INSTITUT PIERRE SIMON LAPLACE
DES SCIENCES DE L'ENVIRONNEMENT

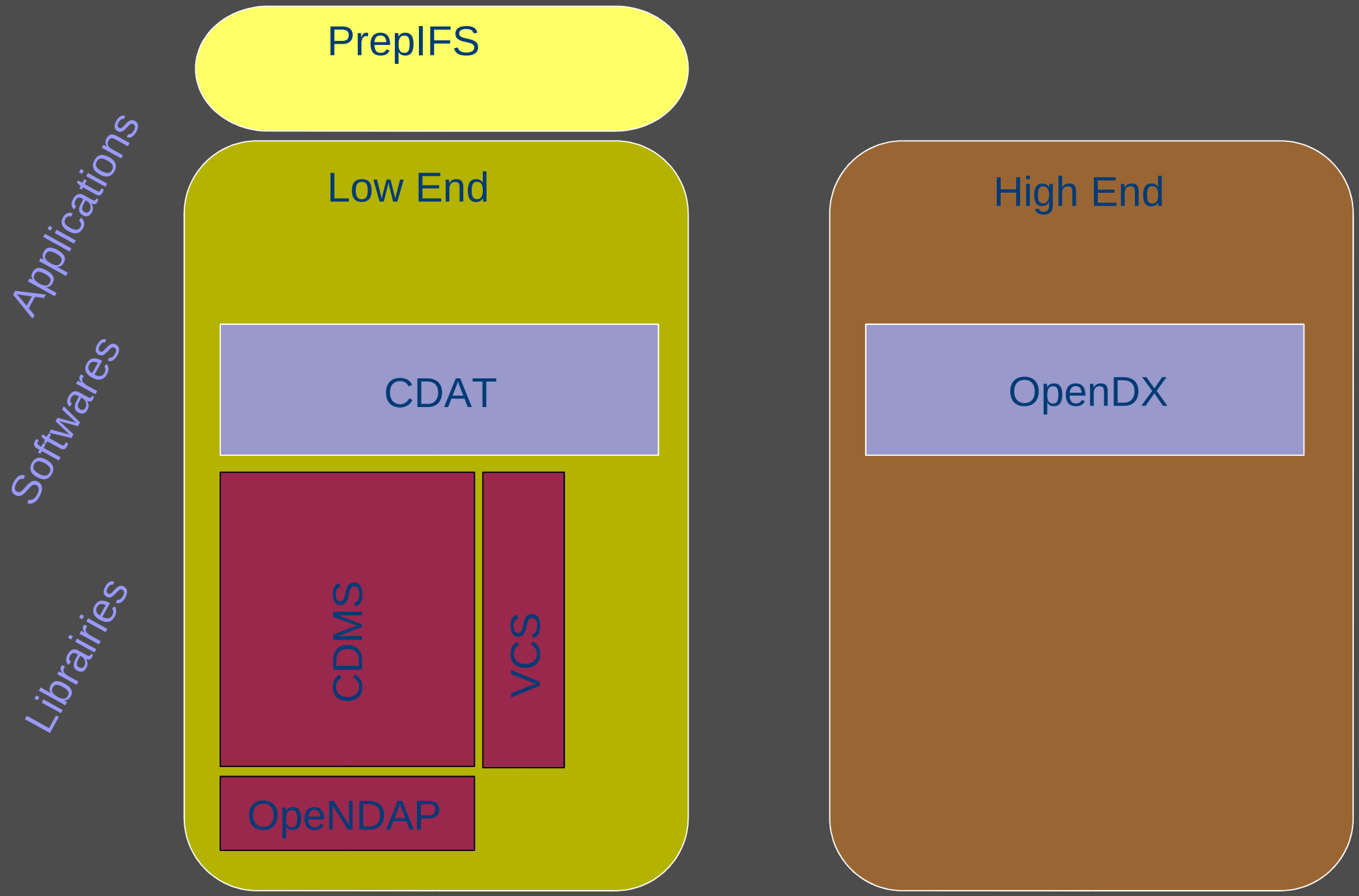
OPeNDAP
CDMS / VTK / Qt – Mapper

PRogram for Integrated Earth System Modeling
prism

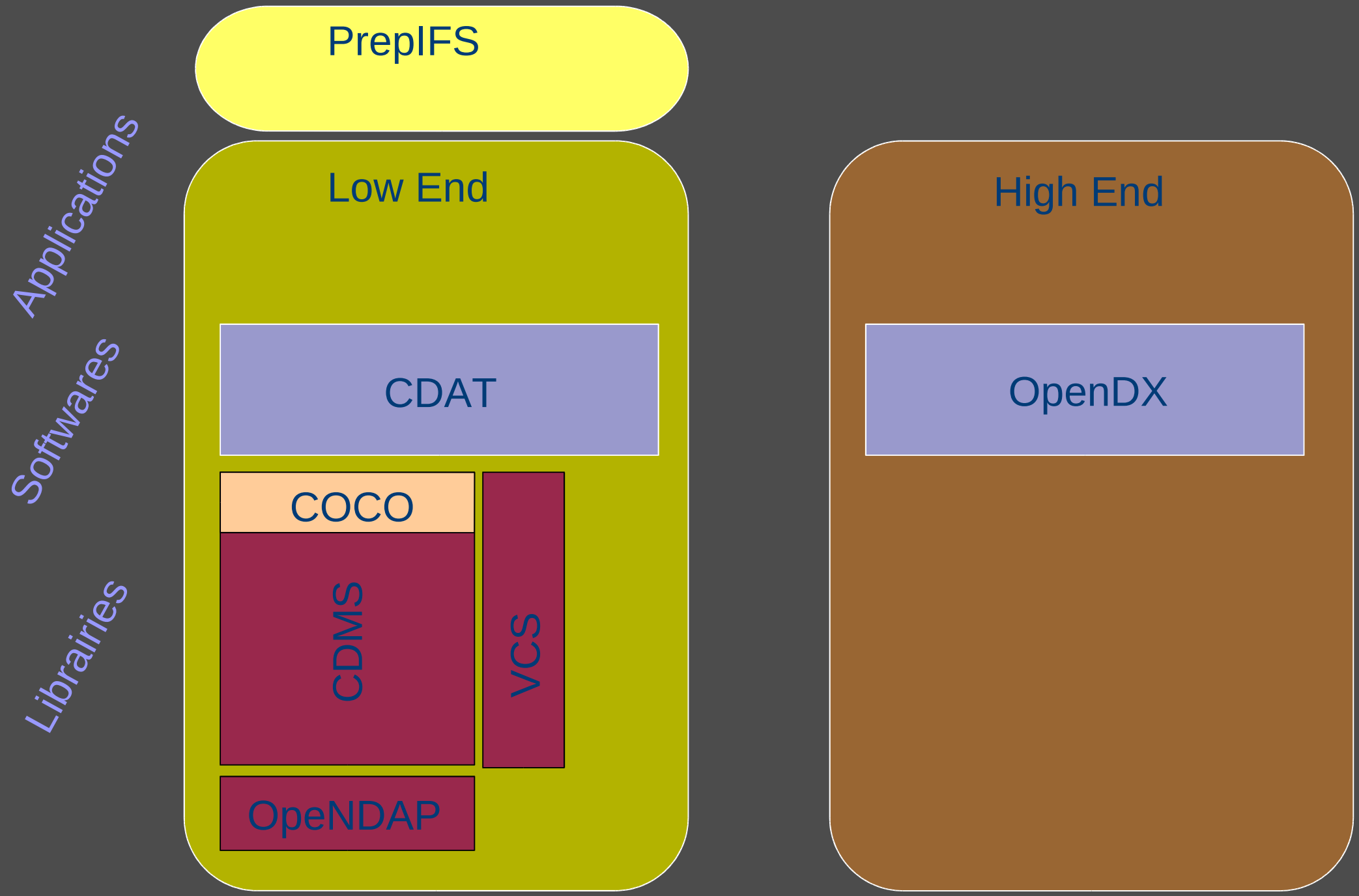
Patrick Brockmann
IPSL France

07/10/2004

Approach


PrepIFS
Applications
Softwares
Librairies
Low End
CDAT
CDMS
VCS
OpeNDAP
High End
OpenDX

