (Bitcoin, if we have time)



# Online tracking and violation of privacy



A short guide to **cookies**

<https://www.wsj.com/video/how-advertisers-use-internet-cookies-to-track-you/92E525EB-9E4A-4399-817D-8C4E6EF68F93.html>

# Online tracking and violation of privacy

- Just **loading** these buttons (not clicking on them) enables tracking
  - This tracking is often not anonymous, i.e., linked to accounts



# How pervasive is online tracking?

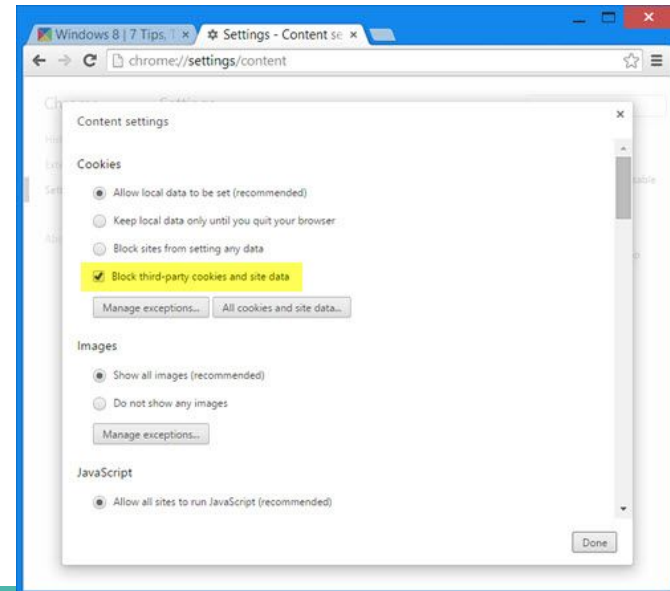
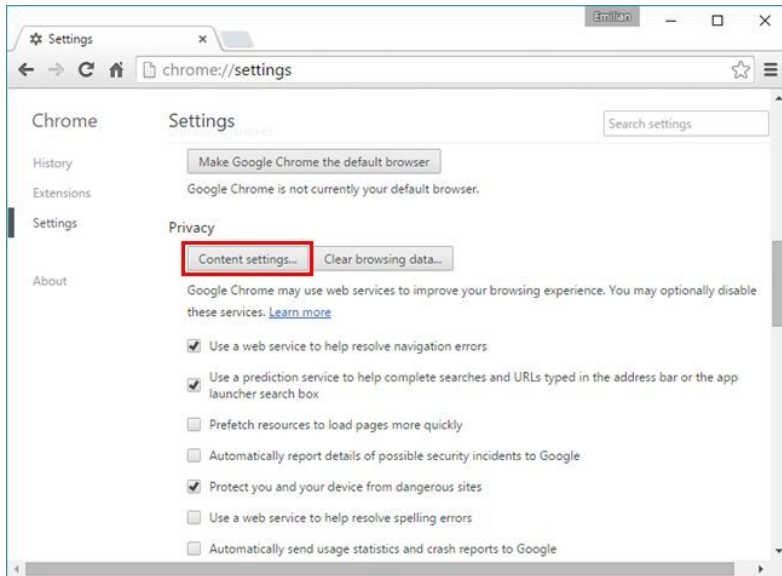
Let's visualize it

