



DPDK

DATA PLANE DEVELOPMENT KIT

Making Networking Apps Scream on Windows with DPDK

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#DPDKSummit

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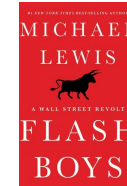
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- ▶ Motivation for Fast Packet Processing on Windows
- ▶ The journey to bring DPDK to Windows
- ▶ What happened to PacketDirect?
- ▶ Roadmap
- ▶ Q&A

Motivation – Time is Money



Fractions of a second (latency) can make all the difference in Olympic races, financial gain or loss in the stock market, and winners and losers in gaming competitions



- ▶ Windows developers need a low-latency, high-throughput network data path for
 - ▶ Gaming and Video Streaming
 - ▶ Cloud Infrastructure
 - ▶ Unified Communications
 - ▶ IoT Edge Gateways
 - ▶ Network Intrusion Detection/Prevention
 - ▶ Other mobile operator network appliances

The Journey: High-Performance Networking on Windows



- ▶ Native Host (Kernel-Mediated IO) Software and Hardware Offloads
- ▶ Virtualized Host Offloads with Hyper-V Virtual Switch
- ▶ Guest VFs with SR-IOV
 - ▶ Multi-tenancy support - Watch this space...
- ▶ User-Mode Applications with RIO Sockets (~750k packets per second)
- ▶ DPDK on Windows...

The Journey: Bringing DPDK to Windows



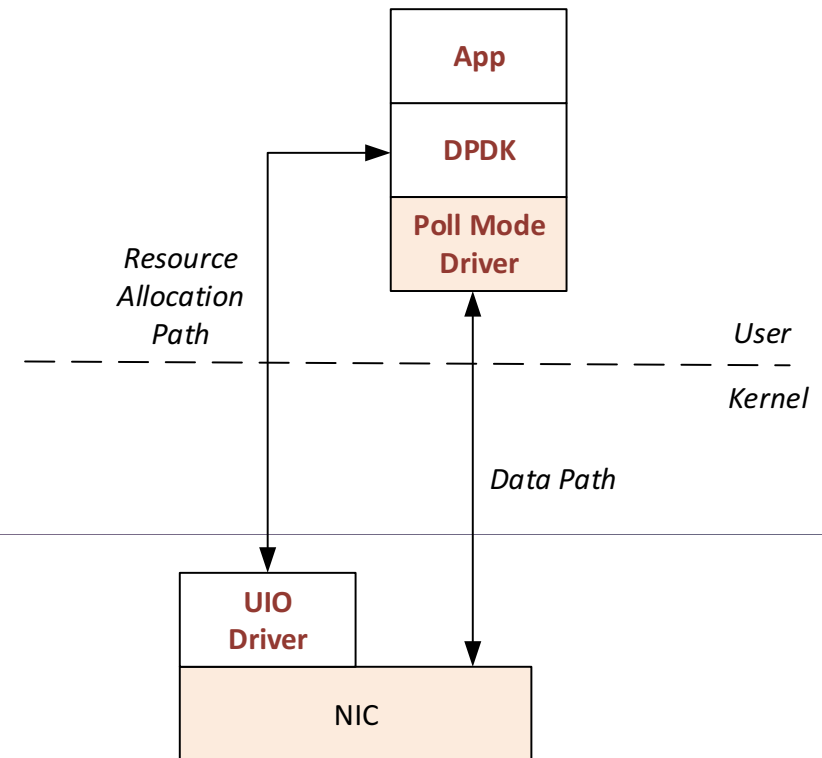
▶ Project Goals

- ▶ Native DPDK Solution on Windows
- ▶ Full parity (features, performance, et. al.) with Linux DPDK implementation
- ▶ Easily enable other IHVs to support DPDK natively on Windows (Common Interfaces)
- ▶ Release work to community as an Open-Source project

