THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

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CINTEX
International Interoperability Extensions to EOSDIS

Final Report

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INTRODUCTION

The Information Technology and Systems Laboratory at the University of Alabama in Huntsville, under the direction of Dr. Sara J. Graves, and in cooperation with the ESDIS Project at GSFC, performed work under Cooperative Agreement NCC 5-140 from April 1996 through August 1997. ITSL drew on in-depth knowledge of the V0 IMS system, gained through long involvement with EOSDIS, in order to serve as a consultant to international data centers joining theV0 IMS network.

MAJOR ACCOMPLISHMENTS

A large part of the research under this cooperative agreement involved working with representatives of the DLR, NASDA, EDC, and NOAA-SAA data centers to propose a set of enhancements and additions to the EOSDIS Version 0 Information Management System (V0 IMS) Client/Server Message Protocol. Helen Conover of ITSL led this effort to provide for an additional geographic search specification (WRS Path/Row), data set- and data center-specific search criteria, search by granule ID, specification of data granule subsetting requests, data set-based ordering, and the addition of URLs to result messages. After these message extensions were proposed, the entire V0 IMS team participated in the review process prior to beginning implementation. While the message extensions were developed in response to CINTEX and EOSDIS V0 data center requirements, they have also been valuable in the ongoing development of a V0-based data search and order system for TRMM. The new message set was baselined in April 1997, though some minor updates have been required during implementation of the extended functionality in the IMS V0 Web Gateway and EOSDIS DAACs.

http://www-v0ims.gsfc.nasa.gov/documents/odl_extensions.html

The "V0 IMS Server Cookbook" is an evolving document, providing resources and information to data centers setting up a V0 IMS Server. Under this Cooperative Agreement, Helen Conover revised, reorganized, and expanded this document, and converted it to HTML. The "V0 IMS Server Cookbook" was published on the Web in October 1996. The current version (Sept. 1997) provides an overview of the EOSDIS V0 IMS, instructions for setting up a new IMS Server within the system, and links to supporting documentation, sample software, and related web pages.

http://harp.gsfc.nasa.gov/documents/Server-cookbook.html

Ms. Conover has also worked extensively with the IRE RAS data center, CPSSI, in Russia. She served as the primary IMS contact for IRE-CPSSI and as IRE-CPSSI's liaison to other members of IMS and Web Gateway (WG) development teams. Her documentation of IMS problems in the IRE environment (Sun servers and low network bandwidth) led to a general restructuring of the V0 IMS Client message polling system, to the benefit of all IMS participants. In addition to the IMS server software and documentation, which are generally available to CINTEX sites, Ms. Conover also provided database design documentation and consulting, order tracking software, and hands-on testing and debug assistance to IRE. In the final pre-operational phase of IRE-CPSSI development, she also supplied information on configuration management, including ideas and processes in place at the Global Hydrology Resource Center (GHRC), an EOSDIS data center operated by ITSL.

SUMMARY OF WORK

The major accomplishments listed above are part of a series of many and diverse tasks performed under this agreement, in the areas of requirements analysis, software development, and documentation.

Documentation

The first task for this project was to bring existing CINTEX documentation resources up to date. In addition to the extensive revisions to the "V0 IMS Server Cookbook", Ms. Conover reviewed and reorganized the CINTEX anonymous FTP site. She consolidated information that had been dispersed between two different FTP servers, removing or updating old documents in the process. In addition, she rationalized the directory organization of the site, and provided new documents where necessary. Many of the updated CINTEX documents refer to each other as appropriate, and the "V0 IMS Server Cookbook" contains an index and links to all CINTEX documentation.

When reviewing V0 IMS and CINTEX documentation, Ms. Conover discovered that V0 IMS Guide server documentation and configuration instructions were no longer available on any of the V0 IMS FTP or WWW sites. While Guide author information had been maintained, the technical information had not been needed since the original EOSDIS DAACs had initially installed guide servers. This documentation was needed, however, to install and configure Guide servers at the CINTEX sites. Ms. Conover initiated a search for the Guide server documentation, and it is once again being maintained in the V0 IMS Web space.

Software

Through its work with the MSFC DAAC and GHRC, EOSDIS data centers located at MSFC, ITSL has provided sample V0 IMS Server software to CINTEX for several years. Due to the ITSL's formal relationship to CINTEX under Cooperative Agreement NCC 5-140, the GHRC V0 IMS Server has become the default server software used by new CINTEX sites. Helen Conover provided several software updates to this V0 IMS sample server during the term of this cooperative agreement. In addition to routine upgrades developed for the GHRC V0 IMS Server and made available to CINTEX, she also fulfilled CINTEX-specific software requests:

- To facilitate semi-automated order processing at those CINTEX data centers that do not support the standard V0 IMS data order protocol, she provided a general "server side email order processing" module. While this module can easily be integrated into a GHRC-based server, documentation was provided to make its integration into any V0 IMS Server feasible.

- For all GHRC data sets, each data granule covers the same geographic area as the other granules in that data set. For this reason, the GHRC V0 IMS Server performs geographic searches at the data set level, but not at the data granule level. However, many CINTEX data centers do require a geographic search capability at the data granule level. To meet this need, Ms. Conover created a CINTEX version of the GHRC V0 IMS Server, which provides a granule level geographic search, and eliminates various other GHRC-specific dependencies.

