

## Enea Fast Path

Enea Fast Path is a cross-platform user space TCP/IP stack that radically accelerates networking performance for any application communicating through IP on multi-core devices. It provides unrivaled performance, linear scalability, higher throughput and lower latency for both termination and forwarding use cases.

### Key Facts

- ▶ High performance TCP/IP stack
- ▶ Optimized for ODP and DPDK
- ▶ Scales linearly on multi-core
- ▶ User space implementation
- ▶ Leverages hardware acceleration
- ▶ Runs on Intel x86 and ARM
- ▶ Backward compatible with OFP
- ▶ Pre-built, tested, and verified
- ▶ Long-term support and maintenance
- ▶ Use case examples:
  - ▶ LTE/5G access networks
  - ▶ Small cell networks
  - ▶ Mobile core networks
  - ▶ High bandwidth VNFs
  - ▶ Webservers
  - ▶ Firewalls
  - ▶ Network and datacenter infrastructure

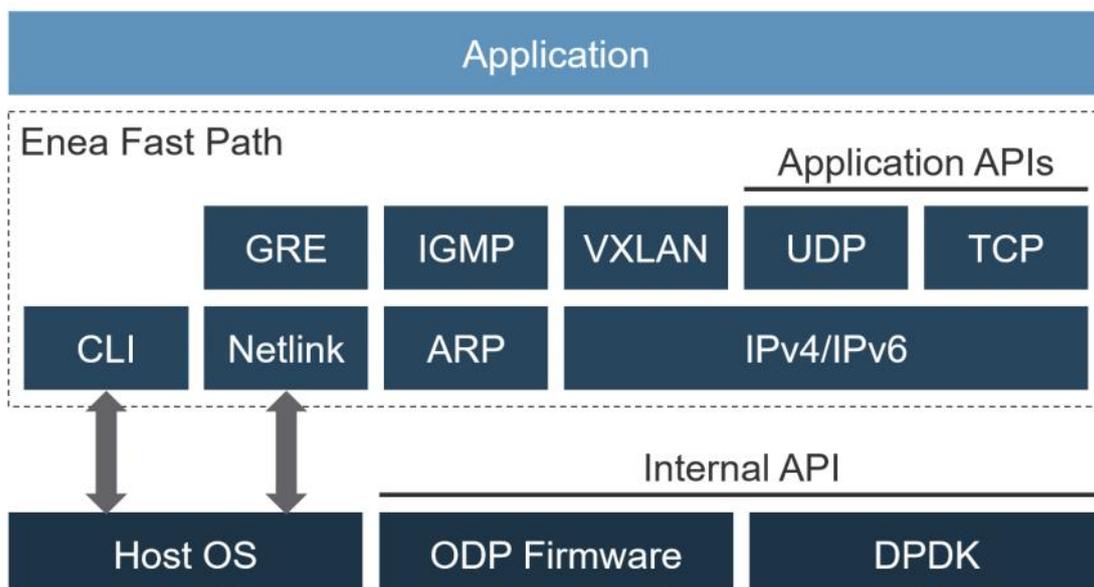
Enea Fast Path is a high performance IP stack that builds on the open source project Open Fast Path, but adds additional performance optimizations and is pre-built, tested and verified, offering a ready-made solution that saves both development time and efforts. Enea also offers commercial maintenance and support.

### Highest Performance

Enea Fast Path is implemented in user space and linked as a library together with the application. Consequently, it avoids the overhead of the kernel/application barrier (system calls and context switches between kernel/application). Compared to the native Linux IP stack, this approach provides significantly better performance, especially when paired with hardware acceleration which Enea Fast Path efficiently leverages through DPDK or ODP.

### Linear Scalability

To leverage the capabilities provided by many- and multi-core processors, the IP stack needs to scale well. Enea Fast Path is designed using an event-driven architecture that allows it to scale performance linearly over an increased number of cores, as opposed to Linux's native IP. On multi-core processors, Enea Fast Path requires less processor capacity to provide the same throughput as other alternatives, consequently providing an opportunity for reduced hardware cost and lower power consumption.



