# iptables Tutorial 1.1.6

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by Oskar Andreasson

# Table of Contents

# Chapter 1. Introduction

## Why this document was written

Well, I found a big empty space in the HOWTO's out there lacking in information about the iptables and netfilter functions in the new Linux 2.4.x kernels. Among other things, I'm going to try to answer questions that some might have about the new possibilities like state matching. Is it possible to allow passive FTP to your server, but not allow outgoing DCC from IRC as an example? I will build this all up from an example rc.firewall[1] file that you can use in your /etc/rc.d/ scripts. Yes, this file was originally based upon the masquerading HOWTO for those of you who recognize it.

Also, there's a small script that I wrote just in case you screw up as much as I did during the configuration available as rc.flush-iptables.txt [2].

## How it was written

I've placed questions to Marc Boucher and others from the core netfilter team. A big thanks going out to them for their work and for their help on this tutorial that I wrote and maintain for boingworld.com. This document will guide you through the setup process step by step, hopefully make you understand some more about the iptables package. I will base most of the stuff here on the example rc.firewall file since I find that example to be a good way to learn how to use iptables. I have decided to just follow the basic chains and from there go down into each and one of the chains traversed in each due order. This tutorial has turned a little bit harder to follow this way but at the same time it is more logical. Whenever you find something that's hard to understand, just consult this tutorial.

## About the author

I'm someone with too many old computers on my hands, sitting with my own LAN and wanting them all to be connected to the Internet, at the same time having it fairly secure. The new iptables is a good upgrade from the old ipchains in this regard. Before, you could make a fairly secure network by dropping all incoming packages not destined to certain ports, but this would be a problem with things like passive FTP or outgoing DCC in IRC, which assigns ports on the server, tells the client about it, and then lets the client connect. There was some child diseases in the iptables code that I ran into in the beginning, and in some respects I found the code not quite ready for release in full production. Today, I'd recommend everyone who uses ipchains or even older ipfwadm etc to upgrade unless they're happy with what their current code is capable of and if it does what they need it to.

## Dedications

First of all I would like to dedicate this document to my wonderful girlfriend Ninel, who may be nontechnical. She has supported me more than I ever can support her to any degree. I wish I could make you just as happy as you make me.

Second of all, I would like to contribute this work to all of the incredibly hard working Linux developers and maintainers. It is people like those who makes this wonderful operating system possible.

## Notes

1. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.firewall.txt
2. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.flush-iptables.txt

# Chapter 2. Preparations

## Where to get iptables

The **iptables** userspace package can be downloaded from the netfilter homepage[1]. The **iptables** package also makes use of kernel space facilities which can be configured into the kernel during **make configure**. The necessary pieces will be discussed a bit further down in this document.

## Kernel setup

To run the pure basics of **iptables** you need to configure the following options into the kernel while doing **make config** or one of it's related commands. :

`CONFIG_PACKET` - This option allows applications and programs that needs to work directly to certain network devices. An example would be tcpdump or snort.

`CONFIG_NETFILTER` - This option is required if you're going to use your computer as a firewall or gateway to the internet. In other words, this is most definitely required if for anything in this tutorial to work at all. I assume you'll want this since you're reading this at all.

And of course you need to add the proper drivers for your interfaces to work properly, ie. Ethernet adapter, `PPP` and `SLIP` interfaces. The above will only add some of the pure basics in iptables. You won't be able to do anything to be pretty honest, it just adds the framework to the kernel. If you want to use the more advanced options in IPTables, you need to set up the proper configuration options in your kernel. Here we will show you the options available in a basic 2.4.9 kernel and a brief explanation :

`CONFIG_IP_NF_CONNTRACK` - This module is needed to make connection tracking. Connection tracking is used by, among other things, NAT and Masquerading. If you need to firewall machines on a LAN you most definitely need this option. For example, this module is required by the rc.firewall.txt to work.

`CONFIG_IP_NF_FTP` - This module is required if you want to do connection tracking on FTP connections. Since FTP connections are quite hard to do connection tracking on in normal cases conntrack needs a so called helper, this option compiles the helper. If you don't add this module you won't be able to FTP through a firewall or gateway properly.

`CONFIG_IP_NF_IPTABLES` - This option is required if you want do any kind of filtering, masquerading or NAT. It adds the whole IPTables identification framework to kernel. Without this you won't be able to do anything at all with iptables.

`CONFIG_IP_NF_MATCH_LIMIT` - This module isn't exactly required but it's used in the example rc.firewall.txt. This adds the possibility to control how many packets per minute that's supposed to be matched with a certain rule. For example, -m limit –limit 3/minute would match a maximum of 3 packets per minute. This module can also be used to avoid certain Denial of Service attacks.

`CONFIG_IP_NF_MATCH_MAC` - This allows us to match packets based on MAC addresses. Every Ethernet adapter has it's own MAC address. We could for instance block packets based on what MAC address used and block a certain computer pretty well since the MAC address don't change. We don't use this option in the rc.firewall.txt example or anywhere else.

`CONFIG_IP_NF_MATCH_MARK` - This allows us to use a MARK match. For example, if we use the target MARK we could mark a packet and then depending on if this

packet is marked further on in the table, we can match based on this mark. This option is the actual match MARK, and further down we will describe the actual target MARK.

`CONFIG_IP_NF_MATCH_MULTIPORT` - This module allows us to match packets with a whole range of destination ports or source ports. Normally this wouldn't be allowed, but with this match it is possible.

`CONFIG_IP_NF_MATCH_TOS` - With this match we can match packets based on their TOS field. TOS stands for Type Of Service field. TOS can also be set by certain rules in the mangle table and via the ip/tc commands.

`CONFIG_IP_NF_MATCH_TCPMSS` - This match allows us to match TCP SYN packets based on their MSS field.

`CONFIG_IP_NF_MATCH_STATE` - This is one of the biggest news in comparison to IPChains. With this module we can do stateful matching on packets. For example, if we've already seen trafic in two directions in a TCP connection, this packet will be counted as ESTABLISHED. This module is used extensively in the rc.firewall.txt example.

`CONFIG_IP_NF_MATCH_UNCLEAN` - This module will allow us to match IP, TCP, UDP and ICMP packets that looks strange or are invalid. We could for example drop these packets, but we never know if they are legitimate or not. Note that this match is still experimental and might not work perfectly in all cases.

`CONFIG_IP_NF_MATCH_OWNER` - This option will allow us to do owner matching. For example, we can allow only the user root to have Internet access. This module was originally just written as an example on what could be done with the new IPTables. Note that this match is still experimental and might not work for everyone.

`CONFIG_IP_NF_FILTER` - This module will add the basic filter table which will enable you to do basic filtering. In the filter table you'll find the input, forward and output chains. This module is required if you plan to do any kind of filtering on packets that you receive and send.

`CONFIG_IP_NF_TARGET_REJECT` - This target allows us to specify that an ICMP error message should be sent in reply to incoming packets instead of plainly dropping them to the floor. Mind you that TCP connections are always reset or refused with a TCP RST packet.

`CONFIG_IP_NF_TARGET_MIRROR` - This allows packets to be bounced back to the sender of the packet. For example, if we set up a MIRROR target on destination port http on our input chain and someone tries to access this port we would plainly bounce his packets back to himself and finally he would see his own homepage.

`CONFIG_IP_NF_NAT` - This module allows network address translation, or NAT in it's different forms. With this option we can do port forwarding, masquerading etc. Note that this option is required for firewalling and masquerading of a LAN and hence for the example rc.firewall.txt to work properly.

`CONFIG_IP_NF_TARGET_MASQUERADE` - This module adds the masquerade target. For instance if we don't know what IP we have to the Internet this would be the preferred way of getting the IP instead of using DNAT or SNAT. In other words, if we use DHCP, PPP, SLIP or some other connection that dynamically assigns us an IP, we need to use this target instead of SNAT. Masquerading gives a slightly higher load on the computer than NAT does, but will work without us knowing the IP in advance.

`CONFIG_IP_NF_TARGET_REDIRECT` - This target is useful together with proxies for example. Instead of letting a packet pass right through, we remap them to go to our local box instead. In other words, we can make a transparent proxy this way.

`CONFIG_IP_NF_TARGET_LOG` - This adds the LOG target to iptables and the functionality of it. We can use this module to log certain packets to syslogd and hense see

the packet further on. This could be useful for forensics or debugging a script you're writing.

`CONFIG_IP_NF_TARGET_TCPMSS` - This option can be used to overcome ISPs and servers who block ICMP Fragmentation needed packets. This can result in webpages not getting through, small mails getting through while larger mails don't get through, ssh works but scp dies after handshake, etc etc. We can then use the TCPMSS target to overcome this by clamping our MSS (Maximum Segment Size) to the PMTU (Path Maximum Transmit Unit). This way, we'll be able to handle what the authors of netfilter themself call "criminally braindead ISPs or servers" in the kernel configuration help.

`CONFIG_IP_NF_COMPAT_IPCHAINS` - Adds a compatibility mode with the old IPChains. Do not look at this as any real long term way of solving this.

`CONFIG_IP_NF_COMPAT_IPFWADM` - Compatibility mode with old ipfwadm. Do absolutely not look at this as a real long term solution.

As you can see, there is a heap of options. I've briefly explained what kind of extra behaviours you can expect from each module here. These are only the options available in a vanilla linux 2.4.9 kernel. If you'd like to get a look at more options, I suggest you look at the patch-o-matic functions in netfilter userland which will add heaps of other options in the kernel. POM fixes are additions that's supposed to be added in the kernel in the future that hasn't quite reached the kernel yet. These functions should be added in the future, but hasn't quite made it in yet. (Note! from recent testing it seems patch-o-matic in netfilter 1.2.3 will not work together with linux kernel 2.4.9 for me. If someone can confirm this for me or if this is only me, I'd appreciate it. I seem to have missed this issue on the netfilter mailing list.)

You will need the following options compiled into your kernel, or as modules, for the rc.firewall.txt script to work. If you need help with the options that the other scripts needs, look at the example firewall scripts section.

CONFIG_PACKET
CONFIG_NETFILTER

CONFIG_IP_NF_CONNTRACK
CONFIG_IP_NF_FTP
CONFIG_IP_NF_IRC
CONFIG_IP_NF_IPTABLES
CONFIG_IP_NF_FILTER
CONFIG_IP_NF_NAT
CONFIG_IP_NF_MATCH_STATE
CONFIG_IP_NF_TARGET_LOG
CONFIG_IP_NF_MATCH_LIMIT
CONFIG_IP_NF_TARGET_MASQUERADE

The above will be required at the very least for the rc.firewall.txt script. In the other example scripts I will explain what requirements they have.

## userland setup

First of all, let's look at how we compile the iptables package. This compilation goes quite a lot hand in hand with the kernel configuration and compilation so you're aware of this. Certain distributions comes with the iptables package preinstalled, one of these are Red Hat 7.1. However, in Red Hat 7.1 it is disabled per default. We'll check closer on how to enable it on this, and other distributions further on.

## Compiling the userland programs

First of all unpack the iptables package. Here, we've used the iptables 1.2.3 package and a vanilla 2.4.9 kernel. Unpack as usual, using "bzip2 -cd iptables-1.2.3.tar.bz2 | tar -xvf -". Hopefully the package should now be unpacked properly into a directory named iptables-1.2.3. For more information read the iptables-1.2.3/INSTALL file which contains pretty good information on compiling and getting the program to run.

After this, there is the option to install extra modules and options etc to the kernel. Note that some of these are highly experimental and may not be a very good idea to install, however, there are heaps of extremely interesting matches and targets etc in this installation step so don't be afraid of at least looking at the things. To do this step we do something like this from the root of the iptables package:

**make pending-patches KERNEL_DIR=/usr/src/linux/**

Note that this only asks about certain patches that are just about to enter the kernel anyways. Also note that the variable KERNEL_DIR should point to the actual place that your kernel source is located at. There might be more patches etc that the developers of netfilter are about to add to the kernel, but is a bit further away from actually getting there. One way to install these are by doing the following:

**make most-of-pom KERNEL_DIR=/usr/src/linux/**

The above command would ask about installing parts of what in netfilter world is called patch-o-matic, but still skip the most extreme things that just might cause havoc in your kernel etc. Note that we say ask, because that's what these commands actually do. They ask you before anything is changed in the kernel source. To be able to install all of the patch-o-matic stuff you will need to do the following command:

**make patch-o-matic KERNEL_DIR=/usr/src/linux/**

Don't forget to read the help for each patch thoroughly before doing anything. Some patches will destroy other patches while others may destroy your kernel if used together with other patches from patch-o-matic etc. Also note that you may totally ignore the above steps if you don't want to patch your kernel, it is in other words not necessary to do the above. However, there are some really interesting things in the patch-o-matic's that you may want to look at so there's nothing bad in just running the commands and see what they contain.

After this you're finished doing the patch-o-matic parts of installation, you may either compile a new kernel making use of the new things that you've added to the source. Don't forget to configure the kernel again since the new patches probably are not added to the configured options and so on. You may wait with the kernel compilation until after the compilation of the userland program iptables though.

Continue by compiling the program. To compile the program you issue a simple command that looks like this:

**make KERNEL_DIR=/usr/src/linux/**

The program should now compile properly, if not, you're on your own, or possibly try the netfilter mailing list who might help you with your problems. There is a few things that might go wrong with the installation of iptables so don't panic if it won't work, try to think logically about it and find out what's wrong or get someone to help.

If everything's worked smoothly, you're ready to install the binaries by now. To do this, you would issue the following command to install them:

**make install KERNEL_DIR=/usr/src/linux/**

Hopefully everything should work in the program now. To use any of the changes in the iptables userland program you should definitely recompile and reinstall your kernel by now if you haven't done so before. For more information about installing the userland things from source, check the INSTALL file in the source which contains excellent information on the subject.

## Installation on Red Hat 7.1

Red Hat 7.1 comes preinstalled with a 2.4.x kernel that has netfilter and iptables compiled in. It also contains all the basic userland programs and configuration files that's needed to run it, however, they've disabled the whole thing by using the backwards compatible ipchains module. Annoying to say the least, and a lot of people are asking different mailing lists why iptables don't work. So, let's take a brief look at how to turn the idiotic thing off and how to install iptables instead. Note that the default Red Hat 7.1 installation today comes with an utterly old version of the userspace programs so you might want to compile a new version of the programs as well as install a new and homecompiled kernel before fully exploiting iptables.

First of all you'll need to turn off the ipchains modules so it won't start in the future. To do this, you'll need to change some filenames in the /etc/rc.d/ directorystructure. The following command should do it:

chkconfig –level 0123456 ipchains off

By doing this we move all the soft links that points to the real script to K92ipchains. The first letter which per default would be S tells the initscripts to start the script. By changing this to K we tell it to Kill the service instead, or not run it. Now the service won't be started in the future.

However, to stop the service from actually running right now we need to run another command. This is the **service** command which can be used to work on currently running services. We would then issue the following command to stop the ipchains service:

**service ipchains stop**

Finally, to start the iptables service. First of all, we need to know which runlevels we want it to run in. Normally this would be in runlevel 2, 3 and 5. These runlevels are used for the following things:

2: Multiuser without NFS or the same as 3 if there is no networking.
3: Full multiuser mode, ie. the normal runlevel to run in.
5: X11. This is used if you automatically boot into Xwindows.

To make iptables run in these runlevels we would do the following commands:

chkconfig –level 235 iptables on

The above commands would in other words make the iptables "service" run in runlevel 2, 3 and 5. If you'd like the iptables programs to run in some other runlevel you'd have to issue the same command in those. However, none of the other runlevels should be used, so you shouldn't really activate it for those runlevels. Level 1 is for single user mode, ie, when you need to fix a screwed up box. Level 4 should be unused, and level 6 is for shutting the computer down.

To activate the service iptables we just run the following command:

**service iptables start**

Of course, there is no rules in the iptables script. To add rules to an Red Hat 7.1 box, there is two common ways. First of all, you chould edit the /etc/rc.d/init.d/iptables script. This would have the bad effect that the rules would be deleted if you updated the iptables package by RPM. The other way would be to load the ruleset and then save them with the iptables-save command and then have it loaded automatically by the rc.d scripts.

First of all we describe the first possibility of doing the set up. To add rules that should be run when the computer starts the service, you add them under the start) section, or in the start() function. Note, if you add the rules under the start) section don't forget to stop the start() function from running in the start) section. Also, don't forget to edit a the stop) section either which tells the script what to do when the computer is going down for example, or when we're entering a runlevel that don't require iptables to run. Also, don't forget to check out the restart section and condrestart. Note that this set up may be automatically erased if you have, for example, Red Hat Network automatically updating your packages. It may also be erased by updating from the iptables RPM package.

The second way of doing the set up would require the following steps to be taken. First of all, make and write a ruleset in a file, or directly to iptables, that will meet your requirements, and don't forget to experiment a bit. When you find a set up that works without problems or bugs as you can see, use the iptables-save command. You could either use it normally, such as iptables-save > /etc/sysconfig/iptables which would save the ruleset to the file /etc/sysconfig/iptables. This file is automatically used by the iptables rc.d script to restore the ruleset in the future. The other way to save the script would be to use service iptables save which would save the script automatically to this file. When you reboot the computer in the future, the iptables rc.d script will use the command iptables-restore to restore the ruleset from the savefile /etc/sysconfig/iptables. Do not intermix this and the previous set up instruction since they may heavily damage eachother and render each and one useless.

