images are then displayed on a Web page using customized JAVA scripts to display the appropriate zone of the orbiter based on the location of the user's cursor. The close-up graphic and database entry for that particular zone can then be seen by selecting the zone. This page contains links into the database to access the images used by the inspection engineer when they make the determination entered into the database. Status for the inspection zones changes as determinations are refined and shown by the appropriate color code.

This work was done by Sharon Goza and David L. Melendrez of Johnson Space Center, Marsha Hennigan of Jacobs Engineering, Daniel LaBasse of MEI Technologies, and Daniel J. Smith, consultant. Further information is contained in a TSP (see page 1). MSC-24484-1

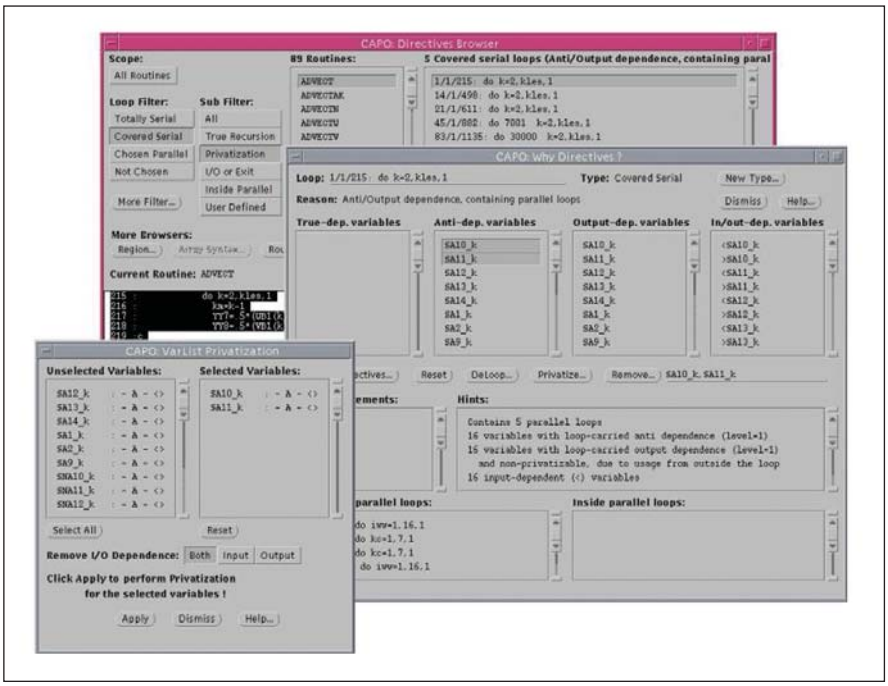
Computer-Aided Parallelizer and Optimizer

Ames Research Center, Moffett Field, California

The Computer-Aided Parallelizer and Optimizer (CAPO) automates the insertion of compiler directives (see figure) to facilitate parallel processing on Shared Memory Parallel (SMP) machines. While CAPO currently is integrated seamlessly into CAPTools (developed at the University of Greenwich, now marketed as ParaWise), CAPO was independently developed at Ames Research Center as one of the components for the Legacy Code Modernization (LCM) project. The current version takes serial FORTRAN programs, performs interprocedural data dependence analysis, and generates OpenMP directives. Due to the widely supported OpenMP standard, the generated OpenMP codes have the potential to run on a wide range of SMP machines.

CAPO relies on accurate interprocedural data dependence information currently provided by CAPTools. Compiler directives are generated through identification of parallel loops in the outermost level, construction of parallel regions around parallel loops and optimization of parallel regions, and insertion of directives with automatic identification of private, reduction, induction, and shared variables.

Attempts also have been made to identify potential pipeline parallelism (implemented with point-to-point synchronization). Although directives are generated automatically, user interaction with the tool is still important for producing good parallel codes. A comprehensive graphical user interface is included for users to interact with the parallelization process.



The **Main GUI** (Directives Browser) for CAPO.

The work was done by Haoqiang Jin of MRJ Technology Solutions for Ames Research Center. For further information, access http://people.nas.nasa.gov/~hjin/CAPO/index.html. ARC-14487-1

CCSDS Advanced Orbiting Systems Virtual Channel Access Service for QoS MACHETE Model

NASA's Jet Propulsion Laboratory, Pasadena, California

To support various communications requirements imposed by different missions, interplanetary communication protocols need to be designed, validated, and evaluated carefully. Multimission Advanced Communications Hybrid Environment for Test and Evaluation (MACHETE), described in "Simulator of Space Communication Networks" (NPO-41373), *NASA Tech Briefs*, Vol. 29, No. 8 (August 2005), p. 44, combines various tools for simulation and performance analysis of space networks. The MACHETE environment supports orbital analysis, link budget analysis, communications network simulations, and hardware-in-the-loop testing. By building abstract behavioral models of network protocols, one can validate performance after identifying the appropriate metrics of interest. The

innovators have extended the MACHETE model library to include a generic link-layer Virtual Channel (VC) model supporting quality-of-service (QoS) controls based on IP streams.

The main purpose of this generic Virtual Channel model addition was to interface fine-grain flow-based QoS (quality of service) between the network and MAC layers of the QualNet simulator, a commercial component of MACHETE. This software model adds the capability of mapping IP streams, based on header fields, to virtual channel numbers, allowing extended QoS handling at link layer. This feature further refines the QoS v existing at the network layer.

