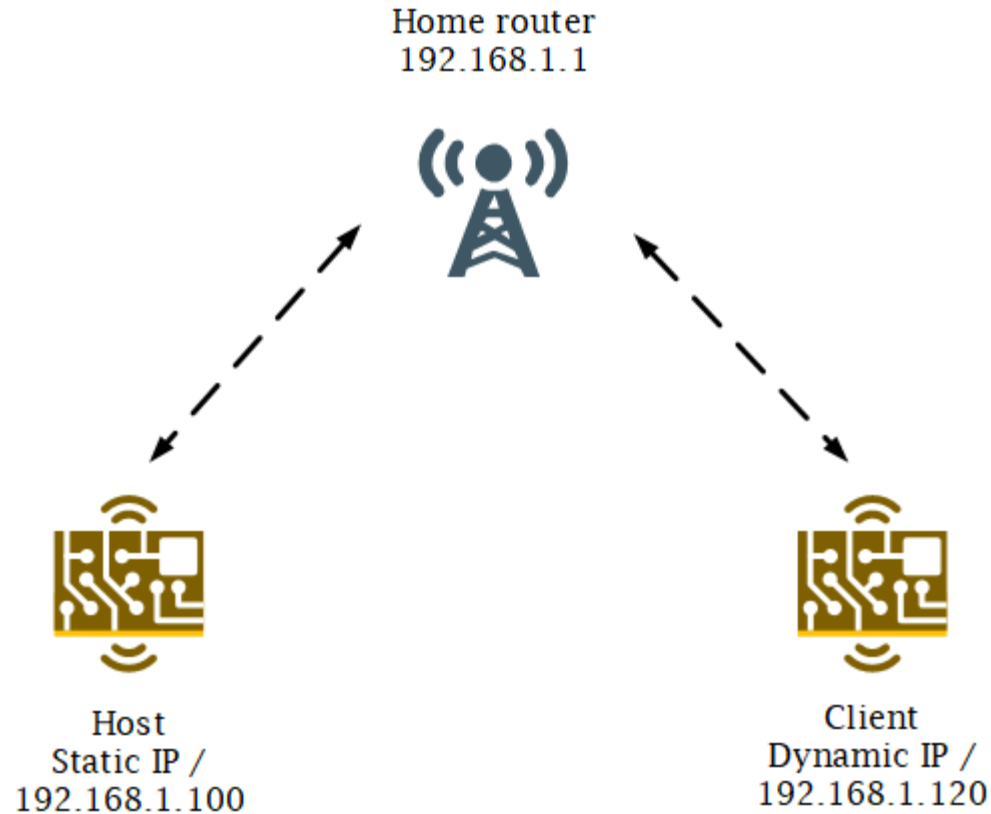

Remote Lab 5

LEVERAGING ZEROTIER AND PORT FORWARDING TECHNIQUES

Wireless communication



```

C cc3100_usage.c  C sl_common.h ×
SL_Common > C sl_common.h > SECOND
73  /*
74  * Values for below macros shall be modified per the acce
75  * SimpleLink device will connect to following AP when th
76  */
77  #define SSID_NAME      "NETGEAR47"      /* Access poi
78  #define SEC_TYPE      SL_SEC_TYPE_WPA_WPA2  /* Securi
79  //#define SEC_TYPE      SL_SEC_TYPE_OPEN  /* Security
80  #define PASSKEY        "quaintcoconut392"
81  #define PASSKEY_LEN    pal_Strlen(PASSKEY) /* Password
82