DPDK on Windows – Architecture



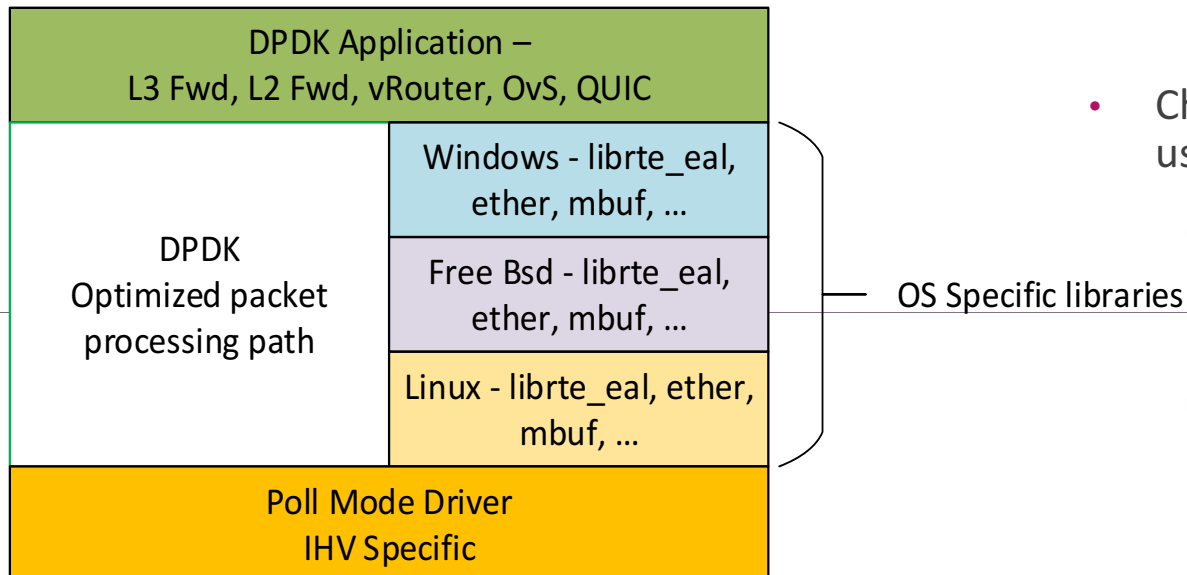
- DPDK libraries and application compiled under Windows
- Using Intel C/C++ compiler (ICC) for performance optimization
- UIO driver used to create physically contiguous memory block and provide user-mode mapping to HW resources
- Post-initialization, the Poll-mode driver (PMD) will send/receive packets directly to/from the NIC, bypassing all packet processing in kernel



DPDK on Windows – Current Status



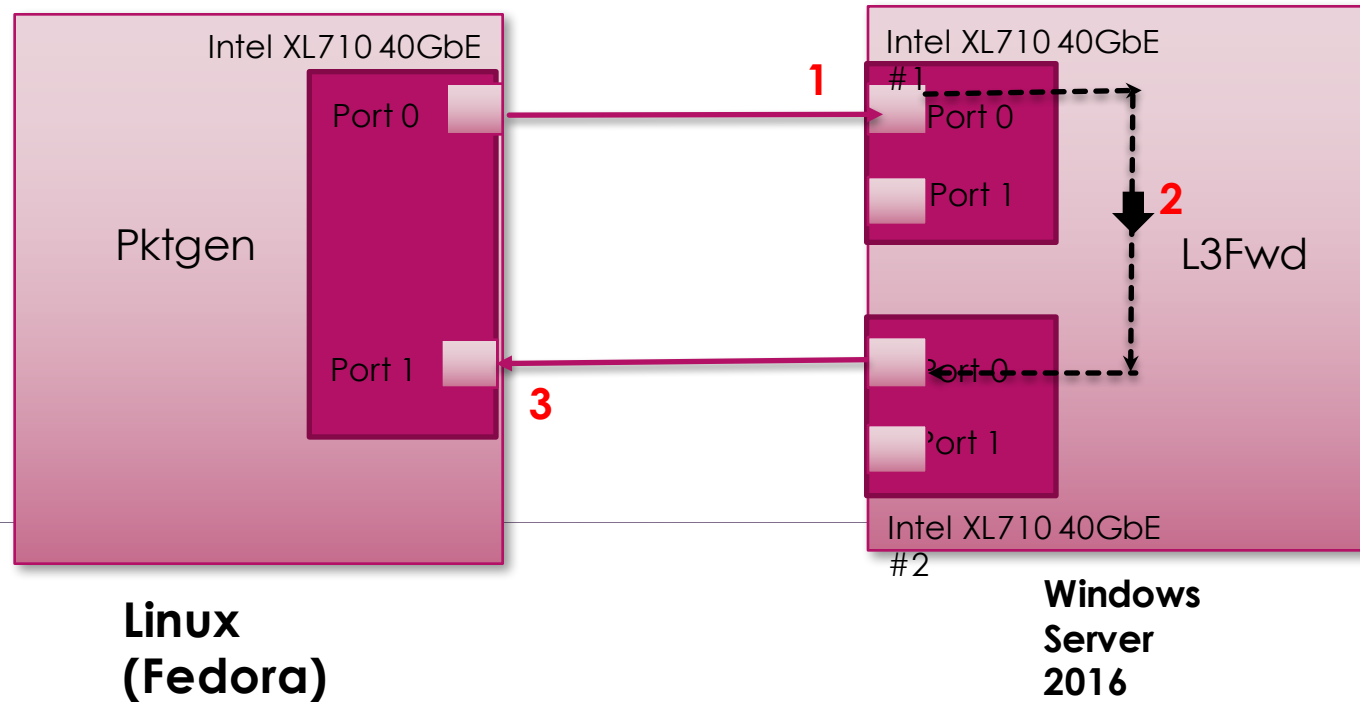
- Windows Server 2016 and Intel 40GbE network devices
- All essential DPDK libraries compiled and working in Windows
 - *librte_eal; librte_ether; librte_ring; librte_mempool; librte_mbuf* etc.
 - Update the i40e PMD to interface with the OS specific interface
- Challenge to create Windows OS compatible headers without using `#ifdef WINDOWS` in core DPDK
 - Use the “magic” of include file dependencies to allow Windows-related changes to be compiled into core DPDK code
 - Need work-arounds for a few GCC-specific implementations:
 - `typeof(x)` – not available in MS/Intel C compiler; requires an inelegant work-around
 - `__attribute__((constructor, used))` – needs an initialization work-around



