



**Digital Earth**

Unlocking the  
World's Knowledge

# Digital Earth

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## The Flood of Geospatial Information

- **NASA has huge volumes of geospatial data**
  - 25 years of Landsat
  - 1 TB/day expected from EOS satellites
- **Other entities also create and use geodata**
  - National/state/local govt, business, academia
- **Global to local scales, historic to forecast times**
- **Data collected for specific purpose is not easily shared outside information community**
- **Internet age has raised expectations regarding data access**

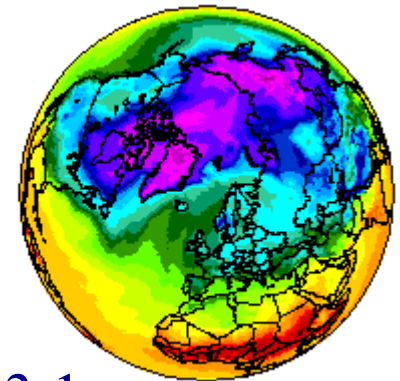
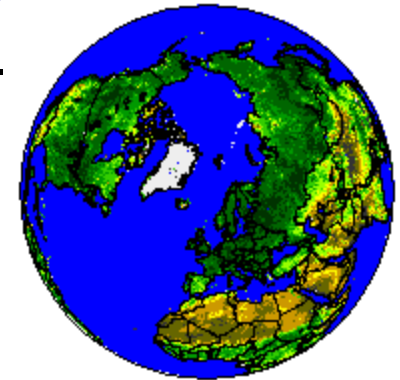
*How to make georeferenced information more easily available and broadly used?*



## Illustrative Example

### List of US Arctic Data Centers:

- 2 telnet access points
- 3 mail/phone contacts
- 6 custom websites to access and/or order
- 1 custom software installation
- 
- 12 incompatible processes



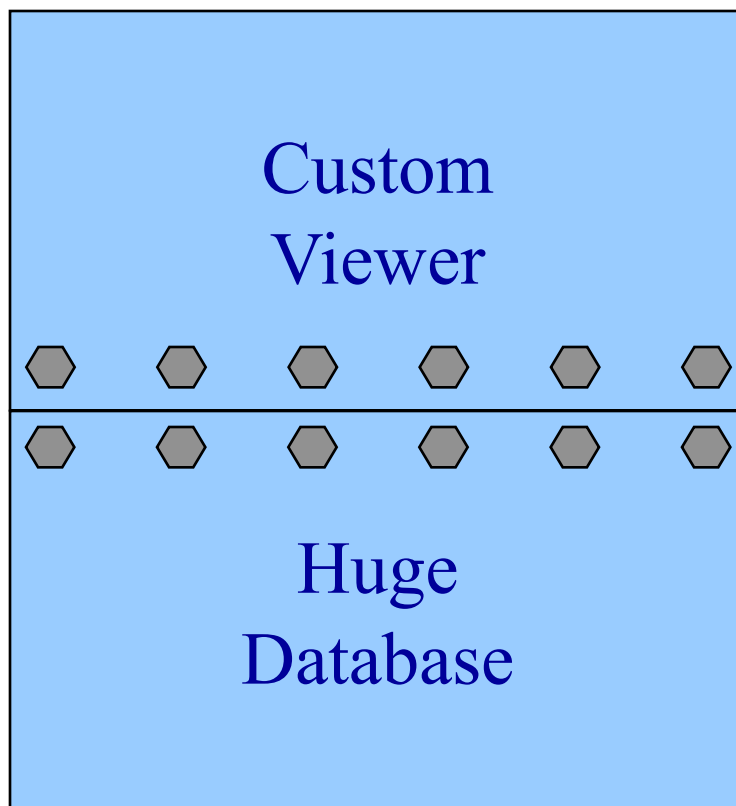
(from Arctic Data Guide, sec. 3.1,  
[http://www.arcus.org/Arctic\\_Data\\_Guide/](http://www.arcus.org/Arctic_Data_Guide/))

