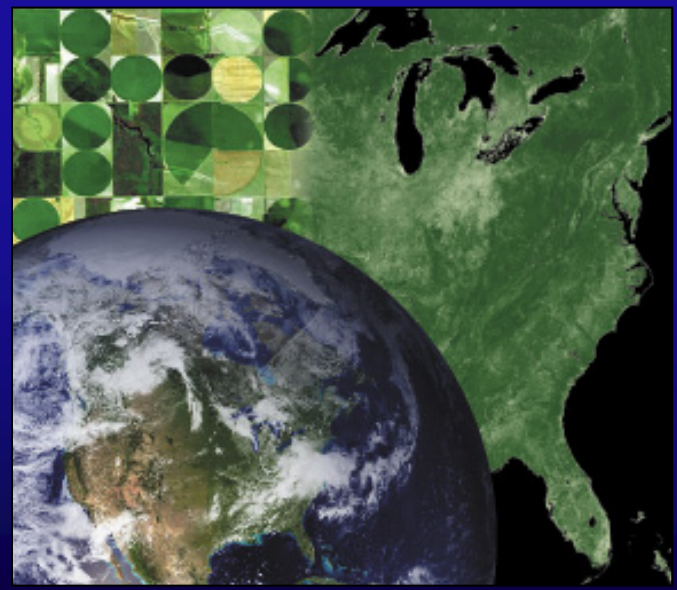
LP DAAC Development

Land Processes DAAC (LP DAAC) User Working Group

August 22-23, 2007



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U.S. Department of the Interior
U.S. Geological Survey

Agenda

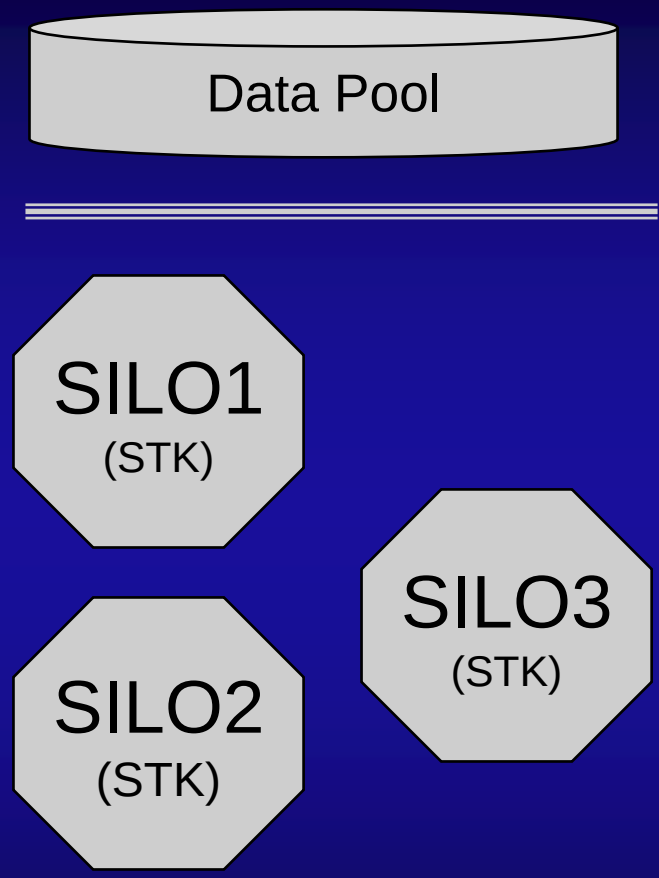
- Major Technologies
- Architectural Goals
- Development Methodology
- Access & Delivery
  - Seamless, MRTWeb, WMS/WCS, Google
- Archive & Processing
  - LODADS, E-MODIS
- Things that didn’t work…
- Future Plans

What are the Major Technologies?

- EOSDIS Core System (ECS)
  - Heterogeneous Storage Infrastructure (SAN, Tape Libraries)
  - Open Systems (Linux, Intel)
  - Web Services Interfaces
    - ECHO WSDL Ordering Component (EWOC)
- DAAC Unique Extensions
  - Web Services Interfaces
    - Machine to Machine Gateway (ECHO / EWOC Interfaces)
    - USGS Billing and Accounting
    - MRTWeb
  - Message Service Bus
    - Used behind MRTWeb
  - OpenLaszlo Flash Interface
    - ASTER Data Acquisition Request (DAR) Tool
  - Extensive use of PERL
    - Customization of S4PM
  - VMWare

