GIS in the Unidata Context

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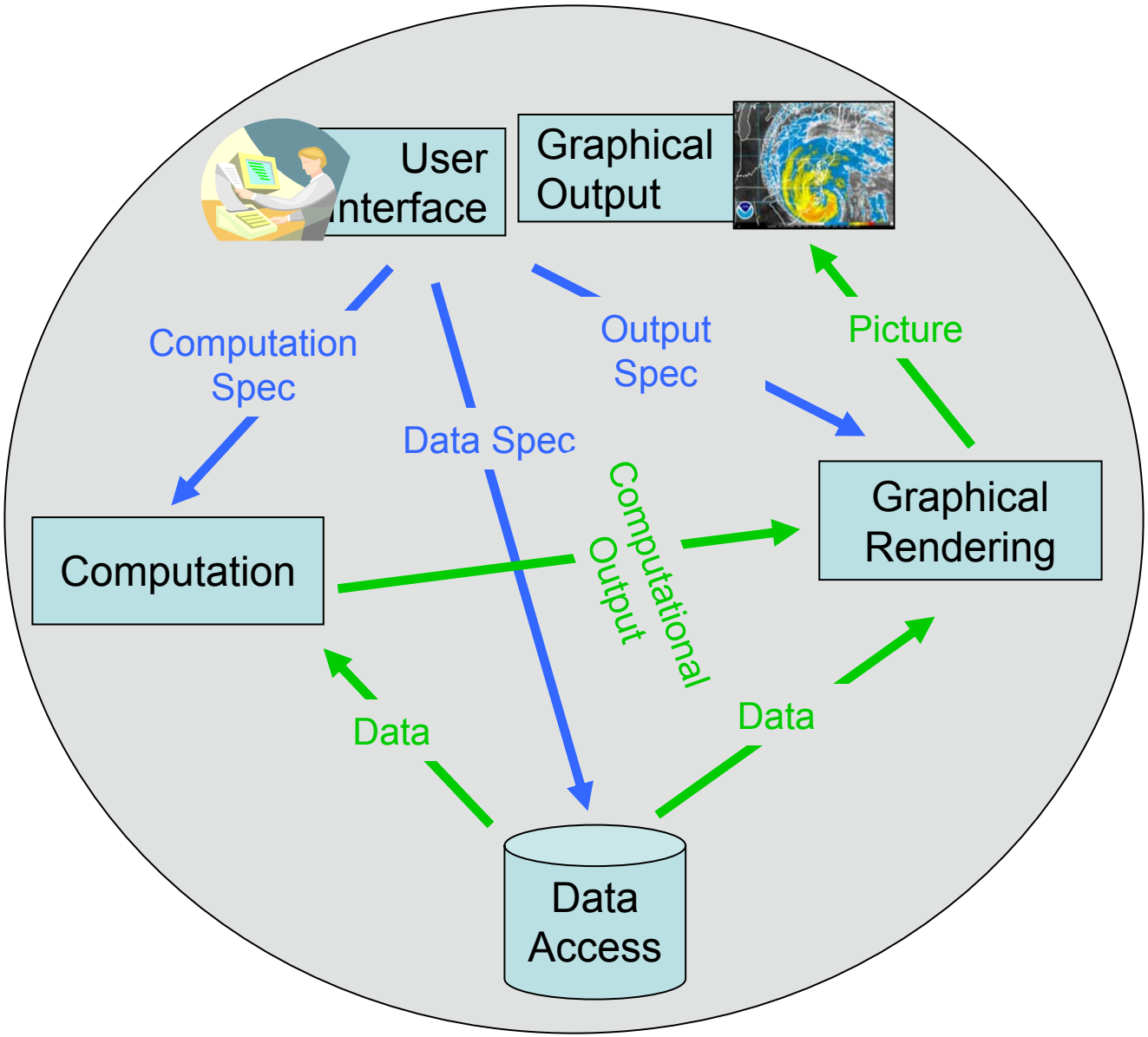
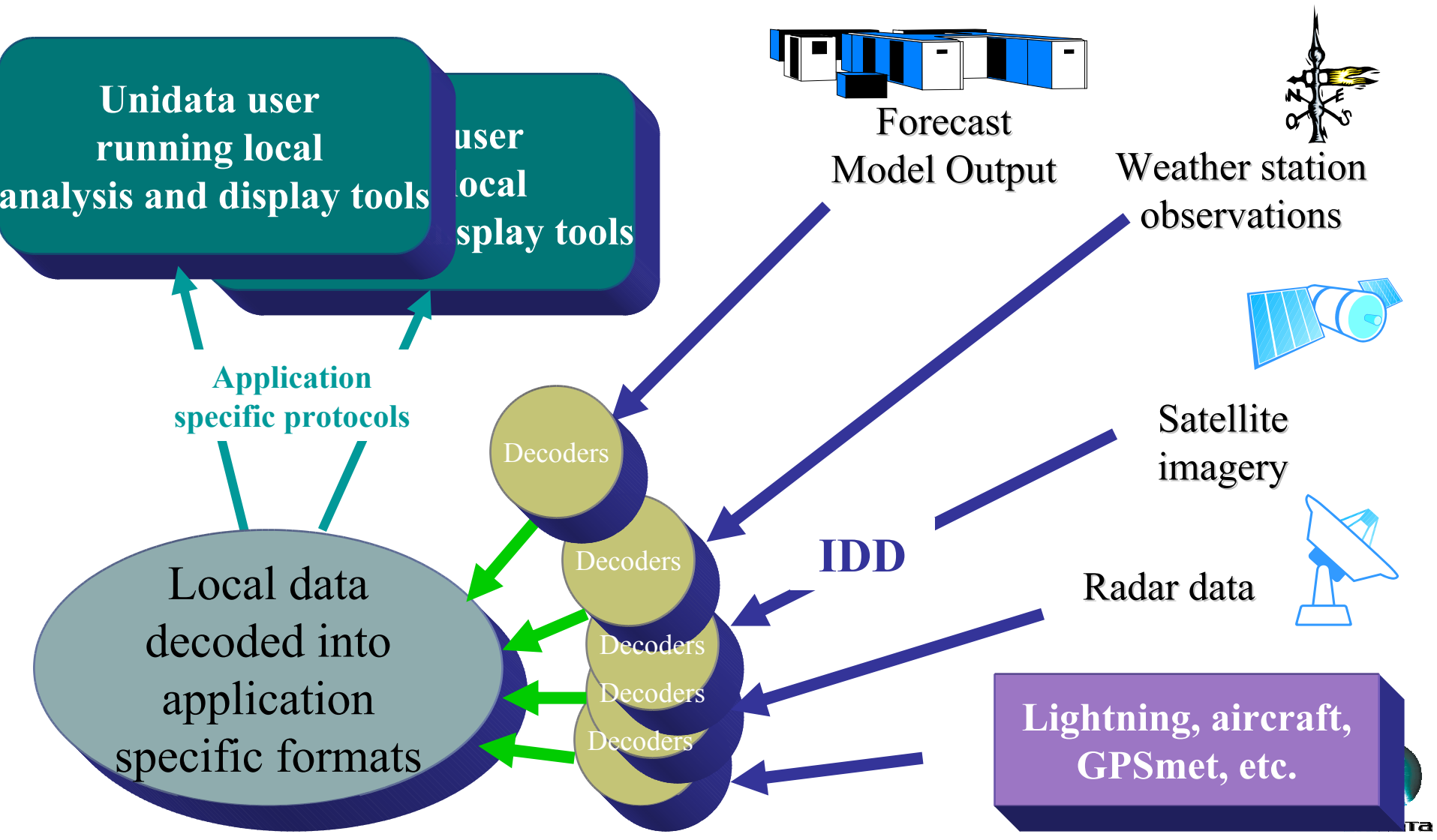
Legacy Stovepipe Monolithic Data Analysis and Display System Components



