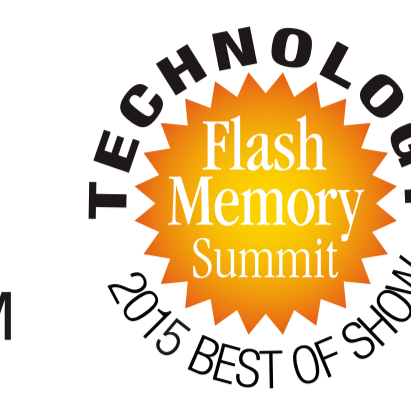
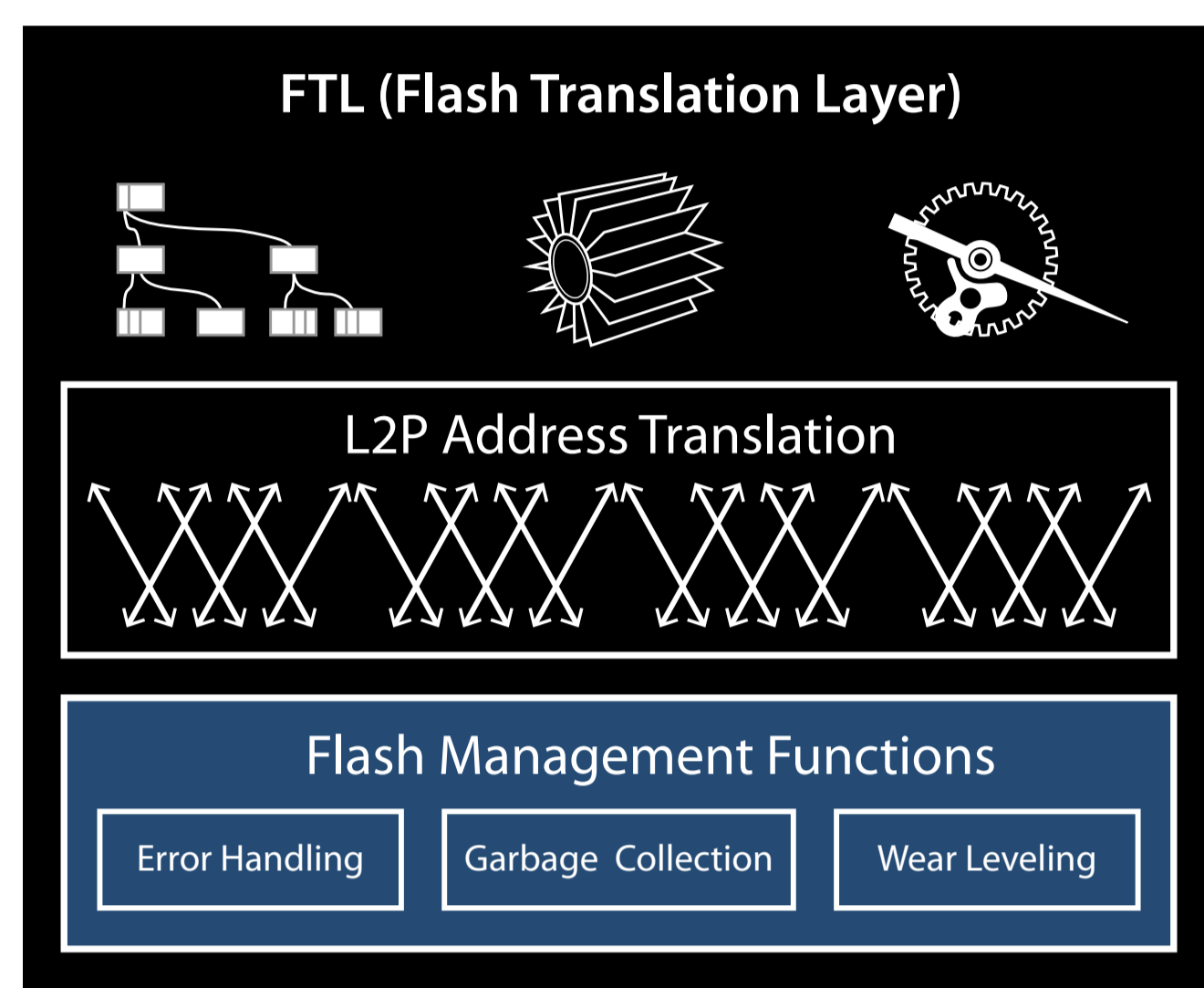


Symphonic[™]

Cooperative Flash Management



SSDs perform Flash Management inside a FTL (Flash Translation Layer)

