HolePunch-UDPTunnel

An UDP tunnel system using NAT hole-punching to provide point-to-point tunnels between two clients across networks, through the use of an intermediatry information server for punching, then creating a VPN tunnel interface and forwarding all traffic through the hole-punched UDP ports.

Project Structure

The project consists of two linked golang projects, HolePunchUDPTunnel is the main project and it calls the executable produced by UDPTunnel:

- HolePunchUDPTunnel
  - Server mode: runs the hole-punch info exchange server.
  - Client mode: presents text user interface to select a client to connect to, performs hole-punch and launches the UDPTunnel.
- UDPTunnel
  - Runs a tunnel client/server with the given IP/ports, creates a vpn between clients when launched automatically by HolePunchUDPTunnel.

Directory Tree

Below is the directory tree of the project:

```
.
├── bin
│   └── HolePunch-UDPTunnel
├── holepunchudptunnel
│   ├── go.mod
│   ├── go.sum
│   ├── go.work
│   ├── main.go
│   ├── natholepunch
│   │   ├── clientdata.go
│   │   ├── client.go
│   │   ├── go.mod
│   │   └── server.go
│   ├── tui
│   │   ├── go.mod
│   │   ├── logging.go
│   │   └── ui.go
│   └── tunnelman
│       ├── go.mod
│       ├── tunneldata.go
│       ├── tunnelexec.go
│       ├── tunnelman.go
│       └── udptunnel
├── LICENSE
├── Makefile
├── README.md
└── udptunnel
    ├── filter.go
    ├── go.mod
    ├── go.sum
    ├── LICENSE.md
    ├── logger.go
    ├── main.go
    └── tunnel.go

7 directories, 27 files
```

Module Function Description

- ***HolePunchUDPTunnel***
  - Main program source directory, relies on compiled executable of support program UDPTunnel
  - **main.go**
    - Starts hole-punch server or hole-punch client plus text user interface (TUI) in client mode
  - ***natholepunch***
    - Sub-module for hole-punch server and client code
    - **server.go**
      - Code for running the hole-punch information exchange server
    - **client.go**
      - Code for running the hole-punch client and performing UDP hole-punching

    - **clientdata.go**
      - Defines structs that hold client data for both client and server
  - *tui*
    - Sub-module for TUI code
    - **ui.go**
      - Code for displaying, rendering and updating the TUI with the information from the other sub-modules
    - **logging.go**
      - Code for redirecting StdOut output from other modules into a text view inside the TUI
  - *tunnelman*
    - Sub-module for UDPTunnel manager code
    - **tunnelman.go**
      - Code for managing UDPTunnel configuration and creating UDPTunnel configuration based on hole-punch operation
    - **tunnelexec.go**
      - Code for executing the UDPTunnel program
      - The binary executable compiled from the UDPTunnel directory is embedded into our HolePunchUDPTunnel executable from this file.
    - **tunneldata.go**
      - Defines structs that hold UDPTunnel configuration data
- *UDPTunnel*
  - Support program source directory, embbeded into and called by HolePunchUDPTunnel
  - **main.go**
    - Reads configuration file and launches a tunnel server/client
  - **tunnel.go**
    - Creates a new tunnel interface (such as tun0) and listens to trafic
    - Forwards raw packets to tunnel interface (local client -> UDPTunnel -> remote client)
    - Accepts raw packets from tunnel interface (local client <- UDPTunnel <- remote client)
  - **filter.go**
    - Security filter to only allow specified ports through the UDP tunnel
  - **logger.go**
    - Prints log and UDP tunnel traffic statistics

Count Lines of Code

Below is the result of counting the lines of code (generated by gocloc):

```
 -------------------------------------------------------------------------------
Language                     files          blank        comment           code
-------------------------------------------------------------------------------
Go                              13            378            643           1789
Markdown                         3             36              0            176
Makefile                         1             11              8             34
-------------------------------------------------------------------------------
TOTAL                           17            425            651           1999
-------------------------------------------------------------------------------
```

Compilation

1. Begin by going to the project directory.
2. Compile the code by running `make all` (if compiling outside of China, change `prepare-cn` to `prepare` in `Makefile` line `12`).
3. Go to the `bin` directory by running `cd bin`.
4. The compiled project executable binary is found as `HolePunch-UDPTunnel` here.

