http://alliance.jpl.nasa.gov/

Name:
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Organization:
JPL
Project:
NASA PLANETARY DATA SYSTEM

Title:
A Model Driven Architecture for Cross-Discipline Data Access

Topic:
Future Technical Directions in Data Management

Abstract of Presentation:

The Planetary Data System (PDS) faces new challenges in managing and providing access to its increasingly large network of heterogeneous and geographically distributed subsystems. The PDS is exploring Object-Oriented Data Technology to support cross-discipline data access using a software component framework and a metadata driven implementation. This approach allows customers to locate data and access subsystems based on existing metadata descriptions. It also allows additional links between subsystems to be developed as data models evolve.

A Model Driven Architecture for Distributed Data Management

Steve Hughes
PDS System Engineer

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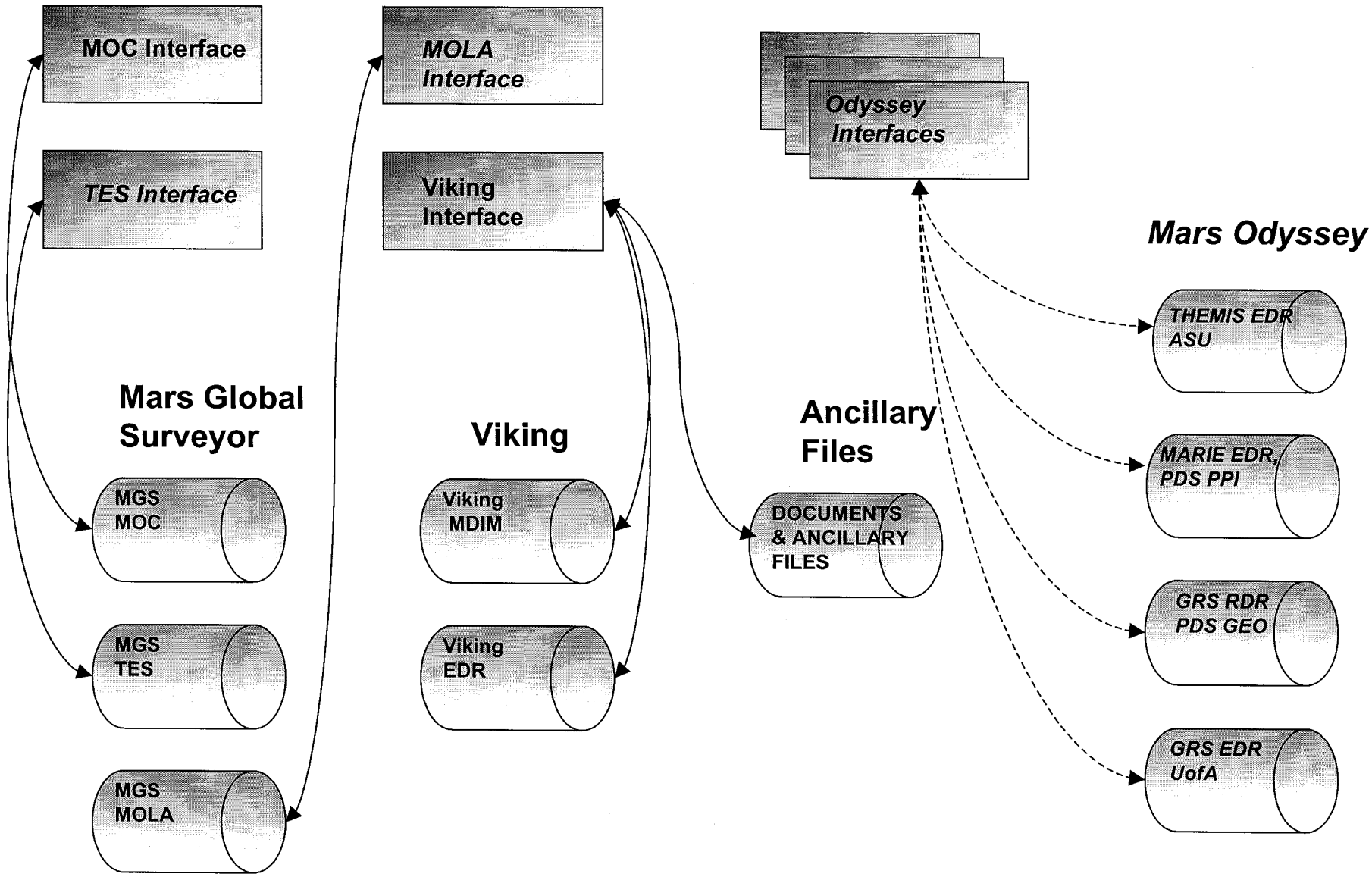
Problem Statement