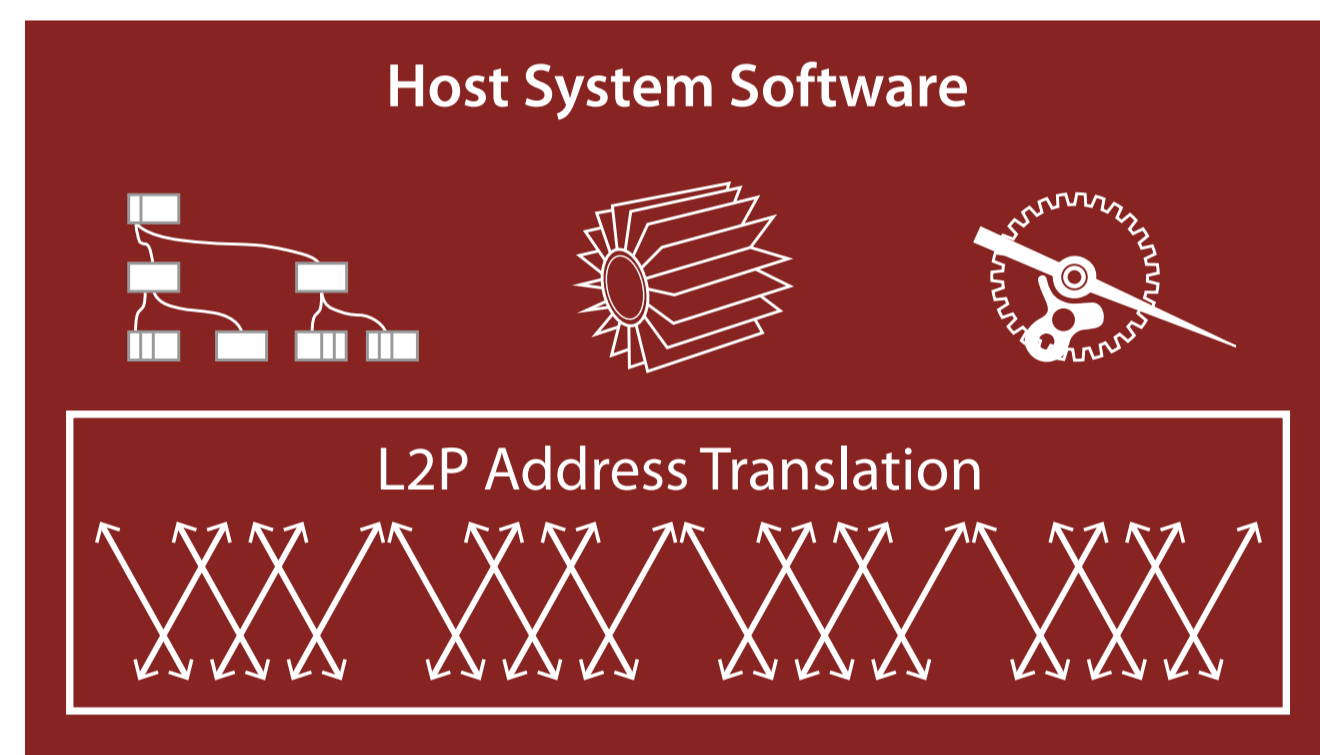


Autonomous & Asynchronous

- Space Management
- Address Translation
- Scheduling
- Data Placement

Non-Overwriting Host System Software (file systems, block managers, object/key value stores)

- Intelligently performs storage management
- System knowledge about data and workloads