When all of these steps are finished we can deinstall the currently installed ipchains and iptables packages. We do this since we don't want the system to mix up the new iptables command with the old preinstalled iptables command. This step is only necessary if you will install iptables from the source package. It's not unusual that the new and the old package get's mixed up since the rpm based installation installs the package in non-standard places and won't get overwritten by the installation for the new iptables package. To do the deinstallation, do as follows:

**rpm -e iptables**

And of course, why keep ipchains lying around when it's of no use? That's done the same way as with the old iptables binaries, etc:

**rpm -e ipchains**

After all this is done you're finished to update the iptables package from source according to the source installation instructions. None of the old binaries, libraries or include files etc should be lying around any more.

## Notes

1. http://netfilter.samba.org/

# Chapter 3. How a rule is built

This chapter will discuss in legth how to build your rules. A rule could be described as the pure rules the firewall will follow when blocking different connections and packets in each chain. Each line you write that's inserted to a chain should be considered a rule. We'll also discuss the basic matches that's available and how to use them as well as the different targets and how we can make new targets to use (ie, new subchains).

## Basics

As we've already explained each rule is a line that the kernel looks at to find out what to do with a packet. If all the criterias, or matches, are met, we perform the target, or jump, instruction. Normally we'd write a rule something like this:

**iptables [table]** <**command**> <**match**> <**target/jump**>

There is nothing that says that the target instruction must be last in the line, however, you'd do this normally to get a better readability. Also, we've used this way of writing rules since it's the most usual way of writing them. Hence, if you read someone elses script you'll most likely recognise the way of writing a rule and understand it quickly.

If you want to use another table than the standard table, you could insert the table specification here. However, it is not necessary to specify it explicitly all the time since iptables per default uses the filter table to implement your commands on. It isn't required to put the table specification at this location, either. It could be set pretty much anywhere in the rule, however, it is more or less standard to put the table specification at the beginning of the commandline.

One thing to think about though; the command should always be first, or directly after the table specification. This tells the iptables command what to do. We'll enter this a bit further on. We use this first variable to tell the program what to do, for example to insert a rule or to add a rule to the end of the chain, or to delete a rule.

The match is the part which we send to the kernel that says what a packet must look like to be matched. We could specify what IP address the packet must come from, or from which network interface the packet must come from etc. There is a heap of different matches that we can use that we'll look closer at further on in this chapter.

Finally we have the target of the packet. If all the matches are met for a packet we tell the kernel to perform this action on the packet. We could tell the kernel to send the packet onto another chain that we create ourself, which must be part of this table. We could tell the kernel to drop this packet dead and do no further processing, or we could tell kernel to send a specified reply to be sent back. As with the rest of the content in this section, we'll look closer at them further on in the chapter.

## Table

The -t option specifies which table to use. Per default, the filter table is used. The following options are available to the -t command:

**Table 3-1. Tables**

| Table | Explanation |
|---|---|

| Table | Explanation |
|---|---|
| nat | The nat table is used mainly for Network Address Translation. Packets in a stream only traverse this table once. The first packet of a stream is allowed, we presume. The rest of the packets in the same stream are automatically NAT'ed or Masqueraded etc, in case they are supposed to have those actions taken on them. The rest of the packets in the stream will in other words not go through this table again, but instead they will automatically have the same actions taken to them as the first packet in the stream. This is one reason why you should not do any filtering in this table, as we will discuss more in length further on. The PREROUTING chain is used to alter packets as soon as they get in to the firewall. The OUTPUT chain is used for altering locally generated packets (ie, on the firewall) before they get to the routing decision. Note that OUTPUT is currently broken. Finally we have the POSTROUTING chain which is used to alter packets just as they are about to leave the firewall. |
| mangle | This table is used mainly for mangling packets. We could change different packets and how their headers look among other things. Examples of this would be to change the TTL, TOS or MARK. Note that the MARK is not really a change to the packet, but a mark for the packet is set in kernelspace which other rules or programs might use further on in the firewall to filter or do advanced routing on with tc as a few examples. The table consists of two built in chains, the PREROUTING and OUTPUT chains. PREROUTING is used for altering packets just as they enter the firewall and before they hit the routing decision. OUTPUT is used for changing and altering locally generated packets before they enter the routing decision. Note that mangle can not be used for any kind of Network Address Translation or Masquerading, the nat table was made for these kinds of operations. |

| Table | Explanation |
|---|---|
| filter | The filter table should be used for filtering packets generally. For example, we could DROP, LOG, ACCEPT or REJECT packets without problems as in the other tables. There are three chain built in to this table. The first one is named FORWARD and is used on all non-locally generated packets that are not destined for our localhost (the firewall, in other words). INPUT is used on all packets that are destined for our local host (the firewall) and OUTPUT is finally used for all locally generated packets. |

This table has hopefully explained the basics about the three different tables that are available. They should be used for totally different things, and you should know what to use each chain for. If you don't understand their usage you may well fall into a pit once someone finds the hole you've unknowingly placed in the firewall yourself. We will however discuss the tables more during this whole tutorial.

## Commands

In this section we'll bring up all the different commands and what can be done with them. The command tells iptables what to do with the rest of the commandline that we send to the program. Normally we want to either add or delete something to some table or another. The following commands are available to iptables:

**Table 3-2. Commands**

| Command |
|---|
| Example |
| Explanation |
| **-A, –append** |
| **iptables -A INPUT ...** |
| This command appends the rule to the end of the chain. The rule will in other words always be put last in the ruleset in comparison to previously added rules, and hence be checked last unless you append more rules later on. |
| **-D, –delete** |
| **iptables -D INPUT –dport 80 -j DROP iptables -D INPUT 1** |
| This command deletes a rule in a chain. This could be done in two ways, either by specifying a rule to match with the -D option (as in the first example) or by specifying the rule number that we want to match. If you use the first way of deleting rules, they must match totally to the entry in the chain. If you use the second way, the rules starts getting numbered at the beginning of each chain, and the top rule is number 1. |
| **-R, –replace** |
| **iptables -R INPUT 1 -s 192.168.0.1 -j DROP** |

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| This command replaces the old entry at this line. It works in the same way as the –delete command, but instead of totally deleting the entry, it will replace it with a new entry. This might be good while experimenting with iptables mainly. |
| **-I, –insert** |
| **iptables -I INPUT 1 –dport 80 -j ACCEPT** |
| Insert a rule somewhere in a chain. The rule is inserted at the actual number that we give. In other words, the above example would be inserted at place 1 in the INPUT chain, and hence it would be the absolutely first rule in the chain from now on. |
| **-L, –list** |
| iptables -L INPUT |
| This command lists all the entries in the specified chain. In the above case, we would list all the entries in the INPUT chain. It's also legal to not specify any chain at all. In the last case, the command would list all the chains in the specified table (To specify table, see section Traversing of tables and chains). The exact output is affected by other options sent to the program, for example -n -v etc. |
| **-F, –flush** |
| **iptables -F INPUT** |
| This command flushes the specified chain from all rules and is equivalent to deleting each rule one by one but is quite a bit faster. The command can be used without options, and will then delete all rules in all chains within the specified table. |
| **-Z, –zero** |
| **iptables -Z INPUT** |
| This command tells the program to zero all counters in a specific chain or in all chains. If you've used the -v option with the -L option, you've probably seen the packet counter in the beginning of each field. To zero this packet counter, use the -Z option. This option works the same as -L except that -Z won't list the rules. If -L and -Z is used together (which is legal), the chains will first be listed, and then the packet counters are zeroised. |
| **-N, –new-chain** |
| **iptables -N allowed** |
| This command tells the kernel to create a new chain by the specified name in the specified table. In the above example we create a chain called allowed. Note that there must be no target of the same name previously to creating it. |
| **-X, –delete-chain** |
| **iptables -X allowed** |
| This command deletes the specified chain from the table. For this command to work, there must be no rules that are referring to the chain that's being deleted. In other words, you'd have to replace or delete all rules referring to the chain before actually deleting the chain. If this option is used without any options, all non-builtin chains are deleted from the specified table. |
| **-P, –policy** |
| **iptables -P INPUT DROP** |

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| This command tells the kernel to set a specified default target, or policy, on a chain. All packets that don't match any rule will then be forced to use the policy of the chain. Legal targets are: DROP, ACCEPT and REJECT (Might be more, mail me if so) |
| **-E, –rename-chain** |
| **iptables -E allowed disallowed** |
| The -E command tells iptables to rename the first name of a chain, to the second name. In the example above we would, in other words, change the name of the chain from allowed to disallowed. Note that this will not affect the actual way the table will work. It is, in other words, just a cosmetic change to the table. |

A command should always be specified, unless you just want to list the built-in help for iptables or get the version of the command. To get the version, use the -v option and to get the help message, use the -h option. As usual, in other words. Here comes a few options that can be used together with a few different commands. Note that we tell you with which commands the options can be used and what effect they will have. Also note that we don't tell you any options here that is only used to affect rules and matches. The matches and targets are instead looked upon in a later section of this chapter.

**Table 3-3. Options**

| **Option** |
| --- |
| **Commands used with** |
| **Explanation** |
| **-v, –verbose** |
| **–list, –append, –insert, –delete, –replace** |
| This command shows a verbose output and is mainly used together with the –list command. If used together with the –list command it makes the output from the command include the interface address, rule options and TOS masks. The –list command will also include a bytes and packet counter for each rule if the –verbose option is set. These counters uses the K (x1000), M (x1,000,000) and G (x1,000,000,000) multipliers. To overcome this and to get exact output, you could use the -x option described later. If this option is used with the –append, –insert, –delete or –replace commands, the program will output detailed information on what happens to the rules and if it was inserted correctly etcetera. |
| **-x, –exact** |
| **–list** |
| This option expands the numerics. The output from –list will in other words not contain the K, M or G multipliers. Instead we will get an exact output of how many packets and bytes that has matched the rule in question from the packets and bytes counters. Note that this option is only usable in the –list command and isn't really relevant for any of the other commands. |
| **-n, –numeric** |
| **–list** |

| Option |
| --- |
| **Commands used with** |
| **Explanation** |
| This option tells iptables to output numerical values. IP addresses and port numbers will be printed by using their numerical values and not hostnames, network names or application names. This option is only applicable to the –list command. This option overrides the default of resolving all numerics to hosts and names if possible. |
| **–line-numbers** |
| **–list** |
| The –line-numbers command is used to output line numbers together with the –list command. Each rule is numbered together with this option and it might be easier to know which rule has which number when you're going to insert rules. This option only works with the –list command. |
| **-c, –set-counters** |
| **–insert, –append, –replace** |
| This option is used when creating a rule in some way or modifying it. We can then use the option to initialize the packets and bytes counters of the rule. The syntax would be something like –set-counters 20 4000 and would tell the kernel to set the packet counter to 20 and byte counter to 4000. |
| **–modprobe** |
| All |
| The –modprobe option is used to tell iptables which command to use when probing for modules to the kernel. It could be used if your modprobe command is not somewhere in the searchpath etc. In such cases it might be necessary to specify this option so the program knows what to do in case a needed module is not loaded. This option can be used with all commands. |

## Matches

This section will talk a bit more about the matches. I've chosen to split down the matches into five different subcategories here. First of all the generic matches which are generic and can be used in all rules. Then we have the TCP matches which can only be applied to TCP packets. We have UDP matches which can only be applied to UDP packets and ICMP matches which can only be used on ICMP packets. Finally we have special matches such as the state, owner and limit matches and so on. These final matches has in turn been split down to even more subcategories even though they might not necessarily be different matches at all. I hope this is a reasonable breakdown and that all people out there can understand this breakdown. To be totally honest, a lot of these breakdowns are derived directly from the iptables man page as well as most of the content of this whole chapter, but it has been rewritten quite a lot.

### Generic matches

This section will deal with Generic matches. A generic match is a kind of match that is always available whatever kind of protocol we are working on or whatever match extensions we have loaded. No special parameters are in other words needed to load these matches at all. I have also added the –protocol match here, even though it is

needed to use some protocol specific matches. For example, if we want to use an TCP match, we need to use the –protocol match and send TCP as an option to the match. However, –protocol is in itself a match, too, since it can be used to match specific protocols. These matches are always available.

**Table 3-4. Generic matches**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| **-p, –protocol** |
| **iptables -A INPUT -p tcp** |
| This match is used to check for certain protocols. Examples of protocols are TCP, UDP and ICMP. This list can vary a bit at the same time since it uses the /etc/protocols[1] if it can't recognise the protocol itself. First of all the protocol match can take one of the three aforementioned protocols, as well as as ALL, which means to match all of the previous protocols. The protocol may also take a numeric value, such as 255 which would mean the RAW IP protocol. Finally, the program knows about all the protocols in the /etc/protocols file as we already explained. The command may also take a comma delimited list of protocols, such as udp,tcp which would match all UDP and TCP packets. If this match is given the numeric value of zero (0), it means ALL protocols, which in turn is the default behaviour in case the –protocol match is not used. This match can also be inversed with the ! sign, so –protocol ! tcp would mean to match the ICMP and UDP protocols. |
| **-s, –src, –source** |
| **iptables -A INPUT -s 192.168.1.1** |
| This is the source match which is used to match packets based on their source IP address. The main form can be used to match single IP addresses such as 192.168.1.1. It could be used with a netmask in a bits form. One way is to do it with an regular netmask in the 255.255.255.255 form (ie, 192.168.0.0/255.255.255.0), and the other way is to only specify the number of ones (1's) on the left side of the network mask. This means that we could for example add /24 to use a 255.255.255.0 netmask. We could then match whole IP ranges, such as our local networks or network segments behind the firewall. The line would then look something like, for example, 192.168.0.0/24. This would match all packets in the 192.168.0.x range. We could also inverse the match with an ! just as before. If we would in other words use a match in the form of –source ! 192.168.0.0/24 we would match all packets with a source address not coming from within the 192.168.0.x range. The default is to match all IP addresses. |
| **-d, –dst, –destination** |
| **iptables -A INPUT -d 192.168.1.1** |
| This is the match used to match packets based on their destination address or addresses. It works pretty much the same as the –source match and has the same syntax, except that it matches based on where the packets came from. To match an IP range, we can add a netmask either in the exact netmask form, or in the number of ones (1's) counted from the left side of the netmask bits. It would then look like either 192.168.0.0/255.255.255.0 or like 192.168.0.0/24 and both would be equivalent to eachother. We could also invert the whole match with an ! sign, just as before. –destination ! 192.168.0.1 would in other words mean to match all packets except those coming from the 192.168.0.1 IP address. |

| Command |
| --- |
| Example |
| Explanation |
| **-i, –in-interface** |
| **iptables -A INPUT -i eth0** |
| This match is used to match based on which interface the packet came in. Note that this option is only legal in the INPUT, FORWARD and PREROUTING chains and will render an error message when used anywhere else. The default behaviour of this match, in case the match isn't specified is to assume a string value of "+". The "+" value is used to match a string of letters and numbers. A single "+" would in other words tell the kernel to match all packets without considering which interface it came in on. The + string can also be used at the end of an interface, and eth+ would in other words match all ethernet devices. We can also invert the meaning of this option with the help of the ! sign. The line would then have a syntax looking something like -i ! eth0, which would mean to match all incoming interfaces, except eth0. |
| **-o, –out-interface** |
| **iptables -A FORWARD -o eth0** |
| The –out-interface match is used to match packets depending on which interface it's going out on. Note that this match is only available in the OUTPUT, FORWARD and POSTROUTING chains, in opposite of the –in-interface match. Other than this, it works pretty much the same as the –in-interface match. The "+" extension is understood so you can match all eth devices with eth+ and so on. To inverse the meaning of the match, you can use the ! sign in exactly the same sense as in the –in-interface match. Of course, the default behaviour if this match is left out is to match all devices, regardless of where the packet is going. |
| **-f, –fragment** |
| **iptables -A INPUT -f** |
| This match is used to match the second and third part of a fragmented packet. The reason for this is that in the case of fragmented packets, there is no way to tell the source or destination ports of the fragments, nor ICMP types, among other things. Also, fragmented packets might in rather special cases be used to compile attacks against computers. Such fragments of packets will not be matched by other rules when they look like this, and hence this match. This option can also be used in conjunction with the ! sign, however, in this case the ! sign must precede the match, like this "! -f". When this match is inversed, we match all head fragments and/or unfragmented packets. What this means is that we match all the first fragments of a fragmented packets, and not the second, third, and so on, fragments. We also match all packets that has not been fragmented during the transfer. Also note that there are defragmentation options within the kernel that can be used which are really good. |

## Implicit matches

This section will describe the matches that are loaded implicitly. Implicit matches are loaded automatically when we tell iptables that this rule will match for example TCP packets with the –protocol match. There are currently 3 types of implicit matches that are loaded automatically for 3 different protocols. These are TCP matches, UDP matches and ICMP matches. The TCP based matches contain a set of different matches

that are available for only TCP packets, and UDP based matches contain another set of matches that are available only for UDP packets, and the same thing for ICMP packets. There is also explicitly loaded matches that you must load explicitly with the -m or –match option which we will go through later on in the next section.

### TCP matches

These matches are protocol specific and are only available when working with TCP packets and streams. To use these matches you need to specify –protocol tcp on the command line before trying to use these matches. Note that the –protocol tcp match must be to the left of the protocol specific matches. These matches are loaded implicitly in a sense, just as the UDP and ICMP matches are loaded implicitly. The other matches will be looked over in the continuation of this section, after the TCP match section.