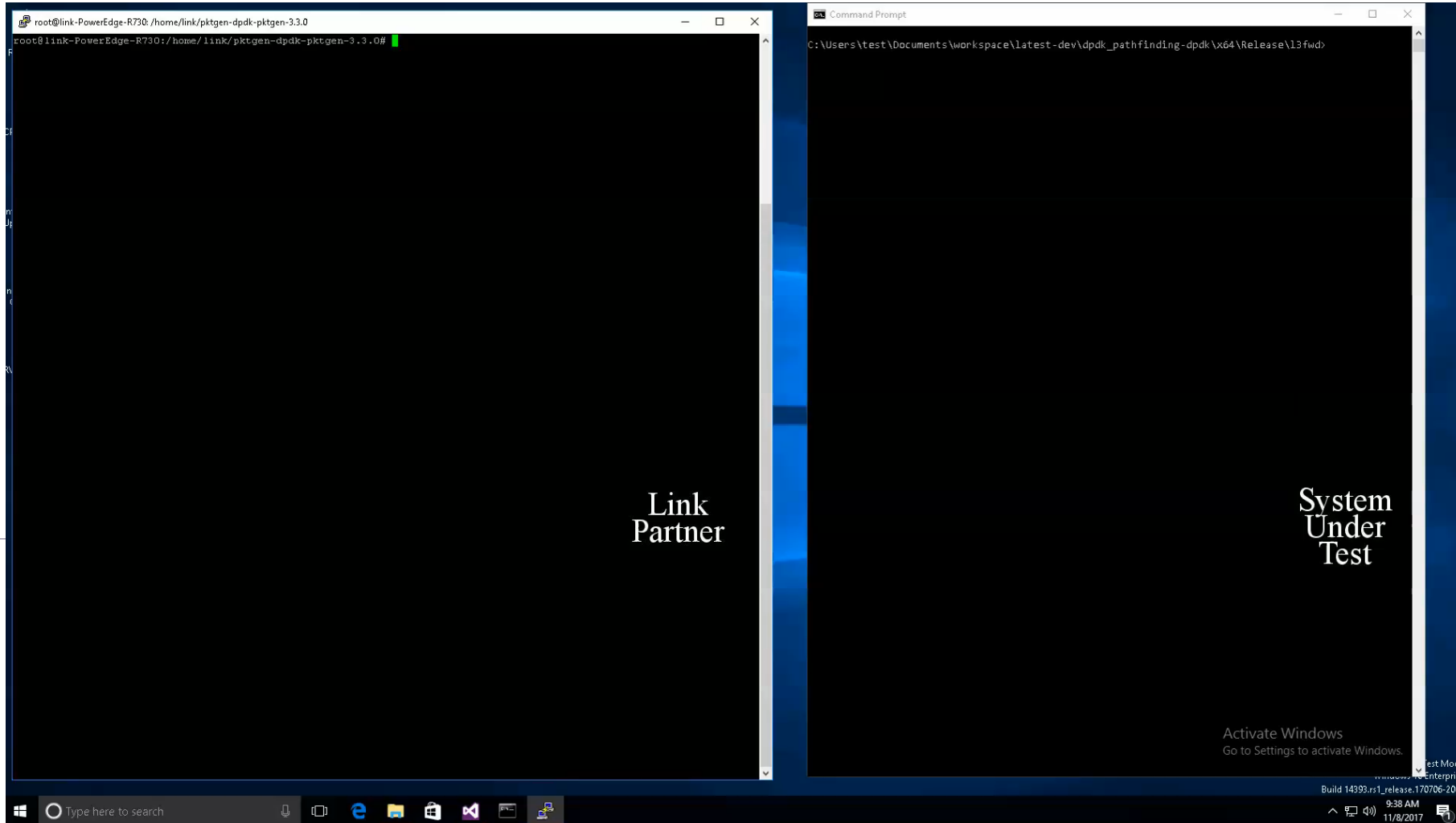
Demo

Manasi Deval, Intel

Demo Setup



Demo Video





Tested L2 FWD and L3 FWD applications.

Bi-directional Performance (using L3Fwd ↔ Pktgen)

Test system configuration

- Intel® *Broadwell* class 2U server
- Intel® Xeon® E5-2699 v4 CPU x 2
- 128GB RAM
- Intel® Ethernet Converged Network Adapter XL 710 (40GbE)
- Windows Server 2016

Packet Size (bytes)	Max pkts/sec (Mpps)
64	71.25665
128	67.01615
256	36.31707

DPDK Performance on Windows at par with Linux!

- ▶ UIO Driver and Microsoft Patches for DPDK v17.08
- ▶ Intending to mainline and publish soon... 😊



- ▶ Initial discussions and POCs starting at Microsoft
 - ▶ Network Security
 - ▶ Infrastructure Workloads
- ▶ Certain applications do not require a protocol stack such as TCP/IP
- ▶ New applications and microservices may include custom protocol stacks which are optimized for the specific workload

What about Kernel-Mode?



- ▶ PacketDirect (PD) - “experimental” feature available in Windows Server 2016 for Hyper-V Virtual Switch to accelerate path into and out of VM
- ▶ Learnings from PD around extensibility, feature gaps, and diagnosability resulted in an evolution to more inclusive design to address both server and client needs
- ▶ Design focus for user-mode vs kernel-mode applications
 - ▶ Accelerating User-Mode Network IO: DPDK
 - ▶ Accelerating Kernel-Mediated Network IO: Evolved PackedDirect