```

Wireless communication

```
cactus — cactus@Cactus-MacBook-Pro — ~ — zsh — 115x35
lo0: flags=8049<UP,LOOPBACK,RUNNING,MULTICAST> mtu 16384
    options=1203<RXCSUM, TXCSUM, TXSTATUS, SW_TIMESTAMP>
    inet 127.0.0.1 netmask 0xff000000
    inet6 ::1 prefixlen 128
    inet6 fe80::1%lo0 prefixlen 64 scopeid 0x1
    nd6 options=201<PERFORMNUD,DAD>
gif0: flags=8010<POINTOPOINT,MULTICAST> mtu 1280
stf0: flags=0<> mtu 1280
XHC1: flags=0<> mtu 0
XHC20: flags=0<> mtu 0
VHC128: flags=0<> mtu 0
XHC0: flags=0<> mtu 0
en5: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    inet6 fe80::aede:48ff:fe00:1122%en5 prefixlen 64 scopeid 0x8
    nd6 options=201<PERFORMNUD,DAD>
    media: autoselect (100baseTX <full-duplex>)
    status: active
ap1: flags=8802<BROADCAST,SIMPLEX,MULTICAST> mtu 1500
    media: autoselect
    status: inactive
en0: flags=8863<UP,BROADCAST,SMART,RUNNING,SIMPLEX,MULTICAST> mtu 1500
    inet6 fe80::144b:20b6::: prefixlen 64 secured scopeid 0xa
    inet6 fde5:f37f:caa3:::331c prefixlen 64 autoconf secured
    inet6 fde5:f37f:caa3:::c5f6 prefixlen 64 deprecated autoconf temporary
    inet6 fde5:f37f:caa3::b34 prefixlen 64 dynamic
    inet 192.168.1.186 netmask 0xfffff00 broadcast 192.168.1.255
    inet6 fde5:f37f:caa3::: prefixlen 64 deprecated autoconf temporary
    inet6 fde5:f37f:caa3::: prefixlen 64 deprecated autoconf temporary
    inet6 fde5:f37f:caa3::: prefixlen 64 deprecated autoconf temporary
    inet6 fde5:f37f:caa3::: prefixlen 64 deprecated autoconf temporary
    inet6 fde5:f37f:caa3::: prefixlen 64 autoconf temporary
    nd6 options=201<PERFORMNUD,DAD>
```

```
Command Prompt
C:\Users\Zero>ipconfig

Windows IP Configuration

Ethernet adapter Ethernet:

    Connection-specific DNS Suffix . : 
    Link-local IPv6 Address . . . . . : fe80::...
    IPv4 Address. . . . . : 10.227.
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.227.

Ethernet adapter VirtualBox Host-Only Network:

    Connection-specific DNS Suffix . : 
    Link-local IPv6 Address . . . . . : fe80::...
    IPv4 Address. . . . . : 192.168.56.1
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 

Unknown adapter Local Area Connection:

    Connection-specific DNS Suffix . : 
    Link-local IPv6 Address . . . . . : fe80::...
    IPv4 Address. . . . . : 10.8.0.2
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 10.8.0.1

Ethernet adapter Ethernet 2:
```

