Making Networking Apps Scream on Windows with DPDK

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Agenda

- Motivation for Fast Packet Processing on Windows
- The journey to bring DPDK to Windows
- What happened to PacketDirect?
- Roadmap
- Q&A
Fractons of a second (lateney) can make all the difference in Olympic races, finacial gain or loss in the stock marken, 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

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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...

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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 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

Intel XL710 40GbE

Pktgen

Port 0

Port 1

Intel XL710 40GbE

Windows Server 2016

L3Fwd

Port 0

Port 1

Port 0

Port 1

Intel XL710 40GbE

#1

#2

#1

#2

Pktgen

Linux (Fedora)

1

2

3

Demo Video
DPDK on Windows – Performance

Tested L2 FWD and L3 FWD applications.

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

Bi-directional Performance (using L3Fwd ↔ Pktgen)

<table>
<thead>
<tr>
<th>Packet Size (bytes)</th>
<th>Max pkts/sec (Mpps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>64</td>
<td>71.25665</td>
</tr>
<tr>
<td>128</td>
<td>67.01615</td>
</tr>
<tr>
<td>256</td>
<td>36.31707</td>
</tr>
</tbody>
</table>

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 PacketDirect
    - 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)
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!

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Roadmap: DPDK on Windows

- Upstream DPDK Code patches for Windows and contribute Windows UIO Driver to open source project
- Work with NIC Partners (IHVs) 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?

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Thank You

Call to Action: Download, Build, and Run apps with DPDK on Windows!

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