Online Privacy and ISPs:
New Factual Study

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Introduction

– Released yesterday:
  - "Online Privacy and ISPs: ISP Access to Consumer Data is Limited and Often Less than Access by Others"
  - Co-authors Justin Hemmings & Alana Kirkland
  - Iisp.gatech.edu/policy
– ISP access to user data is not comprehensive
– ISP access to user data is not unique
– Factual report, no policy recommendations
– Any regulatory action should be based on an accurate factual record

ISPs See Less Than You Think

**NON-ISPs HAVE ACCESS TO
SUBSTANTIAL USER ONLINE INFORMATION
WHILE**

**ENCRYPTION AND VPNs
BLOCK ISP ACCESS TO TRAFFIC**

AND

**INDIVIDUALS USE
MULTIPLE DEVICES**

AND

**INDIVIDUALS USE
MORE THAN ONE ISP**

**ISPs do not have comprehensive or unique
visibility into users' online activity**

Limits on ISP Visibility: Encryption

- Pervasive Encryption:
  - HTTPS blocks ISP visibility into content and full URLs
  - HTTPS allows ISPs to see only host name, www.example.com
- Appendix 1
  - Top 10 web sites either encrypt by default or upon user log-in
  - 42 of top 50 web sites either encrypt by default or upon user log-in
- Appendix 2:CAIDA Internet backbone data
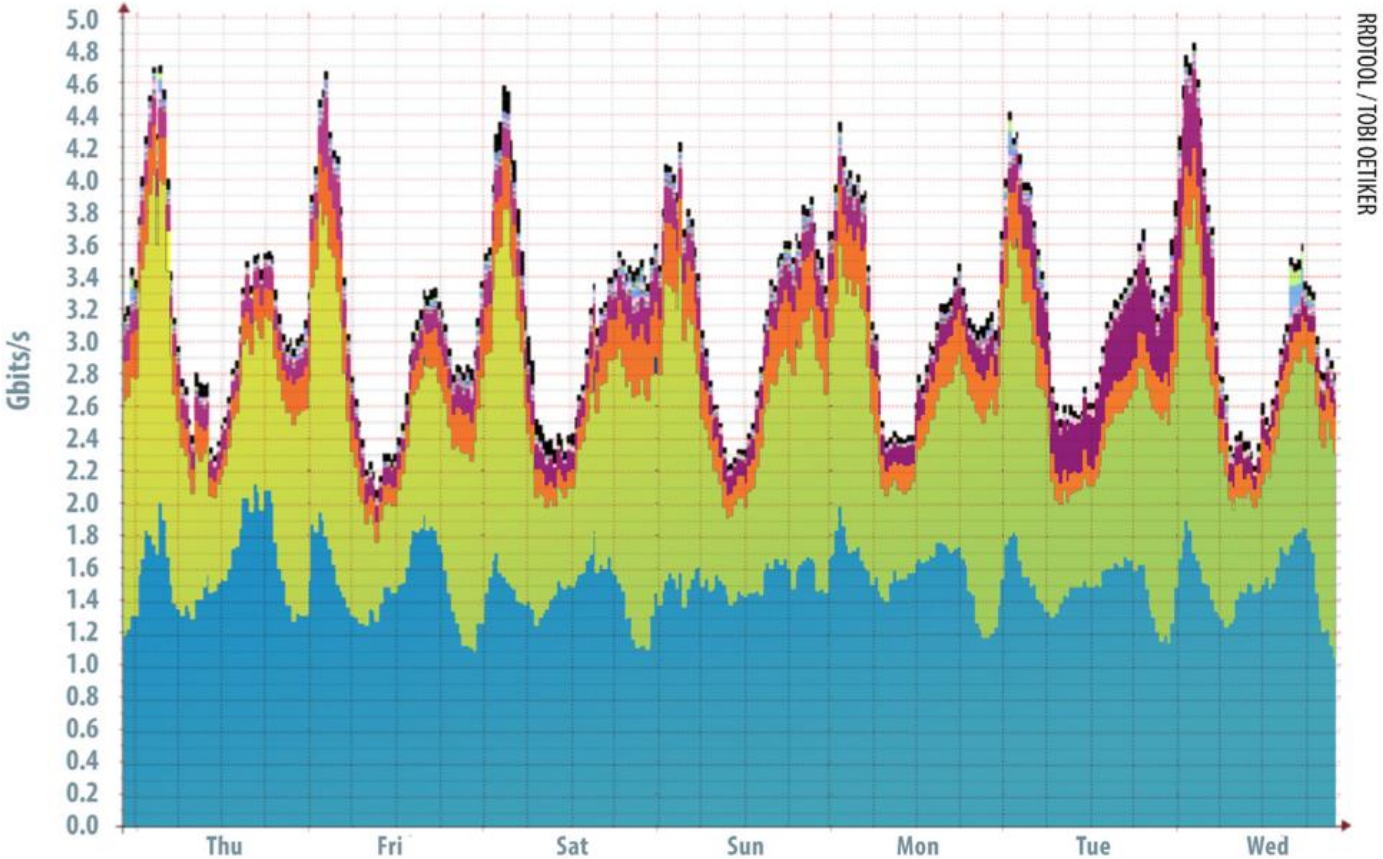 - April 2014 share of HTTPS: 13%
  - February 2016 share of HTTPS: 49%