LP DAAC Archive

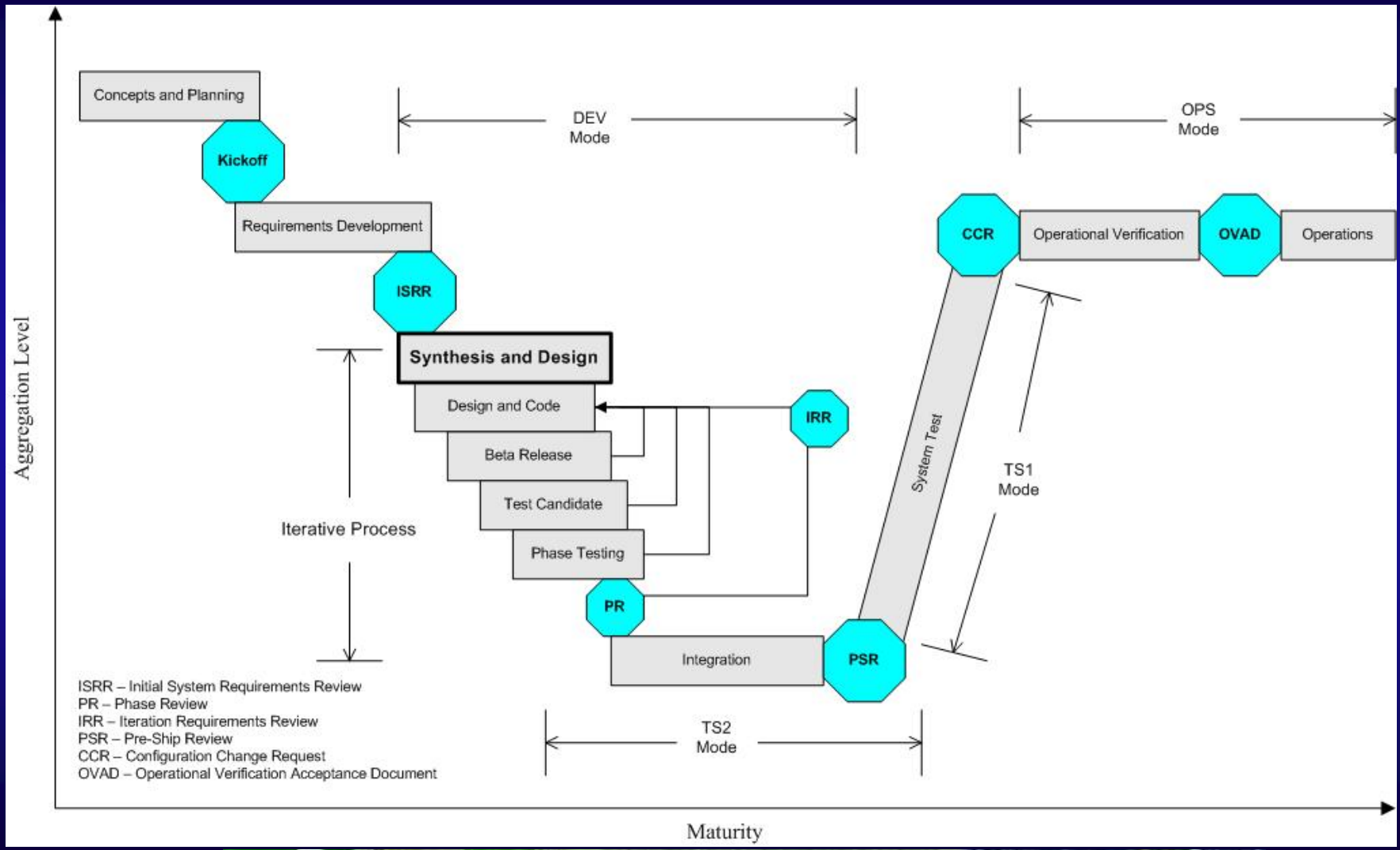
- Nearly 3PB of capacity when fully loaded with 9940B tapes
- Proven ingest into the deep archive of over 3TB of day continuous while accepting more than 1TB/day of orders for distribution
- Data pool archive is separately managed
- Data is not considered “ingested” until data is stored in the deep archive



Architecture Goals

- Customer Data Access Driven
  - Fast, powerful, spatial / simple
  - Access to Data Services – ie. Subset, mosaic, reproject, reformat
- Reliable
  - As an archive center, data stewardship holds significant value
- Scaleable
  - Tradition of large orders and mass distribution of data
  - Allow for inclusion of multiple data sets
- Simple
  - Integrate evolved ESDIS Core System (ECS)
  - Publish data to ECHO
  - Physical reduction in footprint
- Interoperable
  - Interoperable with ECHO, EROS Billing and Accounting, GDS, MODAPS, etc

