

Paraweb

Networked Invisibility*

*** Maybe. See “Questions” poster.**

Paraweb: An Overview

A cloak, not a shield

- Enables obfuscated and deniable web surfing
- Useful when one can't use Tor/VPNs
- Paraweb is a set of open-source protocols for creating hidden world wide webs
- Embedding WWW-extended documents in social media content
- Steganography + WWW = Paraweb!

Paraweb: Demo 1

Embedded Content, Basic Download

- 1) Go to a host page (e.g.,
<https://paraweb.io/example.html>)
- 2) Download the file with embedded content
- 3) Extract the embedded content
- 4) Display the para-site

The Web's Original Vision

Decentralized and universal exchange of information

“What matters is in the connections. ... The web is more a social creation than a technical one. [I, Tim Berners-Lee,] designed it for a social effect – to help people work together. ... The ultimate goal of the Web is to support and improve our weblike existence in the world.”

Trends in the Modern Web

Control and censorship of information – and tools

- Platform enshittification

- <https://www.wired.com/story/tiktok-platforms-cory-doctorow/>

- State-level controls, like the Great Firewall

- <https://www.wired.com/story/uyghur-internet-erased-china/>

- KOSA: restrictions on “any online platform that connects to the internet.”

- <https://www.eff.org/deeplinks/2022/11/kosa-would-let-government-control-what-young-people-see-online>

A Web Conversation (Simplified)

Who knows what?

You

- 1) Source IP
- 2) Domain
- 3) Page
- 4) Parameters
- 5) Metadata
- 6) History
- 7) Purpose
- 8) Response

Mr. ISP

- 1) Source IP
- 2) Domain
- 3) Metadata
- 4) ~History
- 5) ~ ~ Purpose

Mr. Host

- 1) Source IP
- 2) Domain
- 3) Page
- 4) Parameters
- 5) Metadata
- 6) History
- 7) ~Purpose
- 8) Response
- 9) Connections

Knowable

A VPN Web Conversation (Simplified)

Who knows what?

You

- 1) Source IP
- 2) Domain
- 3) Page
- 4) Parameters
- 5) Metadata
- 6) History
- 7) Purpose
- 8) Response

Mr. ISP

- 1) Source IP
- 2) That you are a filthy anarchist VPN user

Knowable

Mr. VPN

- 1) Source IP
- 2) Domain
- 3) Metadata
- 4) ~History?
- 5) ~~Purpose
- 6) That you are a glorious heroic VPN user

Knowable
(but maybe in another jurisdiction)

Mr. Host

- 1) VPN IP
- 2) Domain
- 3) Page
- 4) Parameters
- 5) Metadata
- 6) ~History
- 7) ~Purpose
- 8) Response
- 9) Connections
- 10) That you are a filthy anarchist VPN user