Usage

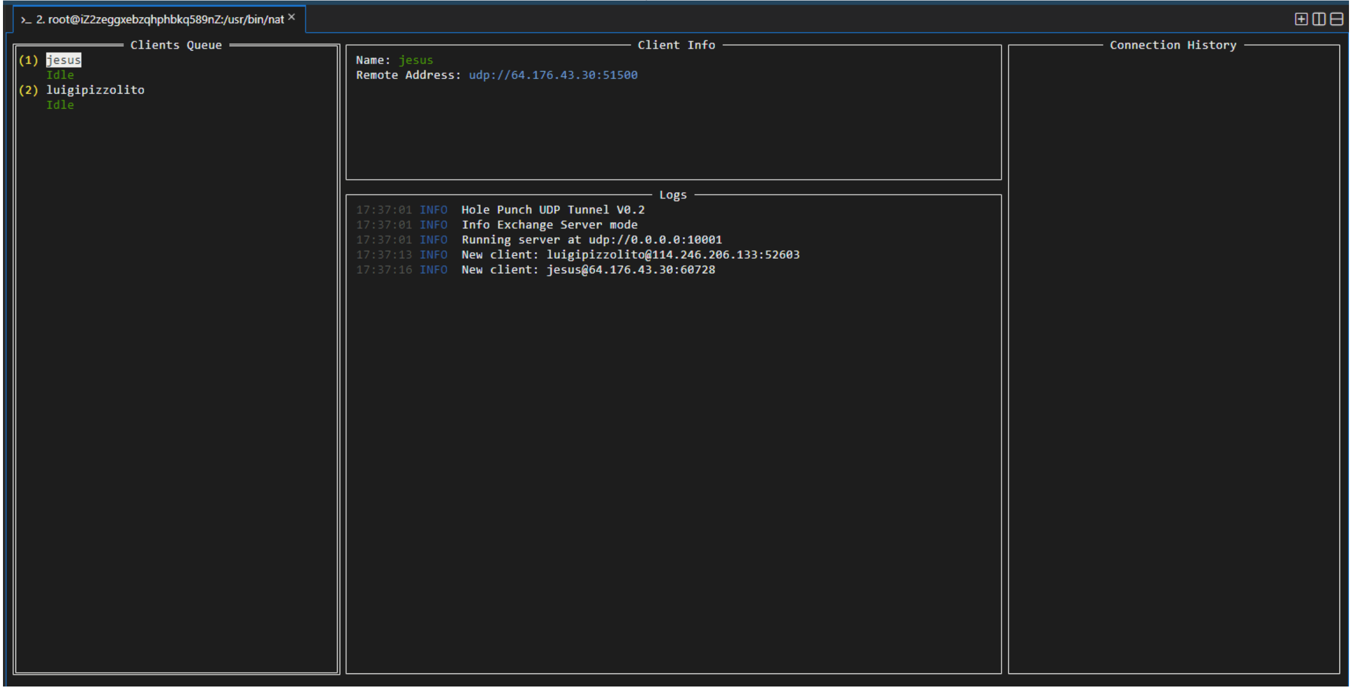
Make sure to launch the executable from the same folder as the executable (i.e. `cd bin && ./HolePunch-UDPTunnel`) To use this project, at least three devices are required:

- Hole-punch info exchange server
  - Must be run on a server with a public IP
  - Run `./HolePunch-UDPTunnel --server`
- Hole-punch client (2 or more)
  - Run on clients behind NATs
  - Shows text user interface (TUI) to user
  - Run `./HolePunch-UDPTunnel -a <Hole-Punch Server Public UP>`
    - replace `<Hole-Punch Server Public UP>` to the actual public IP of the server running the hole-punch info exchange.
    - Default username is taken to be the OS username
    - Other options available through `./HolePunch-UDPTunnel --help`:

```
Usage of bin/HolePunch-UDPTunnel:
  -a string
        Info exchange server IP address to connect to (default "127.0.0.1")
  -l string
        Specify Local side ID (default "luigipizzolito")
  -p string
        Info exchange server port to listen on or connect to (default "10001")
  -r string
        (optional) Specify remote side ID to tunnel to
  -server
        Run in info exchange server mode (run this on a publicly accesible IP)
  -t duration
        Specify reconnection timeout (default 2s)
```

