Содержание

Description of NAT statistics

NAT statistics can be logged to stat_log and via fdpi_ctrl.
To view queue information, you can dump the NAT profile via fdpi_cli.

Logging statistics to fastdpi_stat.log

This is configured using the `dbg_log_mask` parameter in /etc/dpi/fastdpi.conf.
A service reload is required for the changes to take effect: `service fastdpi reload`
Example:
dbg_log_mask=0x2000000

0x40000 - output of NAT initialization details (profiles, public addresses, etc.) to the alert log
0x100000 - output of statistics by blocks of public addresses (if 0x2000000 is set)
0x2000000 - NAT statistics output.

Common for all profiles

```
[STAT    ][2021/12/22-17:33:17:513859] NAT statistics : itrnsl=0, iprof=2,
profile 'cgnat', nttype=0, ref_cnt=1, cidr=94.140.198.84/30
[STAT    ][2021/12/22-17:33:17:513869] NAT statistics : itrnsl=1, iprof=3,
profile 'nat1_1', nttype=1, ref_cnt=1, cidr=16.35.121.0/24

    itrnsl  - internal index of the private<-->public proile converter.
    iprof   - internal index of the profile
    profile - profile name
    nttype  - profile type (0 - cgnat, 1 - 1:1)
    ref_cnt - counter of references of converter usage by profiles
    (Profiles can use one set of CIDR, but different number of restrictions
per session)
    cidr    - list of profile's public addresses CIDR
```

CG-NAT Profile

```
[STAT    ][2021/12/22-17:33:19:252622] NAT statistics : itrnsl=0, iprof=2,
profile 'cgnat', nttype=0, ref_cnt=1, cidr=94.140.198.84/30
        k=0, itrnsld=0, cidr=94.140.198.84/30
                total  TCP : 30/20/0/7/17/ 0/0/0 50/20/0/50/0 5516/8/121
                actual TCP : 0/0/0/0/0 0/0/0 0/0/0/0/0 0/0/0
                total  UDP : 13/4/0/13/1/ 0/0/0 17/4/11/17/0 28/1/3
                actual UDP : 0/0/0/0/0 0/0/0 0/0/0/0/0 0/0/0
                total GRE : 0/0
```

Information on the data converter

```
        k=0, itrnsld=0, cidr=94.140.198.84/30
    k       - itrnsld number
    itrnsld - internal converter data index - the one serving the CIDR
    cidr    - exact cidr

    total   - total statistics
    actual  - статистика изменеий счетчиков за период вывода статистики
(delta_alarm parameter, 15 seconds by default)

    total  TCP : 30/20/0/7/17 0/0/0 50/20/0/50/0 5516/8/121
```

Four groups группы:
1 group — operations with public address ports

```
30/20/0/7/17:

30 - allocation of a new public port
20 - public port reuse
0  - errors of allocating a new public port
7  - performs decrement of number of subscriber sessions on flow releasing
17 - performs decrement of the number of subscriber sessions on public port
reuse
```

2 group — general statistics

```
0/0/0:

0 - calculated CRC by IP when accessed to allocate a public address. Should
be == 0
0 - excessive number of sessions for subscribers
0 - different public addresses in flow and converters - Should be == 0
```

3 group — cache statistics *private* → *public*

```
50/20/0/50/0:

50 - added records to cache
20 - deleted records from cache
0  - found records in cache when new public port is allocated
50 - no public address found for private
0  - errors of adding to cache
```

4 group — conversion statistics *public* → *private* (*inet→subs*)

```
5516/8/121:

5516 - successful translation public → private
8    - port is not in the allocated range of public ports
```

```
121  - translation public → private was not found
```

For TCP/UDP and total/actual statistics are the same.

