T7 DPU Products

High Performance Programmable DPU 1/2.5/10/25/40/50/100/200/400GbE Controller

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

Highlights

- Full suite of Storge 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 1/2.5/10/25/50/100Gb, 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, virtualization and other datacenter networking applications.

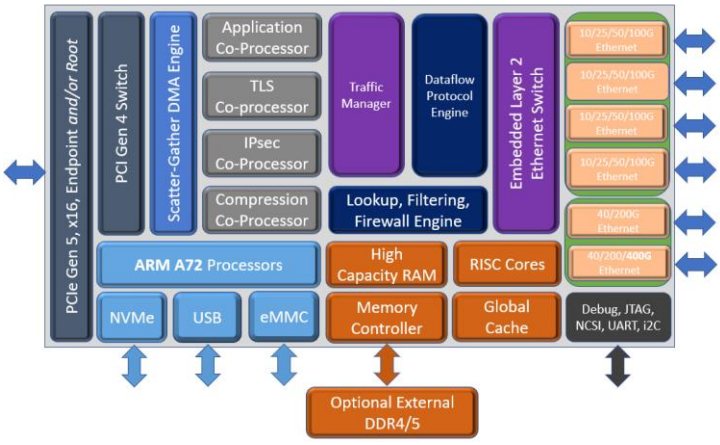
The seventh generation T7 ASIC technology from Chelsio provides the highest performance and efficiency, with dramatically lower host-system CPU communications overhead thanks to on-board hardware that offloads TCP/IP, UDP/IP, iSCSI, FCoE, Unified RDMA (RoCEv2 & iWARP), TLS/IPsec, NVMe-oF, and NVMe/TCP 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 so as 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.



