Direct Broadcast of Earth Observation Data: Ground Station Facilities

College of Oceanic and Atmospheric Science
Oregon State University, USA
COAS Ground Station: Overview

Satellite dish

RF Signal

Down Link Station

Gigabit Switch

Level 2 and 3 data product processing and database ingestion engines

Computational Nodes for providing user access to MODIS data in database.

COAS Environmental Computing Center

2 km Single Mode Optical Fiber

COAS LAN and Internet WAN

Terra/Aqua
Satellite dish -> RF Signal -> Satellite RF Processor: Outputs Level 0 product -> High Speed Serial -> Level 0 to Level 1 Processing (Linux PC) -> Down Link Station

Satellite RF Processor: Outputs Level 0 product -> 10/100 Hub -> Dish Control PC

COAS Ground Station: Down Link Detail

Terra / Aqua

2 km Single Mode Fiber
COAS Ground Station: Dish Base Pad
COAS Ground Station: Satellite Data Processing and Database Ingestion

COAS Environmental Computing Center

Gigabit Switch

VLAN

Down Link Station

2 km Single Mode Optical Fiber

Alpha D520
"Miami" Software for Level 2 and 3 ocean data products.

Sun450
Builds GIF images from HDF-EOS files. Loads products into DB.

Dell 2300, 512MB, 100GB
MS SQL Server DBMS

300 Gigabytes

300 Gigabytes

1 Terabyte

1 Terabyte
Ingestion System:

- Java-based database application (JDBC)
- Ingests optical and satellite data
- Data processing algorithms in database
- Builds database infrastructure for EOSDIS
  - multi-tier distributed information system
Ingestion Tool Architecture

• Two-tier framework
  – First tier
    • Java application
    • Java Swing User Interface (UI)
    • uses JDBC
    • WebLogic Type 4 driver
  – Second tier
    • SQL Server (database)
MODIS Data

• Data Flavors
  – Level 1B
    • raw satellite radiance
  – Level 2
    • ocean color and sea surface temperature
  – Level 3
    • space and time binning
    • statistically mapped product
MODIS Data Processing

• Level 3 files processed
  – HDF ‘C’ library used to extract metadata.
  – GIF image files built for each ocean data product.

• Metadata, GIF images, and HDF-EOS data placed in DBMS
Novel Aspects

- Database has knowledge to drive ingestion
  - identity & processing algorithms
  - software and hardware prerequisites

- Algorithms in the database
  - Java class files
  - byte streams (setBinaryStream)
  - BLOB datatype
COAS Ground Station:
Computational cluster for data distribution.

- **Dell 2400, 512MB, 100GB**
  - DCOM Compute Node & Application Server
- **Dell 2400, 512MB, 100GB**
  - DCOM Compute Node & Application Server
- **Dell 2400, 512MB, 100GB**
  - Real Networks Streaming Media Server
- **Sun Ultra 10**
  - DODS Server
- **Dell 2400, 512MB, 100GB**
  - DB Backup Engine & Graphics File Server
- **Dell 2300, 512MB, 100GB**
  - MS SQL Server DBMS
- **COAS LAN and Internet WAN**
- **COAS Environmental Computing Center**
- **Gigabit Switch**
- **1 Terabyte**
The Earth Science Explorer: 3-tiered XML architecture for database access.
The Earth Science Explorer: 3-tiered XML architecture for database access (cont.)

- ASP Server makes Active Data Objects (ADO) connections to the database.
- Wraps the data with XML tags before returning it to the client.
- `selectNodes()` method available through the XML DOM, used extensively on the client.
- Portions of XML tree extracted using XSL patterns and populated into HTML objects.
The Earth Science Explorer: User Interface

COAS Ground Station: Database Access Client

Mapping datasets in XML to HTML in the Explorer pane.

Results of a query rendered using XSL.
Distributed Oceanographic Data System (DODS) Relational Database Server

- Exposes database content to DODS enabled clients.
- Performs data sub-setting based on client requests.
- Provides access to data through clients that do not otherwise understand HDF or HDF-EOS data formats.
DODS Architecture

COAS Ground Station: DODS Server

DODS Client

Web Server

DODS Server

Data Store

Internet
DODS Enabled Clients:

- Matlab
- IDL
- Ferret
- GrADS
- Tecplot
- Excel
- Web Browsers

COAS Ground Station:
DODS Server
**COAS Ground Station: Complete System**

- **Satellite dish**
  - RF Signal
  - Outputs Level 0 product

- **Level 0 to Level 1 Processing (Linux PC)**

- **10/100 Hub**

- **Gigabit Switch**

- **Dish Control PC**

- **Down Link Station**

- **2 km Single Mode Fiber**

### Computational Nodes

- **Dell 2400, 512MB, 100GB**
  - DB Backup Engine & Graphics File Server

- **Dell 2400, 512MB, 100GB**
  - DCOM Compute Node & Application Server

- **Dell 2400, 512MB, 100GB**
  - Real Networks Streaming Media Server

- **Sun Ultra 10**
  - DODS Server

### Data Product Generation and Database Ingestion

- **Alpha D520**
  - "Miami" Software for Level 2 and 3 ocean data products.

- **Sun450**
  - Builds GIF images from HDF-EOS files. Loads products into DB.

- **Dell 2300, 512MB, 100GB**
  - MS SQL Server DBMS

- **300 Gigabytes**

- **300 Gigabytes**

- **1 Terabyte**

**COAS LAN and Internet WAN**

**362x362 COAS Environmental Computing Center**

**Satellite RF Processor:**

- Outputs Level 0 product
- High Speed Serial
Web sites and email

• COAS Remote Sensing Home Page: http://picasso.oce.orst.edu/ORSOO

• Information on ocean products processing: http://picasso.oce.orst.edu/ORSOO/MODIS/code

• Contact for the Earth Science Explorer: Ganesh Gopalan <gopalang@oce.orst.edu>

• DODS Home Page: http://www.unidata.ucar.edu/packages/dods/
Level 2 (1km) Ocean Product Example from Terra Fluorescence Line Height (683nm)

California Coast  1900 GMT May 17, 2000