Chair of Network Architectures and Services
Department of Informatics
Technical University of Munich

$Something with Firewalls

Curry Club

Cornelius Diekmann

8th September 2016

Linux Firewall

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    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip    ↩
    --hashlimit-name aflood --hashlimit-srcmask 8 -j LOG
-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
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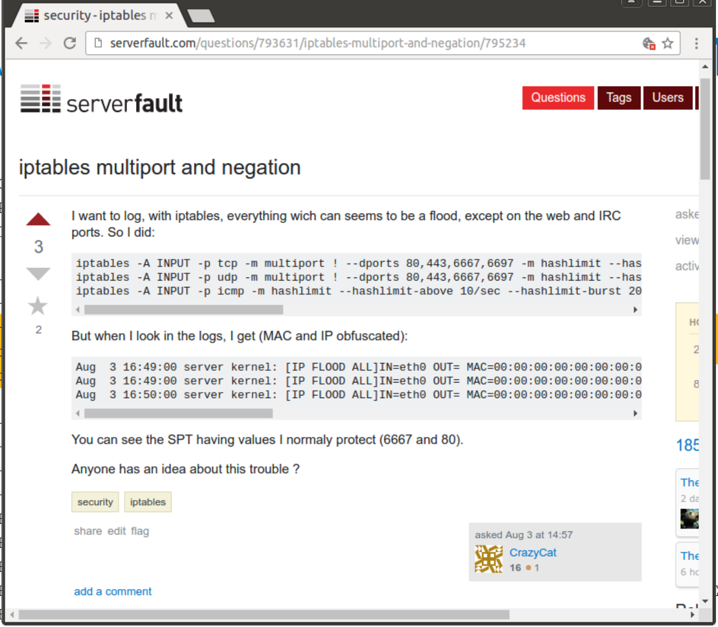
security - iptables m ×
serverfault.com/questions/793631/iptables-multiport-and-negation/795234
serverfault
Questions
Tags
Users

iptables multiport and negation

3

2

I want to log, with iptables, everything wich can seems to be a flood, except on the web and IRC ports. So I did:

```
iptables -A INPUT -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit --has
iptables -A INPUT -p udp -m multiport ! --dports 80,443,6667,6697 -m hashlimit --has
iptables -A INPUT -p icmp -m hashlimit --hashlimit-above 10/sec --hashlimit-burst 20
```

But when I look in the logs, I get (MAC and IP obfuscated):

```
Aug  3 16:49:00 server kernel: [IP FLOOD ALL]IN=eth0 OUT= MAC=00:00:00:00:00:00:00:0
Aug  3 16:49:00 server kernel: [IP FLOOD ALL]IN=eth0 OUT= MAC=00:00:00:00:00:00:00:0
Aug  3 16:50:00 server kernel: [IP FLOOD ALL]IN=eth0 OUT= MAC=00:00:00:00:00:00:00:0
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You can see the SPT having values I normaly protect (6667 and 80).

Anyone has an idea about this trouble ?

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-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit        ↩
    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip         ↩
    --hashlimit-name aflood --hashlimit-srcmask 8 -j LOG
-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
-A GOOD˜STUFF -i lo -j ACCEPT
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```

Linux Firewall

```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
:DOS_PROTECT - [0:0]
:GOOD˜STUFF - [0:0]
-A FORWARD -j DOS_PROTECT
-A FORWARD -j GOOD˜STUFF
-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit     ↩
    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip     ↩
    --hashlimit-name aflood --hashlimit-srcmask 8 -j LOG
-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
-A GOOD˜STUFF -i lo -j ACCEPT
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```

Linux Firewall

```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
:DOS_PROTECT - [0:0]
:GOOD˜STUFF - [0:0]
-A FORWARD -j DOS_PROTECT
-A FORWARD -j GOOD˜STUFF
-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit       ↩
    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip      ↩
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-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
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-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```

Linux Firewall

```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
:DOS_PROTECT - [0:0]
:GOOD˜STUFF - [0:0]
-A FORWARD -j DOS_PROTECT
-A FORWARD -j GOOD˜STUFF
-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit       ↩
    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip       ↩
    --hashlimit-name aflood --hashlimit-srcmask 8 -j LOG
-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
-A GOOD˜STUFF -i lo -j ACCEPT
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
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-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```

Linux Firewall

```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
:DOS_PROTECT - [0:0]
:GOOD˜STUFF - [0:0]
-A FORWARD -j DOS_PROTECT
-A FORWARD -j GOOD˜STUFF
-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit       ↩
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-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
-A GOOD˜STUFF -i lo -j ACCEPT
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```

Linux Firewall

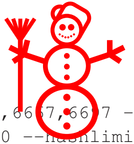
```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
:DOS_PROTECT - [0:0]
:GOOD˜STUFF - [0:0]
-A FORWARD -j DOS_PROTECT
-A FORWARD -j GOOD˜STUFF
-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit       ↩
    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip      ↩
    --hashlimit-name aflood --hashlimit-srcmask 8 -j LOG
-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
-A GOOD˜STUFF -i lo -j ACCEPT
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```

-i ☃

Linux Firewall

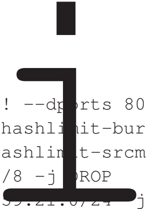
```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
:DOS_PROTECT - [0:0]
:GOOD˜STUFF - [0:0]
-A FORWARD -j DOS_PROTECT
-A FORWARD -j GOOD˜STUFF
-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit      ↩
    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip     ↩
    --hashlimit-name aflood --hashlimit-srcmask 8 -j LOG
-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
-A GOOD˜STUFF -i lo -j ACCEPT
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```

—i



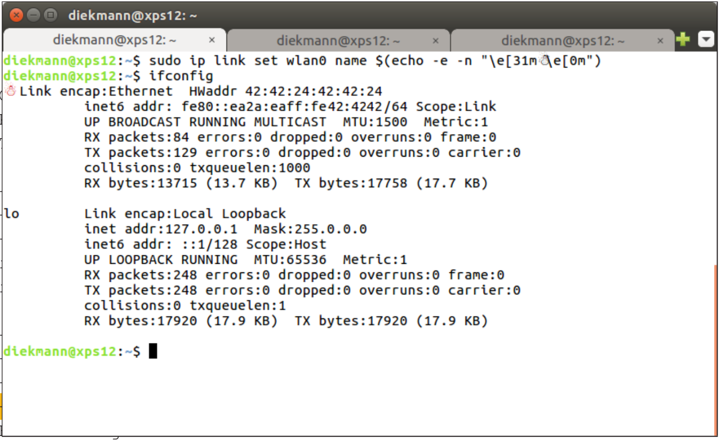
Linux Firewall

```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
:DOS_PROTECT - [0:0]
:GOOD˜STUFF - [0:0]
-A FORWARD -j DOS_PROTECT
-A FORWARD -j GOOD˜STUFF
-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit      ↩
    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip     ↩
    --hashlimit-name aflood --hashlimit-srcmask 8 -j LOG
-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
-A GOOD˜STUFF -i lo -j ACCEPT
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```