## Digital Earth Goals

- **Make geospatial information easy to find, navigate and combine**
  - By standardizing some basic operations
- **Make it easier for content providers to publish geodata & services**
  - By defining a standard framework
- **Enable user communities to share information**
  - And allow domain-specific "intranets"
- **Provide both web and high-performance access**
  - And allow access by specialized applications



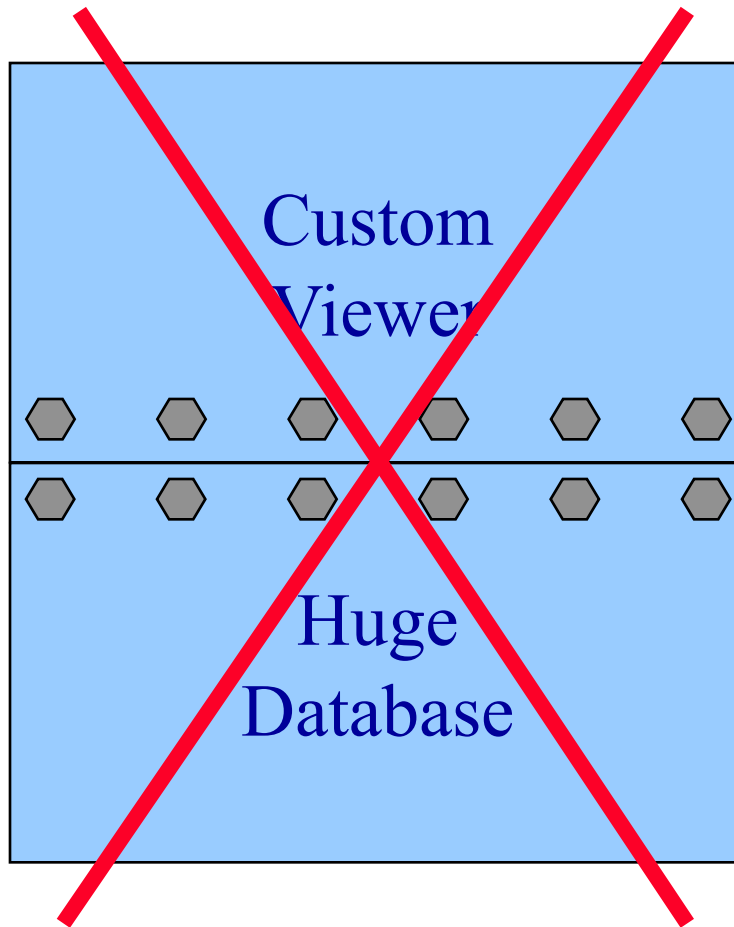
## A Possible Solution...



- Complete control
- Centralized operational responsibility
- Homogeneous collection
- Consistent user interface