Typical Data Handling at a Unidata Site



Examples of Stovepipe Analysis & Display Applications

- Unidata's original versions of the WXP, GEMPAK, and McIDAS programs
- Datasets are delivered and decoded into local files in the required formats via the Unidata Internet Data Distribution (IDD) system
- In the Geographic Information System (GIS) world, ESRI products also worked with local datasets (and no IDD to deliver data from elsewhere)

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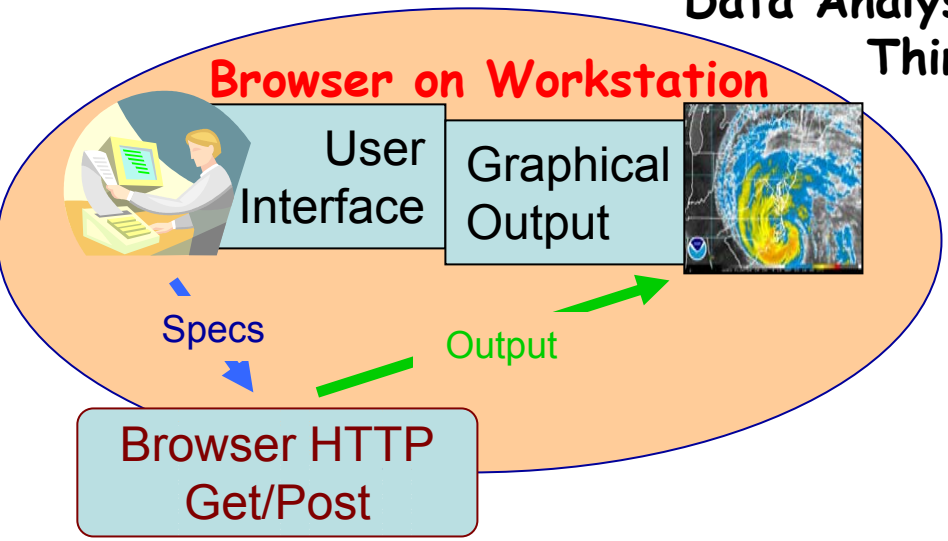
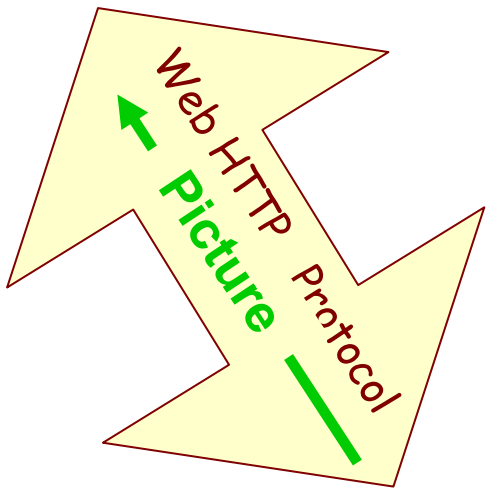
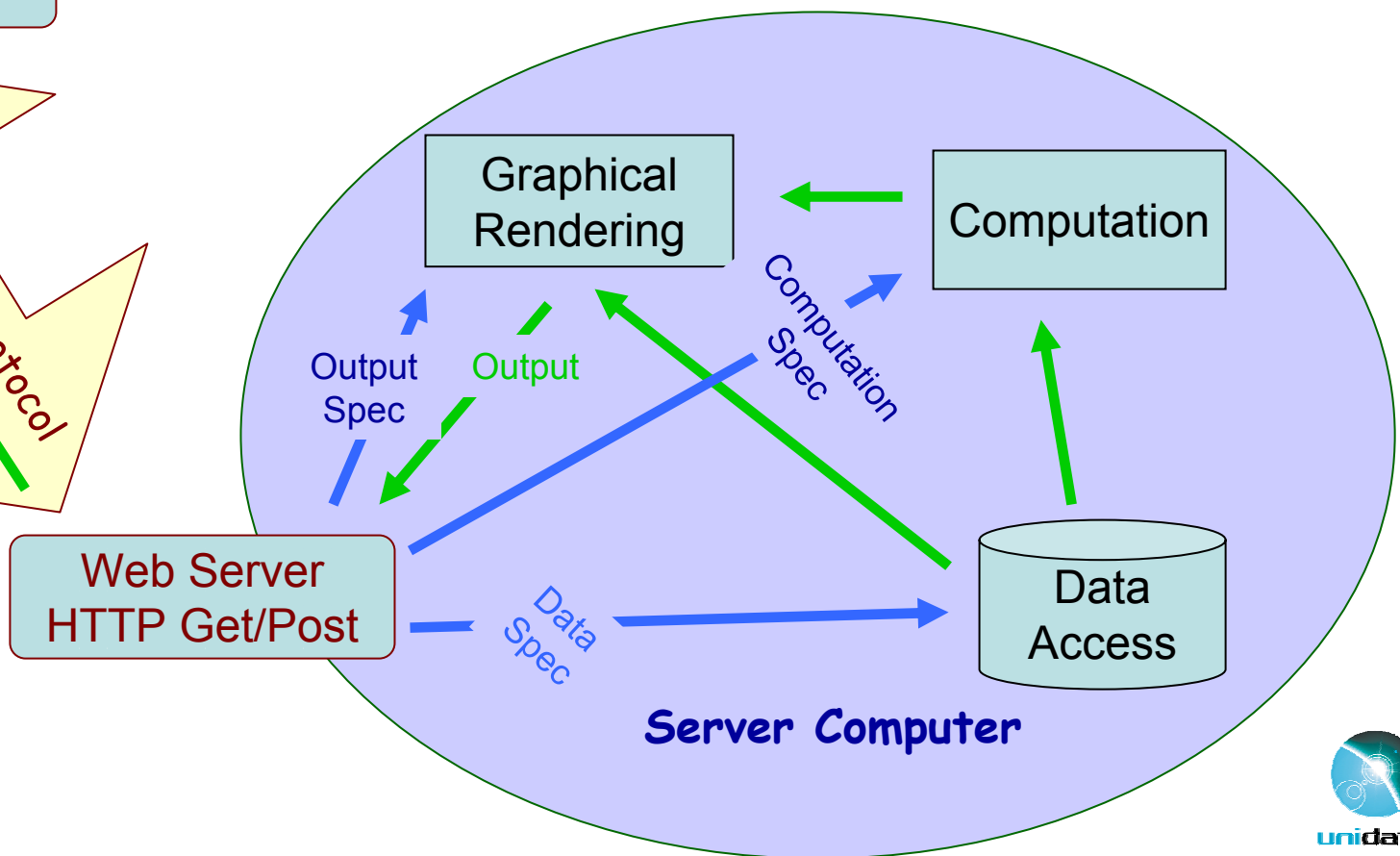
Data Analysis and Display System Components With Thin Client (Browser-based) User Interface



Browser-based "Thin client":

- Computation and graphics on server
- Server determines analysis functionality, sends pictures to client
- Local browser interface for specifying data, computation, graphics output





