T7 DPU Products

High Performance Programmable DPU 1/10/25/40/50/100/200/400GbE Controller

Enables several offloads, programmable compute, encryption, FPGA integration, virtualization over a single wire.

Highlights

- Full suite of Storage features
- Full suite of Cloud features
- Full suite of data center networking features
- Full suite of data streaming features
- Full suite of encryption functions
- Embedded programmable DPU
- Embedded Arm A72 cores, accessible by user
- Adapter or micro-server functionality
- Ability to integrate with an external FPGA
- Integrated Ethernet and PCIe switch
- Software Compatible with T4, T5, and T6

Applications

Datacenter Networking

- Scale out servers and NAS systems
- Consolidate LAN, SAN, and cluster networks (run InfiniBand and Fibre Channel applications on Ethernet)
- Enhanced network and server security

Cloud Computing

- Virtualization features to maximize cloud scaling and utilization
- Cloud-ready functional and management features
- Secure Sockets offload
- Full support for overlay products
- Seamless integration with external FPGA

Networked Storage

- Develop high-performance shared-storage systems providing both file and block level services
- Computational Storage
- Ethernet to the Drive
- Integrated encryption support
- NVMe Fabrics (iWARP & RoCEv2)
- NVMe/TCP (including NVMe offload)
- Very high data-integrity
- Dedupe, Compression support
- RAID, Erasure Coding support

High Performance Computing

- Very low latency Ethernet
- High performance RDMA support
- Increase cluster fabric bandwidth

Streaming Applications

- Internet attack protection
- QoS and Traffic Management
- Video streaming

Edge Products

- Micro Servers
- Gateways
- 5G Appliances
- Firewalls

Overview

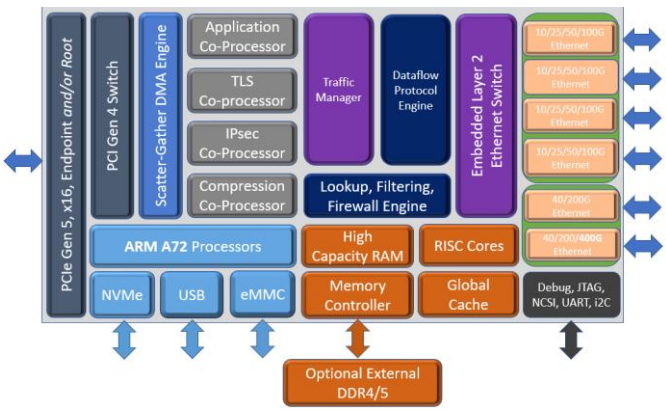
Chelsio's T7 is a quad port 1/10/25/50/100Gb, dual port 40/100/200Gb, or single port 400Gb Ethernet Unified Wire DPU ASIC with a PCI Express 5.0 host bus interface, optimized for storage, cloud computing, HPC, embedded, virtualization, security, AI, and other datacenter networking applications.

The seventh generation T7 ASIC technology from Chelsio provides the highest performance and efficiency, with dramatically lower host system CPU communications overhead. Thanks to on-board hardware, that offloads TCP/IP, UDP/IP, Unified RDMA (RoCEv2 & iWARP), iSCSI, NVMe-oF, NVMe/TCP, NVGRE, VXLAN, and TLS/IPsec processing from its host system and frees up host CPU cycles for user applications. As a result, the system benefits from higher bandwidth, lower latency, and reduced power consumption.

T7 runs the predecessor T4, T5, & T6 silicon software without modification to enable leveraging of the user's existing software investment. T7's architecture is Chelsio's 7th generation DPU technology road-tested across several tier-1 OEMs over the years and has evolved to support all offloads using either card memory or host memory. As a result, T7 technology can now enable a full featured DPU technology in a small memory-free package to address server and cloud applications at an aggressive price point.

The Smart NIC Programmable DPU Solution

In addition to the above offloads, versions of T7 integrate 8 A72 Arm cores that are exposed to the user. These Arm cores offload the traffic to the integrated 400Gb DPU on the chip and as a result the Arm cores are available to support the user's specific application. The T7 transport engine is a programmable DPU that can offload protocol processing per connection, per-server, per-interface, while simultaneously providing complete stateless offload to traffic for non-offloaded connections (processed by operating systems stack running on host CPU). The T7 also provides a flexible direct data placement capability for regular TCP sockets, with all the benefits of zero-copy and kernel bypass without rewriting the applications. To support the Arm Cores, Chelsio provides a full development and debug software package to allow development of application specific firmware.



