IP Masquerading using `iptables`

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Talk's outline

- `iptables` versus `ipchains`
- The goal (or: my goal)
- The packet's way through iptables
- "Classic" masquerading (SNAT)
- DNS faking (with DNAT)
- Other things
- Firewalling with `iptables` (If we have time)
- Questions I'll hopefully answer

Not covered: packet mangling (change TOS, TTL and flags)

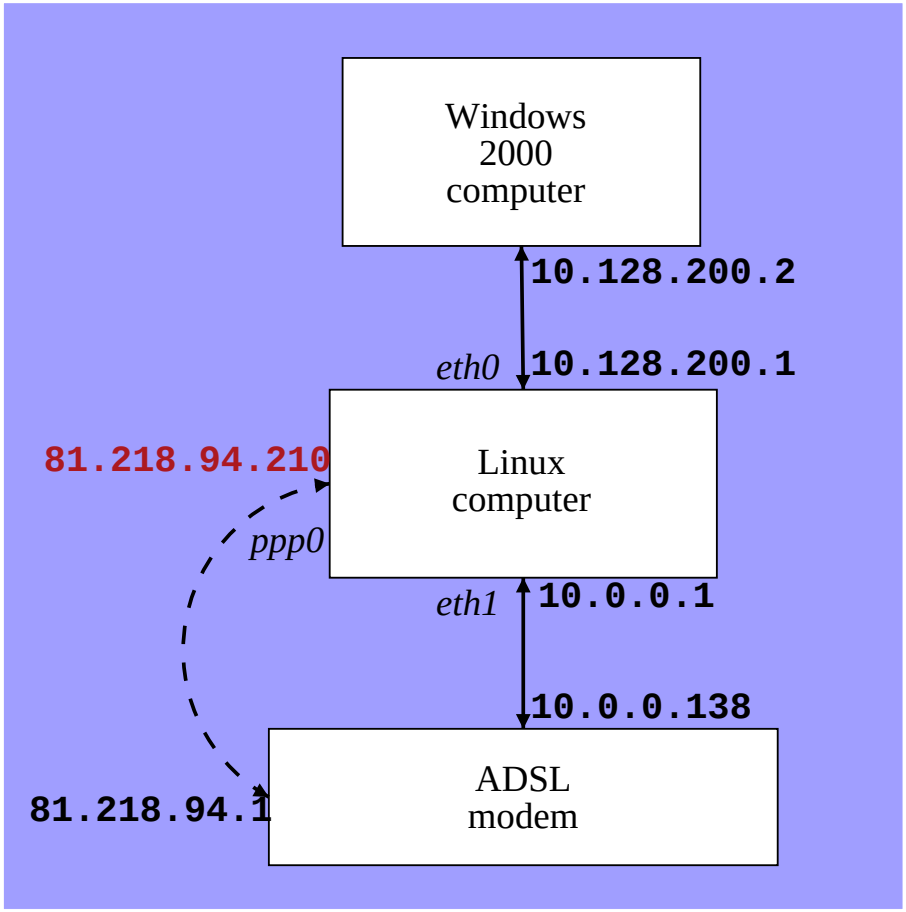
Differences between `iptables` and `ipchains`

- Same author (Rusty Russell), and basically smells the same
- Most important: FORWARD taken apart from INPUT and OUTPUT
- Changes in syntax
- Masqurading is handled “separately”

`ipchains` and `iptables` don't live together

- If the `ipchains` module is resident in the kernel, `iptables` won't `insmod`
- And vice versa
- Typical error message is misleading: "No kernel support"
- Red Hat 7.3 boots up with `ipchains` as default