Knowable

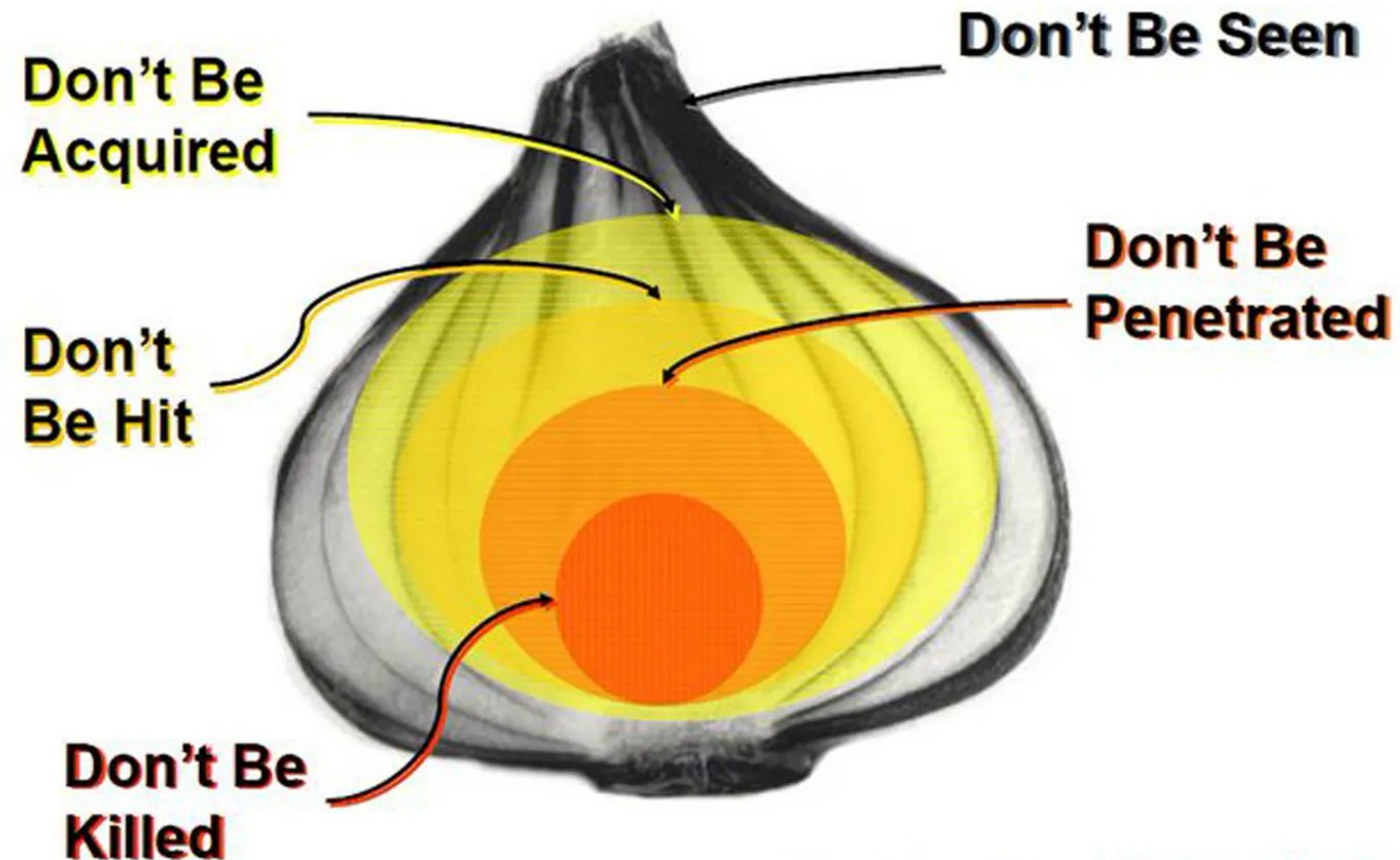
Shared Characteristics of Security

We are knights, noble and true and open

- Everything is as it seems on the web.
- Encryption and obscurity are our shields.
- Exceptions:
 - Scams, cons, grifting
 - Phishing
 - Disinformation
 - Memes
 - Nothing for nice normal law-abiding people like we

