The Integrated Data Viewer: A tool for scientific analysis and visualization

Don Murray
Unidata Program Center

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Outline

- Overview of the Integrated Data Viewer (IDV)
  - What is it?
  - Historical perspective
  - Development by leveraging existing resources
- IDV Features
  - Unique features
  - Web enabled features
- IDV as an Integrator
  - UCAR Collaborations
  - Non-UCAR Collaborations
- Current/Future development
- Summary/Acknowledgements/Links
What is the IDV?

- Freely available Java™ framework and reference application for scientific analysis and visualization
- Provides 2- and 3-D displays of data (grids, in-situ, radar, satellite)
- Stand-alone or networked application
Historical Perspective

- Outgrowth of the MetApps project at Unidata to provide new met tools in Java

- MetApps Project Goals
  - Offer open-source, platform-independent applications for analysis and visualization of geoscientific data by researchers, educators and students
  - Create a component-oriented framework for construction of custom applications
  - Enlist users and other developers in component design and development
Historical Perspective

Why develop new tools?

- Networked world creates opportunities for:
  - remote data access
  - remote collaboration
  - distance learning

- New data sets (Level II NEXRAD, new instruments, new models (WRF), data from other geosciences) create opportunities for new views of the atmosphere and earth system

- Existing Unidata supported applications (McIDAS, GEMPAK) would require extensive modifications to support all of the above
Leveraging Existing Resources

- Java
- VisAD Component Library
- Remote data access protocols
- Unidata community of educators and researchers to guide development
- Experience using and supporting existing viz/analysis packages (GEMPAK, McIDAS, Vis5D)
Leveraging Existing Resources

Why Java?

- Platform independence – supported on most major operating systems and browsers
- Network enabled - allows development of collaborative applications and access to network data holdings
- Object-Oriented design - aids in component development (e.g., reusability, interactivity)
- Java 3D™ - provides ability to create new, innovative views of conventional datasets on low cost hardware
Leveraging Existing Resources

VisAD Component Library

- Created by developer of premier 3D viz package used today in atmospheric science community (Vis5D) with ongoing development at U-WI, UCAR and NCSA
- Powerful mathematical data model that embraces virtually any numerical data set
- General display model that supports 2- and 3-D displays, multiple data views, direct manipulation
- Adapters for multiple data formats (netCDF, HDF-5, FITS, HDF-EOS, McIDAS, Vis5D...) and access to remote data servers.
- Supports data sharing and real-time collaboration among geographically distributed users
Leveraging Existing Resources

Remote Data Access

- Abstract Data Distribution Environment (ADDE)
  - Java client included in VisAD
  - Existing network of ADDE servers at Unidata sites
- Distributed Oceanographic Data System/Open source Project for a Network Data Access Protocol (DODS/OPeNDAP)
  - Java client available
  - netCDF interface
  - VisAD access
  - Used in other geoscience disciplines as well as atmospheric science
- HTTP/FTP
  - Access to both data and documents
Leveraging Existing Resources

MetApps Task Force

- Unidata community members who provided the vision for how evolving technology and changes in teaching and research approaches over the next decade will influence overall requirements for applications software.

- User-centered design allows greater usefulness and usability of software and innovation in how the software displays data
  - Participating in the selection of development projects,
  - Specifying user requirement through the development of use cases,
  - Testing each iteration and providing feedback to the developers.
IDV Features

- Integrated displays of a variety of data types
- Support for a variety data access methods
- Multiple display types
- Interactive probes
- User defined formulas
- Bundling of user preferences
- Integrated HTML viewer
- Easy configuration
- Integrated documentation
Unique IDV Features

- Interactive probes for dataset exploration
  - Parameter readouts
  - Vertical profiles
  - Model soundings
  - Time/Height displays
- QuickTime™ capture and playback
- Incorporation of educational materials
- User defined formulas
- Extensible framework
- Extensive use of network resources
Web enabled features

- Client/Server data access
- XML Configuration
- XML Persistence
- Integrated HTML Viewer
- Use of Java Web Start
Web Enabled Features

Client/Server Data Access

- Access data from DODS/OPeNDAP or ADDE servers, as well as local files, HTTP and FTP
- Allows subsetting of large datasets
- Can use THREDDS catalogs for discovery and usage metadata
- Catalogs can be indexed in digital libraries
Web Enabled Features

XML Configuration

- IDV uses XML to configure the user experience.
- Configuration files can be local or distributed across one or more web servers.
- Offers flexibility to adapt the interface to:
  - learners
  - tasks
  - data sets
  - content areas
Web Enabled Features

