

White Paper

M-WP016

SMART Zefr Whitepaper: Penguin Computing Use Case

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Introduction

Penguin Computing, Inc. is a leader in providing high-performance computing (HPC) and artificial intelligence (AI) infrastructure solutions. The integration of highly reliable Zefr memory in their HPC cluster deployments is critical for ensuring optimal performance, efficiency, and reliability. This white paper explores the benefits of using highly reliable memory in Penguin Computing's data centers and HPC clusters.

Zefr Memory Overview

Zefr is a proprietary screening process performed on OEM original memory modules or SMART Modular built memory modules to deliver ultra-high reliability for demanding workloads.

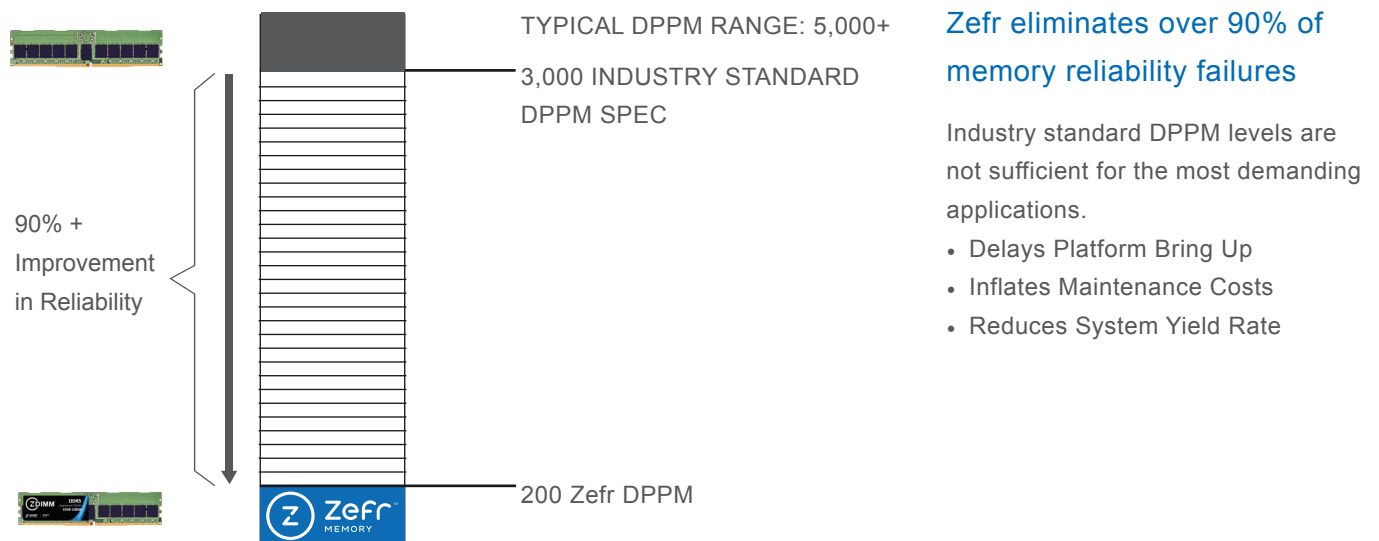


Figure 1. Zefr Memory Overview

Benefits of Using Highly Reliable Zefr™ Memory

1. Enhanced Performance and Efficiency

High-Speed Data Processing: Reliable memory is essential for high-speed data processing, which is vital for the real-time analytics and machine learning applications supported by Penguin Computing. These applications often require massive datasets to be processed in-memory, demanding high throughput and low latency to meet performance requirements.

2. Cost Efficiency and Longevity

Reduced Downtime and Maintenance Costs: Highly reliable memory reduces the likelihood of failures, minimizing downtime and associated costs. This reliability is crucial for maintaining continuous operations in Penguin Computing's data centers, which support mission-critical workloads.

Extended Component Lifespan: Reliable memory components are designed to endure the demanding conditions of data centers, offering a longer lifespan compared to less reliable alternatives. This durability translates to lower replacement and maintenance costs over time.

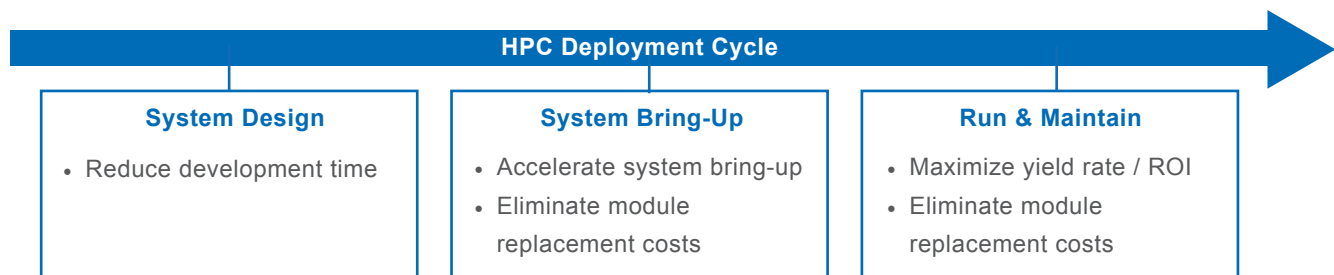


Figure 2. Zefr Benefits in the HPC Deployment Cycle

3. Operational Stability and Scalability

Continuous Operation: Penguin Computing's data centers require components that can operate continuously without failure. Reliable memory is designed to meet these demands, supporting 24/7 operations and ensuring stable performance under varying loads.