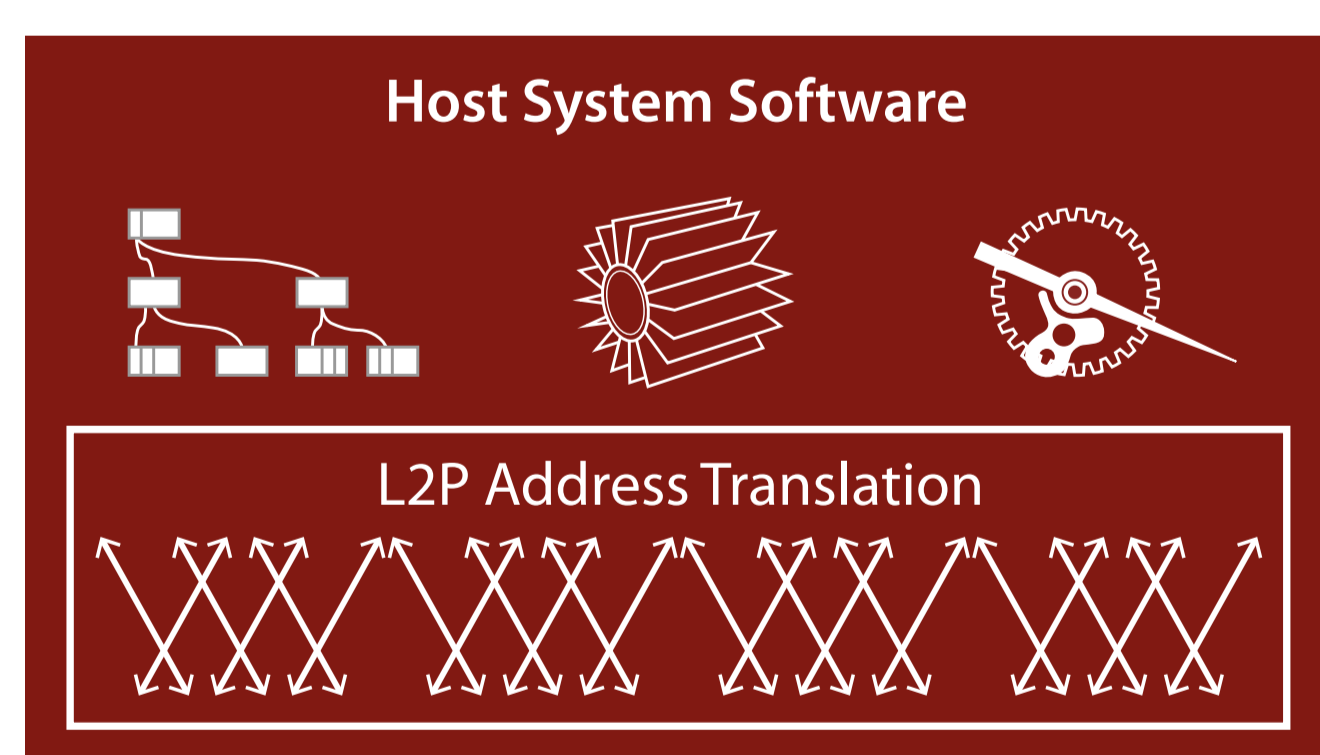
Autonomous & Asynchronous

- Space Management
- Address Translation
- Scheduling
- Data Placement

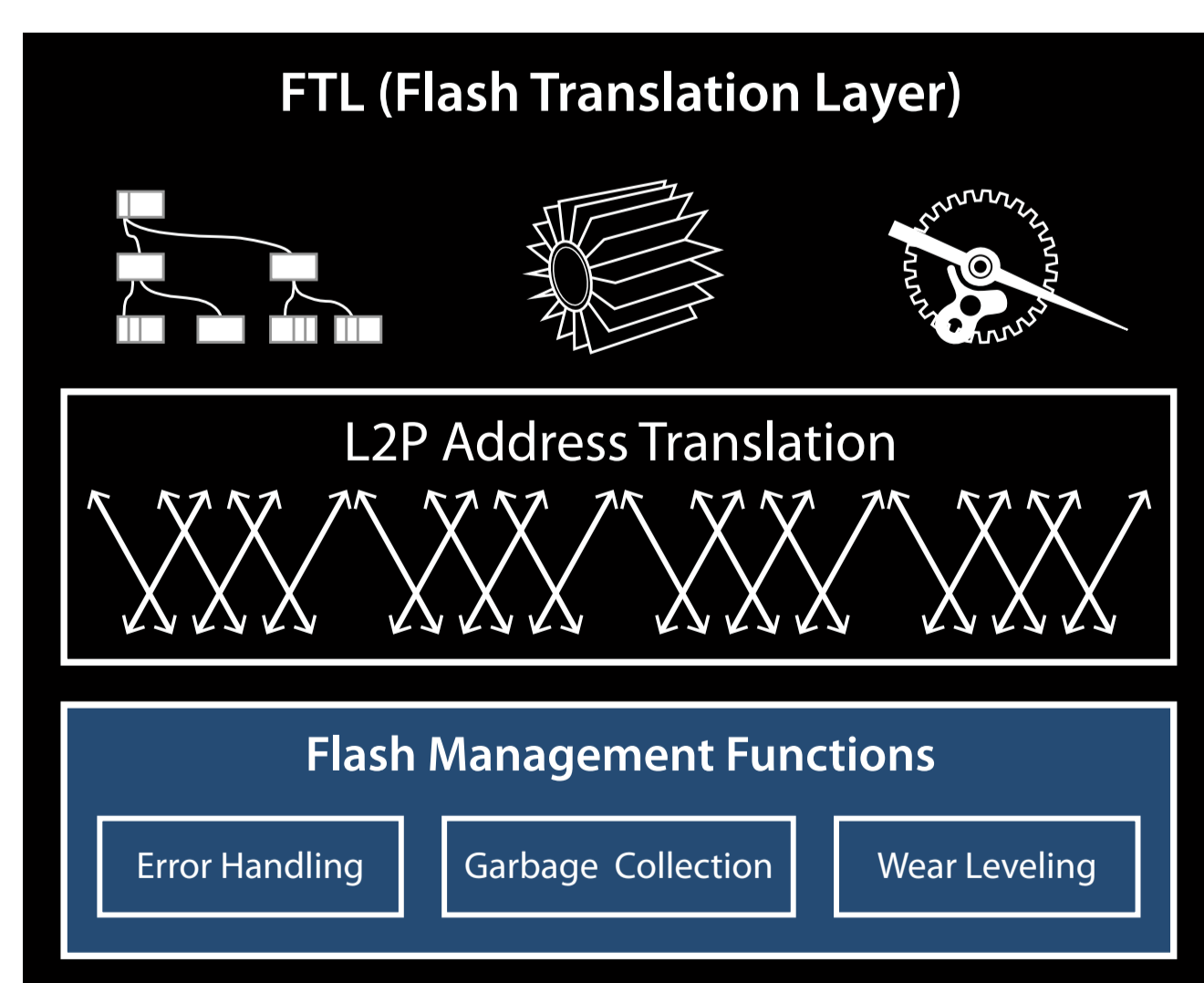
- Segment cleaning process relocates valid data (Garbage Collection)
- Requires "Free Space" (Overprovisioning)
- Has system-level Write Amplification