XML Persistence

- State of the application (loaded data sources and data depictions) can be saved in XML “bundles”
- Bundles can be loaded at startup or imported on-the-fly
- Displays can be annotated and these can be saved in the bundle as explanations
- Bundles can be distributed around the Internet (on web servers or e-mail attachments)
Web Enabled Features

Integrated HTML Viewer

- IDV includes a customized HTML viewer
- Viewer can be used to provide context with associated data displays
- IDV displays can be easily embedded in the HTML
- Can be used as a customized UI which controls the IDV
Web Enabled Features

Use of Java Web Start™

- Java Web Start is used to load in the IDV from a web page.
- JNLP files can include pointers to configuration files and bundles for customization (VGEE).
- Web Start provides automatic updates.

Install and Run the IDV with Web Start

- Install Java
  - If you are running Windows, Windows has Java and you don’t need to install Java. (except for some older versions of Windows which probably do not meet the system requirements anymore).
  - If you are running Solaris or Linux, install Java (generally known as Java 2 Standard Edition or J2SE). Get an official version of Java 1.3 or higher, and no beta or RC versions. Go to Sun’s site: http://java.sun.com/products/standard/
  - Download JRE if you only want to run the IDV and other Java programs, or JDK if you want to write and compile Java source code and run programs.
  - For other systems, Web Start doesn’t work yet, so go to the manual installation section of the User Guide.

- Click here to Download and Install Web Start (one time only)

You only have to install the Web Start program once, unless you need to update to a later version. Under Linux and Solaris, you will be prompted for the pathnames of the installed JRE - the Java runtime environment. Be sure you are running Web Start version 1.0.1.02 or later (but not 1.2) and it is an official (non-beta/RC) version. There is a security problem with earlier versions (1.0, 1.0.1.01, etc.). If you are using Netscape, after installing WebStart, you must exit Netscape, then start Netscape again.

- Click here to Launch the IDV

Once Web Start is installed, you only click here to start the IDV every time.

For additional information about starting the IDV through Web Start, see the IDV User’s Guide and the FAQ.

Go to Unidata’s home page.
IDV as an Integrator

- Data and configuration parameters can be loaded from multiple, distributed servers
- VisAD data model enables computations on disparate datasets
- Metadata (e.g., units, sampling topologies, error estimates and coordinate transforms) is carried along through mathematical operations
- Facilitates collaborations between disciplines
IDV Collaborations in UCAR

- ATD
  - IHOP
  - SPOL in the classroom
- DLESE and SCD
  - Visual Geophysical Exploration Environment (VGEE)
- NSDL
  - Thematic Realtime Environmental Data Distributed Services (THREDDS)
- RAP
  - VisAD development (as part of 4DWX)
- <your group here>
IDV Collaborations outside UCAR

- Air Force Institute of Technology
  - GRIB reader
  - Airborne Laser System
- THREDDS community
  - Catalog testing
  - Component framework development (CDC)
- University of Illinois
  - VGEE development, IDV testing
- Space Science Engineering Center (SSEC) – UW-Madison
  - VisAD enhancements
  - VisBio
- Australian Bureau of Meteorology
  - VisAD enhancements
Current/Future Development

- **New Data Types**
  - NEXRAD Level II data
  - WRF model output
  - Support for additional geoscience data sets (oceanographic, geophysical)
  - GIS data

- **New Features**
  - Web publishing (blogs)
  - Shared, collaborative displays
Summary

Unidata’s IDV is a freely available, powerful analysis and visualization tool which can facilitate education and research by:

- Integrating diverse datasets
- Allowing customized user experiences
- Enabling collaborations
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- UCAR collaborators (ATD – Chris Burghart, Susan Stringer, Mike Daniels; DLESE – Rajul Pandya SCD – Tim Schietlin; RAP – Doug Lindholm; )
For Further Information

- **Integrated Data Viewer homepage**
  - [http://my.unidata.ucar.edu/content/software/metapps](http://my.unidata.ucar.edu/content/software/metapps)

- **VisAD homepage**
  - [http://www.ssec.wisc.edu/~billh/visad.html](http://www.ssec.wisc.edu/~billh/visad.html)

- **VGEE homepage**
  - [http://www.dlese.org/vgee](http://www.dlese.org/vgee)

- **THREDDS**
  - [http://www.unidata.ucar.edu/projects/THREDDS](http://www.unidata.ucar.edu/projects/THREDDS)

- **Answers to questions**
  - support@unidata.ucar.edu