**Table 3-5. TCP matches**

| **Match** |
| --- |
| **Example** |
| **Explanation** |
| **–sport, –source-port** |
| **iptables -A INPUT -p tcp –sport 22** |
| The –source-port match is used to match packets based on their source port. This match can either take a service name or a port number. If you specify a service name, the service name must be in the /etc/services file (look here[1] for an example /etc/services file, or att the appendices) since iptables uses this file to look up the service name in. If you specify the port by port number, the entry of the rule will be slightly faster since iptables don't have to check up the service name, however, it could be a little bit harder to read in case you specify the numeric value. If you are writing a ruleset consisting of a 200 rules or more, you should definitely do this by port numbers since you will be able to notice the difference(On a slow box, this could make as much as 10 seconds in case of a large ruleset consisting of a 1000 rules or so). The –source-port match can also be used to match a whole range of ports in this fashion –source-port 22:80 for example. This example would match all source ports between 22 and 80. If we omit the first port specification, the port 0 is assumed to be the one we mean. –source-port :80 would then match port 0 through 80. And if the last port specification is omitted, port 65535 is assumed. If we would write –source-port 22: we would in turn get a port specification that tells us to match all ports from port 22 through port 65535. If inversed the port specification in port range so the highest port would be first and the lowest would be last, iptables automatically reverses the inversion. If a source port definition looked like –source-port 80:22, it would be understood just the same as –source-port 22:80. We could also invert a match by adding a ! sign like –source-port ! 22 which would mean that we want to match all ports but port 22. The inversion could also be used together with a port range and would then look like –source-port ! 22:80, which in turn would mean that we want to match all ports but port 22 through 80. Note that this match does not handle multiple separated ports and port ranges. For more information about this, look at the multiport match extension. |
| **–dport, –destination-port** |
| **iptables -A INPUT -p tcp –dport 22** |

| Match |
| --- |
| Example |
| Explanation |
| This match is used to match TCP packets depending on its destination port. It uses exactly the same syntax as the –source-port match. It understands port and port range specifications, as well as inversions. It does also reverse high and low ports in a port range specification if the high port went into the first spot and the low port into the last spot. The match will also assume the values of 0 or 65535 if the high or low port is left out in a port range specification. In other words, exactly the same as –source-port in syntax. Note that this match does not handle multiple separated ports and port ranges. For more information about this, look at the multiport match extension. |
| **–tcp-flags** |
| **iptables -p tcp –tcp-flags SYN,ACK,FIN SYN** |
| This match is used to match depending on the TCP flags in a packet. First of all the match takes a list of flags to compare (a mask) and second it takes list of flags that should be set to 1, or turned on. Both lists should be comma-delimited. The match knows about the SYN, ACK, FIN, RST, URG, PSH flags but it also recognizes the words ALL and NONE. ALL and NONE is pretty much selfdescribing, though ALL means to use all flags and NONE means to use no flags for the option it is set. –tcp-flags ALL NONE would in other words mean to check all of the TCP flags and match if none of the flags are set. This option can also be inverted with the ! sign. Also note that the comma delimitation should not include spaces. The correct syntax could be seen in the example above. |
| **–syn** |
| **iptables -p tcp –syn** |
| The –syn match is more or less an old relic from the ipchains days and is still there out of compatibility reasons, and for ease of traversing from one to the other. This match is used to match packets if they have the SYN bit set and the ACK and FIN bits unset. This command would in other words be exactly the same as the –tcp-flags SYN,ACK,FIN SYN match. Such packets are used to request new TCP connections from a server mainly. If you block these packets, you should have effectively blocked all incoming connection attempts, however, you will not have blocked the outgoing connections which a lot of exploits today uses (for example, hack a legit service and then make a program or such make the connect to you instead of setting up an open port on your host). This match can also be inverted with the ! sign in this, "! –syn", way. This would tell the match to match all packet with the FIN or the ACK bits set, in other words packets in an already established connection. |
| **–tcp-option** |
| **iptables -p tcp –tcp-option 16** |
| This match is used to match packets depending on their TCP options. |

### UDP matches

This section describes matches that will only work together with UDP packets. These matches are implicitly loaded when you specify the –protocol UDP match and will be available after this specification. Note that UDP packets are not connection oriented, and hence there is no such thing as different flags to set in the packet to give data

on what the datagram is supposed to do, such as open or closing a connection, or if they are just simply supposed to send data. UDP packets do not require any kind of acknowledgement either. If they are lost, they are simply lost (Not taking ICMP error messaging etcetera into account). This means that there is quite a lot less matches to work with on a UDP packet than there is on TCP packets. Note that the state machine will work on all kinds of packets even though UDP or ICMP packets are counted as connectionless protocols. The state machine works pretty much the same on UDP packets as on TCP packets. There will be more about the state machine in a future chapter.

**Table 3-6. UDP matches**

| **Match** |
|---|
| **Example** |
| **Explanation** |
| **–sport, –source-port** |
| **iptables -A INPUT -p udp –sport 53** |
| This match works exactly the same as its TCP counterpart. It is used to perform matches on packets based on their source UDP ports. It has support for port ranges, single ports and port inversions with the same syntax. To make a UDP port range you could do 22:80 which would match UDP ports 22 through 80. If the first value is omitted, port 0 is assumed. If the last port is omitted, port 65535 is assumed. If the high port comes before the low port, the ports switch place with eachother automatically. Single UDP port matches look as in the example above. To invert the port match, add a ! sign in this, –source-port ! 53 fashion. This would match all ports but port 80. Of course, the match can understand service names as long as they are available in the /etc/services file. For an example /etc/services file, look at the appendices. Note that this match does not handle multiple separated ports and port ranges. For more information about this, look at the multiport match extension. |
| **–dport, –destination-port** |
| **iptables -A INPUT -p udp –dport 53** |
| The same goes for this match as for the UDP version of –source-port, it is exactly the same as the equivalent TCP match, but will work with UDP packets instead. The match is used to match packets based on their UDP destination port. The match handles port ranges, single ports and inversions. To match a single port we do –destination-port 53, to invert this we could do –destination-port ! 53. The first would match all UDP packets going to port 53 while the second would match packets but those going to the destination port 53. To specify a port range, we would do –destination-port 22:80 for example. This example would match all packets destined for UDP port 22 through 80. If the first port is omitted, port 0 is assumed. If the second port is omitted, port 65535 is assumed. If the high port is placed before the low port, they automatically switch place so the low port winds up before the high port. Note that this match does not handle multiple ports and port ranges. For more information about this, look at the multiport match extension. |

## ICMP matches

These are the ICMP matches. These packets are even worse than UDP packets in the sense that they are connectionless. The ICMP protocol is mainly used for error reporting and for connection controlling and such features. ICMP is not a protocol

subordinated to the IP protocol, but more of a protocol beside the IP protocol that helps handling errors. The headers of a ICMP packet is very similar to that of an IP header, but contains differences. The main feature of this protocol is the type header which tells us what the packet is to do. One example is if we try to access an unaccessible IP adress, we would get an ICMP host unreachable in return.For a complete listing of ICMP types, see the ICMP types appendix. There is only one ICMP specific match available for ICMP packets, and hopefully this should suffice. This match is implicitly loaded when we use the –protocol ICMP match and we get access to it automatically. Note that all the generic matches can also be used, so we can know source and destination adress too, among other things.

**Table 3-7. ICMP matches**

| **Match** |
|---|
| **Example** |
| **Explanation** |
| **–icmp-type** |
| **iptables -A INPUT -p icmp –icmp-type 8** |
| This match is used to specify the ICMP type to match. ICMP types can be specified either by their numeric values or by their names. Numerical values are specified in RFC 792. To find a complete listing of the ICMP name values, do a iptables –protocol icmp –help, or check the ICMP types appendix. This match can also be inverted with the ! sign in this, –icmp-type ! 8, fashion. Note that some ICMP types are obsolete, and others again may be "dangerous" for a simple host since they may, among other things, redirect packets to the wrong places. |

## Explicit matches

Explicit matches are matches that must be specifically loaded with the -m or –match option. If we would like to use the state matches for example, we would have to write -m state to the left of the actual match using the state matches. These matches may in turn be specific to some protocols, or was made for testing/experimental use or plainly to show examples of what could be accomplished with iptables. This in turn means that all these matches may not always be useful, however, they should mostly be useful since it all depends on your imagination and your needs. The difference between implicitly loaded matches and explicitly loaded ones is that the implicitly loaded matches will automatically be loaded when you, for example, match TCP packets, while explicitly loaded matches will not be loaded automatically in any case and it is up to you to activate them before using them.

**Table 3-8. MAC matches**

| **Match** | **Example** |
|---|---|
| **Explanation** | |
| **–mac-source** | |
| **iptables -A INPUT –mac-source 00:00:00:00:00:01** | |
| Explanation | |

**Table 3-9. Limit matches**

| **Match** |
| --- |
| **Example** |
| **Explanation** |
| **–limit** |
| **iptables -A INPUT -m limit –limit 3/hour** |
| Explanation |
| **–limit-burst** |
| **iptables -A INPUT -m limit –limit-burst 5** |
| Explanation |

**Table 3-10. Multiport matches**

| **Match** |
| --- |
| **Example** |
| **Explanation** |
| **–source-port** |
| **iptables -A INPUT -p tcp -m multiport –source-port 22,53,80,110** |
| Explanation |
| **–destination-port** |
| **iptables -A INPUT -p tcp -m multiport –destination-port 22,53,80,110** |
| Explanation |
| **–port** |
| **iptables -A INPUT -p tcp -m multiport –port 22,53,80,110** |
| Explanation |

**Table 3-11. Mark matches**

| **Match** |
| --- |
| **Example** |
| **Explanation** |
| **–mark** |
| **iptables -t mangle -A INPUT -m mark –mark 1** |
| Explanation |

**Table 3-12. Owner matches**

| **Match** | **Example** |
| --- | --- |
| **Explanation** | |
| **–uid-owner** | |

| Match | Example |
|---|---|
| **Explanation** | |
| **iptables -A OUTPUT -m owner –uid-owner 500** | |
| Explanation | |
| **–gid-owner** | |
| **iptables -A OUTPUT -m owner –gid-owner 0** | |
| Explanation | |
| **–pid-owner** | |
| **iptables -A OUTPUT -m owner –pid-owner 78** | |
| Explanation | |
| **–sid-owner** | |
| **iptables -A OUTPUT -m owner –sid-owner 100** | |
| Explanation | |

**Table 3-13. State matches**

| Match |
|---|
| **Example** |
| **Explanation** |
| **–state** |
| **iptables -A INPUT -m state –state RELATED,ESTABLISHED** |
| Explanation |

**Table 3-14. Unclean matches**

| Command |
|---|
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-15. TOS matches**

| Match |
|---|
| **Example** |
| **Explanation** |
| **–tos** |
| **iptables -A INPUT -p tcp -m tos –tos 0x16** |
| Explanation |

**Table 3-16. TTL matches**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| **–ttl** |
| **iptables -A OUTPUT -m ttl –ttl 60** |
| Explanation |

## Targets/Jumps

**Table 3-17. ACCEPT target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-18. DROP target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-19. QUEUE target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-20. RETURN target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-21. LOG target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-22. MARK target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-23. REJECT target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-24. TOS target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-25. MIRROR target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-26. SNAT target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-27. DNAT target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-28. MASQUERADE target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Explanation |

**Table 3-29. REDIRECT target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-30. TTL target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

**Table 3-31. ULOG target**

| **Command** |
| --- |
| **Example** |
| **Explanation** |
| Command |
| Example |
| Explanation |

# Chapter 4. Traversing of tables and chains

This chapter will talk about how packets traverse the the different chains and in which order. Also we will speak about in which order the tables are traversed. This is extremely valuable information later on when you write your own specific rules. We will also look at which points certain other parts that also are kernel dependant gets in the picture. With this we mainly mean the different routing decisions and so on. This is especially necessary if you want to write rules with iptables that chould change how different packets get routed, good examples of this is DNAT and SNAT and of course the TOS bits.

## General

When a packet first enters the firewall, it hits the hardware and then get's passed on to the proper device driver in the kernel. Then the packet starts to go through a series of steps in the kernel before it is either sent to the correct application (locally), or forwarded to another host or whatever happens to it. In this example, we're assuming that the packet is destined for another host on another network. The packet goes through the different steps in the following fashion:

**Table 4-1. Forwarded packets**

| Step | Table | Chain | Comment |
|---|---|---|---|
| 1 | | | On the wire(ie, internet) |
| 2 | | | Comes in on the interface(ie, eth0) |
| 3 | mangle | PREROUTING | This chain is normally used for mangling packets, ie, changing TOS and so on. |
| 4 | nat | PREROUTING | This chain is used for Destination Network Address Translation mainly. Source Network Address Translation is done further on. Avoid filtering in this chain since it will be passed through in certain cases. |
| 5 | | | Routing decision, ie, is the packet destined for our localhost or to be forwarded and where. |

| Step | Table | Chain | Comment |
|---|---|---|---|
| 6 | filter | FORWARD | The packet got routed onto the FORWARD chain, only forwarded packets go through here, we do all the filtering here. Note that all traffic that's forwarded goes here, so you need to think about it when writing your ruleset. |
| 7 | nat | POSTROUTING | This chain should first and foremost be used for Source Network Address Translation, avoid doing filtering here since certain packets might pass this chain without ever hitting it. This is also where Masquerading is done. |
| 8 | | | Goes out on the outgoing interface (ie, eth1). |
| 9 | | | Out on the wire again (ie, LAN). |

As you can see, there's quite a lot of steps to pass through. The packet can be stopped at any of the iptables chains, or anywhere else in case it's malformed, however, we're mainly interested in the iptables aspect of this lot. However, do note that there is no specific chains or tables for different interfaces or anything like that. FORWARD is always passed by all packets that's being forwarded over this firewall/router. Now, let's have a look at a packet that's destined for our own localhost. It would pass through the following steps before actually being delivered to our application to receive it:

**Table 4-2. Destination localhost**

| Step | Table | Chain | Comment |
|---|---|---|---|
| 1 | | | On the wire (ie, Internet) |
| 2 | | | Comes in on the interface(ie, eth0) |
| 3 | mangle | PREROUTING | This chain is normally used for mangling packets, ie, changing TOS and so on. |

| Step | Table | Chain | Comment |
|---|---|---|---|
| 4 | nat | PREROUTING | This chain is used for Destination Network Address Translation mainly. Avoid filtering in this chain since it will be passed through in certain cases. |
| 5 | | | Routing decision, ie, is the packet destined for our localhost or to be forwarded and where. |
| 6 | filter | INPUT | This is where we do filtering for all incoming traffic destined for our localhost. Note that all incoming packets destined for this host passes through this chain, no matter what interface and so on it came from. |
| 7 | | | Local process/application (ie, server/client program) |

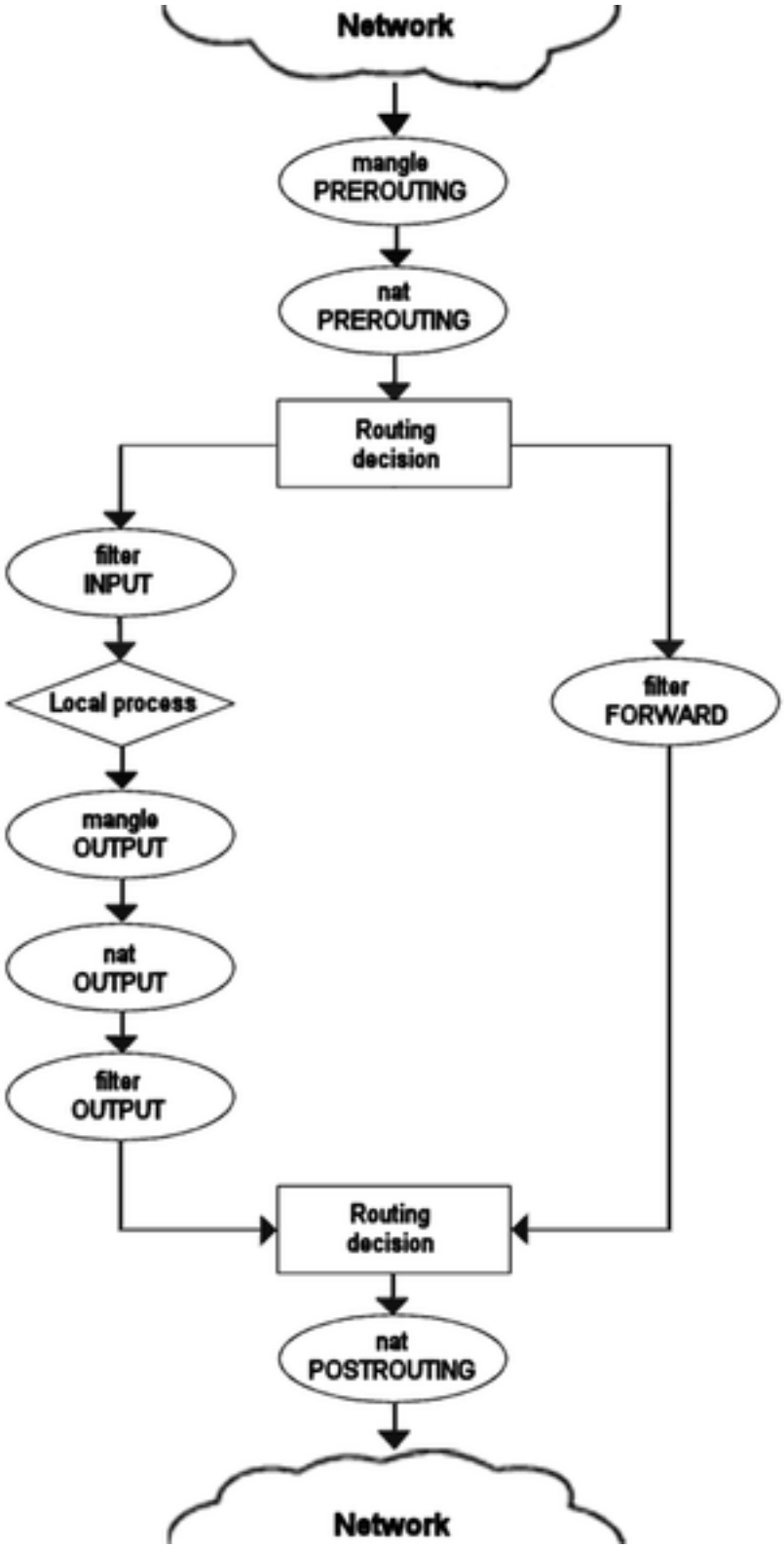
Note that this time the packet was passed through the INPUT chain instead of the FORWARD chain. Quite logical. Most probably the only thing that's really logical about the traversing of tables and chains in your eyes in the beginning, but if you continue to dig in it, I think it gets clearer with time. I think. Finally we look at the outgoing packets from our own localhost and what steps they go through.