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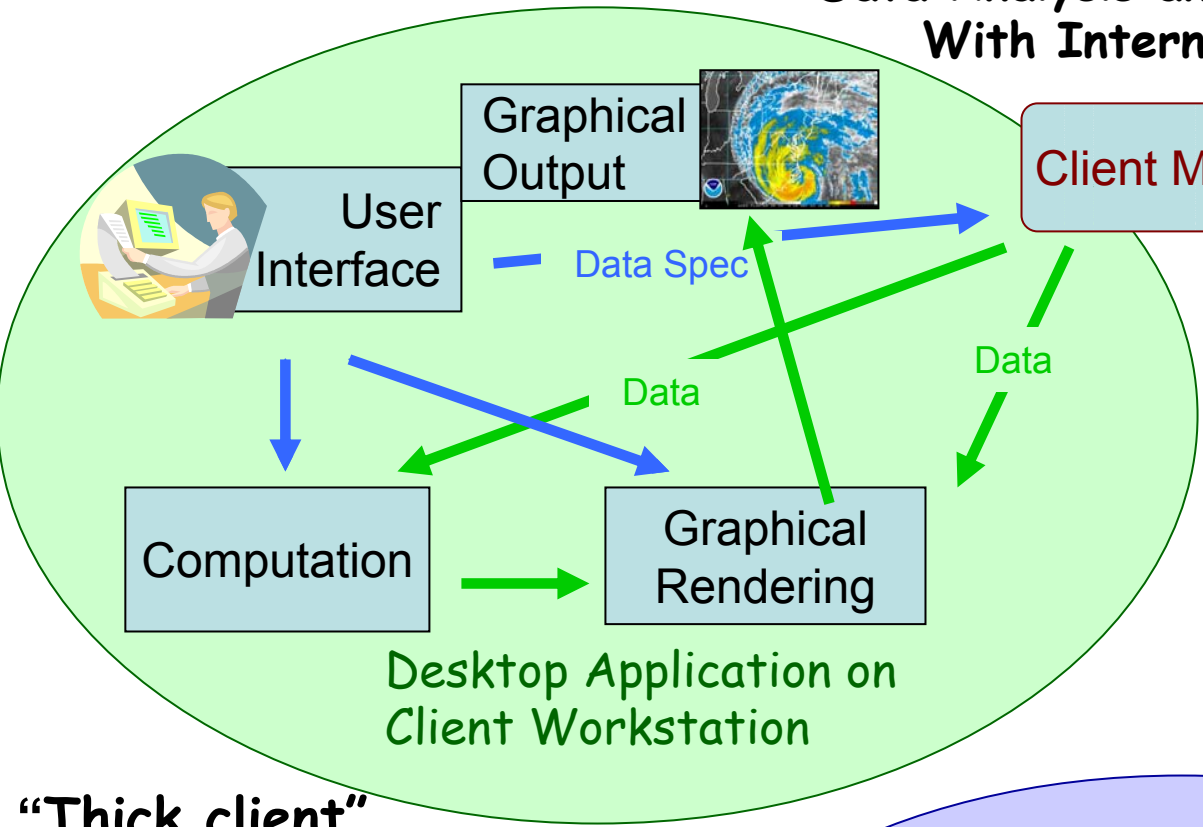
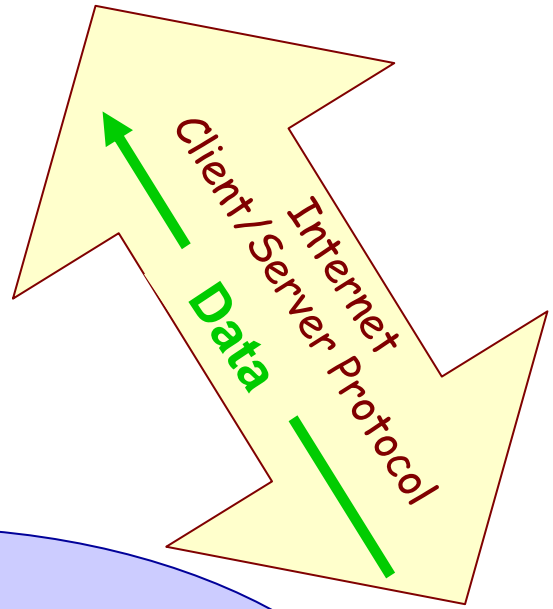
Examples of Thin Client, Browser Based A&D Systems

- The PMEL (Pacific Marine Environment Lab) Live Access Server (LAS) which runs at many sites
- The INGRID site at LDEO/IRI (Lamont Doherty/International Research Institute for climate prediction)
- The Community Data Portal (CDP) at the National Center for Atmospheric Research (NCAR)

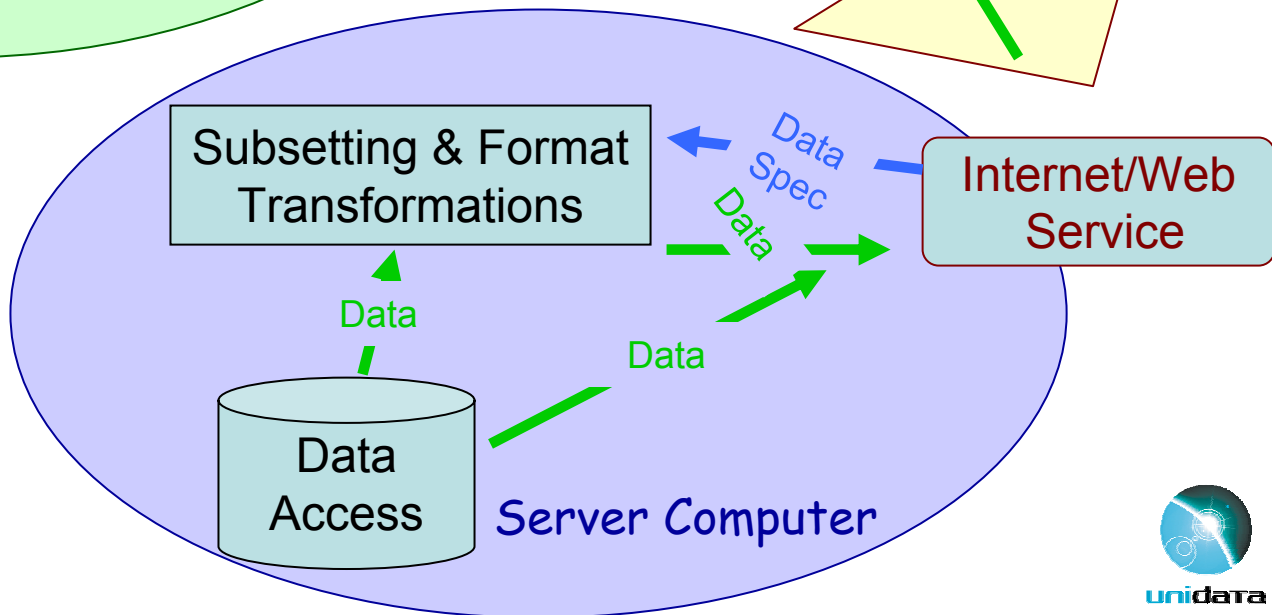
Data Analysis and Display System Components With Internet Client/Server Data Access





"Thick client" Desktop application:

- Computation and graphics on local workstation
- User control of application functionality via desktop application
- Server accesses, subsets, converts, transfers data



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Client/Server Systems and Protocols

- McIDAS now can access data on remote servers using ADDE (Abstract Data Distribution Environment) protocol
- ESRI clients can access data on remote arcIMS (Internet Map Servers)
- Matlab, Kodak's IDL, Unidata IDV can access data via OPeNDAP/DODS protocol
- Open GIS Consortium (OGC) has specified WMS (Web Mapping Service), WFS (Web Feature Service), WCS (Web Coverage Service) protocols

