Subject: L2 network namespaces + macvlan performances
Posted by Benjamin Thery on Fri, 06 Jul 2007 16:48:15 GMT
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Following a discussion we had at OLS concerning L2 network namespace
performances and how the new macvlan driver could potentially improve
them, I've ported the macvlan patchset on top of Eric's net namespace
patchset on 2.6.22-rc4-mm2.

A little bit of history:

Some months ago, when we ran some performance tests (using netperf)
on net namespace, we observed the following things:

Using 'etun', the virtual ethernet tunnel driver, and IP routes
from inside a network namespace,

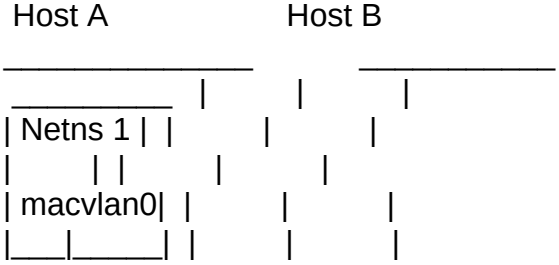
- The throughput is the same as the "normal" case(*)
  (* normal case: no namespace, using physical adapters).
  No regression. Good.

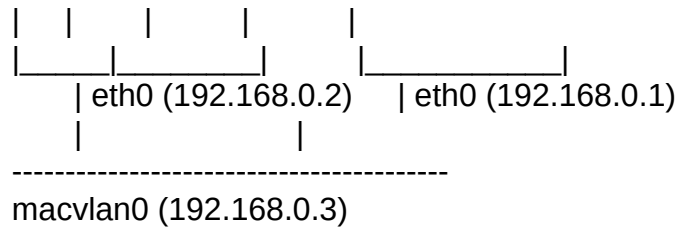
- But the CPU load increases a lot. Bad.
  The reasons are:
 - All checksums are done in software. No hardware offloading.
 - Every TCP packets going through the etun devices are
  duplicated in ip_forward() before we decrease the ttl.
        (packets are routed between both ends of etun)

We also made some testing with bridges, and obtained the same results:
 CPU load increase:
 - No hardware offloading
 - Packets are duplicated somewhere in the bridge+netfilter
        code (can't remember where right now)

This time, I've replaced the etun interface by the new macvlan,
which should benefits from the hardware offloading capabilities of the
physical adapter and suppress the forwarding stuff.

My test setup is:





- netperf runs on host A
- netserver runs on host B
- Adapters speed is 1GB/s

On this setup I ran the following netperf tests: TCP_STREAM,
TCP_MAERTS, TCP_RR, UDP_STREAM, UDP_RR.

Between the "normal" case and the "net namespace + macvlan" case,
results are about the same for both the throughput and the local CPU
load for the following test types: TCP_MAERTS, TCP_RR, UDP_STREAM, UDP_RR.

macvlan looks like a very good candidate for network namespace in
these cases.

But, with the TCP_STREAM test, I observed the CPU load is about the
same (that's what we wanted) but the throughput decreases by about 5%:
from 850MB/s down to 810MB/s.
I haven't investigated yet why the throughput decrease in the case.
Does it come from my setup, from macvlan additional treatments, other?
I don't know yet

Attached to this email you'll find the raw netperf outputs for the
three cases:

- netperf through a physical adapter, no namespace:
 netperf-results-2.6.22-rc4-mm2-netns1-vanilla.txt
- netperf through etun, inside a namespace:
 netperf-results-2.6.22-rc4-mm2-netns1-using-etun.txt
- netperf through macvlan, inside a namespace:
 netperf-results-2.6.22-rc4-mm2-netns1-using-macvlan.txt

macvlan looks promising.

Regards,
Benjamin

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NETPERF RESULTS: the "normal" case :
==========
No network namespace, traffic goes through real 1GB/s physical adapters.

TCP STREAM TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Recv Send Send Utilization Service Demand
Socket Socket Message Elapsed Send Recv Send Recv
Size Size Size Time Throughput local remote local remote
bytes bytes bytes secs. 10^6bits/s % S % S us/KB us/KB

87380 16384 1400 20.03 857.39 6.39 9.75 2.444 3.727

TCP MAERTS TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Recv Send Send Utilization Service Demand
Socket Socket Message Elapsed Send Recv Send Recv
Size Size Size Time Throughput local remote local remote
bytes bytes bytes secs. 10^6bits/s % S % S us/KB us/KB

87380 16384 87380 20.03 763.15 4.75 10.33 2.038 4.434

TCP REQUEST/RESPONSE TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Local /Remote
Socket Size Request Resp. Elapsed Trans. CPU CPU S.dem S.dem
Send Recv Size Size Time Rate local remote local remote
bytes bytes bytes bytes secs. per sec % S % S us/Tr us/Tr

16384 87380 1 1 20.00 12594.24 4.16 6.06 13.212 19.231
16384 87380

UDP UNIDIRECTIONAL SEND TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Socket Message Elapsed Messages CPU Service
Size Size Time Okay Errors Throughput Util Demand
bytes bytes secs # # 10^6bits/sec % SS us/KB

110592 1400 20.00 1701653 0 952.9 6.84 2.354
107520 20.00 1701647 952.9 9.66 3.321

UDP REQUEST/RESPONSE TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Local /Remote
Socket Size Request Resp. Elapsed Trans. CPU CPU S.dem S.dem
Send Recv Size Size Time Rate local remote local remote
bytes bytes bytes bytes secs. per sec % S % S us/Tr us/Tr

110592 110592 1 1 20.00 13789.92 3.82 6.16 11.087 17.855
107520 107520

NETPERF RESULTS: the etun case :
==========
netperf is ran from a network namespace,
traffic goes through etun adapters.