T7 Block Diagram

Features

	T7	N7
Host Interface		
PCI Express Gen5 x16	✔	✔
End Point (EP) operation	✔	✔
Root Complex (RC) operation	✔	
Concurrent RC+EP (NVMe-NVMe Bridge)	✔	
Integrated PCIe Gen4 Switch	✔	
MSI-X, MSI, legacy pin interrupts	✔	✔
Wire Interface		
NRZ or PAM4	✔	✔
4x1/10/25/50/100G or 2x40/100/200G or 1x400G	✔	✔
IEEE 802.3cd (50/100/200GbE)	✔	✔
IEEE 802.3bs 200GbE	✔	✔
IEEE 802.3by 25GbE	✔	✔
IEEE 802.3bm 40GbE/100GbE	✔	✔
IEEE 802.3ba (40/100GbE)	✔	✔
IEEE 802.3bj (100 GbE over copper/backplane)	✔	✔
IEEE 802.3az Energy Efficient Ethernet	✔	✔
IEEE 802.3ap Backplane Ethernet	✔	✔
IEEE 802.3ae (10 GbE)	✔	✔
IEEE 802.3z (1GbE)	✔	✔
IEEE 802.1p Priority	✔	✔
IEEE 802.1Q VLAN Tagging	✔	✔
IEEE 802.1Qbg EVB/VEPA	✔	✔
IEEE 802.1BR Bridge Port Extension	✔	✔
IEEE 802.1Qau Congestion Notification	✔	✔
IEEE 802.1Qbb PFC	✔	✔
IEEE 802.1Qaz (ETS)	✔	✔
IEEE 802.3x Flow Control	✔	✔
IEEE 802.3ad Load-balancing and Failover	✔	✔
Ethernet II and 802.3 encapsulated frames	✔	✔
Multiple MAC addresses per interface	✔	✔
Jumbo Frames up to 9.6 Kbytes	✔	✔
ITU-T G.8262, Sync-E	✔	✔
IEEE 802.1AS Timing and Synchronization	✔	✔
IEEE 1588 PTP	✔	✔
Stateless Offloads		
TCP/UDP checksum offload for IPv4 & IPv6	✔	✔
TSO, LSO, and GSO for IPv4 & IPv6	✔	✔
VLAN filtering, insertion & extraction	✔	✔
Packet filtering and attack protection	✔	✔
Nanosecond granularity 64b timestamping	✔	✔
Ethernet Routing (packet header rewrite)	✔	✔
Packet Tracing and Packet Sniffing	✔	✔
Adaptive interrupt coalescing	✔	✔
Receive side scaling (RSS)	✔	✔

	T7	N7
Storage		
iSCSI initiator and target mode stack	✔	✔
T10 DIF/DIX support for iSCSI	✔	✔
NVMe-oF Offload (iWARP)	✔	✔
NVMe-oF Offload (RoCEv2)	✔	✔
NVMe/TCP Offload	✔	✔
QUIC Offload	✔	✔
Dedupe offload	✔	
Erasure Code offload	✔	
RAID 5/6 offload	✔	
Compression (LZ77+Huffman, Gzip, XP10, zlib)	✔	
Decompression (LZ77+Huffman, Gzip, XP10, zlib)	✔	
PMoF	✔	
iSER	✔	✔
Data-at-rest encryption	✔	✔
Security		
AES 128/256 and SHA1/SHA2 offload	✔	✔
TLS and IPsec co-processor mode	✔	✔
TLS and IPsec inline mode	✔	✔
QUIC co-processor mode	✔	✔
QUIC inline mode	✔	✔
SM2, RSA, ECC, ECDH, ECDSA, DSA, DH	✔	
Inline IPsec & TLS for all Offload Traffic	✔	✔
True Random Number Generator	✔	
Secure firmware update	✔	✔
Hardware Root of Trust support	✔	✔
Cloud & Virtualization		
NVMe Virtualization/Emulation	✔	
Virt-IO	✔	
OVS Offload	✔	
Seamless integration with external FPGA	✔	
Inband Telemetry	✔	✔
NVGRE, VXLAN and GENEVE support	✔	✔
PCI-SIG SR-IOV, 256 VF, 8 PF	✔	✔
264 port virtual switch	✔	✔
EVB, VEPA, Flex10, VNTag	✔	✔
512 MAC addresses	✔	✔
NAT Offload	✔	✔
Streaming		
Integrated Traffic Management	✔	✔
Advanced QoS support	✔	✔
Hierarchical QoS	✔	✔
High Performance RDMA		
Native RoCEv2 support	✔	✔
Native iWARP support	✔	✔
All to All support	✔	✔