Approach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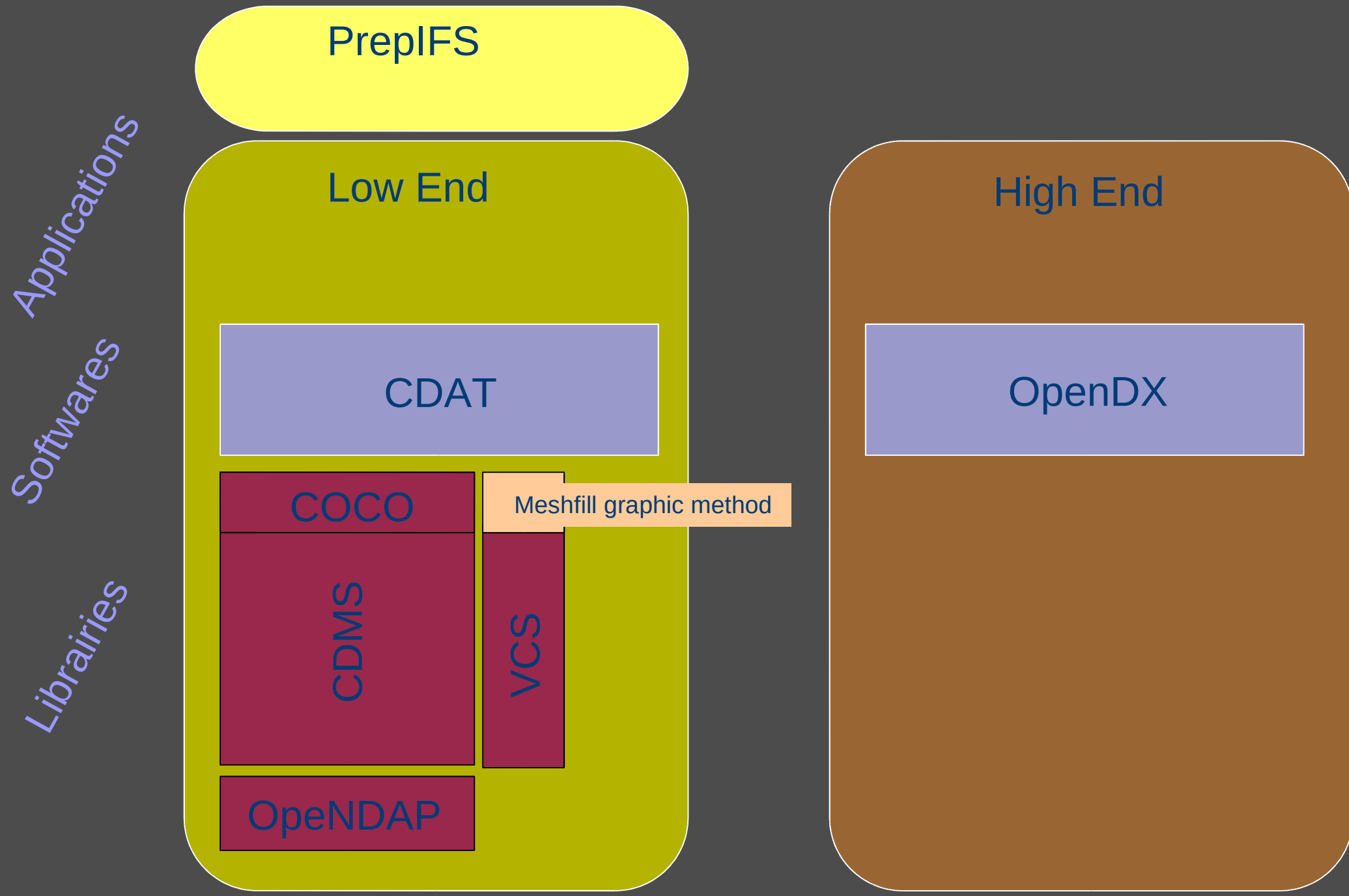
PrepIFS
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Meshfill graphic method