- ITSL has also begun implementing some of the V0 message extensions in the CINTEX sample server. In particular, appropriate URLs can be returned in most of the result messages. During development of this feature, it was discovered that ODL, the language used for passing

messages between V0 IMS Clients and Servers, places limits on the length of "words", thus excluding all but very short URLs from the messages. The Server update is complete, but its release must be coordinated with the phased release of the ODL upgrade required.

In addition to providing software upgrades, Ms. Conover has produced a brief "debugging" guide for use when setting up an IMS Server at a new site. This guide, available on the CINTEX FTP site and through the "V0 IMS Server Cookbook", provides hints for using the debug mechanisms built into both the IMS Server and the Client/Server communication software.

A sample Oracle database has also been made available for CINTEX sites. By loading this database into an existing Oracle DBMS, a data center can easily create the tables expected by the IMS Server, and test a newly installed server for proper operation. The sample database also provides a guide for sites establishing their own IMS inventories. A data dictionary is provided as well, so that those data centers not using the Oracle DMBS have adequate documentation for configuring IMS Server database tables.

Requirements Definition and Consulting Services

A large part of the ITSL task has been assisting with the definition of requirements for extensions to the V0 IMS system. As is noted above, ITSL led the development of new and extended messages for V0 IMS Client/Server communication. Ms. Conover also worked with the V0 Web Gateway team and the GSFC, LaRC, and EDC DAACs to define requirements for the support of Landsat-7 and TRMM data within the V0 IMS.

Ms. Conover has also consulted with many international data centers as they join the V0 IMS network. She has provided guidance to CSIRO and BoM in Australia; CCRS in Canada; DLR, MARF, ESRIN, EURIMAGE, EUMETSAT, and the University of Dundee in Europe; NASDA in Japan; and IRE in Russia. She has also worked with the Web Gateway team on IMS Server issues such as the Server Test Plan, and both Client and Server "stub" software for testing.

Travel, Meetings, and Telecons

Helen Conover was an active participant in several regular telecons including CINTEX and IRE telecons on a monthly basis, V0 IMS developer telecons every 2 to 3 weeks, as well as telecons with TRMM developers and Australia's Bureau of Meteorology, scheduled as needed. She also made the following trips as part of her CINTEX work:

- 4/15/96 – Met with Yonsook Enloe and Jean Bedet at GSFC to review agenda and logistics for the upcoming IRE site visit, grant processing status, as well as general plans for ITSL work with CINTEX.

- 5/20-24/96 – Traveled to Moscow and Fryazino, Russia, as part of a NASA delegation. Her role was to assess IMS and database design status, and to provide database design advice and hands-on IMS server assistance to IRE.

- 7/30-8/1/96 – Attended the EOSDIS Version 0 IMS Developers meeting in Landover, MD, to present proposed extensions to the messages passed between IMS Clients and Servers. These

message modifications were proposed by new international partners in the Version 0 IMS, and proved be useful to the current DAACs as well.

- 9/15-17/96 - Committee On Earth Observation Satellites (CEOS) Joint Subgroup Meetings were held in Sioux Falls, South Dakota, September 15-20, 1996. Ms. Conover gave a presentation on "Proposed Extensions to IMS Client/Server Messages" at the CEOS Interoperability Extensions (CINTEX) Workshop on September 15.

- 12/17/96 – Met at GSFC with Yonsook Enloe and the IMS V0 Web Gateway development team to discuss enhancements to the Web Gateway required for support of the Landsat 7 data system.

- 1/28-29/97 – Attended the ECS Release B Client Review in Landover, MD.

- 2/10-11/97 - Attended a meeting in Greenbelt, MD, with a delegation from the IRE–CPSSI data center. We reviewed their development status and issues, and provided hands-on IMS assistance.

- 8/4-8/97 - Returned to Moscow and Fryazino, Russia, for an operational readiness review. Provided IRE with a list of requirements and recommendations for operational status.

Acronyms

BoM	Bureau of Meteorology
CCRS	Canadian Centre for Remote Sensing
CEOS	Committee on Earth Observation Satellites
CINTEX	CEOS Interoperability Extensions
CPSSI	Center of Processing and Storing the Space Information
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAAC	Distributed Active Archive Center
DBMS	Database Management System
DLR	Deutsche Forschungsanstalt fur Luft- und Raumfahrt
ECS	EOSDIS Core System
EDC	EROS Data Center
EOSDIS	Earth Observing System Data and Information System
ESDIS	Earth Science Data and Information System
ESRIN	European Space Agency's Center in Frascati, Italy
EUMETSAT	European Meteorological Satellite
EURIMAGE	European Image
FTP	File Transfer Protocol
GHRC	Global Hydrology Resource Center
GSFC	Goddard Space Flight Center
HTML	Hypertext Markup Language
IMS	Information Management System
IRE RAS	Institute for Radioengineering and Electronics, Russian Academy of Sciences
ITSL	Information Technology and Systems Laboratory
LaRC	Langley Research Center
MARF	Meteorological Archive Retrieval Facility
MSFC	Marshall Space Flight Center
NASDA	National Space Development Agency of Japan
NOAA-SAA	National Oceanic and Atmospheric Administration – Satellite Active Archive
ODL	Object Description Language
TRMM	Tropical Rainfall Measuring Mission
UAH	University of Alabama in Huntsville
URL	Uniform Resource Locator
V0	Version 0
WG	Web Gateway
WRS	World Reference System
WWW	World Wide Web