	T7	N7
TCP & UDP Offload		
Full TCP stack including IPv4 & IPv6	✔	✔
Extensive RFC compliance, fully featured	✔	✔
VLAN support up to 4096 VLAN IDs	✔	✔
Load balancing and failover capabilities	✔	✔
UDP Sockets API	✔	✔
Low user-to-user latency	✔	✔
Multicast replication on ingress or egress	✔	✔
Patented Seamless Failover	✔	✔
Proxy Switching	✔	✔
High capacity offload without card memory	✔	✔
Data Center Features		
Internet Attack Protection	✔	✔
PFC, DCB, CEE	✔	✔
Time stamping support	✔	✔
Flow mirroring, sampling and statistics	✔	✔
GPUDirect	✔	✔
GPUDirect Storage (GDS)	✔	✔
Embedded Processors		
ARM A72 Cores (1.5 GHz), 2MB L2 Cache	✔	
ARM API (IPDK)	✔	
400Gb DPU Core	✔	✔
Dual-Channel 4800MT/s DDR5	✔	✔
Management and Other Interfaces		
USB 2.0 Host Mode	✔	
USB 2.0 Target Mode	✔	
UART	✔	✔
eMMC 4.51	✔	
NVMe Gen 4, x2	✔	
NC-SI	✔	✔
SPI Flash	✔	✔
I2C, MDIO, GPIO, JTAG	✔	✔
PLDM, MCTP (SMBus or PCIe), RBT	✔	✔
M.2 / U.2 connectors for DAS	✔	
SGMII for 1Gb BMC interconnect	✔	✔
MCTP over PCIe VDM	✔	
JTAG IEEE 1149.1 and IEEE 1149.6	✔	✔
G.8273.2 Class C high-accuracy boundary clock	✔	
SyncE	✔	✔
Boot Facilities		
iSCSI, PXE, UEFI	✔	✔
Secure Boot	✔	✔

Ordering Information

	T7ASIC	N7ASIC
Memory	Optional	Optional
Package Size (0.8mm pitch)	31mm	31mm
400Gb Typ Power*	19-33W	21-29W
400Gb WC Power*	22-37W	24-31W
200Gb Typ Power*	11-22W	11-17W
200Gb WC Power*	14-26W	17-23W

* Configuration dependent

Physical & Environmental

- Fully RoHS Compliant
- Operating Temp: -40° to 55° C or -40° to 131° F
- Operating Humidity: 5 to 95%

Applications

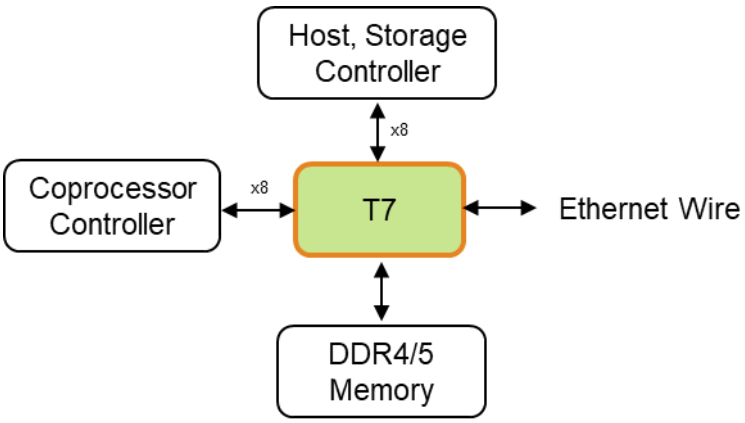


Figure 1 – Generalized Bridge

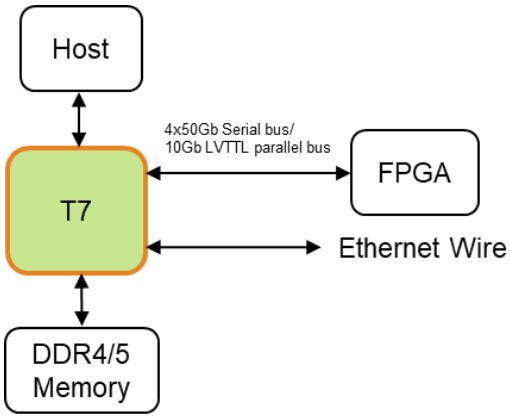


Figure 2 – iNIC Application

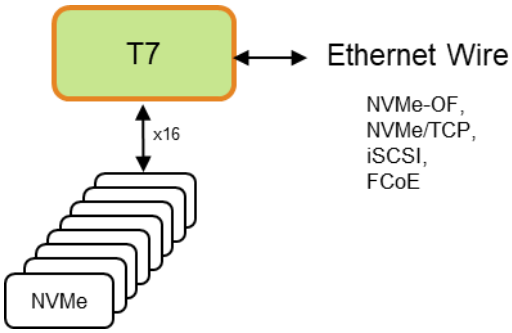


Figure 3 – NVMe-Ethernet Bridge

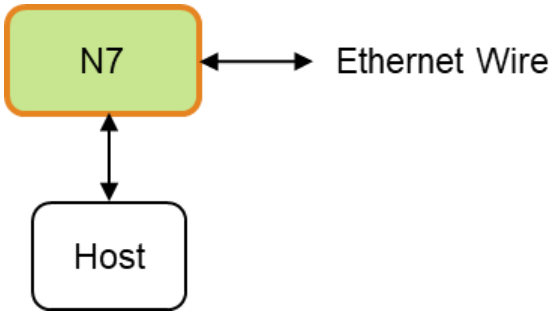


Figure 4 – Legacy Application

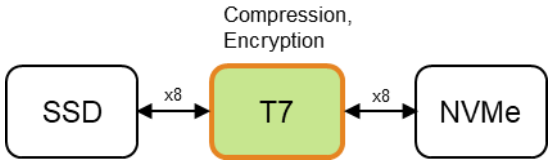


Figure 5 – NVMe-NVMe Bridge