



Engineering Development Group

OutlawCountry v1.0 User Manual

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1. (U) Scope

(U) This document establishes the User Manual for OutlawCountry v1.0 and was prepared by the Remote Development Branch within NCS/IOC/EDG/AED.

1.1 (U) System Overview and Description

(S//NF) OutlawCountry consists of a kernel module that creates a hidden netfilter table on a Linux target. With knowledge of the table name, an operator can create rules that take precedence over existing netfilter/iptables rules.

1.2 (U) Assumptions and Constraints

(S//NF) OutlawCountry v1.0 contains one kernel module for 64-bit CentOS/RHEL 6.x. This module will only work with default kernels. Also, OutlawCountry v1.0 only supports adding covert DNAT rules to the PREROUTING chain.

2. (U) Applicable Documents

Table 1 - (U) Applicable Documents

2015-0283_OutlawCountry v1.0_URD_Rev_B.xlsx
OutlawCountry_v1_0_Test_Plan.docx

3. (U) System Description

3.1 (U) Technical References

Table 2 - (S//NF) Included Files

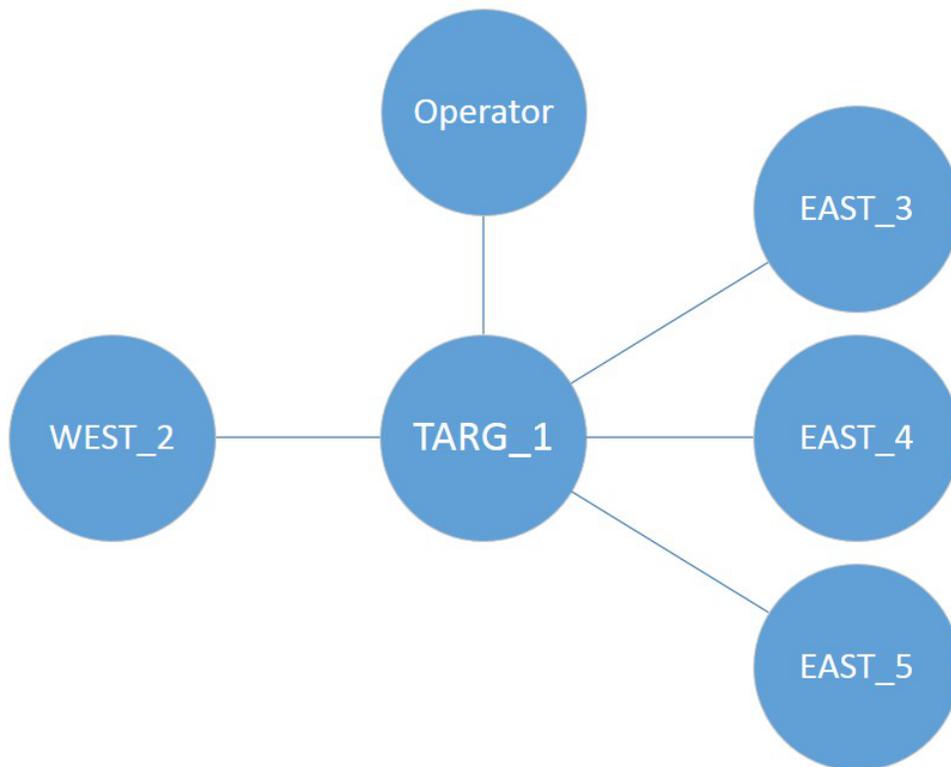
File Name	Size	MD5
nf_table_6_64.ko	9672	2CB8954A3E683477AA5A084964D4665D

(S//NF) When the module is loaded, the hidden table is named “dpxvke8h18”.

3.2 (U) Concept of Operation (CONOP)

(S//NF) The OutlawCountry tool consists of a kernel module for Linux 2.6. The Operator loads the module via shell access to the target. When loaded, the module creates a new netfilter table with an obscure name. The new table allows certain rules to be created using the “iptables” command. These rules take precedence over existing rules, and are only visible to an administrator if the table name is known. When the Operator removes the kernel module, the new table is also removed.

Figure 1 - (S//NF) OutlawCountry Concept of Operation



(S//NF) In the diagram above, the Operator loads OutlawCountry on the target (TARG_1). After doing so, the Operator may add hidden iptables rules to modify network traffic between the WEST and EAST networks. For example, packets that should be routed from WEST_2 to EAST_3 may be redirected to EAST_4.

3.3 (U) Prerequisites

(S//NF) The target must be running a compatible 64-bit version of CentOS/RHEL 6.x (kernel version 2.6.32).

(S//NF) The Operator must have shell access to the target.

(S//NF) The target must have a “nat” netfilter table.

4. (U) Operation

(S//NF) For operational use, shell access is assumed, and root privileges are required.

4.1 (U) Installation

(S//NF) First, select the appropriate kernel module for the target system. For 64-bit CentOS/RHEL 6.x targets, use the “nf_table_6_64.ko” module. Copy the module to the target system, preferably with “nf_table.ko” as the file name.

