Power System Reliability Modeling: A Step Toward Resilient Data Centers

Infineon's Power System Reliability Modeling enhances power reliability in data centers by enabling real-time power supply monitoring, predictive maintenance, and lifetime estimation from component to system level

by Miroslav Milovanovic, published on wevolver.com

Data centers form the backbone of countless digital services, from cloud computing to artificial intelligence (AI). However, as data center infrastructures scale up, they face an increasing number of challenges. First, the rapid adoption of AI is accompanied by significant growth in data volume and increased computing requirements. By 2025, data volume is expected to reach 180 zettabytes, compared to 15 zettabytes in 2015. Additionally, the demand for computing power has been doubling every 3.4 months since 2012 to train cutting-edge AI models. This continuous increase in computational power directly impacts electricity consumption, with AI data centers expected to account for up to 7% of global electricity demand by 2030.

Another significant challenge related to data center infrastructure is power failure. Power shortages in data centers can lead to costly downtimes, data loss, and even equipment damage. To prevent power failures, ensuring power reliability is a critical concern. In response to the demand for stable power supplies, Infineon has introduced its Power System Reliability Modeling (PSRM), a comprehensive solution aimed at enhancing power reliability and reducing the likelihood of outages in data centers and telecom infrastructure by empowering customers accessibility to in-field power supply real-time data.

This article will delve into the importance of PSRM and how it could transform data centers companies interpretation of reliability in power, leading to cost savings, improved sustainability and increased resiliency.

The Growing Power Demand and Risk in Data Centers

Data centers house thousands of servers, networking devices, and other critical systems, consuming vast amounts of electricity. As technologies like AI, machine learning, and neural networking advance, the demand for more computational power grows exponentially. The increasing power density in data centers amplifies the risk of power interruptions. Even a brief outage can disrupt services, potentially affecting millions of users and costing companies significant amounts of revenue. Power inefficiencies also increase operational costs and elevate the carbon footprint of these facilities.

Given these risks, the ability to maintain uninterrupted power supply is paramount, and this is where Infineon's new PSRM comes into play.

What is Power System Reliability Modeling?

Infineon's Power System Reliability Modeling is a solution that combines hardware and software to enhance the reliability and efficiency of power supplies in data centers. It provides a comprehensive view of the entire power system and predicts potential points of failure before they occur. The solution strengths lie in its predictive maintenance enablement capabilities, enabling companies to address in-field issues before they lead to a failure or outage. By utilizing real-time monitoring of the mission profile of the power supply unit, it offers a dynamic understanding of the power supply's current health status and how it effects its long-term reliability.

The PSRM solution focuses on several core insights:

- **Real-time Power Monitoring:** mission profile logging features enable real time tracking of operating conditions of the power systems such as input voltage, output voltage, load current, and temperature. By modelling these parameters with component's FIT rate, we can assess reliability conditions based on the actual mission profile. This allows to anticipate anomalies or fluctuations that could indicate potential problems.

- **Lifetime Estimation:** By analyzing the mission profile over time, one can predict the operational lifespan of different power components, allowing operators to replace parts before they fail and balance the load in redundant systems, secure highly reliable system operations.

- **Predictive Maintenance:** The collected modelled data allows data center operators to carry out maintenance tasks and optimize fleet management operations based on actual performance data, rather than fixed schedules. Data-driven decisions can optimize operational efficiency and reduce unnecessary costs.

Benefits of Power System Reliability Modeling

Reduced Downtime and Operational Costs
One of the most significant advantages of implementing this solution in IT power distribution systems lies in enabling companies to use data to minimize unexpected downtimes and prevent disruptions in operations. Traditional maintenance models rely on reactive or periodic maintenance schedules, where issues are addressed only after they occur, or parts are replaced based on time intervals rather than actual wear and tear. In contrast, predictive maintenance models use real-time data and advanced analytics to anticipate failures, allowing for interventions based on the actual condition of components. By leveraging real-time data from the power supply units, the solution helps companies to ensure that potential problems are identified early, thus preventing power interruptions.

