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Samsung SmartSSD: Accelerating Data-Rich Applications

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Safe Harbor

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Pushing intelligence to the data

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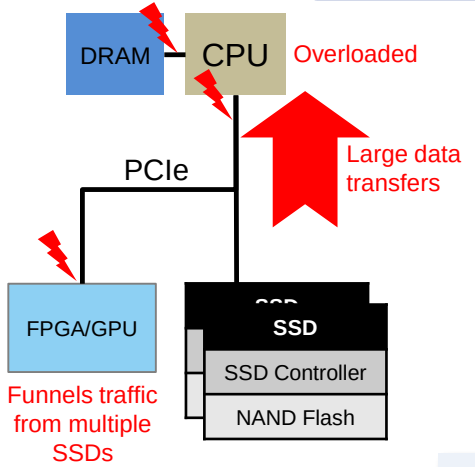
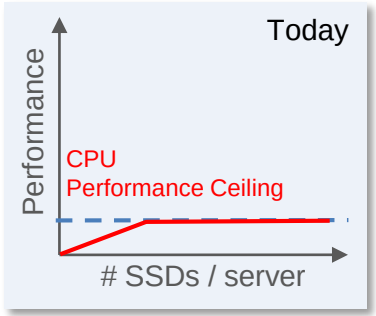
Today's Architecture

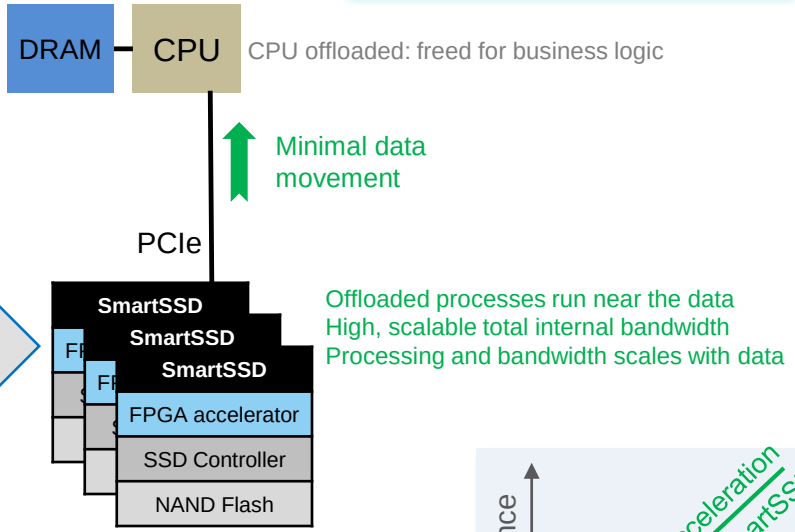


Performance ceiling

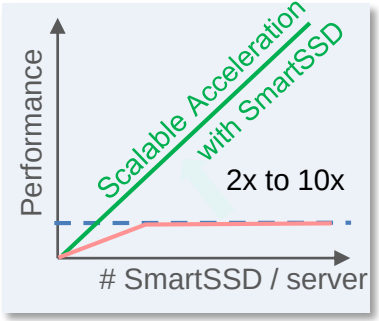


Move compute to the data

SmartSSD Acceleration



Performance scales with data



Samsung SmartSSD Technology Roadmap

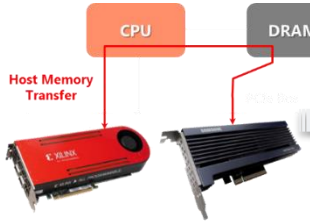
- Roadmap to smaller FF (U.2) and greater integration with SSD controller

www.samsungatfirst.com/smartssd

External FPGA

Moves Data out of SSD for processing

Limited scalability: Funnels 4 SSDs ➔ 1 FPGA

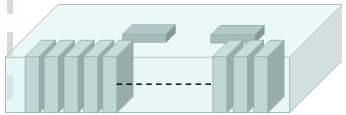


SmartSSD PoC

Internal Data Transfer

Adds Bandwidth and Processing without Funneling

U.2 v1.0 SmartSSD



U.2 FF: Scale Processing to 24 or 48 devices

Greater Integration

More Internal Bandwidth

'2H'2018

HHHL AIC PoC

2H'2019

U.2 MP

Samsung SmartSSD: Proof of Concept

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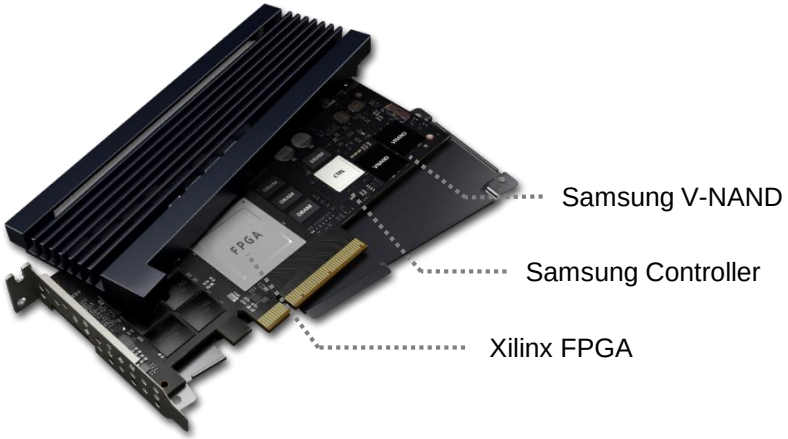
❑ SmartSSD PM983F AIC (announced Samsung Tech Day 2018)

