AMD

SmartSSD® Computational Storage Drive

OVERVIEW

The Samsung SmartSSD computational storage drive (CSD) is the industry's first adaptable computational storage platform. It empowers a new breed of software developers to easily build innovative hardware-accelerated solutions in familiar high-level languages. The SmartSSD dramatically accelerates data intensive applications by 10X or more by pushing compute to where the data lives.

At the heart of the SmartSSD is the AMD Adaptive Platform, a powerful toolkit which enables customers to create customized, scalable applications to solve a broad range of data center problems.

CHALLENGE

Turning Big Data Into Fast Data

The global datasphere will grow from 45 zettabytes in 2019 to 175 by 2025, and nearly 30% of the world's data will need real- time processing. This data explosion provides tremendous opportunity for business insights, but the sheer volume creates challenges for secure storage, retrieval, processing and analysis.

Traditional processor-centric architectures rely on the CPU for all data processing, but moving the data between storage and CPU creates performance bottlenecks for data-intensive applications. The results are unacceptable delays in data processing, high costs, and density and scalability issues

SOLUTION

Bring Compute To Where The Data Lives

The SmartSSD CSD performs high speed computations on data where it is stored. Combining a high performance Samsung Enterprise SSD and an acceleration-dedicated AMD Kintex® Ultrascale+ FPGA with a fast private data path between them, the SmartSSD CSD enables efficient parallel computation on data itself. This unlocks massive performance gains and dense, linear scalability, while freeing the CPU to handle other higher-level tasks more efficiently.

TARGET APPLICATIONS

> AI/ML Inference

> Big Data Analytics

> Business Intelligence

> Data Lake/DB Acceleration

> Data Warehousing

> Encryption/Decryption

> Financial Services

> Genomics

> Search Queries

> Storage & Virtualization

> Transparent Compression

> Video Analytics

> Video File Transcoding

AMD ADAPTIVE PLATFORM

At the heart of the SmartSSD CSD is the AMD Adaptive Platform, which harnesses the programmability of AMD FPGAs to create the first fully customizable computational storage device. The SmartSSD CSD combines the uncompromising performance of hardware acceleration with total programmability, using common high level languages like C, C++ and OpenCL.

The SmartSSD CSD supports the Vitis development environment and accelerator framework, plus a library of acceleration kernels that makes creating new accelerators and integrating them into applications easier than ever before.

With AMD Storage Services, the SmartSSD CSD includes powerful offload capability that is integrated with popular storage software such as dm-crypt and Virtual Data Optimizer.

SIMPLIFIED DEVELOPMENT

The AMD Vitis environment is a unified software toolkit that enables a broad new range of developers – including software engineers and AI scientists – to take advantage of the power of hardware adaptability. The Vitis environment allows development in C, C++, or OpenCL, automatically tailoring the AMD hardware architecture to the software or algorithmic code without the need for hardware expertise. Rather than imposing a proprietary development environment, the Vitis platform plugs into common software developer tools and utilizes a rich set of optimized open source libraries, enabling developers to focus on their algorithms

Additionally, the AMD Run Time environment allows access to the full spectrum of hardware description languages (HDLs), including Verilog and VHDL, for maximum design flexibility and optimization. This design flow also simplifies the re-use of existing accelerator IP designed in HDL for ASICs or FPGAs.

INTERNAL DATA PATH

The FPGA provides logic elements and CPU cores for acceleration. The SSD controller provides the NAND media interface and management while a private, high-speed peer-to-peer link connects the SSD controller to the FPGA and transfers data between them.

AMD STORAGE SERVICES

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SCALABLE PERFORMANCE

Accelerator processing power and accelerator-to-data bandwidth scale with the amount of data and the number of SmartSSD CSDs. SmartSSD CSD-based servers remove PCI-Express bottlenecks, producing near-linear performance scaling even on an over-subscribed host CPU.

PARTNER SOLUTIONS

Using the power of the AMD Adaptive Platform, custom accelerators have been developed by AMD partners, including data analytics, search-in-storage, video file transfer, and no-load compression.

PERFORMANCE EXAMPLES

Real-time Analytics Lives

2.8x

faster SQL query execution on Parquet data from 1 SmartSSD CSD, and performance scales with additional drives

Rich Media

87%

reduction in CPU utilization from 3 SmartSSD CSDs, while maintaining the same video transcoding frame rate

Data Services

72GBps

read rate of LZ4 compressed data and line rate decompression from 24 SmartSSD CSDsin a single 2U server

AMD

SPECIFICATIONS

Form Factor	2.5" (U.2)
Storage Capacity	3.84TB
Host Interface	Single Port PCIe Gen3x4
Spec Compliance	NVMe spec rev. 1.3, PCIe based specification rev 3.0, NVMe Management Interface (NVMe MI) 1.0

NAND Flash Memory	Enterprise Class SSD Controller	
	Samsung V-NAND®	
	Write Endurance	1DWPD for 5 Years
	Sequential Read (128KB)	Up to 3,300 MB/sec
	Sequential Write (128KB)	Up to 2,000 MB/sec
	Random Write (4KB)	Up to 800,000 IOPS
	Random Read (4KB)	Up to 110,000 IOPS
	Uncorrectable Bit Error Rate (UBER)	1 sector per 10^17 bits read
	Mean Time Between Failure (MTBF)	2,000,000 hours

Hot Plug Support	Power Loss Protection Included Inrush Current Protection Included
Dimensions	60 x 100 x 15 mm
Weight	400 grams

Programmable Hardware Accelerator (FPGA)	AMD Kintex™ Ultrascale+ KU15P FPGA	
	System Logic Cells	1.143 Million
	Available LUTs for acceleration tasks	Approx. 300K
	DSP Slices	1,968
	Internal Distributed RAM	34.6 Mbit
	Internal UltraRAM	36.0 Mbit
	Accelerator-dedicated RAM	4 Gbyte DDR4 SDRAM @2400 Mbps
	Speed Grade	-2LE

Temperature	Operating	0 to 70° C
	Non-Operating	-40 to 85° C
Humidity	Non-Operating	5% to 95%, Non-condensing
Power Consumption	Power Management	Dynamic power management and throttling
	Active	<=25W
	Idle	18W
Vibration	Non-Operating	20G (10~2000HZ, sweep sine)
Shock	Non-Operating	1500G, Duration 0.5 msec, Half-Sine Wave

TAKE THE NEXT STEP

Learn more about the SmartSSD® Computational Storage Drive

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