APPLICATION BITS/S - 2 YEARS

RRDTOOL / TOBI OETIKER
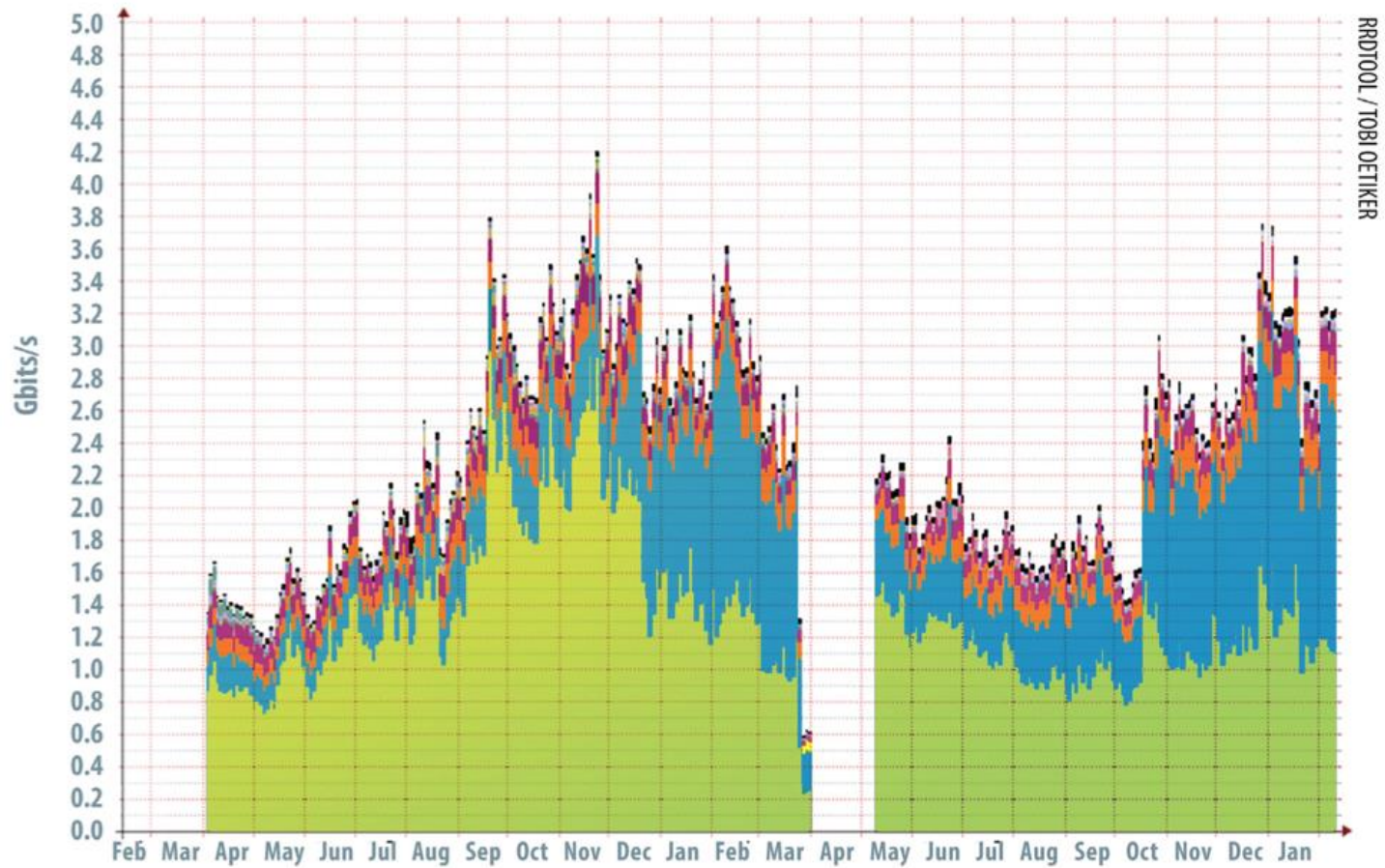
FEBRUARY 10, 2014 - FEBRUARY 10, 2016 UTC