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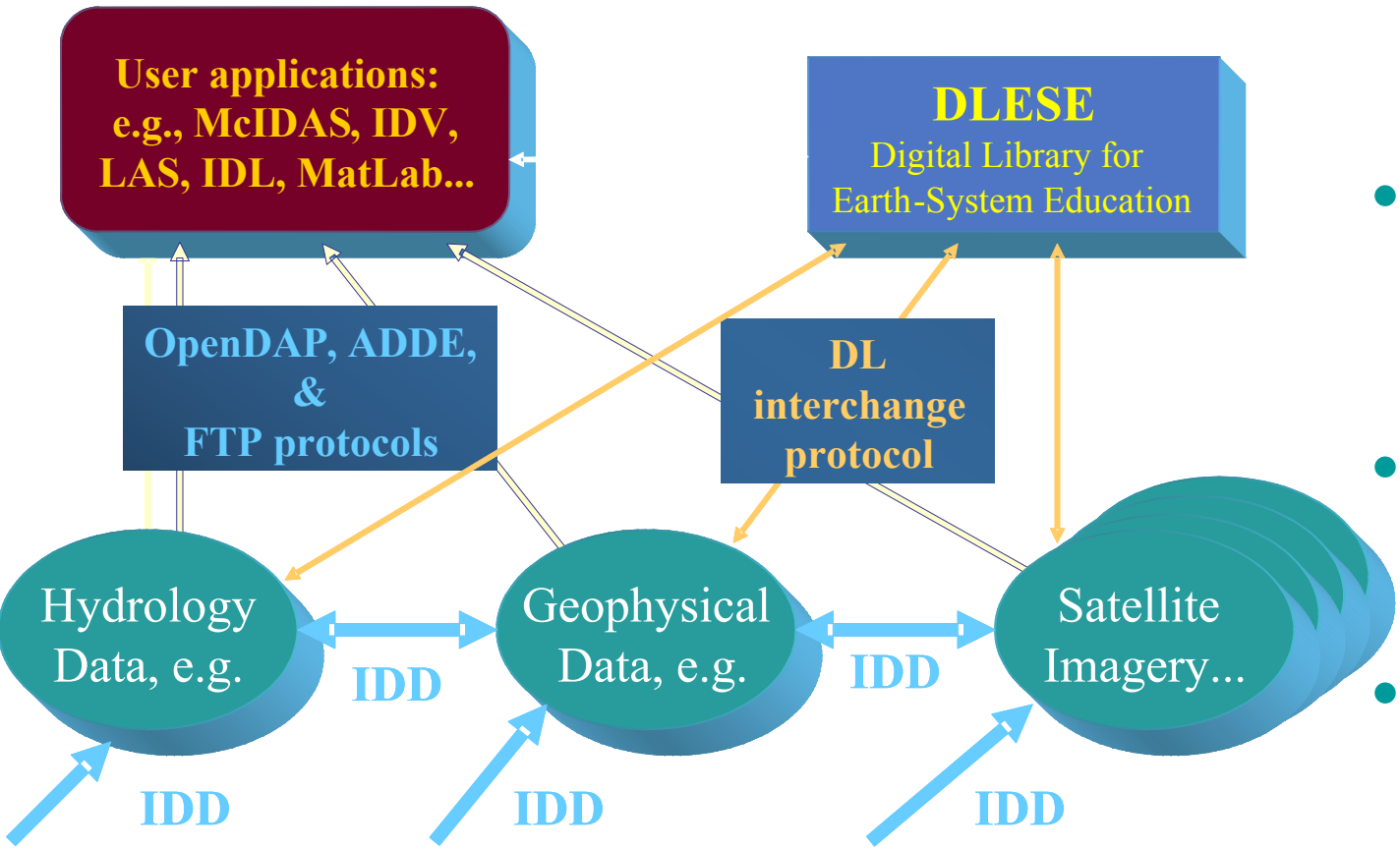
Thematic Real-time Environmental Distributed Data Services (THREDDS)



- Integrate environmental data and tools into the world wide web
- Combine IDD "push" with several forms of pull and DL discovery
- About 25 data providers are THREDDS partners
- Connecting people, documents, and data

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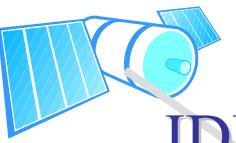
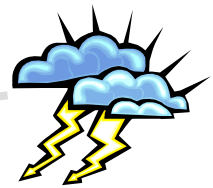
Client/server approach enables integrated analysis and display of disparate datasets from distributed servers via a user-chosen thick client desktop application



IDD

Lightning data server



IDD

Satellite data server

Streamflow data server

IDD

IDD

Client/server data access

Weather Obs. data server

Desktop Application

Flood/landslide computation and data server

Digital library discovery

Demographic data server

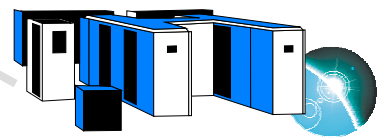
Radar data server

Global model data server

IDD

Weather model computation and data server

IDD



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Client/Server Advantages

- One can perform integrated analysis of datasets that reside on several different remote servers
- User can choose desktop analysis and display software and configure capabilities locally
- The same interface can be used for analyzing datasets from different sources
- Subsetting and common format transformations can be done on the server

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Client/server Challenges

- User has to know where the data reside
- Many systems have to work together
- Different disciplines have different ways of thinking about data (data models)
- It's complicated: too many protocols and conventions
  - Each client has to recognize multiple server protocols
  - Data providers have to implement several different protocols and data transformations

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Oversimplified Data Model Differences

- To the GIS (solid earth) community, the world is:
  - A collection of static *features* (e.g., roads, lakes, plots of land) with geographic footprints on the Earth (surface).
  - The *features* are discrete objects with attributes which can be stored and manipulated conveniently in a **database.**

- To the fluids (atmosphere and oceans) communities, the world is:
  - A set of *parameters* (e.g., pressure, temperature, wind speed) which vary as continuous functions in 3-dimensional space and time.
  - The behavior of the *parameters* in space and time is governed by a set of **equations.**
  - Data are simply approximations to mathematical functions.