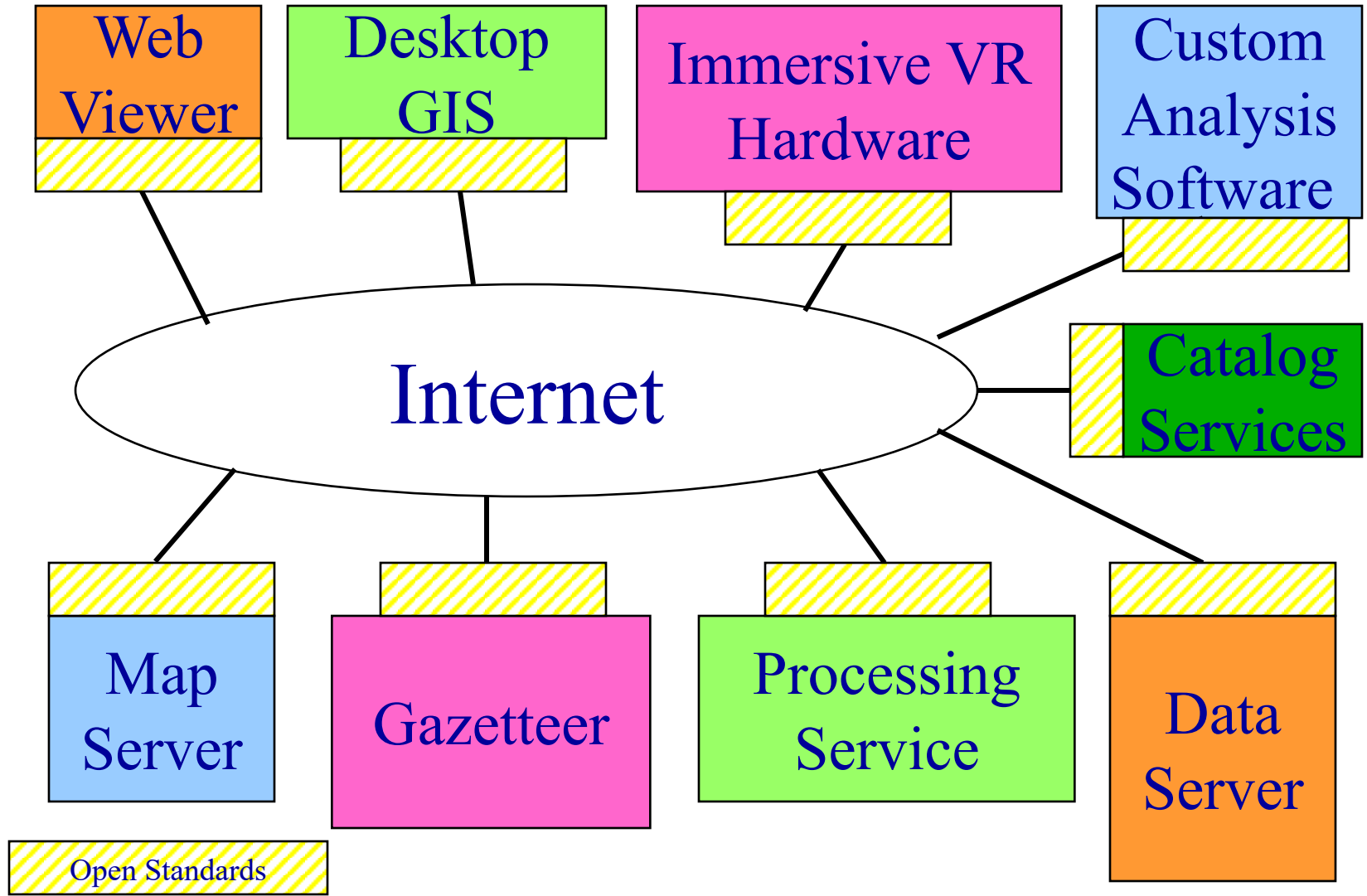
## A Possible Solution...with Limitations



- Data owners lose control
- Maintenance is difficult
- Does not scale well
- Real collections are heterogeneous
- No single interface is good enough



# The Digital Earth Solution



## Conceptual Digital Earth Architecture

Jeff de La Beaujardiere  
NASA



## Digital Earth Benefits

- Scalable distributed computing platform
- Data providers retain ownership and stewardship
- Multiple specialized interfaces can be built on shared infrastructure
- 3rd-Party Services for conversion or processing can be provided





## Analogy with the WWW

- **The World Wide Web comprises**
  - Diverse media: text, graphics, audio, 3D
  - Independent information providers
  - Users with general-purpose browsers
    - or specialized software with web capability
- **The Web works because of common standards**
  - HTML, HTTP, TCP/IP, MIME
- **Ease-of-use is enhanced by intermediary services**
  - Search engines, portals, shop-bots

