

Boeing Complexity and Adaptability Metrics Tool Prototype

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The Complexity and Adaptability Metrics Tool Prototype was designed to use the weighted graph representation of candidate systems in the META design exploration process and compute the resultant calibrated complexity and adaptability metrics of the systems in consideration. To support the metrics analysis, the tool provides import capabilities, graph normalization and aggregation and the application of multiple metrics analysis algorithms analysis to derive the calibrated metrics. The tool supports integration with META design tools such as GME/CyPhyML as well as providing for direct input of artifacts to be analyzed. The tool has an open architecture to support future evolution and extension, including support for new input sources, new metric algorithms, new calibration results, and new metric consumers. Given the commonality of many of these features, and indeed some of the measures, a single tool prototype was created that implements both complexity and adaptability metrics.

The tool consists of three main elements that implement the core functionality of the tool. The central element is the graph store component. A SQL database is used to store the graph representations of design artifacts to which the metrics are applied, as well as the measures and metrics that are calculated by the metrics engines. The metrics engines comprise the second major element. These engines compute the various adaptability and complexity measures from graph representations of design artifacts, and the resulting complexity and adaptability functions that combine the measures according to the calibrated estimation functions. The third major element is the interface for extracting graphs from artifacts. The tool supports extracting graphs from a tool defined spreadsheet format (that was used to capture information from legacy design documents during the calibration process), and from models in CyPhyML, the META design language developed by Vanderbilt, via an interpreter for the GME-based CyPhyML editor.

The tool makes use of a number of COTS and/or open source tools at both build and execution time. These include Microsoft SQL Express 2008 r2 free SQL server, SQL client tools such as the Microsoft SQL Server Management Studio and Microsoft Data Access Components or the TOAD freeware tools, Microsoft Visual Studio, Mathworks MATLAB, and Microsoft Excel 2007. All of these dependencies are documented in the tool documentation. Open source alternatives for the SQL server and client tools, Excel, and MATLAB could be substituted if desired, though a degree of adaptation may be required.