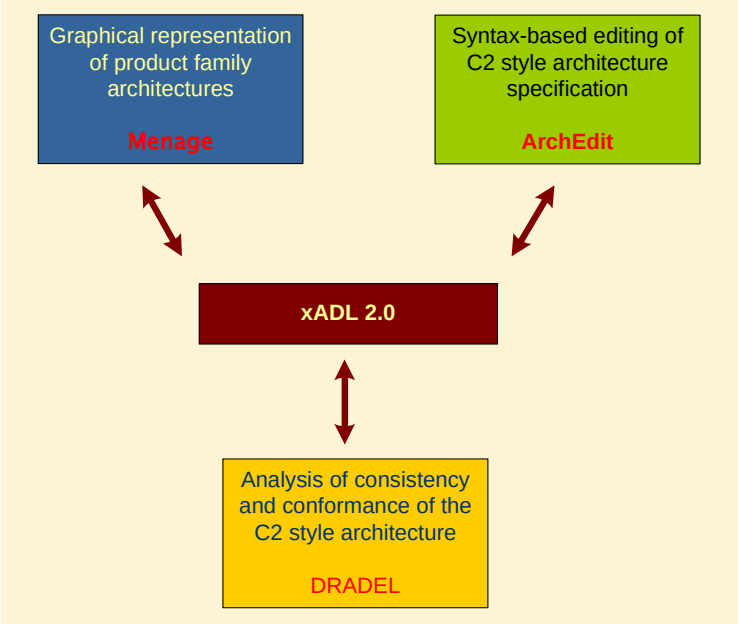
Mae
Managing Architectural Evolution

Software architecture has proven to be an effective mechanism for developing large-scale, complex software systems. As such systems evolve, so do their architectures. Configuration management (CM) techniques have traditionally focused on capturing the evolution of a system's implementation-level artifacts, but have not been applied to artifacts at the architectural level.

USC-CSE and UCI-ISR have developed a technique, along with a supporting toolset, to formally specify, analyze, and evolve software architectures. Using an extensible notation, we are capable of modeling architectures of software product families, and then analyzing, evolving, and automatically generating implementation-level artifacts from the architectural model.

The major goals of this work are:

- simplicity, formality, and extensibility of architectural descriptions of product families
- architectural-level configuration management
- consistency analysis gauges
- flexibility and precision in architectural evolution
- architect's discretion in interpreting the analysis results



Mae's conceptual architecture

To achieve these goals, USC-CSE and UCI-ISR have developed ***Mae***, an integrated environment enabling:

CM at the architectural level

- generic system model combining architectural concepts with those of configuration management
- support for versions, variants, configurations, and optionality
- support for components, connectors, and interfaces and their evolution using subtyping techniques
- integration of versioning and subtyping information that enables Mae to suggest candidate versions of artifacts to replace an existing one
- component evolution via heterogeneous subtyping

Extensible support for architectural specification

- XML-based architectural specification based on UCI-ISR's xADL 2.0 modeling language
- customizable framework independent of architectural style
- rigorous, but flexible type conformance rules

Style-neutral modeling and design

- simple, extensible implementation infrastructure supporting user-defined architectural styles

System generation

- enabled by our implementation infrastructure
- system partially generated directly from architecture
- reduces new implementation effort by up to 50%

Mae is a seamless integration of USC-CSE and UCI-ISR architecture technologies:

USC's DRADEL:
- architectural modeling, analysis, evolution, and implementation
- based on UCI-ISR's xADL2.0 technology

UCI's Ménage:
- managing evolving product line architectures
- defining product line architectures based on variation
- architectural differencing and merging to compare families of architectures

UCI's ArchEdit:
- an Archstudio 3.0 component, enabling the Mae user to edit an architectural specification using a syntax-based editor

UCI's xADL 2.0:
- common internal representation for all the modeling and analysis needs
- extensible and customizable for different styles