Server TUI

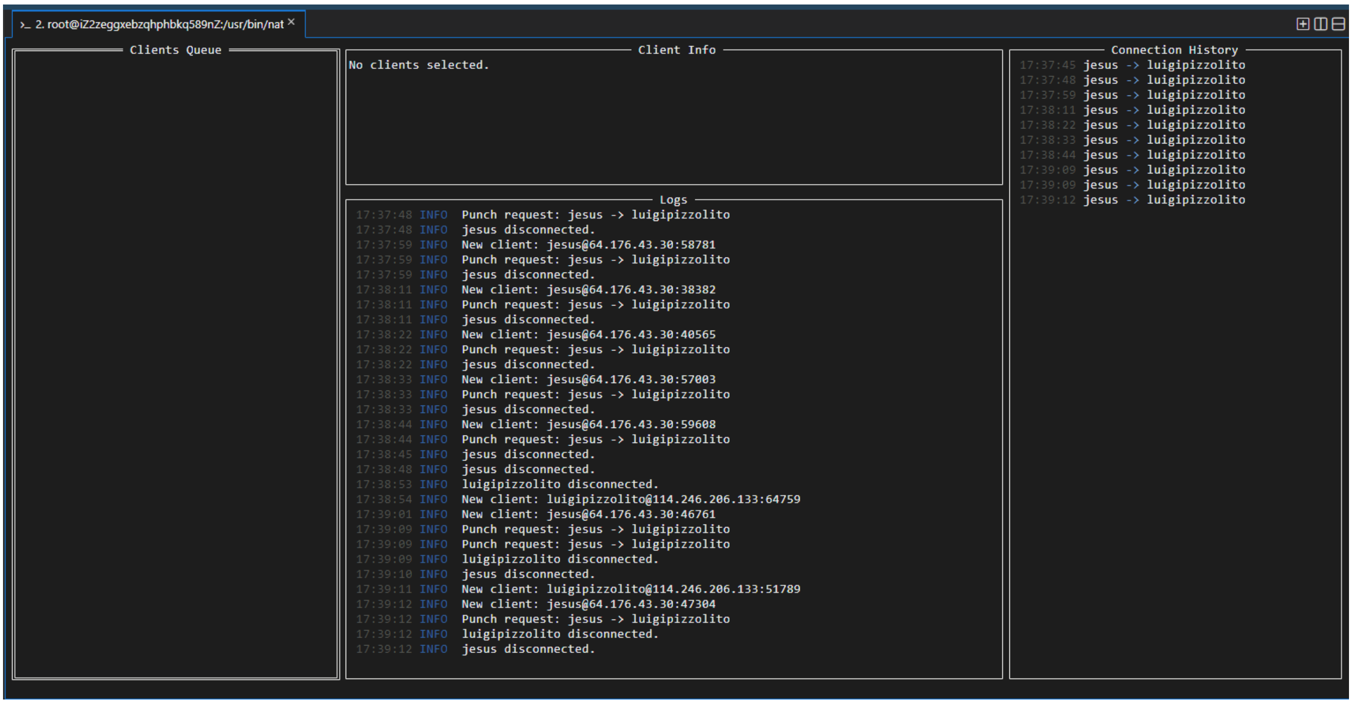
- After running a hole-punch server, the client info, logs and connection history can be seen:



```
(1) jesus
    Idle
(2) luigipizzolito
    Idle
```

```
Name: jesus
Remote Address: udp://64.176.43.30:51500
```

```
17:37:01 INFO  Hole Punch UDP Tunnel V0.2
17:37:01 INFO  Info Exchange Server mode
17:37:01 INFO  Running server at udp://0.0.0.0:10001
17:37:13 INFO  New client: luigipizzolito@114.246.206.133:52603
17:37:16 INFO  New client: jesus@64.176.43.30:60728
```



```
No clients selected.
```