Application	Min	Avg	Max
HTTP	231.80M	1.34G	3.11G
HTTPS	135.66M	609.09M	1.74G
UNKNOWN_UDP	39.29M	156.90M	300.38M
UNKNOWN_TCP	22.27M	12044M	346.39M
RTMP	5.83M	16.57M	28.26M

APPLICATION BITS/S - 1 WEEK

FEBRUARY 03, 2016 - FEBRUARY 10, 2016 UTC

Application	Min	Avg	Max
▇ HTTPS	1.04G	1.53G	2.12G
▇ HTTP	480.93M	1.14G	2.31G
▇ UNKNOWN_UDP	89.05M	232.12M	454.18M
▇ UNKNOWN_TCP	80.40M	180.76M	516.36M

Contrasting Views

- Letter last week:

  ISPs have "comprehensive" visibility into user Internet activity

- Our research:

- **No**
- **SSL encryption blocks content**
- **SSL encryption blocks detailed links**
- **Encryption is becoming predominant**

APRIL 2014

PERCENT OF HTTP TRAFFIC:
60.445652

PERCENT OF HTTPS TRAFFIC:
13.282609

Diagram 3 – screen shot for April 2014 statistics.

FEBRUARY 3 - FEBRUARY 10, 2016

PERCENT OF HTTP TRAFFIC:
35.06694

PERCENT OF HTTPS TRAFFIC:
48.600777

Diagram 4 - screen shot for week in Feb 2016 statistics.

THE EFFECTS OF HTTPS:
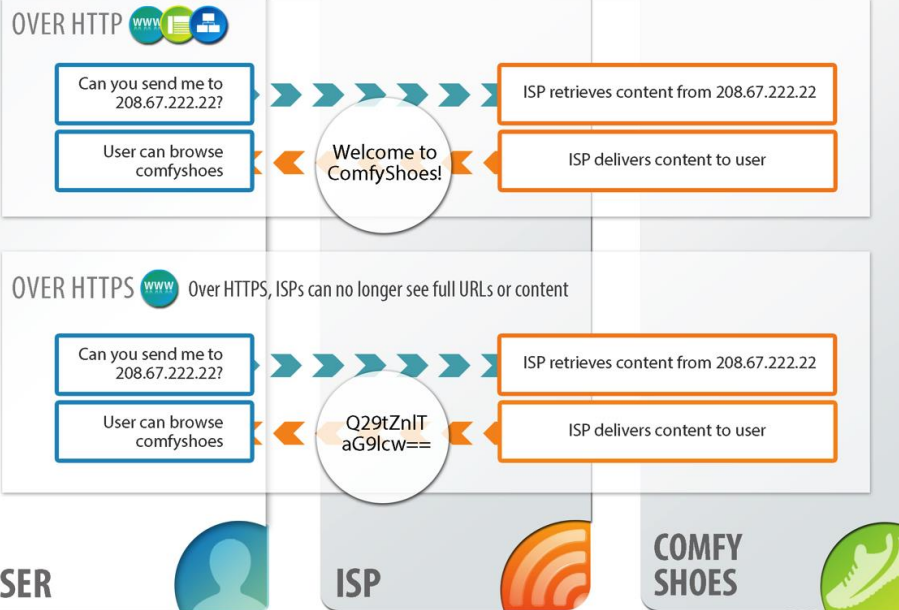
With HTTP, ISPs see: www

With HTTPS, ISPs see: www

STEP 1 - DNS LOOKUP

I want to visit comfyshoes.com

Can you tell me where comfyshoes is located?

comfyshoes.com location: 208.67.222.222

Now I know how to locate comfyshoes

comfyshoes is located at 208.67.222.22

ISP www

www **DNS**

STEP 2 - CONTENT RETRIEVAL

OVER HTTP www

Can you send me to 208.67.222.22?

