

Benefits of FDP on device power efficiency

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Overview

- Why power is important
- Multi workload test results
- Uniform workload test results

Why power is important

- Power usage going up
 - GPUs, DPUs, CPU
 - Datacenters Power Usage
 - 4.4% of US Power in 2023, 176TWh
 - Projected 6.7 to 12% of US Power by 2028, 325 to 580TWh
- Saving power enables more efficient usage of other components
 - More performance in same power footprint
 - Same performance in lower power footprint
- Goal: Show power and relative benefits of FDP

Multiple Workloads

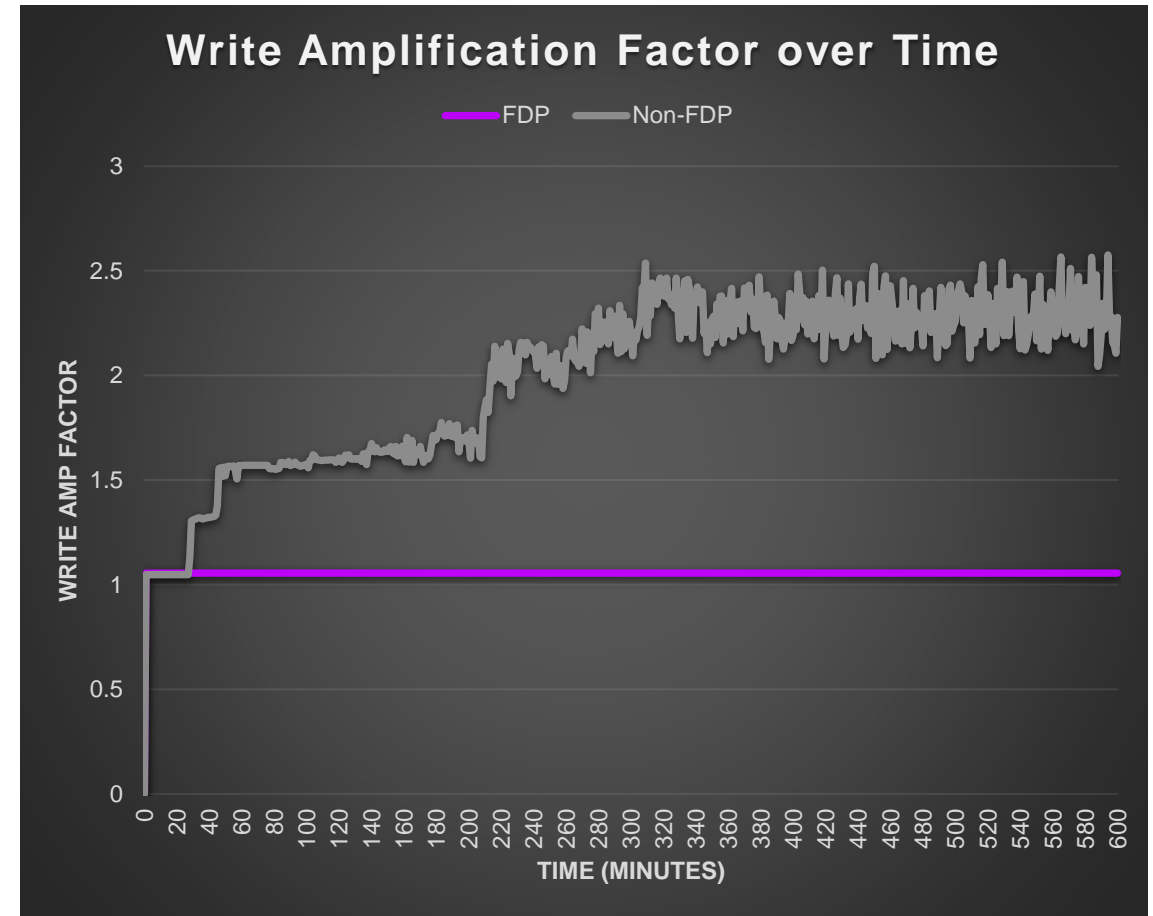
Separate microservices sharing a device

Multiple Distinct Workloads

- Workload Description
 - 8 Separate Jobs
 - Sequential Workloads ranging 4KiB to 128KiB
 - Non-FDP Workload
 - Distinct LBA ranges used for each job.
 - All jobs are writing to the same namespace in parallel
 - FDP Workload
 - 8 equal namespaces (1 reclaim group per namespace)
 - Each job is writing to different namespaces at the same time