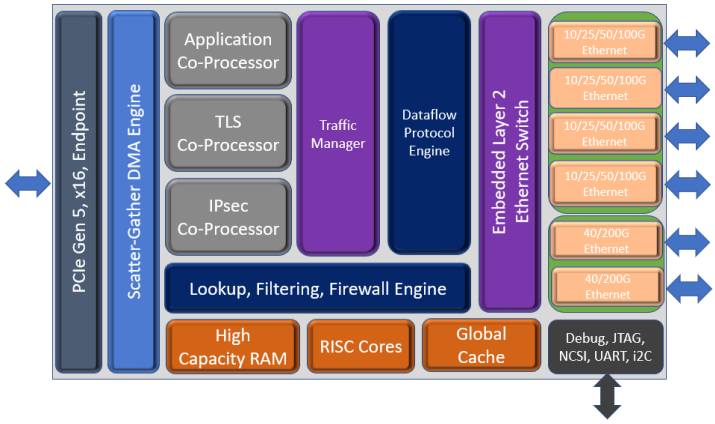
T7 Block Diagram

Features

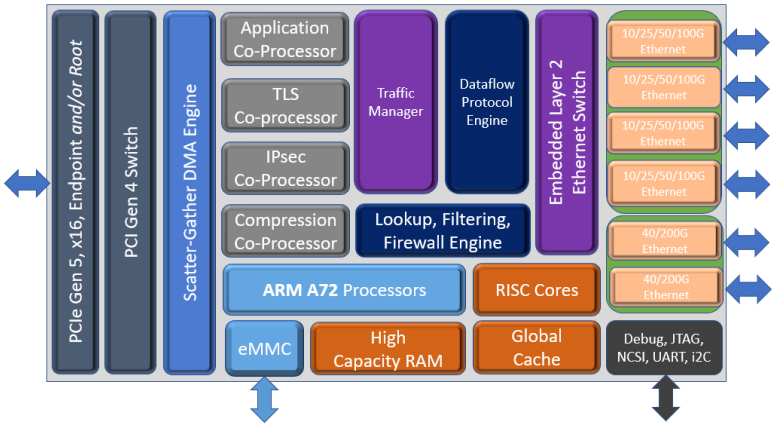
	T7	N7	D7	S74	S72
Host Interface					
PCI Express Gen5 x16	✓	✓	✓	✓	✓
Integrated PCIe switch	✓		✓		
Integrated PCIe bridge	✓		✓		
End Point or Root Complex operation	✓		✓		
MSI-X, MSI, legacy pin interrupts	✓	✓	✓	✓	✓
Wire Interface					
2x1/2.5/10/25/40/50/100	✓	✓	✓	✓	✓
4x1/2.5/10/25/50/100	✓	✓	✓	✓	
2x40/100/200	✓	✓	✓	✓	
1x400	✓				
56Gb PAM4, or 25Gb NRZ	✓	✓	✓	✓	✓
IEEE 802.3bj (100 GbE over copper/backplane)	✓	✓	✓	✓	✓
IEEE 802.3cd (50/100/200 GbE)	✓	✓	✓	✓	✓
IEEE 802.3ba (40/100 GbE)	✓	✓	✓	✓	✓
IEEE 802.3ae (10 GbE)	✓	✓	✓	✓	✓
IEEE 802.3az Energy Efficient Ethernet	✓	✓	✓	✓	✓
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 802.3x 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	✓	✓	✓	✓	✓
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	✓	✓	✓	✓	✓
Streaming					
Integrated Traffic Management	✓	✓	✓	✓	✓
Advanced QoS support	✓	✓	✓	✓	✓

	T7	N7	D7	S74	S72
Storage					
iSCSI initiator and target mode stack	✓	✓	✓	✓	✓
Full FCoE offload (Initiator or Target)	✓	✓	✓	✓	✓
Open FCoE offload (Initiator)	✓	✓	✓	✓	✓
T10 DIF/DIX support for iSCSI	✓	✓	✓	✓	✓
NVMe-oF Offload (iWARP or RoCEv2)	✓	✓	✓	✓	✓
NVMe/TCP Offload	✓	✓	✓	✓	✓
QUIC Offload	✓	✓	✓		
Dedupe offload	✓		✓		
Erasure Code offload	✓		✓		
RAID 5/6 offload	✓		✓		
Block compression	✓		✓		
PMoF	✓		✓		
iSER	✓	✓	✓	✓	✓
Data-at-rest encryption	✓	✓	✓	✓	✓
Security					
AES 128/256 and SHA1/SHA2 offload	✓	✓	✓	✓	✓
TLS and IPsec support	✓	✓	✓	✓	✓
Inline & co-processor modes	✓	✓	✓	✓	✓
SM2, RSA, ECC, ECDH, ECDSA, DSA, DH	✓	✓	✓		
Inline IPsec & TLS for all Offload Traffic	✓	✓	✓	✓	✓
Integrated Block or inline encryption	✓	✓	✓	✓	✓
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	✓	✓	✓	✓	✓

	T7	N7	D7	S74	S72
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	✓	✓	✓	✓	✓
High Performance RDMA					
Native RoCEv2 support	✓	✓	✓	✓	✓
Native iWARP support	✓	✓	✓	✓	✓
All to All support	✓	✓	✓	✓	✓
Data Center Features					
Internet Attack Protection	✓	✓	✓	✓	✓
PFC, DCB, CEE	✓	✓	✓	✓	✓
Time stamping support	✓	✓	✓	✓	✓
Embedded Processors					
ARM A72 Cores, 2MB L2 Cache	8		4		
RISC Cores	8	8	4	4	1
400Gb DPU Core	1	1	1	1	1
Management and Other Interfaces					
USB 2.0 Host Mode	✓				
UART	✓	✓	✓	✓	✓
eMMC 4.51	✓		✓		
NVMe Gen 4, x2	✓				
NC-SI	✓	✓	✓	✓	✓
SPI Flash	✓	✓	✓	✓	✓
I2C, MDIO, GPIO, JTAG	✓	✓	✓	✓	✓
PLDM, MCTP (SMBus or PCIe), RBT	✓	✓	✓	✓	✓
Boot Facilities					
iSCSI, FCoE, PXE, UEFI	✓	✓	✓	✓	✓
Secure Boot	✓	✓	✓	✓	✓