Shared Characteristics of Security

Survivability Onion



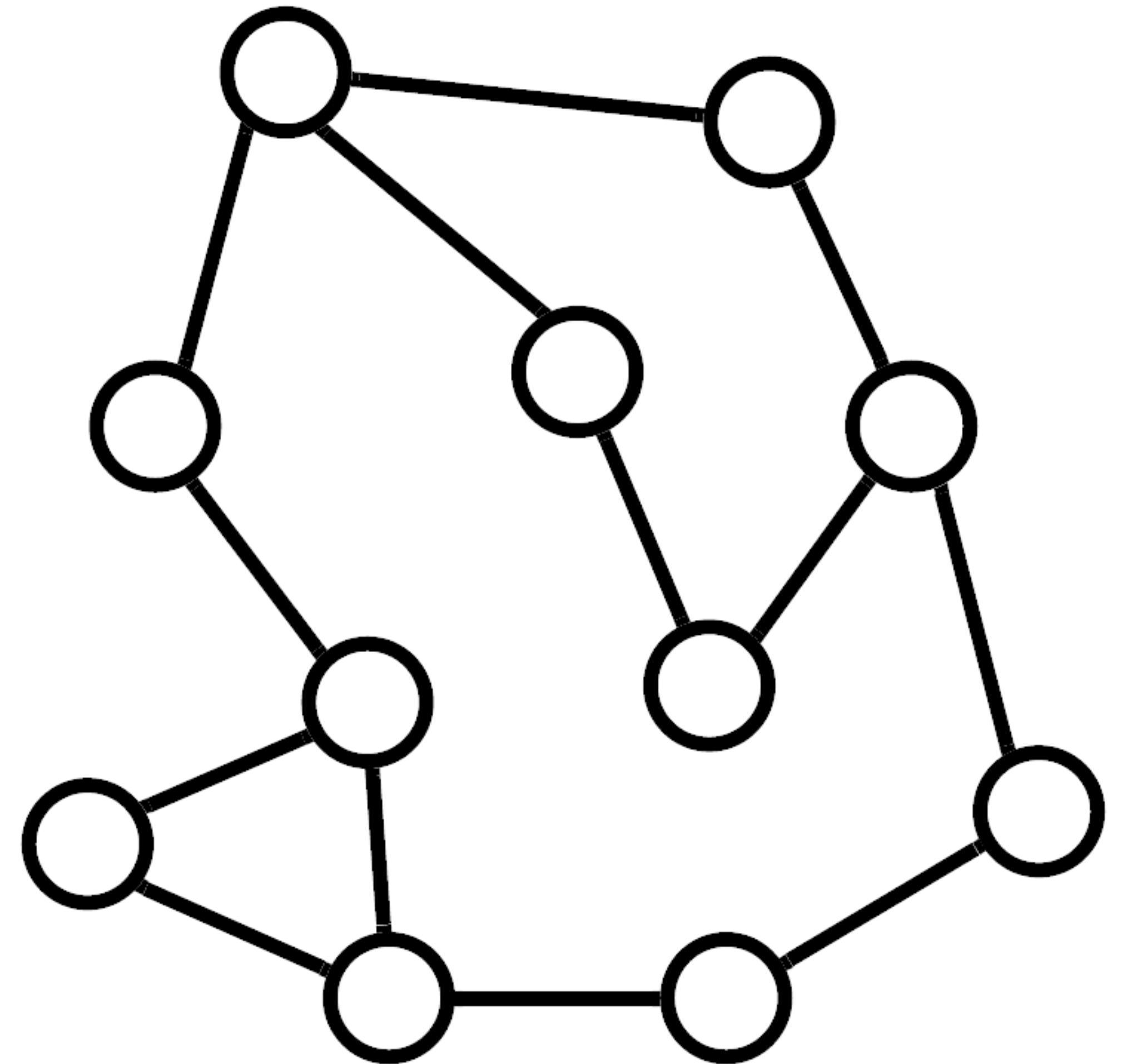
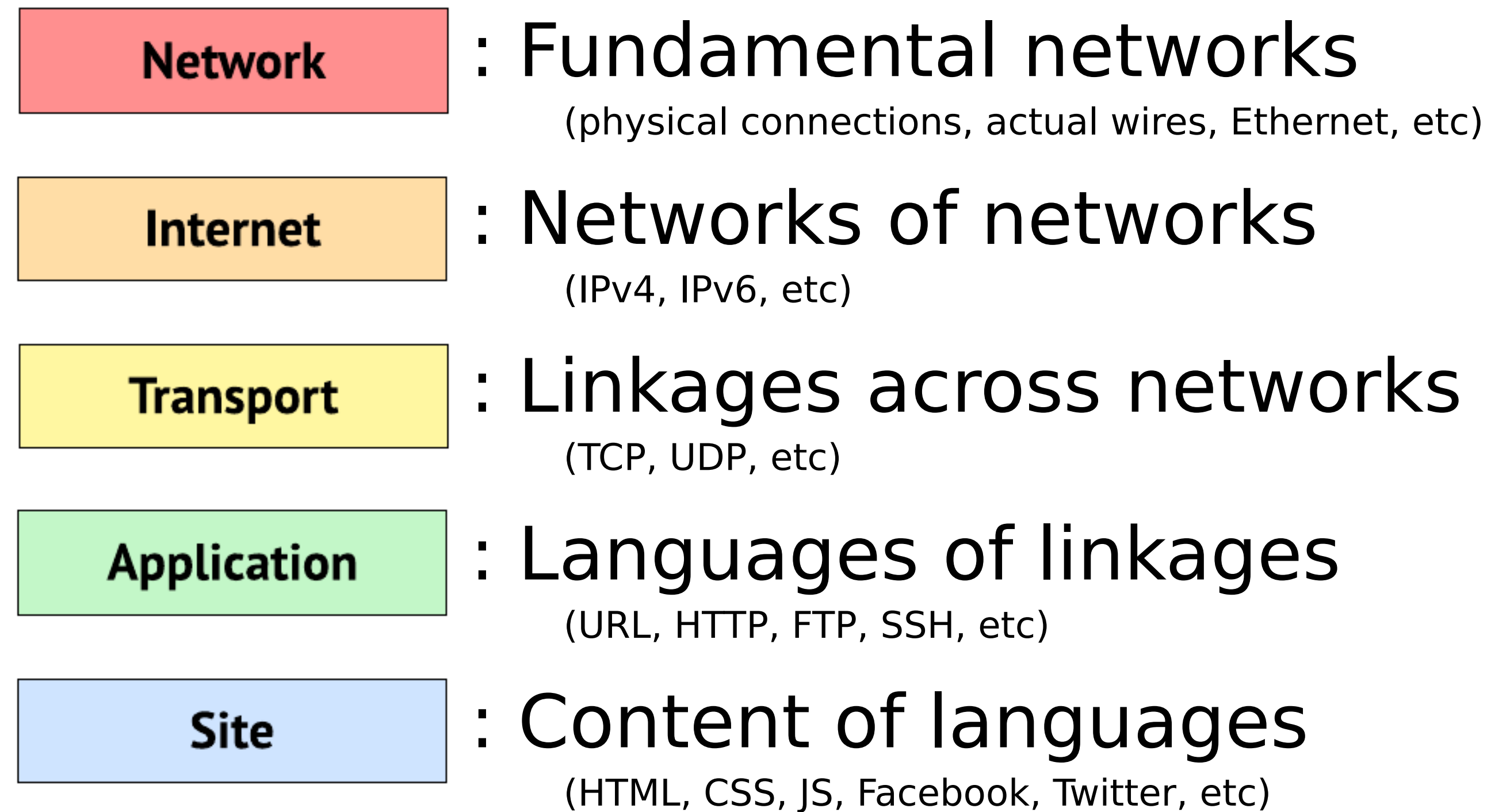
Paraweb: Demo 2