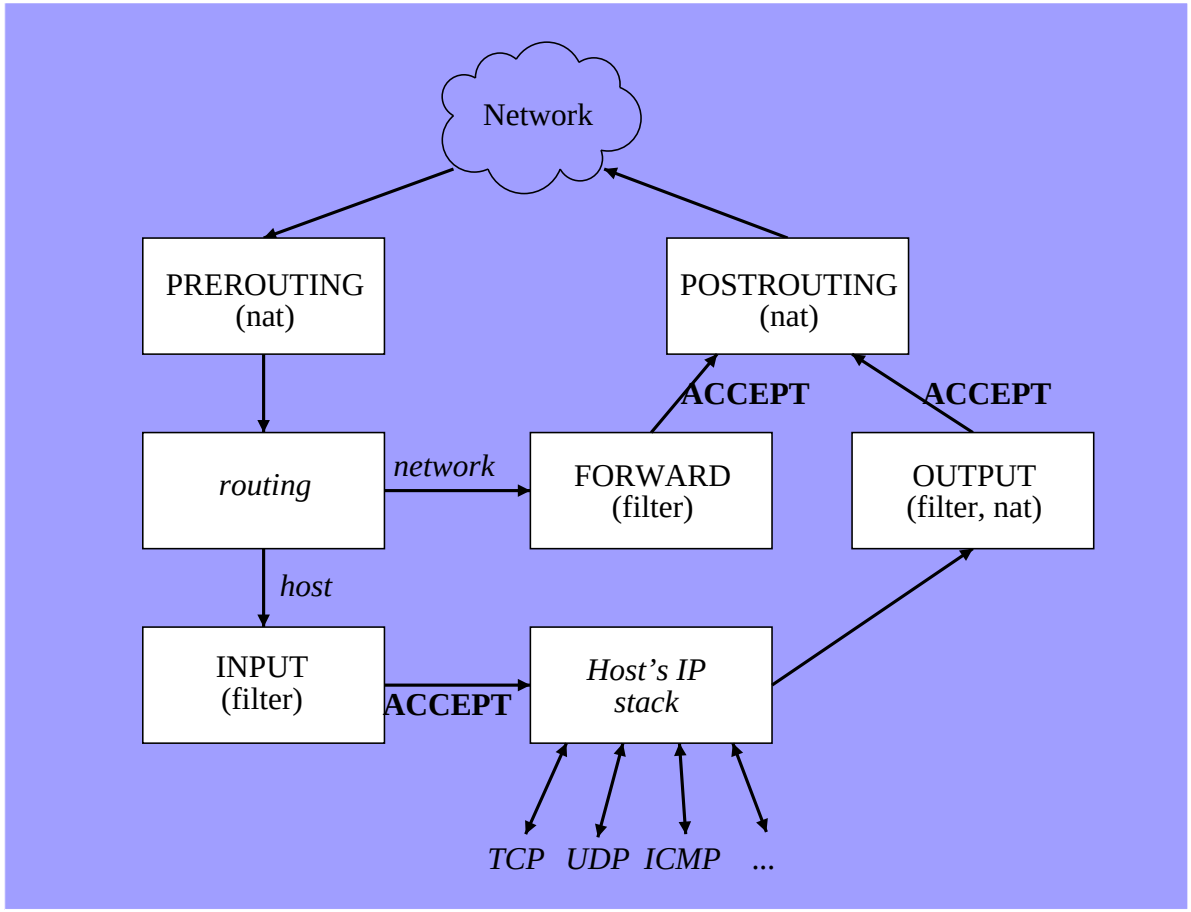
What I wanted in the first place



Requirements

- Windows computer should have a gateway
- DNS issue solved elegantly
- Both computers have access to network at the same time
- Network between computers is trustful
- Proper firewalling
- ADSL modem is considered hostile