All this... even when only utilizing Hard Disk Drives

Redundancy = Dislocation & Double Penalties

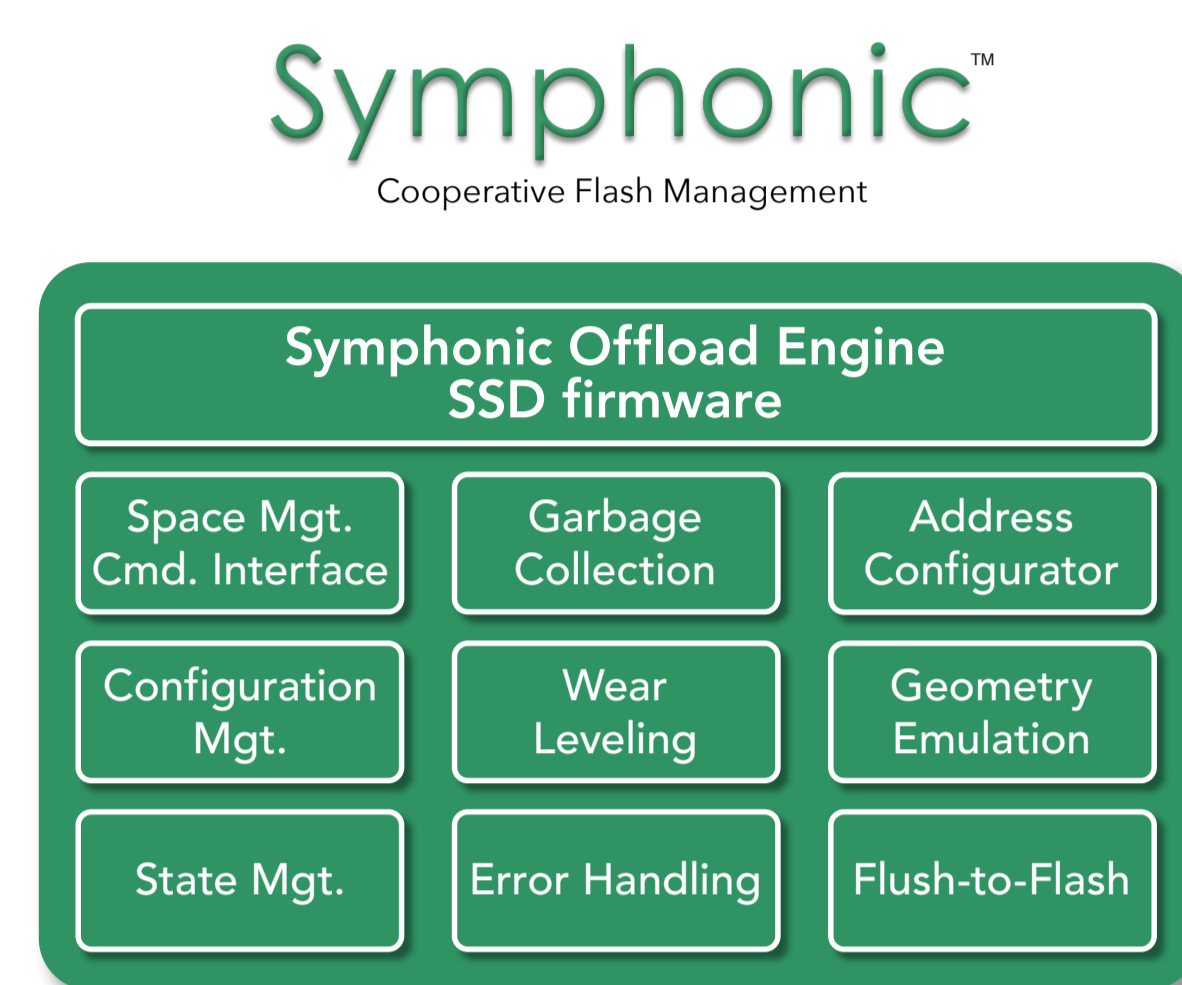


- Double penalty for...
 - Lookups & Locking
 - Garbage Collection
 - Write Amplification

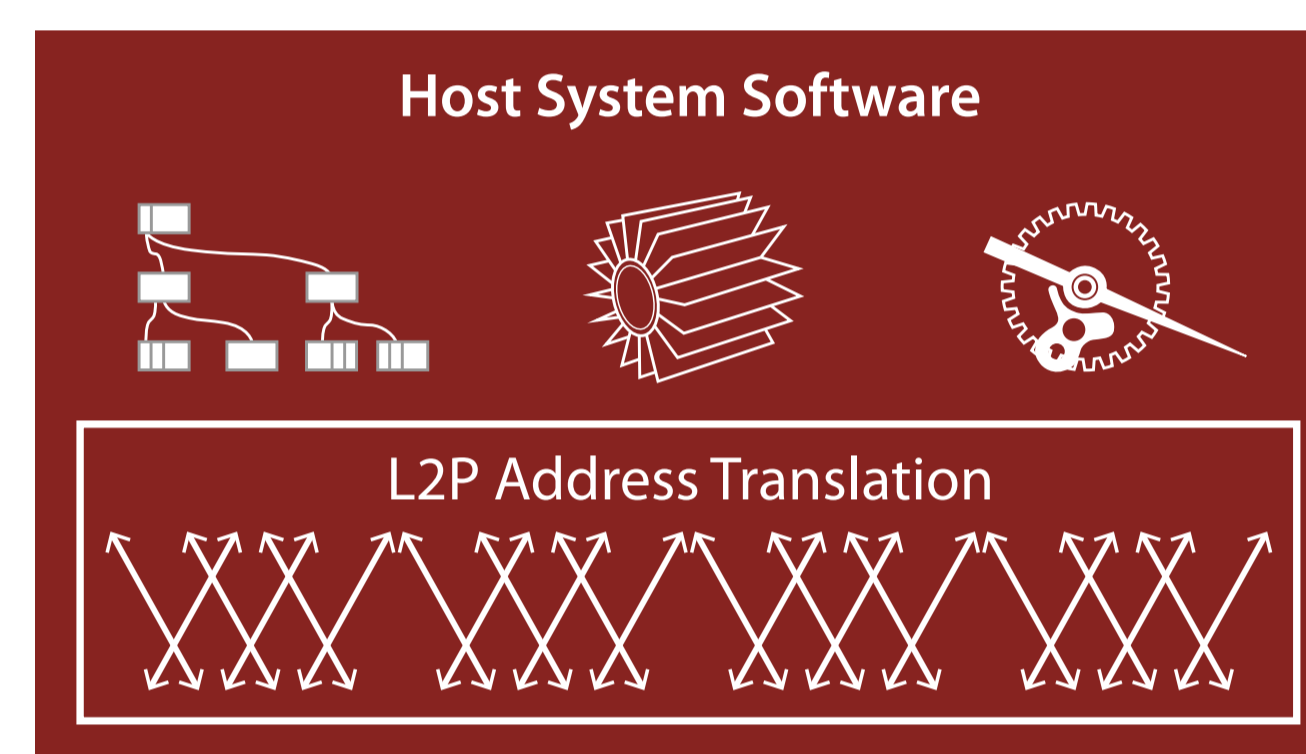
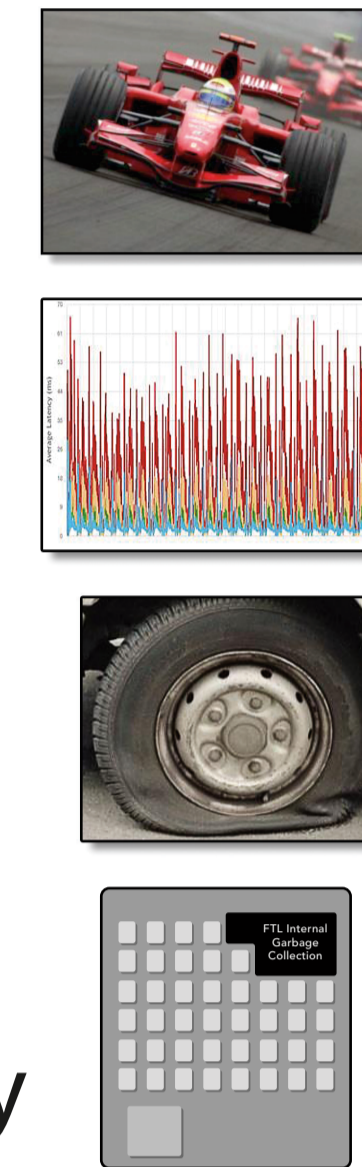