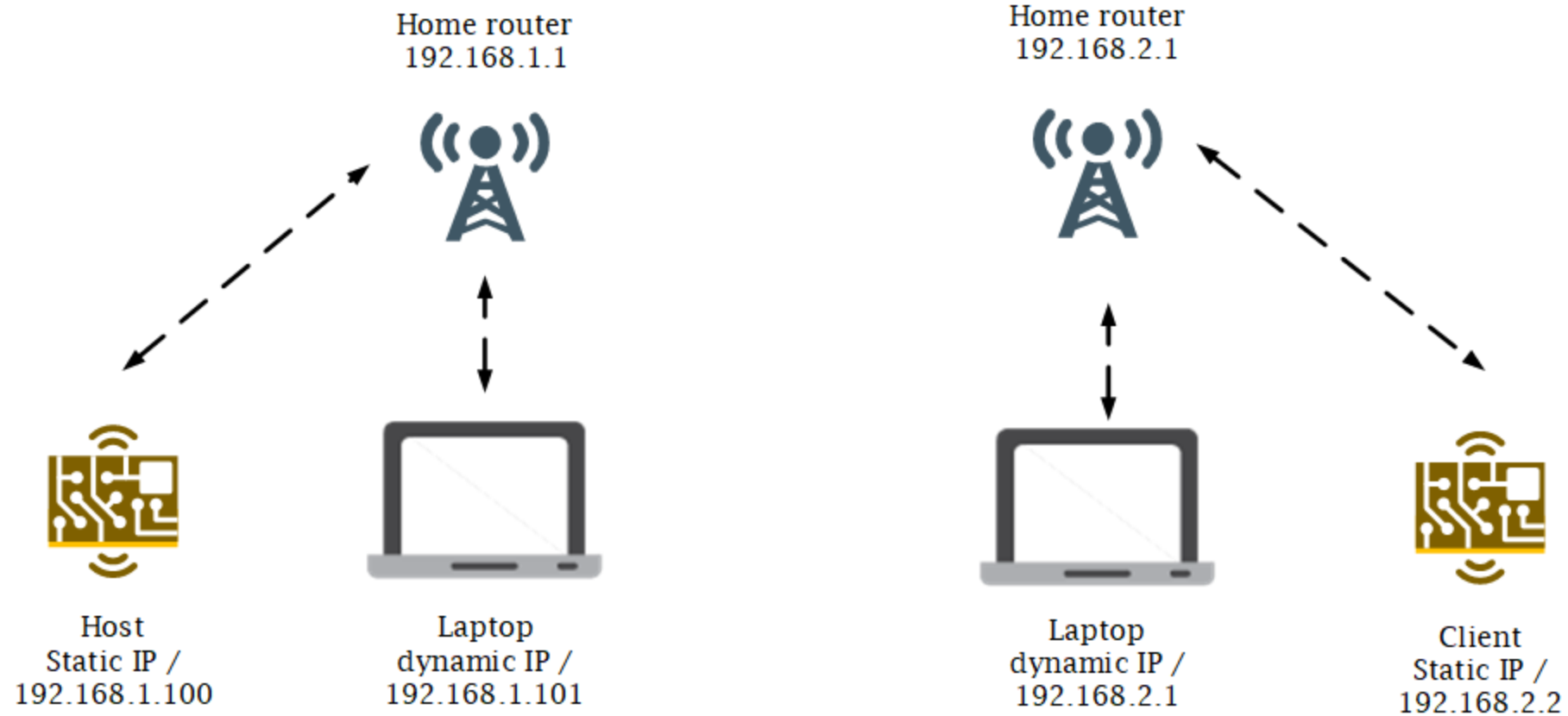
Wireless communication

- Why do we need local ip address?

