

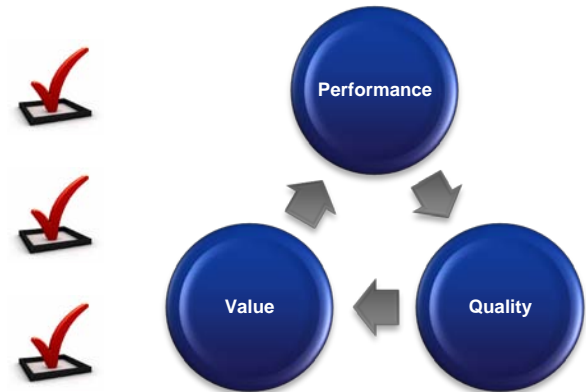
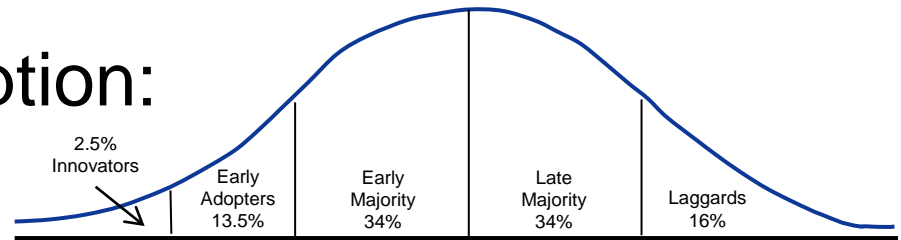
Enterprise SSD's and the Holy Grail

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SSDs for Enterprise Customers

- Initial Enterprise adoption:
 - Performance
 - Power
- Widespread Enterprise adoption requires a more comprehensive approach:
 - Sustained and predictable performance
 - Consistent quality and reliability
 - Value



Serving Enterprise Applications

- Sustained and Consistent Performance

- Always on → 100% duty cycle
- Balanced reading and writing
- No degradation towards end of life



