Shaping the future of IP Broadcasting with Cisco’s vMI and DPDK on Windows

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Agenda

• Video Broadcasting industry transition
• Cisco’s vMI introduction
• How DPDK on Windows solves data rate problems
• Cisco’s vMI-DPDK solution
• Demo
• Code Availability
• Roadmap
• Q&A
Media Broadcasting Evolution

**Past:** Live media production houses embraced technological changes spanning many decades in adoption.

- From **black-and-white** to **color** television transition in the 1950s and 60s
- **Analog -> Digital** video signals through 1980s
- **To standard definition (SD) -> high definition (HD)** transition in the 2000s,

**yet, Today:** An unprecedented, accelerated transition in the media industry is underway

- As 4K/UHD and 8K resolutions in the future become a fundamental part of the broadcast landscape.
IP Networking for Media Broadcasters

- Television and Live media broadcasting houses are migrating:
  - Replacing legacy, domain based Serial Digital Interface (SDI) fabrics
  - To IP-based virtualized environment and infrastructure.
  - Using SMPTE protocols

- Motivation
  - Future-proofing the infrastructure to meet increasing bandwidth demands.
    - 4K, 8K bit rates cannot be carried by existing infrastructure.
  - Leverage benefits of the cloud
    - Do away with dedicated equipment
    - Rapidly scale to new technologies.
  - IP over ethernet spans large distances and can be encrypted.
Windows DPDK for Video Broadcasting

- Available today is Cisco's virtual media interface (vMI) software toolkit – open sourced as “Herisson”
  - Aids media software vendors transitioning from SDI to IP/Ethernet workflows.
  - Today vMI stack is optimized for legacy SDI workflows.

- **Ever Increasing Data Rate Challenge:**
  - Data Rates of SMPTE and IP-based media frames exceed the capacity of today’s Operating Systems IP stacks.

<table>
<thead>
<tr>
<th>Single HD Video Stream</th>
<th>Single HDR 4K Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5Gb/s</td>
<td>Up to 12Gb/s</td>
</tr>
</tbody>
</table>

- With IP frames, vMI libraries need efficient path to the NICs to realize capacity at parity with legacy SDI workflows.

- **Cisco-Microsoft-Intel jointly announcing highly optimized vMI libraries with DPDK on Windows.**
  - Software Networking kit to support media workflows on an ethernet network, on Windows Server Operating System.
  - Windows continues to be the Operating System of Choice for many media software vendors with strong graphics and GPU driver support.

- **Cisco vMI library planned for use in multiple end-customer products and broadcaster solutions.**
Introduction to SMPTE standards

- SMPTE is a set of standards addressing transport of uncompressed media over IP.
- Historically, largely derived from SDI standards.
- All based on RTP protocol.
- SMPTE mandates strict packet timing requirements.
Introduction to vMI (virtual Media Interface) Today

- A set of high-performance open source software tools that processes media IP streams on x86 (Linux/Windows).
- Virtual SDI Card for software appliances.
- Enables virtual SMPTE-stream analysis in virtualized workflow.
- Enables SMPTE traffic pacing.

**Challenges with IP network.**
- SMPTE standard based on RTP meaning that there is no flow control.
- Media processing is a real time process.
- IP transport is mission critical ➔ must not loose a single packet.
- Traditional operating systems are implementing best effort strategy.
Video Broadcasting and Windows DPDK

Today

Tomorrow

SDI router

Media Application

Windows

SDI → SMPTE gateway

Top of Rack

Media Ethernet/IP-network

Rack server

NIC

PCI PT

Windows

Hyper-V

VM + DPDK

Media Application
How Windows DPDK solves the data rate challenge

Multiple streams of high-quality video broadcast with low latency

Before DPDK

- Limited to 5 HD (1080p 60 fps) streams representing ~8Gbps max

With DPDK

- With DPDK, saturate 40Gbps link with 25 HD streams with scale-up expected to 100Gbps (5X increase)

As high-quality video increases from 4K to 8K and beyond, the video broadcasting industry needs a scalable solution using IP and virtualization.

<table>
<thead>
<tr>
<th>Standard Name</th>
<th>IEEE Standard</th>
<th># ports</th>
<th>Per Port speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual HD SDI</td>
<td>SMPTE 372 M</td>
<td>2</td>
<td>1.5 Gbps each</td>
</tr>
<tr>
<td>3G (1080p60)</td>
<td>SMPTE 424</td>
<td>any</td>
<td>2.97 Gbps</td>
</tr>
<tr>
<td>6G (2160p30)</td>
<td>SMPTE.ST2081</td>
<td>any</td>
<td>~6 Gbps</td>
</tr>
<tr>
<td>12G (2160p60)</td>
<td>SMPTE.ST2082</td>
<td>any</td>
<td>~12 Gbps</td>
</tr>
</tbody>
</table>
Code Availability

vMI

- Open Source vMI library for Windows with DPDK to be available in December 2018!!
- Visit Herisson repo on Github.

Windows DPDK

- Cisco’s DPDK patch to support vMI libraries available in branch windpdk-v17.11-rc2.

Call to Action: Download, Build, and Run apps with vMI and DPDK on Windows!
DPDK on Windows – Current Status

- Announced Windows support for DPDK libraries at the DPDK Summit in December 2017, demoed over 70+ Million packets per second!

- **The Windows DPDK draft repo updated to align with v18.08 public release.**

  - Essential libraries and toy applications compiled and working on Windows.

- Intel now supports DPDK Poll Mode Drivers (PMD) for Windows native host.

- **Windows Poll Mode drivers from Chelsio, Cavium and Broadcom are under development.**
DPDK on Windows – Goals and Vision

• Upstreaming Windows DPDK patches in the main repository.
  • Expect phased upstreaming of Windows DPDK core libraries through 2019.

• Support for alternative compilers such as clang.

• More secure, multi-process/multi-user driver model to expose the device to user-mode applications.
  • In-depth look at next session from colleagues at Microsoft and Intel.

• Ensure all DPDK libraries and APIs are fully functional on Windows.

• Future Investigations:
  • Support DPDK in a Windows VM
    • Moving from Native Host to Guest with Direct Device Assignment (DDA) and eventually using a Guest VF
  • Support for Packet Pacing.
  • Core Isolation and reservation with Windows scheduler.
Thank You Contributors!

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Questions?