Linux Firewall

```
*filter
:INPUT DROP
:FORWARD DR
:OUTPUT DRO
:DOS_PROTEC
:GOOD˜STUFF
-A FORWARD -
-A FORWARD -
-A FORWARD -                                                              ↩
    --hashl                                                               ↩
    --hashl
-A FORWARD -
-A FORWARD -
-A FORWARD -
-A FORWARD -
-A FORWARD -
-A GOOD˜STU
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```



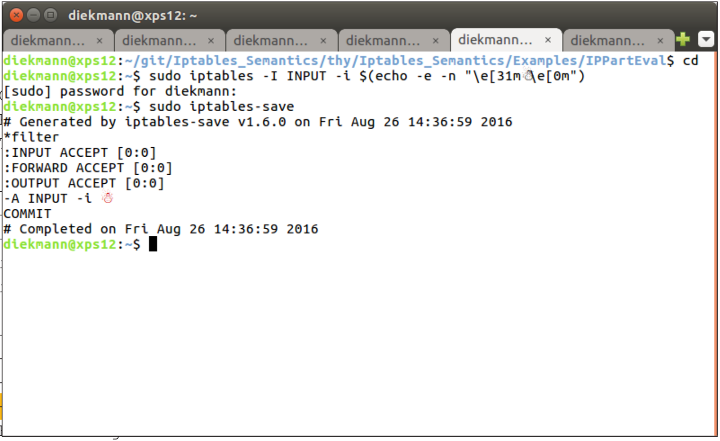
```
diekmann@xps12:~$ sudo ip link set wlan0 name $(echo -e -n "\e[31m☃\e[0m")
diekmann@xps12:~$ ifconfig
☃ Link encap:Ethernet  HWaddr 42:42:24:42:42:24
          inet6 addr: fe80::ea2a:eaff:fe42:4242/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:84 errors:0 dropped:0 overruns:0 frame:0
          TX packets:129 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:13715 (13.7 KB)  TX bytes:17758 (17.7 KB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:248 errors:0 dropped:0 overruns:0 frame:0
          TX packets:248 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:17920 (17.9 KB)  TX bytes:17920 (17.9 KB)

diekmann@xps12:~$ █
```

Linux Firewall

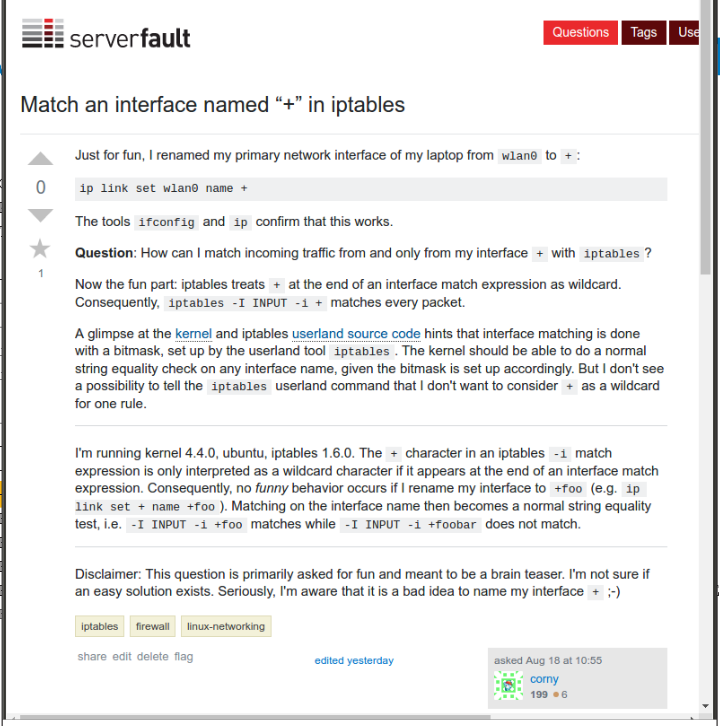
```
*filter
:INPUT DROP
:FORWARD DR(
:OUTPUT DRO
:DOS_PROTEC
:GOOD~STUFF
-A FORWARD -
-A FORWARD -
-A FORWARD -                                                                  ↩
    --hashl                                                                   ↩
    --hashl
-A FORWARD -
-A FORWARD -
-A FORWARD -
-A FORWARD -
-A FORWARD -
-A GOOD~STU
-A GOOD~STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD~STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```



```
diekmann@xps12:~/git/Iptables_Semantics/thy/Iptables_Semantics/Examples/IPPartEval$ cd
diekmann@xps12:~$ sudo iptables -I INPUT -i $(echo -e -n "\e[31m☃\e[0m")
[sudo] password for diekmann:
diekmann@xps12:~$ sudo iptables-save
# Generated by iptables-save v1.6.0 on Fri Aug 26 14:36:59 2016
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A INPUT -i ☃
COMMIT
# Completed on Fri Aug 26 14:36:59 2016
diekmann@xps12:~$ █
```

Linux Firev

```
*filter
:INPUT DROP
:FORWARD DR
:OUTPUT DRO
:DOS_PROTEC
:GOOD~STUFF
-A FORWARD -
-A FORWARD -
-A FORWARD -                                                          ↩
    --hashl                                                           ↩
    --hashl
-A FORWARD -
-A FORWARD -
-A FORWARD -
-A FORWARD -
-A FORWARD
-A GOOD~STU
-A GOOD~STU
-A GOOD~STU
-A DOS_PROT                                                          TURN
-A DOS_PROT
COMMIT
```



Match an interface named “+” in iptables

Just for fun, I renamed my primary network interface of my laptop from `wlan0` to `+`:

```
ip link set wlan0 name +
```

The tools `ifconfig` and `ip` confirm that this works.

Question: How can I match incoming traffic from and only from my interface `+` with `iptables`?

Now the fun part: iptables treats `+` at the end of an interface match expression as wildcard. Consequently, `iptables -I INPUT -i +` matches every packet.

A glimpse at the kernel and iptables userland source code hints that interface matching is done with a bitmask, set up by the userland tool `iptables`. The kernel should be able to do a normal string equality check on any interface name, given the bitmask is set up accordingly. But I don't see a possibility to tell the `iptables` userland command that I don't want to consider `+` as a wildcard for one rule.

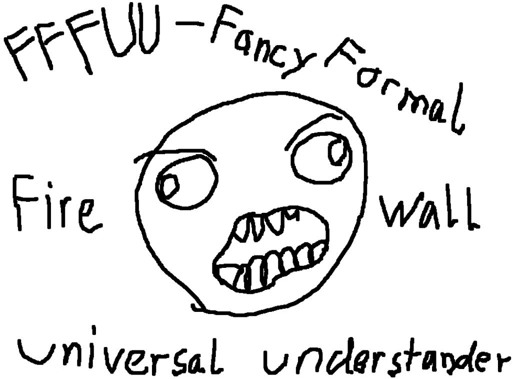
I'm running kernel 4.4.0, ubuntu, iptables 1.6.0. The `+` character in an iptables `-i` match expression is only interpreted as a wildcard character if it appears at the end of an interface match expression. Consequently, no *funny* behavior occurs if I rename my interface to `+foo` (e.g. `ip link set + name +foo`). Matching on the interface name then becomes a normal string equality test, i.e. `-I INPUT -i +foo` matches while `-I INPUT -i +foobar` does not match.

