

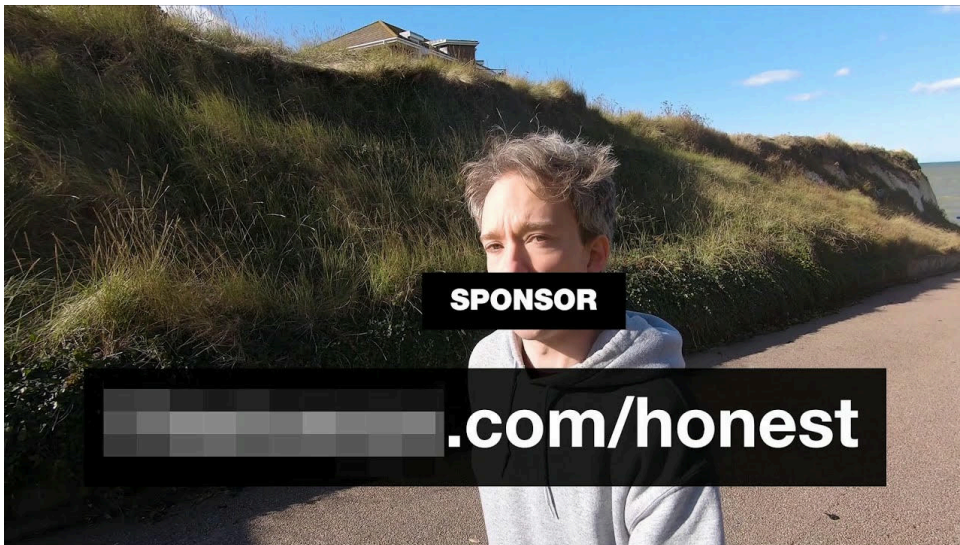
Virtual Private Networks

How they work and when to use them

09.30.2025

Autumn Luzovich (they/them/theirs)

First, a convenient video



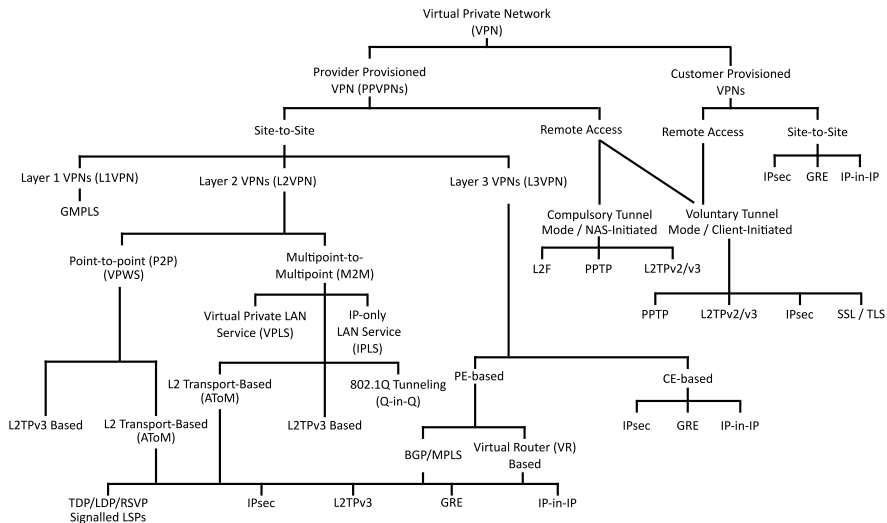
<https://www.youtube.com/watch?v=WVDQEoe6ZWY>

1 What Are They

Preface

VPNs are complicated

Preface (ii)

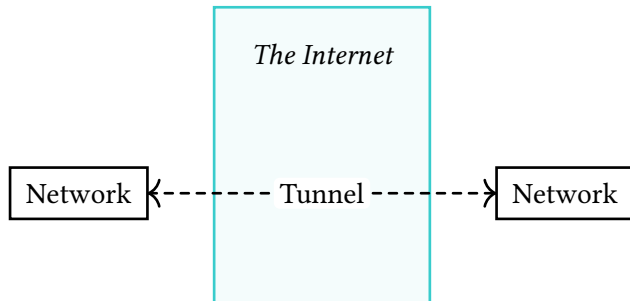


https://commons.wikimedia.org/wiki/File:VPN_classification-en.svg

At its simplest...