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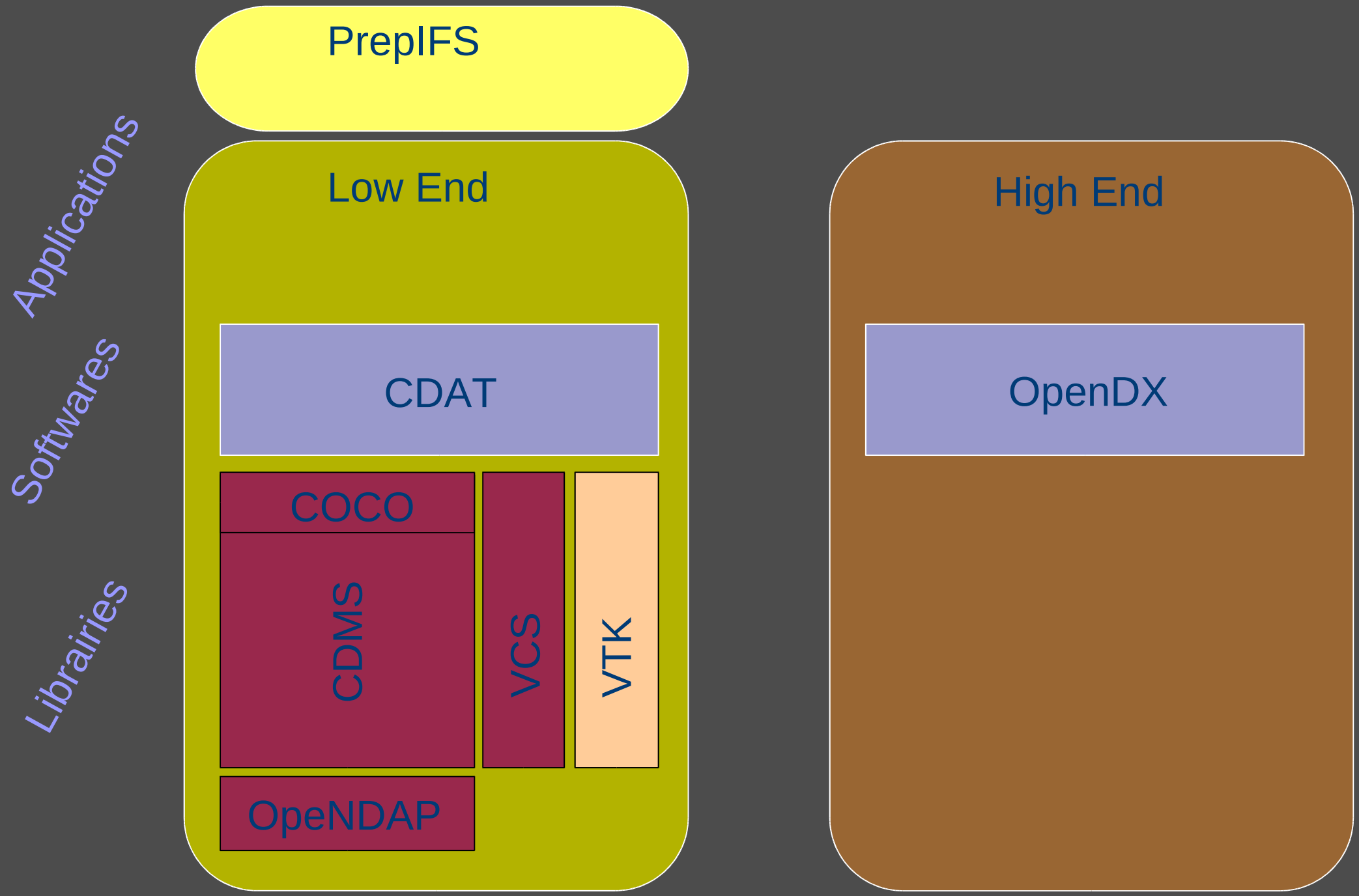
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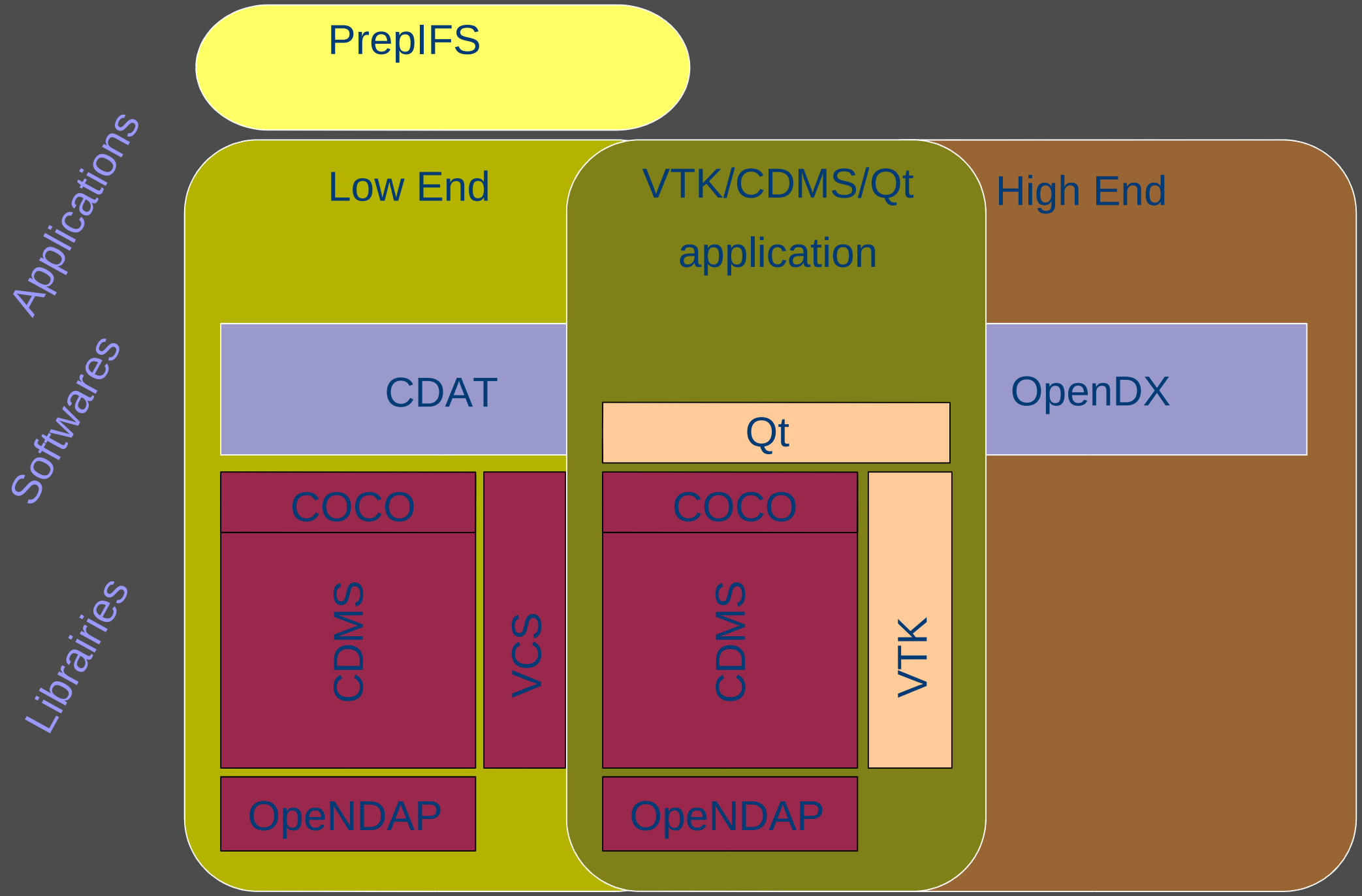