S7 Block Diagram



D7 Block Diagram

Ordering Information

	T7ASIC	N7ASIC	D7ASIC	S74ASIC	S72ASIC
Card Memory	Optional	Optional	-	-	-
Typical Power	17-22W	17W	10-14W	12W	8W
Package Size (0.8mm pitch)	31mm	31mm	21mm	21mm	21mm

Physical & Environmental

- Fully RoHS Compliant
- Operating Temp: 0° to 55° C or 32° to 131° F
- Operating Humidity: 5 to 95%
- Airflow: 200 LFM

Applications

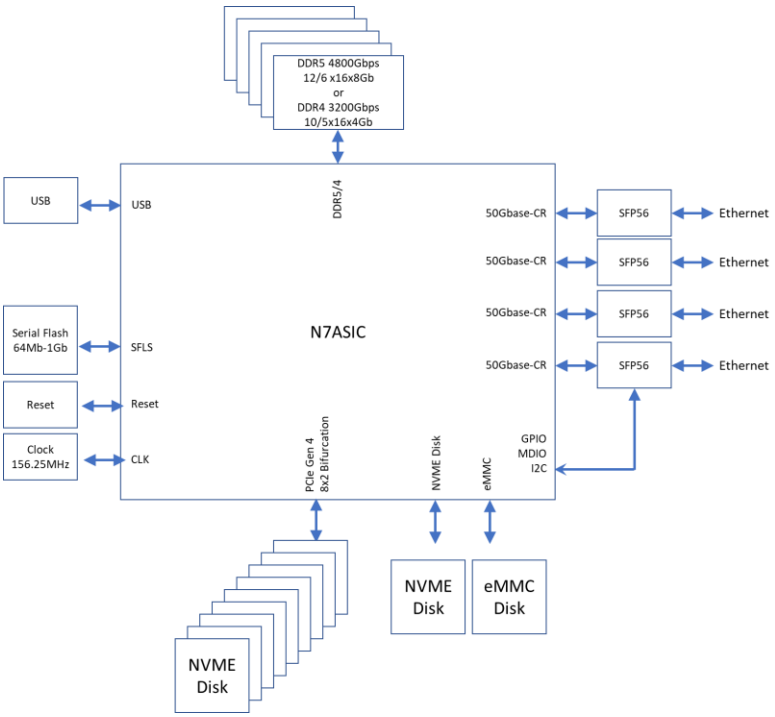


