FD.io VPP Release 20.05 is now Available

The FD.io VPP (Vector Packet Processor) release 20.05 is now available at https://packagecloud.io/fdio/release. FD.io VPP continues to be relentlessly focused on performance. In addition, FD.io VPP continues to add features. All this without sacrificing packet throughput. In this article we highlight some remarkable performance numbers, point to some of the features added in 20.05 and then point to some articles that have been published in the past 5 months.

Table of Contents

Performance Highlights

CSIT

Before we talk about performance I would like to mention where most of these numbers are published and continuously verified. The Continuous System Integration and Testing (CSIT) project provides continuous automated testing for FD.io software projects. These tests continuously look for functional and performance regressions. The tests include tests for No Drop Rate (NDR), and Maximum Receive Rate (MRR). This is done using multiple CPU threads and cores. For more information on the CSIT tests and reports please visit https://docs.fd.io/csit/master/doc, https://docs.fd.io/csit/master/report and https://docs.fd.io/csit/master/trending.

IPsec

The first of these performance numbers I would like to highlight is the IPsec performance numbers.

With FD.io VPP 20.05, a packet size of 1518 bytes and 4 CPU cores the NDR rate is at about 47 GBps. These results were the same whether using 1000, 10000, 20000 or. 40000 tunnels. This testing was done with different packet sizes and different algorithms. Some of the results are highlighted below. These tests were performed using the Skylake Platinum 8180 CPU @2.5GHZ with Turbo boost off and 2 threads/core. The NICs were Intel xxv710-DA2 2p25GE.

AES-256GCM:

Packet size	#cores	#tunnels	Throughput (GBps)
1518	4	1	24
IMIX	4	1	12.6
64	4	1	5
1518	4	1000	47.2
IMIX	4	1000	32.2
64	4	1000	9.75
1518	4	20000	47.1
IMIX	4	20000	21.4
64	4	20000	6.5
1518	4	40000	47
IMIX	4	40000	19.6
64	4	40000	5.66

For a list of all the CSIT IPsec test results please visit https://docs.fd.io/csit/master/report/detailed_test_results/vpp_performance_results/crypto.html

Mellanox RDMA

Remote Direct Memory Access (**RDMA**) is a technology that allows computers in a network to exchange data in main memory without involving the processor, cache or operating system of either computer. VPP 20.05 now supports RDMA. CSIT has started testing with the Mellanox-CX556A. Using a packet size of 64 bytes, here are some of the highlights. CSIT RDMA trending data can be found at https://docs.fd.io/csit/master/trending/trending/ip4-2n-clx-cx556a.html#b-ip4routing-base-rdma

Maximum Receive Rate (MRR):

#Threads	#cores	Throughput (Mpps)
2	1	23
4	2	44
8	4	86

Feature Highlights

Without sacrificing performance features continue to be added to the FD.io VPP codebase. The full feature list for 20.05 can be found in the release note https://docs.fd.io/vpp/20.05/d7/d84/release_notes_2005.html. Here are some of the highlights.

Kubernetes/Calico/VPP

VPP is now completely integrated with the Kubernetes Calico plugin. Now containers can take advantage of VPP's unrivaled IPsec performance.

To see how we got there please take a look at this very interesting article https://medium.com/fd-io-vpp/getting-to-40g-encrypted-container-networking-with-calico-vpp-on-commodity-hardware-d7144e52659a.

SNAP Packaging

Snap packaging includes everything needed run an application in a single compressed binary package. Very useful for dodging distro library version issues. Build on ubuntu 20.04, run on ubuntu 18.04 – or vice versa – no problem

ARM

Arm Neoverse-N1 supports the multi-architecture support mechanism. Key node processing functions will be compiled with dedicated optimized compiler options, tuned per CPU

architecture features, enabled and selected runtime in initialization stage. With these efforts, end users will get higher performance by running VPP on Arm Neoverse-N1 CPUs.