LP DAAC Development Methodology



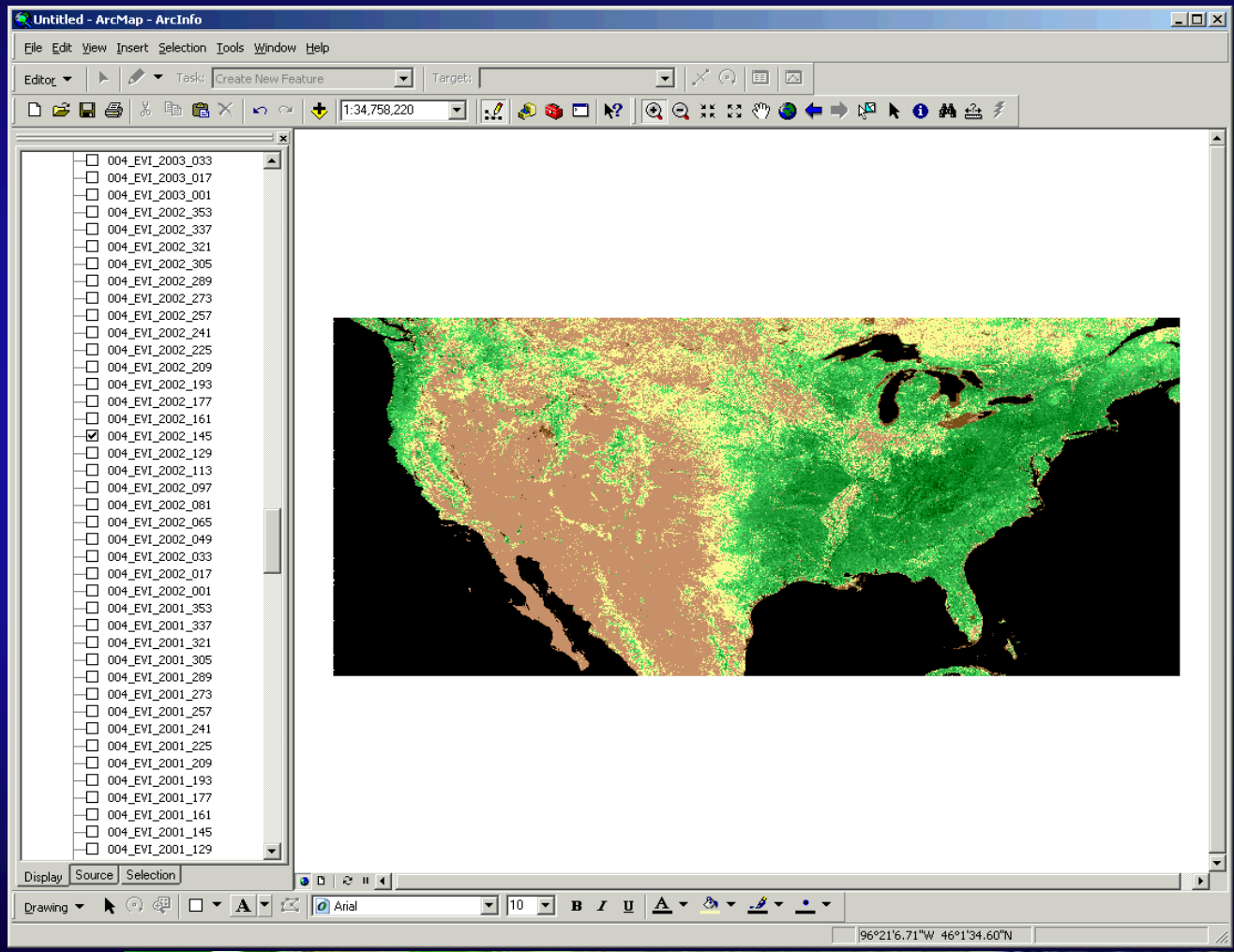
Iterative Development

- Utilize an Iterative Development Process
  - Involve key stakeholders heavily early in the process
  - Several development iterations
  - Stakeholders perform initial tests on early adopted iteration code; gather stakeholder feedback
  - Formal system test period

Access and Delivery

- USGS Seamless WMS Capability
  - MODIS/Terra Vegetation Indices 16-Day L3 Global 1km SIN Grid
- MRTWeb
- NASA GIO OGC Prototype Project
- Google Discussion

USGS Seamless Project OGC WMS MOD13A2 EVI - 2002 Day 145 Layer



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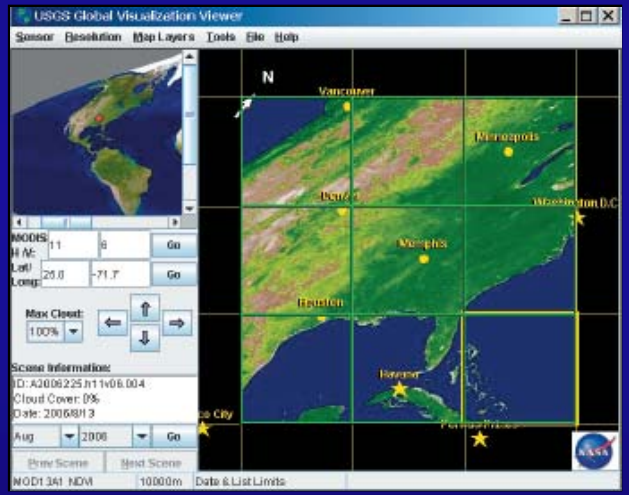
MRTWeb – Software Re-use

LP DAAC adapted and integrated two existing technologies to create MRTWeb

GloVis
(Selection Interface)



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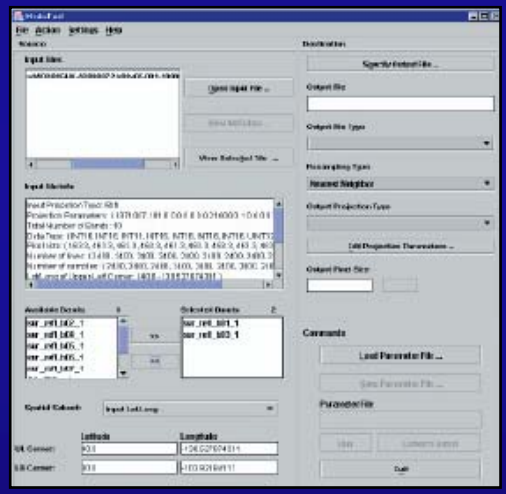
MRT
(Processing Tool)