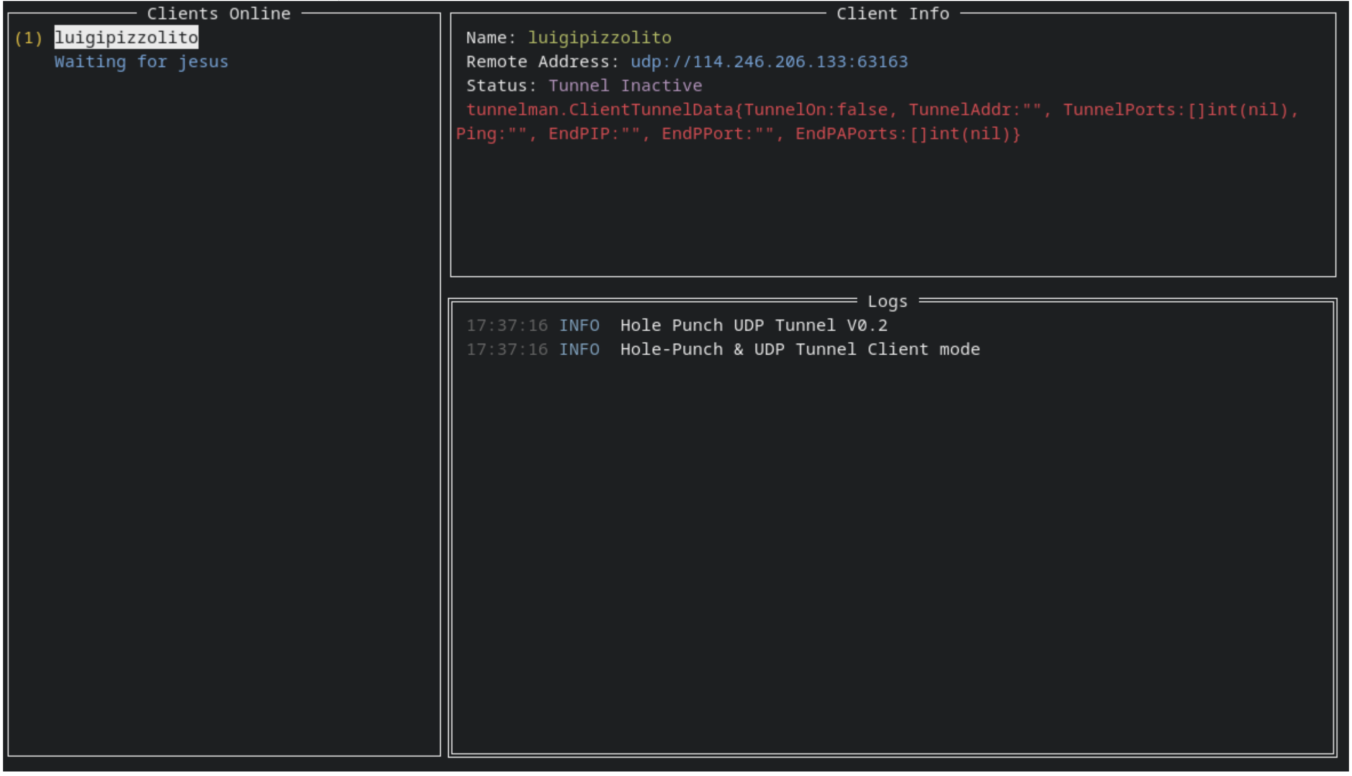
```
17:37:48 INFO  Punch request: jesus -> luigipizzolito
17:37:48 INFO  jesus disconnected.
17:37:59 INFO  New client: jesus@64.176.43.30:58781
17:37:59 INFO  Punch request: jesus -> luigipizzolito
17:37:59 INFO  jesus disconnected.
17:38:11 INFO  New client: jesus@64.176.43.30:38382
17:38:11 INFO  Punch request: jesus -> luigipizzolito
17:38:11 INFO  jesus disconnected.
17:38:22 INFO  New client: jesus@64.176.43.30:40565
17:38:22 INFO  Punch request: jesus -> luigipizzolito
17:38:22 INFO  jesus disconnected.
17:38:33 INFO  New client: jesus@64.176.43.30:57003
17:38:33 INFO  Punch request: jesus -> luigipizzolito
17:38:33 INFO  jesus disconnected.
17:38:44 INFO  New client: jesus@64.176.43.30:59608
17:38:44 INFO  Punch request: jesus -> luigipizzolito
17:38:45 INFO  jesus disconnected.
17:38:48 INFO  jesus disconnected.
17:38:53 INFO  luigipizzolito disconnected.
17:38:54 INFO  New client: luigipizzolito@114.246.206.133:64759
17:39:01 INFO  New client: jesus@64.176.43.30:46761
17:39:09 INFO  Punch request: jesus -> luigipizzolito
17:39:09 INFO  Punch request: jesus -> luigipizzolito
17:39:09 INFO  luigipizzolito disconnected.
17:39:10 INFO  jesus disconnected.
17:39:11 INFO  New client: luigipizzolito@114.246.206.133:51789
17:39:12 INFO  New client: jesus@64.176.43.30:47304
17:39:12 INFO  Punch request: jesus -> luigipizzolito
17:39:12 INFO  luigipizzolito disconnected.
17:39:12 INFO  jesus disconnected.
```

```
17:37:45 jesus -> luigipizzolito
17:37:48 jesus -> luigipizzolito
17:37:59 jesus -> luigipizzolito
17:38:11 jesus -> luigipizzolito
17:38:22 jesus -> luigipizzolito
17:38:33 jesus -> luigipizzolito
17:38:44 jesus -> luigipizzolito
17:39:09 jesus -> luigipizzolito
17:39:09 jesus -> luigipizzolito
17:39:12 jesus -> luigipizzolito
```

Client TUI

- After running a hole-punch client, the TUI can be seen:

- Click, press enter, or press a number key to select a client to connect to.