Disclaimer: This question is primarily asked for fun and meant to be a brain teaser. I'm not sure if an easy solution exists. Seriously, I'm aware that it is a bad idea to name my interface `+` ;-)

Linux Firewall

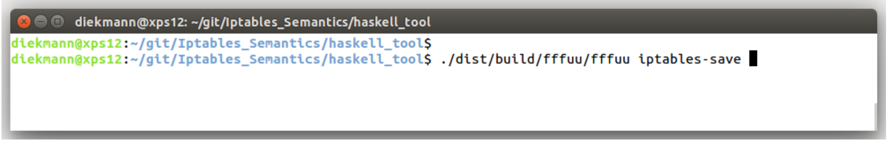
```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
:DOS_PROTECT - [0:0]
:GOOD˜STUFF - [0:0]
-A FORWARD -j DOS_PROTECT
-A FORWARD -j GOOD˜STUFF
-A FORWARD -p tcp -m multiport ! --dports 80,443,6667,6697 -m hashlimit       ↩
    --hashlimit-above 10/sec --hashlimit-burst 20 --hashlimit-mode srcip      ↩
    --hashlimit-name aflood --hashlimit-srcmask 8 -j LOG
-A FORWARD ! -i lo -s 127.0.0.0/8 -j DROP
-A FORWARD -i internal -s 131.159.21.0/24 -j ACCEPT
-A FORWARD -s 131.159.15.240/28 -d 131.159.21.0/24 -j DROP
-A FORWARD -p tcp -d 131.159.15.240/28 -j ACCEPT
-A FORWARD -i ☃ -p tcp -s 131.159.15.240/28 -j ACCEPT
-A GOOD˜STUFF -i lo -j ACCEPT
-A GOOD˜STUFF -m state --state ESTABLISHED -j ACCEPT
-A GOOD˜STUFF -p icmp -m state --state RELATED -j ACCEPT
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 ... --limit 1/sec -j RETURN
-A DOS_PROTECT -i eth1 -p icmp -m icmp --icmp-type 8 -j DROP
COMMIT
```

FFFUU



http://iptables.isabelle.systems/

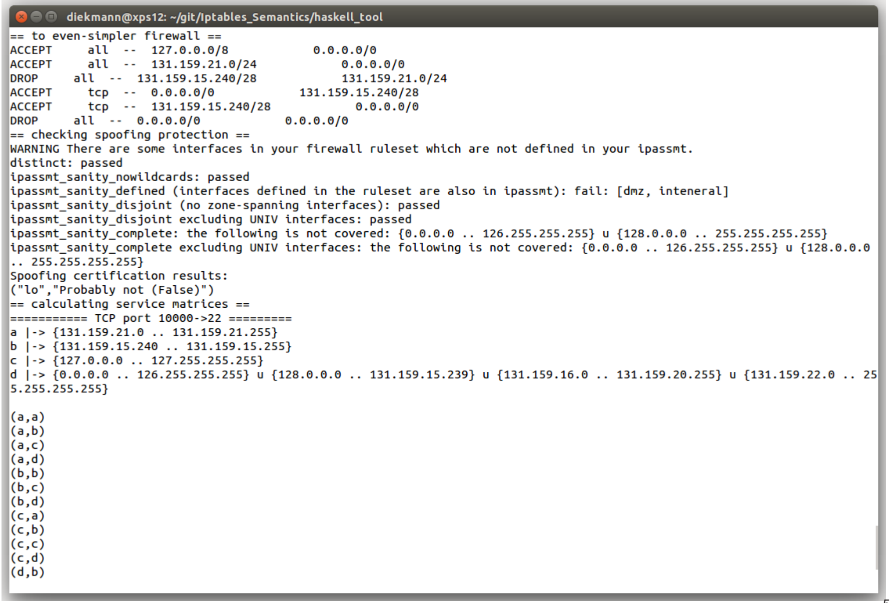
FFFUU: Usage



diekmann@xps12: ~/git/Iptables_Semantics/haskell_tool

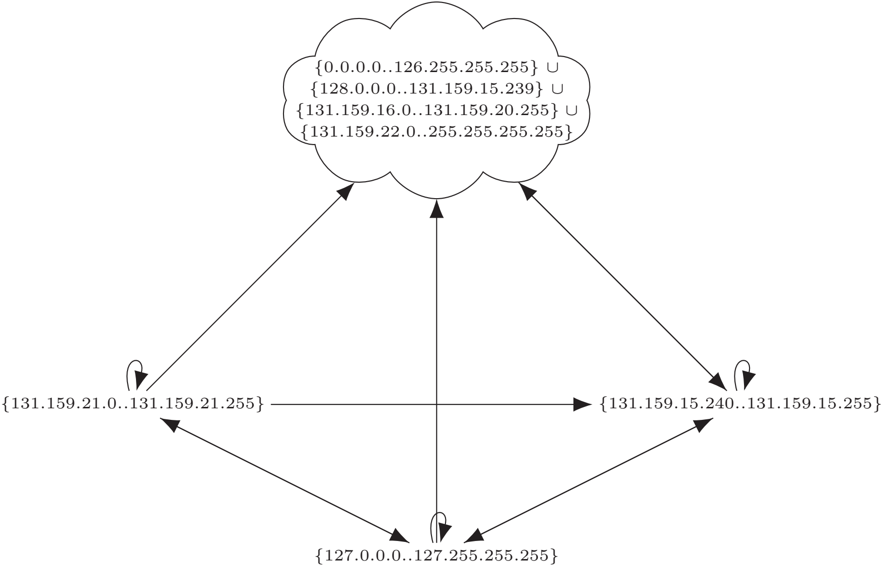
```
diekmann@xps12:~/git/Iptables_Semantics/haskell_tool$
diekmann@xps12:~/git/Iptables_Semantics/haskell_tool$ ./dist/build/fffuu/fffuu iptables-save
```

`http://iptables.isabelle.systems/`



```
== to even-simpler firewall ==
ACCEPT     all  --  127.0.0.0/8            0.0.0.0/0
ACCEPT     all  --  131.159.21.0/24            0.0.0.0/0
DROP     all  --  131.159.15.240/28            131.159.21.0/24
ACCEPT     tcp  --  0.0.0.0/0            131.159.15.240/28
ACCEPT     tcp  --  131.159.15.240/28            0.0.0.0/0
DROP     all  --  0.0.0.0/0            0.0.0.0/0
== checking spoofing protection ==
WARNING There are some interfaces in your firewall ruleset which are not defined in your ipassmt.
distinct: passed
ipassmt_sanity_nowildcards: passed
ipassmt_sanity_defined (interfaces defined in the ruleset are also in ipassmt): fail: [dmz, inteneral]
ipassmt_sanity_disjoint (no zone-spanning interfaces): passed
ipassmt_sanity_disjoint excluding UNIV interfaces: passed
ipassmt_sanity_complete: the following is not covered: {0.0.0.0 .. 126.255.255.255} u {128.0.0.0 .. 255.255.255.255}
ipassmt_sanity_complete excluding UNIV interfaces: the following is not covered: {0.0.0.0 .. 126.255.255.255} u {128.0.0.0
.. 255.255.255.255}
Spoofing certification results:
("lo","Probably not (False)")
== calculating service matrices ==
=========== TCP port 10000->22 ========
a |-> {131.159.21.0 .. 131.159.21.255}
b |-> {131.159.15.240 .. 131.159.15.255}
c |-> {127.0.0.0 .. 127.255.255.255}
d |-> {0.0.0.0 .. 126.255.255.255} u {128.0.0.0 .. 131.159.15.239} u {131.159.16.0 .. 131.159.20.255} u {131.159.22.0 .. 25
5.255.255.255}

(a,a)
(a,b)
(a,c)
(a,d)
(b,b)
(b,c)
(b,d)
(c,a)
(c,b)
(c,c)
(c,d)
(d,b)
```



{0.0.0.0..126.255.255.255} ∪
{128.0.0.0..131.159.15.239} ∪
{131.159.16.0..131.159.20.255} ∪
{131.159.22.0..255.255.255.255}
{131.159.21.0..131.159.21.255}
{131.159.15.240..131.159.15.255}
{127.0.0.0..127.255.255.255}

Properties

Soundness

- You can lookup any pair of IPv4 addresses in the picture
- If there is an arrow between the IPs, then the firewall may allow the communication
- If there is no arrow, then the firewall definitely blocks the communication

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- We translate to a simplified firewall model which is less expressive

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- Overapproximation: our simplified firewall accepts at least all the packets which the original firewall accepts