Virtual Private Network (VPN)

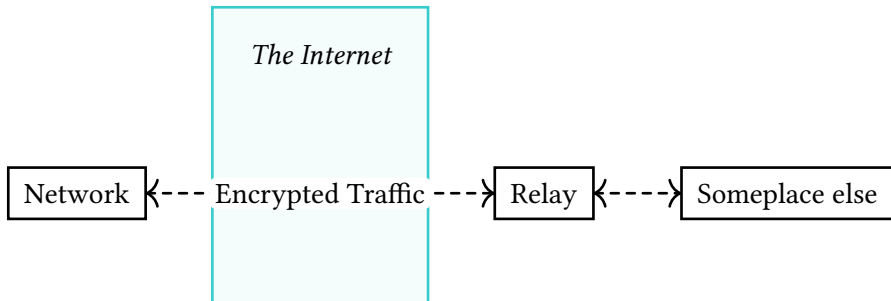
A non-physical way of “connecting” two networks together.



At its not-so simplist...

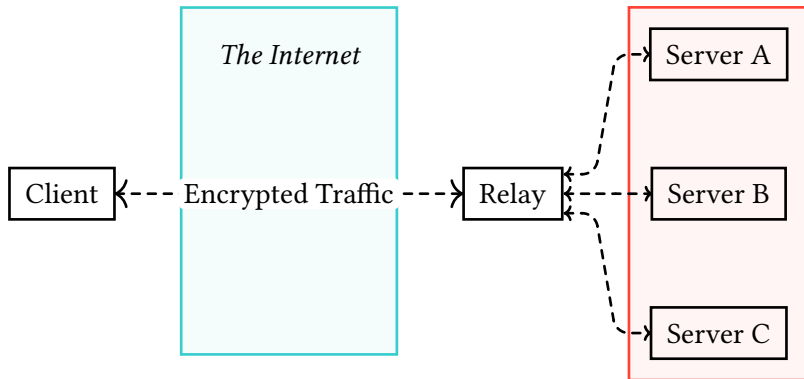
Virtual Private Network (VPN)

An encrypted connection between a client or network and a relay, which routes traffic someplace else.



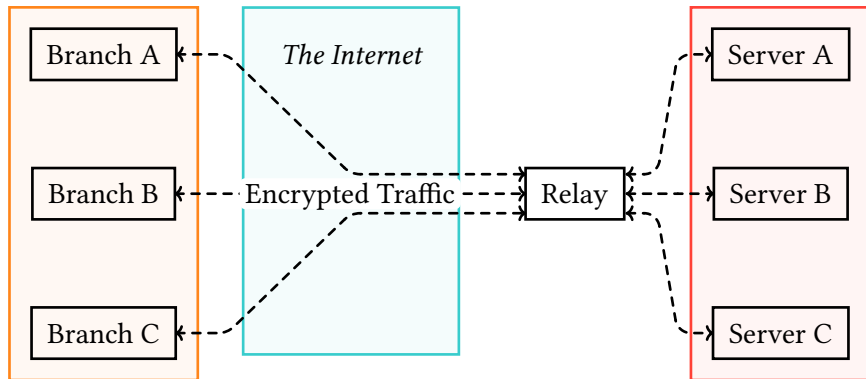
Some categories of VPNs

1.d.a Remote Access



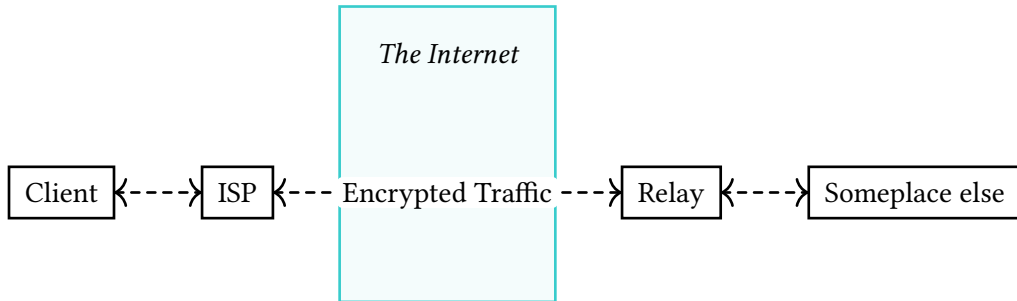
Some categories of VPNs (ii)