TCP STREAM TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Recv Send Send Utilization Service Demand
Socket Socket Message Elapsed Send Recv Send Recv
Size Size Size Time Throughput local remote local remote
bytes bytes bytes secs. 10^6bits/s % S % U us/KB us/KB

87380 16384 1400 40.02 840.64 12.89 -1.00 5.025 -1.000

TCP MAERTS TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Recv Send Send Utilization Service Demand
Socket Socket Message Elapsed Send Recv Send Recv
Size Size Size Time Throughput local remote local remote
bytes bytes bytes secs. 10^6bits/s % S % U us/KB us/KB

87380 16384 87380 40.03 763.30 6.29 -1.00 2.701 -1.000

TCP REQUEST/RESPONSE TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Local /Remote
Socket Size Request Resp. Elapsed Trans. CPU CPU S.dem S.dem

Send Recv Size Size Time Rate local remote local remote
bytes bytes bytes bytes secs. per sec % S % U us/Tr us/Tr

16384 87380 1 1 40.00 12230.34 4.64 -1.00 15.167 -1.000
16384 87380

UDP UNIDIRECTIONAL SEND TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Socket Message Elapsed Messages CPU Service
Size Size Time Okay Errors Throughput Util Demand
bytes bytes secs # # 10^6bits/sec % SU us/KB

110592 1400 40.00 12981742 0 3634.7 25.64 8.801
107520 40.00 3409123 954.5 -1.00 -1.000

UDP REQUEST/RESPONSE TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Local /Remote
Socket Size Request Resp. Elapsed Trans. CPU CPU S.dem S.dem
Send Recv Size Size Time Rate local remote local remote
bytes bytes bytes bytes secs. per sec % S % U us/Tr us/Tr

110592 110592 1 1 40.00 13385.96 4.22 -1.00 12.658 -1.000
107520 107520

NETPERF RESULTS: the "normal" case :
==========
netperf is ran from a network namespace,
traffic goes through a macvlan adapter.

TCP STREAM TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Recv Send Send Utilization Service Demand
Socket Socket Message Elapsed Send Recv Send Recv
Size Size Size Time Throughput local remote local remote
bytes bytes bytes secs. 10^6bits/s % S % S us/KB us/KB

87380 16384 1400 20.03 817.40 7.26 12.96 2.912 5.200

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TCP MAERTS TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1 (192.168.76.1) port 0
AF_INET : +/-2.5% @ 95% conf.
Recv   Send    Send                          Utilization       Service Demand
Socket Socket  Message  Elapsed              Send     Recv     Send    Recv
Size   Size    Size     Time     Throughput  local    remote   local   remote
bytes  bytes   bytes    secs.    10^6bits/s  % S      % S      us/KB   us/KB

 87380  16384  87380    20.03      763.33   4.95     10.32    2.127   4.429
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TCP REQUEST/RESPONSE TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1
(192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Local /Remote
Socket Size   Request Resp.  Elapsed Trans.   CPU    CPU    S.dem   S.dem
Send   Recv   Size    Size   Time    Rate     local  remote local   remote
bytes  bytes  bytes   bytes  secs.   per sec  % S    % S    us/Tr   us/Tr

16384  87380  1       1      20.00   12448.36  4.34   6.21   13.950  19.939
16384  87380
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UDP UNIDIRECTIONAL SEND TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1
(192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Socket  Message  Elapsed      Messages                   CPU      Service
Size    Size     Time         Okay Errors   Throughput   Util     Demand
bytes   bytes    secs            #      #   10^6bits/sec % SS     us/KB

110592    1400   20.00     1704200      0      954.3     7.11     2.440
107520           20.00     1704194             954.3     9.66     3.318

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------------------------------------------------------
UDP REQUEST/RESPONSE TEST from 0.0.0.0 (0.0.0.0) port 0 AF_INET to 192.168.76.1
(192.168.76.1) port 0 AF_INET : +/-2.5% @ 95% conf.
Local /Remote
Socket Size   Request Resp.  Elapsed Trans.   CPU    CPU    S.dem   S.dem
Send   Recv   Size    Size   Time    Rate     local  remote local   remote
bytes  bytes  bytes   bytes  secs.   per sec  % S    % S    us/Tr   us/Tr

110592 110592 1       1      20.00   13751.49   3.98   6.09   11.625  17.788
107520 107520
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