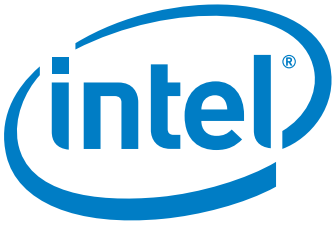


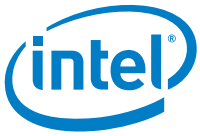
Intel® Data Plane Development Kit (Intel® DPDK)

Release Notes

Package Version: 1.5.1

October 2013

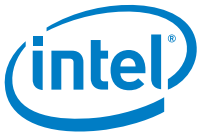
Reference Number: 326001-005



Revision History

Date	Revision	Description
October 2013	-005	Supports public software release 1.5.1
September 2013	-004	Supports public software release 1.5.0
August 2013	-003	Supports public software release 1.4.1
June 2013	-002	Supports public software release 1.3.1
November 2012	-001	Supports public software release 1.2.3

Contents



1.0 Description of Release

These release notes cover the new features, fixed bugs and known issues for Intel® Data Plane Development Kit (Intel® DPDK) release version 1.5.1.

For instructions on compiling and running the release, see the *Intel® DPDK Getting Started Guide*.

1.1 Important Notes

All Intel® DPDK questions and technical problems including those regarding the Ethernet* Controllers for the Poll Mode Driver should be reported through the Intel® Premier Support site http://premier.intel.com/premier or access your IBL account and click the **Intel® Premier Support** link to enter issues under the Product Name "Data Plane Development Kit (DPDK)", which are then routed to our support team.

1.2 Using Intel® DPDK Upgrade Patches

For minor updates to the main Intel® DPDK releases, the software may be made available both as a new full package and as a patch file to be applied to the previously released package. In the latter case, the following commands should be used to apply the patch on top of the already-installed package for the previous release:

```
# cd $RTE_SDK
# patch -p1 < /path/to/patch/file
```

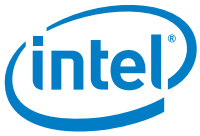
Once the patch has been applied cleanly, the Intel® DPDK can be recompiled and used as before (described in the *Intel® DPDK Getting Started Guide*).

Note: If the patch does not apply cleanly, perhaps because of modifications made locally to the software, it is recommended to use the full release package for the minor update, instead of using the patch.

1.3 Documentation Roadmap

The following is a list of Intel® DPDK documents in the suggested reading order:

- **Release Notes** (this document): Provides release-specific information, including supported features, limitations, fixed issues, known issues and so on. Also, provides the answers to frequently asked questions in FAQ format.
- **Getting Started Guide**: Describes how to install and configure the Intel® DPDK software; designed to get users up and running quickly with the software.
- **Programmer's Guide**: Describes:
  - The software architecture and how to use it (through examples), specifically in a Linux* application (linuxapp) environment
  - The content of the Intel® DPDK, the build system (including the commands that can be used in the root Intel® DPDK Makefile to build the development kit and an application) and guidelines for porting an application



  - Optimizations used in the software and those that should be considered for new development

  A glossary of terms is also provided.

- **API Reference**: Provides detailed information about Intel® DPDK functions, data structures and other programming constructs.
- **Sample Applications User Guide**: Describes a set of sample applications. Each chapter describes a sample application that showcases specific functionality and provides instructions on how to compile, run and use the sample application.

  The following sample applications are included:

  - Command Line
  - Exception Path (into Linux* for packets using the Linux TUN/TAP driver)
  - Hello World
  - Integration with Intel® QuickAssist Technology
  - Link Status Interrupt (Ethernet* Link Status Detection)
  - IPv4 Fragmentation
  - IPv4 Multicast
  - L2 Forwarding (supports virtualized and non-virtualized environments)
  - L3 Forwarding
  - L3 Forwarding in a Virtualized Environment
  - Load Balancing
  - Multi-process
  - Timer
  - VMDQ and DCB L2 Forwarding
  - VMDQ L2 Forwarding
  - VMDQ
  - Kernel NIC Interface (KNI)

  In addition, there are some other applications that are built when the libraries are created. The source for these applications is in the `DPDK/app` directory and are called:

  Once the libraries are created, they can be found in the `build/app` directory.

  - The `test` application provides a variety of specific tests for the various functions in the Intel® DPDK.
  - The `testpmd` application provides a number of different packet throughput tests and examples of features such as how to use the Flow Director found in the Intel® 82599 10 Gigabit Ethernet Controller.

  The `testpmd` application is documented in the *Intel® DPDK Testpmd Application Note* (525362). The `test` application is not currently documented. However, you should be able to run and use `test` application with the command line help that is provided in the application.

2.0 New Features

- Multi-thread Kernel NIC Interface (KNI) for performance improvement
- Virtualization (KVM)
  - — Para-virtualization
    Support `virtio` front-end poll mode driver in guest virtual machine
    Support `vHost` raw socket interface as `virtio` back-end via KNI
  - — SR-IOV Switching for the 10G Ethernet Controller
    Support Physical Function to start/stop Virtual Function Traffic
    Support Traffic Mirroring (Pool, VLAN, Uplink and Downlink)
    Support VF multiple MAC addresses (Exact/Hash match), VLAN filtering
    Support VF receive mode configuration
- Support VMDq for 1 GbE and 10 GbE NICs
- Extension for the Quality of Service (QoS) sample application to allow statistics polling
- New `libpcap`-based poll-mode driver, including support for reading from 3rd Party NICs using Linux kernel drivers
- New multi-process example using `fork()` to demonstrate application resiliency and recovery, including reattachment to and re-initialization of shared data structures where necessary
- New example (`vmdq`) to demonstrate VLAN-based packet filtering
- Improved scalability for scheduling large numbers of timers using the `rte_timer` library
- Support for building the Intel® DPDK as a shared library
- Support for Intel® Ethernet Server Bypass Adapter X520-SR2
- Poll Mode Driver support for the Intel® Ethernet Connection I354 on the Intel Atom Processor C2000 Product Family SoCs

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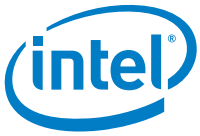
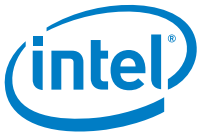


3.0 Supported Features

- IPv6 exact match flow classification in the l3fwd sample application
- Support for multiple instances of the Intel® DPDK
- Support for Intel® 82574L Gigabit Ethernet Controller - Intel® Gigabit CT Desktop Adapter (previously code named “Hartwell”)
- Support for Intel® Ethernet Controller I210 (previously code named “Springville”)
- Early access support for the Quad-port Intel® Ethernet Server Adapter X520-4 (code named “Spring Fountain”)
- Core components:
  - rte_mempool: allocator for fixed-sized objects
  - rte_ring: single- or multi- consumer/producer queue implementation
  - rte_timer: implementation of timers
  - rte_malloc: malloc-like allocator
  - rte_mbuf: network packet buffers, including fragmented buffers
  - rte_hash: support for exact-match flow classification in software
  - rte_lpm: support for longest prefix match in software for IPv4 and IPv6
  - rte_sched: support for QoS scheduling
  - rte_meter: support for QoS traffic metering
  - rte_power: support for power management
- Poll Mode Driver - Common (rte_ether)
  - VLAN support
  - Support for Receive Side Scaling (RSS)
  - IEEE1588
  - Buffer chaining; Jumbo frames
  - TX checksum calculation
  - Configuration of promiscuous mode, and multicast packet receive filtering
  - L2 Mac address filtering
  - Statistics recording
- IGB Poll Mode Driver - 1 GbE Controllers (librte_pmd_e1000)
  - Support for Intel® 82576 Gigabit Ethernet Controller (previously code named “Kawela”)
  - Support for Intel® 82580 Gigabit Ethernet Controller (previously code named “Barton Hills”)
  - Support for Intel® I350 Gigabit Ethernet Controller (previously code named “Powerville”)