1.d.b Site-to-Site

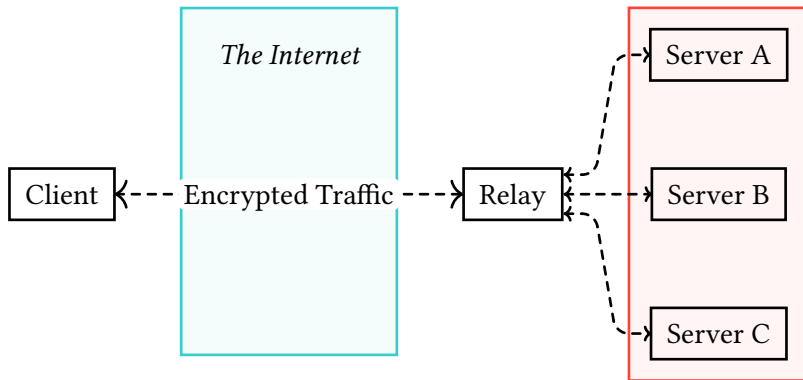


2 What They Can Do

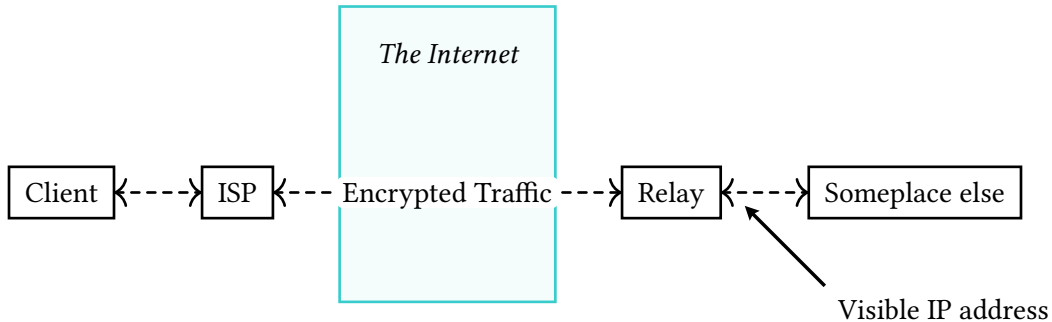
Keeping traffic private from your ISP



Connecting to internal resources

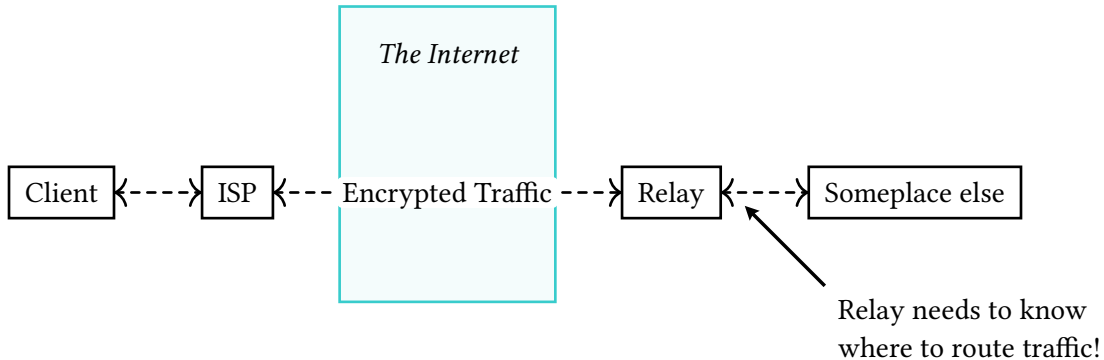


Accessing geo-restricted content



3 What They Can't Do

Keeping traffic private from your VPN provider



Shielding your computer from all attacks

Sophisticated attack methods can still work

Shielding your computer from all attacks (ii)

