Key SSD Requirements for Embedded Applications

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What are the Key SSD Requirements of Embedded Application?

Data Reliability

Power Protection

Sustain Performance

Serviceability

Long Term Product Support

Fix the BOM!!

The list goes on and on….

What are the Key SSD Requirements of Embedded Application?

As we go through the long list of things, what do we REALLY care about?

What are the Key SSD Requirements of Embedded Application?

In Layman's Term

The SSD should just work 100% of the time.

Sunny or Rain.

At the very least, before it breaks, I need to know about it ahead of time.

What are the Key Requirements of Embedded Application?

Turns out, what REALLY matters is…

1. *Reliability*

   If anything would have gone wrong (Error bits), I want reduce the impact **AS MUCH AS Possible.**

2. *Availability*

   If anything would have happened (Power Fail), I want to assure my data is **SAFE**.

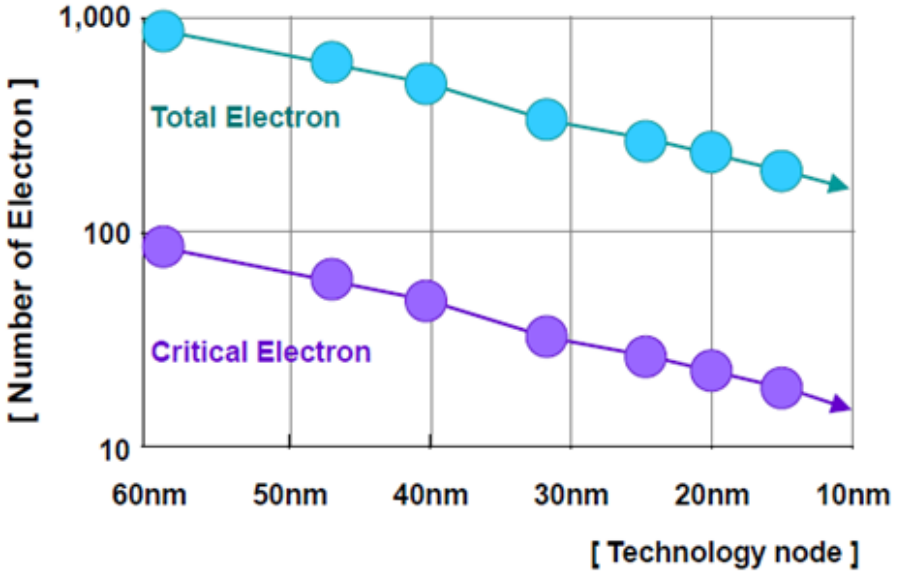
3. *Serviceability*

   If the SSD is about to go down (EOL), I want to know about it…**AHEAD of TIME.**


Data
Reliability

Data Reliability – Why?

- Same Old Story: NAND cells cost-reduction efforts introduce data reliability concerns.
- SLC cost-prohibitive.
- Creative data protection streagy is KEY to ensure data reliability.



Top-to-Bottom Data Reliability

Front End: End To End Data Protection

- ✓ Start protecting data at the minute it enters SSD by generating associated parities.
- ✓ Prevent any soft errors caused by bit flips along the travelling path of data.

Back End: Flash ECC Protection

- ✓ Redundancies generated when data is programmed to flash.
- ✓ p. SLC scheme improves allowable P/E cycle before the guaranteed ECC spec.
- ✓ BCH -> LDPC.

Last Gate: RAID ECC Engine

- ✓ What happen when an uncorrectable error is detected?
- ✓ Important to reconstructing the damaged data by using *RescueParity* that is previously generated and stored in other pages.

Data Reliability – Bottom Line

An SSD controller with multi-layer Error Correction scheme have become increasing important


Availability

Availability

What kind of power protection is needed on embedded SSD?

1. *Built-in external trigger on flush-cache on SPL with system power*
   - ❑ SATA Link Loss Trigger
   - ❑ Voltage Detector Trigger
   - ❑ DevSLP CMD Trigger
2. *Explore alternative non-volatile cache*
   - ❑ MRAM
   - ❑ Disable Write Cache
3. *On-Board Full PLP*
   - ❑ Full P-Fail circuitry support

Every embedded system is UNIQUE.

SSD Availability – Bottom Line

PLP customization often required for each Unique embedded system


Serviceability

Serviceability

What happen when SSDs are in the field?

1. *F/W Upgradeability*
   - ❑ Seamless F/W upgrade with data intact

2. *S.M.A.R.T. Monitoring*
   - ❑ Easily accessible in command lines
   - ❑ Special design to bypass bridge chips

3. *End-of-life behavior*
   - ❑ Performance throttling
   - ❑ Endurance extending
   - ❑ Provide just enough “warning” to end users to signal EOL

SSD Serviceability – Bottom Line

Replacement / Field upgrade is not end of the world, but being able to service the SSD is a key requirements today.

Conclusions

- The traditional rule-of-thumb requirement still intact: BOM Fix, Long Product Support, Sustain Performance.
- The next-phase of embedded requirements focus on R.A.S.
- Various creative schemes are being used on different kinds of use case.

Thank You