Mosaic tiles
Subset an area from a tile, mosaic, or time series
Eliminate unwanted bands or layers
Define projection (n=14)
Set resampling options
Choose file format (HDF, GeoTIFF, binary)

Rapidly visualize tiles within map context
Navigate through time and space
Select tiles of interest for processing

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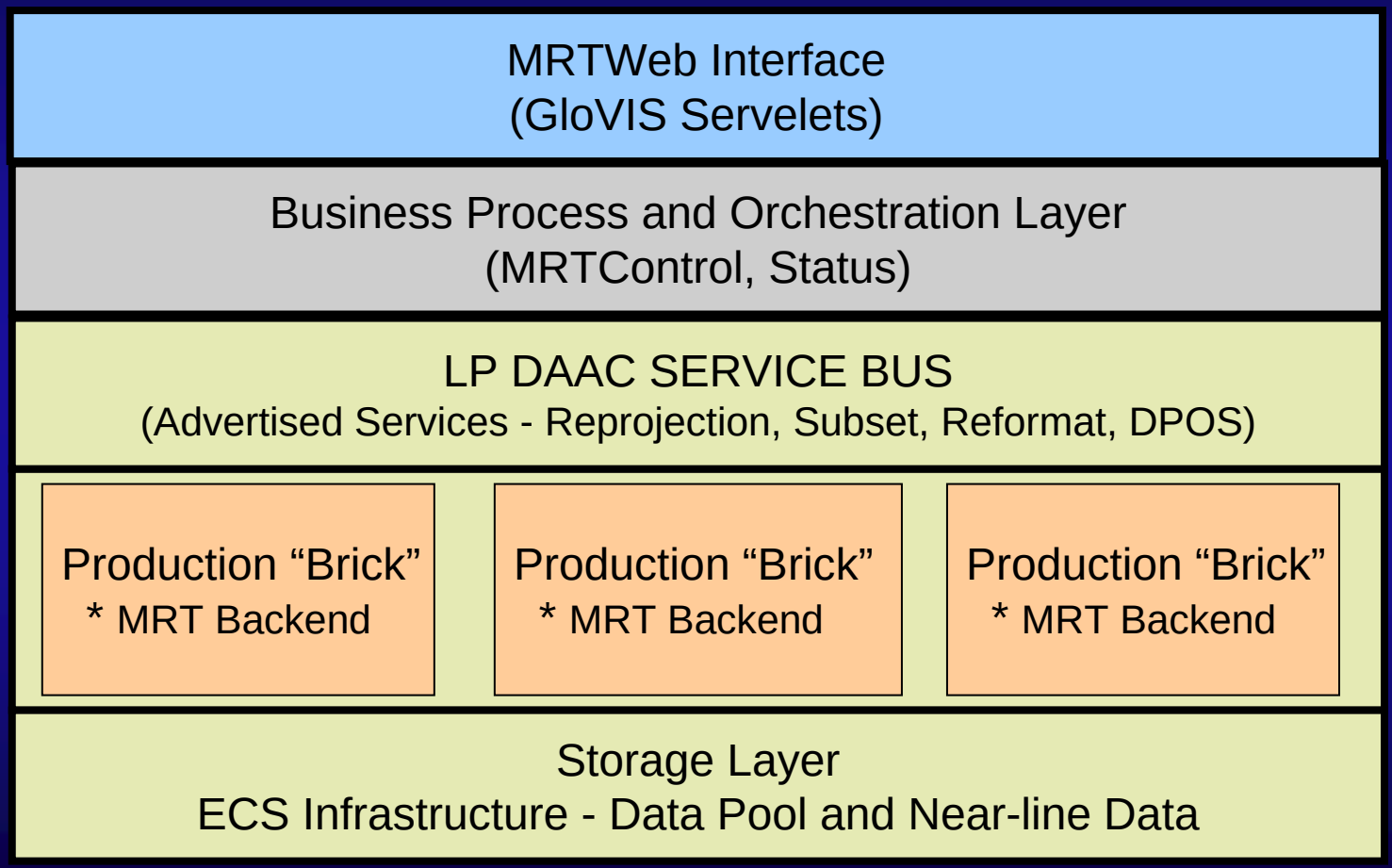
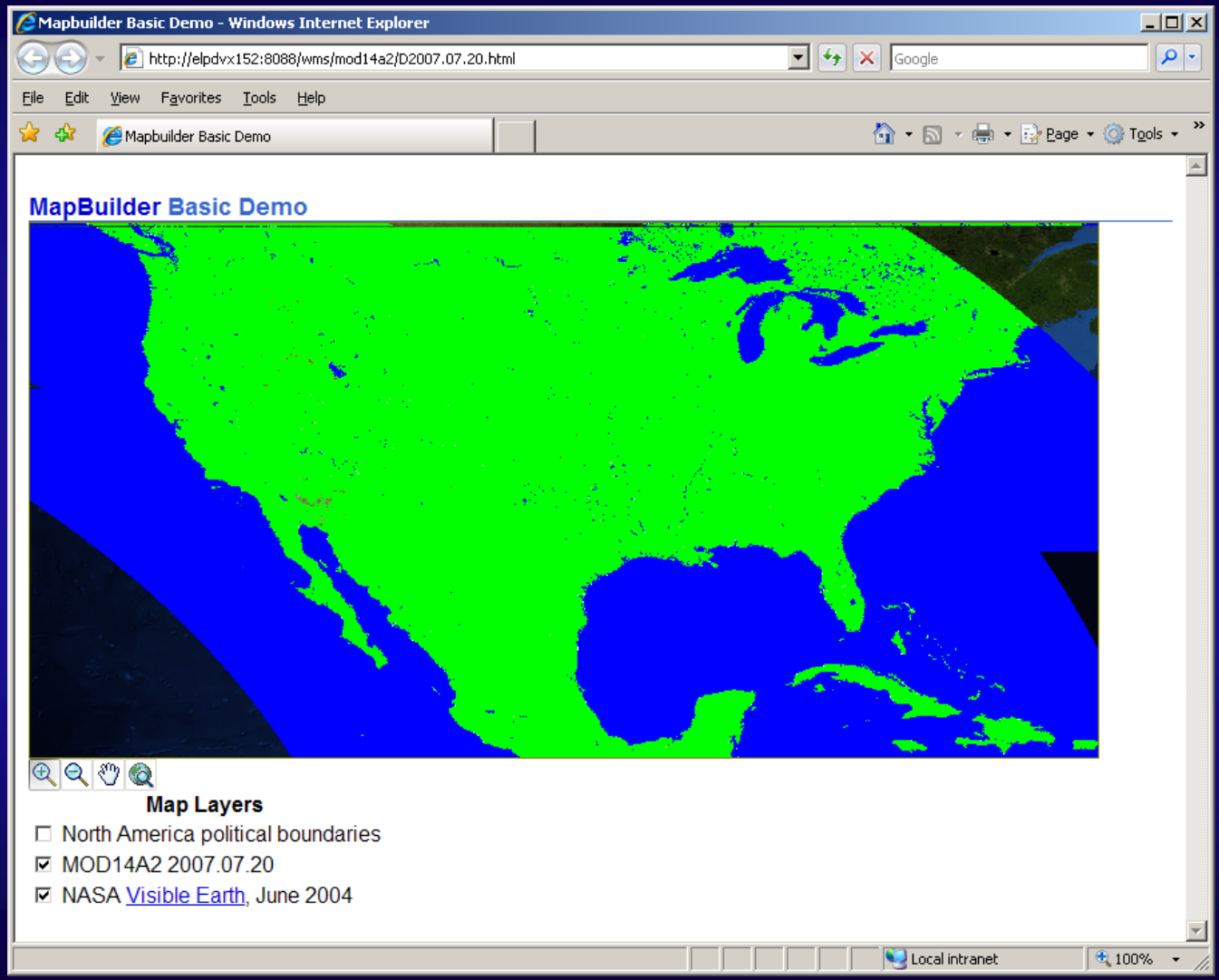
MRTWeb Architecture