*Digital Earth will do for georeferenced information what the World Wide Web did for text and multimedia*

## Federal DE Participants

- NSF
- USGS
- FGDC
- FEMA
- NIMA
- Army Corps
- EPA
- USDA
- NOAA
- Library of Congress
- DARPA
- Commerce
- Defense
- Energy
- HHS
- State Dept
- DOT
- Archives
- TVA
- Interior
- OMB
- Justice



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## **DE Partners/Interested Parties**

- **OpenGIS Consortium**
- **ESRI, Oracle, Microsoft TerraServer, Ionic Software, Compusult, Cubewerx, Skyline Software**
- **United Nations Environment Programme (UNEP)**
- **Global Spatial Data Infrastructure (GSDI)**
- **NASDA (Japan space agency)**
- **The GLOBE Program**
- **Digital Library for Earth Science Education (DLESE)**
- **.geo Forum/SRI International**
- **UC Santa Barbara, U Arizona, UN Omaha**
- **American Museum of Natural History, National Air & Space Museum, Science Museum of Minnesota**
- **CBS News, NBC4 TV (DC)**
- **National States Geographic Info. Council, Lancaster Cty PA**



# Digital Earth Standards

- Focus on interoperability among clients & servers
- Basic philosophy:
  - Adopt existing Open Standards of relevance
    - OGC, FGDC, ISO, W3C, IETF, etc.
  - Do not require Providers to convert their data
    - offer what you have and let the Client choose
- Standards chosen will be listed in *Digital Earth Reference Model (DERM)*
- Starting point: OpenGIS Web Map Server Interface Specification v1.0



# Web Map Server Specification

- **OpenGIS Consortium implementation spec**
  - under consideration as ISO 19128 in TC211
- **Two requirements:**
  - Describe your server ("GetCapabilities")
  - Respond to requests for a map ("GetMap")
- **Optional:**
  - Provide info about a feature on a map (GetFeatureInfo)

*WMS 1.0 is a core specification adopted  
by Digital Earth*

*<http://www.digitalearth.gov/wmt/>*



## "GetCapabilities" Operation

- **Allows Web Map Server to describe itself**
  - list of map layers offered
  - spatial reference system(s)
  - geographic area(s) covered
  - output format(s)
- **Server says what it has;  
Client can accept or reject**
- **Response: XML document**
  - <http://www.digitalearth.gov/wmt/xml/>