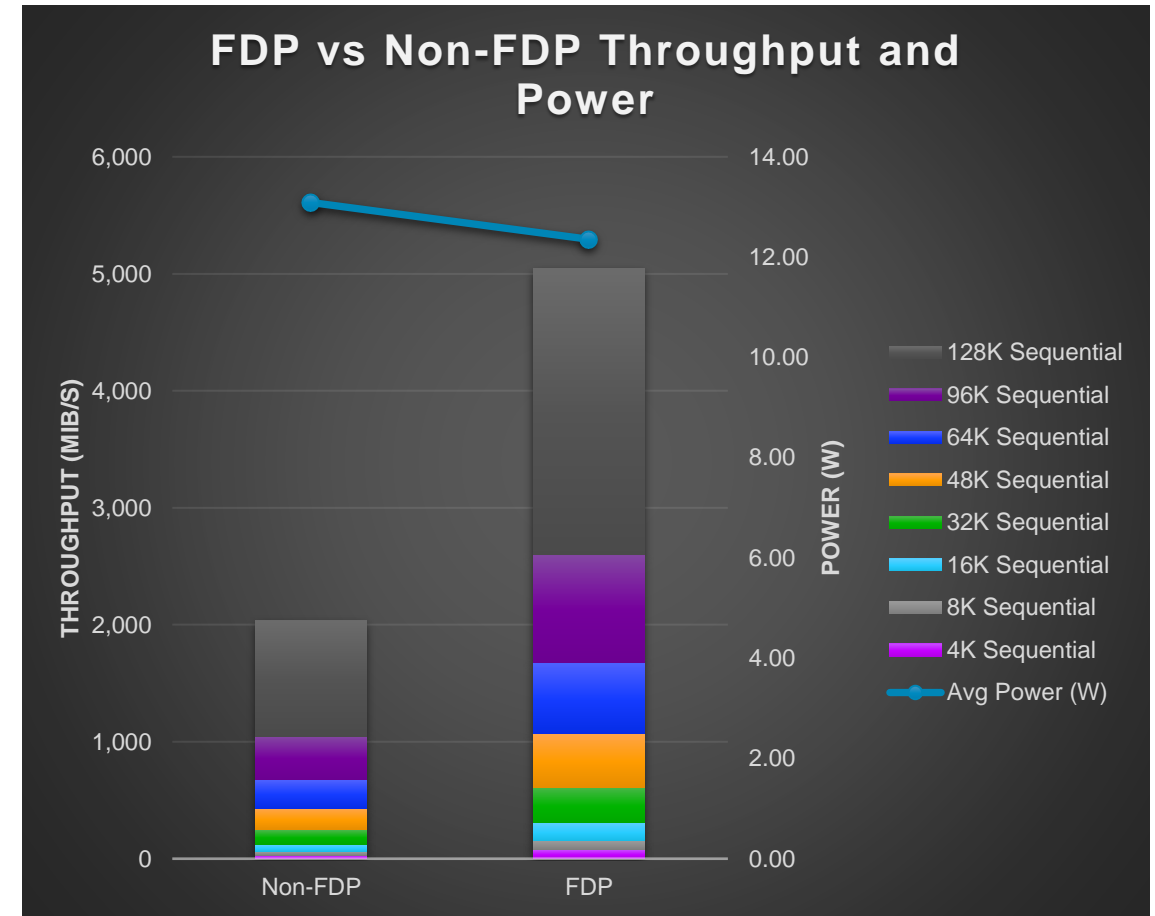
Distinct Workloads – Write Amplification

- Measured at 1-minute intervals for 10 hours
- Workload is all overwrites, no discards sent.
- GC Handled by SSD
- WAF
 - Non-FDP: ~2.3 Average at Steady Date
 - FDP: ~1.05 at Steady State