Browser extension: Disconnect



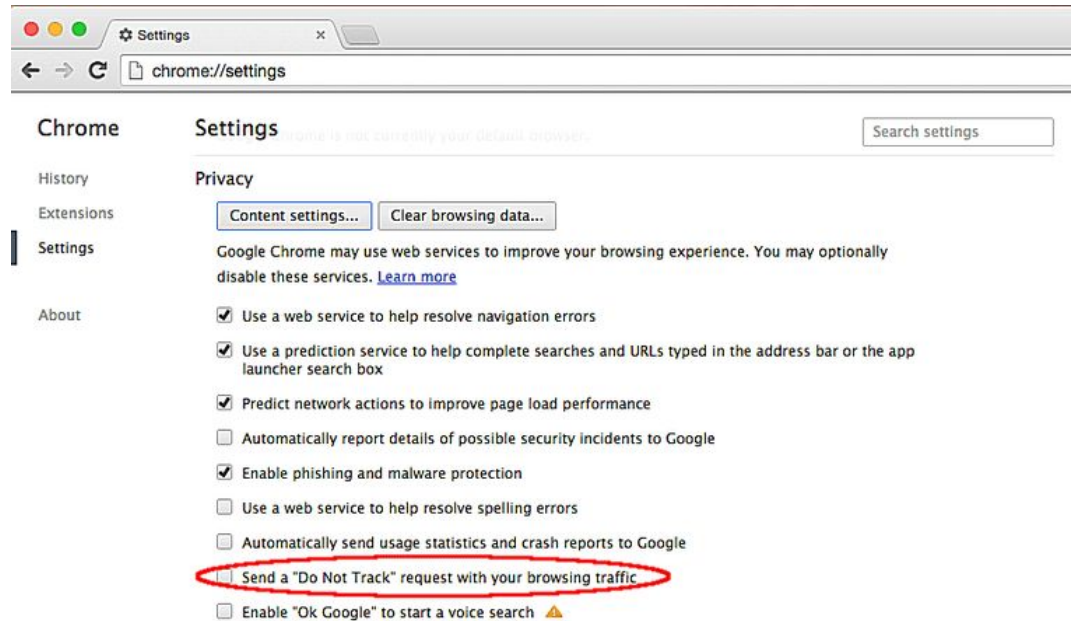
# To protect privacy

- Block third party cookies
  - Chrome as an example
  - Settings → Advanced → Content settings → Block third party cookies



# To protect privacy

- Block third party cookies
- DoNotTrack



# To protect privacy

- Block third party cookies
- DoNotTrack
- AdChoices <https://www.youtube.com/watch?v=7PI9NBdHkDU>

