Engineering modeling is gaining renewed energy with the release of SysML 2

Omdia view

Summary

The world of systems modeling has been infused with renewed interest, as generative artificial intelligence (AI) and large language models (LLMs) disrupt the world of software development and bring model-based software development tools into the mainstream. Omdia recently assessed tools in the AI-assisted software development market and found that modeling-based systems dominate the application development (AppDev) platforms category. In engineering manufacturing, model-based systems engineering (MBSE) is a standard technology approach used during the last couple of decades to help build complex systems—particularly in safety-critical, highly regulated sectors, such as aerospace, defense, and automotive. Systems Modeling Language (SysML) is the most widely used modeling language in this community; its owner, the Object Management Group, released version 2 of the specification in late 2024. Engineering companies using this technology have brought new energy to SysML, as AI technology has focused attention on modeling as a way to reduce complexity and accelerate R&D.

Modernizing the open standard SysML

Since the first version of SysML launched in 2005, there has been progress across the board in technology used to support the research, development, and manufacture of complex engineering systems. SysML needed to keep pace with evolving technology, and the release of version 2 stems from engineering companies taking a renewed interest in MBSE. Some of the world's largest engineering companies have

contributed to the new specification, including Airbus, Boeing, and Lockheed Martin. Support from the tools community will ensure that SysML 2 gains adoption; this includes IBM, Dassault, Intercax, Mgnite, PTC, Siemens, Sparx Systems, and Vitech.

The key features of SysML 2 are summarized below:

- The introduction of a new metamodel for semantics, the Kernel Modeling Language (KerML), adds greater precision when defining complex systems.

- The switch away from Unified Modeling Language (UML), which has certain weaknesses, toward rigorous formal semantics; this adds greater model precision and enables automated reasoning and formal verification, paving the way for the use of AI.

- Unlike in version 1, support for both text and graphical syntax is provided; this allows engineers to choose their preferred style, though textual notation is better for scripting and automation.

- Easier learning of SysML through the introduction of concepts such as namespaces, part definitions, and usage elements.

- Improved interoperability (i.e., model interchange), which has been one of the biggest frictions holding back MBSE, as players in the market try to lock in their customers. With version 2, the Systems Modeling API and Services enables standardized access to models across different tools. If the community adheres to this standard, it will drive the market to greater adoption of MBSE.

- New support for modeling time-based variability, which allows engineers to represent systems that evolve over time, thereby modeling adaptive systems such as autonomous vehicles and Internet of Things (IoT) ecosystems.

- Support for modeling cyber-physical systems and digital twins, integrating sensing, actuation, and simulation. Virtual twins are now a standard approach in manufacturing and robotics.

- Future-proofing through modular architecture and the adoption of open source, which allows SysML to better evolve with technological advances.

Hedley Apperly is vice president of Products at PTC and a member of the Object Management Group (OMG) board of directors. He shares his perspective: "SysML 2 marks a milestone in the evolution of model-based systems engineering, reflecting the industry's need for greater precision and interoperability in complex product development. The standard is the result of deep collaboration among leading engineering companies and tool vendors, including PTC. As part of the OMG Board, I'm proud to support this advancement, which aligns with our vision for connected, cross-discipline engineering."

Conclusion

The renewed focus on modeling has been energized in part by the pace of disruption in the area of AI-assisted software development, where model-based tools are prominent. Many new features in SysML 2 support greater automation, and this will help AI technology to enhance MBSE.

SysML 2 also reflects the realization that the engineering community is better served through the adoption of open standards, and the emphasis on interoperability and model interchange is significant. If the vendor community supports this approach, it will enhance the adoption of MBSE, as well as help to improve safety and quality in complex systems.

Appendix

Further reading

Omdia Universe: No-Low-Pro AppDev Platforms, 2025 (May 2025)

Omdia Universe: No-Low-Pro IDE Assistants, 2025 (May 2025)

Omdia Universe: Regulated Software Lifecycle Management, 2024 (July 2024)

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