PrepIFS
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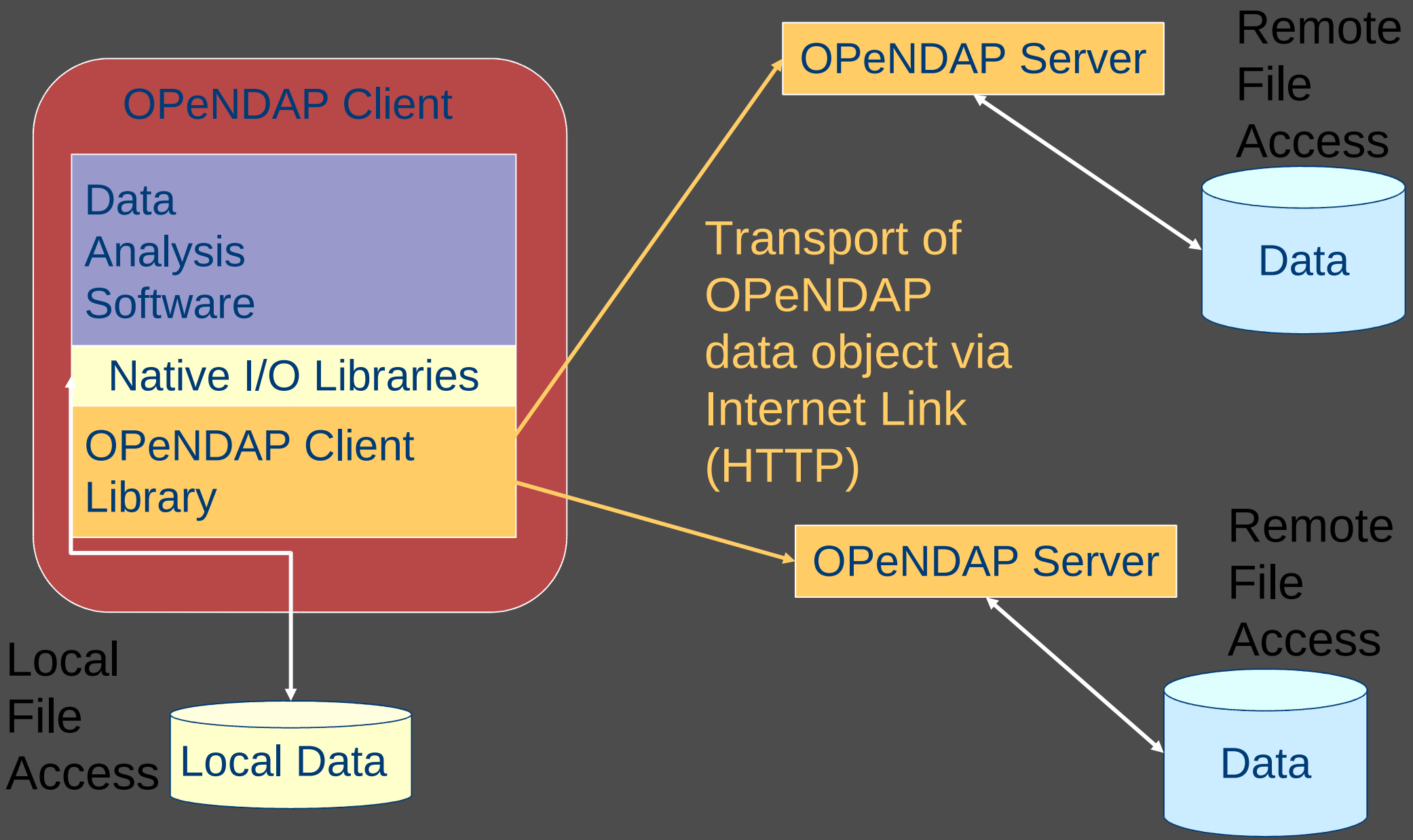
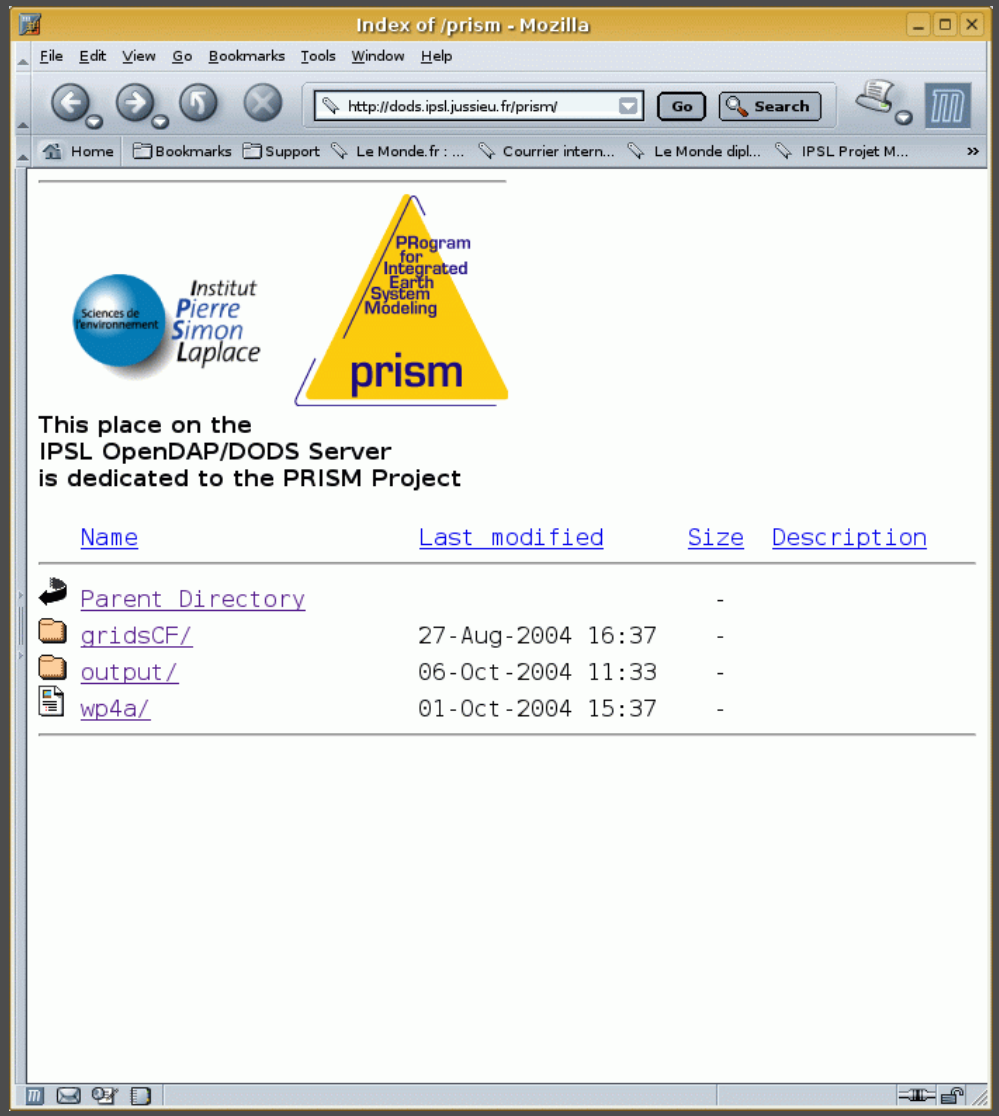
OpeNDAP
OpeNDAP

