

ISPATOM: A Generic Real-Time Data Processing Tool Without Programming

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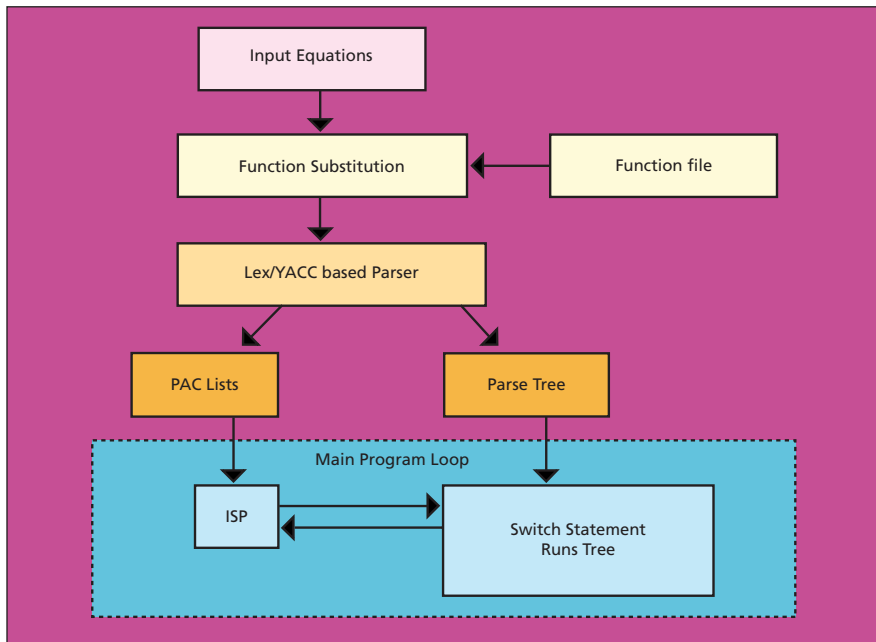
Information Sharing Protocol Advanced Tool of Math (ISPATOM) is an application program allowing for the streamlined generation of “comps,”

which subscribe to streams of incoming telemetry data, perform any necessary computations on the data, then send the data to other programs for display

and/or further processing in NASA mission control centers (see figure). Heretofore, the development of comps was difficult, expensive, and time-consuming: Each comp was custom written manually, in a low-level computing language, by a programmer attempting to follow requirements of flight controllers.

ISPATOM enables a flight controller who is not a programmer to write a comp by simply typing in one or more equation(s) at a command line or retrieving the equation(s) from a text file. ISPATOM then subscribes to the necessary input data, performs all of necessary computations, and sends out the results. It sends out new results whenever the input data change. The use of equations in ISPATOM is no more difficult than is entering equations in a spreadsheet. The time involved in developing a comp is thus limited to the time taken to decide on the necessary equations. Thus, ISPATOM is a real-time dynamic calculator.

This work was done by Adam Dershowitz of United Space Alliance for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-23799



Overview of ISPATOM application flow structure.

Automated Diagnosis and Control of Complex Systems

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Livingstone2 is a reusable, artificial intelligence (AI) software system designed to assist spacecraft, life support systems, chemical plants, or other com-

plex systems by operating with minimal human supervision, even in the face of hardware failures or unexpected events. The software diagnoses the current state of the spacecraft or other system, and recommends commands or repair actions that will allow the system to continue operation. Livingstone2 is an enhancement of the Livingstone diagnosis system that was flight-tested onboard the Deep Space One spacecraft in 1999 (see figure). This version tracks multiple diagnostic hypotheses, rather than just a single hypothesis as in the previous version. It is also able to revise diagnostic decisions made in the past when additional observations become available. In such cases, Livingstone might arrive at an incorrect hypothesis.

Re-architecting and re-implementing the system in C++ has increased performance. Usability has been improved by creating a set of development tools

that is closely integrated with the Livingstone2 engine. In addition to the core diagnosis engine, Livingstone2 includes a compiler that translates diagnostic models written in a Java-like language into Livingstone2's language, and a broad set of graphical tools for model development.

This program was written by James Kurien, Christian Plaunt, Howard Cannon, Mark Shirley, and Will Taylor of Ames Research Center; P. Nayak of USRA-RACS; Benoit Hudson, Andrew Bachmann, Lee Brownston, Sandra Hayden, and Steve Wragg of QSS Group, Inc.; William Millar and Shirley Pepke of Caelum Research Corp.; Scott Christa of Aerospace Computing, Inc.; and Ray Garcia of Foothill-DeAnza Community College. For further information, access <http://opensource.arc.nasa.gov/> or contact the Ames Technology Partnerships Division at (650) 604-2954. ARC-14725-1



Artist's conception of the New Millennium Deep Space One Probe.