ISP retrieves content from 208.67.222.22

User can browse comfyshoes

Welcome to ComfyShoes!

ISP delivers content to user

OVER HTTPS www Over HTTPS, ISPs can no longer see full URLs or content

Can you send me to 208.67.222.22?

ISP retrieves content from 208.67.222.22

User can browse comfyshoes

Q29tZnlT aG9lcw==

ISP delivers content to user

USER

ISP

COMFY SHOES
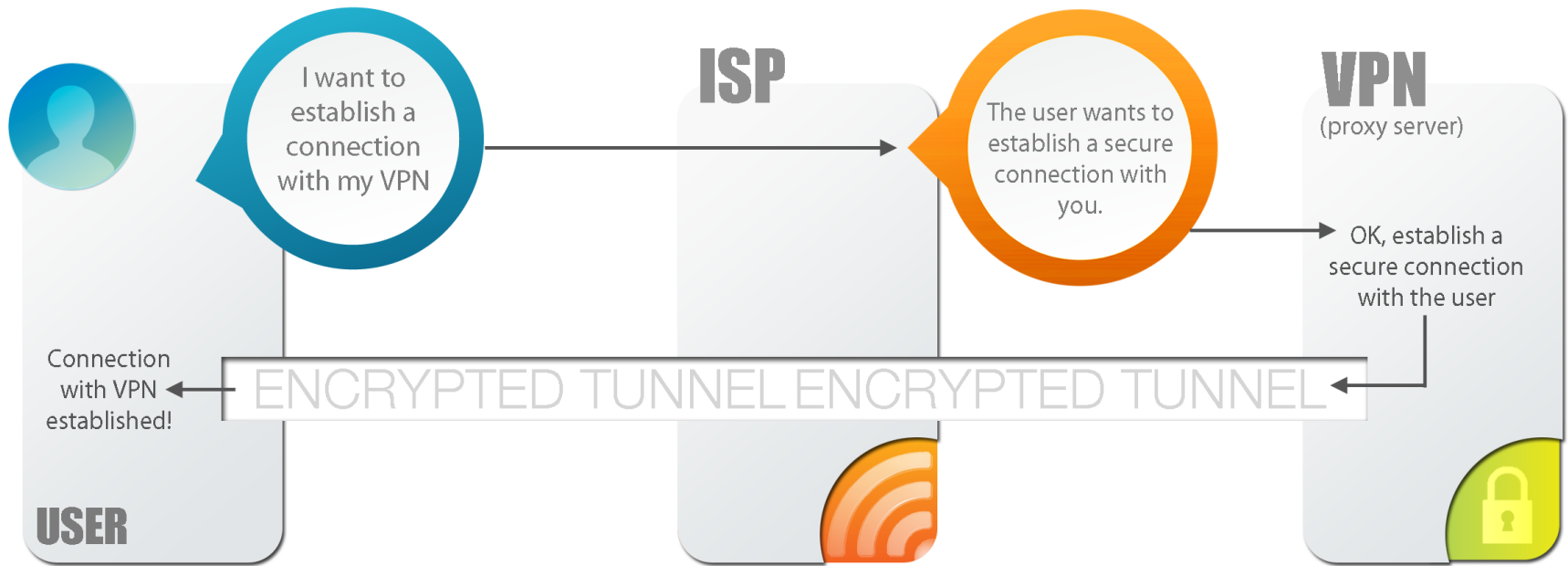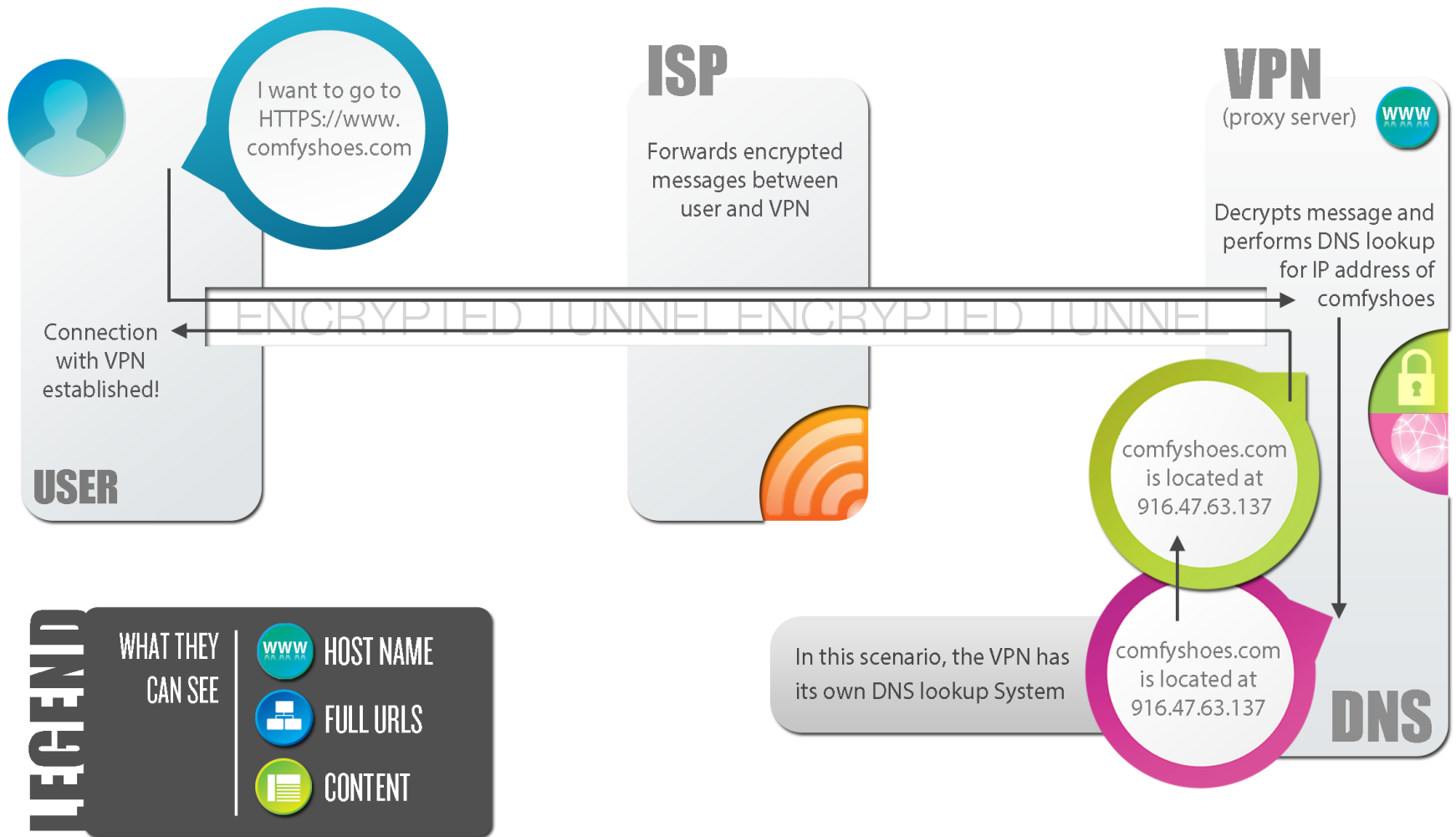
WITH VIRTUAL PRIVATE NETWORKS