Distinct- Throughput and Power Results

- Throughput
 - Non-FDP: ~2000MiB/s
 - FDP: ~5000MiB/s
- Power
 - Non-FDP: 13.09W Average
 - FDP: 12.36W Average
- Throughput Efficiency
 - Non-FDP: ~155MiB/s per Watt
 - FDP: ~408MiB/s per Watt



Uniform Workloads

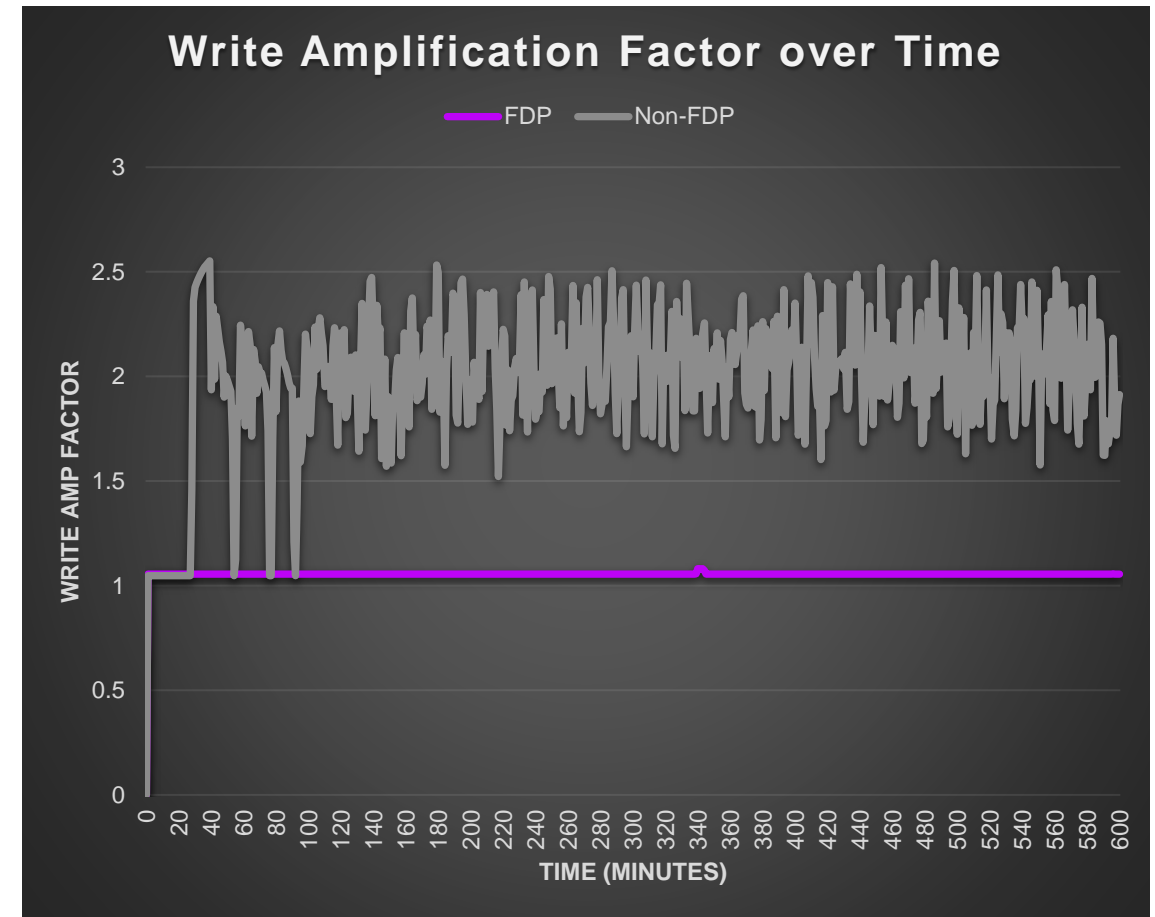
GPU Checkpointing

Uniform Workloads

- Workload Description
 - 8 Separate Jobs
 - Sequential Workloads - 128KiB Block Size
 - Non-FDP Workload
 - Distinct LBA ranges used for each job.
 - All jobs are writing to the same namespace in parallel
 - FDP Workload
 - 8 equal namespaces (1 reclaim group per namespace)
 - Each job is writing to different namespaces at the same time