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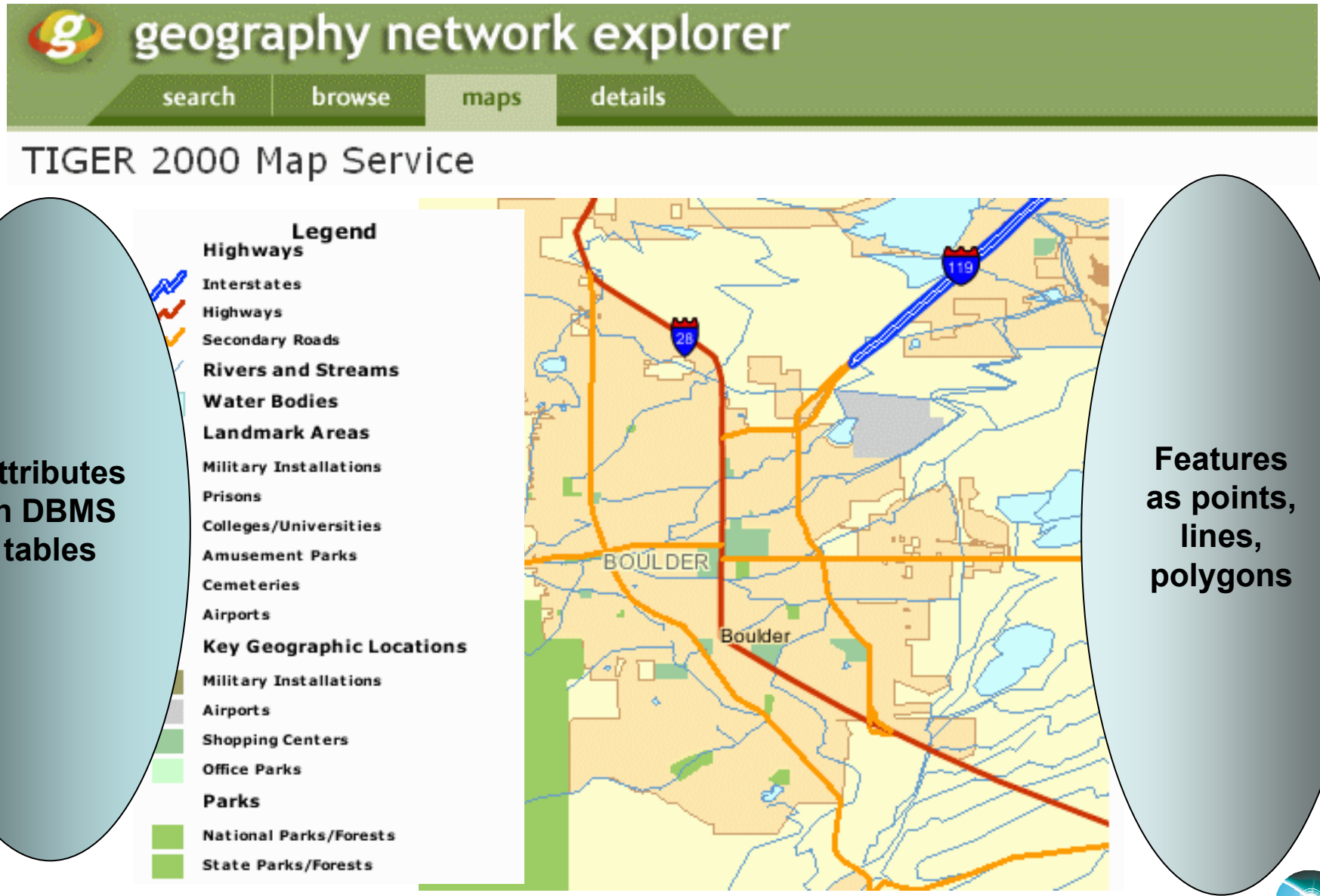
Traditional GIS view