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AdChoices 

AdChoices 

# To protect privacy

- Block third party cookies
- DoNotTrack
- AdChoices

**Problem with these protections? Hard to remember, hard to understand**

# To protect anonymity

- Use VPN
- Use Tor

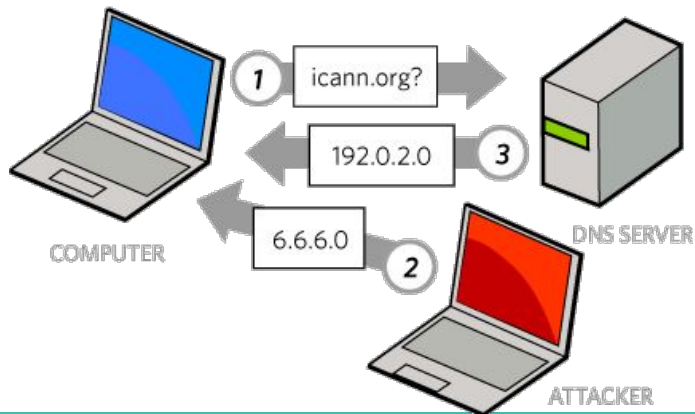


# Schedule for Censorship

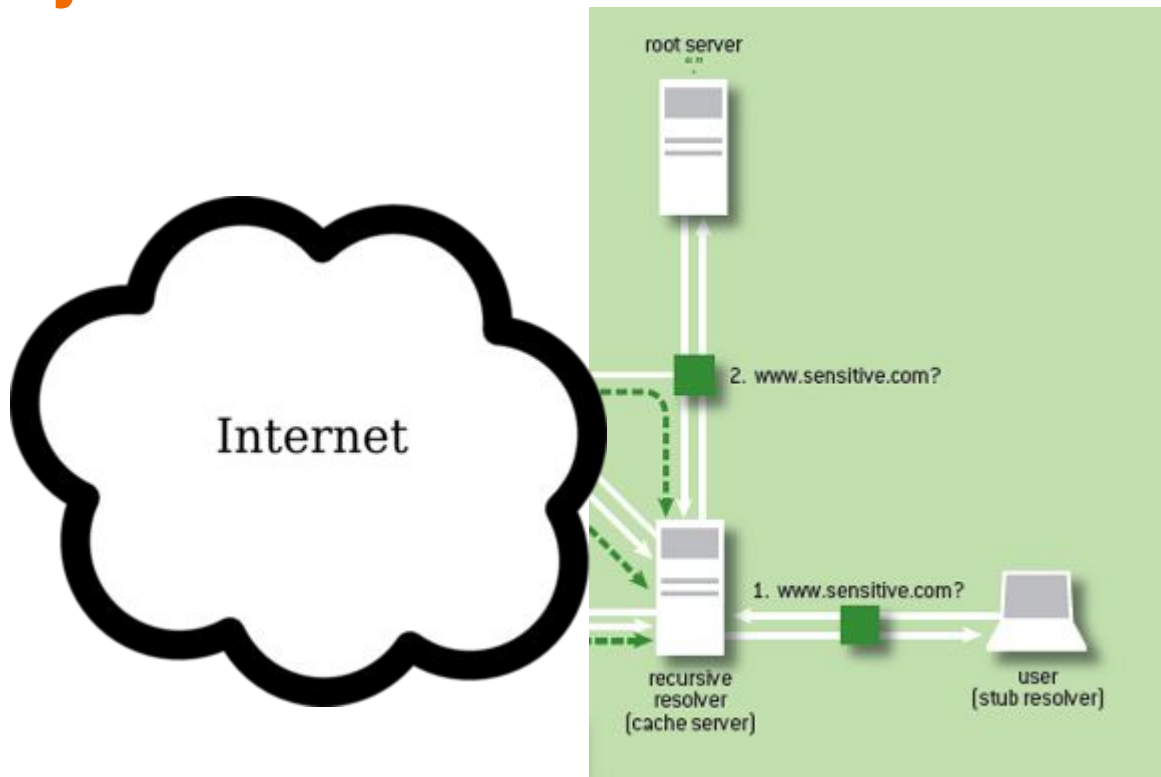
- Censorship techniques
  - DNS injection
  - TCP RST
  - Keyword filtering
  - Deep packet inspection (DPI)
- Attacks on famous anonymity systems
  - Attacks on Tor
  - Attacks on VPN Gate
- Social networks, filter bubble, etc. (if we have time)

# DNS Hijacking

- What's DNS?
  - Domain Name Service
  - Translate the domain name ([www.google.com](http://www.google.com), [www.facebook.com](http://www.facebook.com)) to an IP address (172.217.11.228, hard to remember)
  - Just like a phone book that stores name/phone#
- To hijack DNS