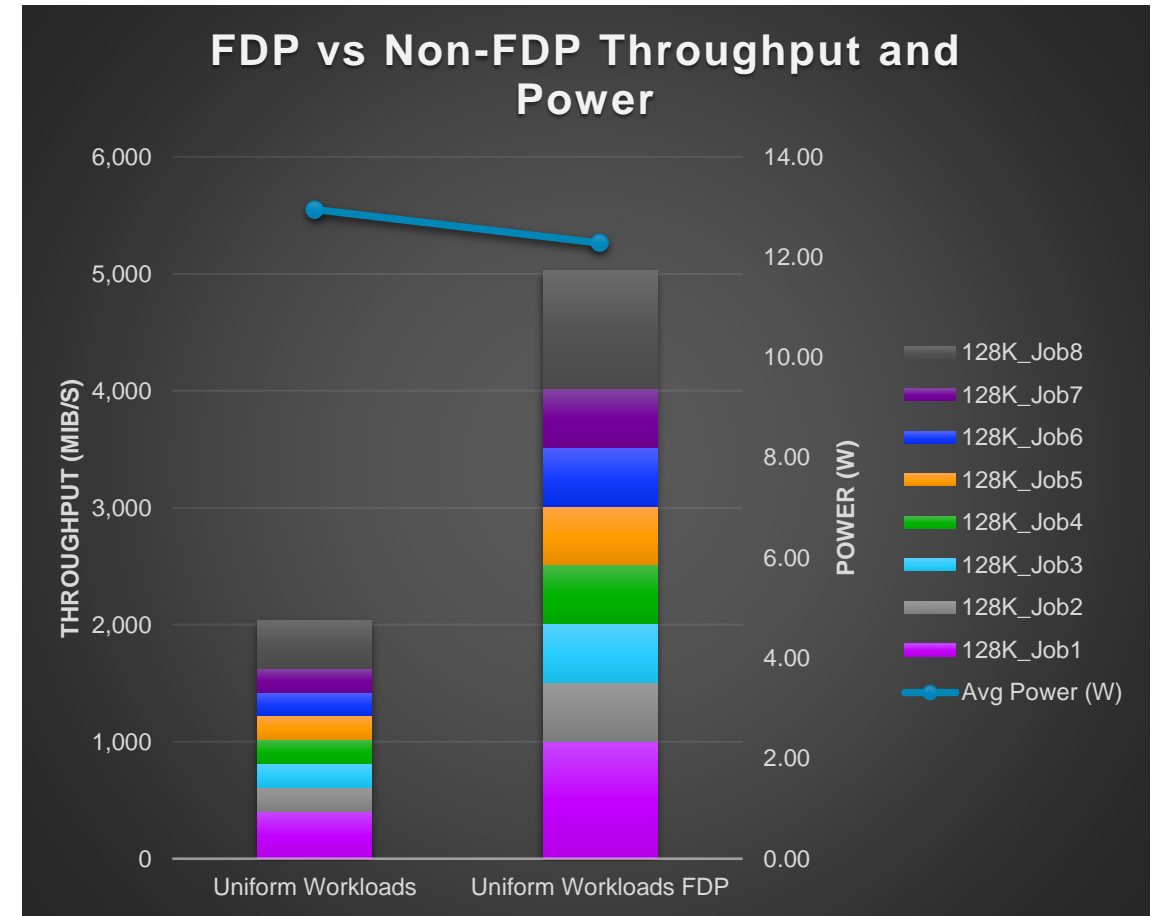
Uniform Workloads– Write Amplification

- Measured at 1-minute intervals for 10 hours
- WAF
 - Non-FDP: ~2.0 Average. Not consistent over 1 minute
 - FDP: ~1.05 at Steady State