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$\neg$ Completeness

- We translate to a simplified firewall model which is less expressive
- Overapproximation: our simplified firewall accepts at least all the packets which the original firewall accepts
- Approximation: it may accept more

Properties

Soundness

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- If there is an arrow between the IPs, then the firewall may allow the communication
- If there is no arrow, then the firewall definitely blocks the communication

$\neg$ Completeness

- We translate to a simplified firewall model which is less expressive
- Overapproximation: our simplified firewall accepts at least all the packets which the original firewall accepts
- Approximation: it may accept more

Example

```
*filter
:INPUT DROP [0:0]
:FORWARD DROP [0:0]
:OUTPUT DROP [0:0]
-A FORWARD -m time --timestart 07:45 --timestop 08:00 --weekdays Mon       ↩
    -m comment --comment Sprechzeiten -j ACCEPT
COMMIT
```

Example

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:INPUT DROP [0:0]
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```

- Overapproximation: Firewall accepts everything

```
target    prot opt  source          destination
ACCEPT    all  --   0.0.0.0/0       0.0.0.0/0
```

Example

```
*filter
:INPUT DROP [0:0]
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  ```

- Sound ☺

Example

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  target    prot opt source         destination
  ACCEPT    all  --  0.0.0.0/0      0.0.0.0/0
  ```

- Sound ☺
- But useless ☹

Example

```
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A FORWARD -m time --timestart 07:45 --timestop 08:00 --weekdays Mon        ↩
    -m comment --comment Sprechzeiten -j DROP
COMMIT
```

Example

```
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
-A FORWARD -m time --timestart 07:45 --timestop 08:00 --weekdays Mon         ↩
    -m comment --comment Sprechzeiten -j DROP
COMMIT
```

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*filter
:INPUT ACCEPT [0:0]
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-A FORWARD -m time --timestart 07:45 --timestop 08:00 --weekdays Mon           ↩
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COMMIT
```

- Overapproximation: Firewall accepts everything

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ACCEPT     all  --  0.0.0.0/0        0.0.0.0/0
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Example

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:INPUT ACCEPT [0:0]
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COMMIT
```

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  ACCEPT    all  --  0.0.0.0/0       0.0.0.0/0
  ```

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Example

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COMMIT
```

- Overapproximation: Firewall accepts everything

```
target     prot opt  source          destination
ACCEPT     all  --   0.0.0.0/0       0.0.0.0/0
```

- Sound ☺
- Exactly what we want ☺

Another Example

```
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
:CHAIN - [0:0]
-A FORWARD -j CHAIN
-A CHAIN -p tcp -m tcp --sport 22 -j RETURN
-A CHAIN -p udp -m udp --dport 80 -j RETURN
-A CHAIN -j DROP
COMMIT
```

- What does it do?

Another Example

```
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
:CHAIN - [0:0]
-A FORWARD -j CHAIN
-A CHAIN -p tcp -m tcp --sport 22 -j RETURN
-A CHAIN -p udp -m udp --dport 80 -j RETURN
-A CHAIN -j DROP
COMMIT
```

- What does it do?
- Accepts everything from TCP srcport 22 and UDP dstport 80.

Another Example: Running fffuu

- Accept everything from TCP srcport 22 and UDP dstport 80.
- drop the rest

```
target   prot opt source        destination
DROP     all  --  0.0.0.0/0     0.0.0.0/0   sports: 0:21 dports: 0:79
DROP     all  --  0.0.0.0/0     0.0.0.0/0   sports: 0:21 dports: 81:65535
DROP     all  --  0.0.0.0/0     0.0.0.0/0   sports: 23:65535 dports: 0:79
DROP     all  --  0.0.0.0/0     0.0.0.0/0   sports: 23:65535 dports: 81:65535
ACCEPT   all  --  0.0.0.0/0     0.0.0.0/0
```

Another Example: Running fffuu

- Accept everything from TCP srcport 22 and UDP dstport 80.
- drop the rest

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target   prot opt source        destination
DROP     all  --  0.0.0.0/0     0.0.0.0/0    sports: 0:21 dports: 0:79
DROP     all  --  0.0.0.0/0     0.0.0.0/0    sports: 0:21 dports: 81:65535
DROP     all  --  0.0.0.0/0     0.0.0.0/0    sports: 23:65535 dports: 0:79
DROP     all  --  0.0.0.0/0     0.0.0.0/0    sports: 23:65535 dports: 81:65535
ACCEPT   all  --  0.0.0.0/0     0.0.0.0/0
```

- Wait, . . .

Another Example: Running fffuu

- Accept everything from TCP srcport 22 and UDP dstport 80.
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target   prot opt source       destination
DROP     all  --  0.0.0.0/0    0.0.0.0/0   sports: 0:21 dports: 0:79
DROP     all  --  0.0.0.0/0    0.0.0.0/0   sports: 0:21 dports: 81:65535
DROP     all  --  0.0.0.0/0    0.0.0.0/0   sports: 23:65535 dports: 0:79
DROP     all  --  0.0.0.0/0    0.0.0.0/0   sports: 23:65535 dports: 81:65535
ACCEPT   all  --  0.0.0.0/0    0.0.0.0/0
```

- Wait, . . .

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DROP     all  --  0.0.0.0/0     0.0.0.0/0    sports: 23:65535 dports: 81:65535
ACCEPT   all  --  0.0.0.0/0     0.0.0.0/0
```

- Wait, . . .
- Does this even make sense?

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- Accept everything from TCP srcport 22 and UDP dstport 80.
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target    prot opt source         destination
DROP      all  --  0.0.0.0/0      0.0.0.0/0    sports: 0:21 dports: 0:79
DROP      all  --  0.0.0.0/0      0.0.0.0/0    sports: 0:21 dports: 81:65535
DROP      all  --  0.0.0.0/0      0.0.0.0/0    sports: 23:65535 dports: 0:79
DROP      all  --  0.0.0.0/0      0.0.0.0/0    sports: 23:65535 dports: 81:65535
ACCEPT    all  --  0.0.0.0/0      0.0.0.0/0
```

- Wait, . . .

- Does this even make sense?

- Not the policy we wanted: Accepts anything with srcport 22 or dstport 80. TCP, UDP, SCTP,

Another Example: Running fffuu

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DROP      all  --  0.0.0.0/0       0.0.0.0/0     sports: 23:65535 dports: 81:65535
ACCEPT    all  --  0.0.0.0/0       0.0.0.0/0
```

- Wait, . . .
- Does this even make sense?
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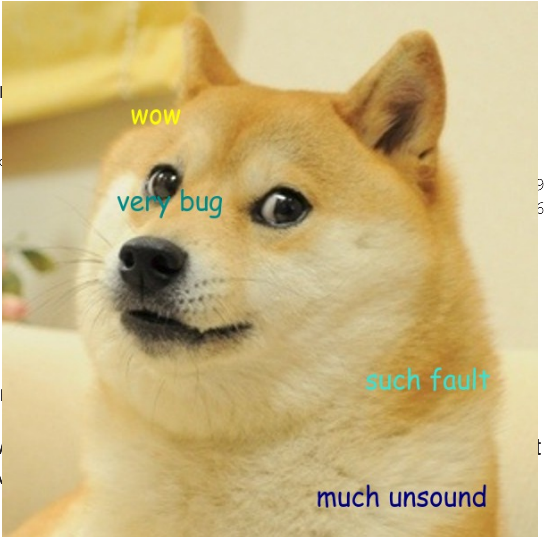
Another Example



- Accept everythi
- drop the rest