Malware and virus protection is only as good as the relay makes it

Other considerations

TLS already secures most requests over the Internet

Other considerations (ii)

Bad actors with access to the relay can compromise most security

Other considerations (iii)

3.c.a HSTS (HTTP Strict Transport Security)

- Per-website policy that prevents browsers from accessing insecure contents over HTTP on future requests
- Header `Strict-Transport-Security` designates length of policy and whether subdomains are included
- HSTS preloading applies policy to a designated list of sites before visiting

3.c.b HTTP blocking

- Web server blocks all requests over HTTP, requiring that they go over HTTPS
- Could limit access to content for devices that don't support HTTPS
- Exists by default within major SDKs (Software Development Kits) like Android and iOS
- Can be toggled on in most major browsers

3.c.c DNS Poisoning

- Penetrated, or rogue DNS server which returns unauthentic responses for queries
- Navigates requests towards malicious servers

4 Vulnerabilities Can Be Disastrous

CVE-2024-3400 — Palo Alto Networks' PAN-OS

Remote Code Execution

CVE-2024-9463/9464 — Palo Alto Networks' Expedition

Credential exposure

Who even uses Palo Alto Networks?

4.c.a Many companies

Including...

- Dell
- Chipotle
- Dollar Tree
- Salesforce
- Campbell's
- TIME
- NBCUniversal
- ADT

4.c.b Many, many universities

Including...

- MIT
- UC Berkeley
- School of Mines
- University of Pennsylvania
- University of Nebraska
- University of Maryland
- University of Wisconsin
- University of Louisville
- University of Denver
- Louisiana State University
- Colorado State University

5 Commercial VPNs

A more secure way to browse the web

TunnelBear encrypts your internet connection to
keep your online activity private on any network.

Fall Sale! Get 67% off

Your first year of TunnelBear for \$119USD \$39.99USD



<https://tunnelbear.com>

TunnelBear (ii)



Change your IP address

Your IP address is kind of like a phone number that tells websites where you are and how to connect to your device. TunnelBear gives you a new IP, so all of your traffic looks like it's coming from somewhere else.



Block online tracking

Advertisers invade your online privacy by targeting your IP for ads. By changing your IP address, TunnelBear blocks common ways advertising trackers follow you around the internet.

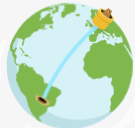


Stay safe on public WiFi

People love public Wi-Fi, but so do hackers. With simple tools, they can capture passwords and logins as they pass through a shared Wi-Fi point. Keep your accounts safe by encrypting your connection with TunnelBear.

<https://www.tunnelbear.com/what-is-vpn#how-it-works>

TunnelBear (iii)



Stay connected to home

Don't miss out on current events or local news when you're travelling. With servers in [47 countries](#), TunnelBear can help you stay connected to home as if you were there.



Stream video faster

Internet service providers regularly throttle services they compete with, but with TunnelBear, you can avoid throttling by keeping your browsing private from your service provider.



Bypass censorship

More governments are trying to censor news and communications outside their borders. TunnelBear can help bypass censorship by connecting to a server in another country, so you can get the information you need.

<https://www.tunnelbear.com/what-is-vpn#how-it-works>

TunnelBear (iv)



Travel securely

Don't trust the Wi-Fi in your hotel? TunnelBear's Grizzly-grade encryption lets you safely check your email, bank account, book flights and more—all without risking your personal information.



Protect your online privacy

Most websites ignore your Human Right to privacy. Whether it's your internet service provider monitoring your connection or advertisers tracking you, exercising your right to privacy is becoming more difficult. With TunnelBear VPN, all of your browsing is encrypted so no one else can see what you're doing.