GSO

Generic Segmentation Offload is a technique to improve throughput. NICs receive Jumbo Frames of size up to 64KB from applications. It reduces the per packet processing in the network stack. Packets are segmented into smaller chunks using software-based segmentation if the physical NIC does not support TCP Segmentation Offload (TSO). Hardware NICs also support some encapsulated types i.e. VXLAN, IPIP for TSO.

Although GSO/TSO is supported already for physical NIC which utilizes DPDK, VPP bonding driver lacks this support. If the physical interface is part of the bonding and GSO is not supported in bonding, the benefit of TSO for the physical NIC is not materialized. By adding GSO support to the VPP bonding driver, we see the full benefit of the GSO for the physical NIC when the physical NIC is enabled for GSO.

VPP already implemented software-based segmentation for regular non-encapsulated traffic. Overlay network support was missing for GSO. Hence overlay networks couldn't benefit from GSO throughput optimization. In this release, software based GSO support for VXLAN tunnel has been implemented in VPP. Users which are using VXLAN based overlay network can benefit from this feature to improve their network throughput with this addition.

Internet Key Exchange Protocol (IKEv2)

Users can now use ikev2_profile_set_ipsec_udp_port API message to specify custom UDP port for IPSec communication (different from 4500 which IPSec uses by default when UDP encapsulation is turned on)

Both IKE peers are now able to detect liveness of their partner by periodically sending empty informational request. In case that responder goes down then initiator starts a new initiation process. If the responder cannot reach the initiator it only cleans up all associated connections for that initiator

DPDK

FD.io VPP now uses DPDK version 20.02

QUIC

The goal of quicly crypto offloading is to use our VPP crypto native engine to encrypt/decrypt Quic packets.

The default behavior is to pass each packet one by one to the quicly external library. With this patch, we are now able to retain several packets and use our crypto API to encrypt/decrypt packets per batch. This new behavior permits to optimize the Quic communication and increase the throughput.

VRRP

VRRPv3 (RFC 5798) provides failover capability for routers on IPv4 and IPv6 networks. Two or more routers, if configured with a VRRP Virtual Router, elect a master to forward packets. If the master becomes unavailable, the remaining peers will elect a new master which will seamlessly takes over forwarding for the Virtual Router.

IPSEC

When creating an IPSEC SA via API, the UDP source port can be specified. This is needed for NAT traversal. When IKE negotiates through a NAT the source port is changed from 4500 to something else. The SA needs to know this, so the packets are correctly encapped when returned. For more information on VPP multi-point tunnels please visit https://wiki.fd.io/view/VPP/IPSec#Multi-point_Tunnels.

TAP

Linux Kernel provides virtual network devices TUN/TAP. TAP is layer 2 device. VPP has implemented TAP interface using virtio backend for fast communication between VPP and applications running on top of Linux network stack.

TUN is layer 3 point-to-point interface. It is faster as compared to TAP interface, as IP packets can traverse through it without ethernet header. Its support has been implemented using virtio backend in VPP, so users can leverage faster communication between VPP and host applications.

Interesting Articles

Since FD.io VPP release several very interesting articles have been written about Fd.io VPP. Some of them are here.

US Army Cyber School Deploys 100 Gbps Router Network with TNSR®

https://www.netgate.com/blog/us-army-cyber.html?utm_campaign=TNSR&utm_content=129157545&utm_medium=social&utm_source=twitter&hss_channel=tw-80797684

Kernel bypass networking with FD.io and VPP

https://medium.com/swlh/kernel-bypass-networking-with-fd-io-and-vpp-fc3a53a669f9?source=friends_link&sk=ab92fa42f7ffdfb6dca39ae9601f3d3e

Building fast QUIC sockets in VPP

https://blogs.cisco.com/cloud/building-fast-quic-sockets-in-vpp

How FD.io VPP Release Improves Multicore IPSec

https://www.lfnetworking.org/blog/2020/03/23/how-fd-io-20-01-release-improves-multicore-ipsec/

The UDPI (Universal Deep Packet Inspection) project

https://wiki.fd.io/view/UDPI

For More Information:

For more information on FD.io VPP please visit https://fd.io/vppproject/vpptech/. For information on the please visit Fd.io project https://fd.io.