The eXtensible Tool-chain for Evaluation of Architectural Models

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The eXtensible Tool-chain for Evaluation of Architectural Models (XTEAM) is a software architecture modeling environment and analysis framework for highly distributed, resource-constrained, and mobile software systems. XTEAM implements a model-driven engineering (MDE) approach to software architecture by combining extensible architectural modeling languages with model transformation engines that generate simulations of a software system. XTEAM simulations measure, record, and analyze critical system properties (such as reliability, performance, and resource consumption) to provide a dynamic, scenario- and risk-driven view of an executing system. XTEAM provides the extensibility to easily accommodate both new modeling language features, such as domain-specific concepts and constraints, and customized architectural analysis techniques.

- **Weighing Architectural Trade-offs**
  Nearly all non-trivial architectural decisions come down to trade-offs between multiple desirable properties, and software architects are expected to engineer the right balance between conflicting goals. Emphasizing one attribute over others will eventually yield diminishing returns, and usually this “tipping-point” between different qualities is anything but obvious. XTEAM 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.

- **Understanding Assemblies of Off-The-Shelf Components**
  In the present day, independent teams or organizations are often responsible for producing components that are ultimately assembled to create a unified system. In such settings, detailed information about individual components (e.g., resource consumption and failure rates) may be available, but the properties of their assembly may not be well-understood. In such a case, XTEAM can produce accurate measurements of the emergent properties of the composed system and exposed system behaviors that result from subtle interactions among components.

- **Incremental System Validation**
  In large-scale development projects, component implementations often become available in a incremental fashion. XTEAM takes advantage of this situation by allowing an architect to transparently substitute the implementation of an individual component for its simulated counterpart in an XTEAM simulation. This has two important consequences: (1) the accuracy of the analysis provided by the simulation is increased, and (2) the component implementation can be easily tested for conformance to its behavioral model in a wide variety of operational scenarios.