- Two autonomous and asynchronous engines
- Requires additional device overprovisioning
- Prevents optimized data placement
- Increases collisions = latency spikes

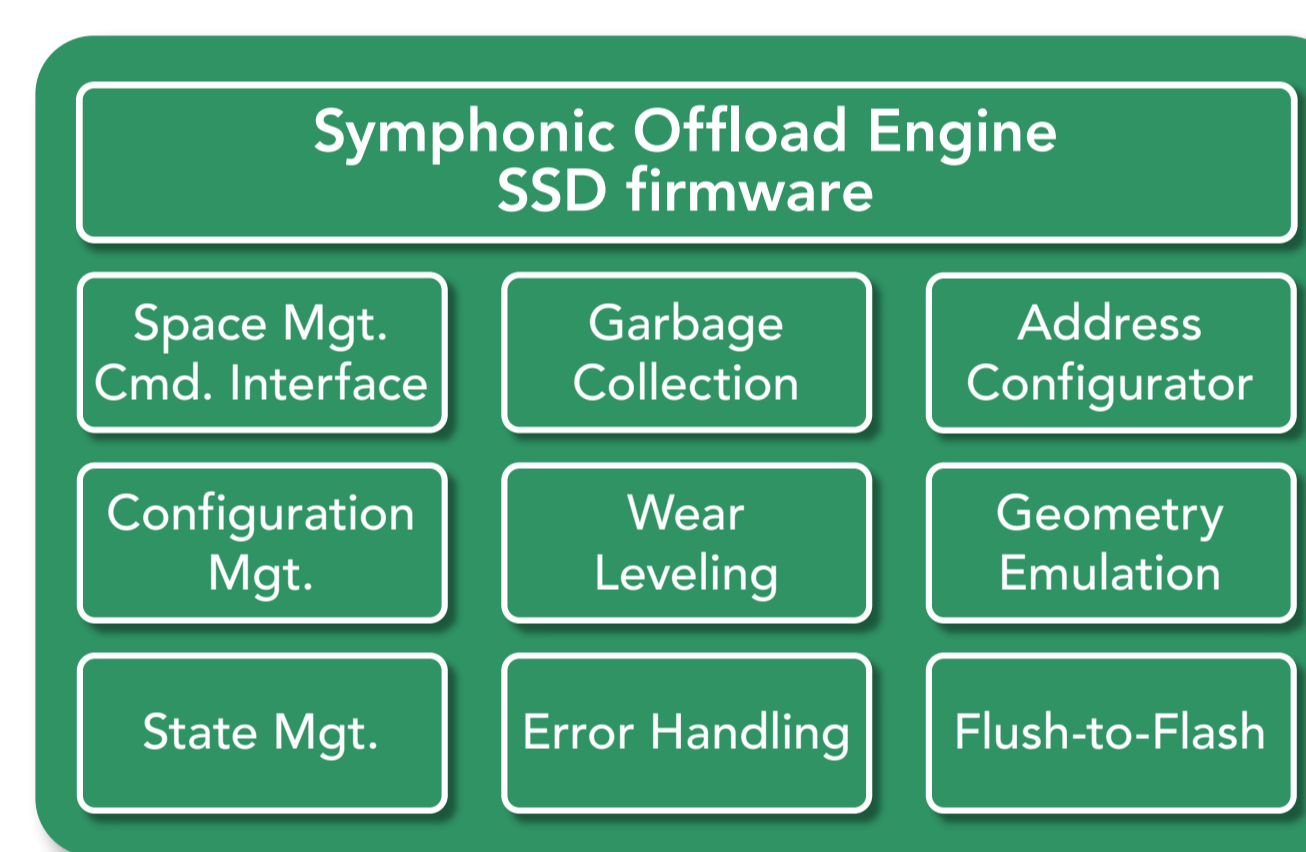
Beats the leading enterprise FTL SSDs...