## Compatibility without Lock-in

Applications based on Enea Fast Path are highly portable and future-proofed. Running on top of both DPDK and ODP and on both ARM and Intel processors, it provides true platform independence which in turn protects software investments.

Backward compatibility with OFP prevents vendor lock-in as the community open source version is always available to fall back upon.

## Data Plane in User Space

Executing in user space, Enea Fast Path not only gains a performance advantage, it also provides additional benefits to the application.

It becomes much easier to modify when the kernel does not have to be touched, for example to add support for new protocols or to reduce footprint by removing unwanted functionality.

It also provides a consistent behavior regardless of the underlying platform, making it easy to port between operating systems or hardware platforms.

## Professional Support and Maintenance

A known weakness of the open source model is the lack of defined support and customer-specific adaptations. Enea provides customer-tailored configurations and has service capabilities for unique customer requirements.

Enea also provides prompt help through global ISO 9001-certified, world-class support.

For comparison - the OFP open source project is provided “as is” by the community.

## Feature Summary

### Optimized TCP/IP Stack

- Optimized modular library for termination and forwarding use cases
- Runs natively in user space, in a guest or in the host system
- Integration with Linux IP stack through TAP interface and Netlink
- Independent of OS version

### Performance optimizations

- Linear scalability on multicore devices
- Optimized for DPDK
- Leveraging hardware acceleration
- Large (Jumbo) frame support
- Highly optimized and scalable internal data structures

### Compatible

- Works on top of both DPDK and ODP
- Supports both Intel x86 and ARM, independent of vendor
- Backward compatible with Open Fast Path

### Protocol support

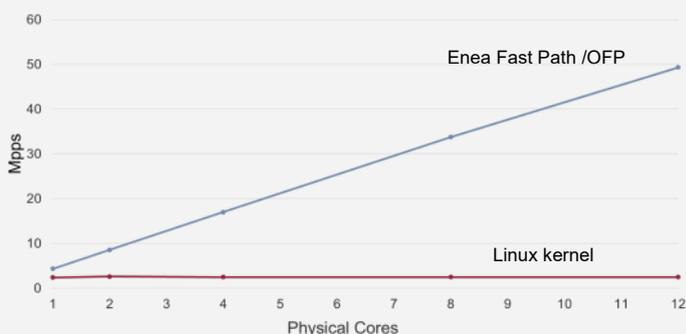
- L4: UDP, TCP, ICMP
- L3: IPv4/IPv6 forwarding and routing, ARP, NDP, fragmentation, VRF, IGMP and multicast
- L2: Ethernet, VLAN, GRE, VXLAN tunneling

### Management

- Packet statistics and configuration debugging
- Management of routes and interfaces with VRF support
- Application APIs: configuration, packet processing, logging, etc.
- Socket APIs: Optimized zero-copy sockets and BSD style socket interface

## High Performance and Linear Scalability

Benchmark example for an IP forwarding application in user space — 256 routes, 4 x 10 Gbps, 64 Byte packets



Benchmark setup:

- Intel Xeon E5-2697 v3 processor (turbo disabled).
- Two 82599 NICs with modified netmap ixgbe 4.1.5 driver (12 rx/tx queue pairs) totaling 4x10Gbps ports.
- Ubuntu 14.04 - 3.16.0-53-generic. CPU isolation used to test kernel IP forwarding.
- OFP fpm\_burstmode example application.
- ODP 1.4.1.0 ext. with multi queue packet I/O support.



Enea develops the software foundation for the connected society with a special emphasis on reducing cost and complexity at the network edge. We supply open-source based NFVI software platforms, embedded DPI software, Linux and Real-Time Operating Systems, and professional services. Solution vendors, Systems Integrators, and Service Providers use Enea to create new networking products and services faster, better and at a lower cost. More than 3 billion people around the globe already rely on Enea technologies in their daily lives. For more information: [www.enea.com](http://www.enea.com)