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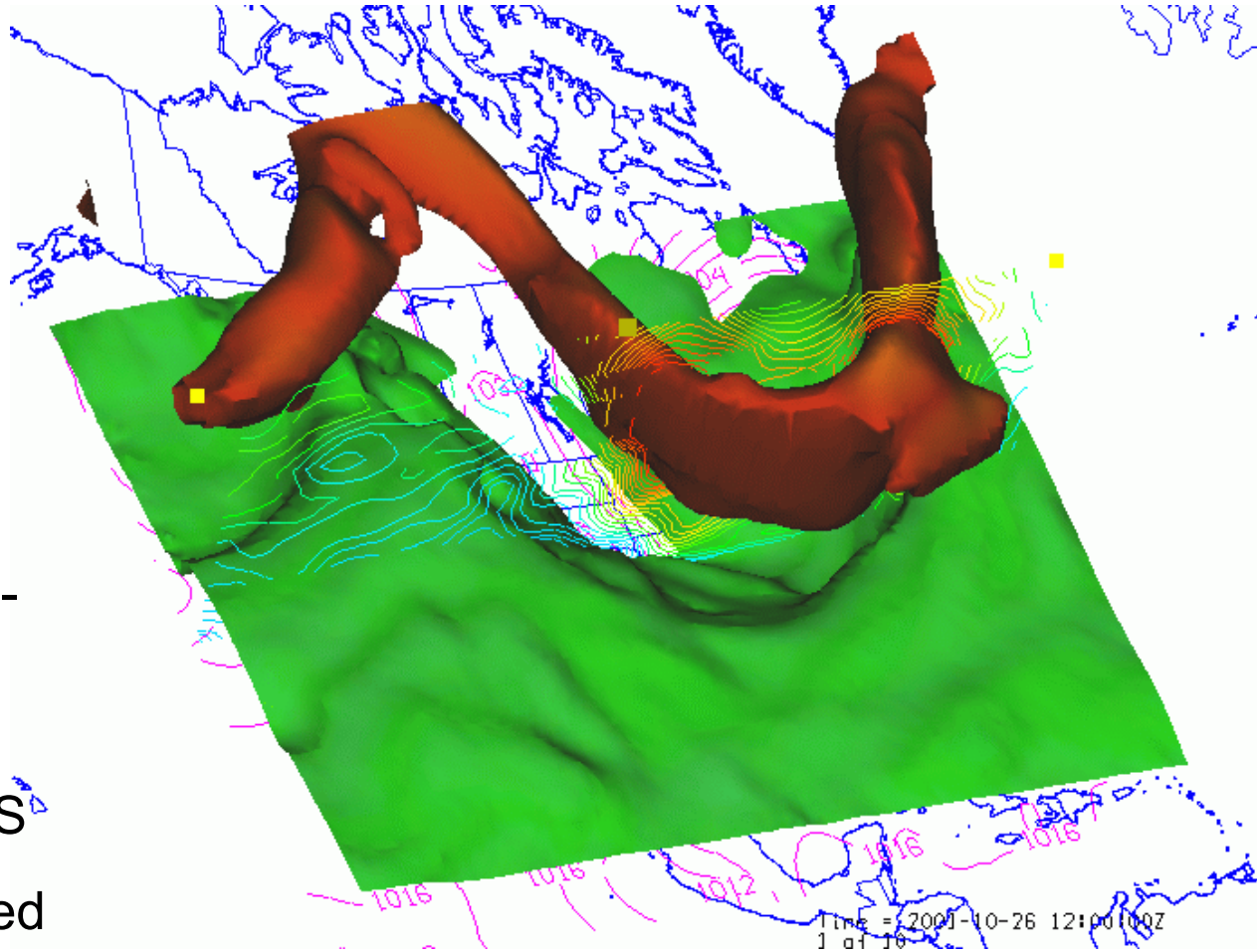
Atmospheric Science view

Hyperspatial structured data (HSD)

- High dimensionality
- Multivalued parameters (pressure contours, wind-speed rendering in 3D)