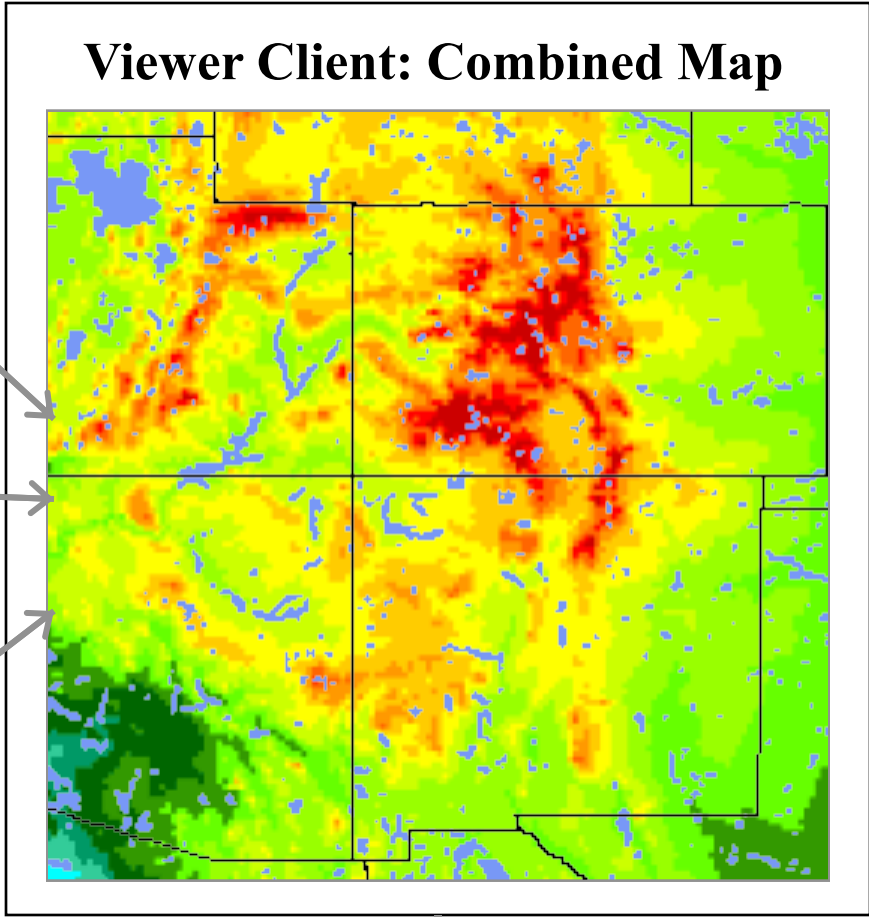
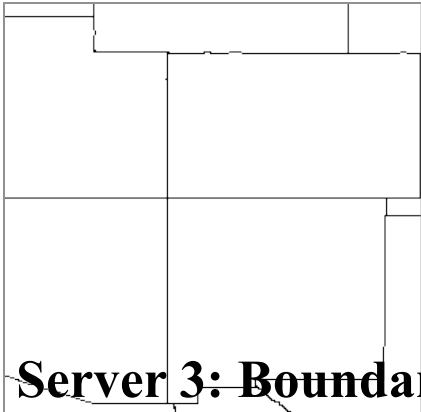
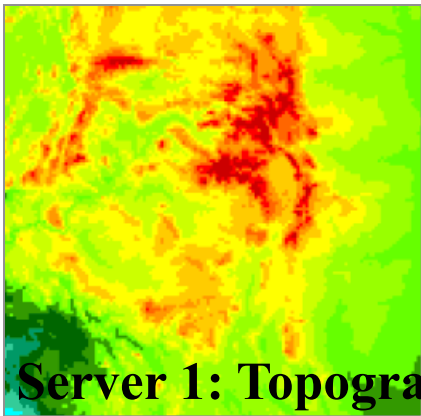


## "GetMap" Operation

- A "map" is a picture (PNG, GIF, JPEG, etc.) of a data layer
  - Specified Width, Height, Bounding Box and Spatial Reference System (SRS)
  - Not actual data values
    - Web Mapping Testbed 2 addresses that
- Two or more GetMap requests *using identical spatial parameters* from one or more Map Servers can be directly overlaid



