

riodic, on-demand, and user-specified information.

Periodic software information is derived mainly from the package managers used on each system. SWIM collects information from native package managers in FreeBSD, Solaris, and IRIX as well as the RPM, Perl, and Python package managers on multiple platforms. Because not all software is avail-

able, or installed in package form, SWIM also crawls the set of relevant paths from the File System Hierarchy Standard that defines the standard file system structure used by all major UNIX distributions. Using these two techniques, the vast majority of software installed on a system can be located. SWIM computes the same information gathered by the periodic

routines for specific files on specific hosts, and locates software on a system given only its name and type.

*This program was written by Paul Kolano of Advanced Management Technology for Ames Research Center. For further information, access <http://opensource.arc.nasa.gov/> or contact the Ames Technology Partnerships Division at (650) 604-2954. ARC-15469-1*

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## Σ Grid Task Execution

*Ames Research Center, Moffett Field, California*

IPG Execution Service is a framework that reliably executes complex jobs on a computational grid, and is part of the IPG service architecture designed to support location-independent computing. The new grid service enables users to describe the platform on which they need a job to run, which allows the service to locate the desired platform, configure it for the required application, and execute the job. After a job is submitted, users can monitor it through periodic notifications, or through queries.

Each job consists of a set of tasks that performs actions such as executing applications and managing data. Each task is executed based on a starting condition that is an expression of the states of other tasks. This formulation allows tasks to be executed in parallel, and also allows a user to specify tasks to execute when other tasks succeed, fail, or are canceled.

The two core components of the Execution Service are the Task Database, which stores tasks that have been submit-

ted for execution, and the Task Manager, which executes tasks in the proper order, based on the user-specified starting conditions, and avoids overloading local and remote resources while executing tasks.

*This program was written by Chaumin Hu of Advanced Management Technology for Ames Research Center. For further information, access <http://opensource.arc.nasa.gov/> or contact the Ames Technology Partnerships Division at (650) 604-2954. ARC-15529-1*

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## Σ Parallel-Processing Software for Correlating Stereo Images

*NASA's Jet Propulsion Laboratory, Pasadena, California*

A computer program implements parallel-processing algorithms for correlating images of terrain acquired by stereoscopic pairs of digital stereo cameras on an exploratory robotic vehicle (e.g., a Mars rover). Such correlations are used to create three-dimensional computational models of the terrain for navigation. In this program, the scene viewed by the cameras is segmented into subimages. Each subimage is assigned to one of a number of central processing units (CPUs) operating simultaneously. Be-

cause each subimage is smaller than a full image, the correlation process takes less time than it would if full images were processed on one CPU. Segmentation and parallelization also make the process more robust in that the smaller subimages present fewer opportunities for a correlation algorithm to "get lost" and thereby fail to converge on a solution. The effectiveness of this program has been demonstrated on several parallel-processing computer systems. Whereas correlation processing of a typ-

ical stereoscopic pair of test images on a single CPU was found to take on the order of one hour, parallel processing of the same images on a 16-CPU cluster was found to take about 3 minutes.

*This program was written by Gerhard Klimeck, Robert Deen, Michael McAuley, and Eric De Jong of Caltech for NASA's Jet Propulsion Laboratory.*

*This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-30631.*

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## Σ Knowledge Base Editor (SharpKBE)