```
target    prot opt so
DROP      all  --  0                                              9
DROP      all  --  0                                              55535
DROP      all  --  0                                               0:79
DROP      all  --  0                                               81:65535
ACCEPT    all  --  0
```

- Wait, . . .
- Does this even r
- Not the policy w   t 80. TCP, UDP, SCTP, ICM
- Very broken!

Another Example: Running fffuu

- Accept everything from TCP srcport 22 and UDP dstport 80.
- drop the rest

```
target    prot opt source          destination
DROP      all  --  0.0.0.0/0       0.0.0.0/0     sports: 0:21 dports: 0:79
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DROP      all  --  0.0.0.0/0       0.0.0.0/0     sports: 23:65535 dports: 81:65535
ACCEPT    all  --  0.0.0.0/0       0.0.0.0/0
```

- Wait, . . .
- Does this even make sense?
- Not the policy we wanted: Accepts anything with srcport 22 or dstport 80. TCP, UDP, SCTP, ICMP, . . .
- Very broken!
- Challenge: Construct unsoundness.

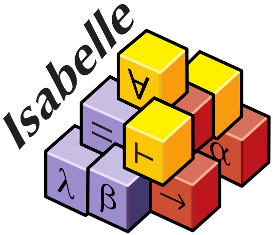
It is ‘formally verified’, how can it be unsound?

It is ‘formally verified’, how can it be unsound?

- Proof?

It is ‘formally verified’, how can it be unsound?

- Proof? ✓ (Isabelle)



It is ‘formally verified’, how can it be unsound?

- Proof? ✓ (Isabelle)
- Does the soundness theorem really mean what we think it means?

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- Proof? ✓ (Isabelle)
- Does the soundness theorem really mean what we think it means? ✓ (trust me)
- Unrealistic assumptions

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- Does the soundness theorem really mean what we think it means? ✓ (trust me)
- Unrealistic assumptions ✓ (checked)

It is ‘formally verified’, how can it be unsound?

- Proof? ✓ (Isabelle)
- Does the soundness theorem really mean what we think it means? ✓ (trust me)
- Unrealistic assumptions ✓ (checked)
- What else?

It is ‘formally verified’, how can it be unsound?

- Proof? ✓ (Isabelle)
- Does the soundness theorem really mean what we think it means? ✓ (trust me)
- Unrealistic assumptions ✓ (checked)
- What else?
- Rowhammer!

It is ‘formally verified’, how can it be unsound?

- Proof? ✓ (Isabelle)
- Does the soundness theorem really mean what we think it means? ✓ (trust me)
- Unrealistic assumptions ✓ (checked)
- What else?
- Rowhammer! Hardware Rootkit!

It is ‘formally verified’, how can it be unsound?

- Proof? ✓ (Isabelle)
- Does the soundness theorem really mean what we think it means? ✓ (trust me)
- Unrealistic assumptions ✓ (checked)
- What else?
- Rowhammer! Hardware Rootkit! Put on your tinfoil hats!

It is ‘formally verified’, how can it be unsound?

- Proof? ✓ (Isabelle)
- Does the soundness theorem really mean what we think it means? ✓ (trust me)
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- What else?
- Rowhammer! Hardware Rootkit! Put on your tinfoil hats! ✗
  (could be, but there is a simpler explanation)

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  (could be, but there is a simpler explanation)
- Okay, it’s the assumptions:

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- Okay, it’s the assumptions:
- Error in the model

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- Rowhammer! Hardware Rootkit! Put on your tinfoil hats! ✗
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- Okay, it’s the assumptions:
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Model: Filtering Behavior

$$\textsc{Skip}\quad \frac{}{\Gamma,\ \gamma,\ p \vdash \langle [],\ t\rangle \Rightarrow t}$$

$$\textsc{Accept}\quad \frac{\text{matches } \gamma\ m\ p}{\Gamma,\ \gamma,\ p \vdash \langle [(m,\ \texttt{Accept})],\ \textcircled{?}\rangle \Rightarrow \textcircled{\checkmark}}$$

$$\textsc{Drop}\quad \frac{\text{matches } \gamma\ m\ p}{\Gamma,\ \gamma,\ p \vdash \langle [(m,\ \texttt{Drop})],\ \textcircled{?}\rangle \Rightarrow \textcircled{\times}}$$

$$\textsc{Reject}\quad \frac{\text{matches } \gamma\ m\ p}{\Gamma,\ \gamma,\ p \vdash \langle [(m,\ \texttt{Reject})],\ \textcircled{?}\rangle \Rightarrow \textcircled{\times}}$$

$$\textsc{NoMatch}\quad \frac{\neg\ \text{matches } \gamma\ m\ p}{\Gamma,\ \gamma,\ p \vdash \langle [(m,\ a)],\ \textcircled{?}\rangle \Rightarrow \textcircled{?}}$$

$$\textsc{Decision}\quad \frac{t \neq \textcircled{?}}{\Gamma,\ \gamma,\ p \vdash \langle rs,\ t\rangle \Rightarrow t}$$

$$\textsc{Seq}\quad \frac{\Gamma,\ \gamma,\ p \vdash \langle rs_1,\ \textcircled{?}\rangle \Rightarrow t \qquad \Gamma,\ \gamma,\ p \vdash \langle rs_2,\ t\rangle \Rightarrow t'}{\Gamma,\ \gamma,\ p \vdash \langle rs_1\ :::\ rs_2,\ \textcircled{?}\rangle \Rightarrow t'}$$

$$\textsc{Log}\quad \frac{\text{matches } \gamma\ m\ p}{\Gamma,\ \gamma,\ p \vdash \langle [(m,\ \texttt{Log})],\ \textcircled{?}\rangle \Rightarrow \textcircled{?}}$$

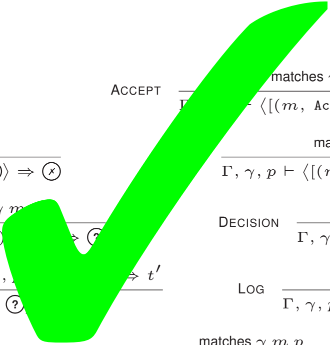
$$\textsc{Empty}\quad \frac{\text{matches } \gamma\ m\ p}{\Gamma,\ \gamma,\ p \vdash \langle [(m,\ \texttt{Empty})],\ \textcircled{?}\rangle \Rightarrow \textcircled{?}}$$

$$\textsc{CallResult}\quad \frac{\text{matches } \gamma\ m\ p \qquad \Gamma,\ \gamma,\ p \vdash \langle \Gamma\ c,\ \textcircled{?}\rangle \Rightarrow t}{\Gamma,\ \gamma,\ p \vdash \langle [(m,\ \texttt{Call}\ c)],\ \textcircled{?}\rangle \Rightarrow t}$$