NASA GIO OGC Prototype

- Demonstrate the functionality of OGC WCS and WMS on MOD14A1 and MOD14A2 data sets
- Prototype (not operational)
- Available through key stakeholders
- Understand potential impacts of running these services on the data pool
- Delivery of a white paper including architecture outline of performance, societal benefits, interoperability and next steps towards an operational environment

Mapserver MOD14A2 Layer



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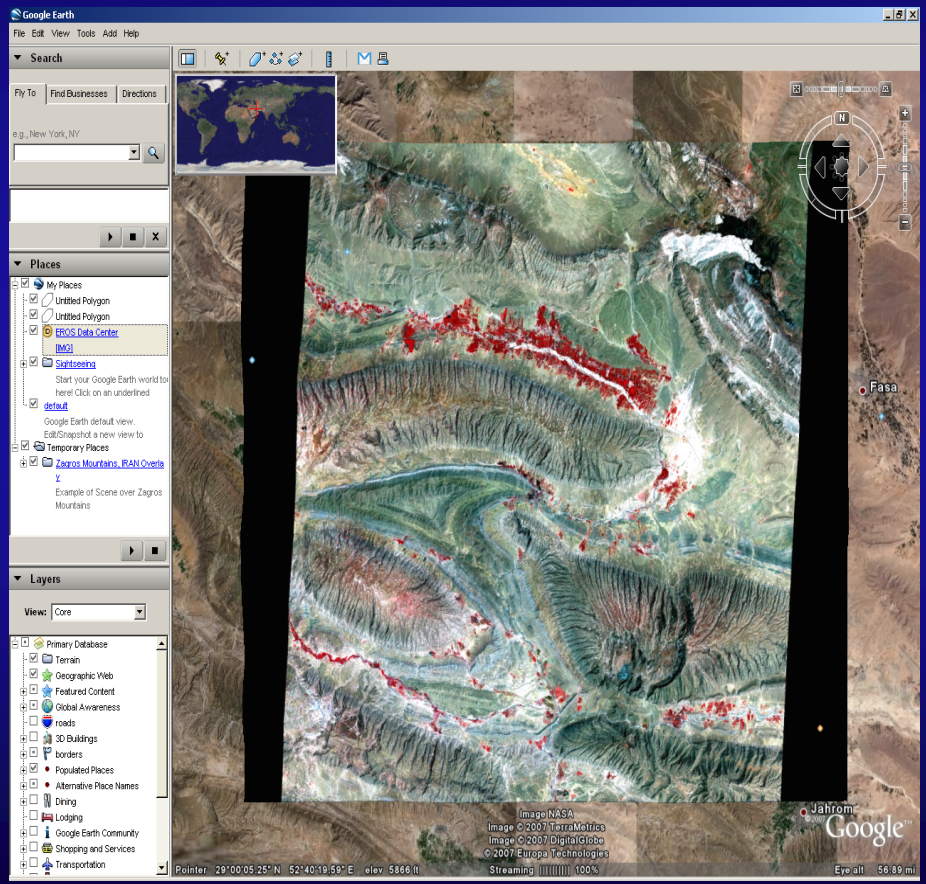
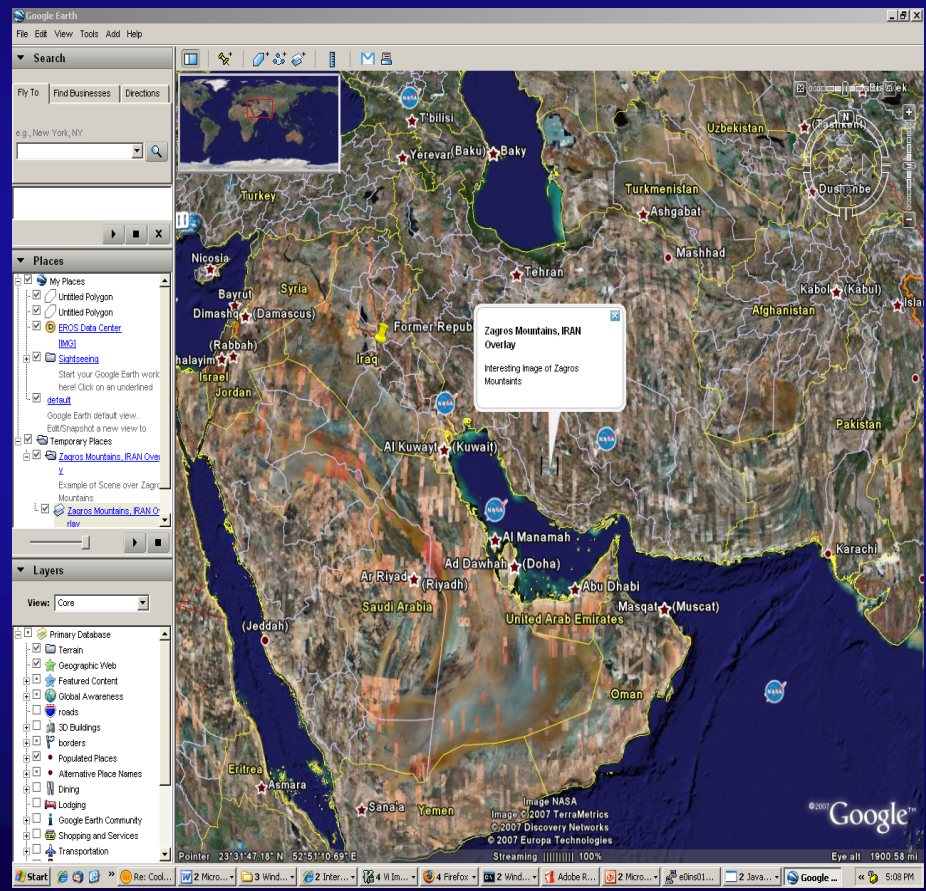
LP DAAC and Google

- Currently the LP DAAC does not utilize Google Earth or other Google tools for data discovery
- The LP DAAC has interest in understanding how Google Earth (or other Google tools) may be utilized for enhanced data discovery
- The LP DAAC plans to do some internal prototyping using Google as a data discovery tool
  - Google Mini – Crawl and Search Metadata
  - How can the LP DAAC leverage Google tools for data discovery and other uses?
  - Understand Layers / Utilization of the NASA Layer?
- Is Google Earth of interest to the user community for discovery of science data?

