INTEL® XEON® PROCESSOR D-1500
INTRODUCING PERFORMANCE ENHANCEMENTS
The Intel® Xeon® Processor D-1500 Product Family is the first Intel® Xeon® Processor-based SOC.

Powerful performance enhancements, large memory capacity and RAS features make Intel® Xeon® Processor D-1500 Product Family a great SDN and NFV platform for telco, enterprise and cloud customer deployments.

This presentation provides the performance benchmark test results when comparing the Intel® Xeon® Processor D-1540 with Intel® Atom™ Processor C2750 when both systems are running Intel® Open Network Platform (Intel® ONP) Release 1.5 software.
# Intel® Xeon® Processor D-1500 vs. Intel Atom C2000

<table>
<thead>
<tr>
<th>Key Values</th>
<th>Intel® Xeon® processor D-1500 product family</th>
<th>Intel® Atom™ processor C2000 product family</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big core</td>
<td>Low power, high power density</td>
<td>Small core</td>
</tr>
<tr>
<td></td>
<td>SOC - One chip solution</td>
<td>Lower power, high physical density</td>
</tr>
<tr>
<td></td>
<td>BGA with integrated 10GbE</td>
<td>One chip solution</td>
</tr>
<tr>
<td></td>
<td>Large (up to 128GB) memory capacity</td>
<td>BGA with 4X 1GbE/2.5 GbE integration</td>
</tr>
<tr>
<td>TDP</td>
<td>~20 – 65W</td>
<td>5 - 20W</td>
</tr>
<tr>
<td>Cores #</td>
<td>2 - 16</td>
<td>2 - 8</td>
</tr>
<tr>
<td>Base Core Freq.</td>
<td>Up to 2.2GHz</td>
<td>Up to 2.4GHz</td>
</tr>
<tr>
<td>Memory Type</td>
<td>RDIMM, UDIMM, SODIMM ECC</td>
<td>SODIMM, UDIMM, VLP UDIMM ECC</td>
</tr>
<tr>
<td></td>
<td>2CH DDR4, DDR3L</td>
<td>2CH DDR3/L</td>
</tr>
<tr>
<td>Max Memory Capacity</td>
<td>128GB</td>
<td>64GB*</td>
</tr>
<tr>
<td>RAS</td>
<td>Good</td>
<td>Basic</td>
</tr>
<tr>
<td>SATA</td>
<td>x6 SATA3</td>
<td>x4 SATA2, x2 SATA3</td>
</tr>
<tr>
<td>PCI Express</td>
<td>x24 Gen3 , x8 Gen2</td>
<td>x16 Gen2</td>
</tr>
<tr>
<td>Integrated Intel® Ethernet</td>
<td>2x 1GbE / 10GbE</td>
<td>4x 1GbE /2.5GbE</td>
</tr>
</tbody>
</table>
What is Intel® ONP Reference Architecture?
Reference Architecture that brings together hardware and open source software ingredients

Optimized server architecture for SDN/NFV in Telco, Enterprise and Cloud

Vehicle to drive development and to showcase solutions for SDN/NFV based on IA

Not a commercial product
INTEL OPEN NETWORK PLATFORM (INTEL ONP) REFERENCE ARCHITECTURE

Intel® ONP Software Ingredients Based on Open Source and Open Standards

- Kilo 2015.1.1
- Lithium SR1
- v2.4.90
- V2.0.0
- 2.3.0.5fc21
- v21

Details of Intel® ONP Release 1.5 can be found on 01.org: https://01.org/packet-processing/intel-ONP-servers

Industry Standard Server Based on Intel Architecture
SYSTEM SETUP - COMPUTE NODES

**INTEL ONP COMPUTE NODE #1**

Intel® ONP Rel. 1.5 Software Ingredients

- Kilo 2015.1.1
- OvS v2.4.90
- DPDK V2.0.0
- KVM 2.3.0.5fc21
- fedora v21

Intel® Xeon® Processor D-1540 @2.0MHz
Cores: 8
LLC Cache: 12 MB
Memory: 32 GB ECC DDR4 @ 2400 MHz
HDD: 2TB

**INTEL ONP COMPUTE NODE #2**

Intel® ONP Rel. 1.5 Software Ingredients

- Kilo 2015.1.1
- OvS v2.4.90
- DPDK V2.0.0
- KVM 2.3.0.5fc21
- fedora v21

Intel® Atom™ Processor C2750 @2.4MHz
Cores: 8
LLC Cache: 4 MB
Memory: 32 GB ECC DDR3 @ 1600 MHz
HDD: 2TB
**SYSTEM SETUP**

- **10Gb Data Network**
  - Traffic Generator
  - L3 traffic with 256 bytes packet size

- **1Gb Management Network**

**INTEL ONP COMPUTE NODE #1**
- DPPD
- Virtual Firewall
- Virtual NAT
- Intel® Xeon® Processor D-1540
- Brocade 5600 Virtual Router*

**INTEL ONP COMPUTE NODE #2**
- DPPD
- Virtual Firewall
- Virtual NAT
- Intel® Atom™ Processor C2750
- Brocade 5600 Virtual Router*

**HPE ProLiant DL380 Gen 9 Server**
- Hewlett Packard Enterprise
- openstack

*Note: Virtual Router and Virtual Firewall are virtual network devices used for security and routing purposes.*
SYSTEM SETUP – HARDWARE CONFIGURATION