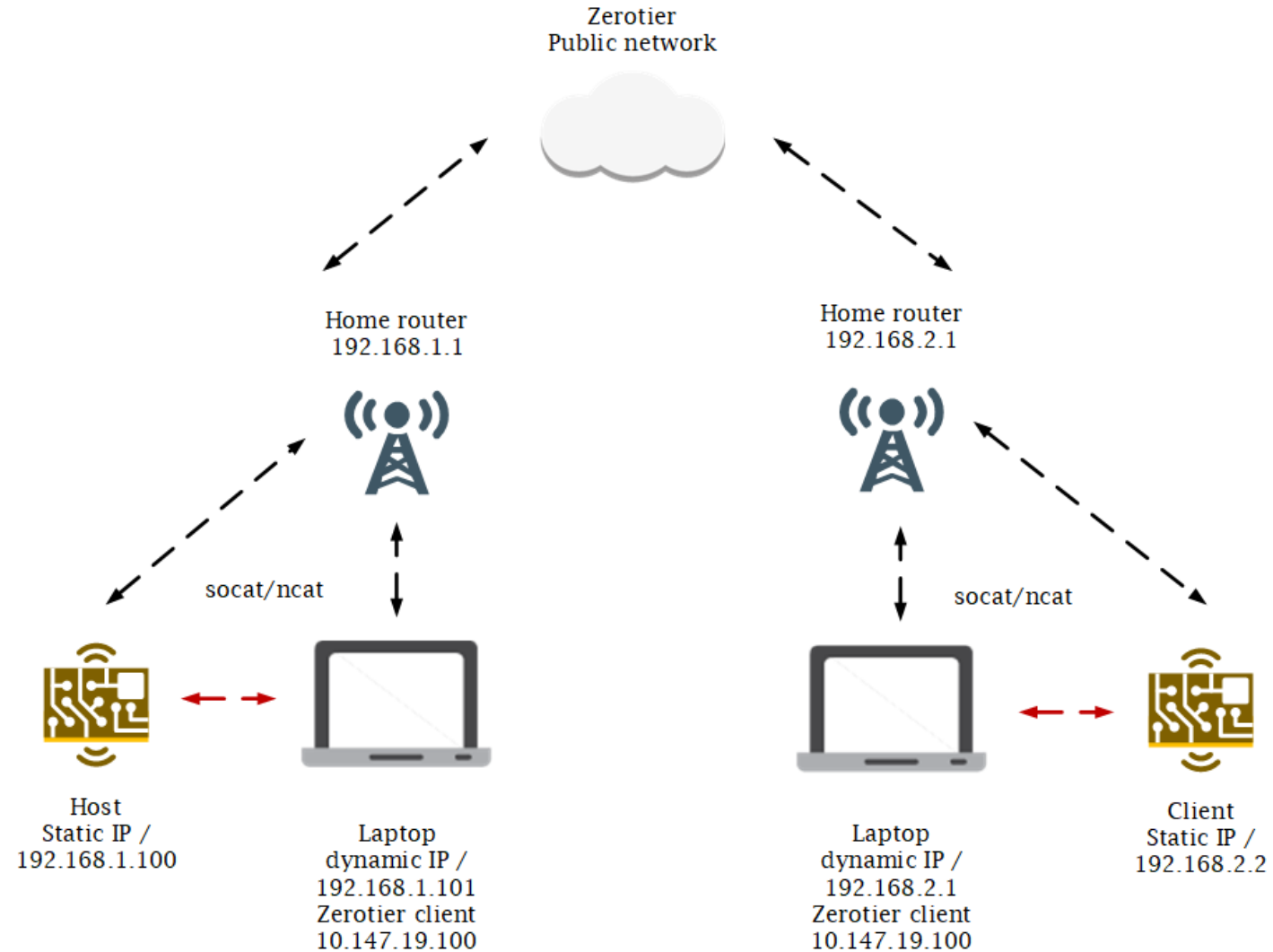
```

cc3100_usage.c  sl_common.h  cc3100_usage.h ×
cc3100_usage > cc3100_usage.h > AP_DNS
33
34  /* IP addressed of server side socket.
35   * Should be in long format, E.g: 0xc0a8010a == 192.168.1.10
36   */
37  #define HOST_IP_ADDR      0xC0A80102      // IP address of server to connect to
38  #define PORT_NUM          5001            // Port number to be used
39  #define NO_OF_PACKETS    1               // Number of packets to send out
40
41  /*
42   * Static IP address for host
43   */
44  #define CONFIG_IP         SL_IPV4_VAL(192,168,1,2) /* Static IP to be configured */
45  #define AP_MASK           SL_IPV4_VAL(255,255,255,0) /* Subnet Mask for the station */
46  #define AP_GATEWAY        SL_IPV4_VAL(192,168,1,1) /* Default Gateway address */
47  #define AP_DNS            SL_IPV4_VAL(0,0,0,0) /* DNS Server Address */
48  #define SL_STOP_TIMEOUT   0xFF
49
  
```

Remote communication



Remote communication



Zerotier

- Free virtual network for devices
- Bring all your private machines together, laptops, servers, phones, even routers
- Enable direct communication capabilities for all your connected devices
- Website: <https://www.zerotier.com/>