  - — Support for Intel® 82574L Gigabit Ethernet Controller - Intel® Gigabit CT Desktop Adapter (previously code named “Hartwell”)
  - — Support for Intel® Ethernet Controller I210 (previously code named “Springville”)
- Poll Mode Driver - 10 GbE Controllers (librte_pmd_ixgbe)
  - — Support for Intel® 82599 10 Gigabit Ethernet Controller (previously code named “Niantic”)
  - — Support for Intel® Ethernet Server Adapter X520-T2 (previously code named “Iron Pond”)
  - — Support for Intel® Ethernet Controller X540-T2 (previously code named “Twin Pond”)
  - — Support for Virtual Machine Device Queues (VMDq) and Data Center Bridging (DCB) to divide incoming traffic into 128 RX queues. DCB is also supported for transmitting packets.
  - — Support for auto negotiation down to 1 Gb
  - — Support for Flow Director
- Environment Abstraction Layer (librte_eal)
  - — Multi-process support
  - — Multi-thread support
  - — 1 Gbyte and 2 Mbyte page support
  - — Atomic integer operations
  - — Querying CPU support of specific features
  - — High Precision Event Timer support (HPET)
  - — PCI device enumeration and blacklisting
  - — Spin locks and R/W locks
- Test PMD application
  - — Support for PMD driver testing
- Test application
  - — Support for core component tests
- Sample applications
  - — Command Line
  - — Exception Path (into Linux* for packets using the Linux TUN/TAP driver)
  - — Hello World
  - — Integration with Intel® Quick Assist Technology drivers 1.0.0, 1.0.1 and 1.1.0 on Intel® Communications Chipset 89xx Series C0 and C1 silicon.
  - — Link Status Interrupt (Ethernet* Link Status Detection
  - — IPv4 Fragmentation
  - — IPv4 Multicast
  - — L2 Forwarding (supports virtualized and non-virtualized environments)
  - — L3 Forwarding
  - — L3 Forwarding in a Virtualized Environment
  - — Load Balancing
  - — Multi-process



  - — Timer
  - — VMDQ and DCB L2 Forwarding
  - — Kernel NIC Interface (with ethtool support)
- Interactive command line interface (rte_cmdline)
- Updated 10 GbE Poll Mode Driver (PMD) to the latest BSD code base providing support of newer ixgbe 10 GbE devices such as the Intel® X520-T2 server Ethernet adapter
- An API for configuring Ethernet flow control
- Support for interrupt-based Ethernet link status change detection
- Support for SR-IOV functions on the Intel® 82599, Intel® 82576 and Intel® i350 Ethernet Controllers in a virtualized environment
- Improvements to SR-IOV switch configurability on the Intel® 82599 Ethernet Controllers in a virtualized environment.
- An API for L2 Ethernet Address “whitelist” filtering
- An API for resetting statistics counters
- Support for RX L4 (UDP/TCP/SCTP) checksum validation by NIC
- Support for TX L3 (IPv4/IPv6) and L4 (UDP/TCP/SCTP) checksum calculation offloading
- Support for IPv4 packet fragmentation
- Support for zero-copy Multicast
- New APIs to allow the “blacklisting” of specific NIC ports.
- Header files for common protocols (IP, SCTP, TCP, UDP)
- Improved multi-process application support, allowing multiple co-operating Intel® DPDK processes to access the NIC port queues directly.
- CPU-specific compiler optimization
- Improvements to the Load Balancing sample application
- The addition of a PAUSE instruction to tight loops for energy-usage and performance improvements
- Updated 10 GbE Transmit architecture incorporating new upstream PCIe* optimizations.
- IPv6 support:
  - — Support in Flow Director Signature Filters and masks
  - — RSS support in sample application that use RSS
  - — Exact match flow classification in the L3 Forwarding sample application

4.0 Supported Operating Systems

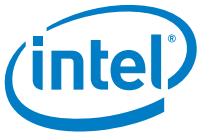
The following Linux* distributions were successfully used to generate or run the Intel® DPDK.

These distributions may need additional packages that are not installed by default, or a specific kernel. Refer to the *Intel® DPDK Getting Started Guide* for details.

4.1 Intel® DPDK 1.4 to Intel® DPDK 1.5

Note the following difference between 1.4 and 1.5:

- Starting with version 1.5, the top-level directory created from unzipping the release package will now contain the release version number, that is, `DPDK-1.5.1/` rather than just `DPDK/`.



5.0 Known Issues and Limitations

This section describes known issues with the Intel® DPDK software, Release 1.5.1.

5.1 In packets provided by the PMD, some flags are missing

Title	**In packets provided by the PMD, some flags are missing**
Reference #	3
Description	In packets provided by the PMD, some flags are missing. The application does not have access to information provided by the hardware (packet is broadcast, packet is multicast, packet is IPv4 and so on).
Implication	The “ol_flags” field in the “rte_mbuf” structure is not correct and should not be used.
Resolution	The application has to parse the Ethernet header itself to get the information, which is slower.
Affected Environment / Platform	All
Driver / Module	Poll Mode Driver (PMD)

5.2 The rte_malloc library is not fully implemented

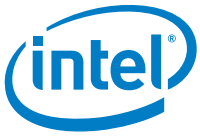
Title	**The rte_malloc library is not fully implemented**
Reference #	6
Description	The rte_malloc library is not fully implemented.
Implication	All debugging features of rte_malloc library described in architecture documentation are not yet implemented.
Resolution	No workaround available.
Affected Environment / Platform	All
Driver / Module	rte_malloc

5.3 HPET reading is slow

Title	**HPET reading is slow**
Reference #	7
Description	Reading the HPET chip is slow.
Implication	An application that calls “rte_get_hpet_cycles()” or “rte_timer_manage()” runs slower.
Resolution	The application should not call these functions too often in the main loop. An alternative is to use the TSC register through “rte_rdtsc()” which is faster, but specific to an lcore and is a cycle reference, not a time reference.
Affected Environment/ Platform	All
Driver/Module	Environment Abstraction Layer (EAL)

5.4 HPET timers do not work on the Osage customer reference platform

Title	**HPET timers do not work on the Osage customer reference platform**
Reference #	17
Description	HPET timers do not work on the Osage customer reference platform (which includes an Intel® Xeon® processor 5500 series processor) using the released BIOS from Intel.
Implication	On Osage boards, the implementation of the “rte_delay_us()” function must be changed to not use the HPET timer.
Resolution	This can be addressed by building the system with the “CONFIG_RTE_LIBEAL_USE_HPET=n” configuration option or by using the --no-hpet EAL option.
Affected Environment/ Platform	The Osage customer reference platform. Other vendor platforms with Intel® Xeon® processor 5500 series processors should work correctly, provided the BIOS supports HPET.
Driver/Module	lib/librte_eal/common/include/rte_cycles.h