Scalability: As Penguin Computing expands its data center capabilities, the need for scalable solutions becomes crucial. Reliable memory can easily integrate into existing infrastructures, allowing for seamless scaling to meet increasing data demands.

4. Contribution to Sustainability Goals

Support for Green Initiatives: By minimizing the need for frequent replacements, reliable memory solutions support green initiatives and help Penguin Computing achieve their sustainability targets.

5. Innovation and Time-to-Market

Accelerated Innovation: By leveraging Zefr Memory, Penguin Computing enables its clients to bring solutions to market faster by reducing the deployment cycle. With the reduction of bring-up issues associated with memory failures, a typical deployment can be reduced from 12 months to 6 months. This is particularly beneficial for industries needing to ramp up their operations quickly to meet processing and analysis needs in areas such as finance, healthcare, and scientific research.

6. Manufacturing Efficiency Improvements

Reduced Troubleshooting Time: By implementing Zefr high-reliability memory in their server builds, Penguin Computing has significantly increased their manufacturing efficiency. The use of Zefr Memory has dramatically reduced the number of non-functional servers due to memory failures, leading to a substantial decrease in troubleshooting time and resources.

Streamlined Production Process: With fewer memory-related issues to address, Penguin's production line can operate more smoothly and efficiently. This improvement allows for faster throughput and reduced production bottlenecks, ultimately leading to quicker delivery times for customers.

7. Cost Savings in Contract Manufacturing

Reduced Debug Time and Costs: In scenarios where contract manufacturers (CMs) are responsible for producing functional Printed Circuit Board Assemblies (PCBAs), the use of Zefr Memory offers significant advantages. Typically, CMs are allowed to invoice for debug time when issues arise. By incorporating Zefr high-reliability memory, the debug time and associated costs are dramatically reduced.

Improved CM Relationships: The reduction in debug time not only saves costs but also improves relationships with contract manufacturers. With fewer issues to resolve, both parties can focus on optimizing other aspects of the manufacturing process, leading to a more productive partnership.

8. OEM Operational Efficiency

Direct Impact on Bottom Line: For Original Equipment Manufacturers (OEMs) who perform final assembly, failing memory components have a direct negative impact on their operational efficiency and expenses. The implementation of Zefr Memory significantly reduces these failures, resulting in:

- Decreased assembly line downtime
- Reduced labor costs associated with troubleshooting and replacing faulty components
- Improved overall product quality and reliability

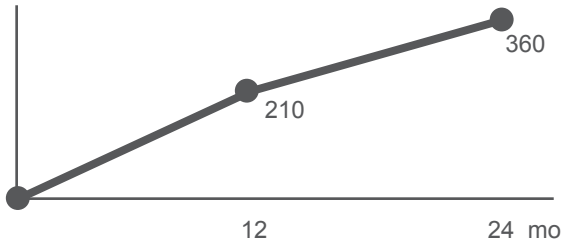
Enhanced Customer Satisfaction: By minimizing memory-related issues, OEMs can deliver more reliable products to their customers. This improvement in product quality leads to higher customer satisfaction, potentially reducing warranty claims and support costs.

System



- HPC System intergrator
- Energy Analysis Application
- 1 Cluster with 1,532 Nodes
- Twelve(12) 16GB RDIMMs per Node
- Two Identical Project Builds

Standard RDIMMs



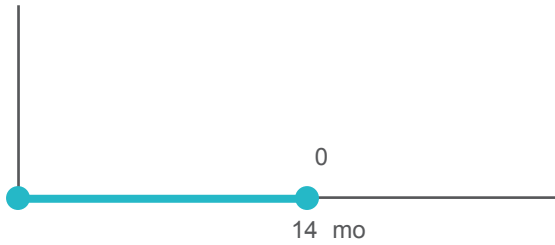
Purchase 18,384 Standard RDIMMs

Build Cluster A:

Standard OEM Memory Processing
 1,532 Nodes, 16GB RDIMMs per Node
 18,384 Standard RDIMMs Installed

Field Failures since Platform Bring up: 306 Failures

Zefr RDIMMs



Purchase 18,384 Zefr RDIMMs

Build Cluster B:

Zefr Memory Processing (**Rejected 500+ RDIMM**)
 1,532 Nodes, 16GB RDIMMs per Node
 18,384 Zefr RDIMMs Installed

Field Failures since Platform Bring up: 0 Failures

Figure 3. HPC deployment Zefr case study

9. Quantifiable Benefits

Metric	Without Zefr Memory	With Zefr Memory	Improvement
Server build time	120 minutes	90 minutes	25% reduction
Troubleshooting time per week	20 hours	5 hours	75% reduction
Memory-related RMA rate	5%	0.5%	90% reduction

Table 1. The impact of using Zefr Memory

These improvements in manufacturing efficiency, cost savings, and operational efficiency demonstrate the significant value that Zefr Memory brings to Penguin Computing's high-performance computing cluster deployments.

Conclusion

The integration of highly reliable Zefr memory in Penguin Computing's high-performance computing cluster deployments offers significant benefits in terms of performance, cost savings, data integrity, operational stability, and sustainability. As Penguin Computing continues to evolve and expand, investing in reliable memory solutions will be crucial in maintaining their competitive advantage and meeting the growing demands of the digital economy.



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