- **Distributed Data Management and Access**
  - PDS needs an integrated view of all data in the PDS
  - Users need integrated spatial/temporal access to data distributed at geographically dispersed sites
  - Scientists need infrastructure support for science analysis and knowledge discovery

Independent Access to PDS Archives (e.g. Mars)



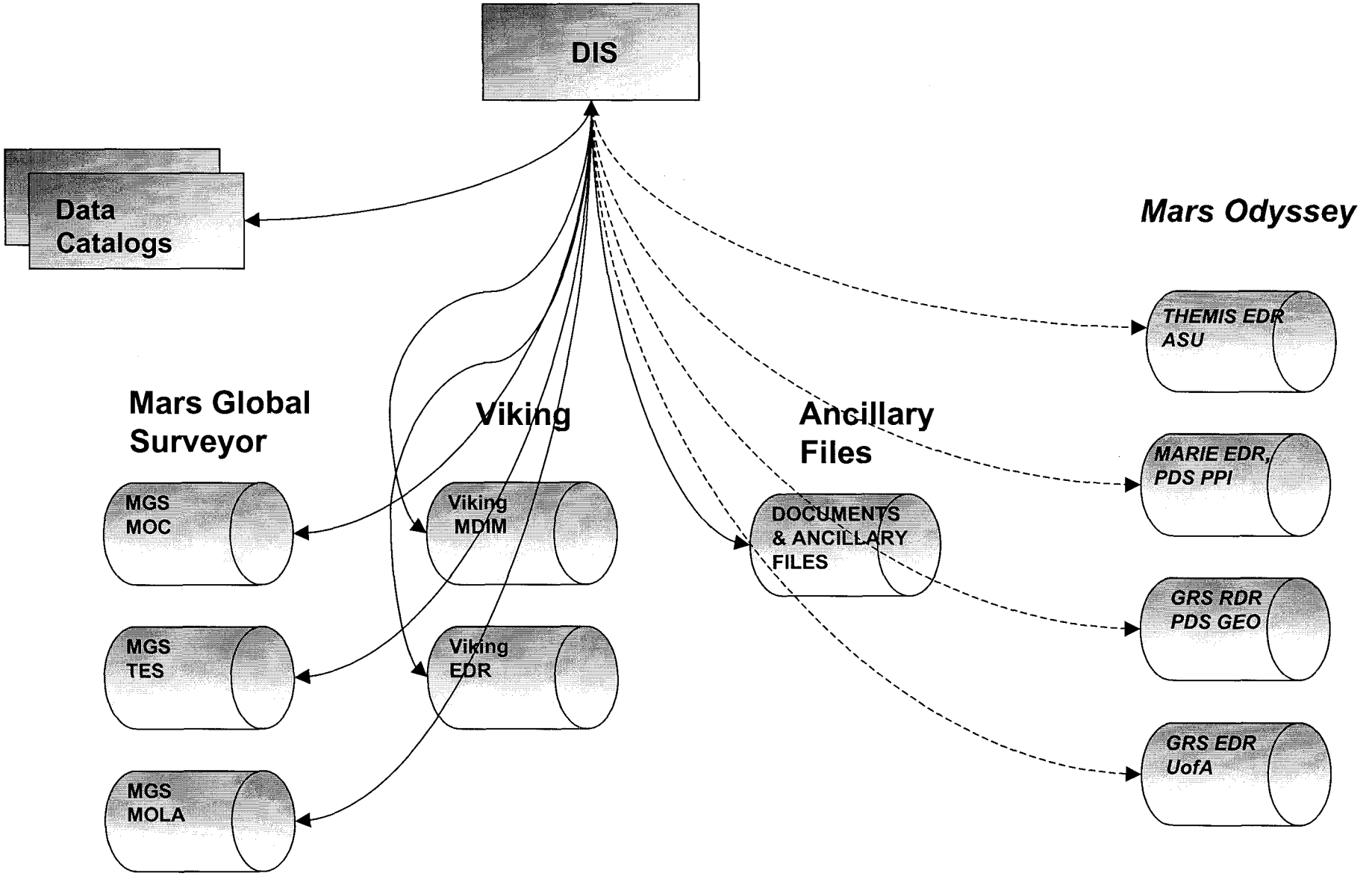
Current Approach (circa 1998)

- **PDS Distributed Inventory System (DIS)**
  - Identified all resources available across the PDS
  - Used Object Description Language (keyword/value) labels to describe data and non-data resources
  - Included URL/FTP links to all online resources
  - Used cgi-script engine to search label database
  - Displayed results in an HTML page