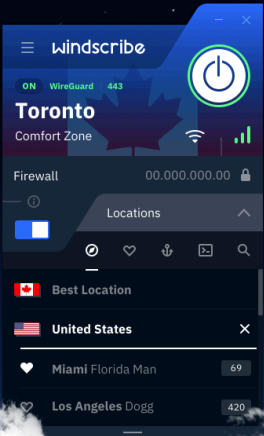


Peer-To-Peer

Internet service providers regularly slow, and even block, torrent connections on their networks. TunnelBear protects you from disconnects and blocks ISP from seeing your traffic, so they can't slow it down.

<https://www.tunnelbear.com/what-is-vpn#how-it-works>

Windscribe



The image shows a mobile app interface for Windscribe. At the top, it says 'windscribe' with a power button icon. Below that, it shows 'ON WireGuard 443'. The current location is 'Toronto' with a 'Comfort Zone' indicator. A firewall status is shown as '00.000.000.00'. A 'Locations' section lists 'Best Location' (Canada), 'United States' (USA), 'Miami Florida Man' (69), and 'Los Angeles Dogg' (420). The app is set against a dark blue background with white clouds at the bottom and a network diagram on the left.

Browse the web privately as it was meant to be

Your online privacy is under attack.
Windscribe sets you free.

Get Windscribe Now

Learn About Windscribe

<https://windscribe.com>

Windscribe (ii)

A VPN, or **Virtual Private Network**, allows you to connect to the internet through an encrypted tunnel, changing your IP and anonymizing your connection in the process. This means that you are able to use a public internet connection, like one in your home or at a cafe, by first encrypting your traffic, sending it to our VPN server, and then to the internet. This allows you to keep your data safe regardless of where you choose to connect to the internet. It prevents the network administrators or internet service providers (ISP) from collecting and storing all your browsing activity and then potentially selling it off for profit. Enabling Windscribe on your device means that your ISP or network administrator will only ever see one connection from that device and that is to Windscribe. No matter what website you're on or what app you're using, the only internet communication would be between your device and the Windscribe VPN server.

The anonymization of your traffic is also very beneficial and it works by connecting you to an IP that many other people are using. When many users are all on the same IP, there is no way to trace back the specific traffic to any one person. [We do not analyze or log any user activity](#) while on the VPN so without these logs, it's impossible to tell who was doing what on which IP.

Finally, because the VPN changes your IP address, another popular use for a it is to appear in different places around the world. When you connect to the VPN, you can select which region you want to appear in. For example, if there is a website or app that only works in Japan and you are located in the USA, then you can connect to one of Windscribe's VPN servers in Japan and it will appear to the website or app as though you are actually located there.

<https://windscribe.com/knowledge-base/articles/what-is-a-vpn/>

[What is a VPN?](#)[What We Offer](#) ▾[Download VPN](#) ▾[Support](#)[Blog](#)[My Account](#)[🌐 English](#)[Get Started](#)

The VPN that just works

Go further with the #1 trusted leader in VPN

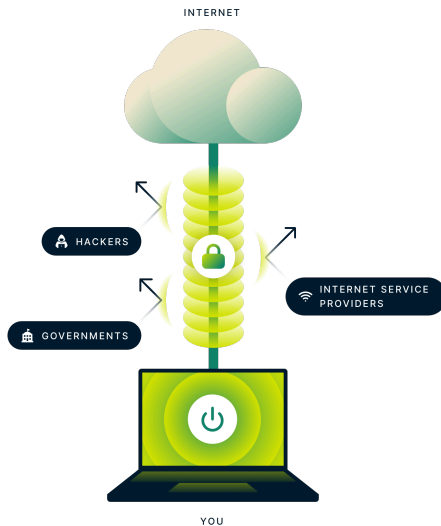
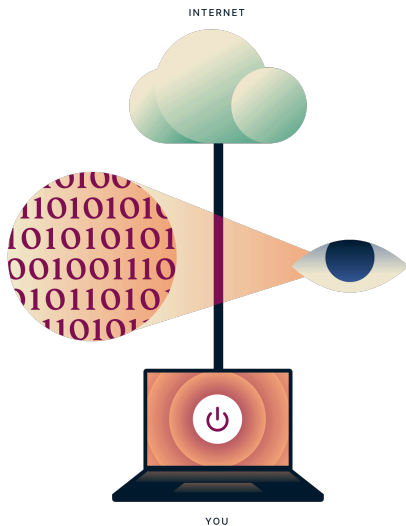
[Get ExpressVPN →](#)