High
Endurance &
High
Performance

- Uncompromising quality and reliability

- Robust data protection
- Factory processes to guarantee quality

- Value

- Enable wide adoption in data center

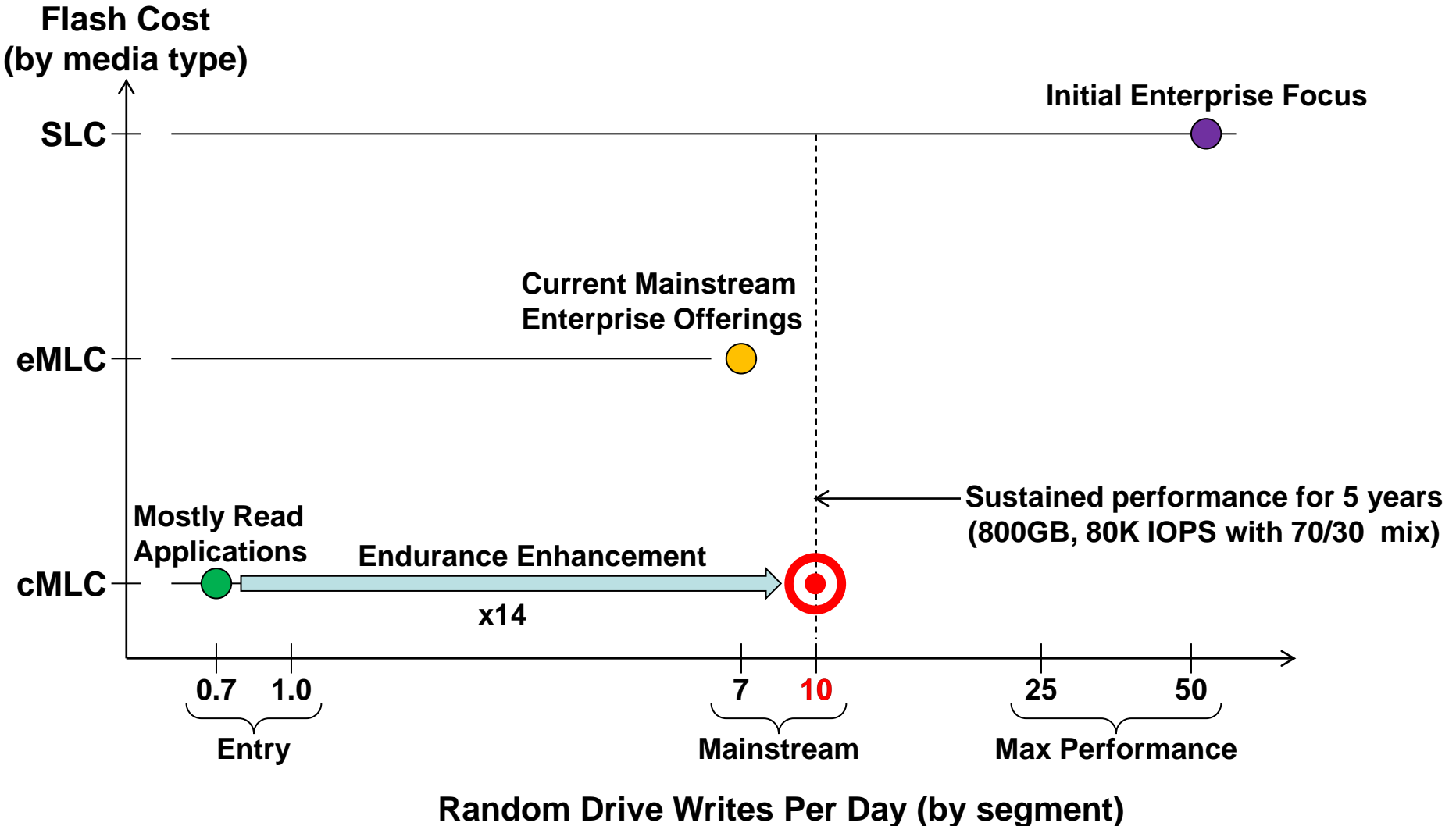


Paradox?

Low
\$/GB



Targeting Value



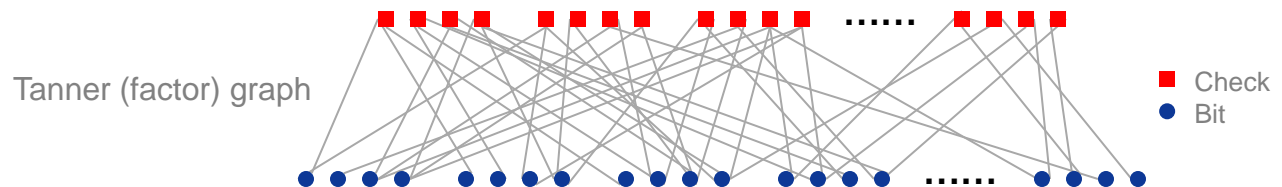
Endurance Enhancement

- Required to deliver 10 random drive writes per day with MLC
- Relying on SSD level opportunities that are not available or economical at flash component level
- Multi-faceted
 - Flash Management
 - Wear Mitigation
 - Error Recovery