- Typically stored in file system rather than DBMS
- (Note the shapefile-based map underneath)



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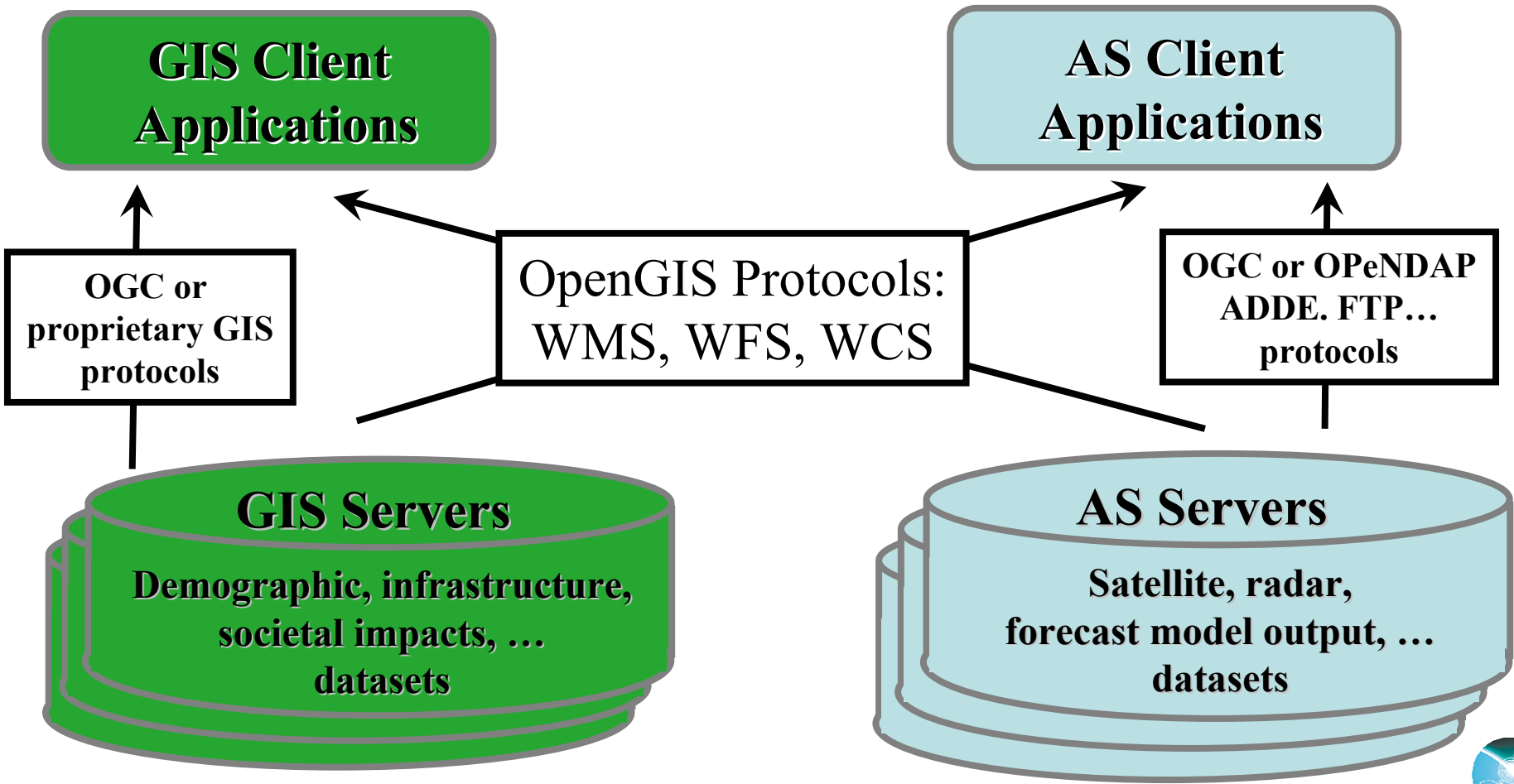
Taking Advantage of Web Services for Data System Interoperability