# Interoperable Web Mapping



**Catalog Service**

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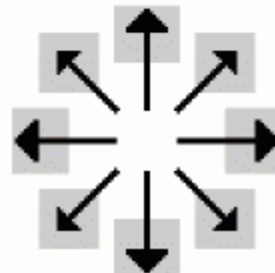
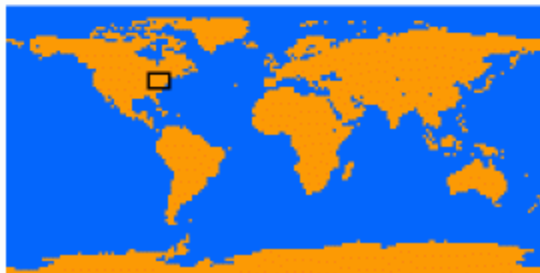
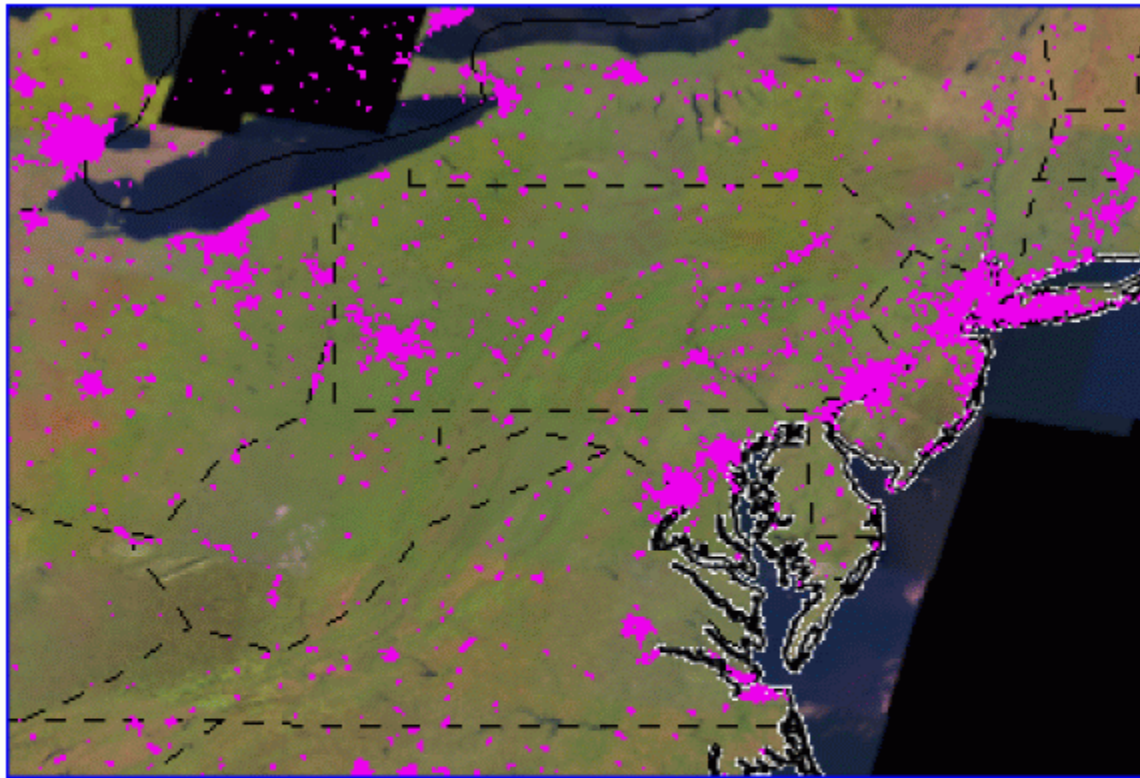


## Web Mapping Testbed phase 2

- **Web Map Server enhancements**
  - Time/elevation/other dimensions, legends, ...
- **Web Coverage Server specification**
  - Gridded fields of georeferenced data
- **Web Feature Server specification**
  - Vector data (points, lines, polygons)
  - Geographic Markup Language (XML)
- **Stateless Catalog services**
- **GeoParsing & GeoCoding/Gazetteer services**



## viewer.digitalearth.gov



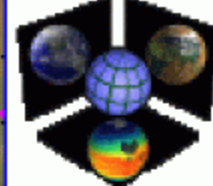
Click on map above to:

◆ Zoom In   ◆ Zoom Out

◆ Recenter

[More Controls](#)

### Digital Earth



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## Video: Digital Earth Workbench



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# Digital Earth Status

- **Growing collection of Web Map Servers**
- **Active work on next-generation standards**
- **Numerous partnerships initiated**
- **Ongoing series of Community Meetings and Interagency Meetings**
- **Public DE Alpha Version in progress**
  - Opening demo at DE2001 (June 25)



## Summary

- **DE defines a framework for distributed storage and standardized access to geodata**
- **DE adopts Open Standards from IT community**
- **Participation and interest are broad-based**

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