**Table 4-3. Source localhost**

| Step | Table | Chain | Comment |
|---|---|---|---|
| 1 | | | Local process/application (ie, server/client program) |
| 2 | Mangle | OUTPUT | This is where we mangle packets, it is suggested that you don't do filtering in this chain since it can have sideeffects. |

| Step | Table | Chain | Comment |
|---|---|---|---|
| 3 | Nat | OUTPUT | This is currently broken, could someone tell me when this will be fixed? Please? |
| 4 | Filter | OUTPUT | This is where we filter packets going out from localhost. |
| 5 | | | Routing decision. This is where we decide where the packet should go. |
| 6 | Nat | POSTROUTING | This is where we do Source Network Address Translation as described earlier. It is suggested that you don't do filtering here since it can have sideeffects, and certain packets might slip through even though you set a default policy of DROP. |
| 7 | | | Goes out on some interface (ie, eth0) |
| 8 | | | On the wire (ie, Internet) |

We've now seen how the different chains are traversed in 3 separate scenarios. If we would figure out a good map of all this, it would look something like this:




Hopefully you got a clearer picture of how the packets traverses the built in chains now. All comments welcome, this might still be wrong or it might change in the fu-

ture. For more information use this script available at http://people.unix-fu.org/andreasson/iptables-tutorial/rc.test-iptables.txt[1].

## Mangle table

This table should as we've already noted mainly be used for mangling packets. In other words, you may freely use the mangle matches etc that could be used to change TOS (Type Of Service) fields and so on. However, it's strongly adviced that you don't use this table to do any filtering in, nor will any DNAT, SNAT or Masquerading work in this table. Target's that only valid in the mangle table:

TOS
TTL
MARK

The TOS target is used to set and/or change the Type of Service field in the packet. This could be used for setting up policies on the network regarding how a packet should be routed and so on. Note that this isn't really used on the internet and most of the routers don't care about the value in this field, and sometimes, they act faulty on what they get. Don't set this in other words for packets going to the internet unless you want to do routing decisions on it with iproute2.

The TTL target is used to change the TTL (Time To Live) field of the packet. We could tell packets to only have a specific TTL and so on. Someone give me a good reason to use this please?=).

The MARK target is used to set special mark values to the packet. These marks could then be recognised by the iproute2 programs to do different routing on the packet depending on what mark they have, or if they don't have any. We could also do bandwidth limiting and Class Based Queuing with this target.

## Nat table

This table should only be used for NAT (Network Address Translation) on different packets. In other words, it should only be used to translate packets source field or destination field. Note that, as we have said before, only the first packet in a stream will hit this chain. After this, the rest of the packets will automatically have the same action taken on them as the first packet. The actual targets that does these kind of things are

DNAT
SNAT
MASQUERADE

The DNAT (Destination Network Address Translation) target is mainly used in cases such as when you have one IP and want to redirect accesses to the firewall to some other host on a DMZ for example. In other words, we change the destination address of the packet and reroute it to some other host.

SNAT (Source Network Address Translation) is mainly used for changing the source address of packets. This is mainly done to hide our local networks or DMZ etc. A good example when this is very good is when we have a firewall that we know the outside IP address of, but need to change our local networks IP numbers to the same of the IP of our firewall. The firewall will with this target automatically De-SNAT and SNAT the packets, hence making it possible to make connections from the LAN to the Internet. If you're network uses 192.168.x.x netmask for example, the packets

would never get back from the Internet because these networks are regulated to be used in LAN's by IANA and RFC's.

The MASQUERADE target is used in exactly the same way as SNAT, but it takes a little bit more overhead to compute. The reason for this is that each time it runs, it automatically checks for the IP address to use, instead of doing as the SNAT target does and just use an IP address submitted while the rule was parsed. This target will on the other hand work properly with Dynamic IP addresses that you may be provided when you connect to the Internet with, for example ppp, slip or dhcp.

## Filter table

The filter table is, of course, mainly used for filtering packets. We can match packets and filter them however we want, and there's nothing special to this chain or special packets that might slip through because they're malformed, etc. This is the place that we actually take action against packets and look at what they contain and DROP/ACCEPT depending on their payload. Of course we may do filtering earlier too, however, this is the place that was designed for it. Almost all targets are usable in this chain, however, the targets discussed previously in this chapter are only usable in their respective tables. We will not go into deeper discussion about this chain though, as you already know, this is where we (should) do the main filtering.

## Notes

1. http://people.unix-fu.org/andreasson/iptables-tutorial/rc.test-iptables.txt

# Chapter 5. rc.firewall file

This chapter will deal with an example firewall setup and how the script file would look. We've used one of the basic setups and dug deeper into how it works and what we do in it. This should be used to get a basic idea on how to solve different problems and what you may need to think about before actually putting your scripts into work. It could be used as is with some changes to the variables, but is not suggested since it may not work perfectly together with your network setup. As long as you have a very basic setup however, it will very likely run perfectly with just a few fixes to it. Also note that there might be more coding efficient ways of making the rules, however, the script's been written for readability so that everyone can understand it without having to know BASH scripting beforehand.

## example rc.firewall

OK, so you've got everything set up and are ready to check out an example `rc.firewall` file, or at least you should be. This example `rc.firewall`[1] (also included as appendix) is large and has lots of comments in it so look at that and then come back here for more explanations.

## explanation of rc.firewall

### Initial loading of extra modules

First, we see to it that the module dependencies files are up to date by issuing an **/sbin/depmod -a** command. After this we load some modules that we might be interested in. For example, if you want to have support for the , `REJECT` and `MASQUERADE` targets and don't have this compiled statically into your kernel, we load these modules.

Next is the option to load `ipt_owner` module, for example only allowing certain users to make certain connections etc. I will not use that in this example but basically, you could allow only `root` to do `FTP` and `HTTP` connections to redhat and `DROP` all the others. Or you could disallow all users but your own user and root to connect from your box to the Internet, might be boring for others, but you will be a bit more secure to bouncing hacker attacks etc.

After this there is the first part used by our state matching filters, the loading of `ip_conntrack_ftp` and `ip_conntrack_irc`. To do what I preached in the beginning of this file, namely doing state matching, disallowing for example passive `FTP` but allowing `DCC` sends to work, we load only the `ip_conntrack_ftp` module, but not the `ip_conntrack_irc` module. For this to work, these two must *not* be compiled into the kernel, i repeat, must *not*. For the vice versa, where we want passive `FTP` to work, but not `DCC` send, we do it the other way around of course, load the `IRC` module, but not the `FTP` module. What this does, is that it adds the ability to the kernel to recognize for example a passive `FTP` connection that is related to a currently active `FTP` control session, but since the `IRC` module is not loaded, the kernel will not know how to recognize if it's related to any currently active stream, and hence it will not allow these connections. If you do it the other way around, the opposite will be in effect.

## Initiating the kernel for IP forwarding and others

After this we start the IP forwarding by echoing a 1 to /proc/sys/net/ipv4/ip_forward in this fashion :

**echo "1" > /proc/sys/net/ipv4/ip_forward**

In case you need dynamic IP support, for example if you use SLIP, PPP or DHCP you may enable the next option, ip_dynaddr by doing the following :

**echo "1" > /proc/sys/net/ipv4/ip_dynaddr**

etc, if there's any other options you might need to turn on you should follow that style, there's other documentations on how to do these things and this isn't either what this document is supposed to help you with.

## Actually starting the masquerading

So, our first mission would be to get the MASQUERADEing up, correct? Well, at least to me. First of all we add a rule to the nat table, in the POSTROUTING chain that will masquerade all packets going out on our interface connected to the Internet. For me this would be eth0, **-t** tells us which table to use, in this case nat, **-A** tells us that we want to Add a new rule to an existing chain named POSTROUTING and **-o eth0** tells us to match all outgoing packets on eth0 and finally we target the packet for MASQUERADE'ing. So all packets that match this rule will be masqueraded to look as it came from your Internet interface. Simple, isn't it?=)

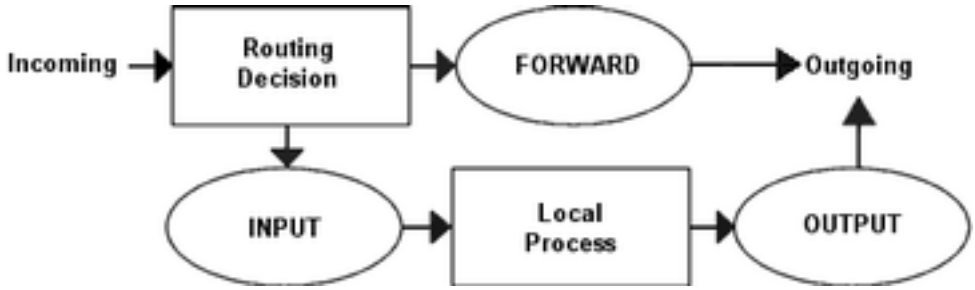
The next step we take is to ACCEPT all packets traversing the FORWARD chain in the default table filter that come from the input interface eth1 which is my interface connecting to the internal network. All packets that are being forwarded on our box traverse the FORWARD chain in the filter table.

The next thing we do is to ACCEPT all packets from anywhere that are ESTABLISHED and/or RELATED to some connection. In other words, we first send a packet from our local box behind eth1, and since it comes from eth1 we ACCEPT it, then when the Internet box replies, it gets caught by this rule since the connection has seen packets in both directions.

The last thing we do is to log all traffic that gets dropped over the border, and hits the default policy. In some cases these might be packets that should have gotten through but didn't, in other cases it might be packets that definitely shouldn't get through and you want to be notified about this. We allow this rule to be matched a maximum of 3 times per minute with a burst limit of 3. This means we get maximally 3 log entries per minute from this specific line, and the burst is also set to 3 so if we get 3 log entries in 2 seconds, it'll have to wait for another 1 minute for the next log entry. This is good if someone starts to flood you with crap stuff that otherwise would generate many megabytes of logs. We also set a prefix to the log with the **–log-prefix** and set the log level with the **–log-level**. Log level tells the **syslogd**, or logging facility what kind of importance this log entry has.

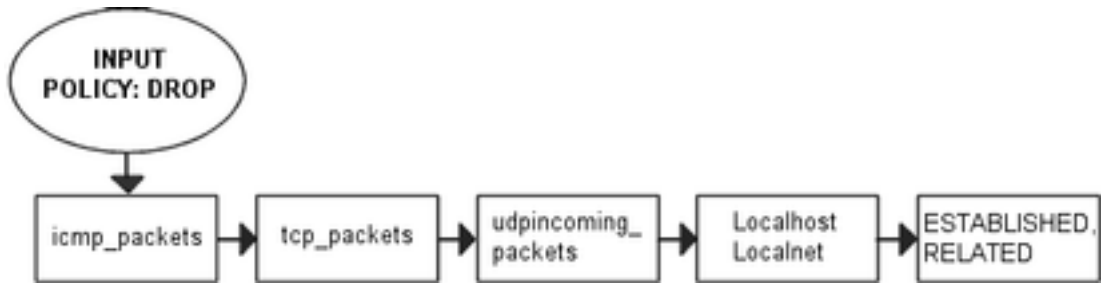
## Displacement of rules to different chains

I've displaced all the different chains in the fashion I've done to save as much CPU as possible but at the same time put the main weight on security. Instead of letting a TCP packet traverse ICMP, UDP and TCP rules, I just simply match all TCP packets and then let the TCP packet traverse another chain. This way we don't get too much overhead out of it all. The following picture will try and explain the basics of how an incoming packet traverses netfilter. This picture was pretty much stolen straight off from the packet-filtering-HOWTO[2].




First a routing decision is made, if it's destined for your host, it's sent to `INPUT`, if it's destined for some box on the localnet it's sent to `FORWARD`. Then they traverse whichever of those chains. When and if your local box replies to the packets destined for the server, they will traverse the `OUTPUT` chain.

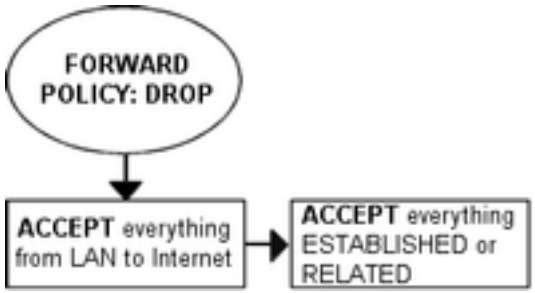
Here is a picture of how they would traverse the `INPUT` and `FORWARD` and `OUTPUT` chains separately since the picture would be way to large if we would fit them all together in one :




When a packet hits the `INPUT` chain, it will first be checked to see if it's an `ICMP` packet, if it is, it's sent to `icmp_packets` and checked if it's allowed or not. If it is, we just drop out of the `INPUT` chain and tell it to `ACCEPT` the packet. If it is not, it will reach the end of the `icmp_packets` chain get back to `INPUT` chain and reach the end with some more checks to see if it's from localhost or localnet, if it is it will be `ACCEPT`'ed. Finally we check to see if the packet somehow belongs to any other connection by checking if it is part of an `ESTABLISHED` or `RELATED` connection, in this case we should `ACCEPT` them. If it doesn't match anything, it will finally hit the chain policy which is set to `DROP` everything that reaches it.

If the packet would instead be a `TCP` packet, it would not match the rule as an `ICMP` packet and hence be sent to the next rule which checks for `TCP` packets. Since it is a `TCP` packet it will match and be sent to the `tcp_packets` chain. Here we will check if it's destined for one of the ports we'd like to allow or not, if it is, we send it on to the allowed chain to do some final checks on it. If it fails at some stage in this check, it'll be passed down to the `INPUT` chain and traverse the same way as the `ICMP` packet did.

`UDP` packets do the same basically, except they will traverse the `udpincoming_packets` chain, and if it fails to match any of the rules in there, it will be passed down to the `INPUT` chain and travel the same way as all the `TCP` and `ICMP` packets.




If the packet is destined to or from our local net it will be routed to the `FORWARD` chain. If the packet comes from our LAN we will just `ACCEPT` it as it is, no more, no less. If we would like to, we could only accept `SYN` packets, but I'm skipping that as it is now. If the packet is destined to our local net on the other hand, we only match packets in `ESTABLISHED` or `RELATED` streams since we don't want hosts from the outside to be able to establish new connections to our LAN. If none of these rules are matched the packet gets `DROP`'ed by our chain policy.


This chain is rather straight forward. We allow everything from localhost to go out, we allow everything from our own local network's ip to go out, and last of all we allow everything from our own ip to go out to the internet. You might want to just erase all this in certain cases, just dont forget to erase the default policy of the `OUTPUT` chain which is set to `DROP` everything.

## Setting up the different chains used

So, now you've got a small picture how the packet traverses the different chains and how they belong together, we'll take care of setting it all up.

First of all, we set all the default policies on the different chains with a quite simple command.

**iptables -P <chain name> <policy>**

The default policy is used every time the packets don't match a rule in the chain. After this, we create the different special chains that we want to use with the **-N** command. The new chains are created and set up with no rules inside of them. The chains we will use are `icmp_packets`, `tcp_packets`, `udpincoming_packets` and the allowed chain for `tcp_packets`. Incoming packets on eth0, of `ICMP` type, will be redirected to the chain `icmp_packets`, of `TCP` type, will be redirected to `tcp_packets` and incoming packets of `UDP` type from eth0 go to `udpincoming_packets` chain.

## PREROUTING chain of the nat table

The PREROUTING chain is pretty much what it says, it does network adress translation on packets before they actually hit the routing tables that sends them onwards to the INPUT or FORWARD chains in the filter table. Note that this chain should not be used for any filtering or such, it should be used for network adress translation, among other things since this chain is only traversed by the first packet in a stream.

First of all we check for obviously spoofed `IP` addresses, such as in case we get packets from the Internet interface that claim to have a source `IP` of 192.168.x.x, 10.x.x.x or 172.16.x.x, in such case, we drop them quicker than hell since these `IP`'s are reserved especially for local intranets and definitely shouldn't be used on the Internet. This might be used in the opposite direction, too, if we get an packet from `$LAN_IFACE` that claims to *not* come from an `IP` address in the range which we know that our LAN is on, we might drop that too. As it looks now, we don't do that though.

## INPUT chain

The `INPUT` chain as I've written it uses mostly other chains to do the hard work. This way we don't get too much load from the iptables, and it will work much better on slow machines which might otherwise drop packets at high loads.

We do certain checks for bad packets here. If you want to fully understand this, you need to look at the Appendices regarding state NEW and non-SYN packets getting through other rules. These packets could be allowed under certain circumstances but in 99% of the cases we wouldn't want these packets to get through. Hence, we log them to our logs and then we DROP them.