30-DAY MONEY-BACK GUARANTEE



<https://expressvpn.com>

ExpressVPN (ii)



<https://www.expressvpn.com/what-is-vpn#how-does-it-work>

Private Internet Access



What is a VPN | Why PIA | Pricing | VPN Features | Download VPN | VPN Servers | Blog | Support

Login | EN | [Get PIA VPN](#)

TAKE BACK CONTROL

Private Internet Access: The Best VPN for Digital Privacy

- ✓ Unrestricted access to worldwide servers
- ✓ Blazing-fast speeds for streaming + file sharing
- ✓ Technical experts on call for 24/7 support

[Get PIA VPN 83% OFF](#)



<https://privateinternetaccess.com>

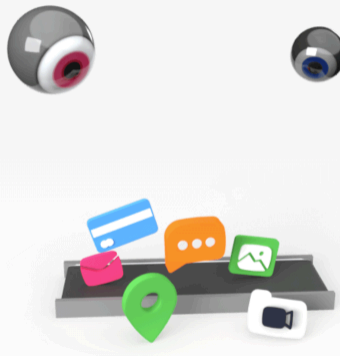
Private Internet Access (ii)

How Does a VPN Work?

PIA VPN acts like a safety buffer between your device and the websites or applications you connect to.

- ✗ Your traffic is exposed
- ✗ You can't easily change your IP address
- ✗ Your access is heavily restricted
- ✗ Data brokers can profit off of your browsing activity
- ✗ Your IP address is public
- ✗ You're exposed to cyber attacks
- ✗ Advertisers can easily profile you
- ✗ You're subject to network restrictions

Get Started With PIA VPN



With VPN



Without VPN

<https://www.privateinternetaccess.com/what-is-vpn>

Private Internet Access (iii)

How Does a VPN Work?

PIA VPN acts like a safety buffer between your device and the websites or applications you connect to.

- ✓ Your traffic is encrypted
- ✓ Your IP address is private
- ✓ You can easily change your IP address
- ✓ You can bypass network restrictions
- ✓ You have more protection from cybercriminals
- ✓ You enjoy unrestricted access to the internet
- ✓ Advertisers will struggle to profile you
- ✓ Data brokers can't profit from your browsing activity

Get Started With PIA VPN



With VPN



Without VPN

<https://www.privateinternetaccess.com/what-is-vpn>



★ No. 1 VPN in 2024 by **techradar**

The most advanced VPN. And much more.

Enjoy a more private and secure internet, block malicious websites, stop web trackers, and monitor your data leaks — all in one app.

