Inline Snort multiprocessing with PF_RING

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Introduction

We have modified PF_RING to work with inline Snort while still supporting the current passive multiprocessing functionality. PF_RING load balances the traffic to analyze by hashing the IP headers in multiple buckets. This allows it to spawn multiple instances of Snort, each processing a single bucket, and achieve higher throughput through multiprocessing. In order to take full advantage of this, you need a multicore processor (like an I7 with 8 processing threads). This should also work well with dual or quad processor boards to increase parallelism even further.

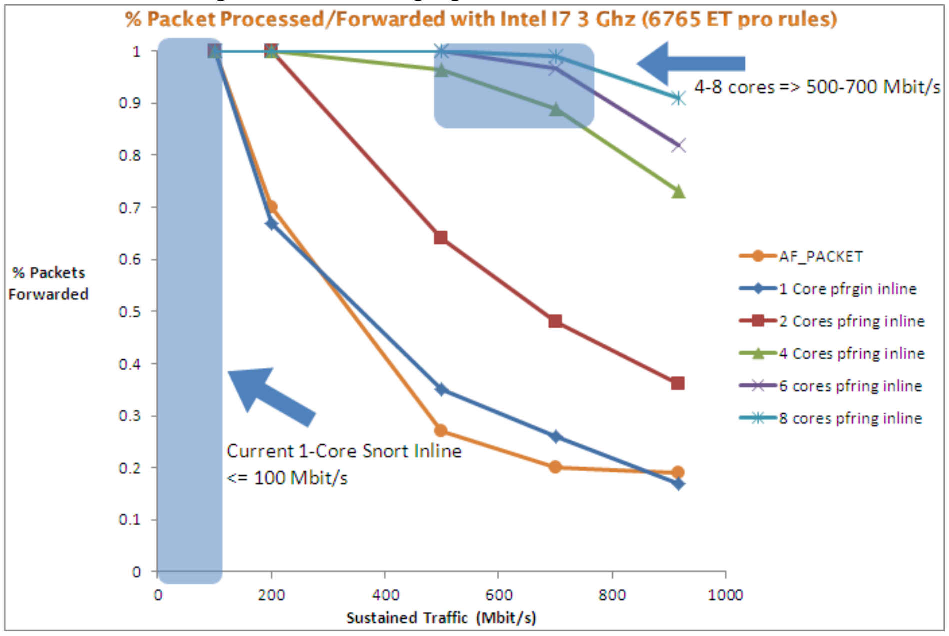
What this means is that you can build a really cheap IPS using standard, off-the-shelf hardware.

If you have any questions or issues, please contact us at support@metaflows.com

Equipment Used

Intel(R) Core(TM) i7 CPU 950 @ 3.07GHz, Dual Intel e1000e, 4 Gig RAM
PF_RING e1000e driver, transparent_mode=1
Operating System: Linux (CentOS preferred)

Snort 2.9.0.x using the 6765 Emerging Threats Pro Rules



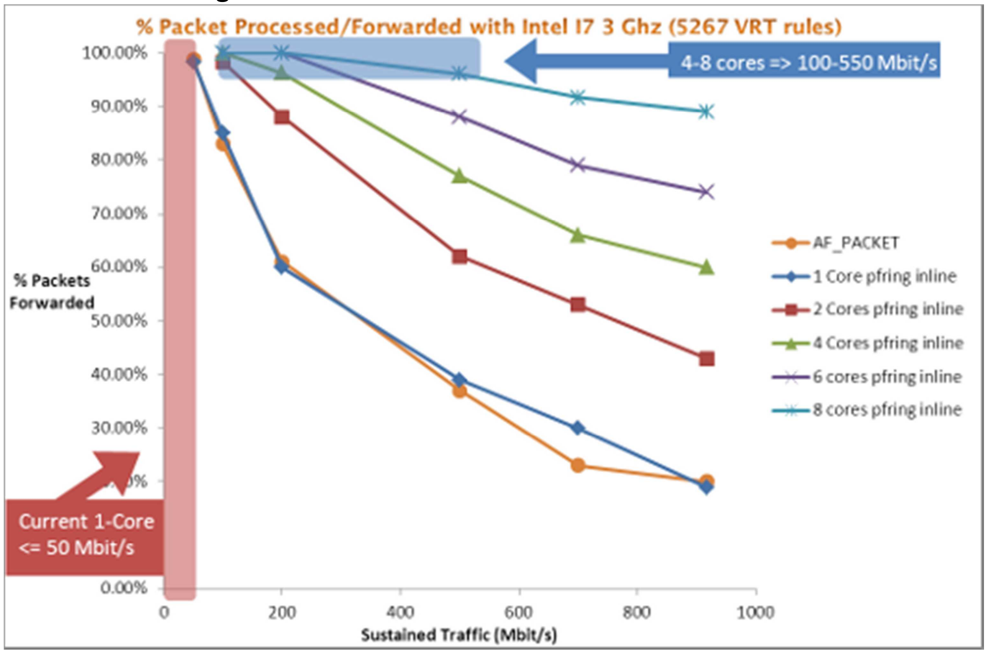
ET-Pro Percentage Packet Forwarded

Bandwidth	1 Core	2 Cores	4 Cores	6 Cores	8 Cores
100	100%	100%	100%	100%	100%

200	67.00%	100%	100%	100%	100%
400	35.00%	64.00%	96.5%	100%	100%
600	26.00%	48.00%	89.00%	96.6%	98.9%
917	17.00%	36.00%	73.00%	82.00%	91.00%

As the graph above illustrates, inline with 1 core can only sustain 100 Mbit/s or less (that's what people get today). With Pfring inline we parallelize the inline processing on up to 8 cores thus achieving almost 700 Mbit/s sustained with ET-Pro rules with approximately 200 microseconds latency.