First of all we match all `ICMP` packets in the `INPUT` chain that come on the incoming interface `$INET_IFACE`, which in my case is eth0, and send those to the `icmp_packets`, which was previously described. After this, we do the same match for `TCP` packets on the `$INET_IFACE` and send those to the `tcp_packets` chain, and after this all `UDP` packets get sent to `udpincoming_packets` chain.

Finally, we check for everything that comes from our `$LOCALHOST_IP`, which would normally be 127.0.0.1 and `ACCEPT` all incoming traffic from there, do the same for everything to `$LAN_IP`, which in my case would be 192.168.0.0/24, and after this, something that some might consider a security problem, I allow everything that comes from my own Internet `IP` that is either `ESTABLISHED` or `RELATED` to some connection. Also, we allow broadcast traffic from our LAN, some applications depend on it such as Samba etc. These applications will not work properly without it.

Before we hit the default policy of the `INPUT` chain, we log it so we might be able to find out about possible problems and or bugs. Either it might be a packet that we just dont want to allow or it might be someone who's doing something bad to us, or finally it might be a problem in our firewall not allowing traffic that should be allowed. In either case we want to know about it so it can be dealt with. Though, we don't log more than 3 packets per minute as to not getting flooded with crap all over the log files, also we set a prefix to all log entries so we know where it came from.

Everything that hasn't yet been caught will be `DROP`'ed by the default policy on the `INPUT` chain. The default policy was set quite some time back, as you might remember.

## The TCP allowed chain

If a packet comes in on eth0 and is of `TCP` type, it travels through the `tcp_packets` chain, if the connection is against an allowed port, we want to do some final checks

on it to see if we actually do want to allow it or not.

First of all, we create the chain the same way as all the others. After that, we check if the packet is a SYN packet. If it is a SYN packet, it is most likely to be the first packet in a new connection so, of course, we allow this. Then we check if the packet comes from an ESTABLISHED or RELATED connection, if it does, then we, again of course, allow it. An ESTABLISHED connection is a connection that has seen traffic in both directions, and since we've got a SYN packet, and a reply to this SYN packet, the connection then must be in state ESTABLISHED. The last rule in this chain will DROP everything else. In this case this pretty much means everything that hasn't seen traffic in both directions, ie, we didn't reply to the SYN packet, or they are trying to start the connection with a non SYN packet. There is *no* practical use of not starting a connection with a SYN packet, except to portscan people pretty much. There is no currently available TCP/IP implementation that supports opening a TCP connection with something else than a SYN packet to my knowledge, hence, DROP the crap since it's 99% sure to be a portscan.

## The ICMP chain

This is where we decide what ICMP types to allow. If a packet of ICMP type comes in on eth0 on the INPUT chain, we then redirect it to the icmp_packets chain as explained before. Here we check what kind of ICMP types to allow. As it is now, I only allow incoming ICMP Echo Replies, Destination unreachable, Redirect and Time Exceeded.

The reason that I allow these ICMP packets are as follows, Echo Replies is what you get for example when you ping another host, if we don't allow this, we will be unable to ping other hosts.

Destination Unreachable is used if a certain host is unreachable, so for example if we send a HTTP request, and the host is unreachable, the last gateway that was unable to find the route to the host replies with a Destination Unreachable telling us that it was unable to find it. This way we won't have to wait until the browser's timeouts kicks in after some 60 seconds or more.

Time Exceeded, is allowed in the case where we might want to traceroute some host or if a packet gets its Time To Live set to 0, we will get a reply about this. For example, when you traceroute someone, you start out with TTL = 1, and it gets down to 0 at the first hop on the way out, and a Time Exceeded is sent back from the first gateway en route to the host we're trying to traceroute, then TTL = 2 and the second gateway sends Time Exceeded, and so on until we get an actual reply from the host we finally want to get to.

For a complete listing of all ICMP types, see the appendix ICMP types. For more information on ICMP types and their usage, i suggest reading the following documents and reports :

- The Internet Control Message Protocol ICMP[3]
- RFC792[4] - By J. Postel

As a side-note, I might be wrong in blocking some of these ICMP types for you, but in my case, everything works perfectly while blocking all the other ICMP types that I don't allow.

## The TCP chain

So now we reach TCP connections. This specifies what ports that are allowed to use on the firewall from the Internet. Though, there is still more checks to do, hence we send each and one of them on to allowed chain, which we described previously.

-A tcp_packets tells **iptables** in which chain to add the new rule, the rule will be added to the end of the chain. **-p TCP** tells it to match `TCP` packets and **-s 0/0** matches all source addresses from 0.0.0.0 with netmask 0.0.0.0, in other words *all* sources addresses, this is actually the default behaviour but I'm using it for brevity in here. **–dport 21** means destination port 21, in other words if the packet is destined for port 21 they also match. If all the criteria are matched, then the packet will be targeted for the allowed chain. If it doesn't match any of the rules, they will be passed back to the original chain that sent the packet to the `tcp_packets` chain.

As it is now, I allow TCP port 21, or FTP control port, which is used to control FTP connections and later on I also allow all RELATED connections, and that way we allow PASSIVE and PORT connections since the ip_conntrack_ftp module is, hopefully, loaded. If we don't want to allow FTP at all, we can unload the ip_conntrack_ftp module and delete the **$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 21 -j allowed** line from the `rc.firewall.txt` file.

Port 22 is SSH, much better than allowing telnet on port 23, if you want to allow anyone from the outside to use a shell on your box at all. Note that you are dealing with a firewall. It is always a bad idea to give others than yourself any kind of access to these kind of boxes. Firewalls should always be kept to a bare minimum and not more.

Port 80 is HTTP, in other words your web server, delete it if you don't want to run a web server on your site.

And finally we allow port 113, which is IDENTD and might be necessary for some protocols like IRC, etc to work properly.

If you feel like adding more open ports with this script, well, its quite self explanatory how to do that by now=).

## The UDP chain

If we do get a UDP packet on the INPUT chain, we send them on to udpincoming_packets where we once again do a match for the UDP protocol with **-p UDP** and then match everything with a source address of 0.0.0.0 and netmask 0.0.0.0, in other words everything again. If they have a source port of 53 also, we ACCEPT them directly.

As it is now, I ACCEPT incoming UDP packets from port 53, which is what we use to do DNS lookups, without this we wouldn't be able to do domain name lookups and we would be reversed to only use IP's. We don't want this behaviour, hence we allow DNS, of course.

I personally also allow port 123, which is NTP or network time protocol. This protocol is used to set your computer clock to the same time as certain other time servers which have *very* accurate clocks. Though, most of you probably don't use this protocol, I'm allowing it per default since I know there are some who actually do.

We currently also allow port 2074, which is used for certain real-time 'multimedia' applications like speak freely which you can use to talk to other people in real-time by using speakers and a microphone, or even better, a headset.

Port 4000 is the ICQ protocol. This should be an extremely well known protocol that is used by the Mirabilis application named ICQ. There is at least 5 different ICQ clones

for Linux and it's one of the most widely used chat programs in the world. I doubt there is any further need to explain what it is.

### OUTPUT chain

Since i know that there's pretty much no one but me using this box which is partially used as a Firewall and a workstation currently, I allow pretty much everything that goes out from it that has a source address `$LOCALHOST_IP`, `$LAN_IP` or `$STATIC_IP`. Everything else might be spoofed in some fashion, even though I doubt anyone that I know would do it on my box. Last of all we log everything that gets dropped. If it does get dropped, we'll sure as hell want to know about it for some reason or another. Either it's a nasty error, or it's a weird packet that's spoofed. Finally we `DROP` the packet in the default policy.

### FORWARD chain

Even though I haven't actually set up a certain section in the `rc.firewall` example file, I would like to comment on the few lines in there anyways. As it is now, we first of all `ACCEPT` all packets coming from our LAN with the following line :

**/usr/local/sbin/iptables -A FORWARD -i $LAN_IFACE -j ACCEPT**

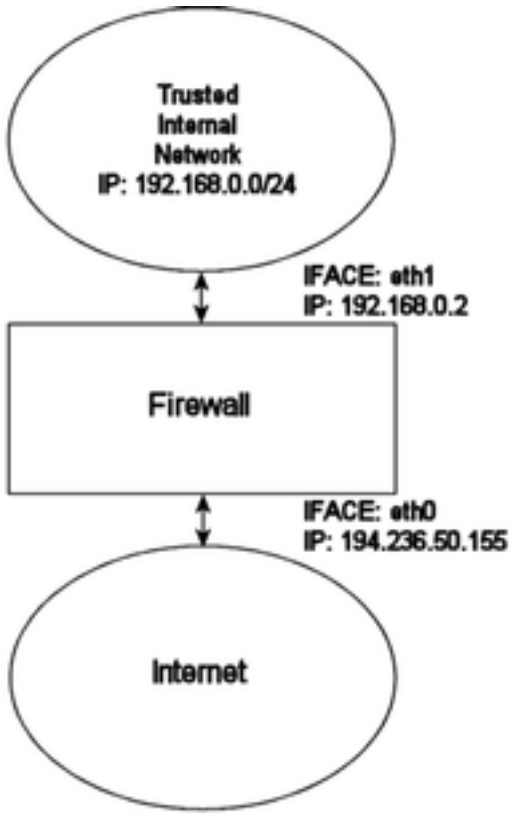
So everything from our Localnet's interface gets `ACCEPT`'ed whatever the circumstances. After this we allow everything in a state `ESTABLISHED` or `RELATED` from everywhere, in other words, if we open a connection from our LAN to something on the Internet, we allow the packets coming back from that site that's either `ESTABLISHED` or `RELATED` but nothing else. And after this we log everything and drop it. We log maximally 3 log entries per minute as to not flood our own logs, and prefix them with a short line that is possible to grep for in the logfiles. Also we log them with debug level. We finally hit the default policy of the `FORWARD` chain that says to `DROP` everything.

## Notes

1. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.firewall.txt
2. http://netfilter.samba.org/unreliable-guides/packet-filtering-HOWTO/index.html
3. http://www.ee.siue.edu/~rwalden/networking/icmp.html
4. ftp://sunsite.unc.edu/pub/docs/rfc/rfc792.txt

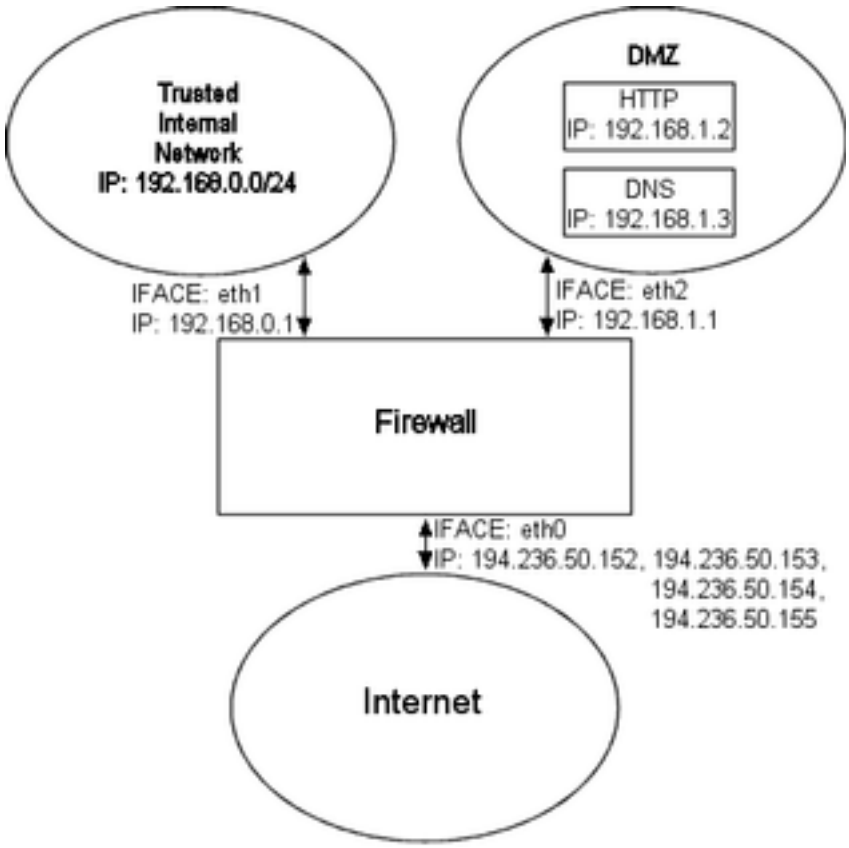
# Chapter 6. Example scripts

## rc.firewall.txt




This is the script that the whole tutorial bases its text on. To find the script go here, rc.firewall.txt[1]. In other words I hope I won't have to write very much about it. Mainly it was written for a two way homed network. For example, where you have one LAN and one Internet Connection. This script also makes the assumption that you have a static IP to the Internet, and hence don't use DHCP, PPP, SLIP or some other protocol that assigns you an IP.

## rc.DMZ.firewall.txt




You will find this script at the following place URL, rc.DMZ.firewall.txt[2]. This script was written for those people out there that has one trusted internal network, one De-Militarized Zone and one Internet connection. The De-Militarized Zone is in this case 1-to-1 NAT'ed and requires you to do some IP aliasing on your firewall, ie, you must make the box recognise packets for more than one IP. In the future you will find examples on how to do IP aliasing in this tutorial, for now, you won't get any practical examples though.

You need to have 2 internal networks with this script as you can see from the picture. One uses IP range 192.168.0.0/24 and consists of a Trusted Internal Network. The other one uses IP range 192.168.1.0/24 and consists of the De-Militarized Zone which we will do 1-to-1 NAT to. If someone from the internet sends a packet to our DNS_IP, then we use DNAT, which stands for Destination Network Adress Translation, to send the packet on to our DNS on the DMZ. When the DNS sees our packet, the packet will be destined for the actual DNS internal network IP, and not for our external DNS IP. If the packet wouldn't have been translated, the DNS wouldn't have answered the packet. We will show a short example of how the DNAT code looks:

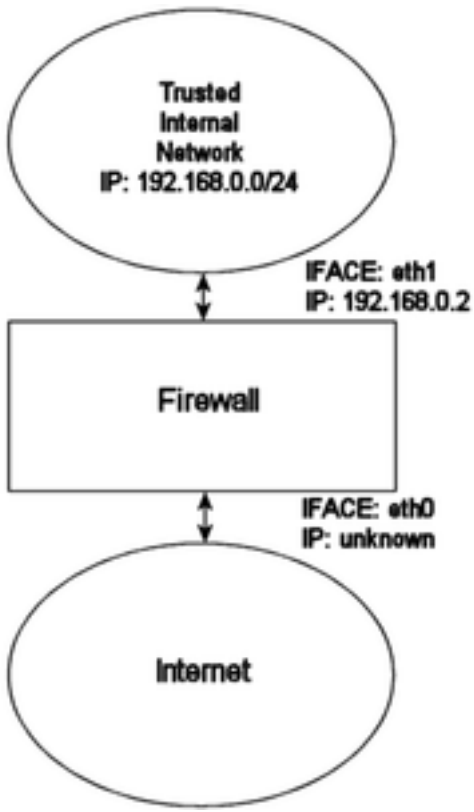
$IPTABLES -t nat -A PREROUTING -p TCP -i $INET_IFACE -d $DNS_IP –dport 53 -j DNAT –to-destination $DMZ_DNS_IP

First of all, DNAT can only be performed in the PREROUTING chain of the nat table. Then we look for TCP protocol on our $INET_IFACE with destination IP that matches our $DNS_IP, and is directed to port 53, which is the TCP port for zone transfers in DNS's. If we actually get such a packet we give a target of DNAT, in other words Destination NAT. After that we specify where we want the packet to go with the –to-destination option and give it the value of $DMZ_DNS_IP, in other words the

IP of the DNS on our DMZ. This is how basic DNAT works. When the reply to the DNAT'ed packet is sent through the firewall, it automatically gets un-DNAT'ed.

By now you should have enough understanding of how everything works to be able to understand this script pretty well without any huge complications. If there is something you don't understand, that hasn't been gone through in the rest of the tutorial, mail me since It's probably a fault on my side.

## rc.DHCP.firewall.txt




This script is pretty much identical to the original rc.firewall.txt. You will find this script at http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.DHCP.firewall.txt[3]. However, this script no longer uses the STATIC_IP variable. The reason is that this won't work together with a dynamic IP connection. The actual changes needed to be done to the original script is minimal, however, I've had some people mail me and ask about the problem so this script will be a good solution for you. This script will allow people who uses DHCP, PPP and SLIP connections to connect to the internet.

The main changes done to the script consists of erasing the STATIC_IP variable as I already said and deleting all referenses to this variable. Instead of using this variable the script now does it's main filtering on the variable INET_IFACE. In other words -d $STATIC_IP has been changed to -i $INET_IFACE. This is pretty much the only changes made and that's all that's needed really.