- 80% ↑ Speed
- 10x ↓ Latency Spikes
- 75% ↓ Wear Out Factor
- 20% ↑ Addressable Flash Capacity



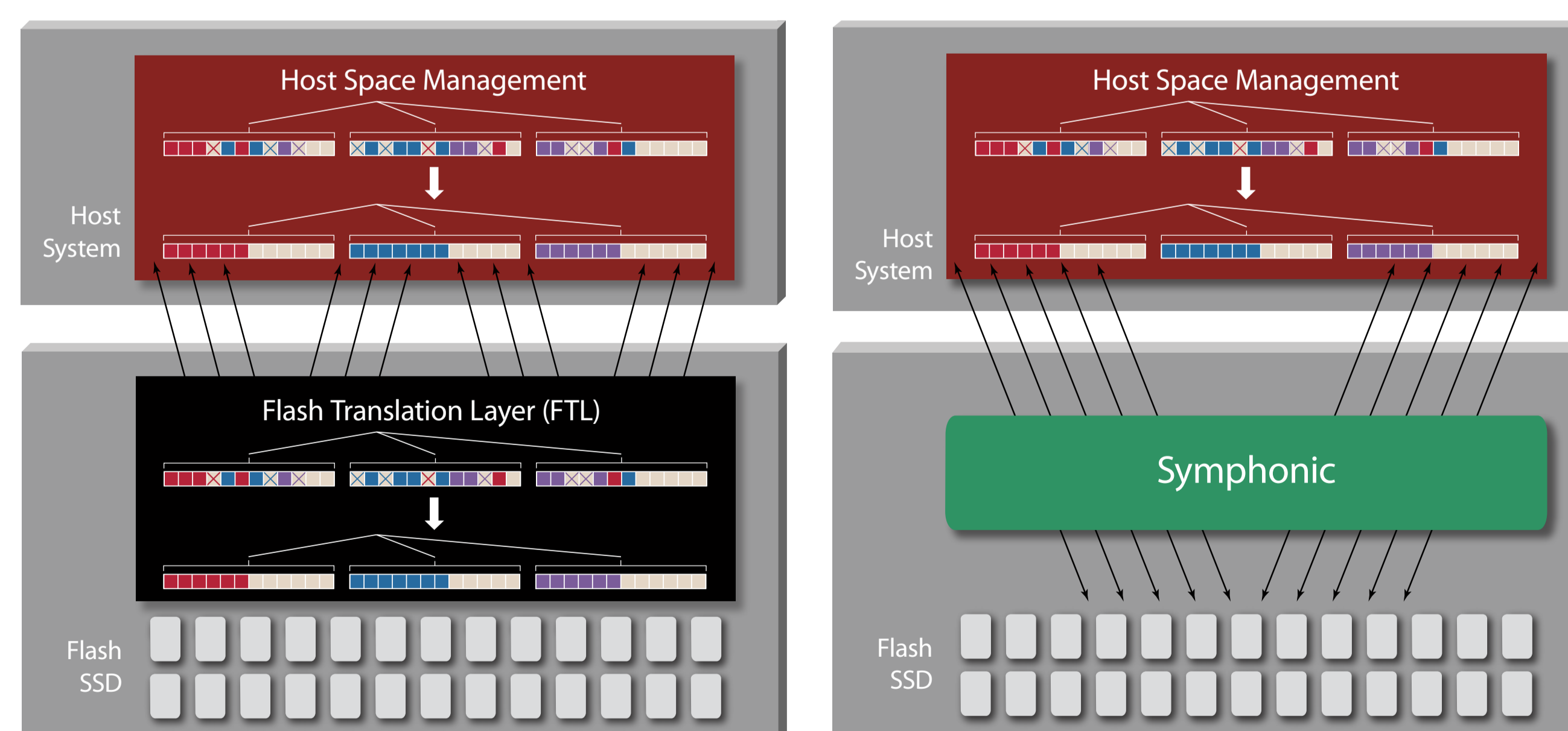
- Leverages host's existing functionality:
 - Space Management
 - Segment Cleaning (Garbage Collection)



