

# Implementing Load balancer functionalities – DPDK vs P4

## A Balanced Viewpoint

A load balancer is a solution that scales out an application server infrastructure to effectively handle an increase in data traffic while preventing the server from being overloaded.

In an NFV world the current focus on load-balancers is towards minimizing the deployment foot-print while ensuring operational flexibility and scalability. Towards this end, it would be prudent to examine DPDK and P4 based implementations while comparing them for merits and usability.

### The different approaches to implementing Load Balance functionalities

Recent trends point to the implementation of load-balancer functionalities by programming the data-path. This approach avoids the use of a separate load-balancer and reduces the overall deployment footprint. A DPDK based load balancer has been classified under this category for the past several years. However, with the introduction of programmable ASIC, there is now a new opportunity to design load balancers based on P4. Here, we look at P4 and DPDK while discussing the potential for these technologies for load balancing.

#### Let's start with a basic definition of DPDK and P4:

**DPDK (Data Plane Development Kit):** A set of libraries and drivers for faster packet processing.

**P4:** A high level programming language which allows for programming the protocol independent forwarding plane.

## Advantages of DPDK over P4

- It is feasible to Implement both L4 and L7 based load balancers. DPDK works by providing an opportunity to apply rules on the entire packet buffer captured on the interfaces. A P4 based load balancer would support only L4.
- The solution can run on both physical and virtual environments provided there are DPDK compatible network controllers for the physical deployment.
- DPDK maintains a session of load balancing groups internally thus avoiding external applications. P4 requires additional controller support to record session information.
- The load balancer can easily support group monitoring and implement the auto-scaling feature. It is complicated to achieve the same with a P4 based switch since additional logic at L2 or controller level needs to be implemented to capture health information of server groups.

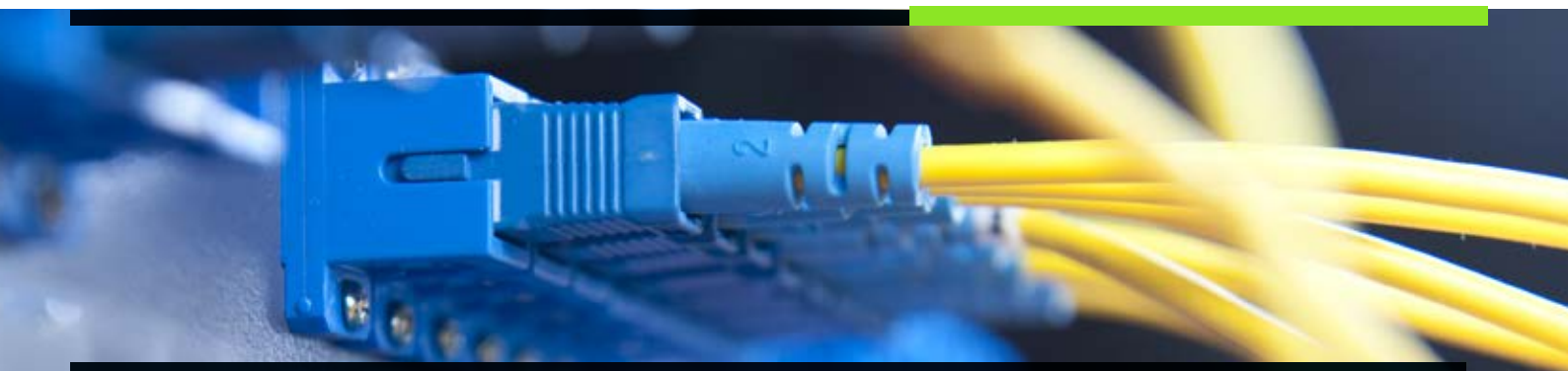
## Advantages of P4 over DPDK

- A P4 based load balancer runs in a programmable switch, so it eliminates the deployment of an actual load balancer. This greatly reduces the deployment footprint and offers a marked improvement from a DPDK based solution.
- A programmable ASIC based implementation is faster and it supports dynamic configuration of the pipeline without a reboot. In DPDK the performance will be limited depending on the infrastructure on which the solution would be deployed.
- The same P4 based load balancer can be installed on multiple programmable ASIC with minimal modification as long it supports P4.

Both DPDK and P4 based solutions allow fast packet processing with line-rate performance. However, P4 has a dynamic pipeline configuration and it achieves a reduction in deployment footprint over a DPDK based implementation.

The P4 runtime libraries provide an efficient orchestration by SDN controllers, so we recommend using P4 based load balancer in deployments where group configurations can remain static, and service provisioning is only L4.

A DPDK load balancer would be an appropriate choice for cloud deployment considering the ease of configuring it for horizontal and vertical scaling scenarios. In future, we expect P4 to gain prominence with improvement in ASIC programmability to support much-needed features like auto-scaling, service monitoring and L7 support.



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