(S//NF) Make sure that the target has a “nat” table:

```
TARG# iptables -t nat -L -nv
```

(S//NF) Load the module using “insmod”:

```
TARG# insmod nf_table.ko
```

(S//NF) The new “dpxvke8h18” table should now be loaded:

```
TARG# iptables -t dpxvke8h18 -L -nv
```

(S//NF) At this point, the module file on disk can safely be removed for operational security:

```
TARG# rm nf_table.ko
```

4.2 (U) Use

(S//NF) The “dpxvke8h18” table has a PREROUTING chain that supports DNAT (Destination Network Address Translation) rules, which can be added with the “-A” or “-I” options available in the “iptables” command:

```
TARG# iptables -t dpxvke8h18 -A PREROUTING \  
-p tcp -s 1.1.1.1 -d 2.2.2.2 --dport 33 \  
-j DNAT --to-destination 4.4.4.4:55
```

(S//NF) The example above applies to TCP traffic from IP 1.1.1.1 that is bound for IP 2.2.2.2, port 33. The traffic is redirected to IP 4.4.4.4, port 55. For more information about iptables and DNAT rules, consult the iptables man pages.

(S//NF) Current rules can be listed using the “iptables -L” command:

```
TARG# iptables -t dpxvke8h18 -L PREROUTING
Chain PREROUTING (policy DROP)
target prot opt source destination
DNAT tcp -- 1.1.1.1 2.2.2.2 tcp dpt:dsp
to:4.4.4.4:55
```

(S//NF) Rules can be removed using the “iptables -D” command:

```
TARG# iptables -t dpxvke8h18 -D PREROUTING 1
```

(S//NF) The above command removes the first rule in the PREROUTING chain.

4.3 (U) Removal

(S//NF) First, flush any remaining rules in the “dpxvke8h18” table:

```
TARG# iptables -t dpxvke8h18 -F
```

(S//NF) Then, remove the “nf_table” module using “rmmod”:

```
TARG# rmmod nf_table
```

(S//NF) NOTE: The “nf_table” name is internal to the module, and is unaffected by the name of the .ko file that was loaded. If the module was named “foo.ko” on target, and “insmod foo.ko” was used to load the module, “rmmod nf_table” should still be used to unload the module.

(S//NF) To confirm that the module is no longer loaded and the table has been removed, use “lsmod” and “iptables”:

```
TARG# lsmod
TARG# iptables -t dpxvke8h18 -L -nv
```

(S//NF) There should be no mention of “nf_table” in the output of the “lsmod” command, and the “iptables” command should display an error message.

5. (U) Troubleshooting

(S//NF) If the module fails to load:

- Is the target kernel version supported?
- Does the “nat” table exist?

(S//NF) If the “dpxvke8h18” table is not available:

- Does the “nf_table” module appear in the output of the “lsmod” command?

(S//NF) If rules cannot be added to the “dpxvke8h18” table:

- Are the rules valid DNAT rules?

(S//NF) If the rules do not appear to redirect traffic:

- Do the rules appear in the “dpxvke8h18” table?
- Is IP forwarding enabled?
- Are there FORWARD rules or policies that block the traffic?

6. (U) Limitations

(S//NF) The kernel modules will only work with compatible Linux kernels. It is possible that a particular target's kernel will be a different version, or be built with a configuration that causes module loading to fail. In that case, it is likely that a new module could be built for that configuration. If requesting support for a new version or configuration, please include the output of the "uname -a" command.

(S//NF) In the context of the "dpxvke8h18" table, the DROP target means that packet processing continues (to the "nat" table, and then the "filter" table). The ACCEPT target means that packet processing stops for the PREROUTING chain. For this reason, the default policy is DROP for this table. **Do *NOT* change the default policy, or add rules that don't have DNAT as the target, without consulting the developer.**

(S//NF) As with normal NAT rules, traffic may be affected by other iptables rules. For example, if the traffic requires forwarding, and a rule or policy in the FORWARD chain blocks the traffic, it will not be forwarded. Similarly, IP forwarding must be enabled. To check, look at "/proc/sys/net/ipv4/ip_forward":

```
TARG# cat /proc/sys/net/ipv4/ip_forward
0
```

(S//NF) A value of "1" indicates that forwarding is enabled. To enable forwarding, "echo" can be used:

```
TARG# echo "1" > /proc/sys/net/ipv4/ip_forward
```

(S//NF) As mentioned in the Installation section, the target must have a "nat" table.

(S//NF) Because the kernel module is not present in the target's "modules.dep" file, the "modprobe" command cannot be used to remove the module. Instead, the "rmmod" command must be used.

(S//NF) If the target's iptables service is stopped or restarted, the kernel module will enter a "dormant" state. The module will remain loaded and appear in the output of the "lsmod" command, but the hidden table will no longer be present. To re-enable the hidden table, uninstall the module using the "rmmod" command, then reinstall the module using the "insmod" command.

(S//NF) IPv6 is not supported.

7. (U) Acronyms/Abbreviations

(U) The Acronyms/Abbreviations used in this document are shown in Table 3.

Table 3 - (U) Acronyms/Abbreviations

Acronym/Abbreviation	Term
DNAT	Destination Network Address Translation
IP	Internet Protocol
RHEL	Red Hat Enterprise Linux
NAT	Network Address Translation
TCP	Transport Control Protocol
UDP	User Datagram Protocol