Add-in card to demo performance

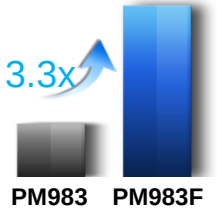
- PoC using PCIe add-in card
- Shown successfully integrated with Bigstream
- Several data-intensive workloads easily ported



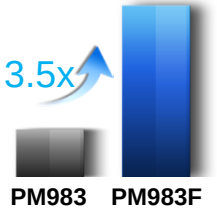
PoC Results

❑ **For I/O-bound workloads, SmartSSD showed 3x to 4x better performance with scalability**

Financial BI (VWAP[1])
Throughput (MOPS)

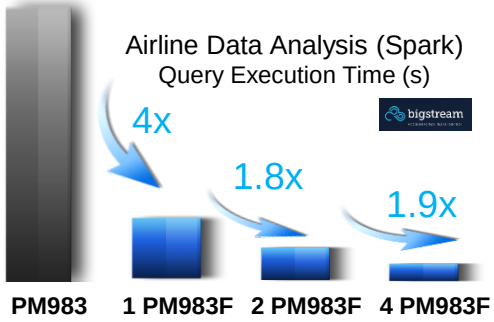


Database (MariaDB)
TPC-H Score, Geo.Mean



* VWAP: Volume Weighted Average Price

Airline Data Analysis (Spark)
Query Execution Time (s)



SmartSSD Platform: Ecosystem Opportunities

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+ Accelerated application frameworks

- Video Encoding
- DB Acceleration
- Search
- ML

+ Accelerated storage services

- Comp/ decomp
- Encrypt/ decrypt
- Erasure Coding

Acceleration platform

- Bring your own IP

Applications

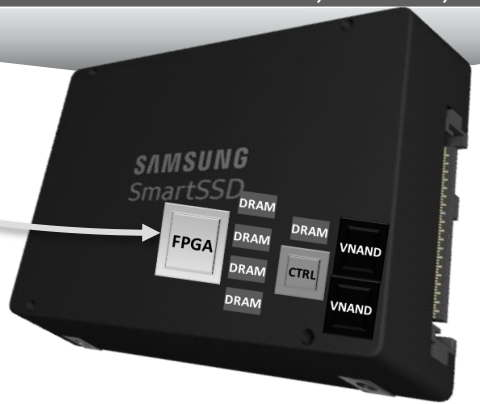
Databases	Video	AI and ML	Storage & Virtualization
PostgreSQL, kafka, ORACLE, Parquet, SQL Server, MySQL, Spark	VP9, H.265 HEVC, OpenCV	theano, PYTORCH, mxnet, Caffe2	

CTACCEL **Connectors to Applications Frameworks**

XILINX **Base Acceleration IP** SAMSUNG

XILINX **Acceleration Stack: IP Dev Toolchain: Runtime, Libraries, API, Drivers** SAMSUNG

Acceleration IP Kernels

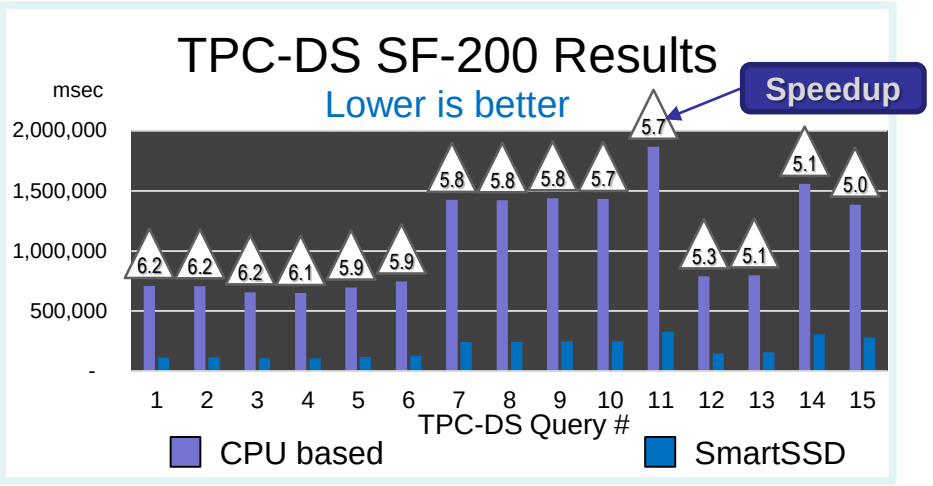


Samsung SmartSSD for Accelerating Data-Intensive Loads

- **For I/O-bound workloads, SmartSSD shows 5-6x speedup, with scalability**

Representative Workloads:

- Storage Services
- Rich Media
- Structured Data



	Block SSD	SmartSSD
CPU	Low-QoS decompression	Consistent latency + metadata offload
Scalability	Limited to 4-8 SSDs/host	Processing and BW scales with data
Accelerator	QAT funnels traffic from multiple SSDs	SSD ⇔Accelerator: Internal data path

	Block SSD	SmartSSD
CPU	Overloaded with serving and xcoding	Freed for HTTP stream analytics
Scalability	Limited to 4-8 SSDs/host	Processing and BW scales with data
Accelerator	FPGA funnels traffic from multiple SSDs	SSD ⇔Accelerator: Internal data path

Samsung SmartSSD Illiustrative Perf. Profile (Row-based)

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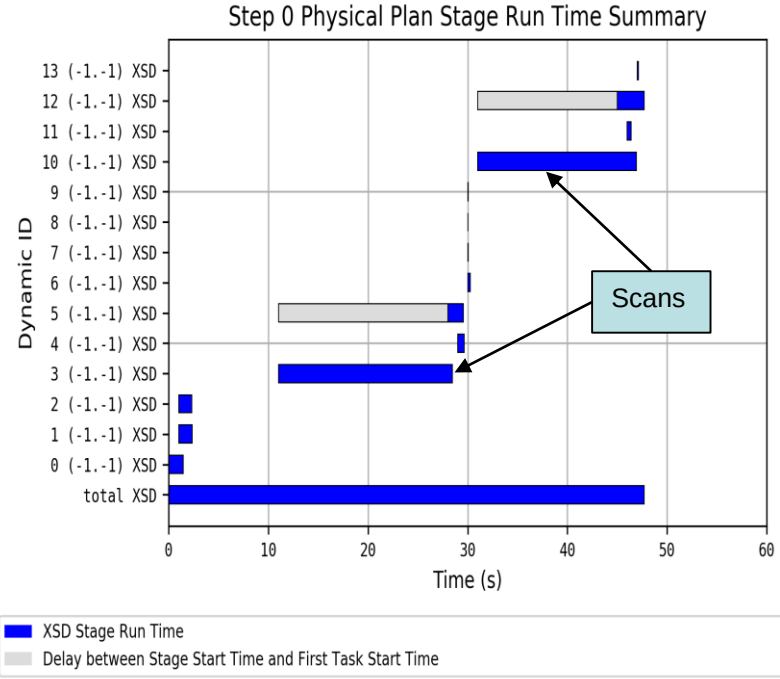

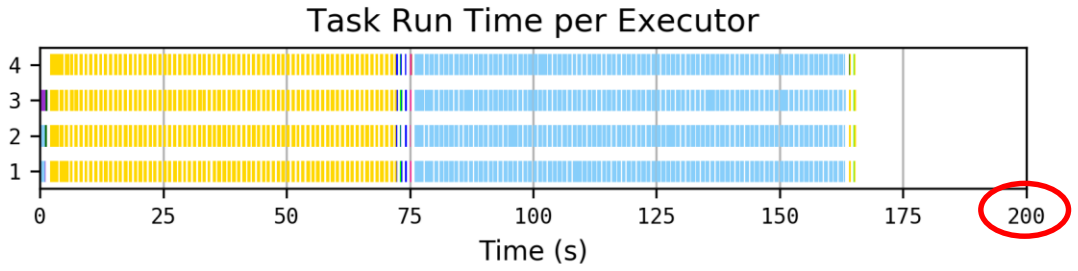

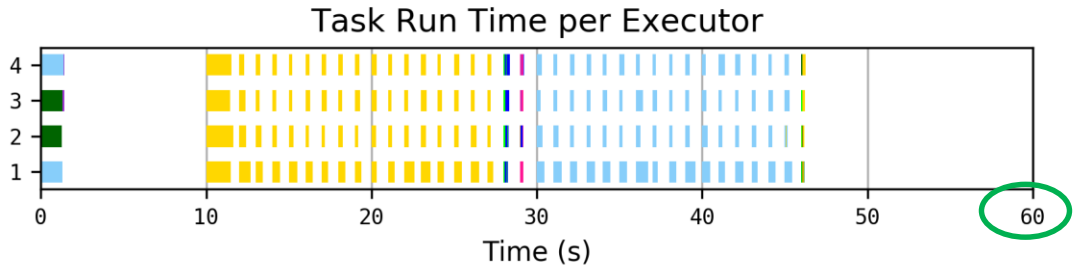

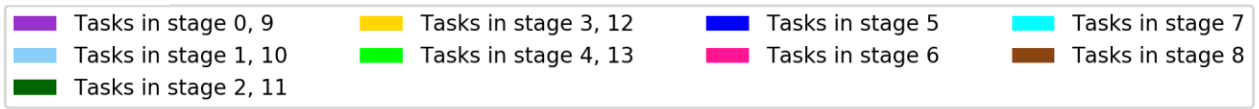

bigstream
ACCELERATING INTELLIGENCE

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Thank You!