Social Media: Normal Usage

- 1) Go <https://www.tumblr.com/paraweb-demo/>
- 2) Enjoy the pretty picture of the mountain
- 3) Rest easy in the security of your HTTPS connection and even your VPN
- 4) Enjoy advertisements for alpine climbing gear and ski vacations
- 5) Get visited by the Feds if the mountain is Cheyenne Mountain

The Modern Web: Tech Stack

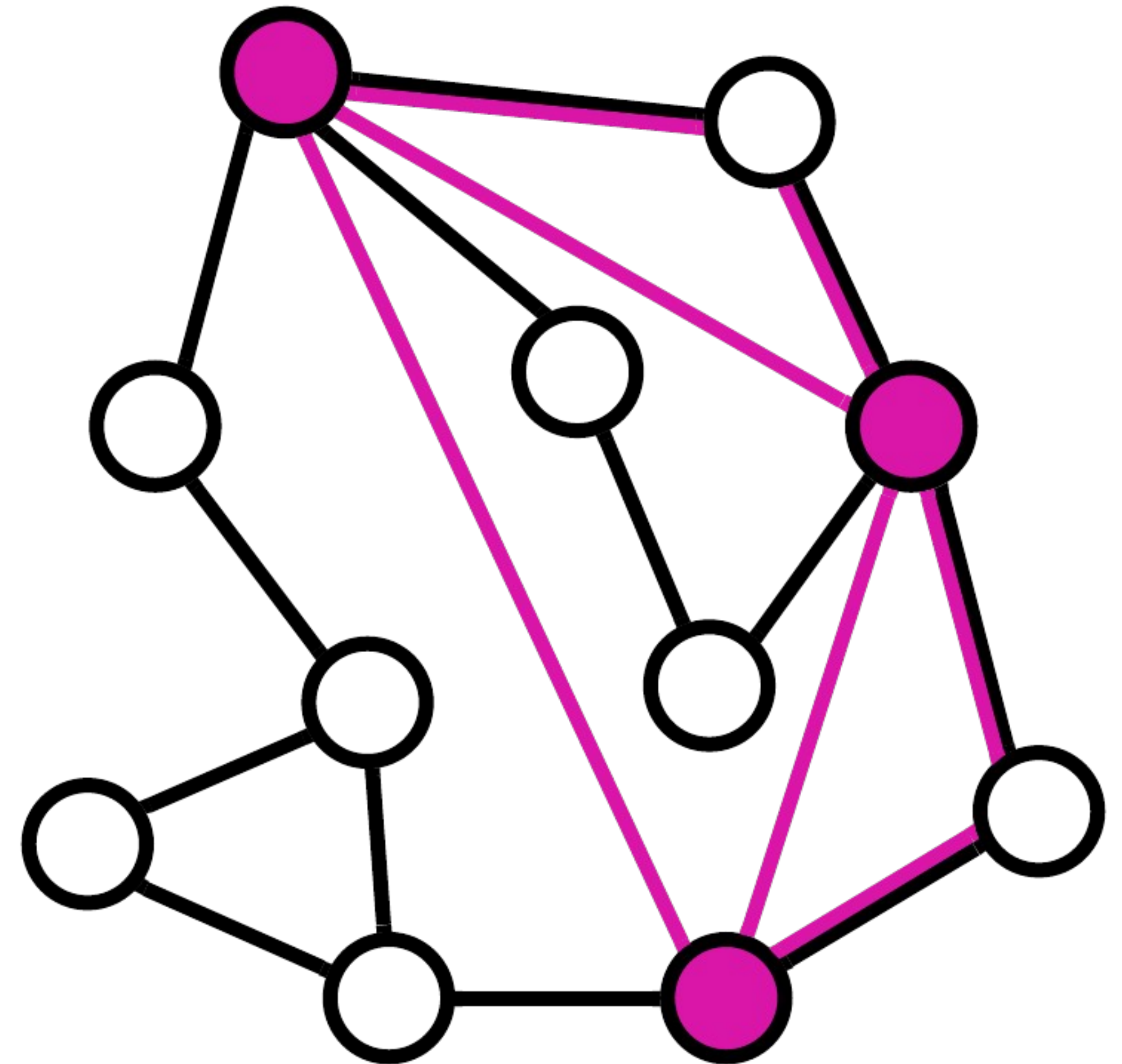
High degree, high throughput, low latency



Paraweb

Low degree, low throughput, high latency, “invisible”

Network	: Fundamental networks (physical connections, actual wires, Ethernet, etc)
Internet	: Networks of networks (IPv4, IPv6, etc)
Transport	: Linkages across networks (TCP, UDP, etc)
Application	: Languages of linkages (URL, HTTP, FTP, SSH, etc)
Site	: Content of languages (HTML, CSS, JS, Facebook, Twitter, etc)
Parasite	: Network hidden in content (hidden URL, HTML, application-layer protocol, etc.)