For GRE – it is GRE by default (when session is not found in PPTP). Only one such session can be created per public address.

```
total GRE : 0/0
0 - address used
0 - number of attempts to create sessions on an already allocated public
address
```

1:1 Profile

```
[STAT    ][2021/12/22-17:17:28:749622] NAT statistics : itrnsl=1, iprof=3,
profile 'nat1_1', nttype=1, ref_cnt=1, cidr=16.35.121.0/24
        k=0, itrnsld=1, cidr=16.35.121.0/24
                total 256/256/0/0/0/0 0/0
```

Group 2 statistics:
1 group - 256/256/0/0/0/0
2 group - 0/0

Example:
dbg_log_mask=0x2100000

Output of public addresses statistics

```
[STAT    ][2021/12/22-21:14:48:385991] NAT statistics : itrnsl=0, iprof=2,
profile 'cgnat', nttype=0, ref_cnt=1, cidr=94.140.198.84/30
        k=0, itrnsld=0, cidr=94.140.198.84/30
                total  TCP : 26/4/0/4/2/ 0/0/0 30/4/0/30/0 3045/1/36
                actual TCP : 0/0/0/0/0 0/0/0 0/0/0/0/0 0/0/0
                        TCP whiteblck ip_mask=0x0, nwhaddr=2
                                whip=94.140.198.84 : sb=64, lsb=64, nb=1008,
whpa=64512, whpb=0, whpf=64512, awhb=4, fwhb=1004, puwhb=0.40%
                                        thr=0, ublock=1, uport=0
                                        thr=1, ublock=1, uport=0
                                        thr=2, ublock=1, uport=0
                                        thr=3, ublock=1, uport=0
                                whip=94.140.198.86 : sb=64, lsb=64, nb=1008,
whpa=64512, whpb=26, whpf=64486, awhb=4, fwhb=1004, puwhb=0.40%
                                        thr=0, ublock=1, uport=0
                                        thr=1, ublock=1, uport=0
                                        thr=2, ublock=1, uport=13
                                        thr=3, ublock=1, uport=13
```

```
TCP whiteblck ip_mask=0x0, nwhaddr=2 :
```

```
    ip_mask - addresses mask
    nwhaddr - the number of public addresses that are under the mask
```

```
whip=94.140.198.84 : sb=64 ( 64 ), nb=1008, whpa=64512, whpb=0, whpf=64512,
awhb=4, fwhb=1004, puwhb=0.40%

    whip=94.140.198.84 - public address
    sb=64       - port block size
    lsb=64      - size of the last block
    nb=1008     - number of port blocks
    whpa=64512  - total ports
    whpb=0      - ports occupied
    whpf=64512  - free ports
    awhb=4      - blocks issued
    fwhb=1004   - free blocks
    puwhb=0.40% - percentage of blocks occupied
```

Added in version 12.1.0

```
whp_salfs   - how many ports are in the 'short' queue
whp_lalfs   - how many ports are in the 'long' queue
whp_ruse    - how many ports can be reused
whp_ruse_salfs  - how many ports can be reused from the 'short' queue
whp_ruse_lalfs  - how many ports can be reused from the 'long' queue
whp_dthr    - how many ports were created in one worker thread but used in
another thread
whp_dthr_salfs  - how many ports were created in one worker thread but used
in another from the 'short' queue
whp_dthr_lalfs  - how many ports were created in one worker thread but used
in another from the 'long' queue
```

Within the public address you can see the distribution of captured ports/blocks by worker threads

```
thr=0, ublock=1, uport=0
thr=0 - worker thread number
ublock=1 - public ports blocks used
uport=0 - public ports used
```

```
thr_salfs   - how many ports are in the 'short' queue
thr_lalfs   - how many ports are in the 'long' queue
thr_ruse    - how many ports can be reused
thr_ruse_salfs  - how many ports can be reused from the 'short' queue
thr_ruse_lalfs  - how many ports can be reused from the 'long' queue
thr_dthr    - how many ports were created in one worker thread but used in
another thread
thr_dthr_salfs  - how many ports were created in one worker thread but used
in another from the 'short' queue
thr_dthr_lalfs  - how many ports were created in one worker thread but used
in another from 'long' queue
```