DIS Label

```
OBJECT = DATA_SET ;
 DATA_SET_NAME = VO1/VO2 MARS VISUAL IMAGING SUBSYSTEM DIGITAL IMAGING MODEL;
 DATA_SET_ID = VO1/VO2-M-VIS-5-DIM-V1.0;
 DATA_SET_DESC = http://pds.jpl.nasa.gov/cgi-bin/remote.pl?ds:VO1/VO2%2BMARS%...;
 DATA_SET_TERSE_DESC = http://pds.jpl.nasa.gov/cgi-bin/remote.pl?ds:VO1/VO2%2BM...;
 DATA_SET_RELEASE_DATE = 1991;
 LINK = http://www-pdsimage.wr.usgs.gov/PDS/public/mapmaker/mapmkr.htm;
 ARCHIVE_STATUS = ARCHIVED;
 ARCHIVE_STATUS_NOTE = Passed peer review with all liens resolved. Available through PDS and NSSDC;
 ARCHIVE_SCHEDULE_NOTE = 1999-08-18:ARCHIVED;
 DATA_OBJECT_TYPE = IMAGE;
 START_TIME = N/A;
 STOP_TIME = N/A;
 NODE_NAME = IMAGING;
 CURATING_NODE_ID = IMAGING;
 DATA_ENGINEER_ID = N/A;
 TARGET_NAME = MARS;
 TARGET_TYPE = PLANET;
 MISSION_NAME = VIKING;
 INSTRUMENT_HOST_NAME = VIKING ORBITER 1, VIKING ORBITER 2;
 INSTRUMENT_HOST_TYPE = SPACECRAFT;
 INSTRUMENT_NAME = VISUAL IMAGING SUBSYSTEM - CAMERA A, VISUAL IMAGING SUBSYSTEM - CAMERA B;
 INSTRUMENT_TYPE = VIDICON CAMERA;
 NSSDC_DATA_SET_ID = 75-075A-01F, 75-083A-01C;
 VOLUME_ID = VO_2001, VO_2002, ...;
 VOLUME_LINK = ftp://pdsimage.wr.usgs.gov/cdroms/vo_2001/, ftp://pdsimage.wr.usgs.gov/cdroms/vo_2002/, ...
 KEYVALUES = CAMERA, DIGITAL, DIM, IMAGING, MARS, MODEL, ORBITER, PLANET, SPACECRAFT, SUBSYSTEM,
     TABLE, VIDICON, VIKING, VIS, VISUAL, VO1, VO2, VO_2001, VO_2002, ...;
 LABEL_REVISION_NOTE = 2000-09-19 C:CN S:CN LN:AY:DN;
END_OBJECT;
```

DIS Links to Mars Archives



Lessons Learned

- Identified metadata as key to the solution
  - Identifies and describes data and resources
  - Provides search attributes
  - Helps determine whether query can be resolved by resource

- However
  - ODL is not a universal interchange language
  - Resource heterogeneity is still visible
  - Navigation and access is limited to http links
  - System interoperability is not supported

Next Generation DIS
XML/JAVA/CORBA (OODT)

- Use common interchange language
- Hide heterogeneity using encapsulation
- Allow communication between all components using message passing protocol
- Maintain system location independence
- Provide scaleable and extensible solution

XML Profile Example – Data Set


```
<profile>
   <profAttributes>
      <profId>1.3.6.1.4.1.1306.2.102</profId>
      <profType>profile</profType>
   </profAttributes>
   <resAttributes>
      <Identifier>VO1/VO2-M-VIS-5-DIM-V1.0</Identifier>
      <Title>VO1/VO2_MARS_VISUAL_IMAGING_SUBSYSTEM_DIGITAL...
      <Format>text/html</Format>
      <resContext>NASA.PDS</resContext>
      <resClass>data.dataSet</resClass>
      <resLocation>http://pdsproto.jpl.nasa.gov/catalog/dataset/Resultsds.CFM?...
   </resAttributes>
```