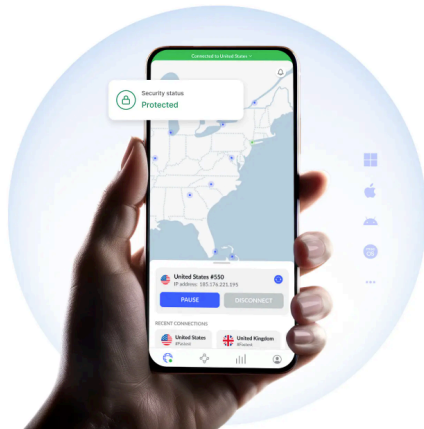


74% off NordVPN + 3 extra months

Get NordVPN

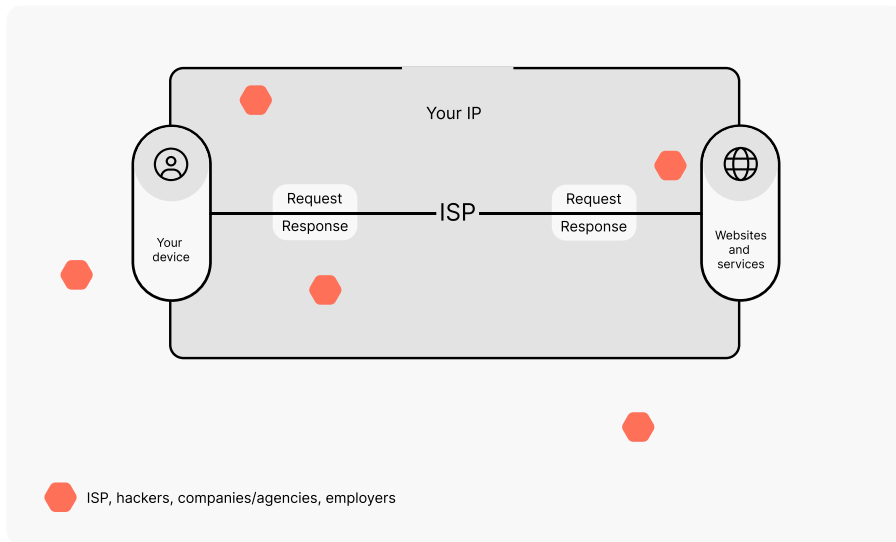
00 : 09 : 13 : 43

🔒 30-day money-back guarantee



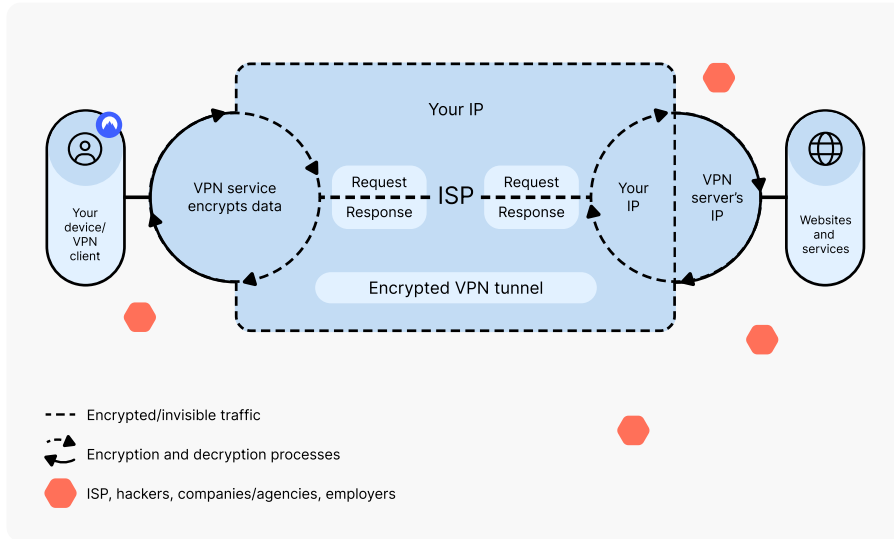
<https://nordvpn.com>

NordVPN (ii)



<https://nordvpn.com/what-is-a-vpn/>

NordVPN (iii)






<https://nordvpn.com/what-is-a-vpn/>

References

- <https://www.paloaltonetworks.com/cyberpedia/types-of-vpn>
- <https://www.fcc.gov/consumer-governmental-affairs/fcc-announces-effective-date-net-neutrality-order>
- <https://vulcan.io/blog/fixing-cve-2024-3400/>
- <https://nvd.nist.gov/vuln/detail/CVE-2024-9463>

OCTOBER'S TOP VPN DISCOUNTS

 ExpressVPN	3 mths FREE Get Deal >
 NordVPN®	Save 70% Get Deal >
 Surfshark®	Save 86% Get Deal >

References (ii)

5.g.a Rabbit-hole content

- <https://security.paloaltonetworks.com>
- <https://www.fcc.gov/document/fcc-restores-net-neutrality-0>
- https://en.wikipedia.org/wiki/Virtual_private_network
- https://en.wikipedia.org/wiki/Transport_Layer_Security
- https://en.wikipedia.org/wiki/DNS_hijacking
- https://en.wikipedia.org/wiki/HTTP_Strict_Transport_Security
- <https://www.chromium.org/hsts/#preloaded-hsts-sites>

