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Effective Simulation Data Management

Maximizing value from simulation data

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Effective management of simulation data in CAE environments

Simulation has become a cornerstone of modern product development, playing a vital role in the computer-aided engineering (CAE) process. As the volume and complexity of simulation data grow, managing this information efficiently is critical for ensuring innovation, quality, and speed in product development. This document explores strategies for realizing a secure and scalable IT platform, integrating ISV SDM software stacks in bespoke simulation IT landscapes.

Key objectives of simulation data management

Managing simulation data in CAE environments focuses on:

- **Optimized data usage**: Ensuring simulation data, models, and results are accessible and usable across projects and teams.
- **Improved organization**: Maintaining structured and traceable records of simulation processes and outputs over the product lifecycle.
- **Compliance**: Effective fulfillment of legal & regulatory requirements to enable digital-only product homologation and conformity assessment
- **Enhanced collaboration**: Facilitating seamless communication and data sharing among engineering teams.

Approaches to managing simulation data

Single Source of Data Truth

A Single Source of Data Truth (SSOT) ensures that all simulation data is unified and consistent, providing one authoritative version accessible to all stakeholders. This guarantees transparency, traceability, and alignment throughout a project lifecycle.

Even if the technical setup is decentralized, such as in a follow-the-sun model, data from all locations synchronizes into this single trusted repository. This approach enables seamless collaboration across time zones while maintaining data quality and accelerating decision-making.

Integrating simulation data with broader processes

Linking simulation data to other CAE and product lifecycle management (PLM) tools enhances alignment between simulation results and overall project objectives. This integration also enables advanced reporting and analytics capabilities.

Automation and standardization

Standardizing workflows for data input, simulation execution, and result storage reduces errors and improves consistency. Automation helps streamline repetitive tasks, enabling engineers to focus on innovation.

Technologies

SDM application stack
- SCALE
- PDTech
- Hexagon

PDM platform
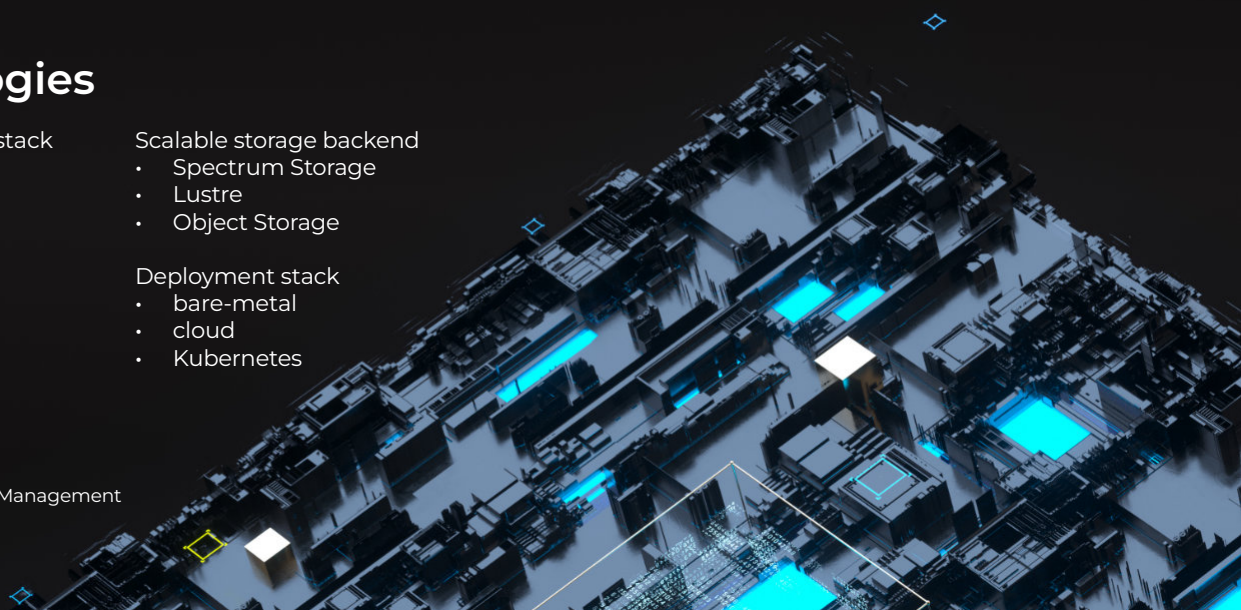- 3DX
- Teamcenter

Scalable storage backend
- Spectrum Storage
- Lustre
- Object Storage

Deployment stack
- bare-metal
- cloud
- Kubernetes

Challenges in SDM

Data and toolchain complexity
Integrating diverse file formats, data types and APIs used across tools and teams.

Scalability
Adapting management practices to accommodate ever-growing volumes of simulation data.

Data security
Ensuring sensitive data remains protected while enabling collaboration especially with external suppliers and in hybrid cloud scenarios.

Benefits of effective SDM

Higher efficiency
reducing time spent searching for and duplicating simulation data

Informed decisions
leveraging historical simulation data to improve design accuracy and performance

Risk mitigation
identifying potential issues early through better data accessibility and analysis

Cost savings
minimizing redundant simulations and optimizing resource utilization

Our Insights: Scalable Kubernetes solution with scale.SDM

Our solution, serving as the foundation for container-based CAE simulation data management, can be tailored to the specific needs and individual requirements of each customer situation. For one of our clients in the automotive industry, this is achieved using a "lightweight" Kubernetes distribution and open-source tools deployed on virtualized servers. This approach enabled the cost-efficient implementation of a highly available and scalable Kubernetes environment for simulation data.

As resource demands increase or requirements evolve, our solution facilitates a seamless transition to a fully supported Kubernetes platform on dedicated physical hardware or, alternatively, to a highly scalable, managed cloud environment, ensuring maximum flexibility and future-proofing.

Conclusion

Effective simulation data management is an essential aspect of the CAE environment, driving innovation, improving collaboration, and reducing costs. By adopting strategies that emphasize data accessibility, organization, and integration, engineering teams can fully leverage their simulation efforts to create superior products. With a strong focus on managing the complexities of simulation data, organizations can ensure a competitive edge in today's fast-paced industries.

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