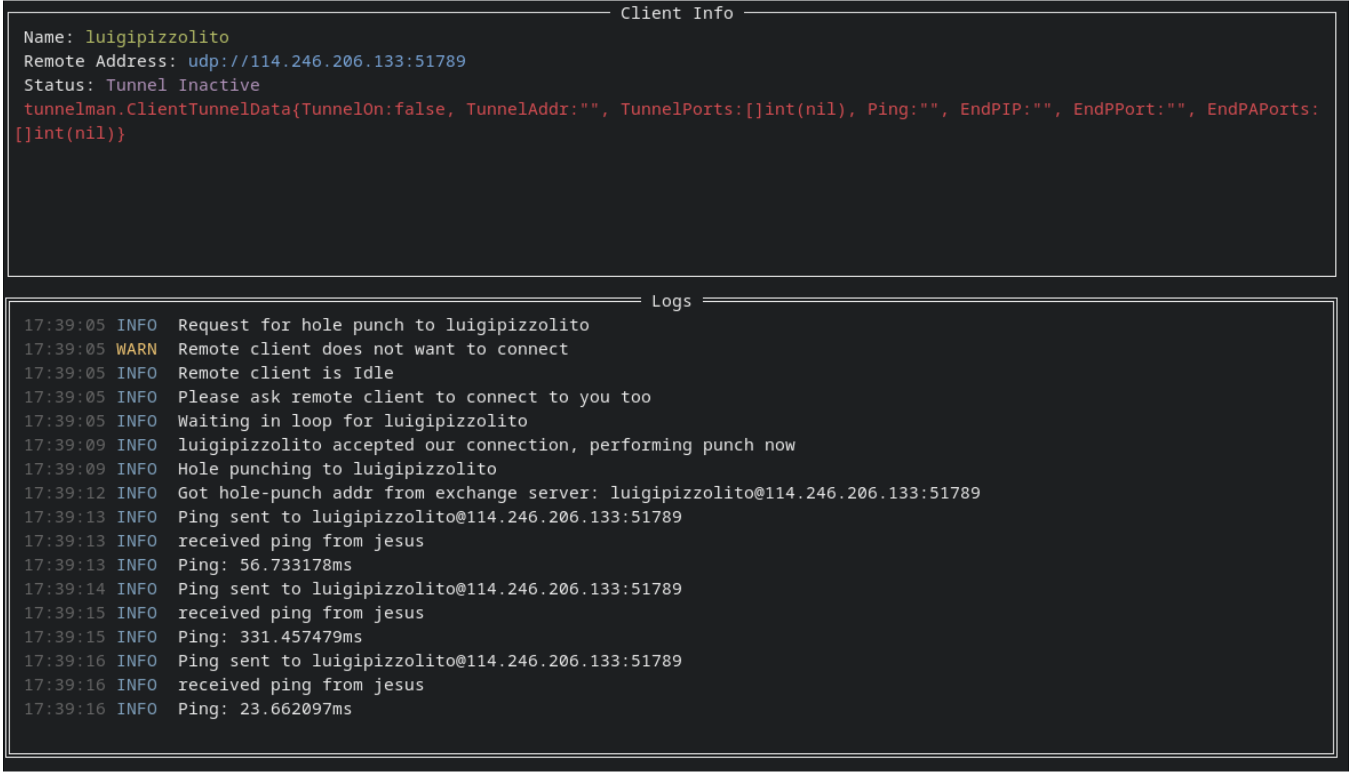


```
(1) luigipizzolito
    Waiting for jesus
```

```
Name: luigipizzolito
Remote Address: udp://114.246.206.133:63163
Status: Tunnel Inactive
tunnelman.ClientTunnelData{TunnelOn:false, TunnelAddr:"", TunnelPorts:[]int(nil),
Ping:"", EndPIP:"", EndPPort:"", EndPAPorts:[]int(nil)}
```

```
17:37:16 INFO  Hole Punch UDP Tunnel V0.2
17:37:16 INFO  Hole-Punch & UDP Tunnel Client mode
```