5.5 Not all variants of supported NIC types have been used in testing

Title	**Not all variants of supported NIC types have been used in testing**
Reference #	28
Description	The supported network interface cards can come in a number of variants with different device ID's. Not all of these variants have been tested with the Intel® DPDK. The NIC device identifiers used during testing: • Intel® 82576 Gigabit Ethernet Controller [8086:10c9] • Intel® 82576 Quad Copper Gigabit Ethernet Controller [8086:10e8] • Intel® 82580 Dual Copper Gigabit Ethernet Controller [8086:150e] • Intel® I350 Quad Copper Gigabit Ethernet Controller [8086:1521] • Intel® 82599EB Dual Fibre 10 Gigabit Ethernet Controller [8086:10fb] • Intel® Ethernet Server Adapter X520-T2 [8086: 151c] • Intel® Ethernet Controller X540-T2 [8086:1528] • Intel® 82574L Gigabit Network Connection [8086:10d3] • Emulated Intel® 82540EM Gigabit Ethernet Controller [8086:100e] • Emulated Intel® 82545EM Gigabit Ethernet Controller [8086:100f] • Intel® Ethernet Server Adapter X520-4 [8086:154a] • Intel® Ethernet Controller I210 [8086:1533]
Implication	Risk of issues with untested variants.
Resolution	Use tested NIC variants. For those supported Ethernet controllers, additional device IDs may be added to the software if required.
Affected Environment / Platform	All
Driver / Module	Poll-mode drivers

5.6 Multi-process sample app requires exact memory mapping

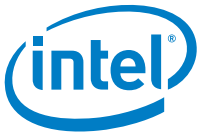
Title	**Multi-process sample app requires exact memory mapping**
Reference #	30
Description	The multi-process example application assumes that it is possible to map the hugepage memory to the same virtual addresses in client and server applications. Occasionally, very rarely with 64-bit, this does not occur and a client application will fail on startup. The Linux “address-space layout randomization” security feature can sometimes cause this to occur.
Implication	A multi-process client application fails to initialize.
Resolution	See the “Multi-process Limitations” section in the *Intel® DPDK Programmer’s Guide* for more information.
Affected Environment / Platform	All
Driver / Module	Multi-process example application

5.7 Unstable system performance across application executions with 2MB pages

Title	**Unstable system performance across application executions with 2MB pages**
Reference #	IXA00372346
Description	The performance of a Intel® DPDK application may vary across executions of an application due to a varying number of TLB misses depending on the location of accessed structures in memory. This situation occurs on rare occasions.
Implication	Occasionally, relatively poor performance of Intel® DPDK applications is encountered.
Resolution / Workaround	Using 1 GB pages results in lower usage of TLB entries, resolving this issue.
Affected Environment / Platform	Systems using 2 MB pages
Driver / Module	All

5.8 Packets are not sent by the 1 GbE / 10 GbE SR-IOV driver when the source MAC address is not the MAC address assigned to the VF NIC

Title	**Packets are not sent by the 1 GbE / 10 GbE SR-IOV driver when the source MAC address is not the MAC address assigned to the VF NIC**
Reference #	IXA00168379
Description	The 1 GbE/10 GbE SR-IOV driver can only send packets when the Ethernet header's source MAC address is the same as that of the VF NIC. The reason for this is that the Linux "ixgbe" driver module in the host OS has its anti-spoofing feature enabled.
Implication	Packets sent using the 1 GbE/10 GbE SR-IOV driver must have the source MAC address correctly set to that of the VF NIC. Packets with other source address values are dropped by the NIC if the application attempts to transmit them.
Resolution / Workaround	Configure the Ethernet source address in each packet to match that of the VF NIC.
Affected Environment / Platform	All
Driver / Module	1 GbE/10 GbE VF Poll Mode Driver (PMD)



5.9 SR-IOV drivers do not fully implement the rte_ethdev API

Title	**SR-IOV drivers do not fully implement the rte_ethdev API**
Reference #	59
Description	The SR-IOV drivers only supports the following rte_ethdev API functions: • rte_eth_dev_configure() • rte_eth_tx_queue_setup() • rte_eth_rx_queue_setup() • rte_eth_dev_info_get() • rte_eth_dev_start() • rte_eth_tx_burst() • rte_eth_rx_burst() • rte_eth_dev_stop() • rte_eth_stats_get() • rte_eth_stats_reset() • rte_eth_link_get() • rte_eth_link_get_no_wait()
Implication	Calling an unsupported function will result in an application error.
Resolution / Workaround	Do not use other rte_ethdev API functions in applications that use the SR-IOV drivers.
Affected Environment / Platform	All
Driver / Module	VF Poll Mode Driver (PMD)

5.10 PMD does not work with --no-huge EAL command line parameter

Title	**PMD does not work with --no-huge EAL command line parameter**
Reference #	IXA00373461
Description	Currently, the Intel® DPDK does not store any information about memory allocated by malloc() (for example, NUMA node, physical address), hence PMD drivers do not work when the --no-huge command line parameter is supplied to EAL.
Implication	Sending and receiving data with PMD will not work.
Resolution / Workaround	Use huge page memory.
Affected Environment / Platform	Systems running the Intel® DPDK on Linux
Driver / Module	Poll Mode Driver (PMD)

5.11 Some hardware off-load functions are not supported by the VF Driver

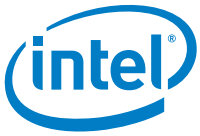
Title	**Some hardware off-load functions are not supported by the VF Driver**
Reference #	IXA00378813
Description	Currently, configuration of the following items is not supported by the VF driver: • IP/UDP/TCP checksum offload • Jumbo Frame Receipt • HW Strip CRC
Implication	Any configuration for these items in the VF register will be ignored. The behavior is dependant on the current PF setting.
Resolution / Workaround	For the PF (Physical Function) status on which the VF driver depends, there is an option item under PMD in the config file. For others, the VF will keep the same behavior as PF setting.
Affected Environment / Platform	All
Driver / Module	VF (SR-IOV) Poll Mode Driver (PMD)

5.12 Kernel crash on IGB port unbinding

Title	**Kernel crash on IGB port unbinding**
Reference #	74
Description	Kernel crash may occur when unbinding 1G ports from the igb_uio driver, on 2.6.3x kernels such as shipped with Fedora 14.
Implication	Kernel crash occurs.
Resolution / Workaround	Use newer kernels or do not unbind ports.
Affected Environment / Platform	2.6.3x kernels such as shipped with Fedora 14
Driver / Module	IGB Poll Mode Driver (PMD)

5.13 Link status change not working with MSI interrupts

Title	**Link status change not working with MSI interrupts**
Reference #	IXA00378191
Description	MSI interrupts are not supported by the PMD.
Implication	Link status change will only work with legacy or MSI-X interrupts.
Resolution / Workaround	The igb_uio driver can now be loaded with either legacy or MSI-X interrupt support.
Affected Environment / Platform	All
Driver / Module	Poll Mode Driver (PMD)