 - ▶ New driver model based on Windows Driver Framework (WDF)
 - ▶ New network data-path for Windows (WinSock APIs sit on top of this model)
 - ▶ More details coming soon... (Crawl, Walk, Run)

Microsoft loves Open Source Software (OSS)



- ▶ Over the past few years Microsoft transformed into a company that embraces open source
 - ▶ Docker
 - ▶ Kubernetes
 - ▶ Linux
- ▶ Towards this end, we have been working closely with Intel in bringing this DPDK submission to the open source community
- ▶ We want to develop an eco-system of high-performance applications, built on Windows, and would love to hear from you!

Roadmap: DPDK on Windows



- ▶ Upstream DPDK Code patches for Windows and contribute Windows UIO Driver to open source project
- ▶ Work with NIC Partners (IHV) to bring Poll-Mode Drivers to Windows
- ▶ Ensure all DPDK libraries and APIs are fully functional on Windows (Close any gaps)
- ▶ Enable Co-Existence with other network stacks (e.g. for simple host management)
- ▶ Enable DPDK over IOV path into VM / Container with Guest VF
- ▶ [Longer Term] Protocol Stacks integration
- ▶ [Longer Term] Improve Security for multi-tenancy
- ▶ [Longer Term] Hardware Spreading and Steering

Questions?



Thank You



- ▶ **Call to Action:** Download, Build, and Run apps with DPDK on Windows!
- ▶ Jason Messer (jmesser@microsoft.com) @jmesser81 on Slack, GitHub, etc.
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