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High Performance I/O Acronym Cheat Sheet

Hewlett Packard Enterprise

As the trusted advisors to your HPE clients, you don't always have the time to soak in all the terms we use. Nor do you have time to dig into the benefits these capabilities provide. Sure, you can search for acronyms on the Web and will most likely find sterile definitions of each term without understanding the benefit your customer can see by leveraging the technology.

To help you understand how these technologies can benefit your customers, I recommend that you familiarize yourself with the following list of key acronyms for both Ethernet and Fibre Channel I/O.

General Terms (Apply to both Ethernet and Fibre Channel Transports)

Terminology	What is it?	Customer Benefits	Implementation Notes
IOPS (I/O Operations per Second)	The number of I/O transactions that occur per second	IOPS benefit applications like OLT databases, data warehousing or decision support systems that require many transactions	
Latency	The time it takes for a requestor to send a request and receive notification command was completed	Lower latency helps transaction performance sensitive applications like HPC, HFT and VDI	
RDMA	Remote Direct Memory Access – the ability to access memory directly from the I/O patch, bypassing the processor.	Reduces I/O transaction latency, which can improve application performance	Three different versions (RoCE v1, RoCE v2, iWARP) exist, each with different implementation requirements
Non-Volatile Memory Express (NVMe)	Streamlined set of optimized for SSD and storage-class memory storage devices	Provides increase storage performance and lower latency than SAS, SATA or SCSI protocols	Requires NVMe-enabled drivers, I/O, Networking and Memory/Storage devices
Storage Performance Developer Kit (SPDK)	Set of tools and libraries for writing high performance, scalable, user-mode storage applications by using a polled mode, which avoids kernel context switches and eliminates interrupt handling overhead.	Application response times should improve given SPDK based Polled Mode Drivers (PMDs) eliminate costly interrupt handling and kernel context switching	
Forward Error Correction (FEC)	Enhanced error correction encoding now part of 25GbE and 32Gb FC Standards	Improves transmission reliability Reduces potential data transmission errors	RS-FEC = Reed Solomon FC-FEC = Firecode (also called BASE-R)

High Performance Ethernet Terminology

Terminology	What is it?	Customer Benefits	Implementation Notes
Storage Offloads (iSCSI, FCoE)	Ability to converge NIC and storage traffic on single wire	Reduces I/O complexity Lowers Total Cost of Ownership (TCO) Provides storage Quality of Service (QoS)	This can be implemented with software initiators when using L2 NIC or fully offloaded in the adapter hardware when using a Converged Network Adapter (CNA).
Internet Small Computer System Interface (iSCSI)	Protocol for transporting SCSI storage commands across Ethernet transport	Allows customers to use standard Ethernet network equipment for shared storage connectivity in a Storage Area Network (SAN)	Best practice requires a dedicated network infrastructure for iSCSI SAN, instead of simply adding storage traffic to existing LAN.
Fibre Channel over Ethernet (FCoE)	Protocol for transporting Fibre Channel storage commands across Ethernet transport	Allows customers to use Enhanced Ethernet network equipment for shared storage connectivity in a Storage Area Network (SAN).	Best practice uses a single-hop only. FCoE connectivity is best suited to go from Host to Top-of-rack Converged switch. This requires a minimum of 10GbE bandwidth and lossless Ethernet infrastructure.
Converged Network Adapter (CNA)	An Ethernet adapter that has hardware offload for storage protocols (FCoE and iSCSI)	Increases I/O flexibility and functionality offering LAN and SAN connectivity in a single connection	Some vendors call their adapters CNAs even when using software initiators.
FlexFabric Adapter (FFA)	HPE-specific Marketing term for a Converged Network Adapter	Increases I/O flexibility and functionality offering LAN and SAN connectivity in a single connection	All HPE FlexFabric adapters have the storage offload capability within the adapter. FFA does not require software initiators.
Stateless Offloads – TCP/UDP Checksum, LSO, RSC	Ability to offload and optimize TCP/IP processing in the adapter instead of doing the processing in the OS	Improves Ethernet networking performance to and from the server connection	Adapters can be designed to provide all offloads in hardware. Some use both hardware and software.

