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Abstract: Environmental modeling framework (EMF) design goals are multi-dimensional and often include many aspects of general software framework development. Many functional capabilities offered by current EMFs are closely related to interoperability and reuse aspects. For example, an EMF needs to support development productivity and interoperability with other modeling tools, protocols, and programming languages, thereby minimizing overall integration effort. Facilitating data exchange between modules, classes, or components representing parts of a whole model is also an essential EMF feature. In general, EMFs should enable flexible model development rather than enforce complex and rigid development concepts. Additionally, full-featured EMFs should enable module connectivity (and manage data exchange while considering the type and physical scale of geospatial objects), support conversion based on physical units, and account for the location of data in distributed computing environments. The Java Connection Framework (JCF) was developed in an attempt to improve upon various connectivity approaches in existing EMF architectures. This paper discusses key JCF design features (i.e., the Adapter which supports interoperability/reusability and facilitates a simple method for connecting components that allows fine grained parallelism, and the Context which is a robust data exchange design concept that facilitates the passing of data to components) and constraints, and illustrates numerous software engineering practices that have made JCF development and application straight-forward and practical. Framework design functionality is demonstrated through integration of the component-based AgroEcoSystem-Watershed (AgES-W) environmental model into the JCF. The key advancements in component interoperability, reusability, and connectivity as offered by the JCF (and presented herein) should be applicable and transferable to the environmental software development and modeling community in general.

Keywords: Environmental modeling framework; Model components; Software engineering; Java Connection Framework; Component interoperability and reusability.