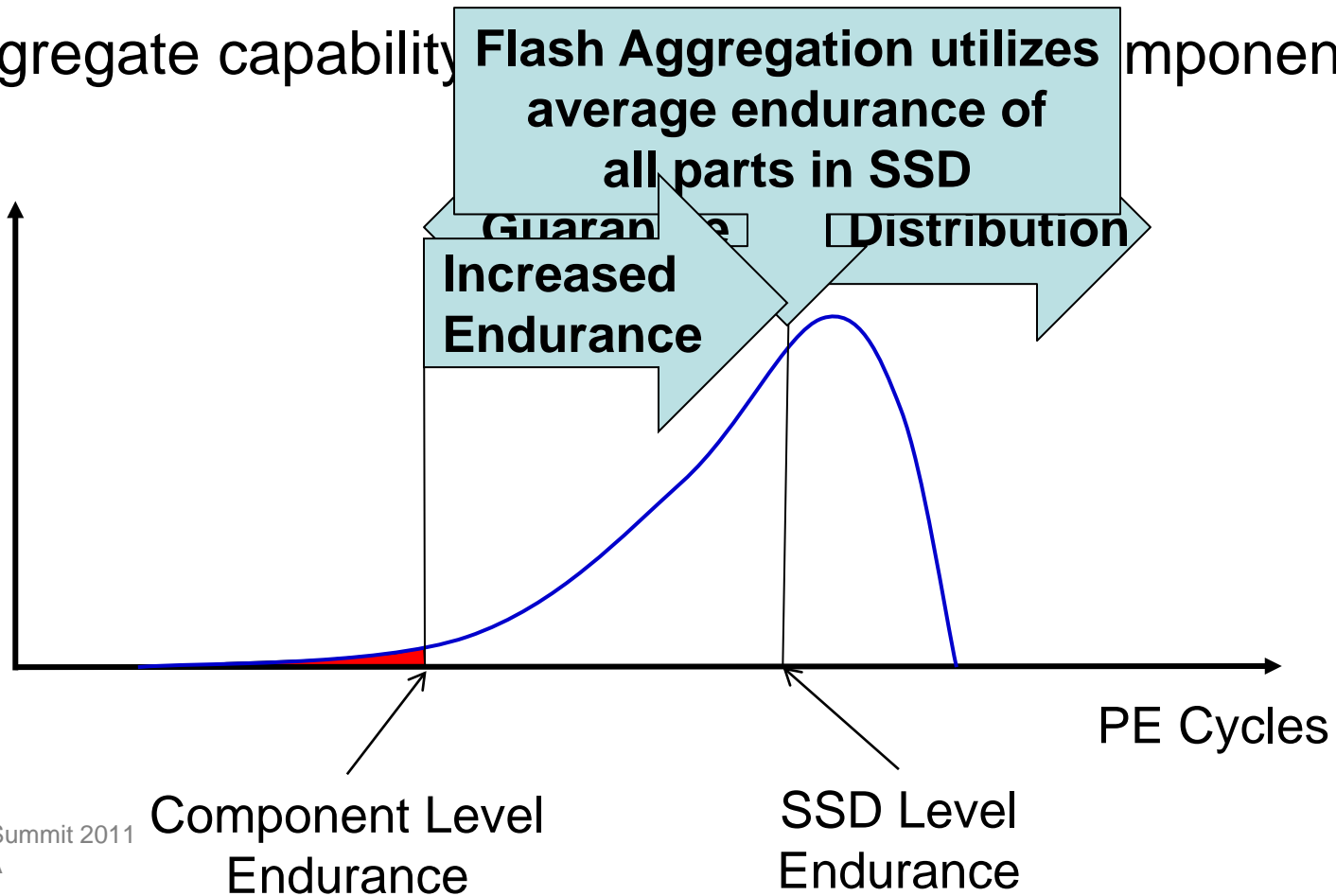
SSD Level Opportunities

- Adjusting flash settings
 - Optimal settings for each die
 - Adjusted over life of product
- Flash aggregation
 - Take advantage of population statistics
- Sharing expensive features
 - e.g. gate-intensive LDPC channel



Flash Aggregation

- Take advantage of population statistics
- Analogous to variable density techniques in HDD
- Aggregate capability