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10GBASE-T	Ability to run 10Gb I/O over RJ45 connection, CAT6 copper cable	Reduces CAPEX associated with deploying 10GbE	10GBASE-T lowers cost per port but has distance limitation of 100 meters and latency is an order of magnitude higher than SFP+ connections.
Network or NIC Partitioning (NPAR)	Virtually divide the adapter's physical port into multiple PCIe physical functions presented to the host OS as individual adapters	Provides Virtual Machine (VM) QoS Reduces CPU utilization	The number of physical functions can vary between adapters. There are typically either 4 or 8 physical functions per port.
Single-Root I/O Virtualization (SR-IOV)	Provide v-switch capability without utilizing hypervisor	Increases performance Reduces VM-to-VM latency Improves VM scalability Reduces CPU utilization	In some adapters, when SR-IOV is enabled, other capabilities (like NPAR) are disabled. Marvell FastLinQ Ethernet E3 adapters can run NPAR and SR-IOV concurrently.
Overlay Networks - Tunneling (NVGRE, VXLAN, GRE, GENEVE)	Encapsulation to bypass vLAN boundaries and allow for connecting to 16 million source/destination network nodes together via an isolated connection	Reduces network complexity and costs Overcomes vLAN limitations	Used primarily in Cloud and hyper-scale data center environments.
Universal RDMA	Ability to support RoCE and iWARP concurrently on a single adapter	Provides more flexibility for customers needing low latency connectivity	Supported on Marvell FastLinQ Ethernet E4 adapters.
RDMA over Converged Ethernet (RoCE)	Allow for direct processing of I/O commands by bypassing TCP/IP stack over converged Ethernet connections	Produces faster transactions by reducing latency Reduces CPU utilization	RoCE requires implementing Data Center Bridging (DCB) in the network to provide lossless Ethernet connectivity.

Terminology	What is it?	Customer Benefits	Implementation Notes
iWARP	Allow for direct processing of I/O commands by bypassing TCP/IP stack over standard L2/L3 Ethernet connections	Produces faster transactions by reducing latency Reduces CPU Utilization	iWARP can run over existing 10GbE or higher L2/L3 networks.
iSCSI Extensions for RDMA (iSER)	Protocol that extends iSCSI for use with RDMA	Enables higher bandwidth performance, lower latency and lower CPU utilization for iSCSI storage connectivity	RDMA-enabled Marvell FastLinQ Ethernet adapter technology will support iSER with RoCE or iWARP RDMA
Data Plane Developer Kit (DPDK)	Moves I/O processing from Kernel space to User space	Speeds packet processing to service more I/O requests	DPDK is supported only in Linux today.
Smart Auto-negotiation (SmartAN)	Firmware feature that automatically sets BW and FEC settings based on connection type for 10/25GbE connections	No manual intervention with adapters when connecting to 10/25GbE switches	If no link is established with SmartAN enabled, check optics, cables and switch port settings
Precision Time Protocol (PTP) – IEEE 1588	Synchronization of system clocks throughout a network.	Allows time-stamping of Ethernet packets	Used in financial trading environments
NVMe over Ethernet Fabric (NVMe-oF)	Ability to transmit NVMe commands (instead of SCSI) in Ethernet packets and RDMA across lossless Ethernet network	Higher performance server to storage networking connectivity compared to iSCSI	Requires, lossless Ethernet network, RDMA and NVMe-enabled O/S, Ethernet Adapters, drivers, I/O, Networking and Memory/Storage devices
NVMe over TCP/IP	Ability to transmit NVMe commands over standard TCP/IP Ethernet without RDMA or DCB.	Improves server to storage networking performance Runs on standard TCP/IP network.	Standard to be finalized by end of 2018.

High Performance Fibre Channel Terminology

Terminology	What is it?	Customer Benefits	Implementation Notes
16GFC Fibre Channel	Fifth generation of FC protocol with specific enhancements and supporting effective bandwidth of 13.6Gbps	Improved performance, reliability and management of Fibre Channel fabric and network	Backward compatible to 4Gb and 8Gb Fibre Channel. HPE SN1000Q, QMH2672 and 3830C are examples of standard 16GFC HBAs.
Enhanced 16GFC Fibre Channel	Enhanced version of 16GFC that improves performance, reduces power and adds new features like BB-CR	Improved performance, reliability and management of Fibre Channel fabric and network	Backward compatible to 4Gb and 8Gb Fibre Channel. HPE SN1100Q are examples of Enhanced 16GFC HBAs.
32GFC Fibre Channel	Sixth generation of FC protocol with specific enhancements over prior generations and supporting effective bandwidth of 27.2Gbps	Improved performance, reliability and management of Fibre Channel fabric and network	Backward Compatible to 8Gb and 16GFC Fibre Channel. HPE SN1600Q and 5830C are examples of 32GFC HBAs.
N-port ID Virtualization (NPIV)	Allows a single HBA port to register multiple World-Wide Port Names on a single physical port	Simplifies FC connectivity to virtual server or blade environments	Requires the NPIV port to connect to a FC switch and not directly to storage.
StorFusion™	A collection of enhanced features and capabilities associated with Marvell QLogic 16GFC and 32GFC Fibre Channel adapters	Improve FC SAN orchestration, manageability and reliability when using QLogic HBAs with supported FC switches	Requires Marvell QLogic 16GFC or 32FC HBAs connected to 16GFC or later Brocade or Cisco FC SAN fabrics.
Forward Error Correction (FEC)	Enhanced error correction encoding now part of 32GFC Standard	Improves transmission reliability Reduces potential data errors in FC SAN	FEC is implemented in Enhanced 16GFC adapters and required 32GFC adapters.