The output format is the same.

```
fdpi_ctrl list status --service 11 --ip 192.168.4.20
Autodetected fastdpi params : dev='em1', port=29001
connecting 94.140.198.68:29001 ...

================================
192.168.4.20    crcip=0xd649d853        nttype=0        profile='cgnat'
itrnsl=0 itrnsld=0       whiteip=94.140.198.86   sess_tcp=127
active_sess_tcp=0       sess_udp=108     active_sess_udp=1       indmtd=4
```

Output:

```
192.168.4.20        - private IP
crcip=0xd649d853    - CRC of the private IP
nttype=0            - NAT type: 0 - cgnat, 1 - 1:1
profile='cgnat'   - profile name
itrnsl=0        - internal index of the converter private<-->public profile.
itrnsld=0           - internal converter data index
whiteip=94.140.198.86   - public address
sess_tcp=127        - number of TCP sessions
active_sess_tcp=0   - Number of active NAT translations for TCP
sess_udp=108        - number of UDP sessions
active_sess_udp=1   - Number of active NAT translations for UDP
indmtd=4                - internal index of subscriber data (subscriber
metadata)

fdpi_ctrl list status --service 11 --ip 192.168.4.20 --outformat=json
fdpi_ctrl list status --service 11 --ip 192.168.4.20 --outformat=json  | jq
.

fdpi_ctrl list all status --service 11
fdpi_ctrl list all status --service 11 --outformat=json
```

The format is the same.

Key to command to view NAT profile statistics via fdpi_ctrl

Command:

```
fdpi_ctrl list status --service 11 --profile.name cgnat
```

Output:

```
nttype=0        profile='test_nat_cgnat'        itrnsl=0        nitrnsld=1
        itrnsld=0       cidr=94.140.198.84/30
                proto=TCP       ip_mask=0x0     nwhaddr=2
                        proto=TCP       ip_mask=0x0     whip=94.140.198.84
sb=64   lsb=64  nb=1008 whpa=64512      whpb=0  whpf=64512      awhb=4
```

```
fwhb=1004       puwhb=0.40%     whp_salfs=0     whp_lalfs=0     whp_ruse=0
whp_ruse_salfs=0        whp_ruse_lalfs=0        whp_dthr=0
whp_dthr_salfs=0        whp_dthr_lalfs=0
                                nthr=0  ublock=1        uport=0 thr_salfs=0
thr_lalfs=0     thr_ruse=0      thr_ruse_salfs=0        thr_ruse_lalfs=0
thr_dthr=0      thr_dthr_salfs=0        thr_dthr_lalfs=0
                                nthr=1  ublock=1        uport=0 thr_salfs=0
thr_lalfs=0     thr_ruse=0      thr_ruse_salfs=0        thr_ruse_lalfs=0
thr_dthr=0      thr_dthr_salfs=0        thr_dthr_lalfs=0
```

Key:

```
nttype          - profile type (0 - cgnat, 1 - 1:1)
profile         - profile name
itrnsl          - internal index of private<-->public profile converter
nitrnsld        - number of profile converter data (number of CIDR)
itrnsld         - internal converter data index - the one serving the CIDR
cidr            - exact CIDR
proto           - TCP/UDP
ip_mask         - addresses mask
nwhaddr         - the number of public addresses which fall under the mask or
CRC (depends on rx_dispatcher parameter)
whip            - public address
sb              - size of the block of ports to be allocated
lsb             - size of the last block
nb              - number of prot blocks
whpa            - ports in total
whpb            - ports occupied
whpf            - free ports
awhb            - blocks issued
fwhb            - free blocks
puwhb           - percentage of blocks occupied
whp_salfs       - is in the 'short' queue
whp_lalfs       - in the 'long' queue
whp_ruse        - can be used
whp_ruse_salfs  - can be used in 'short' queue
whp_ruse_lalfs  - can be used in 'long' queue
whp_dthr        - number of elements ithr_owner != ithr by queue
whp_dthr_salfs  - number of elements ithr_owner != ithr by 'short' queue
whp_dthr_lalfs  - number of elements ithr_owner != ithr by 'long' queue
```