5.14 Twinpond and Ironpond NICs do not report link status correctly

Title	**Twinpond and Ironpond NICs do not report link status correctly**
Reference #	IXA00378800
Description	Twin Pond/Iron Pond NICs do not bring the physical link down when shutting down the port.
Implication	The link is reported as up even after issuing "shutdown" command unless the cable is physically disconnected.
Resolution / Workaround	None.
Affected Environment / Platform	Twin Pond and Iron Pond NICs
Driver / Module	Poll Mode Driver (PMD)

5.15 Discrepancies between statistics reported by different NICs

Title	**Discrepancies between statistics reported by different NICs**
Reference #	IXA00378113
Description	Gigabit Ethernet devices from Intel include CRC bytes when calculating packet reception statistics regardless of hardware CRC stripping state, while 10-Gigabit Ethernet devices from Intel do so only when hardware CRC stripping is disabled.
Implication	There may be a discrepancy in how different NICs display packet reception statistics.
Resolution / Workaround	None
Affected Environment / Platform	All
Driver / Module	Poll Mode Driver (PMD)

5.16 Error reported opening files on Intel® DPDK initialization

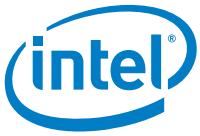
Title	**Error reported opening files on Intel® DPDK initialization**
Reference #	91
Description	On Intel® DPDK application startup, errors may be reported when opening files as part of the initialization process. This occurs if a large number, for example, 500 or more, or if hugepages are used, due to the per-process limit on the number of open files.
Implication	The Intel® DPDK application may fail to run.
Resolution / Workaround	If using 2 MB hugepages, consider switching to a fewer number of 1 GB pages. Alternatively, use the “ulimit” command to increase the number of files which can be opened by a process.
Affected Environment / Platform	All
Driver / Module	Environment Abstraction Layer (EAL)

5.17 Intel® QuickAssist Technology sample application does not work on a 32-bit OS on Shumway

Title	**Intel® QuickAssist Technology sample applications does not work on a 32-bit OS on Shumway**
Reference #	93
Description	The Intel® Communications Chipset 89xx Series device does not fully support NUMA on a 32-bit OS. Consequently, the sample application cannot work properly on Shumway, since it requires NUMA on both nodes.
Implication	The sample application cannot work in 32-bit mode with emulated NUMA, on multi-socket boards.
Resolution / Workaround	There is no workaround available.
Affected Environment / Platform	Shumway
Driver / Module	All

5.18 IEEE1588 support not working with an Intel® Ethernet Controller I210 NIC

Title	**IEEE1588 support not working with an Intel® Ethernet Controller I210 NIC**
Reference #	IXA00380285
Description	IEEE1588 support is not working with an Intel® Ethernet Controller I210 NIC.
Implication	IEEE1588 packets are not forwarded correctly by the Intel® Ethernet Controller I210 NIC.
Resolution / Workaround	There is no workaround available.
Affected Environment / Platform	All
Driver / Module	IGB Poll Mode Driver



5.19 Differences in how different Intel NICs handle maximum packet length for jumbo frame

Title	**Differences in how different Intel NICs handle maximum packet length for jumbo frame**
Reference #	96
Description	10 Gigabit Ethernet devices from Intel do not take VLAN tags into account when calculating packet size while Gigabit Ethernet devices do so for jumbo frames.
Implication	When receiving packets with VLAN tags, the actual maximum size of useful payload that Intel Gigabit Ethernet devices are able to receive is 4 bytes (or 8 bytes in the case of packets with extended VLAN tags) less than that of Intel 10 Gigabit Ethernet devices.
Resolution / Workaround	Increase the configured maximum packet size when using Intel Gigabit Ethernet devices.
Affected Environment / Platform	All
Driver / Module	Poll Mode Driver (PMD)

5.20 Link status interrupt not working in VF drivers

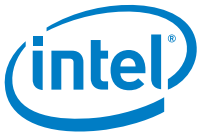
Title	**Link status interrupts not working in the VF drivers**
Reference #	IXA00381312
Description	Due to the driver not setting up interrupts for VF drivers, the NIC does not report link status change to VF devices.
Implication	Link status interrupts will not work in VM guests.
Resolution / Workaround	There is no workaround available.
Affected Environment / Platform	All
Driver / Module	VF (SR-IOV) Poll Mode Driver (PMD)

5.21 Gcc might generate Intel® AVX instructions for processors without Intel® AVX support

Title	**Gcc might generate Intel® AVX instructions for processors without Intel® AVX support**
Reference #	IXA00382439
Description	When compiling Intel® DPDK (and any Intel® DPDK app), gcc may generate Intel® AVX instructions, even when the processor does not support Intel® AVX.
Implication	Any Intel® DPDK app might crash while starting up.
Resolution / Workaround	Either compile using icc or set EXTRA_CFLAGS='-O3' prior to compilation.
Affected Environment / Platform	Platforms which processor does not support Intel® AVX.
Driver / Module	Environment Abstraction Layer (EAL)

5.22 KNI does not provide Ethtool support for all NICs supported by the Poll-Mode Drivers

Title	**KNI does not provide ethtool support for all NICs supported by the Poll Mode Drivers**
Reference #	IXA00383835
Description	To support ethtool functionality using the KNI, the KNI library includes separate driver code based of the linux kernel drivers. Because this driver code is separate from the driver code for the poll-mode drivers, the set of supported NICs for these two components may differ. Because of this, in this release, the KNI driver does not provide “ethtool” support for the Intel® Ethernet Connection I354on the Intel Atom Processor C2000 Product Family SoCs.
Implication	Ethtool support with KNI will not work for NICs such as the Intel® Ethernet Connection I354. Other KNI functionality, such as injecting packets into the Linux kernel is unaffected.
Resolution / Workaround	None
Affected Environment / Platform	Platforms using the Intel® Ethernet Connection I354 or other NICs unsupported by KNI ethtool
Driver / Module	KNI



6.0 Resolved Issues

This section describes previously known issues that have been resolved since release version 1.2.

6.1 MP Client Example app - flushing part of TX is not working for some ports if set specific port mask with skipped ports

Title	**MP Client Example app - flushing part of TX is not working for some ports if set specific port mask with skipped ports**
Reference #	52
Description	When ports not in a consecutive set, for example, ports other than ports 0,1 or 0,1,2,3, are used with the client-server sample app, when no further packets are received by a client, the application may not flush correctly any unsent packets already buffered inside it.
Implication	Not all buffered packets are transmitted if traffic to the client application is stopped. While traffic is continually received for transmission on a port by a client, buffer flushing happens normally.
Resolution / Workaround	Changed line 284 of the client.c file: from “send_packets(port);” to “send_packets(ports->id[port]);”
Affected Environment / Platform	All
Driver / Module	Client-Server Multi-process Sample application