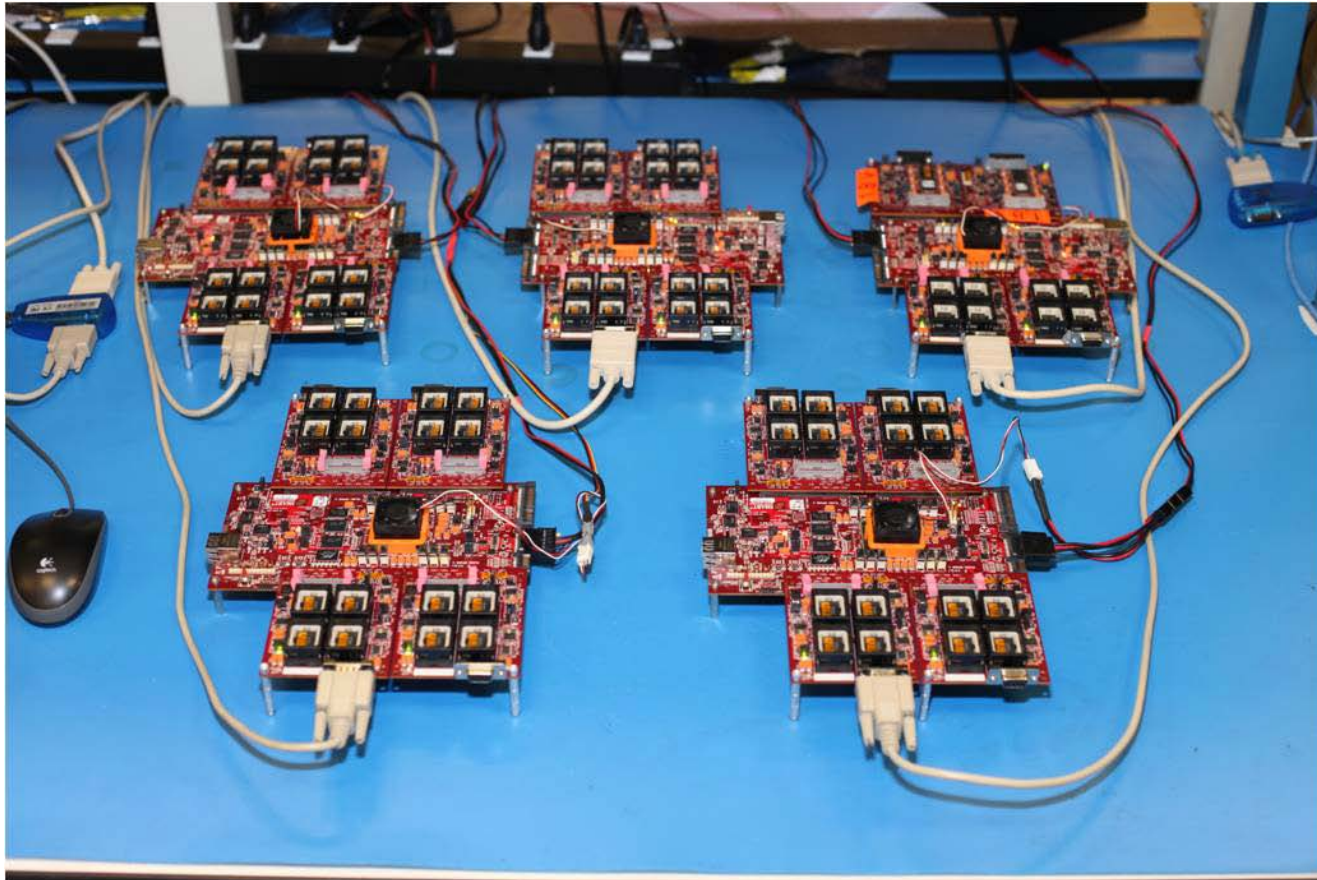


Flash Characterization

- State-of-the-Art “Kitchen” to prepare “Secret Sauce”
- Develop and demonstrate endurance enhancements
 - Large scale testing
 - Data warehouse and analysis infrastructure
- Five Star Chefs:
 - In-house NAND Flash Reliability expertise



State-of-the-Art “Kitchen”



Guarantee Outgoing Quality

- Traditional On-going Reliability Testing (ORT)
 - Well established in HDD
 - SSD Challenge → End-of-life wear
- Need new processes
 - Capability to greatly accelerate testing
 - Simulate end-of-life behavior
 - Guarantee consistent performance
 - No end-of-life degradation

Holy Grail for Enterprise SSD's



Performance

Quality

Value



Thank You!

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