**Compute node: #1**
- **Intel® Xeon®** Processor D-1540, 8-core, 45W (2.0GHz with 2.6GHz Turbo).
- 32GB DDR4 RDIMM of RAM running @ 2133.
- One PCIe x16 slot containing an Intel® Ethernet Converged Network Adapter X520-DA2 10GbE NIC.
- ATX board
- 2x 1GbE
- 2x 10GbE (10g-base-T)
- Mini-ITX
- 6x SATA ports
- 2TB Western Digital HDD (WD2003FZEX)

**Compute node: #2**
- **Intel® Atom Processor C2750**, 8-core, 2.4GHz
- 32GB DDR3 @ 1600 (the platform only supports up to 1600.)
- Four PCIe slots (one slot has a VGA card, another has the Intel X520-DA2 10GbE NIC.
- 4x 1GbE (10g-base-T)
- 4x SATA-3 ports, 2x SATA-2 ports.
- 2TB Western Digital HDD* (WD2003FZEX)

**Traffic Generator**
- **Intel® Camelback Mountain Reference Board**
- Generator has Intel Xeon Processor D-1528, 6-core @ 1.9 GHz
- 32-GB of ECC RDIMM installed of DDR4-2133.
- One Intel® Ethernet Converged Network Adapter X520-DA2 10GbE NIC

**Network HW**
- Data network 10GbE Switch is an Intel 48-port SFP+ switch.
- Management network switch is a 3x 1GbE Netgear* 8-port network switches.

**Orchestrator**
- HPE ProLiant DL380 Gen 9* with 4x 1GbE and 4x SFP+ ports (on Intel® Ethernet Converged Network Adapter X520-DA2 10GbE NIC).
- System has dual Xeon E5-2680v3 @ 2.5GHz
- 128GB DDR4 Registered DIMM with ECC
- 1.2 TB (900MB HDD + 300MB SSD)
**DPPD Highlights:**

- DPPDs are Linux user space applications based on the Data Plane Development Kit (DPDK).
- DPPD is a configurable data plane environment, which we leverage to characterize actual VNF performance.
- DPPD can be instantiated with different configurations like L3 forwarding, packet drop/classify, GRE encap/decap, etc. based on the required application.
- More sources on DPPD:
  
  Overview: https://01.org/intel-data-plane-performance-demonstrators/quick-overview

**DPPD on Intel ONP compute node:**

- Two DPPD instances emulate a virtual Firewall and a virtual NAT VNFs
- Used as a simple L3 forward tool to emulate traffic flow between the VNFs
- DPPD instances are instantiated with “acl” and “nat+routing” configuration
Comparing Throughput

Intel® Xeon® Processor D-1540 performed 2.5x better than Intel® Atom™ Processor C2750 with 256 bytes packet size at rate of 1.5Gb/s with zero packet loss.

Throughput Performance Ratio

<table>
<thead>
<tr>
<th>Throughput</th>
<th>Performance Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5Gb/s</td>
<td>1X 1.0</td>
</tr>
<tr>
<td>1Gb/s</td>
<td>1.6X 1.6</td>
</tr>
<tr>
<td>1.5Gb/s</td>
<td>2.5X 2.5</td>
</tr>
</tbody>
</table>

Disclaimer: Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. System #1 under test: Intel® Xeon® D-1540, 8-core, 45W (2.0GHz with 2.6GHz Turbo), 32GB DDR4 2133, Intel® X520-DA2 10GbE NIC, ATX board, 2x 10GbE, 2x 1GbE, Mini-ITX, 6x SATA ports, 2TB Western Digital HDD. System #2 under test: Intel® Atom C2750, 8-core, 2.4GHz, 32GB DDR3 @ 1600, one PCI slot with a VGA card, another PCI with Intel X520-DA2 10GbE NIC, 4x 1GbE, 4x SATA-3 ports, 2x SATA-2 ports, 2TB Western Digital HDD. For more complete information visit http://www.intel.com/performance
What does this mean to you?

The Intel® Atom™ processor C2000 product family and Intel® Xeon® processor D-1500 product family provide a variety of options enabling you to select a single system-on-a-chip (SoC) that meets your price/performance needs.

Intel® Atom™ processor C2000 product family delivers maximum CPU density while deploying the lowest power solution on a SOC.

Intel® Xeon® processor D-1500 product family delivers a unique combination of server-class performance and features, with low power and smaller SOC footprint.

For the test setup described in the previous slides, the Intel® Xeon® processor D-1540 handles up to 2.5x the throughput vs the Intel® Atom™ processor C2750 (when transmitting 256 bytes packet traffic at a rate of 1.5Gb/s with zero packet loss).

Disclaimer: Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. System #1 under test: Intel® Xeon® D-1540, 8-core, 45W (2.0GHz with 2.6GHz Turbo), 32GB DDR4 RAM, 1GbE NICs, ATX board; 2x 1GbE, 1x 10GbE (10g-based T). System #2 under test: Intel® Atom C2750, 8-core, 2.4GHz, 32GB DDR3, 16GB RAM, 1x PCI slot with a VGA card, 4x SATA-3 ports, 2TB Western Digital HDD (WD2003FZX). For more complete information visit http://www.intel.com/performance.
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