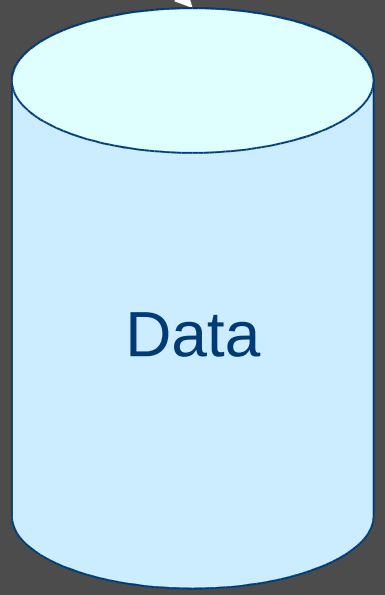
What is OPeNDAP?



IPSL OpeNDAP/DODS server



http://dods.ipsl.jussieu.fr/prism



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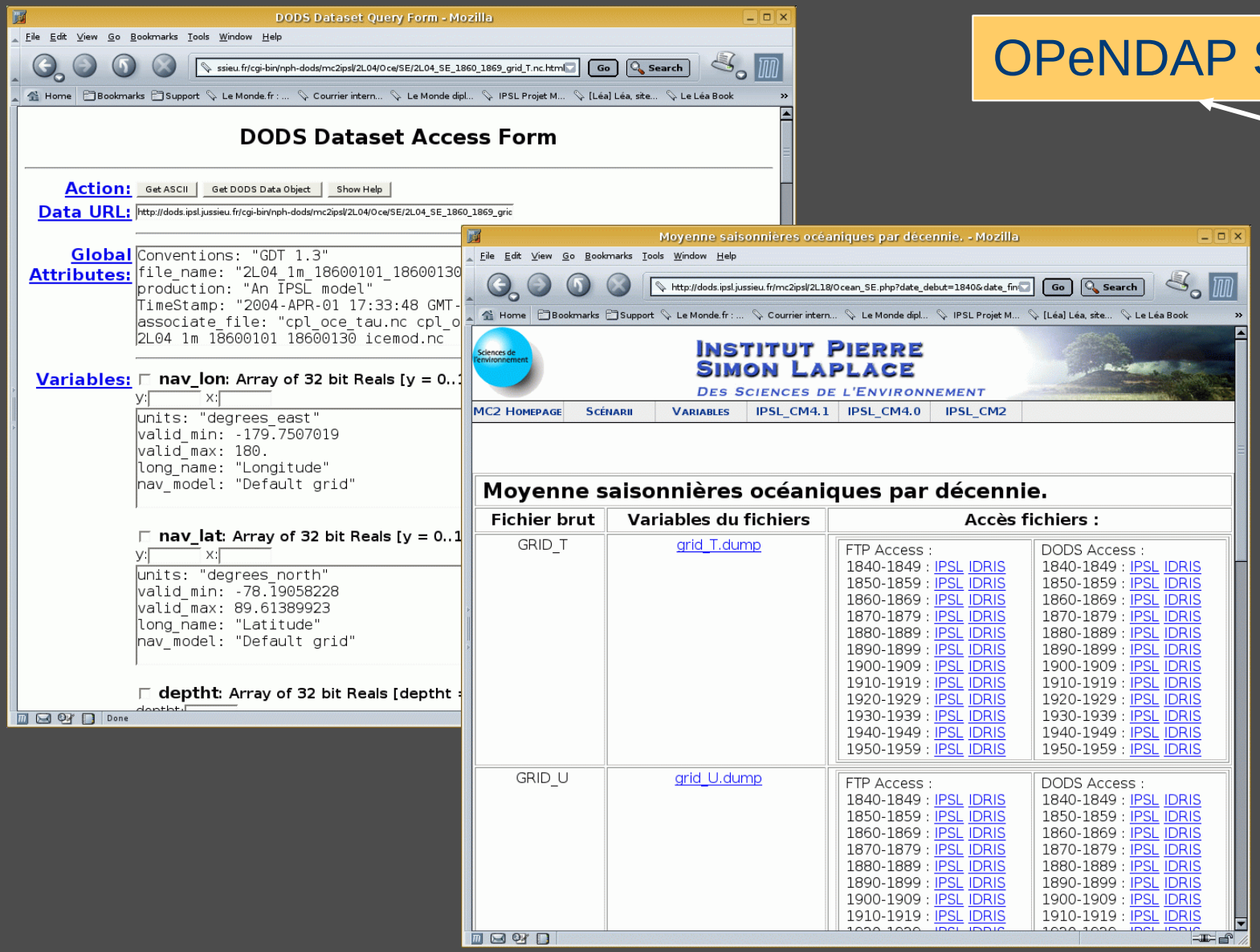