Figure 2 – Single Chip Server Application

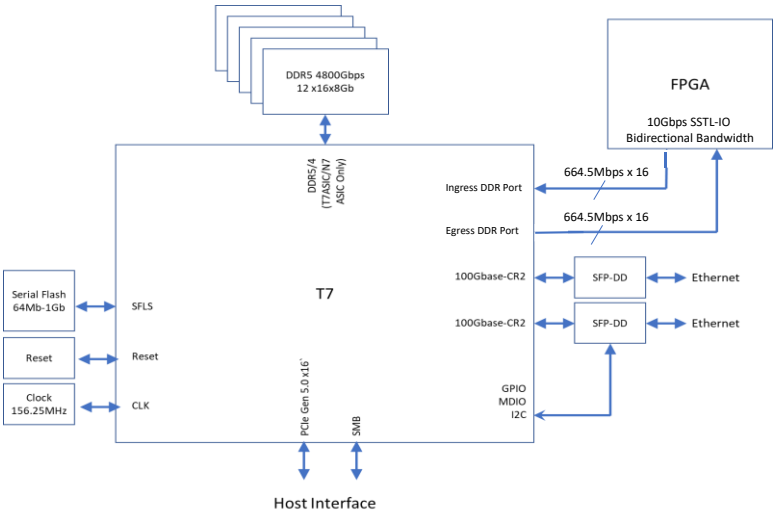


Figure 1 – iNIC Application

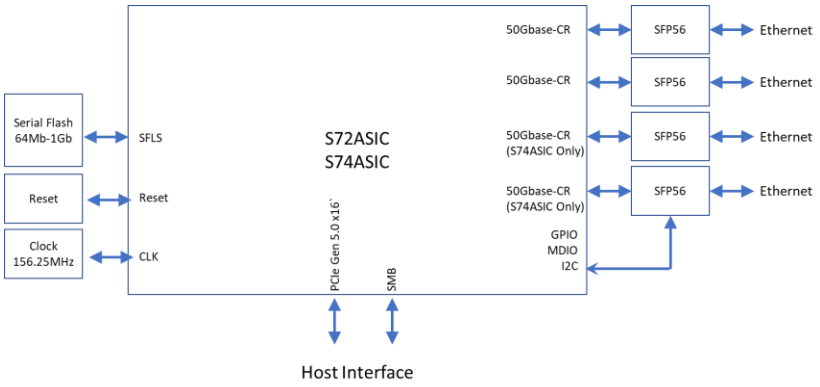


Figure 3 – Standard NIC Application

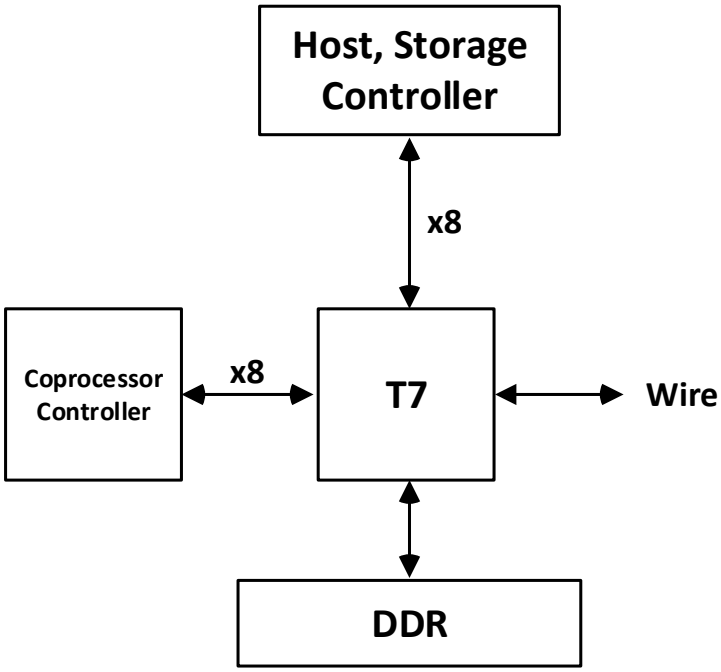


Figure 4 – Generalized Bridge

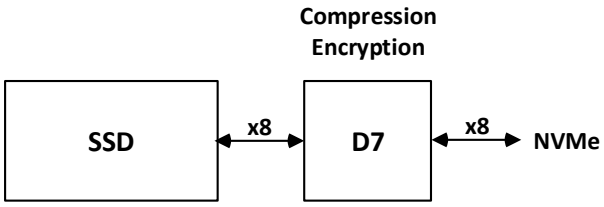


Figure 5 – NVMe-NVMe Bridge

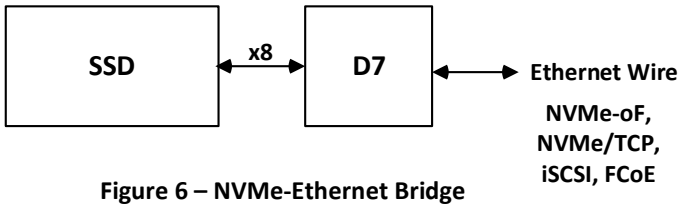


Figure 6 – NVMe-Ethernet Bridge

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