# DNS Hijack Doesn't Affect Us?



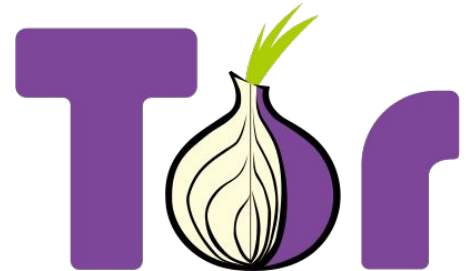


# DNS Hijack Doesn't Affect Us?

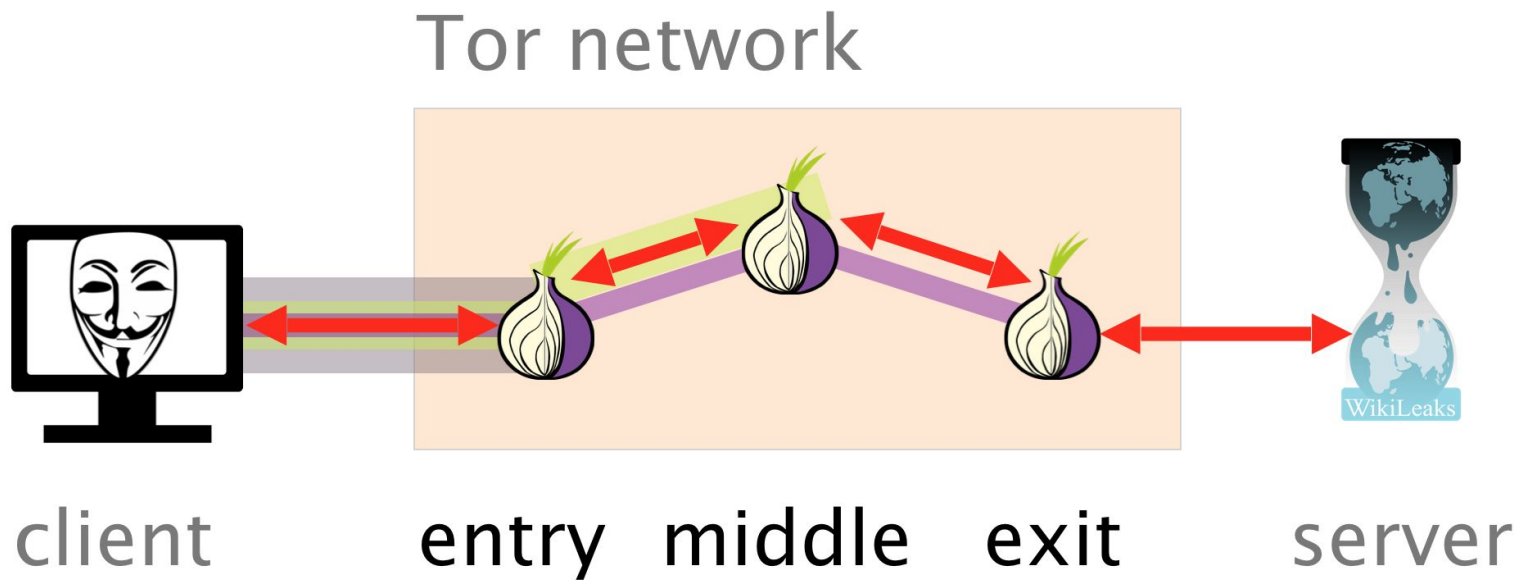
**About 24% of US open DNS servers are affected by collateral damage**

# What is Tor?

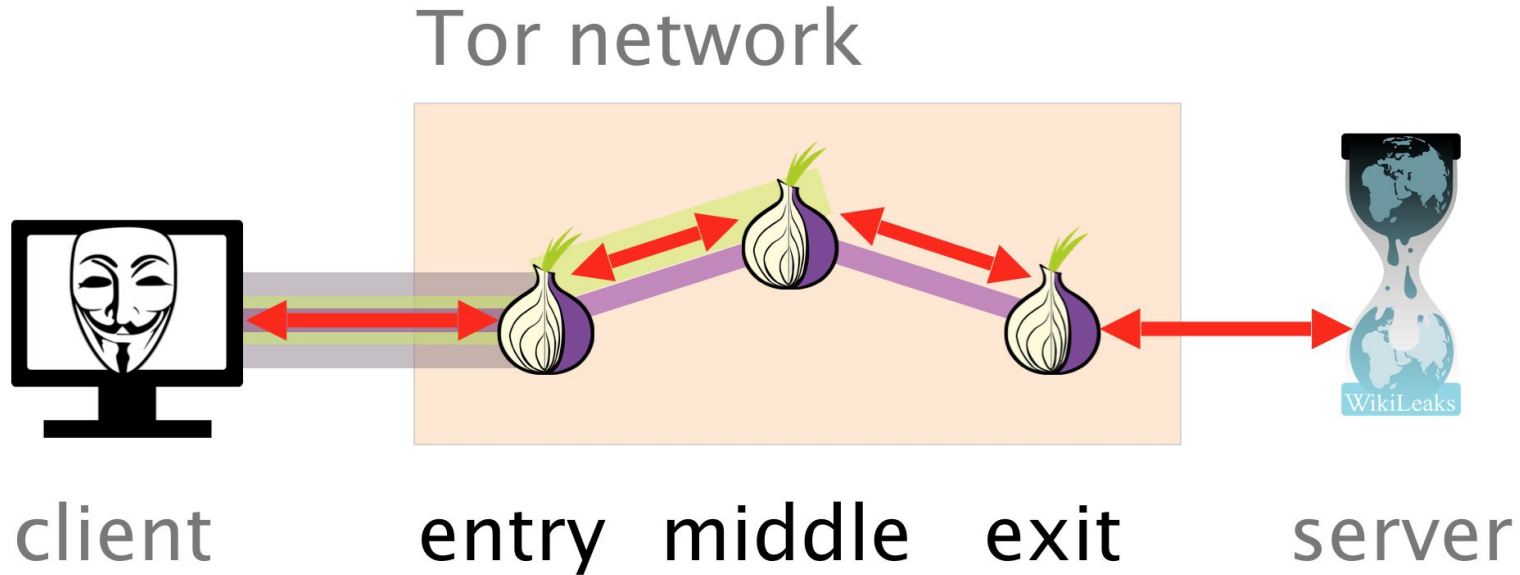
- Tor (The Onion Router) is free software for anonymous communication
  - Directs Internet traffic through Tor network to conceal a user's location
    - Makes it difficult to trace Internet activity