6.2 Packet truncation with Intel® I350 Gigabit Ethernet Controller

Title	**Packet truncation with Intel I350 Gigabit Ethernet Controller**
Reference #	IXA00372461
Description	The setting of the hw_strip_crc field in the rte_eth_conf structure passed to the rte_eth_dev_configure() function is not respected and hardware CRC stripping is always enabled. If the field is set to 0, then the software also tries to strip the CRC, resulting in packet truncation.
Implication	The last 4 bytes of the packets received will be missing.
Resolution / Workaround	Fixed an omission in device initialization (setting the STRCRC bit in the DVMOLR register) to respect the CRC stripping selection correctly.
Affected Environment / Platform	Systems using the Intel® I350 Gigabit Ethernet Controller
Driver / Module	1 GbE Poll Mode Driver (PMD)

6.3 Device initialization failure with Intel® Ethernet Server Adapter X520-T2

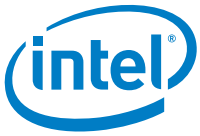
Title	**Device initialization failure with Intel® Ethernet Server Adapter X520-T2**
Reference #	55
Description	If this device is bound to the Linux kernel IXGBE driver when the Intel® DPDK is initialized, the device initialization fails with error code -17 "IXGBE_ERR_PHY_ADDR_INVALID".
Implication	The device is not initialized and cannot be used by an application.
Resolution / Workaround	Introduced a small delay in device initialization to allow Intel® DPDK to always find the device.
Affected Environment / Platform	Systems using the Intel® Ethernet Server Adapter X520-T2
Driver / Module	10 GbE Poll Mode Driver (PMD)

6.4 Intel® DPDK kernel module is incompatible with Linux kernel version 3.3

Title	**Intel® DPDK kernel module is incompatible with Linux kernel version 3.3**
Reference #	IXA00373232
Description	The igb_uio kernel module fails to compile on systems with Linux kernel version 3.3 due to API changes in kernel headers.
Implication	The compilation fails and Ethernet controllers fail to initialize without the igb_uio module.
Resolution / Workaround	Kernel functions pci_block_user_cfg_access()/pci_cfg_access_lock() and pci_unblock_user_cfg_access()/pci_cfg_access_unlock() are automatically selected at compile time as appropriate.
Affected Environment / Platform	Linux systems using kernel version 3.3 or later
Driver / Module	UIO module

6.5 Initialization failure with Intel® Ethernet Controller X540-T2

Title	**Initialization failure with Intel® Ethernet Controller X540-T2**
Reference #	57
Description	This device causes a failure during initialization when the software tries to read the part number from the device EEPROM.
Implication	Device cannot be used.
Resolution / Workaround	Removed unnecessary check of the PBA number for the device.
Affected Environment / Platform	Systems using the Intel® Ethernet Controller X540-T2
Driver / Module	10 GbE Poll Mode Driver (PMD)



6.6 rte_eth_dev_stop() function does not bring down the link for 1 GB NIC ports

Title	**rte_eth_dev_stop() function does not bring down the link for 1 GB NIC ports**
Reference #	IXA00373183
Description	When the rte_eth_dev_stop() function is used to stop a NIC port, the link is not brought down for that port.
Implication	Links are still reported as up, even though the NIC device has been stopped and cannot perform TX or RX operations on that port.
Resolution	The rte_eth_dev_stop() function now brings down the link when called.
Affected Environment / Platform	All
Driver / Module	1 GbE Poll Mode Driver (PMD)

6.7 It is not possible to adjust the duplex setting for 1GB NIC ports

Title	**It is not possible to adjust the duplex setting for 1 GB NIC ports**
Reference #	66
Description	The rte_eth_conf structure does not have a parameter that allows a port to be set to half-duplex instead of full-duplex mode, therefore, 1 GB NICs cannot be configured explicitly to a full- or half-duplex value.
Implication	1 GB port duplex capability cannot be set manually.
Resolution	The PMD now uses a new field added to the rte_eth_conf structure to allow 1 GB ports to be configured explicitly as half- or full-duplex.
Affected Environment / Platform	All
Driver / Module	1 GbE Poll Mode Driver (PMD)

6.8 Calling rte_eth_dev_stop() on a port does not free all the mbufs in use by that port

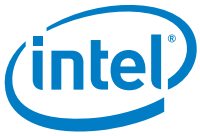
Title	**Calling rte_eth_dev_stop() on a port does not free all the mbufs in use by that port**
Reference #	67
Description	The rte_eth_dev_stop() function initially frees all mbufs used by that port's RX and TX rings, but subsequently repopulates the RX ring again later in the function.
Implication	Not all mbufs used by a port are freed when the port is stopped.
Resolution	The driver no longer re-populates the RX ring in the rte_eth_dev_stop() function.
Affected Environment / Platform	All
Driver / Module	IGB and IXGBE Poll Mode Drivers (PMDs)

6.9 PMD does not always create rings that are properly aligned in memory

Title	**PMD does not always create rings that are properly aligned in memory**
Reference #	IXA00373158
Description	The NIC hardware used by the PMD requires that the RX and TX rings used must be aligned in memory on a 128-byte boundary. The memzone reservation function used inside the PMD only guarantees that the rings are aligned on a 64-byte boundary, so errors can occur if the rings are not aligned on a 128-byte boundary.
Implication	Unintended overwriting of memory can occur and PMD behavior may also be effected.
Resolution	A new rte_memzone_reserve_aligned() API has been added to allow memory reservations from hugepage memory at alignments other than 64-bytes. The PMD has been modified so that the rings are allocated using this API with minimum alignment of 128-bytes.
Affected Environment/ Platform	All
Driver/Module	IGB and IXGBE Poll Mode Drivers (PMDs)

6.10 Checksum offload might not work correctly when mixing VLAN-tagged and ordinary packets

Title	**Checksum offload might not work correctly when mixing VLAN-tagged and ordinary packets**
Reference #	IXA00378372
Description	Incorrect handling of protocol header lengths in the PMD driver
Implication	The checksum for one of the packets may be incorrect.
Resolution/ Workaround	Corrected the offset calculation.
Affected Environment/ Platform	All
Driver/Module	Poll Mode Driver (PMD)



6.11 Port not found issue with Intel® 82580 Gigabit Ethernet Controller

Title	**Port not found issue with Intel® 82580 Gigabit Ethernet Controller**
Reference #	50
Description	After going through multiple driver unbind/bind cycles, an Intel® 82580 Ethernet Controller port may no longer be found and initialized by the Intel® DPDK.
Implication	The port will be unusable.
Resolution / Workaround	Issue was not reproducible and therefore no longer considered an issue.
Affected Environment / Platform	All
Driver / Module	1 GbE Poll Mode Driver (PMD)

6.12 Packet mbufs may be leaked from mempool if rte_eth_dev_start() function fails

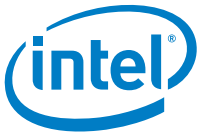
Title	**Packet mbufs may be leaked from mempool if rte_eth_dev_start() function fails**
Reference #	IXA00373373
Description	The rte_eth_dev_start() function allocates mbufs to populate the NIC RX rings. If the start function subsequently fails, these mbufs are not freed back to the memory pool from which they came.
Implication	mbufs may be lost to the system if rte_eth_dev_start() fails and the application does not terminate.
Resolution / Workaround	mbufs are correctly deallocated if a call to rte_eth_dev_start() fails.
Affected Environment / Platform	All
Driver / Module	Poll Mode Driver (PMD)