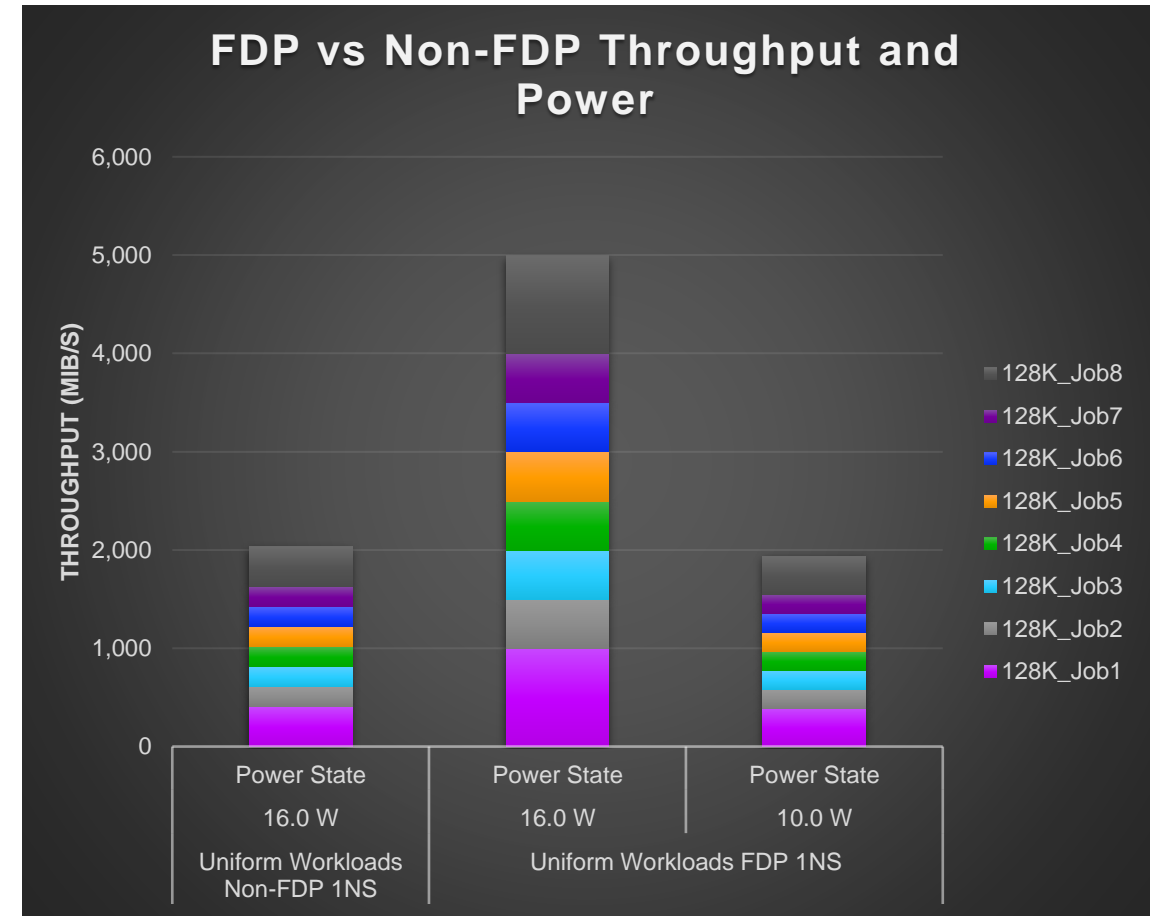
Uniform Workloads - Throughput and Power Results

- Throughput
 - Non-FDP: ~2000MiB/s
 - FDP: ~5000MiB/s
- Power
 - Non-FDP: 12.95W Average
 - FDP: 12.28W Average
- Throughput Efficiency
 - Non-FDP: ~157MiB/s per Watt
 - FDP: ~409MiB/s per Watt



Power State Restriction

- Uniform Workload (Sequential 128K – 8 Jobs)
- Power Efficiency
 - Non FDP – 16W Power State
 - 16W Power State
 - ~2000 MiB/s, 12.94 W
 - FDP
 - 16W Power State
 - ~5000 MiB/s, 12.36 W
 - 10W Power State
 - ~1937 MiB/s, 6.47 W





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