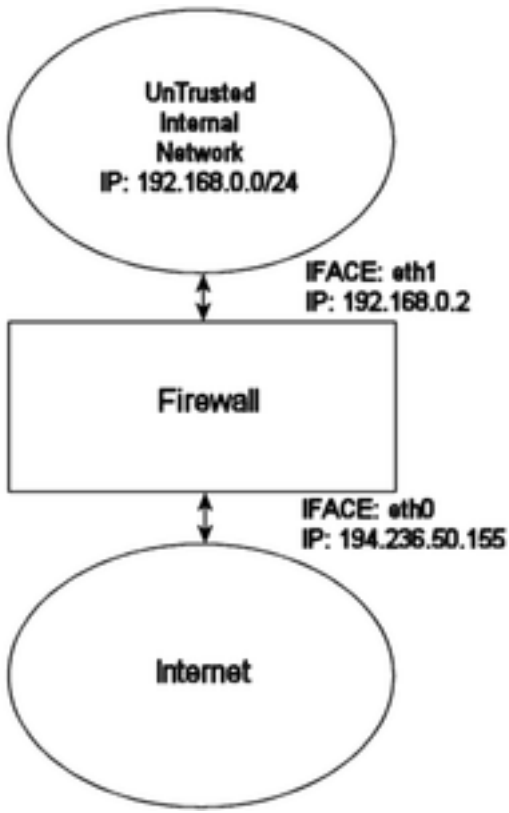
There is some more things to think about though. We can no longer filter in the INPUT chain depending on, for example, –in-interface $LAN_IFACE –dst $INET_IP. This in turn forces us to filter only based on interfaces in such cases where the internal machines must access the internet adressable IP. One great example is if we are

running an HTTP on our firewall. If we go to the main page, which contains static links back to the same host, which could be some dyndns solution, we would get a real hard trouble. The NAT'ed box would ask the DNS for the IP of the HTTP server, then try to access that IP. In case we filter based on interface and IP, the NAT'ed box would be unable to get to the HTTP because the INPUT chain would DROP the packets flat to the ground. This also applies in a sense to the case where we got a static IP, but in such cases it could be gotten around by adding rules which checks the LAN interface packets for our INET_IP, and if so ACCEPT them.

As you may read from above, it may be a good idea to grab a script, or write one, that handles dynamic IP in a better sense. We could for example make a script that grabs the IP from ifconfig and adds it to a variable, upon bootup of the internet connection. A good way to do this, would e to use for example the ip-up scripts provided with pppd and some other programs. For a good site, check out the linuxguruz.org iptables site which has a huge collection of scripts available to download.

NOTE: This script might be a bit less secure than the rc.firewall.txt script. I would definitely advise you to use that script if at all possible since this script is more open.

## rc.UTIN.firewall.txt




The script is available from http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.UTIN.firewall
This script will in contrast to the other scripts block the LAN that's sitting behind us. In other words, we don't trust anyone on any networks we connect to. We also disallow people on our LAN to do anything but specific tasks on the Internet. The only things we actually allow is POP3, HTTP and FTP access to the internet. We also don't trust the internal users to access the firewall more than we trust users on the Internet.

This script follows the golden rule to not trust anyone, not even our own employees. This is a sad fact, but a large part of the hacks and cracks that a company gets hit by is a matter of people from their own staff doing the bad thing. This script will hopefully give you some clues as to what you can do with your firewall to strengthen it up. It's not very different from the original rc.firewall.txt script, but it does give a few hints at what we would normally let through etc.

## rc.test-iptables.txt

The rc.test-iptables.txt script is available here[5]. This script can be used to test all the different chains, but it might need some tweaking depending on your configuration, such as turning on ip_forwarding, and setting up masquerading etc. It will work for mostly everyone though who has all the basic set up and all the basic tables loaded into kernel. All it really does is set some LOG targets which will log ping reply's and ping requests. This way, you will get information on which chain was traversed and in which order. For example, run this script and then do:

**ping -c 1 host.on.the.internet**

And **tail -n 0 -f /var/log/messages** while doing this command. This should show you all the different chains used etc.

Note that this script was written for testing purposes only. In other words, it's not a good idea to have rules like this that logs everything of one sort since your log partitions might get filled up quickly and it would be an effective DoS against you and might lead to attacks on you that would be unlogged.

## rc.flush-iptables.txt

This script should not really be called a script in itself. However, you'll find it at http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.flush-iptables.txt[6]. The script will reset and flush all your tables and chains. The script starts by setting the default policies to ACCEPT on the INPUT, OUTPUT and FORWARD chains of the filter table. After this we reset the default policies of the PREROUTING, POSTROUTING and OUTPUT chains of the NAT table. We do this first so we won't have to bother about closed connections and packets not getting through. This script is intended for actually setting up and troubleshooting your firewall, and hence we only care about opening the whole thing up and reset it to default values.

After this we flush all chains first in the filter table and then in the NAT table. This way we know there is no redundant rules lying around anywhere. When all of this is done, we jump down to the next section where we erase all the user specified chains in the NAT and filter tables. When this step is done, we consider the script done. You might consider adding rules to flush your MANGLE table in certain cases though, especially if you use it.

One final word on this issue. Certain people has mailed me asking from me to put this script into the original rc.firewall script using redhat Linux syntax where you type something like rc.firewall start and the script starts. However, I will not do that since this is a tutorial and should be used as a place to fetch ideas mainly and it shouldn't be filled up with shell scripts and strange syntax. Adding shell script syntax and other things makes the script harder to read as far as I am concerned and the tutorial was written with readability in mind and will continue being so.

## Notes

1. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.firewall.txt
2. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.DMZ.firewall.txt
3. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.DHCP.firewall.txt
4. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.UTIN.firewall.txt
5. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.test-iptables.txt
6. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.flush-iptables.txt

# Appendix A. Listing your active ruleset

To list your currently active ruleset you run a special option to the iptables command. This would look like the following:

```
iptables -L
```

This command should list your currently active ruleset, and translate everything possible to a more readable form. For example, it will translate all the different ports according to the /etc/services file as well as DNS all the IP's to get DNS records instead. The latter can be a bit of a problem though. For example, it will try to resolve LAN IP's, ie 192.168.1.1, to something useful. 192.168.0.0/16 is a private range though and should not resolve to anything and a the command will seem to hang while resolving the IP. To get around this problem we would do something like the following:

```
iptables -L -n
```

Another thing that might be interesting is to see a few statistics about each policy, rule and chain. We could get this by adding the verbose flag. It would then look something like this:

```
iptables -L -n -v
```

There is also a few files that might be interesting to look at in the /proc filesystem. For example, it might be interesting to know what connections are currently in the conntrack table. This table contains all the different connections currently tracked and serves as a basic table so we always know what state a connection currently is in. This table can not be edited though and even if it was possible, it would be a bad idea. To see the table you can do the following:

```
cat /proc/net/conntrack | less
```

The above command will show all currently tracked connections even though it might be a bit hard to understand everything.

# Appendix B. Passive FTP but no DCC

This is one of the really nice parts about the new **iptables** support in the 2.4.x kernels, you can for example allow Passive `FTP` connections, but not allow `DCC` send functions with the new state matching code. You may ask yourself how, well, its quite simple once you get to think of it=). Just compile the ip_conntrack_irc and ip_conntrack_ftp modules in the kernel. What these modules does is that they add support to the contrack module so it can distinguish a passive `FTP` connection or a `DCC` send connection, without these modules they can't recognize these connections. If you for example want to allow passive `FTP`, but not `DCC` send, you would load the ip_conntrack_ftp module, but not the ip_conntrack_irc module and then do :

**/usr/local/sbin/iptables -A INPUT -p TCP -m state –state RELATED -j ACCEPT**

To allow passive `FTP` but not `DCC`. If you would want to do the reverse, you'd just load the `ip_conntrack_irc` module, but not the `ip_conntrack_ftp` module.

# Appendix C. State NEW packets but no SYN bit set

There is a certain "feature" in iptables that is not so well documented and may therefore be overlooked by a lot of people(yes, including me). If you use state NEW, packets with the SYN bit unset will get through your firewall. This feature is there because in certain cases we wan't to consider that a packet may be part of an already ESTABLISHED connection on, for instance, another firewall. This feature makes it possible to have two or more firewalls, and the main firewall goes down. The firewalling of this subnet would then be taken over by our secondary firewall, and state NEW will therefore allow pretty much any kind of TCP connection, regardless if this is the actual 3-way handshake or not. To take care of this problem we add the following rules to our firewalls INPUT, OUTPUT and FORWARD chain:

**$IPTABLES -A INPUT -p tcp ! –syn -m state –state NEW -j LOG –log-prefix "New not syn:"**
**$IPTABLES -A INPUT -p tcp ! –syn -m state –state NEW -j DROP**

The above rules will take care of this problem. This is a badly documented problem of the netfilter/iptables project and should definitely be more highlighted. In other words, a huge warning is at it's place for this kind of behaviour on your firewall.

Note that there is some troubles with the above rules and bad Microsoft TCP/IP implementations. The above rules will lead to certain conditions where packets generated by microsoft products gets labeled as a state NEW and hence get logged and dropped. It will however not lead to broken connections to my knowledge. The matter is that when a connection gets closed and the final FIN/ACK has been sent and the state machine of netfilter has closed this connection and it is no longer in the conntrack table. At this point the faulty Microsoft implementation sends another packet which is considered as state NEW but lacks the SYN bit and hence gets matched by the above rules. In other words, don't worry to much about this rule, or if you are worried anyways, set the –log-headers option to the rule and log the headers too and you'll get a better look at what the packet looks like.

There is one more known problem with these rules. If someone is currently connected to the firewall, lets say from the LAN, and you have the script set to be activated when running an PPP connection. In this case, when you start the PPP connection, the person previously connected through the LAN will be more or less killed. This only applies when you're running with the conntrack and nat codebases as modules, and the modules are loaded and unloaded each time you run the script. Another way to get this problem is to run the rc.firewall script from a telnet connection from a host not on the actual firewall. To put it simple, you connect a telnet or other stream connection. Start the connection tracking modules, then load the NEW not SYN packet rules. Finally, the telnet client or daemon tries to send something. the connection tracking code will not recognise this connection as a legal connection since it hasn't seen packets in any direction on this connection before, also there will be no SYN bits set since it isn't actually the first packet in the connection. Hence, the packet will match to the rules and be logged and afterwards dropped to the ground.

# Appendix D. ISP's who use assigned IP's

I've added this since a friend of mine told me something i've totally forgotten, certain stupid ISP's use `IP`'s assigned by IANA for their own local networks. For example, the swedish ISP and phone monopoly Telia uses this approach for example on their DNS servers, which uses the 10.x.x.x `IP` range. The problem you'll most probably run into is that we, in this script, don't allow connections from any `IP`'s in the 10.x.x.x range to us, because of spoofing possibilities. Well, here's unfortunately an example where you actually might have to lift a bit on those rules. You might just insert an `ACCEPT` rule above the spoof section to allow traffic from those DNS servers, or you could just comment out that part of the script. This is how it might look :

**/usr/local/sbin/iptables -t nat -I PREROUTING -i eth1 -s 10.0.0.1/32 -j ACCEPT**

I'd like to take my moment to bitch at these ISP's. These ranges are not assigned for you to use for dumb stuff like this, at least not to my knowledge, for large corporate sites it's more than ok, or your own home network, but you're not supposed to force us to open up ourself just because of some whince of yours.

# Appendix E. Updating and flushing your tables

If at some point you screw up your **iptables**, there are actually commands to flush them, so you don't have to reboot. I've actually gotten this question a couple times by now so I thought I'd answer it right here. If you added a rule in error, you might just change the **-A** parameter to **-D** in the line you added in error. **iptables** will find the erroneous line and erase it for you, in case you've got multiple lines looking exactly the same in the chain, it erases the first instance it finds matching your rule. If this is not the wanted behaviour you might try to use the **-D** option as **iptables -D INPUT 10** which will erase the 10th rule in the `INPUT` chain.

There is also instances where you want to flush a whole chain, in this case you might want to run the **-F** option. For example, **iptables -F INPUT** will erase the whole `INPUT` chain, though, this will not change the default policy, so if this is set to `DROP` you'll block the whole `INPUT` chain if used as above. To reset the chain policy, do as how you set it to `DROP`, for example **iptables -P INPUT ACCEPT**.

I've made a small script[1] (available as an appendix as well) that will flush and reset your **iptables** that you might consider using while setting up your `rc.firewall` file properly. One thing though, if you start mucking around in the mangle table, this script will not erase those, it's rather simple to add the few lines needed to erase those but i've not added those here since the mangle table is not used in my `rc.firewall` script so far.

## Notes

1. http://people.unix-fu.org:8080/andreasson/iptables-tutorial/rc.flush-iptables.txt

# Appendix F. ICMP types

This is a complete listing of all ICMP types:

**Table F-1. ICMP types**

| TYPE | CODE | Description | Query | Error |
|---|---|---|---|---|
| 0 | 0 | Echo Reply | x | |
| 3 | 0 | Network Unreachable | | x |
| 3 | 1 | Host Unreachable | | |
| 3 | 2 | Protocol Unreachable | | |
| 3 | 3 | Port Unreachable | | |
| 3 | 4 | Fragmentation needed but no frag. bit set | | |
| 3 | 5 | Source routing failed | | |
| 3 | 6 | Destination network unknown | | |
| 3 | 7 | Destination host unknown | | |
| 3 | 8 | Source host isolated (obsolete) | | |
| 3 | 9 | Destination network administratively prohibited | | |
| 3 | 10 | Destination host administratively prohibited | | |
| 3 | 11 | Network unreachable for TOS | | |
| 3 | 12 | Host unreachable for TOS | | |
| 3 | 13 | Communication administratively prohibited by filtering | | |
| 3 | 14 | Host precedence violation | | |

| TYPE | CODE | Description | Query | Error |
|---|---|---|---|---|
| 3 | 15 | Precedence cutoff in effect | | |
| 4 | 0 | Source quelch | | |
| 5 | 0 | Redirect for network | | |
| 5 | 1 | Redirect for host | | |
| 5 | 2 | Redirect for TOS and network | | |
| 5 | 3 | Redirect for TOS and host | | |
| 8 | 0 | Echo request | x | |
| 9 | 0 | Router advertisement | | |
| 10 | 0 | Route sollicitation | | |
| 11 | 0 | TTL equals 0 during transit | | x |
| 11 | 1 | TTL equals 0 during reassembly | | |
| 12 | 0 | IP header bad (catchall error) | | |
| 12 | 1 | Required options missing | | |
| 13 | 0 | Timestamp request (obsolete) | | |
| 14 | 0 | Timestamp reply (obsolete) | | |
| 15 | 0 | Information request (obsolete) | | |
| 16 | 0 | Information reply (obsolete) | | |
| 17 | 0 | Address mask request | | |
| 18 | 0 | Address mask reply | | |

# Appendix G. Other resources and links

Here's a list of links to resources and where i've gotten information from etc :

- ip-sysctl.txt[1] - from the 2.4.14 kernel. A little bit short but a good reference for the IP networking controls and what they do to the kernel.
- ip_dynaddr.txt[2] - from the 2.4.14 kernel. A really short reference to the ip_dynaddr settings available via sysctl and the proc filesystem.
- iptables.8[3] - The iptables 1.2.4 man page. This is an HTML'ized version of the man page which is an excellent reference when reading/writing iptables rulesets. Always have it at hand.
- http://netfilter.filewatcher.org/[4] - The official netfilter and iptables site. It is a must for everyone wanting to set up iptables and netfilter in linux.
- http://netfilter.filewatcher.org/netfilter-faq.html[5] - The official netfilter Frequently Asked Questions. Also a good place to stat at when wondering what iptables and netfilter is about.
- http://netfilter.filewatcher.org/unreliable-guides/packet-filtering-HOWTO/index.html[6] - Rusty Russells Unreliable Guide to packet filtering. Excellent documentation about basic packet filtering with iptables written by one of the core developers of iptables and netfilter.
- http://netfilter.filewatcher.org/unreliable-guides/NAT-HOWTO/index.html[7] - Rusty Russells Unreliable Guide to Network Address Translation. Excellent documentation about Network Address Translation in iptables and netfilter written by one of the core developers, Rusty Russell.
- http://netfilter.filewatcher.org/unreliable-guides/netfilter-hacking-HOWTO/index.html[8] - Rusty Russells Unreliable Netfilter Hacking HOWTO. One of the few documentations on how to write code in the netfilter and iptables userspace and kernel space codebase. This was also written by one of the core developers, Rusty Russell.
- http://www.linuxguruz.org/iptables/[9] - Excellent linkpage with links to most of the pages on the internet about iptables and netfilter. Also maintains a list of different iptables scripts for different purposes.
- http://www.docum.org[10] - Excellent information about the CBQ, tc and ip commands in Linux. One of the few sites that has any information at all about these programs. Maintained by Stef Coene.
- http://lists.samba.org/mailman/listinfo/netfilter[11] - The official netfilter mailing-list. Extremely useful in case you have questions about something not covered in this document or any of the other links here.

And of course the **iptables** source, documentation and individuals who helped me.

## Notes

1. other/ip-sysctl.txt
2. other/ip_dynaddr.txt
3. other/iptables.html
4. http://netfilter.filewatcher.org/
5. http://netfilter.filewatcher.org/netfilter-faq.html
6. http://netfilter.filewatcher.org/unreliable-guides/packet-filtering-HOWTO/index.html

7. http://netfilter.filewatcher.org/unreliable-guides/NAT-HOWTO/index.html
8. http://netfilter.filewatcher.org/unreliable-guides/netfilter-hacking-HOWTO/index.html
9. http://www.linuxguruz.org/iptables/
10. http://www.docum.org
11. http://lists.samba.org/mailman/listinfo/netfilter

# Appendix H. Acknowledgements

I would like to thank the following people for their help on this document:

- *Fabrice Marie*[1], For major updates to my horrible grammar and spelling. Also a huge thanks for updating the tutorial to DocBook format with make files etc.
- *Marc Boucher*[2], For helping me out on some aspects on using the state matching code.
- *Frode E. Nyboe*[3], For greatly improving the `rc.firewall` rules and giving great inspiration while i was to rewrite the ruleset and being the one who introduced the multiple table traversing into the same file.
- *Chapman Brad*[4], *Alexander W. Janssen*[5], Both for making me realize I was thinking wrong about how packets traverse the basic NAT and filters tables and in which order they show up.
- *Michiel Brandenburg*[6], *Myles Uyema*[7], For helping me out with some of the state matching code and getting it to work.
- *Kent 'Artech' Stahre*[8], For helping me out with the graphics. I know I suck at graphics, and you're better than most I know who do graphics;). Also thanks for checking the tutorial for errors etc.
- *Anders 'DeZENT' Johansson*, For hinting me about strange ISP's and so on that uses reserved networks on the Internet, or at least on the internet for you.
- *Jeremy 'Spliffy' Smith*[9], For giving me hints at stuff that might screw up for people and for trying it out and checking for errors in what I've written.