6.13 Promiscuous mode for 82580 NICs can only be enabled after a call to rte_eth_dev_start for a port

Title	**Promiscuous mode for 82580 NICs can only be enabled after a call to rte_eth_dev_start for a port**
Reference #	IXA00373833
Description	For 82580-based network ports, the rte_eth_dev_start() function can overwrite the setting of the promiscuous mode for the device. Therefore, the rte_eth_promiscuous_enable() API call should be called after rte_eth_dev_start() for these devices.
Implication	Promiscuous mode can only be enabled if API calls are in a specific order.
Resolution / Workaround	The NIC now restores most of its configuration after a call to rte_eth_dev_start().
Affected Environment / Platform	All
Driver / Module	Poll Mode Driver (PMD)

6.14 Incorrect CPU socket information reported in /proc/cpuinfo can prevent the Intel® DPDK from running

Title	**Incorrect CPU socket information reported in /proc/cpuinfo can prevent the Intel® DPDK from running**
Reference #	63
Description	The Intel® DPDK uses information supplied by the Linux kernel to determine the hardware properties of the system being used. On rare occasions, information supplied by /proc/cpuinfo does not match that reported elsewhere. In some cases, it has been observed that the CPU socket numbering given in /proc/cpuinfo is incorrect and this can prevent Intel® DPDK from operating.
Implication	The Intel® DPDK cannot run on systems where /proc/cpuinfo does not report the correct CPU socket topology.
Resolution / Workaround	CPU socket information is now read from /sys/devices/cpu/cpuN/topology
Affected Environment / Platform	All
Driver / Module	Environment Abstraction Layer (EAL)



6.15 L3FWD sample application may fail to transmit packets under extreme conditions

Title	**L3FWD sample application may fail to transmit packets under extreme conditions**
Reference #	IXA00372919
Description	Under very heavy load, the L3 Forwarding sample application may fail to transmit packets due to the system running out of free mbufs.
Implication	Sending and receiving data with the PMD may fail.
Resolution / Workaround	The number of mbufs is now calculated based on application parameters.
Affected Environment / Platform	All
Driver / Module	L3 Forwarding sample application

6.16 L3FWD-VF might lose CRC bytes

Title	**L3FWD-VF might lose CRC bytes**
Reference #	IXA00373424
Description	Currently, the CRC stripping configuration does not affect the VF driver.
Implication	Packets transmitted by the Intel® DPDK in the VM may be lacking 4 bytes (packet CRC).
Resolution / Workaround	Set “strip_crc” to 1 in the sample applications that use the VF PMD.
Affected Environment / Platform	All
Driver / Module	IGB and IXGBE VF Poll Mode Drivers (PMDs)

6.17 32-bit Intel® DPDK sample applications fails when using more than one 1 GB hugepage

Title	**32-bit Intel® DPDK sample applications fails when using more than one 1 GB hugepage**
Reference #	31
Description	32-bit applications may have problems when running with multiple 1 GB pages on a 64-bit OS. This is due to the limited address space available to 32-bit processes.
Implication	32-bit processes need to use either 2 MB pages or have their memory use constrained to 1 GB if using 1 GB pages.
Resolution	EAL now limits virtual memory to 1 GB per page size.
Affected Environment / Platform	64-bit systems running 32-bit Intel® DPDK with 1 GB hugepages
Driver / Module	Multi-process sample application

6.18 l2fwd fails to launch if the NIC is the Intel® 82571EB Gigabit Ethernet Controller

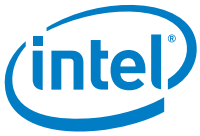
Title	**l2fwd fails to launch if the NIC is the Intel® 82571EB Gigabit Ethernet Controller**
Reference #	IXA00373340
Description	The 82571EB NIC can handle only one TX per port. The original implementation allowed for a more complex handling of multiple queues per port.
Implication	The l2fwd application fails to launch if the NIC is 82571EB.
Resolution	l2fwd now uses only one TX queue.
Affected Environment/ Platform	All
Driver/Module	Sample Application

6.19 32-bit Intel® DPDK applications may fail to initialize on 64-bit OS

Title	**32-bit Intel® DPDK applications may fail to initialize on 64-bit OS**
Reference #	IXA00378513
Description	The EAL used a 32-bit pointer to deal with physical addresses. This could create problems when the physical address of a hugepage exceeds the 4 GB limit.
Implication	32-bit applications may not initialize on a 64-bit OS.
Resolution/ Workaround	The physical address pointer is now 64-bit.
Affected Environment/ Platform	32-bit applications in a 64-bit Linux* environment
Driver/Module	Environment Abstraction Layer (EAL)

6.20 Lpm issue when using prefixes >24

Title	**Lpm issue when using prefixes >24**
Reference #	IXA00378395
Description	Extended tbl8's are overwritten by multiple lpm rule entries when the depth is greater than 24.
Implication	LPM tbl8 entries removed by additional rules.
Resolution/ Workaround	Adding tbl8 entries to a valid group to avoid making the entire table invalid and subsequently overwritten.
Affected Environment/ Platform	All
Driver/Module	Sample applications



6.21 IXGBE PMD hangs on port shutdown when not all packets have been sent

Title	**IXGBE PMD hangs on port shutdown when not all packets have been sent**
Reference #	IXA00373492
Description	When the PMD is forwarding packets, and the link goes down, and port shutdown is called, the port cannot shutdown. Instead, it hangs due to the IXGBE driver incorrectly performing the port shutdown procedure.
Implication	The port cannot shutdown and does not come back up until re-initialized.
Resolution / Workaround	The port shutdown procedure has been rewritten.
Affected Environment / Platform	All
Driver / Module	IXGBE Poll Mode Driver (PMD)

6.22 Config file change can cause build to fail

Title	**Config file change can cause build to fail**
Reference #	IXA00369247
Description	If a change in a config file results in some Intel® DPDK files that were needed no longer being needed, the build will fail. This is because the *.o file will still exist, and the linker will try to link it.
Implication	Intel® DPDK compilation failure
Resolution	The Makefile now provides instructions to clean out old kernel module object files.
Affected Environment / Platform	All
Driver / Module	Load balance sample application

6.23 rte_cmdline library should not be used in production code due to limited testing

Title	**rte_cmdline library should not be used in production code due to limited testing**
Reference #	34
Description	The rte_cmdline library provides a command line interface for use in sample applications and test applications distributed as part of Intel® DPDK. However, it is not validated to the same standard as other Intel® DPDK libraries.
Implication	It may contain bugs or errors that could cause issues in production applications.
Resolution	The rte_cmdline library is now tested correctly.
Affected Environment / Platform	All
Driver / Module	rte_cmdline

6.24 Some *_INITIALIZER macros are not compatible with C++

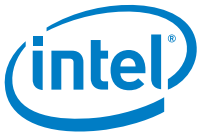
Title	**Some *_INITIALIZER macros are not compatible with C++**
Reference #	IXA00371699
Description	These macros do not work with C++ compilers, since they use the C99 method of named field initialization. The TOKEN_*_INITIALIZER macros in librte_cmdline have this problem.
Implication	C++ application using these macros will fail to compile.
Resolution / Workaround	Macros are now compatible with C++ code.
Affected Environment / Platform	All
Driver / Module	rte_timer, rte_cmdline