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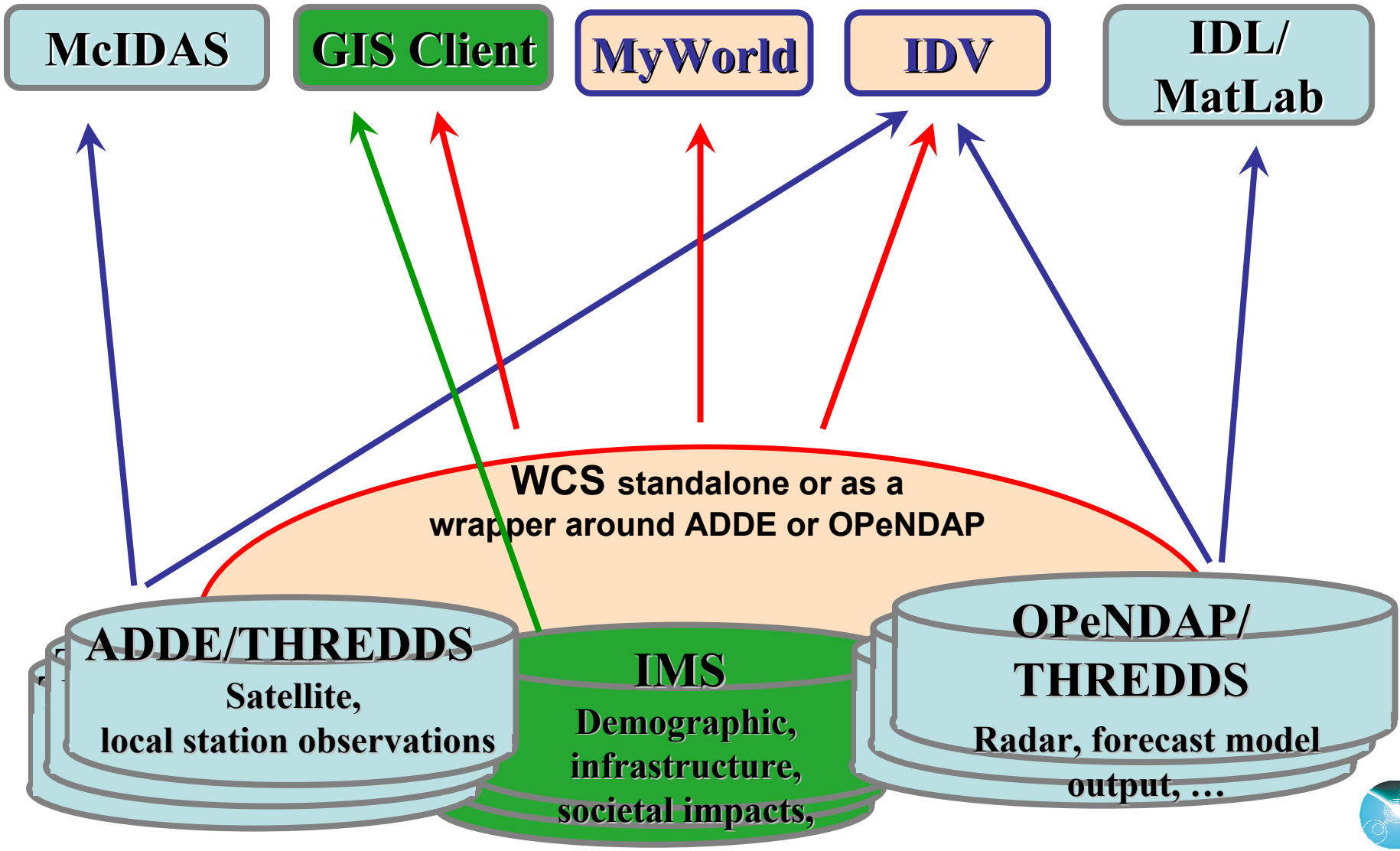
Current projects



Advantages of Standards Approach

- Single interface for clients
- Data providers can:
  - use current services with WCS layer or wrapper
  - Move toward a single service protocol
- Usage and discovery metadata interfaces are part of the specification

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Disadvantages of Standards Approach

- We aren't there yet:
  - Key standards are still evolving
  - Implementations are few and raw
  - Process is slow and cumbersome
  - Risk that vendors won't adopt them
- Legacy systems are installed, working, and have momentum
- Data models and metadata conventions still need to be agreed upon

Current Thinking

- There is no single solution for integrated analysis and display of disparate datasets at this time
- Multiple approaches are teaching us a lot (the hard way) and will guide ultimate system
- The payoff is great enough that it is crucial that we continue to work toward a solution
- Open GIS/ISO standards approach is the best hope at the moment

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