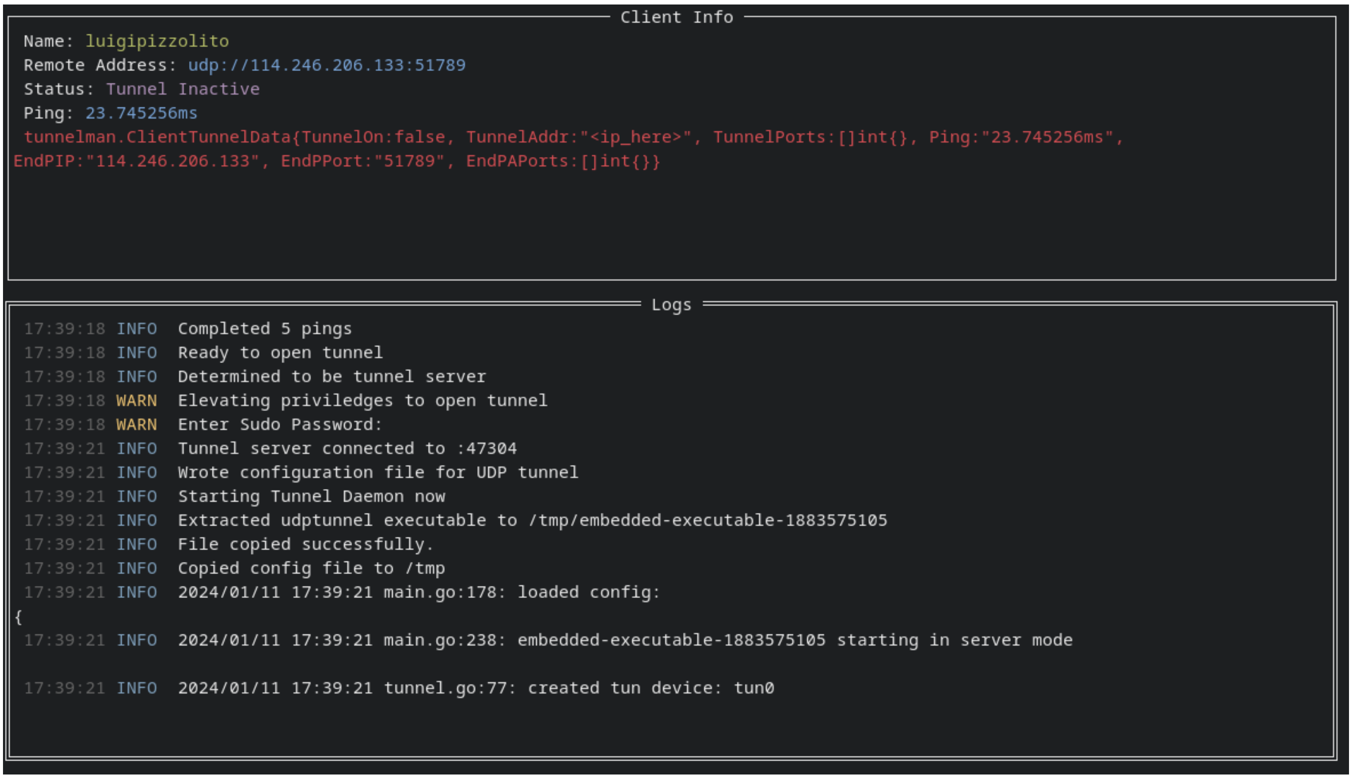
- The hole-punch operation will begin, and pings will be sent in between clients:



```
Name: luigipizzolito
Remote Address: udp://114.246.206.133:51789
Status: Tunnel Inactive
tunnelman.ClientTunnelData{TunnelOn:false, TunnelAddr:"", TunnelPorts:[]int(nil), Ping:"", EndPIP:"", EndPPort:"", EndPAPorts:
[]int(nil)}
```

```
17:39:05 INFO  Request for hole punch to luigipizzolito
17:39:05 WARN  Remote client does not want to connect
17:39:05 INFO  Remote client is Idle
17:39:05 INFO  Please ask remote client to connect to you too
17:39:05 INFO  Waiting in loop for luigipizzolito
17:39:09 INFO  luigipizzolito accepted our connection, performing punch now
17:39:09 INFO  Hole punching to luigipizzolito
17:39:12 INFO  Got hole-punch addr from exchange server: luigipizzolito@114.246.206.133:51789
17:39:13 INFO  Ping sent to luigipizzolito@114.246.206.133:51789
17:39:13 INFO  received ping from jesus
17:39:13 INFO  Ping: 56.733178ms
17:39:14 INFO  Ping sent to luigipizzolito@114.246.206.133:51789
17:39:15 INFO  received ping from jesus
17:39:15 INFO  Ping: 331.457479ms
17:39:16 INFO  Ping sent to luigipizzolito@114.246.206.133:51789
17:39:16 INFO  received ping from jesus
17:39:16 INFO  Ping: 23.662097ms
```

- After sucessful hole-punch, `sudo` password is prompted, enter sudo password to launch the UDP tunnel:

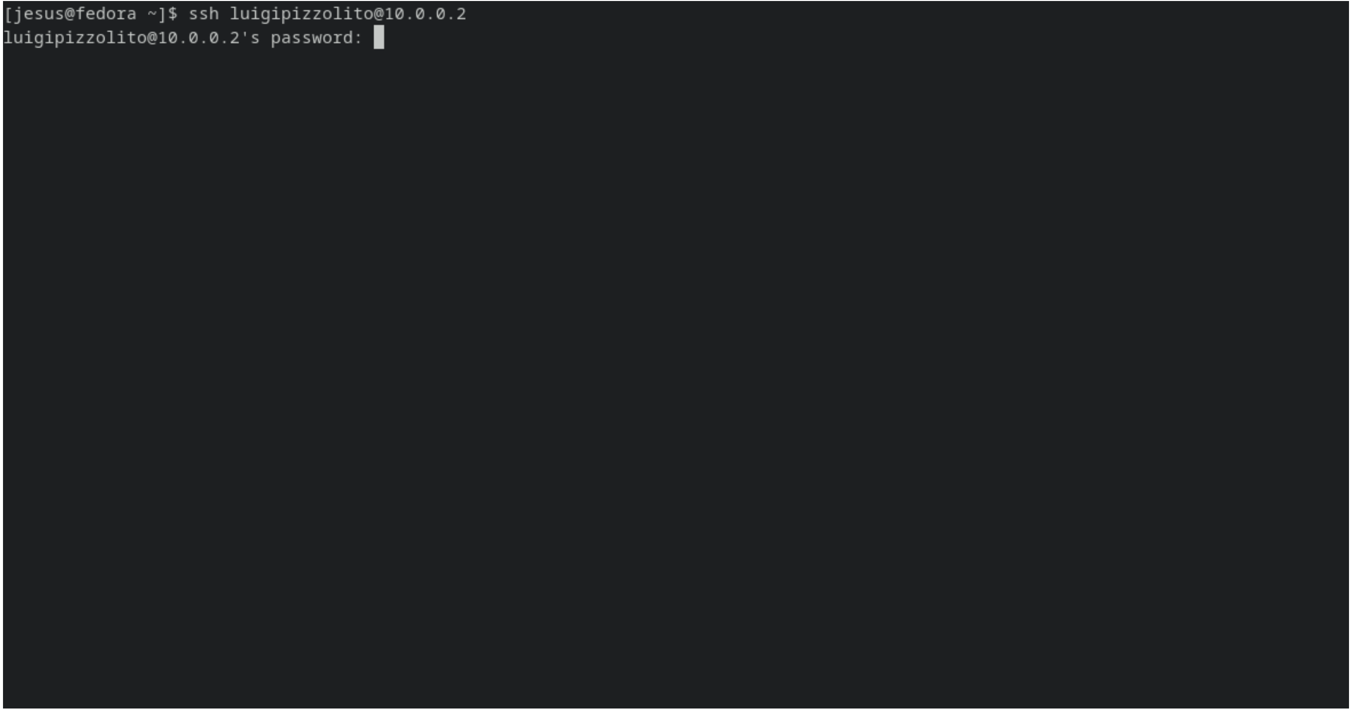


```
Client Info
Name: luigipizzolito
Remote Address: udp://114.246.206.133:51789
Status: Tunnel Inactive
Ping: 23.745256ms
tunnelman.ClientTunnelData{TunnelOn:false, TunnelAddr:"<ip_here>", TunnelPorts:[]int{}, Ping:"23.745256ms",
EndPIP:"114.246.206.133", EndPPort:"51789", EndPAPorts:[]int{}}
```

