Remote Asynchronous Message Service Gateway

The Remote Asynchronous Message Service (RAMS) gateway is a special-purpose AMS application node that enables exchange of AMS messages between nodes residing in different AMS “continua,” notionally in different geographical locations. JPL’s implementation of RAMS gateway functionality is integrated with the ION (Interplanetary Overlay Network) implementation of the DTN (Delay-Tolerant Networking) bundle protocol, and with JPL’s implementation of AMS itself. RAMS protocol data units are encapsulated in ION bundles and are forwarded to the neighboring RAMS gateways identified in the source gateway’s AMS management information base.

Each RAMS gateway has interfaces in two communication environments: the AMS message space it serves, and the RAMS network — the grid or tree of mutually aware RAMS gateways — that enables AMS messages produced in one message space to be forwarded to other message spaces of the same venture. Each gateway opens persistent, private RAMS network communication channels to the RAMS gateways of other message spaces for the same venture, in other continua. The interconnected RAMS gateways use these communication channels to forward message petition assertions and cancellations among themselves. Each RAMS gateway subscribes locally to all subjects that are of interest in any of the linked message spaces. On receiving its copy of a message on any of these subjects, the RAMS gateway node uses the RAMS network to forward the message to every other RAMS gateway whose message space contains at least one node that has subscribed to messages on that subject. On receiving a message via the RAMS network from some other RAMS gateway, the RAMS gateway node forwards the message to all subscribers in its own message space.

In this way, the RAMS protocol enables the free flow of published application messages across arbitrarily long, deep space links while protecting efficient use of those links: only a single copy of any message is ever transmitted on any RAMS network communication channel, no matter how many subscribers will receive copies when the message reaches its destination message space.

Note that the nature of the RAMS network communication channels depends on the implementation of the RAMS network. In order to communicate over the RAMS network for a given venture, each RAMS gateway must know the RAMS network location — an endpoint in the protocol used to implement the RAMS network (e.g., the DTN bundle protocol) — at which every other RAMS gateway for that venture receives RAMS network traffic. Again, this extension of the publish/subscribe model to interplanetary communications is invisible to application nodes. Application functionality is unaffected by these details of network configuration, and the only effects on behavior are those that are intrinsic to variability in message propagation latency.

This work was done by Shin-Yuan Wang of Caltech and Scott C. Burleigh of SBAR 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 Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-44048.

Automatic Tie Pointer for In-Situ Pointing Correction

The MARSAUTOTIE program generates tie points for use with the Mars pointing correction software “In-Situ Pointing Correction and Rover Microlocalization,” (NPO-46696) Software Tech Briefs, Vol. 34, No. 9 (September 2010), page 18, in a completely automated manner, with no operator intervention. It takes the place of MARSTIE, although MARSTIE can be used to interactively edit the tie points afterwards. These tie points are used to create a mosaic whose seams (boundaries of input images) have been geometrically corrected to reduce or eliminate errors and mis-registrations. The methods used to find appropriate tie points for use in creating a mosaic are unique, having been designed to work in concert with the “MARSTIE program to be most effective in reducing or eliminating geometric seams in a mosaic.

The program takes the input images and finds overlaps according to the nominal pointing. It then finds the most interesting areas using a scene activity metric. Points with higher scene activity are more likely to correlate successfully in the next step. It then uses correlation techniques to find matching points in the overlapped image. Finally, it performs a series of steps to reduce the number of tie points to a manageable level. These steps incorporate a number of heuristics that have been devised using experience gathered by tie pointing mosaics manually during MER operations. The software makes use of the PIG library as described in “Planetary Image Geometry Library” (NPO-46658), NASA Tech Briefs, Vol. 34, No. 12 (December 2010), page 30, so it is multi-mission, applicable without change to any in-situ mission supported by PIG.

The MARSAUTOTIE algorithm is automated, so it requires no user intervention. Although at the time of this reporting it has not been done, this program should be suitable for integration into a fully automated mosaic production pipeline.

This work was done by Robert G. Deen of Caltech for NASA’s Jet Propulsion Laboratory. For more information, contact inoffice@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-47083.

Jitter Correction

Jitter_Correct.m is a MATLAB function that automatically measures and corrects inter-frame jitter in an image sequence to a user-specified precision. In addition, the algorithm dynamically adjusts the image sample size to increase the accuracy of the measurement.

The Jitter_Correct.m function takes an image sequence with unknown frame-to-frame jitter and computes the translations of each frame (column and row, in pixels) relative to a chosen reference frame with sub-pixel accuracy. The translations are measured using a Cross Correlation Fourier transformation method in which the relative phase of the two transformed images is fit to a plane. The measured translations are then used to correct the inter-frame jitter of the image sequence. The function also dynamically expands the image sam-

Software
ple size over which the cross-correlation is measured to increase the accuracy of
the measurement. This increases the robustness of the measurement to variable
magnitudes of inter-frame jitter.

This work was done by Mordecai J. Waegell
and David M. Palacios of Caltech for NASA’s
Jet Propulsion Laboratory. For more informa-
tion, contact iaoffice@jpl.nasa.gov.

This software is available for commercial li-
censing. Please contact Daniel Broderick of
the California Institute of Technology at
danielb@caltech.edu. Refer to NPO-47215.