Zerotier client

- Installation
 - <https://www.zerotier.com/download/>
 - Find network id from <https://my.zerotier.com/network>
- Enable and authenticate joined device

Auth?	Address	Name/Description	Managed IPs	Last Seen	Version	Physical IP
<input checked="" type="checkbox"/>	19... 9e:...	(short name) (description)	10.147.19... +	ONLINE	1.4.6	28...-45-28-2
<input checked="" type="checkbox"/>	3b... 9e:...	(short name) (description)	10.147.19... +	ONLINE	1.4.6	128...-200-0
<input checked="" type="checkbox"/>	bc... 9e:...	(short name) (description)	10.147.19... +	ONLINE	1.4.6	128...-200-0

Zerotier client

```

cactus — cactus@Cactuss-MacBook-Pro — -zsh — 115x35
..upportPackage -zsh ... ~ +
Last login: Tue Mar 24 17:18:28 on ttys001
[→ ~ ifconfig | grep "192.168.1\|10.147"
    inet 192.168.1.186 netmask 0xffffffff broadcast 192.168.1.255
    inet 10.147.19.211 netmask 0xffffffff broadcast 10.147.19.255
[→ ~ █
  
```

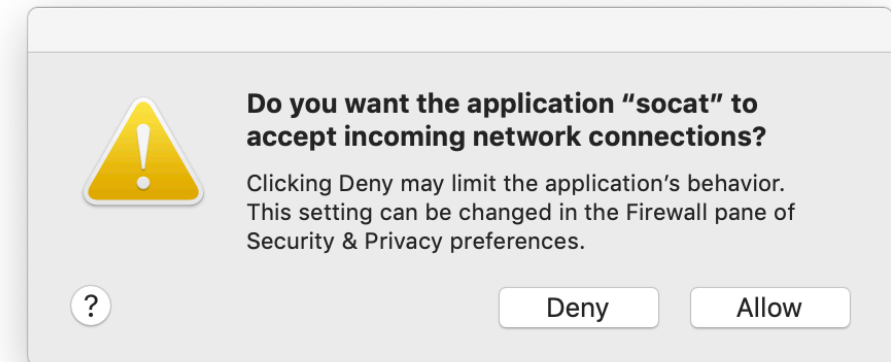
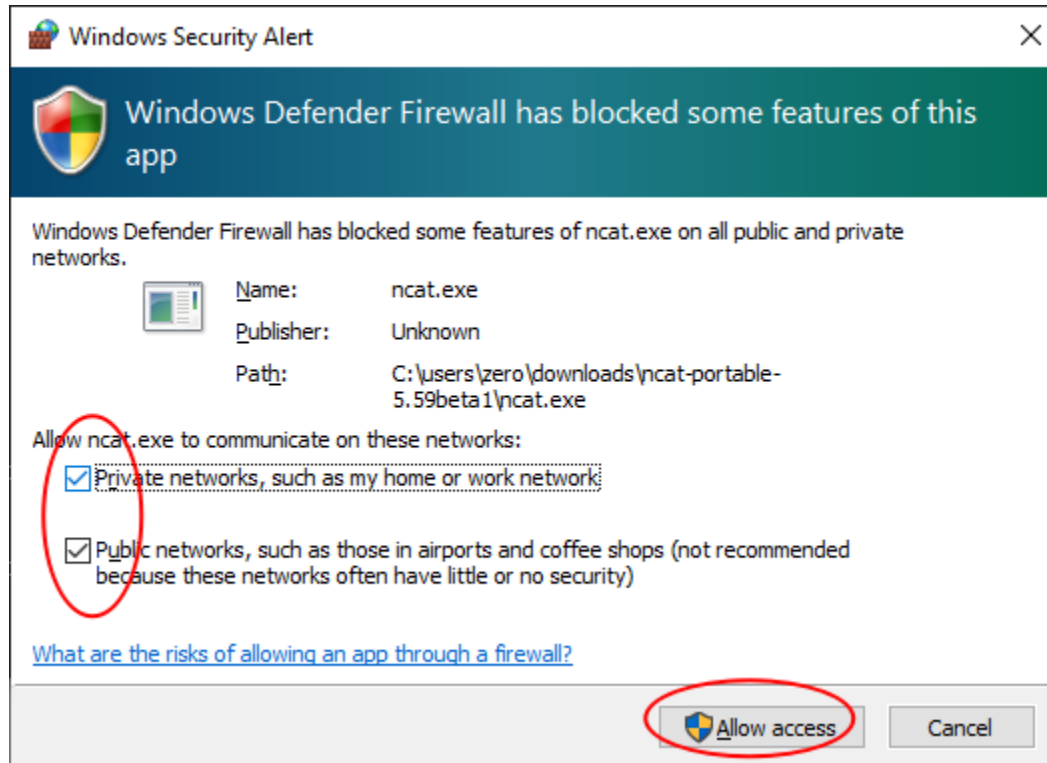
Port forwarding