$$\textsc{CallReturn}\quad \frac{\text{matches } \gamma\ m\ p \qquad \Gamma\ c = rs_1\ :::\ (m',\ \texttt{Return})\ ::\ rs_2 \qquad \text{matches } \gamma\ m'\ p \qquad \Gamma,\ \gamma,\ p \vdash \langle rs_1,\ \textcircled{?}\rangle \Rightarrow \textcircled{?}}{\Gamma,\ \gamma,\ p \vdash \langle [(m,\ \texttt{Call}\ c)],\ \textcircled{?}\rangle \Rightarrow \textcircled{?}}$$

Background ruleset Γ : $\mathit{chain\ name} \rightarrow \mathit{rule\ list}$

Model: Filtering Behavior



SKIP $$\frac{}{\Gamma,\gamma,p \vdash \langle [],\ t \rangle \Rightarrow t}$$

ACCEPT $$\frac{\text{matches } \gamma\ m\ p}{\Gamma \quad \vdash \langle [(m,\ \texttt{Accept})],\ \textcircled{?} \rangle \Rightarrow \textcircled{\checkmark}}$$

DROP $$\frac{\text{matches } \gamma\ m\ p}{\Gamma,\gamma,p \vdash \langle [(m,\ \texttt{Drop})],\ \textcircled{?} \rangle \Rightarrow \textcircled{\times}}$$

$$\frac{\text{matches } \gamma\ m\ p}{\Gamma,\gamma,p \vdash \langle [(m,\ \texttt{Reject})],\ \textcircled{?} \rangle \Rightarrow \textcircled{\times}}$$

NOMATCH $$\frac{\neg \text{ matches } \gamma\ m}{\Gamma,\gamma,p \vdash \langle [(m,\ a) \quad \Rightarrow \textcircled{?}}$$

DECISION $$\frac{t \neq \textcircled{?}}{\Gamma,\gamma,p \vdash \langle rs,\ t \rangle \Rightarrow t}$$

SEQ $$\frac{\Gamma,\gamma,p \vdash \langle rs_1,\ \textcircled{?} \rangle \Rightarrow t \qquad \Gamma,\gamma, \quad \Rightarrow t'}{\Gamma,\gamma,p \vdash \langle rs_1 ::: rs_2,\ \textcircled{?}}$$

LOG $$\frac{\text{matches } \gamma\ m\ p}{\Gamma,\gamma,p \vdash \langle [(m,\ \texttt{Log})],\ \textcircled{?} \rangle \Rightarrow \textcircled{?}}$$

EMPTY $$\frac{\text{matches } \gamma\ m\ p}{\Gamma,\gamma,p \vdash \langle [(m,\ \texttt{Empty})],\ \textcircled{?} \rangle \Rightarrow \textcircled{?}}$$

CALLRESULT $$\frac{\text{matches } \gamma\ m\ p \qquad \Gamma,\gamma,p \vdash \langle \Gamma\ c,\ \textcircled{?} \rangle \Rightarrow t}{\Gamma,\gamma,p \vdash \langle [(m,\ \texttt{Call}\ c)],\ \textcircled{?} \rangle \Rightarrow t}$$

CALLRETURN $$\frac{\text{matches } \gamma\ m\ p \qquad \Gamma\ c = rs_1 ::: (m',\ \texttt{Return}) :: rs_2 \qquad \text{matches } \gamma\ m'\ p \qquad \Gamma,\gamma,p \vdash \langle rs_1,\ \textcircled{?} \rangle \Rightarrow \textcircled{?}}{\Gamma,\gamma,p \vdash \langle [(m,\ \texttt{Call}\ c)],\ \textcircled{?} \rangle \Rightarrow \textcircled{?}}$$

Background ruleset Γ : *chain name* $\rightarrow$ *rule list*

Model: Filtering Behavior

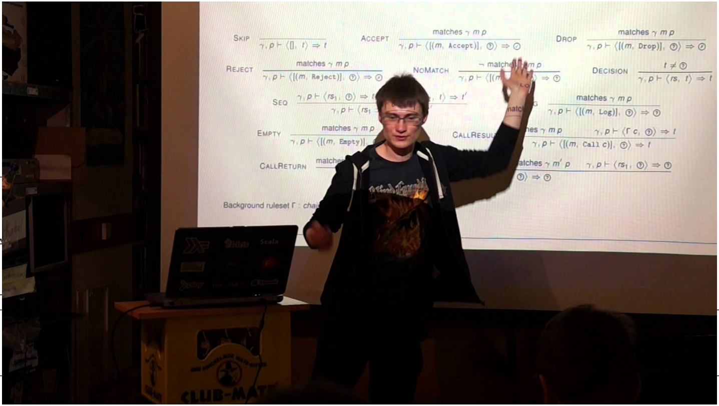
SKIP

DROP $\Gamma,$

NOMA

SEQ $\Gamma, \gamma, p \vdash$

EMPTY Γ, γ, p



$\textcircled{?}$

$\Rightarrow t$

$$\text{CALLRETURN}\quad \frac{\text{matches } \gamma\ m\ p \qquad \Gamma\ c = rs_1 \ ::: \ (m', \ \texttt{Return}) \ :: \ rs_2 \qquad \text{matches } \gamma\ m'\ p \qquad \Gamma, \gamma, p \vdash \langle rs_1, \ \textcircled{?}\rangle \Rightarrow \textcircled{?}}{\Gamma, \gamma, p \vdash \langle [(m, \ \texttt{Call}\ c)], \ \textcircled{?}\rangle \Rightarrow \textcircled{?}}$$

Background ruleset Γ : $chain\ name \rightarrow rule\ list$

Model: Matching Features

$$\begin{array}{lcl}
\text{datatype } \mathit{primitive} & = & \text{IIface } `\mathit{string}' \\
 & & \text{OIface } `\mathit{string}' \\
 & & \text{Src } `32\ \mathit{word} \times \mathit{nat}' \\
 & & \text{Dst } `32\ \mathit{word} \times \mathit{nat}' \\
 & & \text{Protocol } `\mathit{prot}' \qquad \#\text{where } \mathit{prot} \text{ is either } \mathit{Any} \text{ or } 8\ \mathit{word} \\
 & & \text{Src-Ports } `16\ \mathit{word} \times 16\ \mathit{word}' \\
 & & \text{Dst-Ports } `16\ \mathit{word} \times 16\ \mathit{word}' \\
 & & \text{CT-State } `\mathit{ctstate\ set}' \\
 & & \text{Extra } `\mathit{string}'
\end{array}$$

Model: Matching Features

datatype *primitive* = IIface ‘*string*’

OIface ‘*string*’

Src ‘32 *wor*

Dst ‘32 *at*’

Protoc #w *ot* is either *Any* or 8 *word*

Src- *word* × 16 *d*’

D 16 *word* × 16 *word*’

CT ‘*ctstate set*’

Extra ‘*string*’

Model: Matching Features

datatype IIface ‘$string$’

There is no such things as ports!

Src ‘$32\ word \times nat$’

Dst ‘$32\ word \times nat$’

Protocol ‘$prot$’ #where $prot$ is either Any or $8\ word$

Src-Ports ‘$16\ word \times 16\ word$’

Dst-Ports ‘$16\ word \times 16\ word$’

CT-State ‘$ctstate\ set$’

Extra ‘$string$’

Model: Matching Features

datatype

There is no such things as ports!

but there are TCP ports, UDP ports, SCTP ports, . . .

Dst ‘$32\ word \times nat$’

Protocol ‘$prot$’ #where $prot$ is either Any or $8\ word$

Src-Ports ‘$16\ word \times 16\ word$’

Dst-Ports ‘$16\ word \times 16\ word$’

CT-State ‘$ctstate\ set$’

Extra ‘$string$’

Model: Matching Features

datatype

There is no such things as ports!

but there are TCP ports, UDP ports, SCTP ports, . . .

Dst ‘$32\ word \times nat$’

Protocol ‘$prot$’ #where $prot$ is either Any or $8\ word$

Src-Ports ‘$8\ word$’ ‘$16\ word \times 16\ word$’

Dst-Ports ‘$8\ word$’ ‘$16\ word \times 16\ word$’

CT-State ‘$ctstate\ set$’

Extra ‘$string$’

Negating Matches on Ports

- `! (-p tcp --dport 80) -j ACCEPT`

Negating Matches on Ports

- `! (-p tcp --dport 80) -j ACCEPT`
- `! -p tcp -j ACCEPT`
  `-p tcp ! --dport80 -j ACCEPT`

Negating Matches on Ports