And of course everyone else I talked to and asked for comments on this file, sorry for not mentioning everyone.

## Notes

1. mailto:fabrice@celestix.com
2. mailto:marc+nf@mbsi.ca
3. mailto:fen@improbus.com
4. mailto:kakadu_croc@yahoo.com
5. mailto:yalla@ynfonatic.de
6. mailto:michielb@stack.nl
7. mailto:myles@puck.nether.net
8. mailto:artech@boingworld.com
9. mailto:di99smje@chl.chalmers.se

# Appendix I. Example rc.firewall script

Version 1.1.6
http://people.unix-fu.org/andreasson/
By: Oskar Andreasson
Contributors: Jim Ramsey, Phil Schultz, Göran Båge, Doug Monroe, Jasper Aikema, Kurt Lieber

Version 1.1.5 (14 November 2001)
http://people.unix-fu.org/andreasson/
By: Oskar Andreasson
Contributors: Fabrice Marie, Merijn Schering and Kurt Lieber

Version 1.1.4 (6 November 2001)
http://people.unix-fu.org/andreasson
By: Oskar Andreasson
Contributors: Stig W. Jensen, Steve Hnizdur, Chris Pluta and Kurt Lieber

Version 1.1.3 (9 October 2001)
http://people.unix-fu.org/andreasson
By: Oskar Andreasson
Contributors: Joni Chu, N.Emile Akabi-Davis and Jelle Kalf

Version 1.1.2 (29 September 2001)
http://people.unix-fu.org/andreasson
By: Oskar Andreasson

Version 1.1.1 (26 September 2001)
http://people.unix-fu.org/andreasson
By: Oskar Andreasson
Contributors: Dave Richardson

Version 1.1.0 (15 September 2001)
http://people.unix-fu.org/andreasson
By: Oskar Andreasson

Version 1.0.9 (9 September 2001)
http://people.unix-fu.org/andreasson
By: Oskar Andreasson

Version 1.0.8 (7 September 2001)
http://people.unix-fu.org/andreasson
By: Oskar Andreasson

Version 1.0.7 (23 August 2001)
http://people.unix-fu.org/andreasson
By: Oskar Andreasson
Contributors: Fabrice Marie

Version 1.0.6
http://people.unix-fu.org/andreasson
By: Oskar Andreasson

Version 1.0.5
http://people.unix-fu.org/andreasson

By: Oskar Andreasson
Contributors: Fabrice Marie

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Version 1.1, March 2000



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# Appendix L. Example rc.firewall script

```
#!/bin/sh
#
# rc.firewall - Initial SIMPLE IP Firewall script for Linux 2.4.x and iptables
#
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#
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# Place, Suite 330, Boston, MA  02111-1307   USA
#

############
# Configuration options, these will speed you up getting this script to
# work with your own setup.

#
# your LAN's IP range and localhost IP. /24 means to only use the first 24
# bits of the 32 bit IP adress. the same as netmask 255.255.255.0
#
# INET_IP is used by me to allow myself to do anything to myself, might
# be a security risc but sometimes I want this. If you don't have a static
# IP, I suggest not using this option at all for now but it's stil
# enabled per default and will add some really nifty security bugs for all
# those who skips reading the documentation=)

LAN_IP="192.168.0.2"
LAN_IP_RANGE="192.168.0.0/16"
LAN_BCAST_ADRESS="192.168.255.255"
LAN_IFACE="eth1"

LO_IFACE="lo"
LO_IP="127.0.0.1"

INET_IP="194.236.50.155"
INET_IFACE="eth0"

IPTABLES="/usr/local/sbin/iptables"

#########
# Load all required IPTables modules
#

#
```

```
# Needed to initially load modules
#
/sbin/depmod -a

#
# Adds some iptables targets like LOG, REJECT and MASQUARADE.
#
/sbin/modprobe ipt_LOG
#/sbin/modprobe ipt_REJECT
/sbin/modprobe ipt_MASQUERADE

#
# Support for owner matching
#
#/sbin/modprobe ipt_owner

#
# Support for connection tracking of FTP and IRC.
#
#/sbin/modprobe ip_conntrack_ftp
#/sbin/modprobe ip_conntrack_irc

#
# Enable ip_forward, this is critical since it is turned off as defaul in
# Linux.
#

echo "1" > /proc/sys/net/ipv4/ip_forward

#
# Dynamic IP users:
#
#echo "1" > /proc/sys/net/ipv4/ip_dynaddr

#
# tcp_packets chain
#
# Take care of bad TCP  packets that we don't want
#

$IPTABLES -N tcp_packets
$IPTABLES -A tcp_packets -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A tcp_packets -p tcp ! –syn -m state –state NEW -j DROP

#
# Enable simple IP Forwarding and Network Address Translation
#

$IPTABLES -t nat -A POSTROUTING -o $INET_IFACE -j SNAT –to-source $INET_IP

#
# Bad TCP packets we don't want
#

$IPTABLES -A FORWARD -p tcp -j tcp_packets
```

```
#
# Accept the packets we actually want to forward
#

$IPTABLES -A FORWARD -i $LAN_IFACE -j ACCEPT
$IPTABLES -A FORWARD -m state –state ESTABLISHED,RELATED -j ACCEPT
$IPTABLES -A FORWARD -m limit –limit 3/minute –limit-burst 3 -j LOG \
–log-level DEBUG –log-prefix "IPT FORWARD packet died: "

#
# Set default policies for the INPUT, FORWARD and OUTPUT chains
#

$IPTABLES -P INPUT DROP
$IPTABLES -P OUTPUT DROP
$IPTABLES -P FORWARD DROP

#
# Create separate chains for ICMP, TCP and UDP to traverse
#

$IPTABLES -N icmp_packets
$IPTABLES -N tcp_packets
$IPTABLES -N udpincoming_packets

#
# The allowed chain for TCP connections
#

$IPTABLES -N allowed
$IPTABLES -A allowed -p TCP –syn -j ACCEPT
$IPTABLES -A allowed -p TCP -m state –state ESTABLISHED,RELATED -j ACCEPT
$IPTABLES -A allowed -p TCP -j DROP

#
# ICMP rules
#

# Changed rules totally
$IPTABLES -A icmp_packets -p ICMP -s 0/0 –icmp-type 8 -j ACCEPT
$IPTABLES -A icmp_packets -p ICMP -s 0/0 –icmp-type 11 -j ACCEPT

#
# TCP rules
#

$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 21 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 22 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 80 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 113 -j allowed

#
# UDP ports
#
```

```
# nondocumented commenting out of these rules
#$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 53 -j ACCEPT
#$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 123 -j ACCEPT
$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 2074 -j ACCEPT
$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 4000 -j ACCEPT

############################
# PREROUTING chain.
#
# Do some checks for obviously spoofed IP's
#

$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 192.168.0.0/16 -j DROP
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 10.0.0.0/8 -j DROP
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 172.16.0.0/12 -j DROP


############################
# INPUT chain
#
# Bad TCP packets we don't want.
#

$IPTABLES -A FORWARD -p tcp -j tcp_packets

#
# Rules for incoming packets from the internet.
#

$IPTABLES -A INPUT -p ICMP -i $INET_IFACE -j icmp_packets
$IPTABLES -A INPUT -p TCP -i $INET_IFACE -j tcp_packets
$IPTABLES -A INPUT -p UDP -i $INET_IFACE -j udpincoming_packets

#
# Rules for special networks not part of the Internet
#

$IPTABLES -A INPUT -p ALL -i $LAN_IFACE -d $LAN_BCAST_ADRESS -j ACCEPT
$IPTABLES -A INPUT -p ALL -i $LO_IFACE -s $LO_IP -j ACCEPT
$IPTABLES -A INPUT -p ALL -i $LAN_IFACE -s $LAN_IP_RANGE -j ACCEPT
$IPTABLES -A INPUT -p ALL -d $INET_IP -m state –state ESTABLISHED,RELATED \
-j ACCEPT
$IPTABLES -A INPUT -m limit –limit 3/minute –limit-burst 3 -j LOG \
–log-level DEBUG –log-prefix "IPT INPUT packet died: "

#############################
# OUTPUT chain
#
#
# Bad TCP packets we don't want.
#

$IPTABLES -A FORWARD -p tcp -j tcp_packets

#
# Special OUTPUT rules to decide which IP's to allow.
```

```
#

$IPTABLES -A OUTPUT -p ALL -s $LO_IP -j ACCEPT
$IPTABLES -A OUTPUT -p ALL -s $LAN_IP -j ACCEPT
$IPTABLES -A OUTPUT -p ALL -s $INET_IP -j ACCEPT

#
# Log weird packets that don't match the above.
#

$IPTABLES -A OUTPUT -m limit –limit 3/minute –limit-burst 3 -j LOG \
–log-level DEBUG –log-prefix "IPT OUTPUT packet died: "
```

# Appendix M. Example rc.DMZ.firewall script

```
   #!/bin/sh
#
# rc.DMZ.firewall - DMZ IP Firewall script for Linux 2.4.x and iptables
#
# Copyright (C) 2001  Oskar Andreasson <blueflux@koffein.net>
#
# This program is free software; you can redistribute it and/or modify
# it under the terms of the GNU General Public License as published by
# the Free Software Foundation; version 2 of the License.
#
# This program is distributed in the hope that it will be useful,
# but WITHOUT ANY WARRANTY; without even the implied warranty of
# MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
# GNU General Public License for more details.
#
# You should have received a copy of the GNU General Public License
# along with this program or from the site that you downloaded it
# from; if not, write to the Free Software Foundation, Inc., 59 Temple
# Place, Suite 330, Boston, MA  02111-1307   USA
#

############
# Configuration options, these will speed you up getting this script to
# work with your own setup.

#
# your LAN's IP range and localhost IP. /24 means to only use the first 24
# bits of the 32 bit IP adress. the same as netmask 255.255.255.0
#
# STATIC_IP is used by me to allow myself to do anything to myself, might
# be a security risc but sometimes I want this. If you don't have a static
# IP, I suggest not using this option at all for now but it's stil
# enabled per default and will add some really nifty security bugs for all
# those who skips reading the documentation=)

LAN_IP="192.168.0.2"
LAN_BCAST_ADRESS="192.168.0.255"
LAN_IFACE="eth1"

INET_IP="194.236.50.152"
INET_IFACE="eth0"

HTTP_IP="194.236.50.153"
DNS_IP="194.236.50.154"
DMZ_HTTP_IP="192.168.1.2"
DMZ_DNS_IP="192.168.1.3"
DMZ_IP="192.168.1.1"
DMZ_IFACE="eth2"

LO_IP="127.0.0.1"
LO_IFACE="lo"
```

```
IPTABLES="/usr/local/sbin/iptables"

########################################
#
# Load all required IPTables modules
#

#
# Needed to initially load modules
#

/sbin/depmod -a

#
# Adds some iptables targets like LOG, REJECT and MASQUARADE.
#

/sbin/modprobe ipt_LOG
/sbin/modprobe ipt_MASQUERADE

#
# Support for connection tracking of FTP and IRC.
#
#/sbin/modprobe ip_conntrack_ftp
#/sbin/modprobe ip_conntrack_irc


#CRITICAL:  Enable IP forwarding since it is disabled by default.
#

echo "1" > /proc/sys/net/ipv4/ip_forward

#
# Dynamic IP users:
#
#echo "1" > /proc/sys/net/ipv4/ip_dynaddr

########################################
#
# Chain Policies gets set up before any bad packets gets through
#

$IPTABLES -P INPUT DROP
$IPTABLES -P OUTPUT DROP
$IPTABLES -P FORWARD DROP

#
# the allowed chain for TCP connections, utilized in the FORWARD chain
#

$IPTABLES -N allowed
$IPTABLES -A allowed -p TCP –syn -j ACCEPT
$IPTABLES -A allowed -p TCP -m state –state ESTABLISHED,RELATED -j ACCEPT
$IPTABLES -A allowed -p TCP -j DROP

#
```

```
# ICMP rules, utilized in the FORWARD chain
#


$IPTABLES -N icmp_packets

# Changed rules totally
$IPTABLES -A icmp_packets -p ICMP -s 0/0 –icmp-type 8 -j ACCEPT
$IPTABLES -A icmp_packets -p ICMP -s 0/0 –icmp-type 11 -j ACCEPT


########################################
# POSTROUTING chain in the nat table
#
# Enable IP SNAT for all internal networks trying to get out on the Internet
#

$IPTABLES -t nat -A POSTROUTING -o $INET_IFACE -j SNAT –to-source $INET_IP



########################################
# PREROUTING chain in the nat table
#
# Do some checks for obviously spoofed IP's
#

$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 192.168.0.0/16 -j DROP
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 10.0.0.0/8 -j DROP
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 172.16.0.0/12 -j DROP
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s $INET_IP -j DROP

#
# Enable IP Destination NAT for DMZ zone
#

$IPTABLES -t nat -A PREROUTING -p TCP -i $INET_IFACE -d $HTTP_IP –dport 80 \
-j DNAT –to-destination $DMZ_HTTP_IP
$IPTABLES -t nat -A PREROUTING -p TCP -i $INET_IFACE -d $DNS_IP –dport 53 \
-j DNAT –to-destination $DMZ_DNS_IP
$IPTABLES -t nat -A PREROUTING -p UDP -i $INET_IFACE -d $DNS_IP –dport 53 \
-j DNAT –to-destination $DMZ_DNS_IP

########################################
#
# FORWARD chain
#
# Get rid of bad TCP packets
#

$IPTABLES -A FORWARD -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A FORWARD -p tcp ! –syn -m state –state NEW -j DROP

#
# DMZ section
```

```
#
# General rules
#

$IPTABLES -A FORWARD -i $DMZ_IFACE -o $INET_IFACE -j ACCEPT
$IPTABLES -A FORWARD -i $INET_IFACE -o $DMZ_IFACE -m state \
–state ESTABLISHED,RELATED -j ACCEPT
$IPTABLES -A FORWARD -i $LAN_IFACE -o $DMZ_IFACE -j ACCEPT
$IPTABLES -A FORWARD -i $DMZ_IFACE -o $LAN_IFACE -j ACCEPT

#
# HTTP server
#

$IPTABLES -A FORWARD -p TCP -i $INET_IFACE -o $DMZ_IFACE -d $DMZ_HTTP_IP \
–dport 80 -j allowed
$IPTABLES -A FORWARD -p ICMP -i $INET_IFACE -o $DMZ_IFACE -d $DMZ_HTTP_IP \
-j icmp_packets

#
# DNS server
#

$IPTABLES -A FORWARD -p TCP -i $INET_IFACE -o $DMZ_IFACE -d $DMZ_DNS_IP \
–dport 53 -j allowed
$IPTABLES -A FORWARD -p UDP -i $INET_IFACE -o $DMZ_IFACE -d $DMZ_DNS_IP \
–dport 53 -j ACCEPT
$IPTABLES -A FORWARD -p ICMP -i $INET_IFACE -o $DMZ_IFACE -d $DMZ_DNS_IP \
-j icmp_packets

#
# LAN section
#

$IPTABLES -A FORWARD -i $LAN_IFACE -j ACCEPT
$IPTABLES -A FORWARD -m state –state ESTABLISHED,RELATED -j ACCEPT

#
# LOG all packets reaching here
#

$IPTABLES -A FORWARD -m limit –limit 3/minute –limit-burst 3 -j LOG \
–log-level DEBUG –log-prefix "IPT FORWARD packet died: "


############################################################
#
# Firewall rules
# Rules applying to the firewall box
#
#
# INPUT chain
#
# Get rid of bad packets
#
```

```
$IPTABLES -A INPUT -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A INPUT -p tcp ! –syn -m state –state NEW -j DROP

#
# Packets from the Internet to this box
#

$IPTABLES -A INPUT -p ICMP -i $INET_IFACE -j icmp_packets

#
# Packets from LAN, DMZ or LOCALHOST
#

# From DMZ Interface to DMZ firewall IP
$IPTABLES -A INPUT -p ALL -i $DMZ_IFACE -d $DMZ_IP -j ACCEPT

# From LAN Interface to LAN firewall IP
$IPTABLES -A INPUT -p ALL -i $LAN_IFACE -d $LAN_IP -j ACCEPT
$IPTABLES -A INPUT -p ALL -i $LAN_IFACE -d $LAN_BCAST_ADRESS -j ACCEPT

# From Localhost interface to Localhost IP
$IPTABLES -A INPUT -p ALL -i $LO_IFACE -d $LO_IP -j ACCEPT

# All established and related packets incoming from the internet to the
# firewall
$IPTABLES -A INPUT -p ALL -d $INET_IP -m state –state ESTABLISHED,RELATED \
-j ACCEPT

# Logging rule
$IPTABLES -A INPUT -m limit –limit 3/minute –limit-burst 3 \
-j LOG –log-level DEBUG –log-prefix "IPT INPUT packet died: "

############################################################
#
# OUTPUT chain
#

#
# Get rid of bad TCP packets
#

$IPTABLES -A OUTPUT -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A OUTPUT -p tcp ! –syn -m state –state NEW -j DROP

#
# Allow ourself to send packets not spoofed everywhere
#

$IPTABLES -A OUTPUT -p ALL -o $LO_IFACE -s $LO_IP -j ACCEPT
$IPTABLES -A OUTPUT -p ALL -o $LAN_IFACE -s $LAN_IP -j ACCEPT
$IPTABLES -A OUTPUT -p ALL -o $INET_IFACE -s $INET_IP -j ACCEPT

#
# Logging rule
```

```
#

$IPTABLES -A OUTPUT -m limit –limit 3/minute –limit-burst 3 -j LOG \
–log-level DEBUG –log-prefix "IPT OUTPUT packet died: "
```