- socat
 - socat - Multipurpose relay (SOcket CAT)
 - <https://linux.die.net/man/1/socat>
- Installation
 - Linux: install via distributions repository (apt install socat)
 - Mac: install via brew package manager (brew install socat)
 - <https://brew.sh/>
 - Windows: pre-built binary executable file
 - <https://github.com/StudioEtrange/socat-windows>

Port forwarding

- Example usage of socat (execute on your laptop)
- `socat -dd -x udp4-recv:15001 udp4-sendto:192.168.53.149:5001`
 - -dd verbose output
 - -x print data with decimal format
 - `udp4-recv:15001` listen on port 15001
 - `udp4-sendto:192.168.53.149:5001` forward whatever udp data you received on port 15001 to udp port 5001 of 192.168.53.149
- ALLOW incoming connection when your laptop pops up warning windows (firewall restriction)

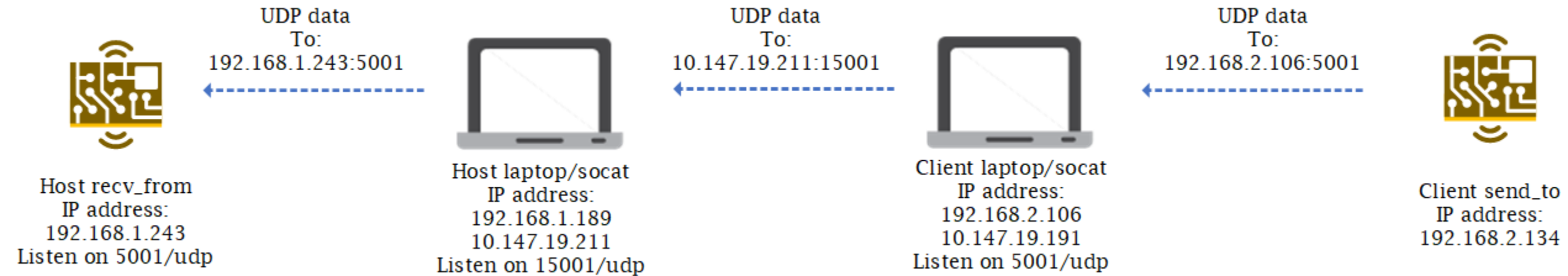
Port forwarding



Host/Client development

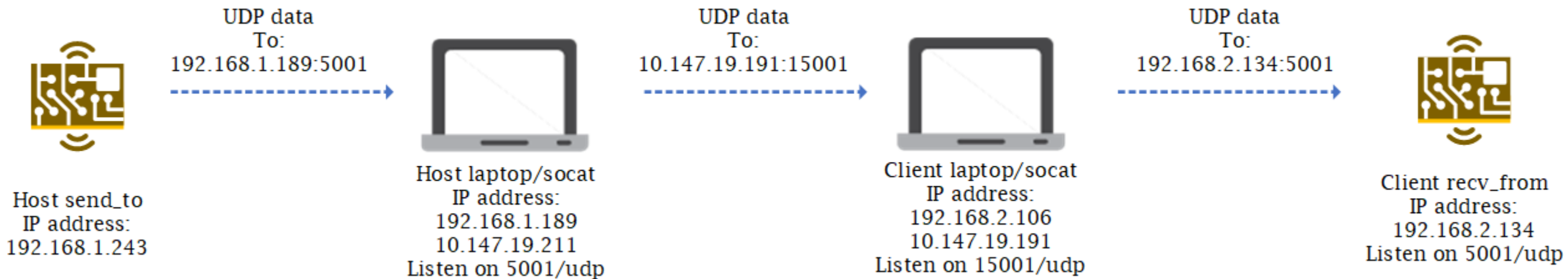
- Before:
 - Your board send/receive data to/from the other board
- Now:
 - Your board send/receive data to/from your laptop
 - Meanwhile your laptop forward the data to your partner's laptop
 - Your partner's board receive/send data from/to his/her board
- Commands:
 - `socat -dd -x udp4-recv:5001 udp4-sendto:10.147.19.191:15001`
 - `socat -dd -x udp4-recv:15001 udp4-sendto:192.168.1.243:5001`

Host development



- Host laptop:
 - `socat -dd -x udp4-recv:15001 udp4-sendto:192.168.1.243:5001`
- Client laptop
 - `socat -dd -x udp4-recv:5001 udp4-sendto:10.147.19.211:15001`

Client development