`rx_dispatcher` parameter description at the link

Key to command to view the dump NAT profile statistics

Command:

```
fdpi_cli nat dump whaddr queue test_nat_cgnat
```

Output:

```
profile='test_nat_cgnat' itrnsl=0
        cidr='94.140.198.84/30' itrnsld=0
                whip=94.140.198.86
                        proto=TCP
                                entryp :
                                        ithr=0, ihead=0, itail=0
                                        ithr=1, ihead=0, itail=0
                                        ithr=2, ihead=133, itail=265
                                        ithr=3, ihead=193, itail=327
                                data :
                                        sind=129, inext=257, iprev=258,
whport=1152, graddr=192.168.4.20:60637 tml='2023/03/06 16:28:09,
-00:00:10.657 (7472516905147512 ticks)', lifetime=120, canreuse=0, ialf=1,
imtd=516, iown=2, ilst=2, subproto=0, decr_sess=0, ind_gcache_slice=1,
igcache=40
                                        sind=130, inext=151, iprev=148,
whport=1153, graddr=192.168.4.20:52553 tml='2023/03/06 16:27:50,
-00:00:29.455 (7472459405058624 ticks)', lifetime=30, canreuse=0, ialf=0,
imtd=516, iown=2, ilst=2, subproto=0, decr_sess=0, ind_gcache_slice=1,
igcache=1
```

Key:

```
profile        - profile name
itrnsl         - internal index of the private<-->public profile converter

cidr           - exact CIDR
itrnsld        - internal converter data index - the one serving the CIDR

whip           - public address
proto          - TCP/UDP
```

The implementation of the used ports queue for public addresses uses a single array - let's call it WHP, of size 0xffff. It is used to build a list of used ports for the worker thread. Index 0 is used as a stub (empty).

Thread queues cannot be output as a list, because records in the queue are moved in the process, which may cause the output to loop. Therefore, the WHP array is output 'as is' for occupied entries.

```
entryp : sets entry points to the list of public ports of the worker thread
    ithr   - worker thread number
    ihead  - top of the list
    itail  - the last element of the list
```

```
data : WHP white port array data (only occupied entries are output)
```

```
    sind         - record index
    inext            - next record index
    iprev            - previous record index
    whport           - public port
    graddr           - private address, which the public address is assigned
to
    tml              - time of the last record access
    lifetime         - timeout, time in seconds, the record lifetime
(depends on the parameters for short/long queue)
    canreuse         - sign that the record can be used again
    ialf             - number of the processing queue :
                           en_nalfs_shrt = 0,  # queue with a short
lifetime
                           en_nalfs_long = 1,  # long queue
    indmtd           - internal index of the subscriber's data (subscriber's
metadata)
    iown             - owner thread which has created the record
    ilst             - number of the thread which has last accessed the
record
    subproto         - the protocol the record was allocated for from UDP
                        typedef enum en_nat_borrw_udp: u_int8_t
                        {
                            ennatborwu_ORG     = 0, # UDP/TCP
                            ennatborwu_DFLTGRE = 1, # общий GRE
                            ennatborwu_MAX     = 2, # ICMP
                        } en_nat_borrw_udp_t;
    decr_sess        - a mark that the port usage counter on the private
address has decremented
    ind_gcache_slice - index of the 'private --> public' transcoding cache-
slice
    igcache          - index in the corresponding cache-slice recoding
'private --> public'
```

Monitoring Free/Busy Ports on Whitelisted Addresses

Proactive monitoring helps avoid issues with a shortage of free ports and the resulting inability to create new sessions, by allocating additional blocks of whitelisted addresses or reducing port allocation limits when resources in the current pool are exhausted.

Free ports on a white address = whpf (unallocated) + whp_ruse (ready for reuse)
Busy ports on a white address = whpb (allocated) - whp_ruse (ready for reuse)