`iptables`: The IP packet's flow



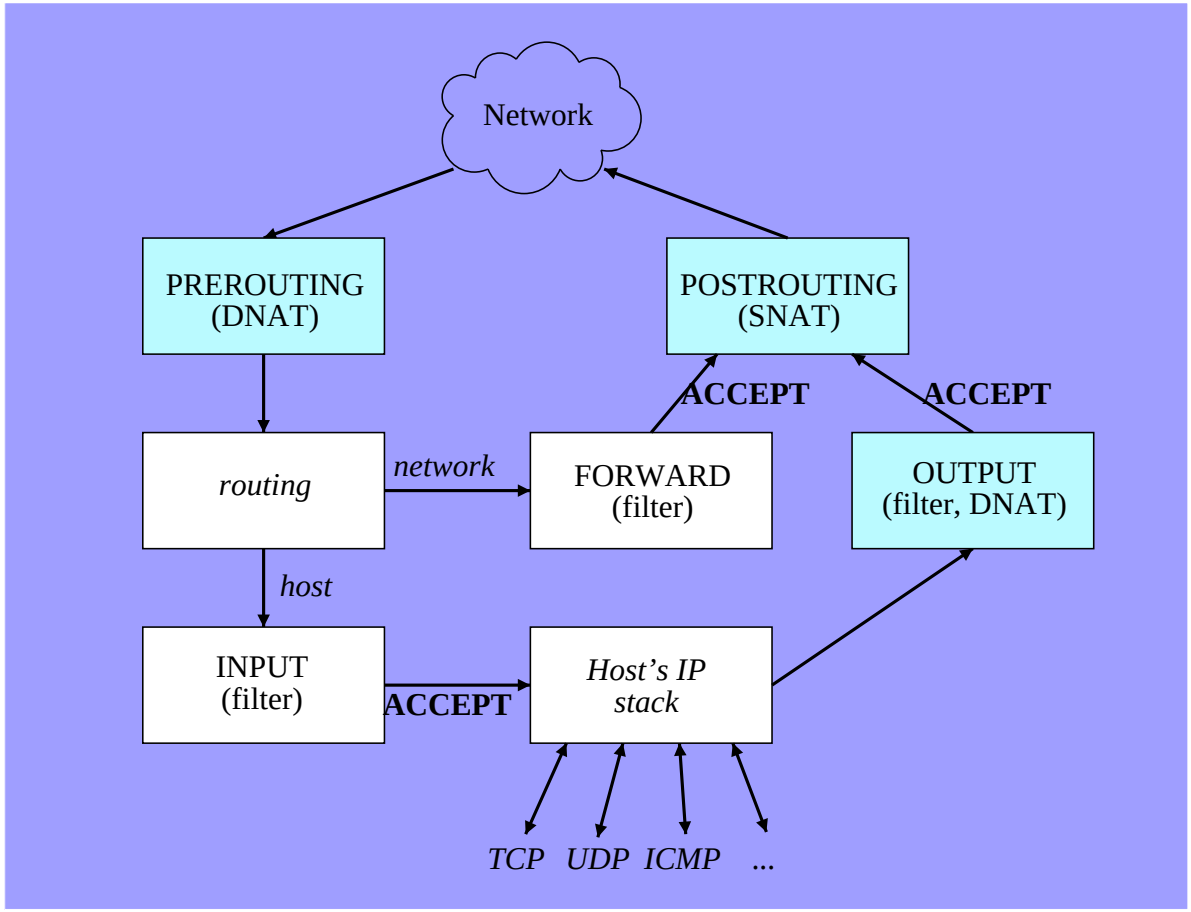
`iptables`: How to swallow this

- Packet filtering (firewalls) and manipulation (masquerading) are neighbours
- Therefore, the same tools are used
- Think routing tables
- Chains: Think subroutines
- Each chain is terminated with a *target*, or next line taken
- Subchains work exactly like subroutines
- Tables: Group of chains: `filter` and `nat`
- Each chain has a policy – the default target

What is Masquerading?

- All computers appear to have the same IP
- This is done with Network Adress Translation
- It’s easy to fake the “outgoing packet”
- “Incoming packets” must be translated too
- Port translation – a must

`iptables`: The IP packet's flow



Source Network Address Translation (SNAT)

- On ADSL: catch packets going out on `ppp0`
- The *source* IP is changed
- Source port numbers may be changed
- Easiest rule: Do SNAT on all packets going out on `ppp0`
- Will include OUTPUT packets by accident, but who cares?
- Remember: Every SNAT produces an implicit DNAT
- And vice versa

“Incoming” packets

- The problem: Where should the packet go?
- Simple TCP connection: `iptables` remembers the port numbers
- UDP: Tricky
- DNS: Return the answer to whoever asked
- ICMP: Ping answers go the right way (!)
- FTP, ICQ and friends: Requires special treatment (they work for me as a basic client)
- When the other side opens a connection, that has to be treated specially
- `iptables` has application-based modules

Defining SNAT `iptables` commands

The strict way:

```
iptables -t nat -A POSTROUTING -o ppp0 -j SNAT \
                               --to $PPPIP
```

The liberal way:

```
iptables -t nat -A POSTROUTING -o ppp0 -j MASQUERADE
```

- The “liberal” form is better for temporary connections:
- MASQUERADE automatically chooses address
- MASQUERADE forgets old connections when interface goes down
- For dial-up, cable modems and ADSL: MASQUERADE wins

POSTROUTE is just another chain

- Selective rules can be used
- Different manipulations are possible
- Use `-j ACCEPT` to let the packet through untouched

The wrong way to masquerade

```
iptables -t nat -A POSTROUTING -j MASQUERADE
```

- This makes masquerading the default policy for any outgoing packet
- ... including any forwarded packet.
- All forwarded packets will appear to come from the masquerading host.
- May confuse firewalls
- Even worse, may confuse service applications to compromise security

Masquerading and firewalling

- The internal computers are implicitly firewalled
- The main computer gets all the unrelated packets
- Main computer must be protected
- Main computer protected with INPUT and OUTPUT chains
- Other computers protected with FORWARD chains
- Note that FORWARD chains also apply to the intranet connection