# What is Tor?

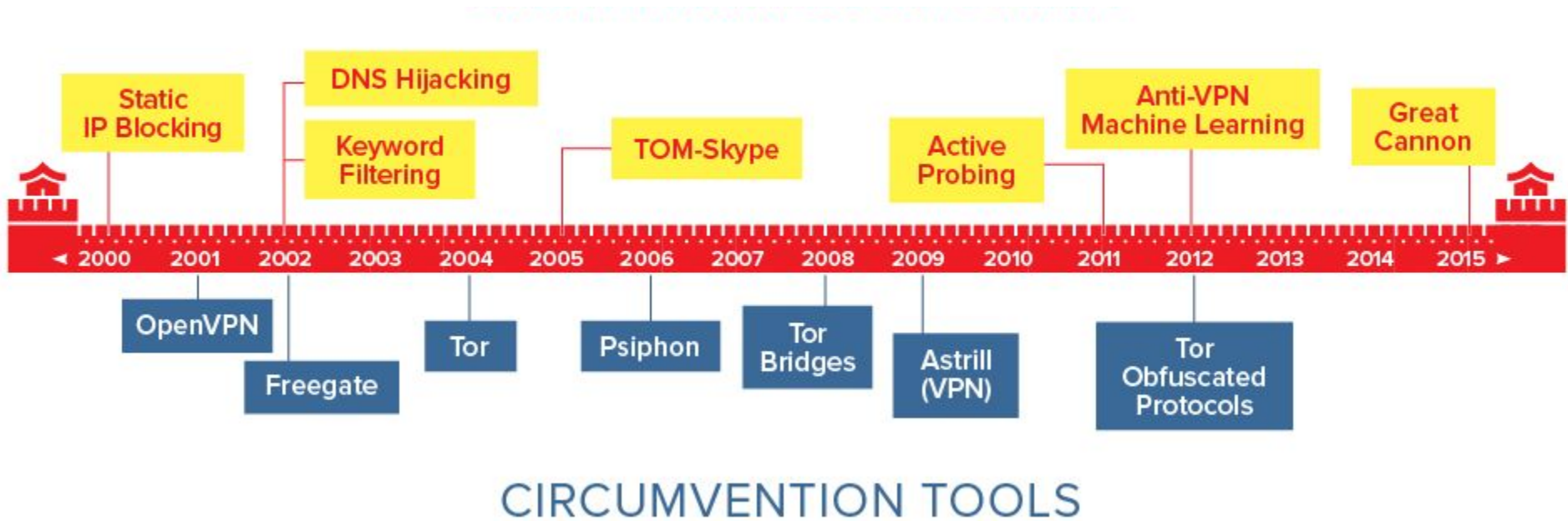


# What is Tor?



**Tor is slooooooooooooooowwwww**

**But good for censorship circumvention**



Similar techniques have been used in Iran, Egypt, Libya, etc.

# Readings of the Week

- Anonymity Loves Company: Usability and the Network Effect
- Privacy as Contextual Integrity (optional)