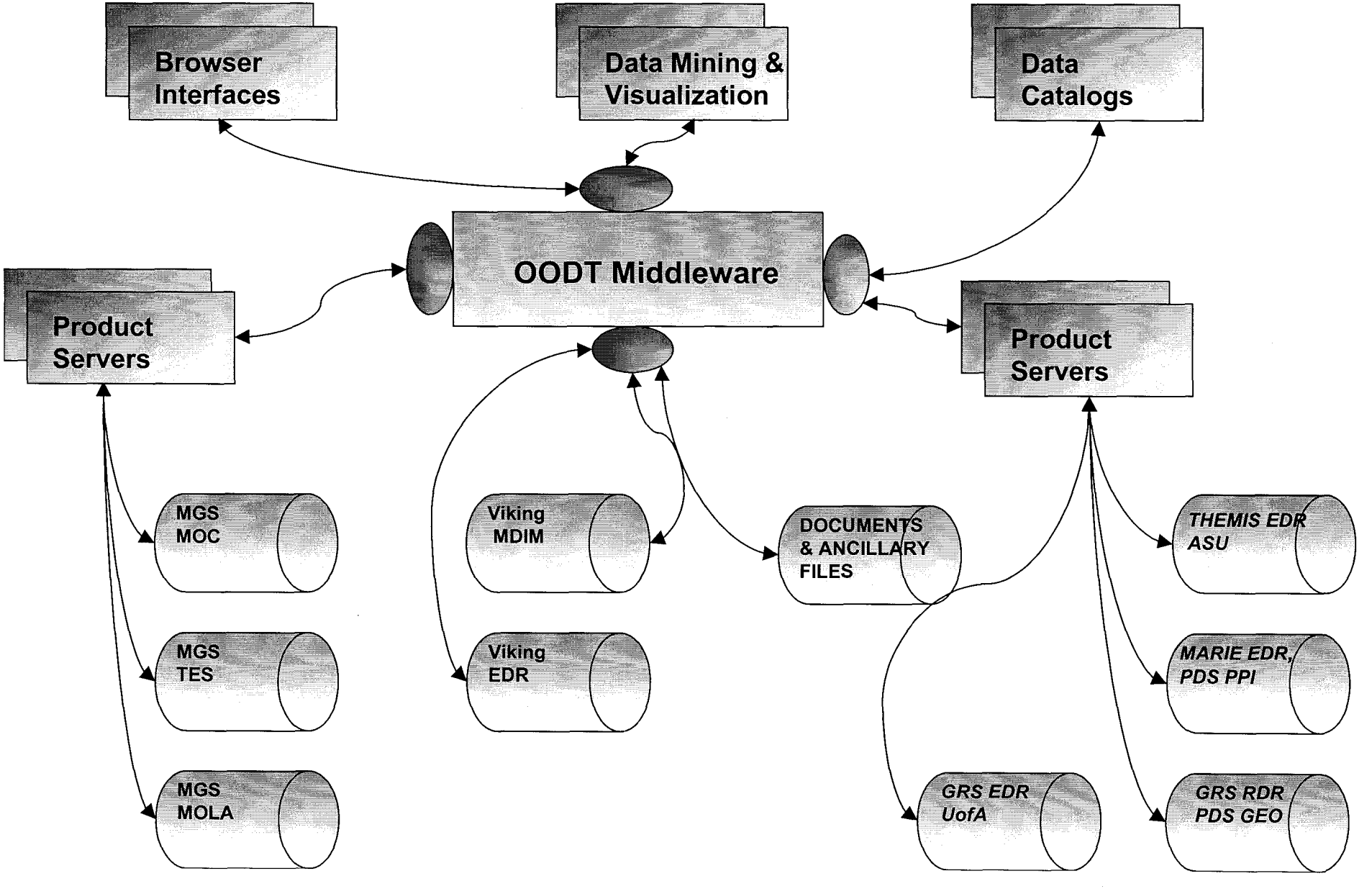
XML Profile Example – Data Set (cont)


```
<profElement>
    <elemName>MISSION_NAME</elemName>
    <elemType>ENUMERATION</elemType>
    <elemValue>VIKING</elemValue>
</profElement>
<profElement>
    <elemName>TARGET_NAME</elemName>
    <elemType>ENUMERATION</elemType>
    <elemValue>MARS</elemValue>
</profElement>
<profElement>
    <elemName>MAXIMUM_LATITUDE</elemName>
    <elemType>REAL</elemType>
    <elemMinValue>-87.50000</elemMinValue>
    <elemMaxValue>90.00000</elemMaxValue>
</profElement>
```