MSLICE Sequencing

MSLICE Sequencing is a graphical tool for writing sequences and integrating
them into RML files, as well as for producing SCMF files for uplink. When
operated in a testbed environment, it also supports uplinking these SCMF files
to the testbed via Chill.

This software features a freeform textual sequence editor featuring syntax
coloring, automatic content assistance (including command and argument
completion proposals), complete with types, value ranges, units, and descrip-
tions from the command dictionary that appear as they are typed. The sequence
editor also has a “field mode” that allows tabbing between arguments and displays
type/range/units/description for each argument as it is edited. Color-coded
error and warning annotations on problematic tokens are included, as well as
indications of problems that are not visible in the current scroll range. “Quick
Fix” suggestions are made for resolving problems, and all the features afforded
by modern source editors are also included such as copy/cut/paste, undo/redo,
as well as find-and-replace system optionally using regular expressions.

The software offers a full XML editor for RML files, which features syntax color-
ing, content assistance and problem annotations as above. There is a form-
based, “detail view” that allows structured editing of command arguments and se-
quence parameters when preferred. The “project view” shows the user’s “work-
space” as a tree of “resources” (projects, folders, and files) that can subsequently
be opened in editors by double-clicking.

Files can be added, deleted, dragged-dropped/copied-pasted between folders
or projects, and these operations are undoable and redoable.

A “problems view” contains a tabular list of all problems in the current work-
space. Double-clicking on any row in the table opens an editor for the appropriate
sequence, scrolling to the specific line with the problem, and highlighting the
problematic characters. From there, one can invoke “quick fix” as described above
to resolve the issue. Once resolved, saving the file causes the problem to be re-
moved from the problem view.

This work was done by Thomas M. Crockett,
Joseph C. Joswig, Khawaja S. Shams, Jeffrey S.
Norris, and John R. Morris of Caltech for NASA’s
Jet Propulsion Laboratory. For more informa-
tion, contact iaoffice@jpl.nasa.gov.

This software is available for commercial licen-
sing. Please contact Daniel Broderick of
the California Institute of Technology at
danielb@caltech.edu. Refer to NPO-47292.

EOS MLS Level 2

Data Processing Software

Version 3

This software accepts the EOS MLS cal-
librated measurements of microwave radi-
ances products and operational meteorological
data, and produces a set of estimates of atmospheric temperature and composition.
This version has been designed to be as flexible as possible. The
software is controlled by a Level 2 Configura-
tion File that controls all aspects of the
software: defining the contents of state
and measurement vectors, defining the
configurations of the various forward
models available, reading appropriate a
priori spectroscopic and calibration data,
performing retrievals, post-processing re-
sults, computing diagnostics, and out-
putting results in appropriate files.

In production mode, the software op-
erates in a parallel form, with one in-
stance of the program acting as a master,
coordinating the work of multiple slave
instances on a cluster of computers, each computing the results for individ-
ual chunks of data. In addition, to do
conventional retrieval calculations and
producing geophysical products, the
Level 2 Configuration File can instruct
the software to produce files of simul-
ated radiances based on a state vector
formed from a set of geophysical prod-
uct files taken as input. Combining both
the retrieval and simulation tasks in a
single piece of software makes it far eas-
ier to ensure that identical forward
model algorithms and parameters are
used in both tasks. This also dramatically
reduces the complexity of the code
maintenance effort.

This work was done by Nathaniel J. Livesey,
W. Van Snyder, William G. Read, Michael J.
Schwartz, Alyn Lambert, Michelle L. Santor,
Honghan T. Nguyen, Lucien Froidevaux,
Shuhui Wang, Gloria L. Manney, Dong L.
Wu, and Paul A. Wagner of Caltech;
Christina Vuu of Raytheon; and Hugh C.
Pumphrey of the University of Edinburgh for
NASA’s Jet Propulsion Laboratory. For more in-
formation, contact iaoffice@jpl.nasa.gov.

This software is available for commercial li-
censing. Please contact Daniel Broderick of
the California Institute of Technology at
danielb@caltech.edu. Refer to NPO-47221.

DspaceOgre 3D Graphics

Visualization Tool

This general-purpose 3D graphics vi-
sualization C++ tool is designed for visu-
alization of simulation and analysis data
for articulated mechanisms. Examples of
such systems are vehicles, robotic arms,
bio-mechanics models, and biomechanical
structures. DspaceOgre builds upon the
open-source Ogre3D graphics visualiza-
tion library. It provides additional classes
to support the management of complex
scenes involving multiple viewpoints and
different scene groups, and can be used
as a remote graphics server.

This software provides improved sup-
port for adding programs at the graphics
processing unit (GPU) level for im-
proved performance. It also improves
upon the messaging interface it exposes
for use as a visualization server.

This work was done by Abhinandan Jain,
Steven Myint, and Marc I. Pomerantz of
Caltech for NASA’s Jet Propulsion Labora-
tory. For more information, contact iaof-
face@jpl.nasa.gov.

This software is available for commercial li-
censing. Please contact Daniel Broderick of
the California Institute of Technology at
danielb@caltech.edu. Refer to NPO-47380.