Netconf 2005

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Experiments & Experiences with FIB lookup and route cache
What we hear/got

dst cache overflow reports
  RCU related
  mistuned, misunderstood etc.

fib_lookup complaints
  what to expect
  BSD comparisons. Radix-tree
  ToS/semantic questionable
  fib_hash considered bad
Getting forward :)  

“Infrastructure” for test & development

stats to understand what happens

tools and setups to study

Preroute patches w. Jamal 2004
pktgen DoS, scripts w. routing table

steady Linux API work to prepare to
plugin new algos. Most from DaveM.

So much research
Still so little usable for Linux
FIB overview

FIB vs. dst hash performance

fib_hash
fib_hlist
fib_hash2
fib_trie
classifier lookup?
unified lookup?
fib_hash (current)

Fast - Yes
General purpose
Very integrated
fib_hlist

Tutorial
KISS
hlist with semantic_match
Very fast with small tables
For embedded system etc?
Note!
Zero for fib_hlist :) Still decent many apps.
fib_hash2

Vargese inspired, use what got

$2^{24}$ hash lookup w. sorted hlist
Makes /24 entries of plens 1-23
/0 special case. Huge...
TABLE_LOCAL with a few entries

Idea was to test performance
with the fastest algo we could think of.

Not for embedded system etc? :-)

Reduced it became fib_hlist
fib_hash2/route cache compare

- route cache
- FIB lookup
- FIB lookup DoS
First trie. In theory variable key length, 32, 128 bits etc

Algo for dynamic trie written in Java. Memory leak and stack handling were problems.

Also prefix matching based on fib_sematic match

Cisco CEF has fixed 256 childs 8-8-8-8 or 16-8-8 (GSR) LC-trie is child size is dynamic 2-12 bits seen

Need to be verified. New netlink call to do fib_lookup

Can be improved...
fib_trie performance comparison

forwarding kpps

Linux 2.6.16 1 CPU used (SMP) Opteron 1.6 GHz e1000

Preroute pathes to disable route hash
LOCAL/MAIN tables

fib_lookup() in ip_fib.h

Always looks up LOCAL table before MAIN

Extra lookup costs performance when not to localhost.

We discussed this with Alexey...
LOCAL/MAIN tables

Aver depth: 4.48
Max depth: 6
Leaves: 25
Internal nodes: 18

Aver depth: 3.22
Max depth: 7
Leaves: 158936
Internal nodes: 39440
Route hash/GC

Strategies for GC run. Better work!!

Timer based vs on demand
/proc/sys/net/ipv4/route/gc_interval
/proc/sys/net/ipv4/route/gc_min_interval_ms

GC without GC run. Very robust...

rt_intern_hash() cand rt_free() chain length to long.

ip_rt_gcc_elasticity can be dynamic.... ????

total flush for fib insert/delete....
32/64 bit || sizeof(struct sk_buff)

Gcc 3.4 x86_64 vs i686 on same HW
Per device hash

Per device input route hash

isolate dev's
less locking
same performance

output used shared hash

given up for the moment
Preroute patches

Started hacking with Jamal a year ago

Do full fib_lookup() for every packet

Lot's of interest from Paul's and people doing “hi-risk” hosting.

Very useful for FIB testing.

Works only with gatewayed hosts.
Skb recycling/reuse
TCP performance

2.6.11.7 SMP kernel using one CPU driver e1000 NAPI - no-NAPI. Opteron 1.6 GHz e1000 w 82546GB.
TCP performance when receiving DoS on other NIC

2.6.11.7 SMP kernel using one CPU driver e1000 NAPI - no-NAPI. Opteron 1.6 GHz e1000 w 82546GB.
ipv6 performance

Forwarding kpps 76 byte pkt.

Linux 2.5.12 1 CPU(SMP) Opteron 1.6 GHz e1000

How rDoS work on sparse routing table?
Goodbye to old friends?

FASTROUTE
HW-FLOWCONTROL
10 GbE early days

TX performance IXGB

in pps

- Op 1.6 NAPI
- Op 1.6 noNAPI
- XEON
Hi-perf filtering

Need for hi-pref stateless filtering
netfilter API

hi-pac?
tc-stuff?

netfilter API

share fib_semantic_match()