6.25 No traffic through bridge when using exception_path sample application

Title	**No traffic through bridge when using exception_path sample application**
Reference #	IXA00168356
Description	On some systems, packets are sent from the exception_path to the tap device, but are not forwarded by the bridge.
Implication	The sample application does not work as described in its sample application quide.
Resolution / Workaround	If you cannot get packets though the bridge, it might be because IP packet filtering rules are up by default on the bridge. In that case you can disable it using the following: # for i in /proc/sys/net/bridge/bridge_nf-*; do echo 0 > $i; done
Affected Environment / Platform	Linux
Driver / Module	Exception path sample application

6.26 Segmentation Fault in testpmd after config fails

Title	**Segmentation Fault in testpmd after config fails**
Reference #	IXA00378638
Description	Starting testpmd with a parameter that causes port queue setup to fail, for example, set TX WTHRESH to non 0 when tx_rs_thresh is greater than 1, then doing “port start all”.
Implication	Seg fault in testpmd
Resolution / Workaround	Testpmd now forces port reconfiguration if the initial configuration failed.
Affected Environment / Platform	All
Driver / Module	testpmd



6.27 Linux kernel pci_cfg_access_lock() API can be prone to deadlock

Title	**Linux kernel pci_cfg_access_lock() API can be prone to deadlock**
Reference #	IXA00373232
Description	The kernel APIs used for locking in the igb_uio driver can cause a deadlock in certain situations.
Implication	Unknown at this time; depends on the application.
Resolution / Workaround	The igb_uio driver now uses the pci_cfg_access_trylock() function instead of pci_cfg_access_lock().
Affected Environment / Platform	All
Driver / Module	IGB UIO Driver

6.28 When running multi-process applications, “rte_malloc” functions cannot be used in secondary processes

Title	**When running multi-process applications, “rte_malloc” functions cannot be used in secondary processes**
Reference #	35
Description	The rte_malloc library provides a set of malloc-type functions that reserve memory from hugepage shared memory. Since secondary processes cannot reserve memory directly from hugepage memory, rte_malloc functions cannot be used reliably.
Implication	The librte_malloc functions, for example, rte_malloc(), rte_zmalloc() and rte_realloc() cannot be used reliably in secondary processes.
Resolution / Workaround	In addition to re-entrancy support, the Intel® DPDK now supports the reservation of a memzone from the primary thread or secondary threads. This is achieved by putting the reservation-related control data structure of the memzone into shared memory. Since rte_malloc functions request memory directly from the memzone, the limitation for secondary threads no longer applies.
Affected Environment / Platform	All
Driver / Module	rte_malloc

6.29 Configuring maximum packet length for IGB with VLAN enabled may not take into account the length of VLAN tag

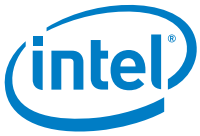
Title	**Configuring maximum packet length for IGB with VLAN enabled may not take into account the length of VLAN tag**
Reference #	IXA00379880
Description	For IGB, the maximum packet length configured may not include the length of the VLAN tag even if VLAN is enabled.
Implication	Packets with a VLAN tag with a size close to the maximum may be dropped.
Resolution / Workaround	NIC registers are now correctly initialized.
Affected Environment / Platform	All with IGB NICs
Driver / Module	IGB Poll Mode Driver (PMD)

6.30 Intel® I210 Ethernet controller always strips CRC of incoming packets

Title	**Intel® I210 Ethernet controller always strips CRC of incoming packets**
Reference #	IXA00380265
Description	The Intel® I210 Ethernet controller (NIC) removes 4 bytes from the end of the packet regardless of whether it was configured to do so or not.
Implication	Packets will be missing 4 bytes if the NIC is not configured to strip CRC.
Resolution / Workaround	NIC registers are now correctly initialized.
Affected Environment / Platform	All
Driver / Module	IGB Poll Mode Driver (PMD)

6.31 EAL can silently reserve less memory than requested

Title	**EAL can silently reserve less memory than requested**
Reference #	IXA00380689
Description	During application initialization, the EAL can silently reserve less memory than requested by the user through the -m application option.
Implication	The application fails to start.
Resolution	EAL will detect if this condition occurs and will give an appropriate error message describing steps to fix the problem.
Affected Environment / Platform	All
Driver / Module	Environmental Abstraction Layer (EAL)



6.32

6.33 Unused hugepage files are not cleared after initialization

Title	**Hugepage files are not cleared after initialization**
Reference #	IXA00383462
Description	EAL leaves hugepages allocated at initialization in the hugetlbfs even if they are not used.
Implication	Reserved hugepages are not freed back to the system, preventing other applications that use hugepages from running.
Resolution / Workaround	Reserved and unused hugepages are now freed back to the system.
Affected Environment / Platform	All
Driver / Module	EAL

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7.0 Frequently Asked Questions (FAQ)

7.1 When running the test application, I get “EAL: map_all_hugepages(): open failed: Permission denied Cannot init memory”?

This is most likely due to the test application not being run with `sudo` to promote the user to a superuser.

7.2 If I want to change the number of TLB Hugepages allocated, how do I remove the original pages allocated?

The number of pages allocated can be seen by executing the `cat /proc/meminfo |grep Huge` command. Once all the pages are `mmap`ped by an application, they stay that way. If you start a test application with less than the maximum, then you have free pages. When you stop and restart the test application, it looks to see if the pages are available in the `/dev/huge` directory and `mmap`s them. If you look in the directory, you will see n number of 2M pages files. If you specified 1024, you will see 1024 files. These are then placed in memory segments to get contiguous memory.

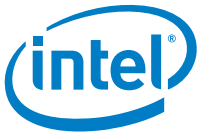
If you need to change the number of pages, it is easier to first remove the pages. The `tools/setup.sh` script provides an option to do this. See the “Quick Start Setup Script” section in the *Intel® DPDK Getting Started Guide* for more information.

7.3 I have set up a total of 1024 Hugepages (that is, allocated 512 2M pages to each NUMA node). However, if I execute “l2fwd -c f -m 64 –n 3 -- -p 3”, I get the following output, indicating that there are no socket 0 hugepages to allocate the mbuf and ring structures to?

The `-m` command line parameter does not guarantee that huge pages will be reserved on specific sockets. Therefore, allocated huge pages may not be on socket 0. To request memory to be reserved on a specific socket, please use the `--socket-mem` command-line parameter instead of `-m`.

7.4 I am running a 32-bit Intel® DPDK application on a NUMA system, and sometimes the application initializes fine but cannot allocate memory. Why is that happening?

32-bit applications have limitations in terms of how much virtual memory is available, hence the number of hugepages they are able to allocate is also limited (1 GB per page size). If your system has a lot (>1 GB per page size) of hugepage memory, not all of it will be allocated. Due to hugepages typically being allocated on a local NUMA node, the hugepages allocation the application gets during the initialization depends on which NUMA node it is running on (the EAL does not affinitize cores until much later in the



initialization process). Sometimes, the Linux OS runs the Intel® DPDK application on a core that is located on a different NUMA node from Intel® DPDK master core and therefore all the hugepages are allocated on the wrong socket.