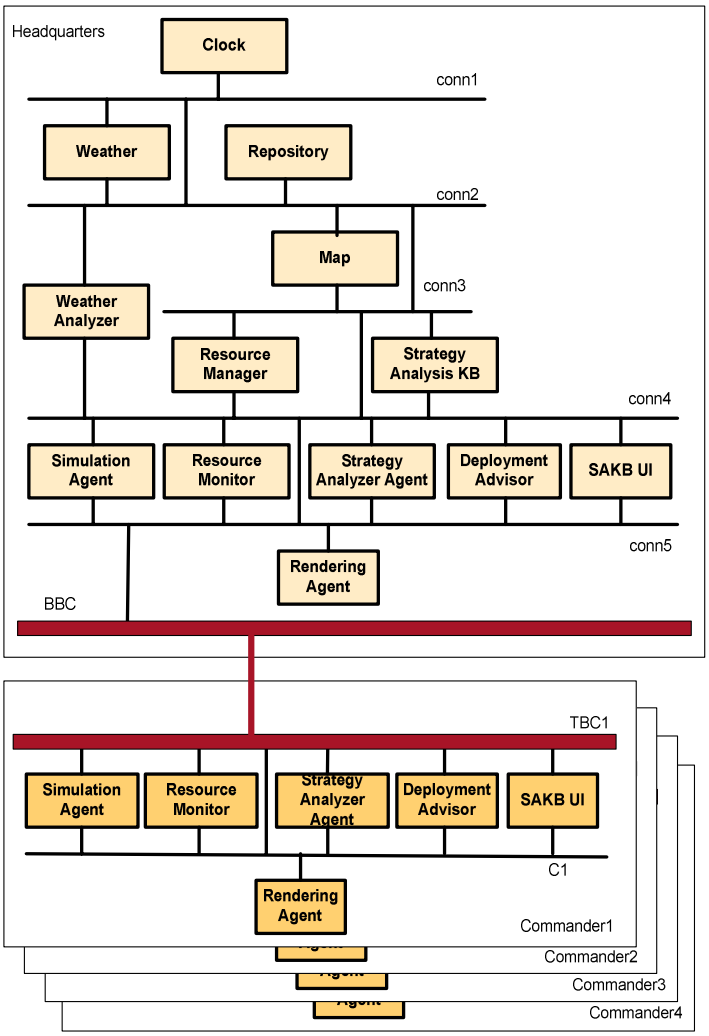


Figure A

Figure A below depicts the architecture of an example application architected and designed in Mae environment. Troops Deployment System (TDS) is a distributed application architected, modeled, analyzed and implemented at USC-CSE. Its deployment architecture consists of a headquarters and several commanders. The components communicate via asynchronous events.

Figure B displays the GUI of the Mae integrated environment. This includes the Mae main menu, Ménage's GUI front-end, ArchEdit's architecture editor and DRADEL's analysis.

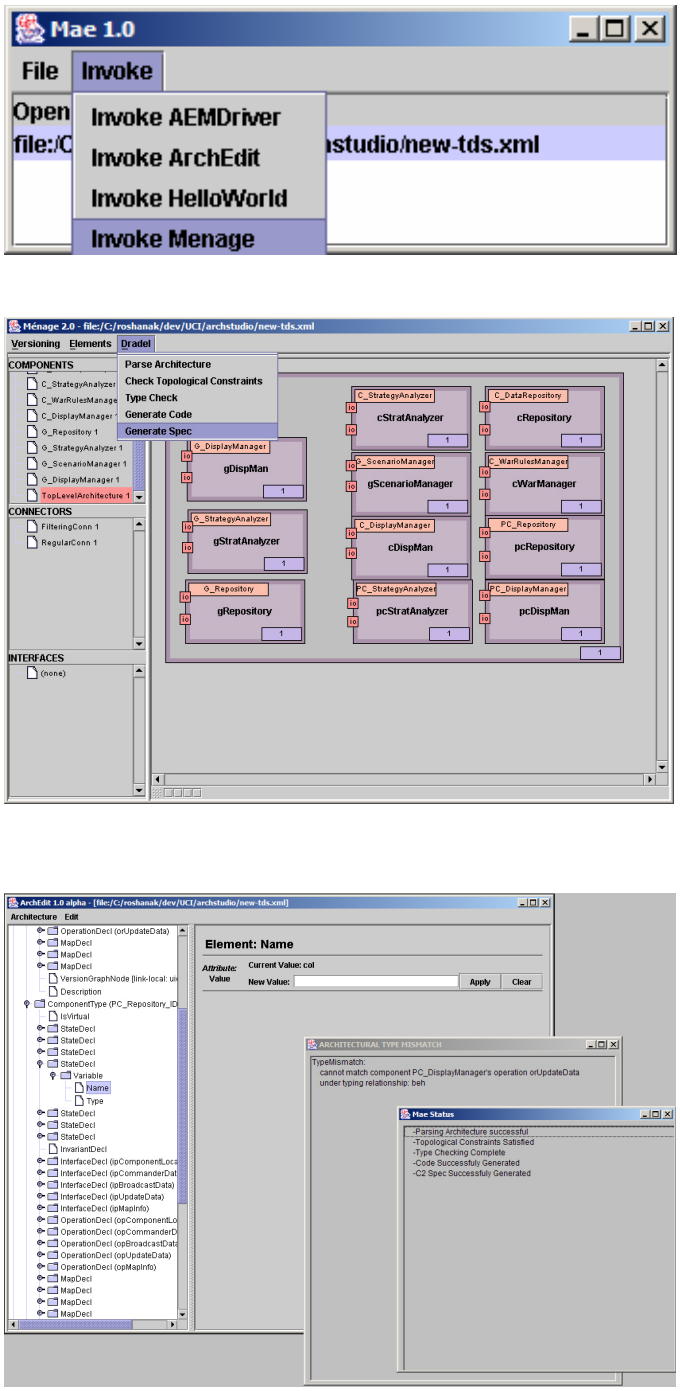


Figure B

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