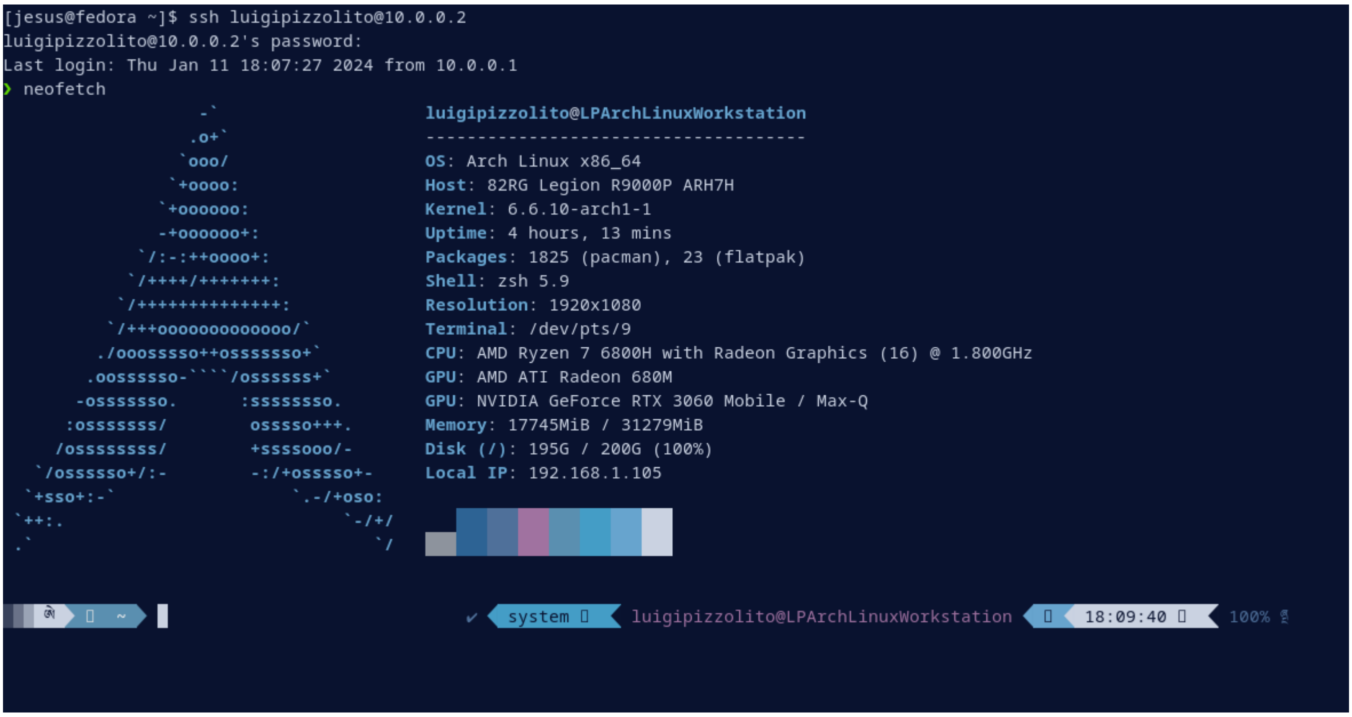
```
Logs
17:39:18 INFO  Completed 5 pings
17:39:18 INFO  Ready to open tunnel
17:39:18 INFO  Determined to be tunnel server
17:39:18 WARN  Elevating priviledges to open tunnel
17:39:18 WARN  Enter Sudo Password:
17:39:21 INFO  Tunnel server connected to :47304
17:39:21 INFO  Wrote configuration file for UDP tunnel
17:39:21 INFO  Starting Tunnel Daemon now
17:39:21 INFO  Extracted udptunnel executable to /tmp/embedded-executable-1883575105
17:39:21 INFO  File copied successfully.
17:39:21 INFO  Copied config file to /tmp
17:39:21 INFO  2024/01/11 17:39:21 main.go:178: loaded config:
{
17:39:21 INFO  2024/01/11 17:39:21 main.go:238: embedded-executable-1883575105 starting in server mode

17:39:21 INFO  2024/01/11 17:39:21 tunnel.go:77: created tun device: tun0
```

- After launching UDP tunnel, one client is assigned IP `10.0.0.1` and the other client is assigned IP `10.0.0.2`
- You may now access the other client with any application or protocol (including TCP) directly by using their IP.
- For example, SSHing into the other client:



```
[jesus@fedora ~]$ ssh luigipizzolito@10.0.0.2
luigipizzolito@10.0.0.2's password: 
```



```
[jesus@fedora ~]$ ssh luigipizzolito@10.0.0.2
luigipizzolito@10.0.0.2's password:
Last login: Thu Jan 11 18:07:27 2024 from 10.0.0.1
❯ neofetch
                   -`                    luigipizzolito@LPArchLinuxWorkstation
                  .o+`                   -------------------------------------
                 `ooo/                   OS: Arch Linux x86_64
                `+oooo:                  Host: 82RG Legion R9000P ARH7H
               `+oooooo:                 Kernel: 6.6.10-arch1-1
               -+oooooo+:                Uptime: 4 hours, 13 mins
             `/:-:++oooo+:               Packages: 1825 (pacman), 23 (flatpak)
            `/++++/+++++++:              Shell: zsh 5.9
           `/++++++++++++++:             Resolution: 1920x1080
          `/+++ooooooooooooo/`           Terminal: /dev/pts/9
         ./ooosssso++osssssso+`          CPU: AMD Ryzen 7 6800H with Radeon Graphics (16) @ 1.800GHz
        .oossssso-````/ossssss+`         GPU: AMD ATI Radeon 680M
       -osssssso.      :ssssssso.        GPU: NVIDIA GeForce RTX 3060 Mobile / Max-Q
      :osssssss/        osssso+++.       Memory: 17745MiB / 31279MiB
     /ossssssss/        +ssssooo/-       Disk (/): 195G / 200G (100%)
   `/ossssso+/:-        -:/+osssso+-     Local IP: 192.168.1.105
  `+sso+:-`                 `.-/+oso:
 `++:.                           `-/+/
 .`                                 `/

    ~                          ✔  system   luigipizzolito@LPArchLinuxWorkstation    18:09:40   100%
```