Google Earth - Discussion





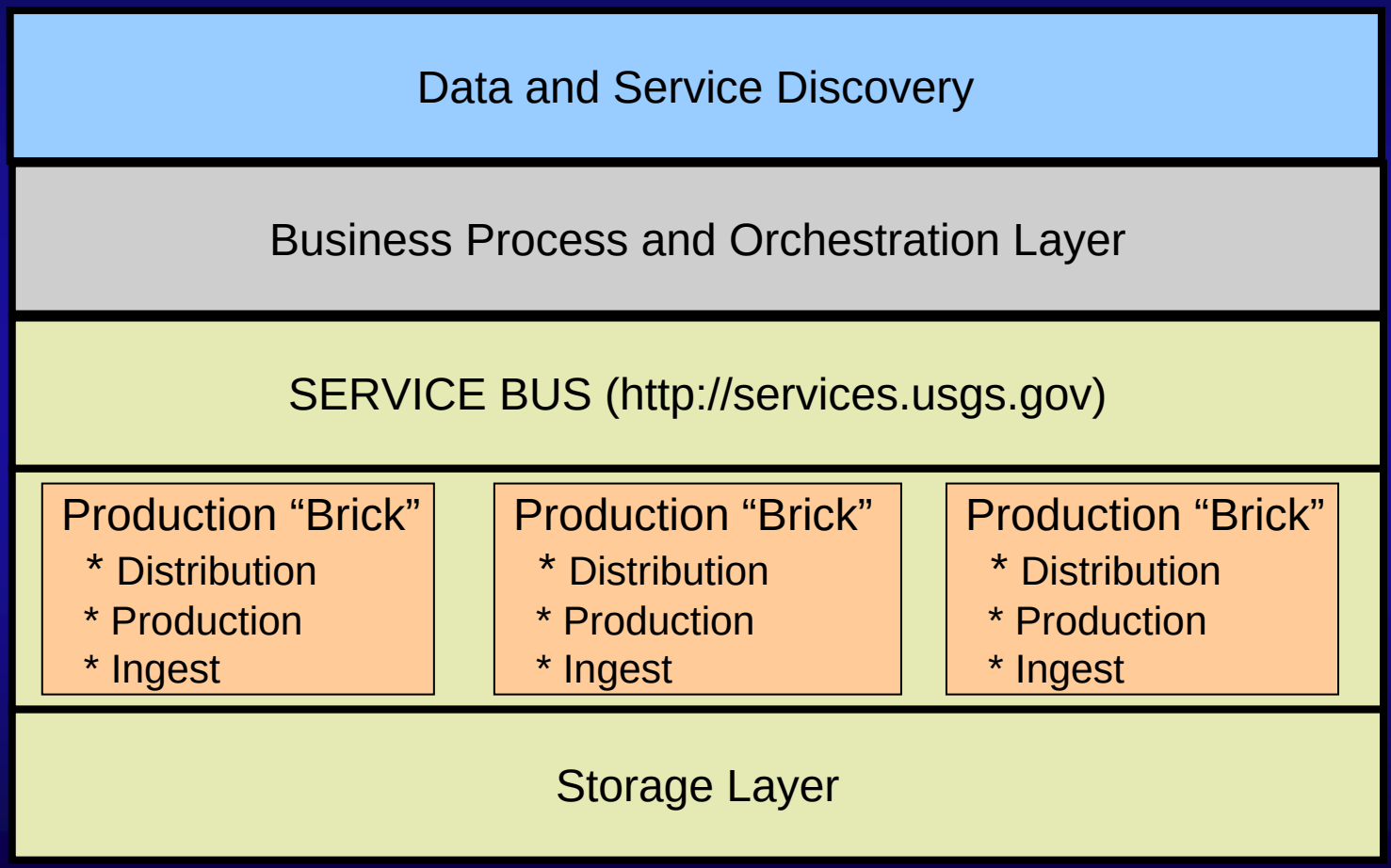
Archive and Processing

- Low Cost Data Archive and Distribution System (LODADS) Prototype Work
- USGS eMODIS

LODADS USGS LTA Prototype

- Demonstrate the Capability to Ingest, Archive and Produce of both ASTER and MODIS Data
  - USGS EOS Project (LRS) with USGS Long-term Archive
  - Produce ASTER L1B's
  - Produce MODIS Surface Reflectance Swath Products (MOD09)
  - Ingest, Archive, and Distribute Data
- Commodity Hardware
- Software Reuse (S4PM)
- Interoperable (USGS EBAS, Data Providers, etc)
- Apply Engineering Principals

FY06 USGS LTA Prototype
'DATA GRID' System Concept



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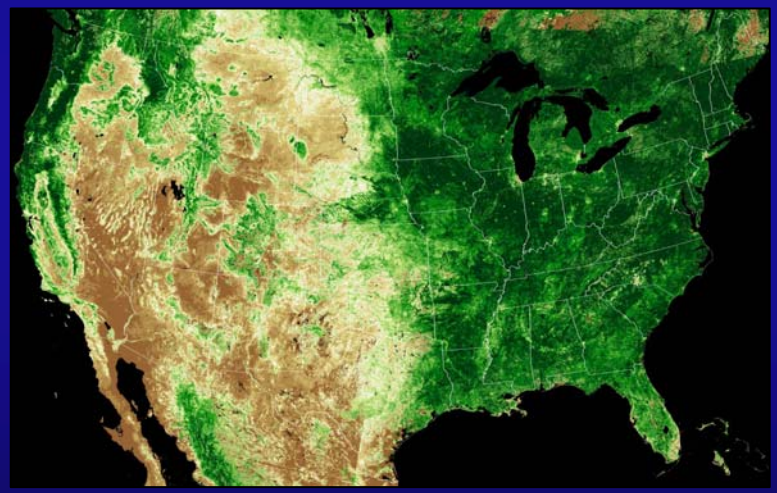
LTA MODIS Processing Prototype Lessons Learned