Paraweb: Demo 3

Social Media Site

- 1) Find Paraweb host page: <https://www.tumblr.com/paraweb-demo/>
- 2) Right-click on image to get super-long content URL:
<https://64.media.tumblr.com/30a5f22c9997d492c8e1961d099a2c...>
- 3) Get Tumblr script: <https://github.com/paraweb-demo/paraweb-demo>
- 4) Run script:

```
python paraweb_browser_basic_tumblr.py "https://64.media...
```

Paraweb: Demo 4

Basic Paraweb Traversal

- 1) Start with a host page (e.g., <https://paraweb.io/example.html>)
- 2) Follow links around the webring

Paraweb Protocols

Adapting the core protocols of the World Wide Web

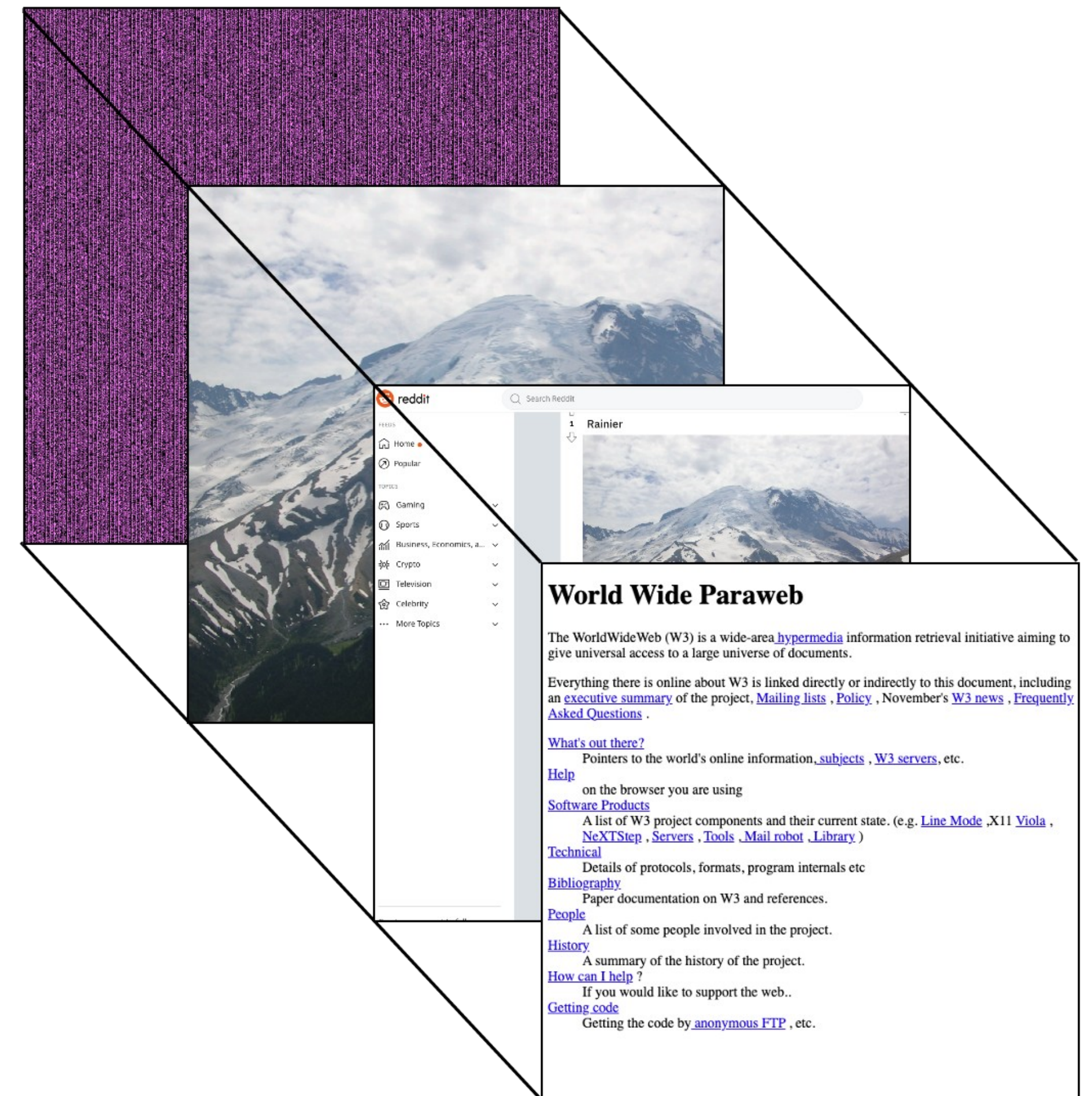
“For the Web, these elements were, in decreasing order of importance, universal resource identifiers (URIs), the Hypertext Transfer Protocol (HTTP), and the Hypertext Markup Language (HTML).”