-
  ```
  ! (-p tcp --dport 80) -j ACCEPT
  ```

-
  ```
  ! -p tcp -j ACCEPT
  -p tcp ! --dport80 -j ACCEPT
  ```

- $\neg(\mathit{tcp} \land \mathit{port80}) = \neg \mathit{tcp} \lor (\mathit{tcp} \land \neg \mathit{port80})$

Negating Matches on Ports

- `! (-p tcp --dport 80) -j ACCEPT`
- `! -p tcp -j ACCEPT`
  `-p tcp ! --dport80 -j ACCEPT`
- $\neg(tcp \wedge port80) = \neg tcp \vee (tcp \wedge \neg port80)$
- Dependent matches?

Negating Matches on Ports

-
  ```
  ! (-p tcp --dport 80) -j ACCEPT
  ```

-
  ```
  ! -p tcp -j ACCEPT
  -p tcp ! --dport80 -j ACCEPT
  ```

- $\neg(\mathit{tcp} \wedge \mathit{port80}) = \neg\mathit{tcp} \vee (\mathit{tcp} \wedge \neg\mathit{port80})$

- Dependent matches?

- Match on ports, possibly get a match on protocols for free!

Negating Matches

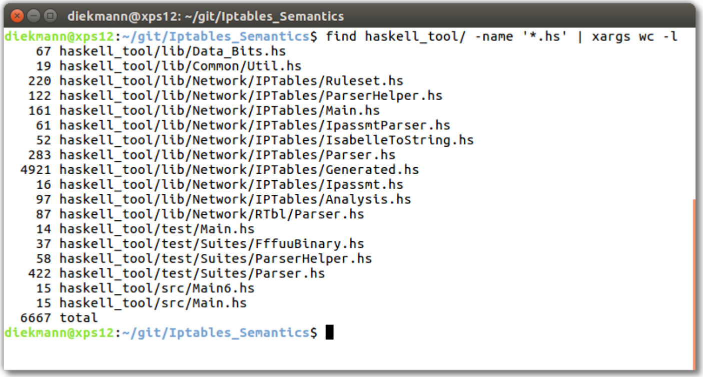
- `! (-p tcp -`
- `! -p tcp -j`
  `-p tcp ! --`
- $\neg(tcp \land port8$
- Dependent mat
- Match on ports,

Negating Matches on Ports

- `! (-p tcp --dport 80) -j ACCEPT`
- `! -p tcp -j ACCEPT`
  `-p tcp ! --dport80 -j ACCEPT`
- $\neg(tcp \wedge port80) = \neg tcp \vee (tcp \wedge \neg port80)$
- Dependent matches?
- Match on ports, possibly get a match on protocols for free!
- Common firewall research: just translate match expressions to SAT . . .

Fixing the Bug in the Code

- The error exists only in your head!



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diekmann@xps12:~/git/Iptables_Semantics$ find haskell_tool/ -name '*.hs' | xargs wc -l
    67 haskell_tool/lib/Data_Bits.hs
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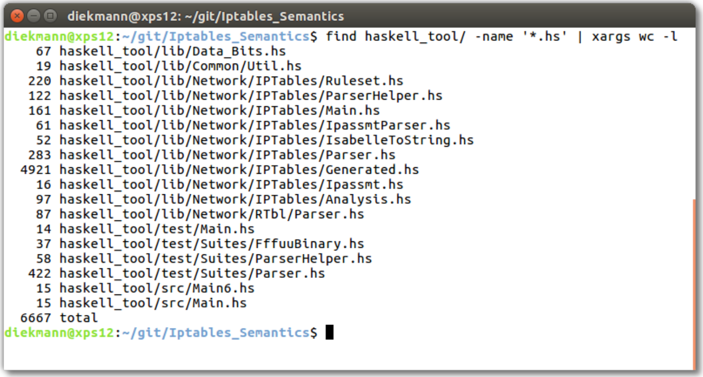
  6667 total
diekmann@xps12:~/git/Iptables_Semantics$ 
```

Fixing the Bug in the Code

- The error exists only in your head!
- May be repeated throughout the code . . .



diekmann@xps12: ~/git/Iptables_Semantics

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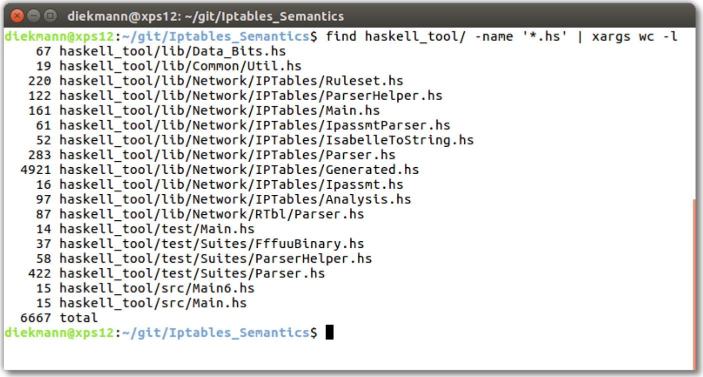
Fixing the Bug in the Code

- The error exists only in your head!
- May be repeated throughout the code . . .
- Fixing may cause odd side effects . . .
  - Normalization routines assume that once a primitive is normalized, another routine will not destroy that



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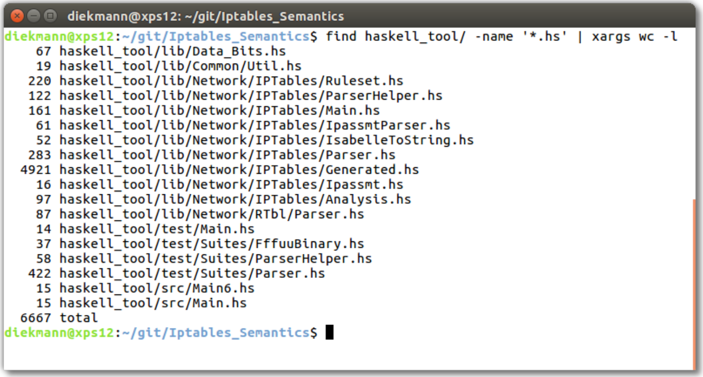
diekmann@xps12:~/git/Iptables_Semantics$ █
```

Fixing the Bug in the Code

- The error exists only in your head!
- May be repeated throughout the code . . .
- Fixing may cause odd side effects . . .
  - Normalization routines assume that once a primitive is normalized, another routine will not destroy that
- Almost impossible to get right!



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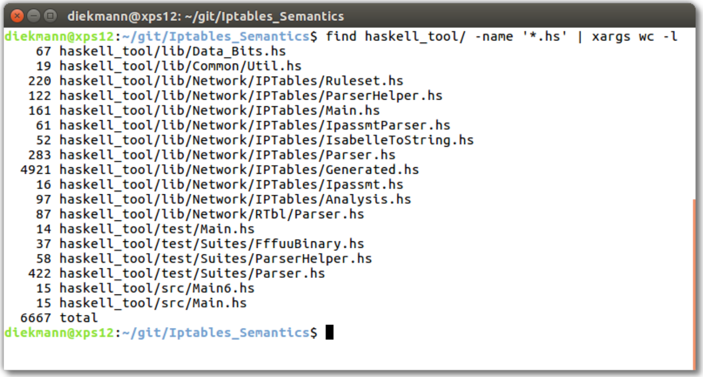
We don’t fix the Code!

- We fix the model!



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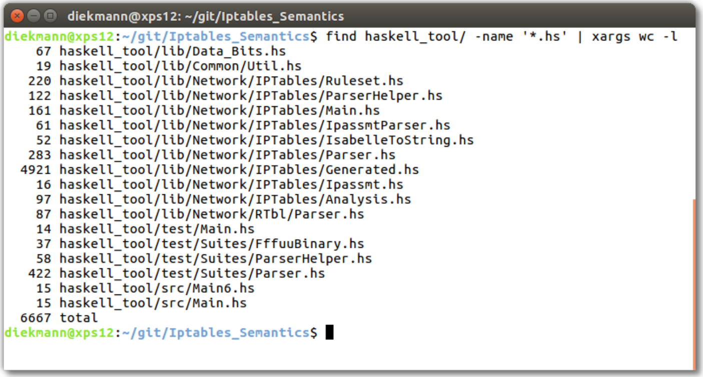
diekmann@xps12:~/git/Iptables_Semantics$ █
```

We don’t fix the Code!