## Appendix N. Example rc.UTIN.firewall script

```
   #!/bin/sh
#
# rc.firewall - UTIN Firewall script for Linux 2.4.x and iptables
#
# Copyright (C) 2001  Oskar Andreasson <blueflux@koffein.net>
#
# This program is free software; you can redistribute it and/or modify
# it under the terms of the GNU General Public License as published by
# the Free Software Foundation; version 2 of the License.
#
# This program is distributed in the hope that it will be useful,
# but WITHOUT ANY WARRANTY; without even the implied warranty of
# MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
# GNU General Public License for more details.
#
# You should have received a copy of the GNU General Public License
# along with this program or from the site that you downloaded it
# from; if not, write to the Free Software Foundation, Inc., 59 Temple
# Place, Suite 330, Boston, MA  02111-1307   USA
#

############
# Configuration options, these will speed you up getting this script to
# work with your own setup.

#
# your LAN's IP range and localhost IP. /24 means to only use the first 24
# bits of the 32 bit IP adress. the same as netmask 255.255.255.0
#
# INET_IP is used by me to allow myself to do anything to myself, might
# be a security risc but sometimes I want this. If you don't have a static
# IP, I suggest not using this option at all for now but it's still
# enabled per default and will add some really nifty security bugs for all
# those who skips reading the documentation=)

LAN_IP="192.168.0.2"
LAN_BCAST_ADRESS="192.168.0.255"
LAN_IFACE="eth1"

LO_IFACE="lo"
LO_IP="127.0.0.1"

INET_IP="194.236.50.155"
INET_IFACE="eth0"

IPTABLES="/usr/local/sbin/iptables"

#########
# Load all required IPTables modules
#

#
# Needed to initially load modules
```

```
#
/sbin/depmod -a

#
# Adds some iptables targets like LOG, REJECT and MASQUARADE.
#
/sbin/modprobe ipt_LOG
#/sbin/modprobe ipt_REJECT
/sbin/modprobe ipt_MASQUERADE

#
# Support for owner matching
#
#/sbin/modprobe ipt_owner

#
# Support for connection tracking of FTP and IRC.
#
#/sbin/modprobe ip_conntrack_ftp
#/sbin/modprobe ip_conntrack_irc

#
# Enable ip_forward, this is critical since it is turned off as defaul in
# Linux.
#

echo "1" > /proc/sys/net/ipv4/ip_forward

#
# Dynamic IP users:
#
#echo "1" > /proc/sys/net/ipv4/ip_dynaddr

#
# Enable simple IP Forwarding and Network Address Translation
#

$IPTABLES -t nat -A POSTROUTING -o $INET_IFACE -j SNAT –to-source $INET_IP

#
# Bad TCP packets we don't want
#

$IPTABLES -A FORWARD -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A FORWARD -p tcp ! –syn -m state –state NEW -j DROP

#
# Accept the packets we actually want to forward between interfaces.
#

$IPTABLES -A FORWARD -p tcp –dport 21 -i $LAN_IFACE -j ACCEPT
$IPTABLES -A FORWARD -p tcp –dport 80 -i $LAN_IFACE -j ACCEPT
$IPTABLES -A FORWARD -p tcp –dport 110 -i $LAN_IFACE -j ACCEPT

$IPTABLES -A FORWARD -m state –state ESTABLISHED,RELATED -j ACCEPT
```

```
$IPTABLES -A FORWARD -m limit –limit 3/minute –limit-burst 3 -j LOG \
–log-level DEBUG –log-prefix "IPT FORWARD packet died: "

#
# Set default policies for the INPUT, FORWARD and OUTPUT chains
#

$IPTABLES -P INPUT DROP
$IPTABLES -P OUTPUT DROP
$IPTABLES -P FORWARD DROP

#
# Create separate chains for ICMP, TCP and UDP to traverse
#

$IPTABLES -N icmp_packets
$IPTABLES -N tcp_packets
$IPTABLES -N udpincoming_packets

#
# The allowed chain for TCP connections
#

$IPTABLES -N allowed
$IPTABLES -A allowed -p TCP –syn -j ACCEPT
$IPTABLES -A allowed -p TCP -m state –state ESTABLISHED,RELATED \
-j ACCEPT
$IPTABLES -A allowed -p TCP -j DROP

#
# ICMP rules
#

# Changed rules totally
$IPTABLES -A icmp_packets -p ICMP -s 0/0 –icmp-type 8 -j ACCEPT
$IPTABLES -A icmp_packets -p ICMP -s 0/0 –icmp-type 11 -j ACCEPT

#
# TCP rules
#

$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 21 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 22 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 80 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 113 -j allowed

#
# UDP ports
#

$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 53 -j ACCEPT
$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 123 -j ACCEPT
$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 2074 -j ACCEPT
$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 4000 -j ACCEPT

#
```

```
# PREROUTING chain.
#
# Do some checks for obviously spoofed IP's
#

$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 192.168.0.0/16 -j DROP
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 10.0.0.0/8 -j DROP
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 172.16.0.0/12 -j DROP
$IPTABLES -t nat -A PREROUTING -i $LAN_IFACE ! -s 192.168.0.0/16 -j DROP

#
# INPUT chain
#
# Take care of bad TCP  packets that we don't want
#

$IPTABLES -A INPUT -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A INPUT -p tcp ! –syn -m state –state NEW -j DROP

#
# Rules for incoming packets from anywhere
#

$IPTABLES -A INPUT -p ICMP -j icmp_packets
$IPTABLES -A INPUT -p TCP -j tcp_packets
$IPTABLES -A INPUT -p UDP -j udpincoming_packets

#
# Rules for special networks not part of the Internet
#

$IPTABLES -A INPUT -p ALL -i $LO_IFACE -d $LO_IP -j ACCEPT
$IPTABLES -A INPUT -p ALL -d $INET_IP -m state –state ESTABLISHED,RELATED \
-j ACCEPT
$IPTABLES -A INPUT -m limit –limit 3/minute –limit-burst 3 \
-j LOG –log-level DEBUG –log-prefix "IPT INPUT packet died: "

#
# OUTPUT chain
#

$IPTABLES -A OUTPUT -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A OUTPUT -p tcp ! –syn -m state –state NEW -j DROP

$IPTABLES -A OUTPUT -p ALL -s $LO_IP -j ACCEPT
$IPTABLES -A OUTPUT -p ALL -s $LAN_IP -j ACCEPT
$IPTABLES -A OUTPUT -p ALL -s $INET_IP -j ACCEPT
$IPTABLES -A OUTPUT -m limit –limit 3/minute –limit-burst 3 \
-j LOG –log-level DEBUG –log-prefix "IPT OUTPUT packet died: "
```

# Appendix O. Example rc.DHCP.firewall script

```
   #!/bin/sh
#
# rc.firewall - DHCP IP Firewall script for Linux 2.4.x and iptables
#
# Copyright (C) 2001  Oskar Andreasson <blueflux@koffein.net>
#
# This program is free software; you can redistribute it and/or modify
# it under the terms of the GNU General Public License as published by
# the Free Software Foundation; version 2 of the License.
#
# This program is distributed in the hope that it will be useful,
# but WITHOUT ANY WARRANTY; without even the implied warranty of
# MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.  See the
# GNU General Public License for more details.
#
# You should have received a copy of the GNU General Public License
# along with this program or from the site that you downloaded it
# from; if not, write to the Free Software Foundation, Inc., 59 Temple
# Place, Suite 330, Boston, MA  02111-1307   USA
#

############
# Configuration options, these will speed you up getting this script to
# work with your own setup.

#
# your LAN's IP range and localhost IP. /24 means to only use the first 24
# bits of the 32 bit IP adress. the same as netmask 255.255.255.0
#


LAN_IP="192.168.0.2"
LAN_IP_RANGE="192.168.0.0/16
LAN_BCAST_ADRESS="192.168.0.255"
LAN_IFACE="eth1"

LO_IFACE="lo"
LO_IP="127.0.0.1"

INET_IFACE="eth0"

IPTABLES="/usr/local/sbin/iptables"

#########
# Load all required IPTables modules
#

#
# Needed to initially load modules
#
/sbin/depmod -a

#
```

```
# Adds some iptables targets like LOG, REJECT and MASQUARADE.
#
/sbin/modprobe ipt_LOG
#/sbin/modprobe ipt_REJECT
/sbin/modprobe ipt_MASQUERADE

#
# Support for owner matching
#
#/sbin/modprobe ipt_owner

#
# Support for connection tracking of FTP and IRC.
#
#/sbin/modprobe ip_conntrack_ftp
#/sbin/modprobe ip_conntrack_irc

#
# Enable ip_forward, this is critical since it is turned off as default
# in Linux.
#

echo "1" > /proc/sys/net/ipv4/ip_forward

#
# Dynamic IP users:
#
#echo "1" > /proc/sys/net/ipv4/ip_dynaddr

#
# POSTROUTING chain in the nat table
#
#$IPTABLES -t nat -A POSTROUTING -p tcp –tcp-flags SYN,RST SYN \
#-j TCPMSS –clamp-mss-to-pmtu
$IPTABLES -t nat -A POSTROUTING -o $INET_IFACE -j MASQUERADE

#
# Bad TCP packets we don't want
#

$IPTABLES -A FORWARD -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A FORWARD -p tcp ! –syn -m state –state NEW -j DROP

#
# Accept the packets we actually want to forward
#

$IPTABLES -A FORWARD -i $LAN_IFACE -j ACCEPT
$IPTABLES -A FORWARD -m state –state ESTABLISHED,RELATED -j ACCEPT
$IPTABLES -A FORWARD -m limit –limit 3/minute –limit-burst 3 \
-j LOG –log-level DEBUG –log-prefix "IPT FORWARD packet died: "

#
# Set default policies for the INPUT, FORWARD and OUTPUT chains
#
```

```
$IPTABLES -P INPUT DROP
$IPTABLES -P OUTPUT DROP
$IPTABLES -P FORWARD DROP

#
# Create separate chains for ICMP, TCP and UDP to traverse
#

$IPTABLES -N icmp_packets
$IPTABLES -N tcp_packets
$IPTABLES -N udpincoming_packets

#
# The allowed chain for TCP connections
#

$IPTABLES -N allowed
$IPTABLES -A allowed -p TCP –syn -j ACCEPT
$IPTABLES -A allowed -p TCP -m state –state ESTABLISHED,RELATED -j ACCEPT
$IPTABLES -A allowed -p TCP -j DROP

#
# ICMP rules
#

# Changed rules totally
$IPTABLES -A icmp_packets -p ICMP -s 0/0 –icmp-type 8 -j ACCEPT
$IPTABLES -A icmp_packets -p ICMP -s 0/0 –icmp-type 11 -j ACCEPT

#
# TCP rules
#

$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 21 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 22 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 80 -j allowed
$IPTABLES -A tcp_packets -p TCP -s 0/0 –dport 113 -j allowed

#
# UDP ports
#

$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 53 -j ACCEPT
$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 123 -j ACCEPT
$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 2074 -j ACCEPT
$IPTABLES -A udpincoming_packets -p UDP -s 0/0 –source-port 4000 -j ACCEPT

#
# PREROUTING chain.
#
# Do some checks for obviously spoofed IP's
#

$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 192.168.0.0/16 -j DROP
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 10.0.0.0/8 -j DROP
```

```
$IPTABLES -t nat -A PREROUTING -i $INET_IFACE -s 172.16.0.0/12 -j DROP


#
# INPUT chain
#
# Take care of bad TCP  packets that we don't want
#

$IPTABLES -A INPUT -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A INPUT -p tcp ! –syn -m state –state NEW -j DROP

#
# Rules for incoming packets from the internet
#

$IPTABLES -A INPUT -p ICMP -i $INET_IFACE -j icmp_packets
$IPTABLES -A INPUT -p TCP -i $INET_IFACE -j tcp_packets
$IPTABLES -A INPUT -p UDP -i $INET_IFACE -j udpincoming_packets

#
# Rules for special networks not part of the Internet
#

$IPTABLES -A INPUT -p ALL -i $LO_IFACE -s $LO_IP -j ACCEPT
$IPTABLES -A INPUT -p ALL -i $LAN_IFACE -s $LAN_IP_RANGE -j ACCEPT
$IPTABLES -A INPUT -p ALL -i $INET_IFACE -m state \
–state ESTABLISHED,RELATED -j ACCEPT
$IPTABLES -A INPUT -m limit –limit 3/minute –limit-burst 3 \
-j LOG –log-level DEBUG –log-prefix "IPT INPUT packet died: "

#
# OUTPUT chain
#

$IPTABLES -A OUTPUT -p tcp ! –syn -m state –state NEW -j LOG \
–log-prefix "New not syn:"
$IPTABLES -A OUTPUT -p tcp ! –syn -m state –state NEW -j DROP

$IPTABLES -A OUTPUT -p ALL -s $LO_IP -j ACCEPT
$IPTABLES -A OUTPUT -p ALL -o $LAN_IFACE -j ACCEPT
$IPTABLES -A OUTPUT -p ALL -o $INET_IFACE -j ACCEPT
$IPTABLES -A OUTPUT -m limit –limit 3/minute –limit-burst 3 \
-j LOG –log-level DEBUG –log-prefix "IPT OUTPUT packet died: "
```

## Appendix P. Example rc.flush-iptables script

```
   #!/bin/sh
#
# rc.flush-iptables - Resets iptables to default values.
#
# Copyright (C) 2001  Oskar Andreasson <blueflux@koffein.net>
#
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# Place, Suite 330, Boston, MA  02111-1307   USA

#
# Configurations
#
IPTABLES="/usr/local/sbin/iptables"

#
# reset the default policies in the filter table.
#
$IPTABLES -P INPUT ACCEPT
$IPTABLES -P FORWARD ACCEPT
$IPTABLES -P OUTPUT ACCEPT

#
# reset the default policies in the nat table.
#
$IPTABLES -t nat -P PREROUTING ACCEPT
$IPTABLES -t nat -P POSTROUTING ACCEPT
$IPTABLES -t nat -P OUTPUT ACCEPT

#
# reset the default policies in the mangle table.
#
$IPTABLES -t mangle -P PREROUTING ACCEPT
$IPTABLES -t mangle -P OUTPUT ACCEPT

#
# flush all the rules in the filter and nat tables.
#
$IPTABLES -F
$IPTABLES -t nat -F
$IPTABLES -t mangle -F
#
# erase all chains that's not default in filter and nat table.
```

```
#
$IPTABLES -X
$IPTABLES -t nat -X
$IPTABLES -t mangle -X
```

# Appendix Q. Example rc.test-iptables script

```
   #!/bin/bash
#
# rc.test-iptables - test script for iptables chains and tables.
#
# Copyright (C) 2001  Oskar Andreasson <blueflux@koffein.net>
#
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# from; if not, write to the Free Software Foundation, Inc., 59 Temple
# Place, Suite 330, Boston, MA  02111-1307   USA
#

#
# Filter table, all chains
#
iptables -t filter -A INPUT -p icmp –icmp-type echo-request \
-j LOG –log-prefix="filter INPUT:"
iptables -t filter -A INPUT -p icmp –icmp-type echo-reply \
-j LOG –log-prefix="filter INPUT:"
iptables -t filter -A OUTPUT -p icmp –icmp-type echo-request \
-j LOG –log-prefix="filter OUTPUT:"
iptables -t filter -A OUTPUT -p icmp –icmp-type echo-reply \
-j LOG –log-prefix="filter OUTPUT:"
iptables -t filter -A FORWARD -p icmp –icmp-type echo-request \
-j LOG –log-prefix="filter FORWARD:"
iptables -t filter -A FORWARD -p icmp –icmp-type echo-reply \
-j LOG –log-prefix="filter FORWARD:"

#
# NAT table, all chains except OUTPUT which don't work.
#
iptables -t nat -A PREROUTING -p icmp –icmp-type echo-request \
-j LOG –log-prefix="nat PREROUTING:"
iptables -t nat -A PREROUTING -p icmp –icmp-type echo-reply \
-j LOG –log-prefix="nat PREROUTING:"
iptables -t nat -A POSTROUTING -p icmp –icmp-type echo-request \
-j LOG –log-prefix="nat POSTROUTING:"
iptables -t nat -A POSTROUTING -p icmp –icmp-type echo-reply \
-j LOG –log-prefix="nat POSTROUTING:"
iptables -t nat -A OUTPUT -p icmp –icmp-type echo-request \
-j LOG –log-prefix="nat OUTPUT:"
iptables -t nat -A OUTPUT -p icmp –icmp-type echo-reply \
-j LOG –log-prefix="nat OUTPUT:"
```

```
#
# Mangle table, all chains
#
iptables -t mangle -A PREROUTING -p icmp –icmp-type echo-request \
-j LOG –log-prefix="mangle PREROUTING:"
iptables -t mangle -A PREROUTING -p icmp –icmp-type echo-reply \
-j LOG –log-prefix="mangle PREROUTING:"
iptables -t mangle -A OUTPUT -p icmp –icmp-type echo-request \
-j LOG –log-prefix="mangle OUTPUT:"
iptables -t mangle -A OUTPUT -p icmp –icmp-type echo-reply \
-j LOG –log-prefix="mangle OUTPUT:"
```