

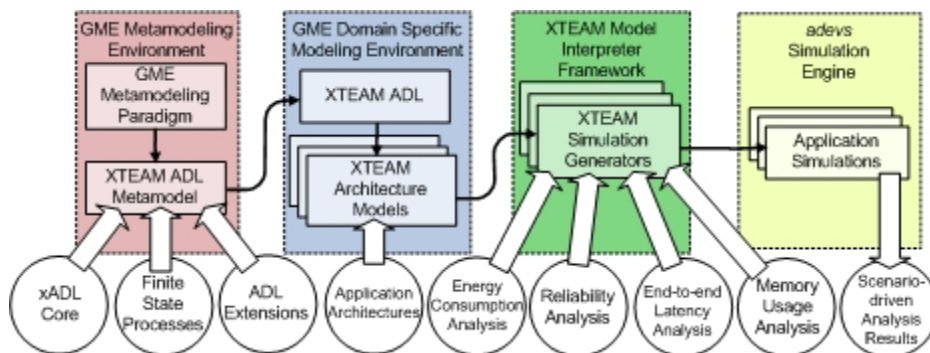


## The eXtensible Tool-chain for Evaluation of Architectural Models

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**Overview:** The eXtensible Tool-chain for Evaluation of Architectural Models (XTEAM) implements a model-driven engineering (MDE) approach to software architecture that combines extensible modeling languages based on architectural constructs with a model interpreter framework that enables rapid implementation of customized dynamic analyses at the architectural level. XTEAM consists of a suite of architecture description language (ADL) extensions and model transformation engines targeted specifically for highly distributed, resource-constrained, and mobile computing environments. XTEAM model transformations generate system simulations that provide a dynamic, scenario- and risk-driven view of the executing system. XTEAM provides the extensibility to easily accommodate both new modeling language features and new architectural analyses.

**Technical Description:** Using a meta-programmable modeling environment, GME, we created the XTEAM ADL by composing a structural ADL, the xADL Core, with a behavioral ADL, FSP. With this language basis, we implemented the XTEAM model interpreter framework, which provides the ability to generate simulations of application architectures that execute in the *adevs* discrete event simulation engine. We then enhanced the XTEAM ADL with domain-specific language extensions that capture system characteristics relating to energy consumption, reliability, latency, and memory usage. Finally, we utilized the extension mechanisms built into the model interpreter framework in such a way as to generate simulations that measure, analyze, and record the properties of interest.



### Purpose:

- **Providing Design Rationale**

The XTEAM approach to software architecture provides a means of experimentation with fundamental design decisions and the rationalization of those decisions through quantifiable means. By generating and executing simulations of a distributed system, the consequences of crucial architectural choices can be better understood.

- **Weighing Architectural Trade-offs**

Nearly all non-trivial architectural decisions come down to trade-offs between multiple desirable properties. Rather than relying solely on intuition or past experience to achieve the right balance, XTEAM allows an architect to determine the relationships between various design goals and increase system utility experimentally.

- **Understanding Compositions of Off-The-Shelf Components**

XTEAM can produce accurate measurements of the emergent properties of a system assembled from components produced by independent teams or organizations. This knowledge ultimately enhances the architects' understanding of the system and increases their confidence in the ability of the composed system to meet end-user operational goals.