QoS at the network layer (e.g. diff-serv) supports few QoS classes, so data from one class will be aggregated together; differentiating between flows internal to a class/priority is not supported. By adding QoS classification capability between network and MAC layers through VC, one maps multiple VCs onto the same physical link. Users then specify different VC weights, and different queuing and scheduling policies at the link layer. This VC model supports system performance analysis of various virtual channel link-layer QoS queuing schemes independent of the network-layer QoS systems.

This work was done by Esther H. Jennings and John S. Segui of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.

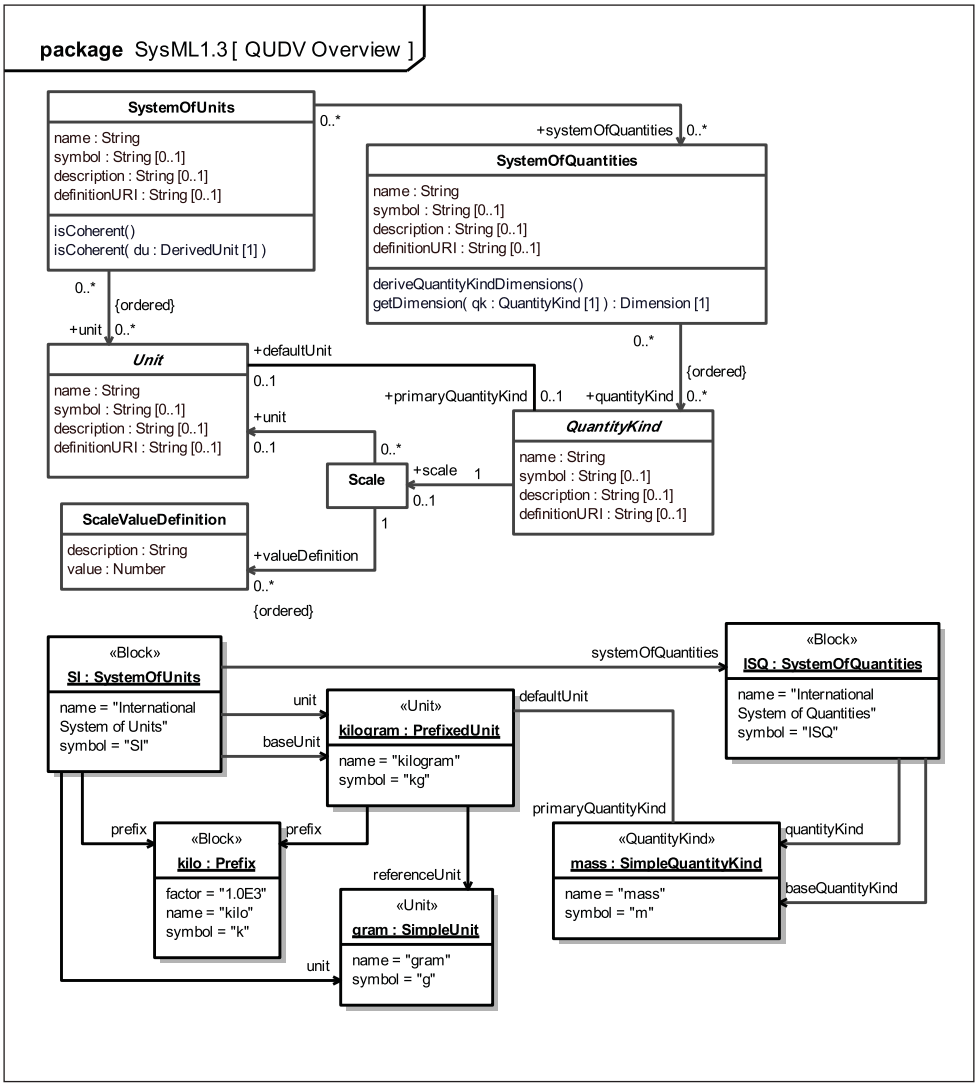
This software is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-47464.

Conceptual Model of Quantities, Units, Dimensions, and Values

NASA's Jet Propulsion Laboratory, Pasadena, California

JPL collaborated with experts from industry and other organizations to develop a conceptual model of quantities, units, dimensions, and values based on the current work of the ISO 80000 committee revising the International System of Units & Quantities based on the International Vocabulary of Metrology (VIM). By providing support for ISO 80000 in SysML via the International Vocabulary of Metrology (VIM), this conceptual model provides, for the first time, a standard-based approach for addressing issues of unit coherence and dimensional analysis into the practice of systems engineering with SysMLbased tools. This conceptual model provides support for two kinds of analyses specified in the International Vocabulary of Metrology (VIM): coherence of units as well as of systems of units, and dimension analysis of systems of quantities.

To provide a solid and stable foundation, the model for defining quantities, units, dimensions, and values in SysML is explicitly based on the concepts defined in VIM. At the same time, the model library is designed in such a way that extensions to the ISQ (International System of Quantities) and SI Units (Systeme International d'Unites) can be represented, as well as any alternative systems of quantities and units.



The key abstractions defined in the conceptual model of **Quantities, Units, Dimensions and Values** (QUDV) based on normative references in ISO 80000-1:2009, and an excerpt of its application for the SI Units and Quantities as defined in ISO 8000-1:2009, in NIST's Reference on Constants, Units and Uncertainty, and in the IEEE/ASTM American National Standards for Metric Practice SI-10™ 2010.