OPeNDAP Server

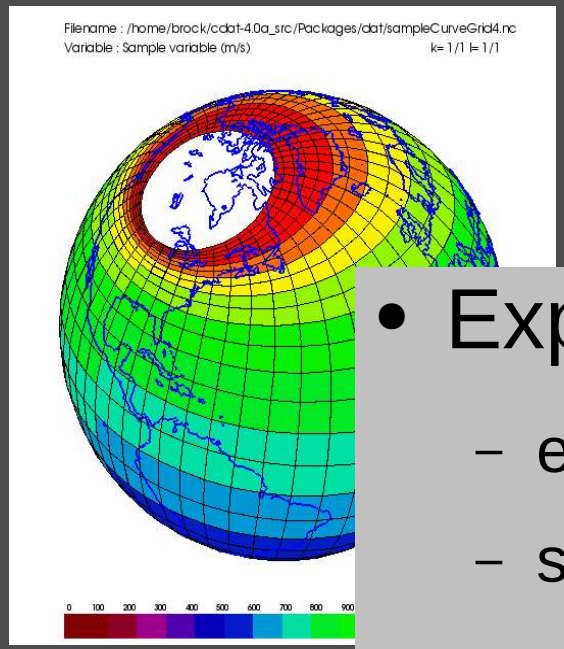
Data

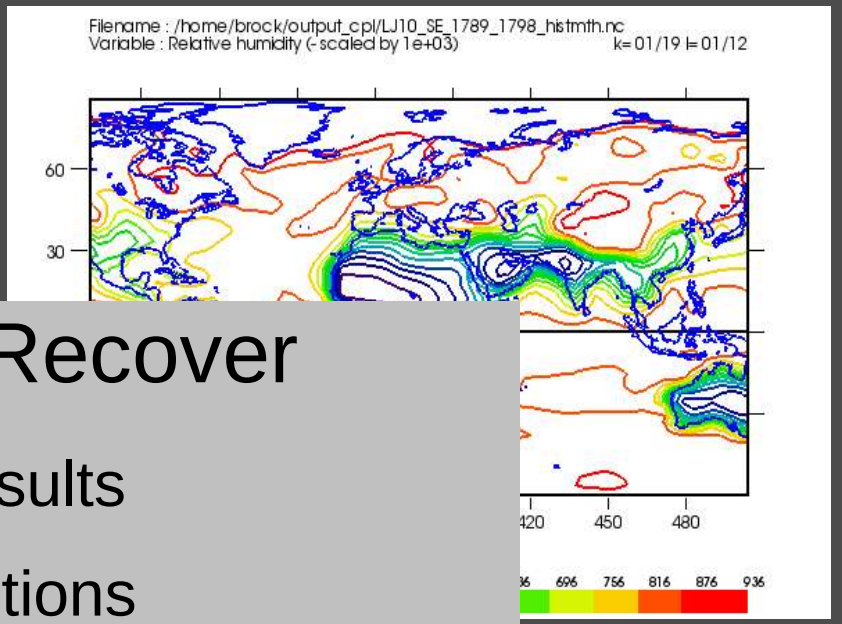
OASIS coupler files,

CF compliance test files,

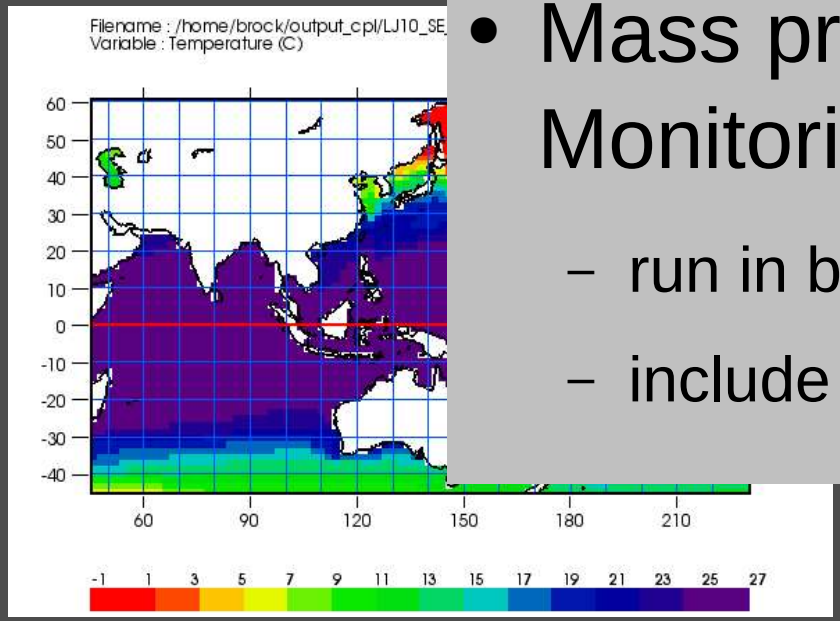
Coupled models output files,

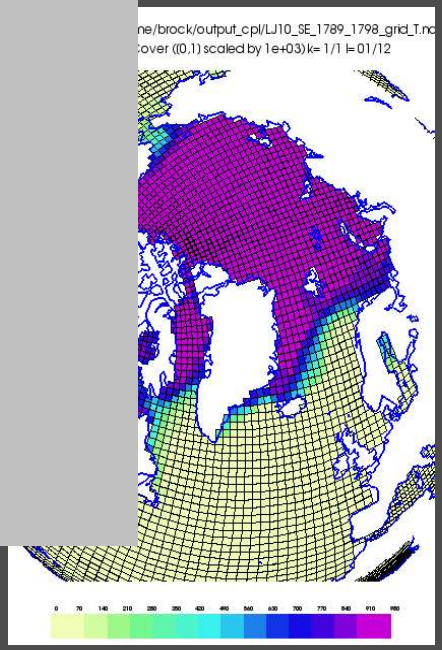
IPCC simulations output files





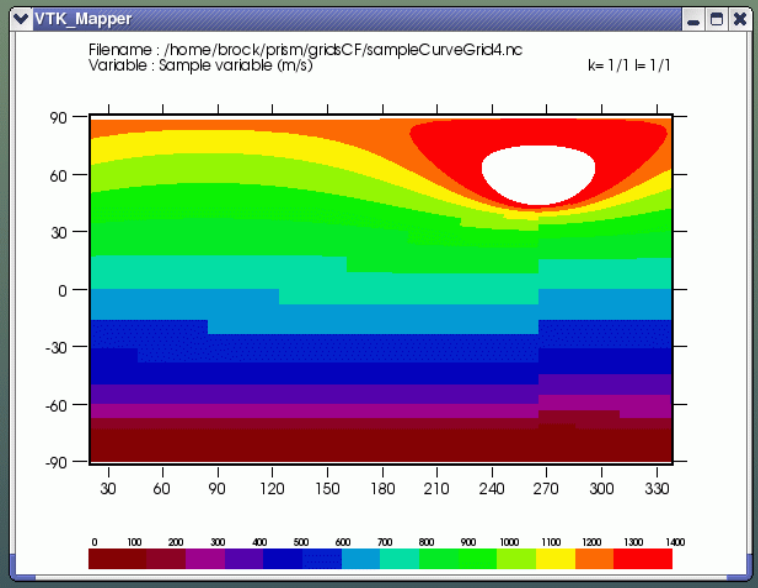