This predictive approach results in fewer power outages, lower operational costs, and increased system reliability. Data center operators no longer have to deal with the unpredictability of power-related issues, ensuring smoother operations and higher profitability.

Improved Energy Efficiency and Sustainability
Power reliability isn't just about preventing outages; it's also about optimizing power usage. With the insights provided with the help of Infineon's solution, data center providers can assess and optimize the energy efficiency of their power systems. This is particularly important in the context of sustainability, where data centers are under increasing pressure to reduce their environmental impact.

Hence, data centers can achieve higher energy efficiency by ensuring that their power systems are operating optimally, reducing waste and unnecessary power consumption. In a long run, lower energy use means lower carbon emissions, helping companies meet their sustainability goals while also cutting operational costs.

Enhanced System Reliability
Reliability modeling on the system level empowers customers' power supply operation and real-time monitoring capabilities. The solution will shed light on vital insights into the complete system health status and proactively allow optimization of its usage to extend the operational lifetime. By leveraging these capabilities, customers can manage their power supply systems based on system health, ensuring enhanced reliability and prolonged operational continuity for critical infrastructure. The key benefits of enhanced system reliability provided by the solution can be summarized as:

- Real-time system diagnostics to any power supply
- Powerful system reliability-centric value proposition
- Seamless integration into power designs through power controllers
- Easy usage

The Future of Data Center Power Management
Infineon's Power System Reliability Modeling is a crucial innovation at a time when data centers are becoming more integral to global infrastructure. With the rise of AI, cloud services, and the Internet of Things (IoT), the demand for reliable, efficient, and sustainable power systems is greater than ever. Infineon's solution directly addresses these needs, offering a way to enhance power system resilience while also reducing operational costs and environmental impact.

The introduction of PSRM underscores Infineon's commitment to providing cutting-edge solutions that go beyond simple component manufacturing.
By integrating hardware and software, the company offers a holistic approach to power system reliability modelling when designing the next gen of power supplies. Hence, it supports the increasingly complex needs of modern data centers manufacturers and users.

Conclusion

As data centers continue to expand in size and complexity, innovations like Infineon's Power System Reliability Modeling will be critical in ensuring that they remain resilient, profitable, and sustainable in the future. The solution enables real-time power supply health monitoring and lifetime estimation, helping to reduce downtime, maximize device usage, lower operational costs, and improve energy efficiency.

Finally, it should not be overlooked that Infineon offers a comprehensive array of additional solutions for AI data centers, covering everything from the grid to the core. The innovative technologies represent a significant step forward in addressing the power challenges, and the offered solutions are poised to redefine the way data centers operate.

www.infineon.com/reliabilitymodeling

Published by
Infineon Technologies AG
Am Campeon 1-15, 85579 Neubiberg
Germany

© 2025 Infineon Technologies AG.
All rights reserved.

Public

Date: 01/2025

Stay connected!

Scan QR code and explore offering
www.infineon.com

Please note!
This Document is for information purposes only and any information given herein shall in no event be regarded as a warranty, guarantee or description of any functionality, conditions and/or quality of our products or any suitability for a particular purpose. With regard to the technical specifications of our products, we kindly ask you to refer to the relevant product data sheets provided by us. Our customers and their technical departments are required to evaluate the suitability of our products for the intended application.

We reserve the right to change this document and/or the information given herein at any time.

Additional information
For further information on technologies, our products, the application of our products, delivery terms and conditions and/or prices, please contact your nearest Infineon Technologies office (www.infineon.com).

Warnings
Due to technical requirements, our products may contain dangerous substances. For information on the types in question, please contact your nearest Infineon Technologies office.

Except as otherwise explicitly approved by us in a written document signed by authorized representatives of Infineon Technologies, our products may not be used in any life-endangering applications, including but not limited to medical, nuclear, military, life-critical or any other applications where a failure of the product or any consequences of the use thereof can result in personal injury.