- Host laptop:
 - `socat -dd -x udp4-recv:5001 udp4-sendto:10.147.19.191:15001`
- Client laptop
 - `socat -dd -x udp4-recv:15001 udp4-sendto:192.168.2.134:5001`

socat output

```
cactus — socat -dd -x udp4-recv:5001 udp4-sendto:10.147.19.191:15001 — socat -dd -x udp4-recv:5001 udp4-sendto:...
..upportPackage    -zsh ...    ...berry-pi-dl: ~ — ssh pi@192.168.1.243    socat -dd -x udp4...
Last login: Tue Mar 24 19:06:04 on ttys002
socat -dd -x udp4-recv:5001 udp4-sendto:10.147.19.191:15001
→ ~ socat -dd -x udp4-recv:5001 udp4-sendto:10.147.19.191:15001
2020/03/24 19:32:00 socat[9237] N successfully prepared local socket LEN=16 AF=2 0.0.0.0:0
2020/03/24 19:32:00 socat[9237] N starting data transfer loop with FDs [5,5] and [6,6]
2020/03/24 19:32:17 socat[9237] N received packet with 5 bytes from LEN=16 AF=2 192.168.1.243:35276
> 2020/03/24 19:32:17.894093 length=5 from=0 to=4
  74 65 73 74 0a
2020/03/24 19:32:17 socat[9237] N local address: LEN=16 AF=2 0.0.0.0:64021
2020/03/24 19:32:18 socat[9237] N received packet with 5 bytes from LEN=16 AF=2 192.168.1.243:35276
> 2020/03/24 19:32:18.503423 length=5 from=5 to=9
  74 65 73 74 0a
2020/03/24 19:32:18 socat[9237] N local address: LEN=16 AF=2 0.0.0.0:64021
2020/03/24 19:32:26 socat[9237] N received packet with 27 bytes from LEN=16 AF=2 192.168.1.243:35276
> 2020/03/24 19:32:26.905693 length=27 from=10 to=36
  74 68 69 73 20 69 73 20 67 6f 69 6e 67 20 74 6f 20 62 65 20 61 20 74 65 73 74 0a
2020/03/24 19:32:26 socat[9237] N local address: LEN=16 AF=2 0.0.0.0:64021
```