Snort 2.9.0.x using the 5267 VRT Rules



This graph again illustrates that using Pfring inline to parallelize the inline processing increases performance with the VRT rules as well.

VRT Percentage Packet Forwarded

Bandwidth	**1 Core**	**2 Cores**	**4 Cores**	**6 Cores**	**8 Cores**
50	98.30%	100%	100%	100%	100%
100	85.00%	98.30%	100%	100%	100%
200	60.00%	88.00%	96.2%	100%	100%
500	39.00%	62.00%	77.00%	88.00%	96.10%
700	30.00%	53.00%	66.00%	79.00%	91.70%
917	19.00%	43.00%	60.00%	74.00%	89.00%

Please note: performance numbers are greatly affected by the type and number of Snort rules used and the type of traffic being sent through.

Installation Instructions

Install the following packages
libdnet-1.12
kernel-devel
libtool
subversion
automake
make
autoconf
pcre-devel
libpcap-devel
flex
bison
byacc
gcc
zlib-devel
gcc-c++

#Build the PF_RING inline libraries and kernel module:

#download our modified PF_RING source http://www.metaflows.com/pfring/PF_RING.tgz

```
tar xvfz PF_RING.tgz
cd  PF_RING; make clean
cd kernel;
make clean; make; make install
cd ../userland/lib;
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/lib;
export LIBS='-L/usr/local/lib';
./configure;
make clean; make; make install
cd ../libpcap;
export LIBS='-L/usr/local/lib -lpfring -lpthread';
./configure;
make clean; make; make install;
make clean; make; make install-shared
ln -s /usr/local/lib/libpfring.so /usr/lib/libpfring.so
```

#Build the daq-0.6.2 libraries:
#downlaod daq-0.6.2 http://www.snort.org/dl/snort-current/daq-0.5.tar.gz

```
tar xvfz daq-0.6.2.tgz
cd daq-0.6.2;
chmod 755 configure;
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/lib;
export LIBS="-L/usr/local/lib -lpcap -lpthread"
./configure --disable-nfq-module --disable-ipq-module \
--with-libpcap-includes=/usr/local/include \
--with-libpcap-libraries=/usr/local/lib \
--with-libpfring-includes=/usr/local/include/ \
--with-libpfring-libraries=/usr/local/lib
make clean; make; make install
```

#Go back to the PF_RING directory and build the daq interface module

```
cd  PF_RING/userland/snort/pfring-daq-module;
autoreconf -ivf;
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/lib
export LIBS='-L/usr/local/lib -lpcap -lpfring -lpthread';
./configure; make; make install
```

# Build Snort 2.9.x #

```
cd snort-2.9.x;
make clean ;
export LD_LIBRARY_PATH=$LD_LIBRARY_PATH:/usr/local/lib;
export LIBS='-L/usr/local/lib -lpfring -lpthread'
./configure --with-libpcap-includes=/usr/local/includes \
--with-libpcap-libraries=/usr/local/lib \
--with-libpfring-includes=/usr/local/include/ \
--with-libpfring-libraries=/usr/local/lib \
--enable-zlib --enable-perfprofiling
make
make install
```

# Load PF_RING MODULE
####### ATTENTION #########
#The OS will try to load the PF_RING kernel module with default
#parameters anytime any application with PF_RING runs
#The default parameters are wrong when running inline
#****Never run inline with tx_capture****
#Therefore is always a good idea to remove pf_ring.ko and reload it with
#the correct parameter before running inline

```
rmmod pf_ring.ko
insmod pf_ring.ko enable_tx_capture=0
```

# Run Snort
# Run as many instances as your system can handle limited only to value of \
#CLUSTER_LEN in PF_RING/kernel/linux/pf_ring.h at compile time (and your memory)
#Remember to replace the interfaces with ones appropriate for your instance.

```
ifconfig eth0 up
ifconfig eth1 up
snort -c snort.serv.conf -A console -y -i eth0:eth1 \
--daq-dir /usr/local/lib/daq --daq pfring --daq-var clusterid=10 \
--daq-mode inline -Q
```

#If you want even faster performance (about 20% more) and you have one of the Ethernet interfaces in
#PF_RING/drivers, you can run in transparent mode 1. We have only extensively tested the e1000e
#driver and we know it is very reliable.
#To use transparent mode 1 with an e1000e interface:

```
cd PF_RING/drivers/intel/e1000e/e1000e-1.3.10a/src;
make clean;
make;
make install
```

#Now you need to replace the e1000e module by either
#rebooting or removing the old one and reloading the new driver in
#/lib/modules/`uname -r`/kernel/drivers/net/e1000e/
#You also need to reload the `pf_ring.ko` module to enable transparent mode 1
#also increasing the buffer size to handle spikes in throughput

```
rmmod pf_ring.ko
insmod pf_ring.ko enable_tx_capture=0 transparent_mode=1
min_num_slots=16384
```

#If you have any issues, you can contact us at support@metaflows.com or visit the Metaflows Google
#group for support http://groups.google.com/group/metaflows