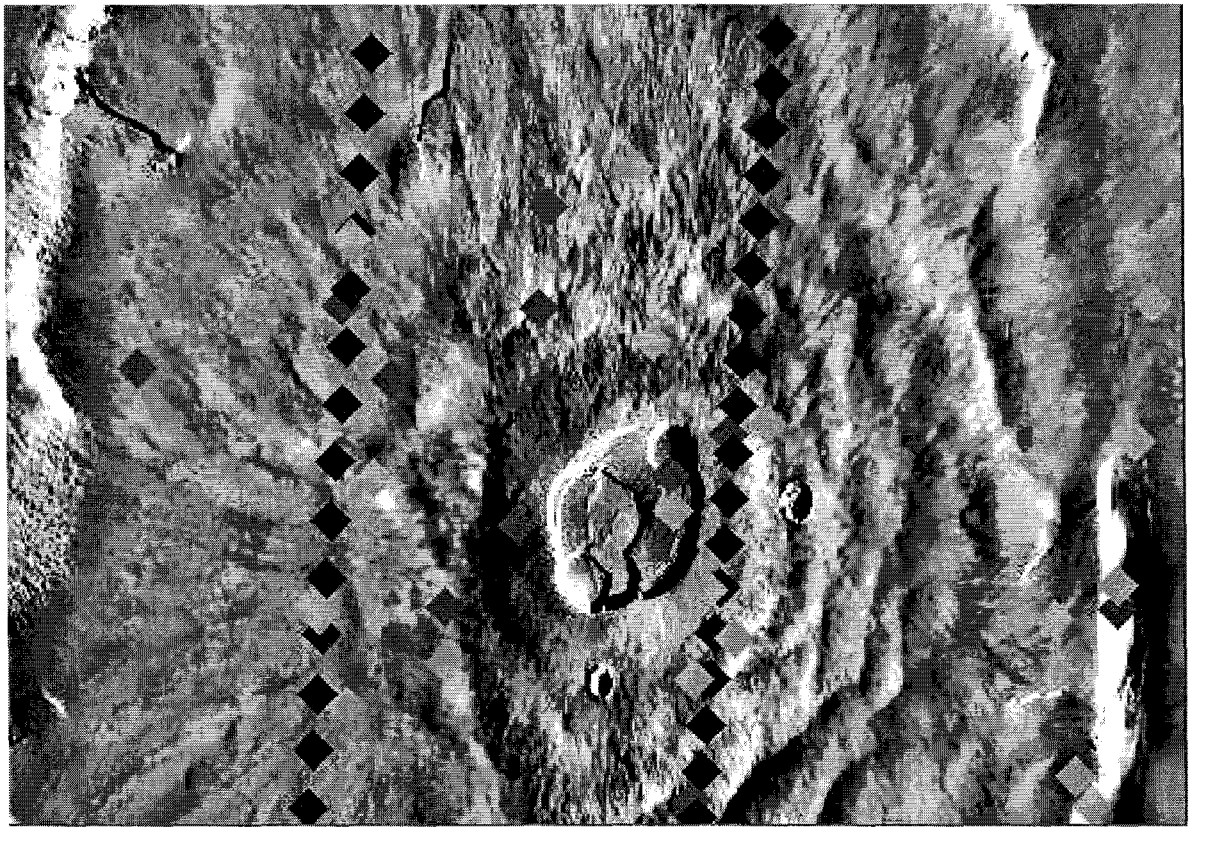
XML Profile Example – Product Server

```
<profile>
  <profAttributes>
    <profId>1.3.6.1.4.1.1306.2.54</profId>
    <profDataDictId>1.3.6.1.4.1.1306.2.10</profDataDictId>
  </profAttributes>
  <resAttributes>
    <Identifier>PDS Product Server</Identifier>
    <Title>PDS Product Server
    <Format>image/pds</Format>
    <Language>en</Language>
    <resContext>PDS</resContext>
    <resAggregation>data.granule</resAggregation>
    <resClass>system.productServer</resClass>
    <resLocation>iiop://JPL.PDS.Product_Server</resLocation>
 </resAttributes>
```

Next Generation DIS



MGS Coverage Plot



OODT Collaborations

Program/Project	Domain	Data Architecture Areas of Interest
Enterprise Applications	Institutional	Data Location Metadata Management Service Product Exchange Service
Planetary Data System	Space Science	Data Location Metadata Management Service Product Exchange Service
National Cancer Institute	Biomedical	Data Location Metadata Management Service Product Exchange Service
SeaWinds/QuickScat	Earth Science	Archive Service
Children's Hospital Los Angeles	Pediatric Medicine	Archive Service

Papers

- OODT Papers (http://oodt/doc/papers)
  - "Science Search and Retrieval using XML" by OODT Team. Presented at Second National Conference on Scientific and Technical Data, National Academy of Sciences, Washington D.C. March 2000.
  - "A Distributed Component Framework for Science Data Product Interoperability" by OODT Team. Presented at the 17th Annual International CODATA conference. Baveno, Italy. October 2000.