- 1) Para-URI:** enough detail to find the linked host and decrypt content
Example: host URI + encryption scheme
- 2) Para-HTTP:** WWW traversal of social media to linked host
Examples: just a straight-up HTTP request of para-site's host page
- 3) Para-HTML:** encryption and format of encoded content
Example: HTML encoded directly bit-by-bit in the LSB of red pixels

Paraweb: A Review

Back to the beginning of the presentation

- **Modern social networks:** data-, link-, and throughput-rich enough to be treated as a physical network layer.
- **Paraweb:** steganographically encrypts hidden structured content in innocuous social network messages.
- **Paraweb:** adapts core components of the visible web: URI, HTTP, and HTML.
- **Paraweb:** embeds an “invisible” Web 1.0 in Web 2.0.



Paraweb: Any Questions?



Community

- 1) What's it good for?
- 2) Developer community
- 3) Ease of use
- 4) Spreading the word

World Wide Web

- 1) Reciprocal links
- 2) Web directories
- 3) Web 2.0 interactivity

Technical Stuff

- 1) Is there a fatal flaw?
- 2) Measuring discoverability and deniability
- 3) Maturing technical specifications
- 4) Components of a para-URI
- 5) Better steganography
- 6) How to deal with loss
- 7) ?

Bonus Paraweb: Differentiator 1

Isn't this just steganography?

- Steganography: been around awhile
- Historically used like FTP and email servers
 - China exfiltrating GE secrets
 - https://www.theregister.com/2023/01/04/ge_turbine_china_prison/
 - U.S. using phony sites as dead drops
 - https://www.theregister.com/2023/01/04/ge_turbine_china_prison/
- Paraweb differentiator: WWW protocols for encrypted content.

Bonus Paraweb: Differentiator 2

What on earth can this do that VPNs don't do better?

- VPNs and Tor: been around awhile
- VPN usage is identifiable
- Paraweb differentiator: traversal is obfuscated and deniable.
- Low observability and hard to prove

Bonus Paraweb: Demo 5

Basic Publishing

- 1) Get encode script: <https://github.com/paraweb-demo/paraweb-demo>
- 2) Write some content to upload (like an HTML thing).
- 3) Get an image from somewhere
- 4) Embed content in image with encode script:

```
python paraweb_creator_basic.py input_image.png -mes...
```
- 5) Upload content to host site
- 6) View!

Bonus Paraweb: Benefits

A cloak, not a shield

- **Steganography + web standards:** an open, invisible world wide web
- **Hyperlinking payloads:** transform covert channels into covert network
- **Accessible:** no special software
- **Cloaked:** content resembles regular social network content
- **Deniable:** usage duplicates regular social network usage
- **Targeted:** most useful in censored networks, not open networks
- **Scenario 1:** democracy advocates in highly monitored environments
- **Scenario 2:** reporters safely interviewing sources in censored networks
- **Scenario 3:** widely shared (“viral”) content increases both cloaking and deniability