1. Establishing a connection to a VPN

WITH VIRTUAL PRIVATE NETWORKS

2. DNS Lookup

I want to go to HTTPS://www.comfyshoes.com

Connection with VPN established!

USER

ISP

Forwards encrypted messages between user and VPN

ENCRYPTED TUNNEL ENCRYPTED TUNNEL

VPN
(proxy server)

WWW

Decrypts message and performs DNS lookup for IP address of comfyshoes

comfyshoes.com is located at 916.47.63.137

In this scenario, the VPN has its own DNS lookup System

comfyshoes.com is located at 916.47.63.137

DNS

LEGEND

WHAT THEY CAN SEE

WWW HOST NAME

FULL URLS

CONTENT

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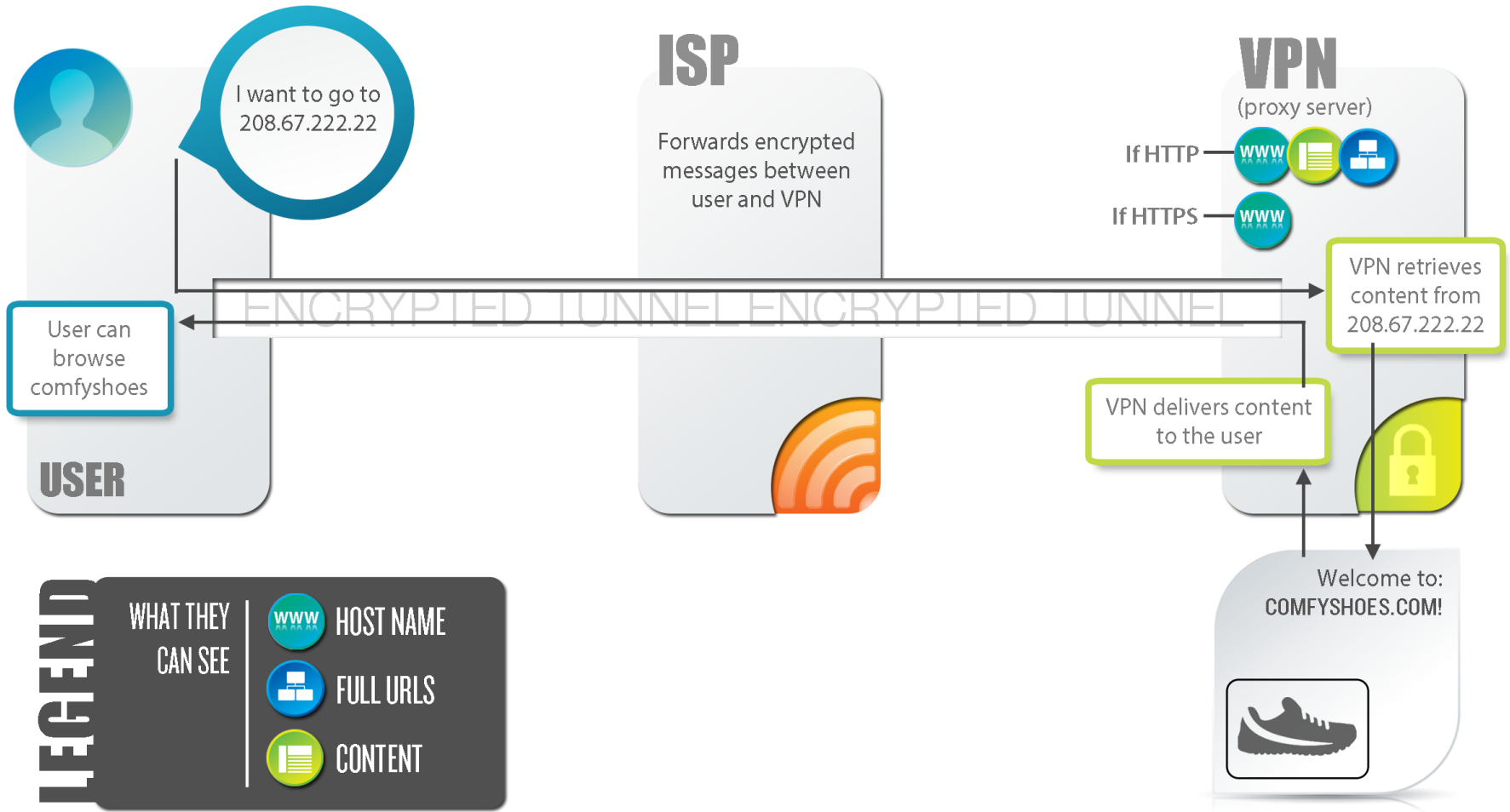
INDIVIDUALS USE MORE THAN ONE ISP

ISPs do not have comprehensive or unique visibility into users' online activity

"Unique" Visibility of ISPs?

- "Contexts" and cross-context tracking:
  - Social networks
  - Search
  - Webmail/messaging
  - OS, especially mobile
  - Mobile apps
  - Interest-based advertising
  - Browsers
  - Internet video
  - E-commerce
- Combining user data about any one device
- Then, cross-device tracking

CROSS CONTEXT CHART

AMAZON

APPLE

AT&T

COMCAST

FACEBOOK

GOOGLE

MICROSOFT

TWC

VERIZON

YAHOO

WEB SEARCH   DIGITAL ADS

SOCIAL   E-COMMERCE

ONLINE VIDEO   OTT MESSAGING

OPERATING SYSTEM   ISP

EMAIL CLIENT   BROWSER

OVER 5% OF MARKET   IN MARKET   NOT IN MARKET

Conclusion

- Report seeks to describe online ecosystem, personal information, the role of ISPs and other major players
- Policy should be based on accurate facts about today's and tomorrow's markets
- We welcome comments and corrections

Credits