Terminology	What is it?	Customer Benefits	Implementation Notes
T10 Protection Information (T10-PI, T10-DIF)	Update to SCSI Standard to increase data integrity	Improves data fault tolerance and resiliency	Both the host initiator and storage target must support T10-PI to make it useful.
Fabric Assigned WWN, (FA-WWN)	Pre-configure adapter WWN at the switch port, replacing factory assigned settings	Eliminates need to have servers available and powered up to zone the fabric Reduces SAN deployment time by as much as 30%	FA-WWN is only supported by Marvell QLogic adapters and Brocade today.
Fabric-based Boot LUN (F-BLD)	Pre-configure boot LUN setting at the switch port	Eliminates the need to configure boot LUN setting at the server	F-BLD is only supported by Marvell QLogic adapters and Brocade today.
Link Cable Beaconing (LCB)	Enables LEDs to be activated at both ends of the cable from either HBA or switch commands	Simplifies identification of cabling connections	
Diagnostic Port (D-Port)	Ability to put both adapter and switch port in diagnostic mode to streamline cabling and optics diagnostics	Simplifies troubleshooting SAN connectivity issues	
FC Ping, FC Trace Route	SAN diagnostic features enabled with QLogic QConvergeConsole	Simplifies troubleshooting SAN connectivity issues	Requires Marvell QLogic QCC Management Software
Fibre Channel Device Management Interface (FDMI), Read Diagnostic Parameter (RDP)	Enhanced diagnostic and parameter information that can be transmitted in a Gen 5 or Gen 6 FC SAN	Reduces troubleshooting effort by as much as 50%	

Terminology	What is it?	Customer Benefits	Implementation Notes
Class Specific Control/Priority (CS_CTL)	Data field within FC frame that specifies the priority of a frame relative to other frames.	Allows for defining Quality of Service for specific workloads in a SAN	Common names for this capability are QoS, CS_CTL or ExpressLane
Fibre Channel Device Management Interface (FDMI), Read Diagnostic Parameter (RDP)	Enhanced diagnostic and parameter information that can be transmitted in a Gen 5 or Gen 6 FC SAN	Reduces troubleshooting effort by as much as 50%	
Buffer to Buffer Credit Recovery (BB-CR)	Enhances performance and resiliency by automatically recovering buffer credits, which can be lost on long distance and lossy connections with the potential to stall I/O or degrade performance.	Enhances data integrity to allow customers to deploy higher data rates	Only supported on select 16Gb Gen 5 and 32Gb Gen 6 Fibre Channel adapters
Virtual Machine ID (VM-ID)	Ability to tag Fibre Channel frames with Virtual Machine information for use in monitoring and diagnostics	Enables System/SAN administrator to monitor FC traffic from VM to LUN	Requires VM-ID enabled Adapters, Switches and Storage
Dual-port Isolation Design	ASIC design utilizing dedicated processor, memory and firmware for each adapter port	Ensures predictable per-port performance Increases overall SAN reliability	All Marvell QLogic Fibre Channel adapters, including 16GFC or 32GFC adapters, implement this design.
NVMe over Fibre Channel Fabric (FC-NVMe)	Ability to transmit NVMe commands (instead of SCSI) in Fibre Channel frames across a Fibre Channel network	Higher performance server to storage networking connectivity compared to standard FC or iSCSI	Requires NVMe-enabled Operating System, FC drivers, I/O, Networking and Memory/Storage devices

Today's I/O is much more capable than it was just a few years ago. We hope the tables above provide you some insight into what these new capabilities are and how they might benefit your customers. If you need help, just let us know. The HPE Team at Marvell can be your I/O subject matter experts in the background. Contact any of our Business Development Managers listed on our Marvell HPE team contact page.

We are here to help you make more informed choices for your customers regarding I/O technology and to make sure you are taking advantage of the I/O capabilities available to differentiate the HPE Server and Storage solutions you configure. We look forward to hearing from you and helping you make intelligent I/O matter for your customers.

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