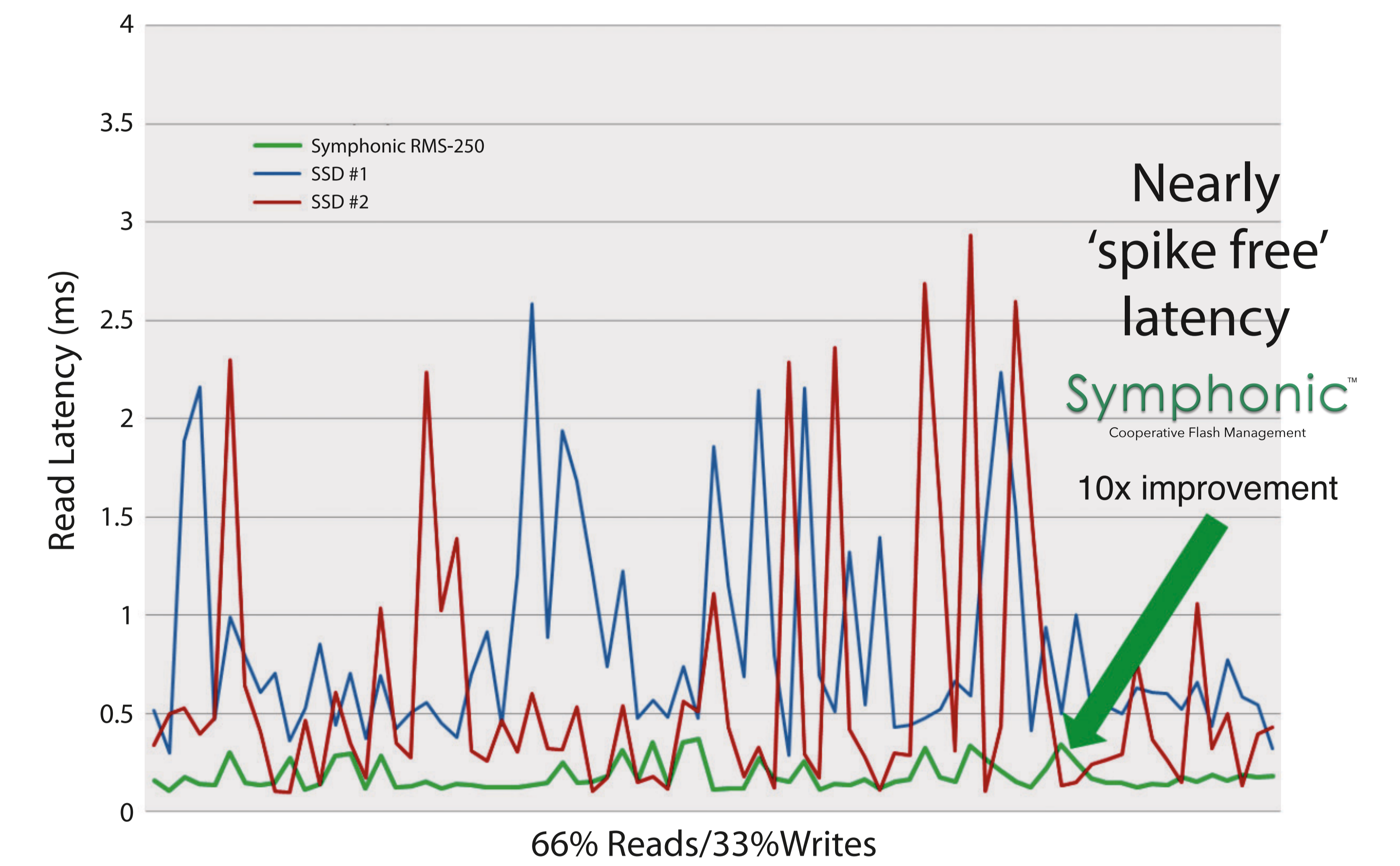
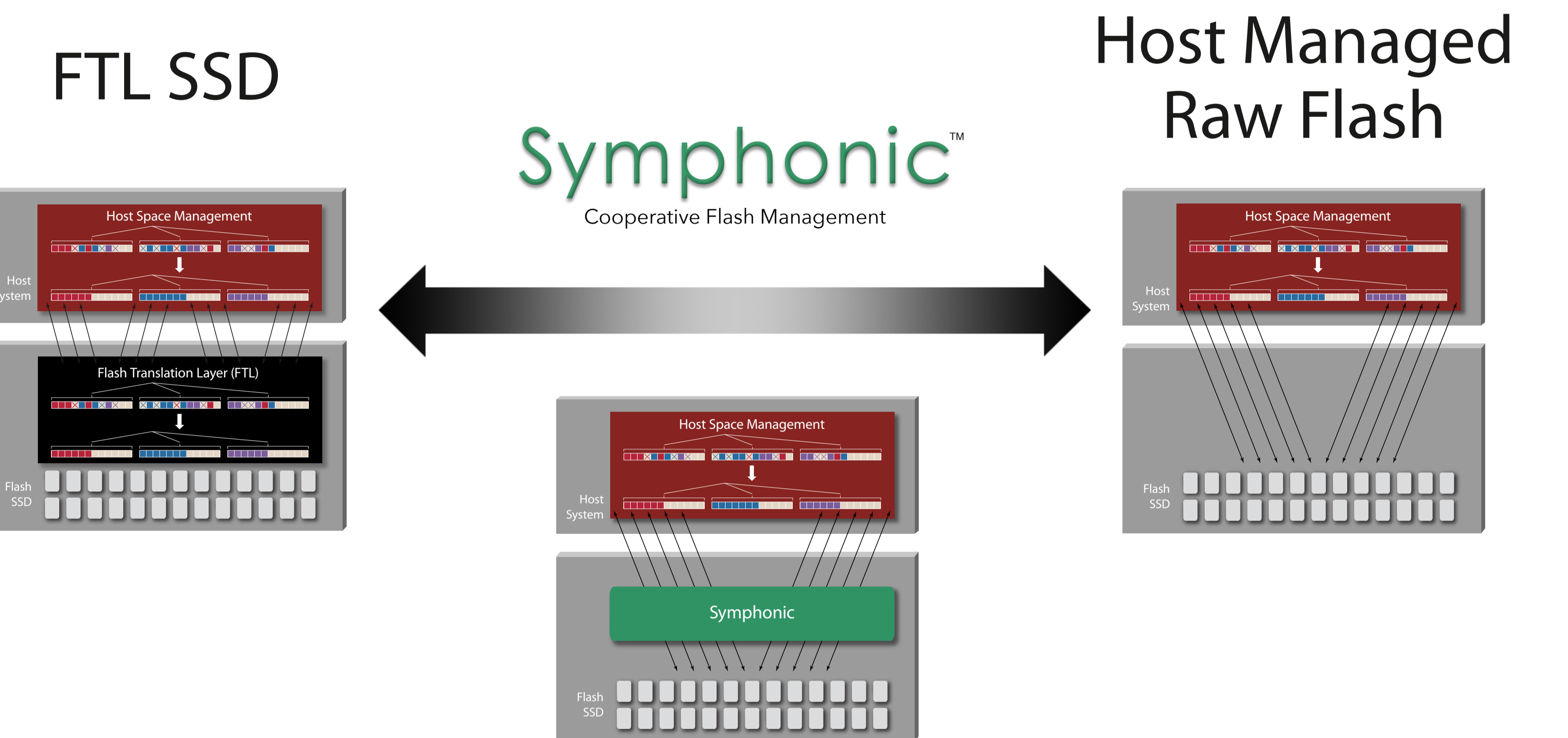
- Replaces the FTL to create Offload Engine
- NVMe API with custom vendor-specific extensions
- Appears as a NVMe Block Device