DNS faking with DNAT

- The other computers have constant DNS addresses
- The address is translated with DNAT

```
iptables -t nat -A PREROUTING -d 10.2.0.1 \
     -j DNAT --to-destination 192.115.106.31
iptables -t nat -A PREROUTING -d 10.2.0.2 \
     -j DNAT --to-destination 192.115.106.35
```

Automatic DNS DNAT setup

- In an ADSL connection, the DNS addresses are given on connection
- An `ip-up.local` script writes these addresses in the `resolv.conf` file

```
DNScount=1
for nameserver in \
 ‘perl -nle "/nameserver\D*(\d*\.\d*\.\d*\.\d*)/i && \
     (\\$1=~/^127/ || print \\$1)" /etc/resolv.conf‘;
do iptables -t nat -A PREROUTING -d 10.2.0.$DNScount \
             -j DNAT --to-destination $nameserver
  let DNScount=DNScount+1;
done;
```

- The perl statement above extracts the two addresses

The MTU on the Windows computer

- ADSL ppp connection has MTU of 1452
- Normal Ethernet has MTU 1500
- Windows computer doesn’t know it goes through ADSL
- Fragmentation
- Fixed by adding an entry in Window’s registry

Other tricks

- Server on masqueraded host (DNAT)
- Port remapping (redirection)
- Load balancing (One-to-many forward DNAT)
- Packet mangling

The `filter` chains

- INPUT, OUTPUT and FORWARD
- Targets with ACCEPT, DROP, REJECT or QUEUE
- A set of selective rules makes a firewall

Example: A firewall

Close everything and flush chains

```
iptables -P INPUT DROP
iptables -P OUTPUT DROP
iptables -P FORWARD DROP
iptables -F -t nat
iptables -F -t filter
iptables -X
```

Example: A firewall (cont.)

Allow everything on loopback interface

```
iptables -A INPUT -i lo -j ACCEPT
iptables -A OUTPUT -o lo -j ACCEPT
```

Example: A firewall (cont.)

Keep ADSL modem short

```
iptables -A INPUT -i eth1 -s 10.0.0.138/32 \
          -d 10.0.0.0/8 -p tcp \
          --sport 1723 -m state \
          --state ESTABLISHED,RELATED -j ACCEPT
iptables -A INPUT -i eth1 -s 10.0.0.138/32 \
           -d 10.0.0.0/8 -p gre -j ACCEPT
iptables -A INPUT -i eth1 -j DROP
iptables -A OUTPUT -o eth1 -s 10.0.0.0/8 \
          -d 10.0.0.138/32 -p tcp --dport 1723 \
          -j ACCEPT
iptables -A OUTPUT -o eth1 -s 10.0.0.0/8 \
          -d 10.0.0.138/32 -p gre -j ACCEPT
iptables -A OUTPUT -o eth1 -j DROP
```

Example: A firewall (cont.)

Linux computer with network rules:

```
iptables -A OUTPUT -o ppp0 -s $PPPIP -j ACCEPT
iptables -A INPUT -s ! 10.128.0.0/16 -p tcp \
          --dport 0:1023 -j DROP
iptables -A INPUT -i ppp0 -d $PPPIP -m state \
          --state ESTABLISHED,RELATED -j ACCEPT
```

Example: A firewall (cont.)

Everything is allowed on internal network

```
iptables -A INPUT -s 10.128.0.0/16 \
          -d 10.128.0.0/16 -j ACCEPT
iptables -A OUTPUT -s 10.128.0.0/16 \
          -d 10.128.0.0/16 -j ACCEPT
```

Example: A firewall (cont.)

Forwarding....

```
iptables -A FORWARD -i ppp0 -o eth0 -m state \
          --state ESTABLISHED,RELATED -j ACCEPT
iptables -A FORWARD -i eth0 -o ppp0 -j ACCEPT
iptables -A FORWARD -j DROP
```

Note that there is no forwarding in internal network

`iptables` script finale

- Make sure that the main chains end with DROP
- Zero counters

```
iptables -A INPUT -j DROP
iptables -A OUTPUT -j DROP
iptables -A FORWARD -j DROP
iptables -Z
```

Summary

- It works really well
- It’s not difficult to set up if you know what you’re doing

References

- Linux IP Masquerade HOWTO (a version written in Jan 2003 is available)
- `man iptables`

The End

Questions?

Slides were made with LaTeX, using the `prosper` document class