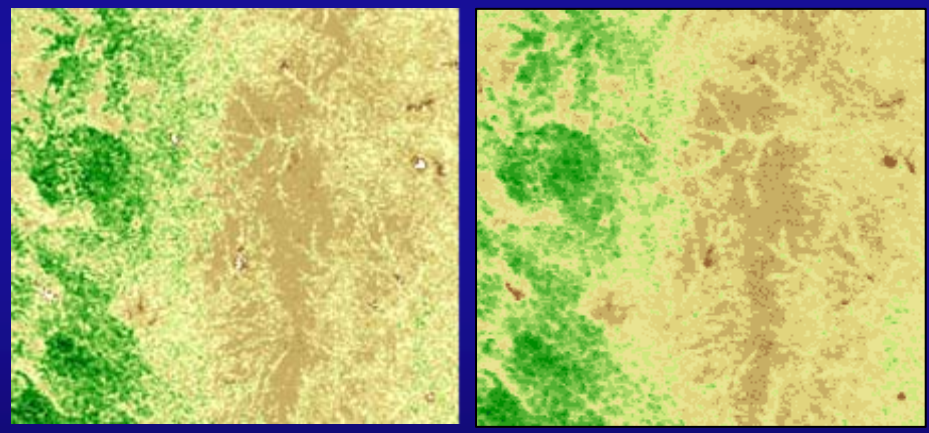
- MODIS Processing from Level 0 to Surface Reflectance can be Challenging but Manageable
  - Ancillary Products
  - Complex Data Flow
- The Project Exposed Ingest, Distribution and Production as a Service and Clustered It
  - Very Scaleable
  - Low Cost Hardware
- Reuse
  - Service Bus Reuse for MRTWeb
  - Potential for Expanded Distribution Capabilities Built on the ECS Infrastructure
- Work Continues in Support of the USGS LTA and the eMODIS Project

eMODIS: Enhanced MODIS Processing

- USGS-funded activity to prototype the system and evaluate products
- Specifications developed to satisfy U.S. monitoring requirements:
  - Products generated within ~24 hours of satellite data acquisition (using inputs obtained from the NOAA MODIS Near-Real-Time (NRT) System)
  - Core output product: Rolling 7-day NDVI composite (i.e., a new 7-day composite every day)
  - Continental U.S. extent, Lambert Equal Area Azimuthal projection, Geotiff format
- Leverages existing code (e.g., from discontinued MODIS DB system)



A prototype Terra eMODIS NDVI composite for the period August 2-8, 2006



The increased spatial resolution of MODIS (left) improves upon AVHRR (right) for characterizing and monitoring greenness

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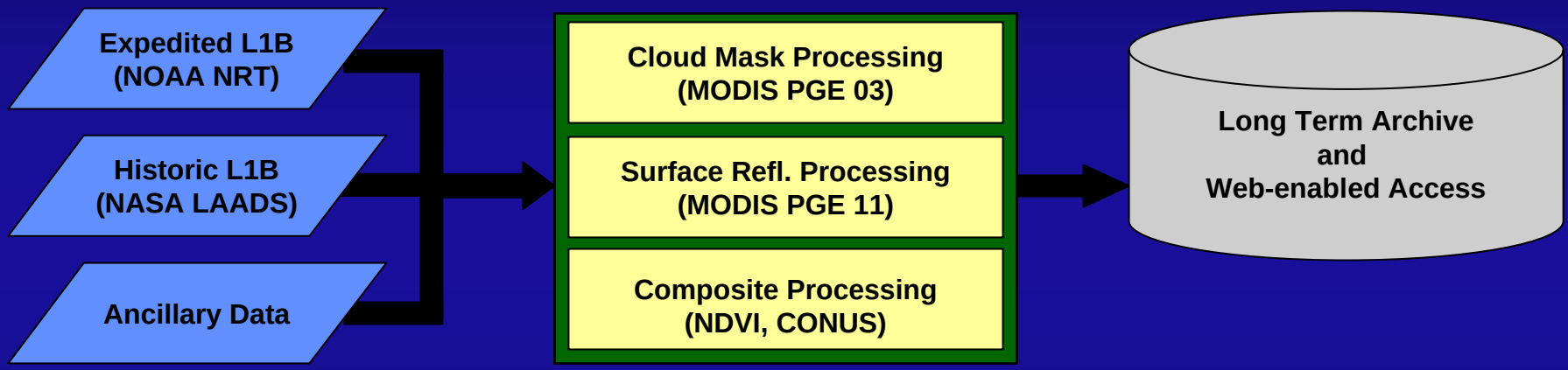
eMODIS Processing Flow



Were there technologies that didn't pan out? Why?

- DOWS Prototype
  - Implementation Woes
    - Data management activities (create themes of data in GeoTiff)
    - Slow response
    - Internal knowledge
- SOA
  - Difficult to Build a Robust Service Bus Using HTTP as the Transport Layer
    - Need a robust message queue
  - HTTP can be prone to error and timeouts
- Grid Computing (Globus Toolkit)
  - Heavy framework given the scope of work
  - Trade ruled this out quickly

What changes do you see coming?

- Decreasing storage cost enables more data to be accessed on-line
- Increasing computational power allows more sophisticated data delivery services
- Increasing user expectation for fast, visual interfaces ups the design ante
- Increasing emphasis on societal benefits underscore challenges in enabling the use of disparate data sets as well as communicating the relevance and impact of the data

Data Access Vision

- Data Pool
  - Enable more online data
- Web Services Prototype
  - NASA GSFC GIO and USGS Infrastructure
  - Potential delivery mechanism for ASTER Global DEM
- MRTWeb
  - Go Live (as new Data Pool client?)
  - Expand concept to ASTER
- Data Visualization
  - Google Earth / Google Tools / Enabling Technologies
  - Clients ?

Questions…