- Explore, Discover, Recover
  - explore interactively results
  - switch and discover options
  - recover the command with exacts arguments and options
- Mass production documents, Monitoring simulations
  - run in batch mode
  - include in scripts

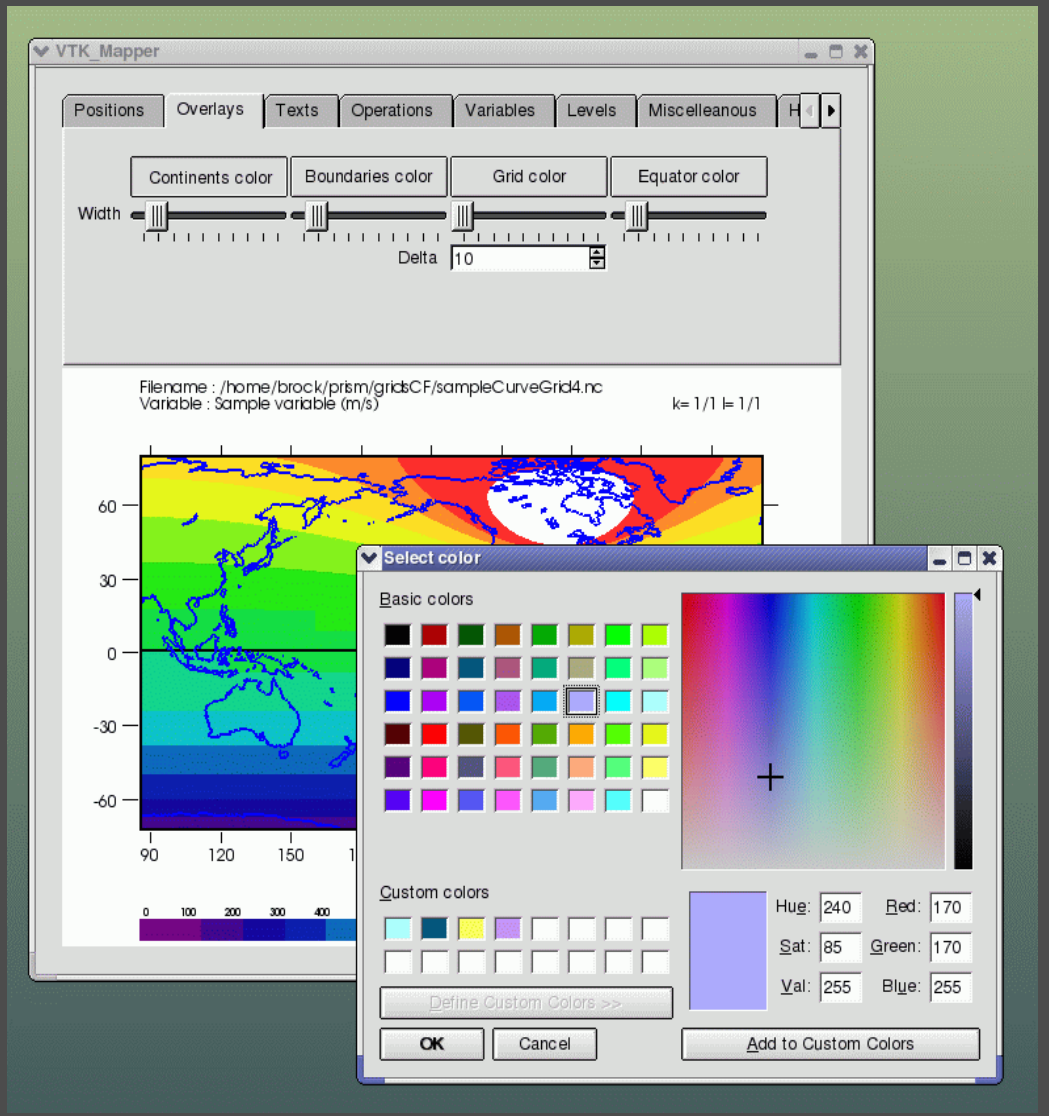




3 modes of use :