- We fix the model! The semantics, the assumptions, . . .



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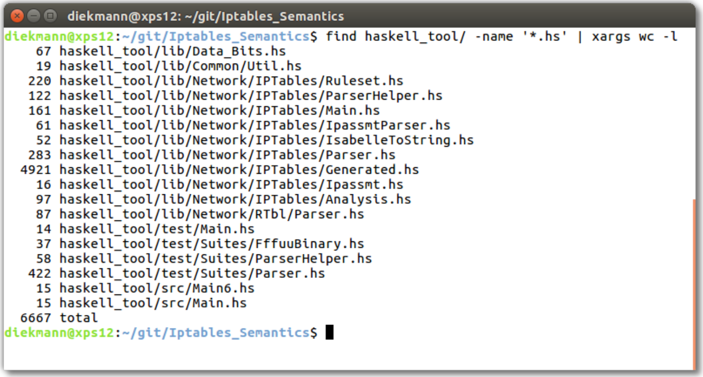
We don’t fix the Code!

- We fix the model! The semantics, the assumptions, . . .
- You saw the `diff` before



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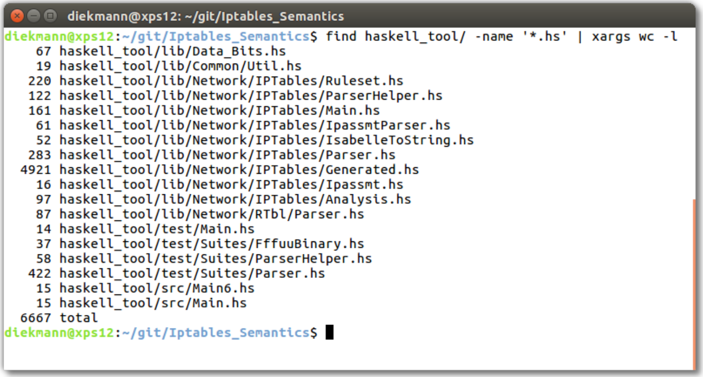
diekmann@xps12:~/git/Iptables_Semantics$ █
```

We don't fix the Code!

- We fix the model! The semantics, the assumptions, . . .
- You saw the `diff` before
- Proofs will fail ⟶ we know exactly where we need to fix stuff!



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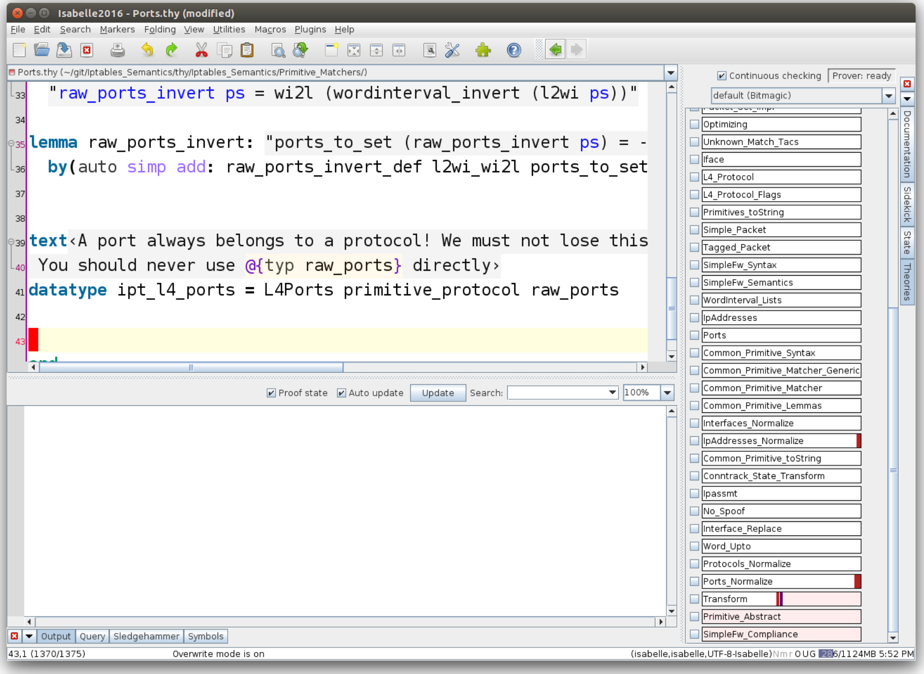
Isabelle2016 - Ports.thy (modified)
File Edit Search Markers Folding View Utilities Macros Plugins Help
Ports.thy (~/git/Iptables_Semantics/thy/Iptables_Semantics/Primitive_Matchers/)
☑ Continuous checking
Prover: ready
default (Bitmagic)
Documentation
Sidekick
State
Theories
☑ Proof state
☑ Auto update
Update
Search:
100%
Output
Query
Sledgehammer
Symbols

```
  "raw_ports_invert ps = wi2l (wordinterval_invert (l2wi ps))"

lemma raw_ports_invert: "ports_to_set (raw_ports_invert ps) = -
  by(auto simp add: raw_ports_invert_def l2wi_wi2l ports_to_set


text‹A port always belongs to a protocol! We must not lose this
 You should never use @{typ raw_ports} directly›
datatype ipt_l4_ports = L4Ports primitive_protocol raw_ports


end
```

□ Optimizing
□ Unknown_Match_Tacs
□ Iface
□ L4_Protocol
□ L4_Protocol_Flags
□ Primitives_toString
□ Simple_Packet
□ Tagged_Packet
□ SimpleFw_Syntax
□ SimpleFw_Semantics
□ WordInterval_Lists
□ IpAddresses
□ Ports
□ Common_Primitive_Syntax
□ Common_Primitive_Matcher_Generic
□ Common_Primitive_Matcher
□ Common_Primitive_Lemmas
□ Interfaces_Normalize
□ IpAddresses_Normalize
□ Common_Primitive_toString
□ Conntrack_State_Transform
□ Ipassmt
□ No_Spoof
□ Interface_Replace
□ Word_Upto
□ Protocols_Normalize
□ Ports_Normalize
□ Transform
□ Primitive_Abstract
□ SimpleFw_Compliance

43,1 (1370/1375)   Overwrite mode is on   (isabelle,isabelle,UTF-8-Isabelle) N m r O U G 286/1124MB 5:52 PM

Fixed Model

```
*filter
:INPUT ACCEPT [0:0]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
:CHAIN - [0:0]
-A FORWARD -j CHAIN
-A CHAIN -p tcp -m tcp --sport 22 -j RETURN
-A CHAIN -p udp -m udp --dport 80 -j RETURN
-A CHAIN -j DROP
COMMIT
```

Simplified

```
DROP     udp  --  0.0.0.0/0    0.0.0.0/0   dports: 0:79
DROP     udp  --  0.0.0.0/0    0.0.0.0/0   dports: 81:65535
DROP     tcp  --  0.0.0.0/0    0.0.0.0/0   sports: 0:21
DROP     tcp  --  0.0.0.0/0    0.0.0.0/0   sports: 23:65535
ACCEPT   all  --  0.0.0.0/0    0.0.0.0/0
```