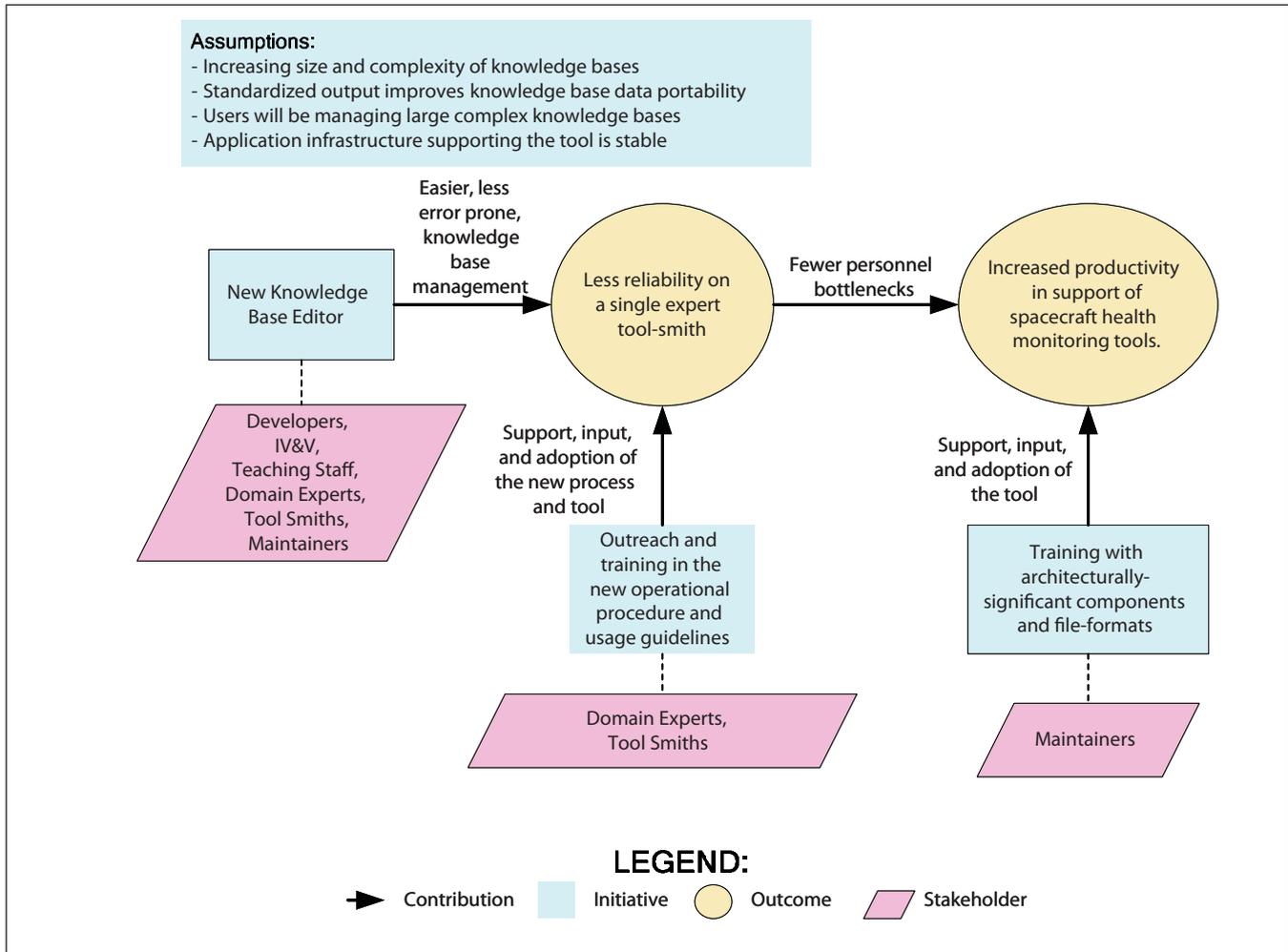
*NASA's Jet Propulsion Laboratory, Pasadena, California*

The SharpKBE software provides a graphical user interface environment for domain experts to build and manage knowledge base systems. Knowledge bases can be exported/translated to various target languages automatically, including customizable target languages.

The tool enhances current practices by minimizing reliance on toolsmiths for system workflow management, and also improves the quality and maintenance of those systems by reducing the number of errors within the knowledge bases. This tool's primary capability is in the

area of expert systems modeling, specifically where there is a need to capture and efficiently manage large quantities of domain information (see figure).

The SharpKBE supports C# and SHINE targets, and in concert with SHINE additionally produces C and



Benefits Chain Diagram

C++ targets. The knowledge base, which is created via graphical expression editors, is saved to a standardized XML document structure that is more flexible than previously existing formats, which were written in LISP-style syntax. This provides the user with intuitive mechanisms for viewing and modifying

knowledge bases (see example) as well as the ability to produce customized style sheets. The editor can support the auto-coding paradigm for fault detection systems in flight software applications with reduced cost.

*This program was written by Raffi Tikidjian, Mark James, and Ryan Mackey of Cal-*

*tech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*

*This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-44476.*

## Parallel Computing With Satellite Orbit Analysis Program

NASA's Jet Propulsion Laboratory, Pasadena, California

This software innovation speeds up the computation time of the Satellite Orbit Analysis Program (SOAP) tool by parallelizing the code using the message-passing interface (MPI) library. The speed increases almost linearly with the number of processors, allowing the per-study duration of the visualization and analysis of space missions to take place in hours, rather than overnight. The software can conduct a parametric study involving millions of design vec-

tors in a few hours of computational time by distributing the design scenarios among multiple processors. This allows SOAP to run in a parallel mode on JPL's new, high-performance computer cluster, which has 1024 Intel Xeon processors.

Parametric Study and Contours in SOAP were the first targets of parallelization. The two functions compute one or more variables over a given time period and become quickly com-

putationally intensive as report duration, time resolution, and variable complexity increase. The spatial and variable domains are sliced and distributed to each processor proportionally to its processing power. The result of the computation over the slice is collected at the end of the computation, and a single processor handles the file-writing task. Each space and variable domain contribution is completely independent so that message