To avoid this scenario, either lower the amount of hugepage memory available to 1 GB per page size (or less), or run the application with `taskset`, affinitizing the application to a would-be master core. For example, if your EAL coremask is 0xff0, the master core will usually be the first core in the coremask (0x10); this is what you have to supply to taskset, for example, `taskset 0x10 ./l2fwd -c 0xff0 -n 2`. In this way, the hugepages have a greater chance of being allocated to the correct socket. Additionally, a `--socket-mem` option could be used to ensure the availability of memory for each socket, so that if hugepages were allocated on the wrong socket, the application simply will not start.

7.5 On application startup, there is a lot of EAL information printed. Is there any way to reduce this?

Yes, each EAL has a configuration file that is located in the `/config` directory. Within each configuration file, you will find `CONFIG_RTE_LOG_LEVEL=8`. You can change this to a lower value, such as 6 to reduce this printout of debug information. The following is a list of LOG levels that can be found in the `rte_log.h` file. You must remove, then rebuild, the EAL directory for the change to become effective as the configuration file creates the `rte_config.h` file in the EAL directory.

```
#define RTE_LOG_EMERG    1U  /* System is unusable.               */
#define RTE_LOG_ALERT    2U  /* Action must be taken immediately. */
#define RTE_LOG_CRIT     3U  /* Critical conditions.              */
#define RTE_LOG_ERR      4U  /* Error conditions.                 */
#define RTE_LOG_WARNING  5U  /* Warning conditions.               */
#define RTE_LOG_NOTICE   6U  /* Normal but significant condition. */
#define RTE_LOG_INFO     7U  /* Informational.                    */
#define RTE_LOG_DEBUG    8U  /* Debug-level messages.             */
```

7.6 How can I tune my network application to achieve lower latency?

Traditionally, there is a trade-off between throughput and latency. An application can be tuned to achieve a high throughput, but the end-to-end latency of an average packet typically increases as a result. Similarly, the application can be tuned to have, on average, a low end-to-end latency at the cost of lower throughput.

To achieve higher throughput, the Intel® DPDK attempts to aggregate the cost of processing each packet individually by processing packets in bursts. Using the `testpmd` application as an example, the “burst” size can be set on the command line to a value of 16 (also the default value). This allows the application to request 16 packets at a time from the PMD. The `testpmd` application then immediately attempts to transmit all the packets that were received, in this case, all 16 packets. The packets are not transmitted until the tail pointer is updated on the corresponding TX queue of the network port. This behavior is desirable when tuning for high throughput because the cost of tail pointer updates to both the RX and TX queues can be spread across 16 packets, effectively hiding the relatively slow MMIO cost of writing to the PCIe* device.

However, this is not very desirable when tuning for low latency, because the first packet that was received must also wait for the other 15 packets to be received. It cannot be transmitted until the other 15 packets have also been processed because the NIC will not know to transmit the packets until the TX tail pointer has been updated, which is not done until all 16 packets have been processed for transmission.

To consistently achieve low latency even under heavy system load, the application developer should avoid processing packets in bunches. The testpmd application can be configured from the command line to use a burst value of 1. This allows a single packet to be processed at a time, providing lower latency, but with the added cost of lower throughput.

7.7 Without NUMA enabled, my network throughput is low, why? I have a dual Intel® Xeon® E5645 processors @ 2.40 GHz with four Intel® 82599 10 Gigabit Ethernet NICs. Using eight logical cores on each processor with RSS set to distribute network load from two 10 GbE interfaces to the cores on each processor.

Without NUMA enabled, memory is allocated from both sockets, since memory is interleaved. Therefore, each 64B chunk is interleaved across both memory domains.

The first 64B chunk is mapped to node 0, the second 64B chunk is mapped to node 1, the third to node 0, the fourth to node 1. If you allocated 256B, you would get memory that looks like this:

```
256B buffer

Offset 0x00 - Node 0
Offset 0x40 - Node 1
Offset 0x80 - Node 0
Offset 0xc0 - Node 1
```

Therefore, packet buffers and descriptor rings are allocated from both memory domains, thus incurring QPI bandwidth accessing the other memory and much higher latency. For best performance with NUMA disabled, only one socket should be populated.

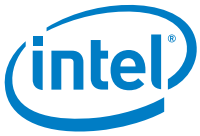
7.8 I am getting errors about not being able to open files. Why?

As the Intel® DPDK operates, it opens a lot of files, which can result in reaching the open files limits, which is set using the ulimit command or in the limits.conf file. This is especially true when using a large number (>512) of 2 MB huge pages. Please increase the open file limit if your application is not able to open files. This can be done either by issuing a ulimit command or editing the limits.conf file. Please consult Linux* manpages for usage information.

7.9 Does my kernel require patching to run the Intel® DPDK?

Any kernel greater than version 2.6.33 can be used without any patches applied. The following kernels may require patches to provide hugepage support:

- kernel version 2.6.32 requires the following patches applied:
  - add hugepage support to pagemap
  - fix hugepage memory leak
  - add nodemask arg to huge page alloc
    (not mandatory, but recommended on a NUMA system to support per-NUMA node hugepages allocation)



- kernel version 2.6.3, requires the following patches applied:
  - fix hugepage memory leak
  - add hugepage support to pagemap
  - add uio name attributes and port regions
  - add nodemask arg to huge page alloc
    (not mandatory, but recommended on a NUMA system to support per-NUMA node hugepages allocation)

Note: Blue text in the lists above are direct links to the patch downloads.

7.10 VF driver for IXGBE devices cannot be initialized.

Some versions of Linux* IXGBE driver do not assign a random MAC address to VF devices at initialization. In this case, this has to be done manually on the VM host, using the following command:

```
ip link set <interface> vf <VF function> mac <MAC address>
```

where `<interface>` being the interface providing the virtual functions e.g. `eth0`, `<VF function>` being the virtual function number e.g. `0`, and `<MAC address>` being the desired MAC address.

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Appendix A Intel® DPDK License Overview

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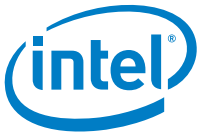
kni_dev.h kni_ethtool.c kni_misc.c kni_net.c	**1st Released:** 1.3 **Location:** DPDK/lib/librte_eal/linuxapp/kni/ **Description:** The KNI kernel loadable module is a standard net driver which allows Intel DPDK Linux userspace applications to exchange packets/data with the Linux kernel.	GPLv2 License Information
rte_kni_common.h	**1st Released:** 1.3 **Location:** DPDK/lib/librte_eal/linuxapp/eal/include/exec-env/ **Description:** The KNI header files is utilized by both the Intel DPDK userspace application and the KNI kernel loadable module	Dual BSD/LGPLv2 License Information
All files under this directory are for the ethtool functionality.	**1st Released:** 1.3 **Location:** DPDK/lib/librte_eal/linuxapp/kni/ethtool **Description:** The igb and ixgbe drivers for the Ethtool function available with the KNI kernel loadable.	GPLv2 License Information
rte_pci_dev_ids.h	**1st Released:** 1.3 **Location:** DPDK/lib/librte_eal/common/include **Description:** Contains the PCI device ids for all devices.	Dual BSD/GPL License Information



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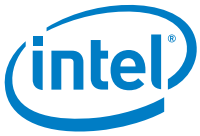

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