- Executes Garbage Collection processes on SSD
- Provides optimized geometric alignment, integration and serviceability
- Abstracts low level NAND attributes
- Transparently provides Wear Leveling and Error Handling

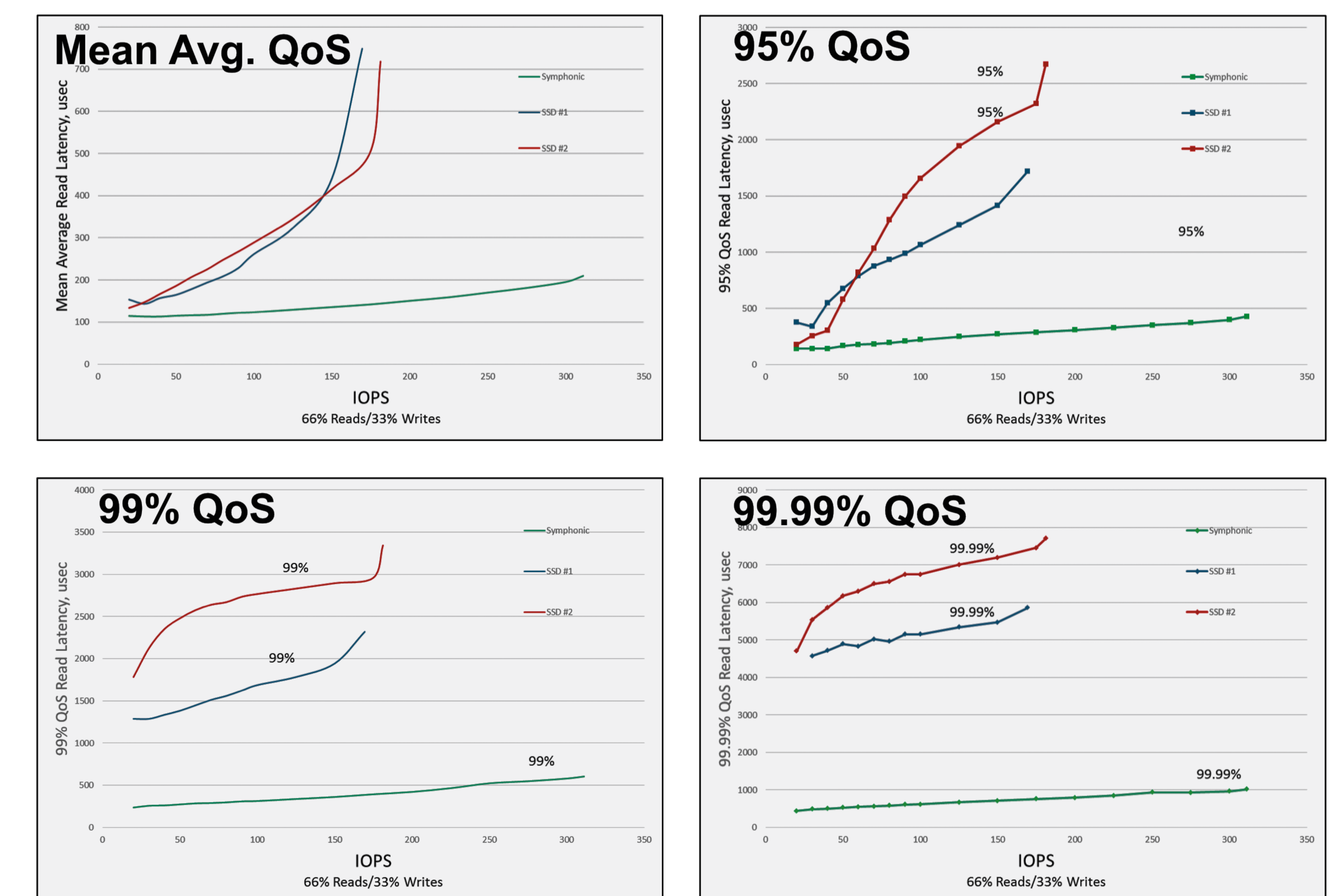
Eliminates 'Log on Log' Collisions & Double Write Amplification



Coherent Data Placement & Deterministic Scheduling



Latency @ IOPS



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