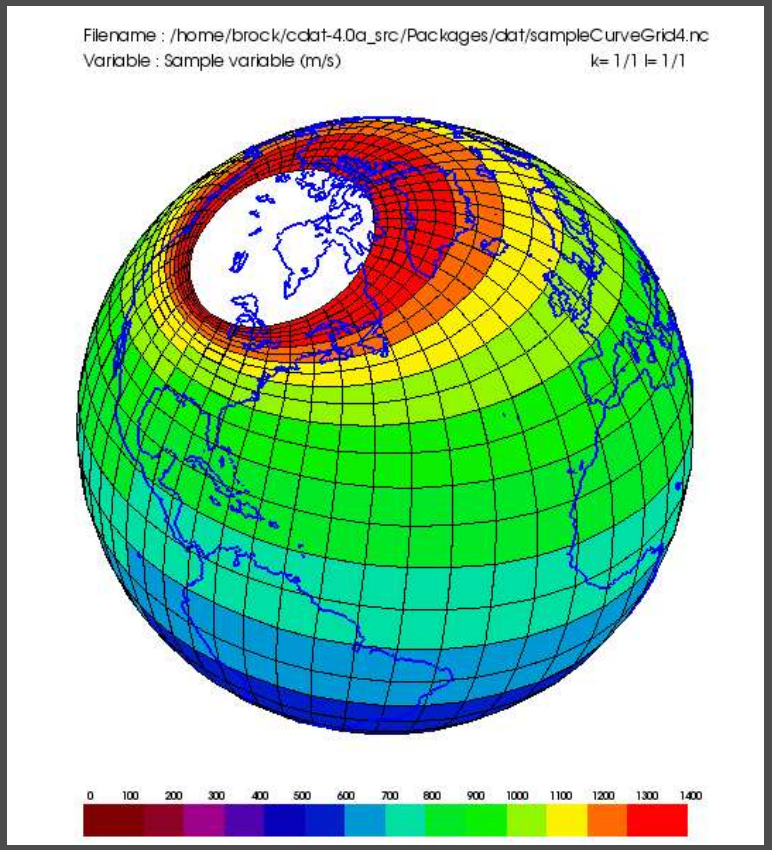
- Interactive with a GUI interface
- Interactive
- Offscreen

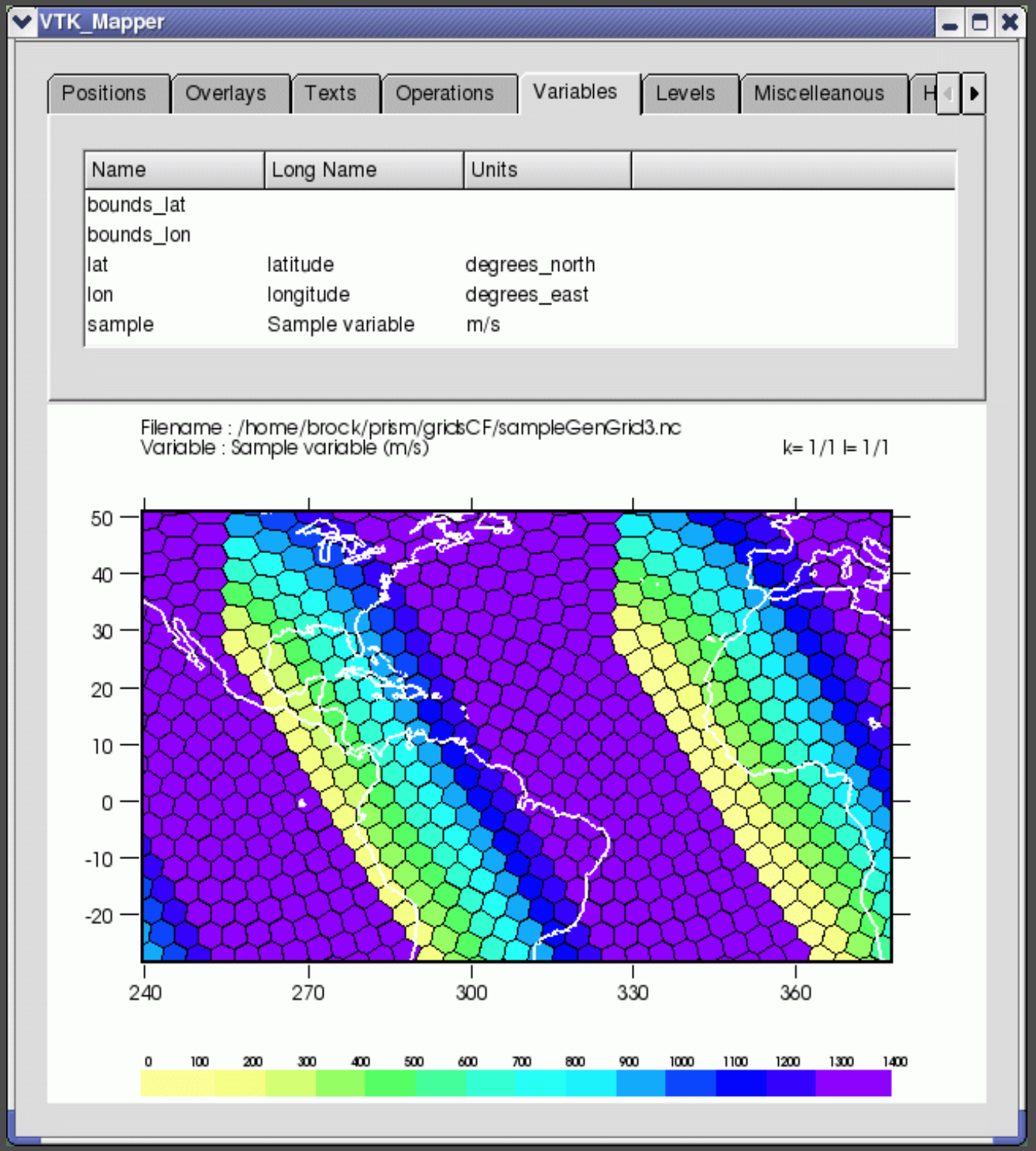





```
> mapper.py --offscreen /home/brock/prism/gridsCF/sampleCurveGrid4.nc sample
```

- Rectilinear, Curvilinear and Generic grids
- Isocontours, Isolines, Mesh plots



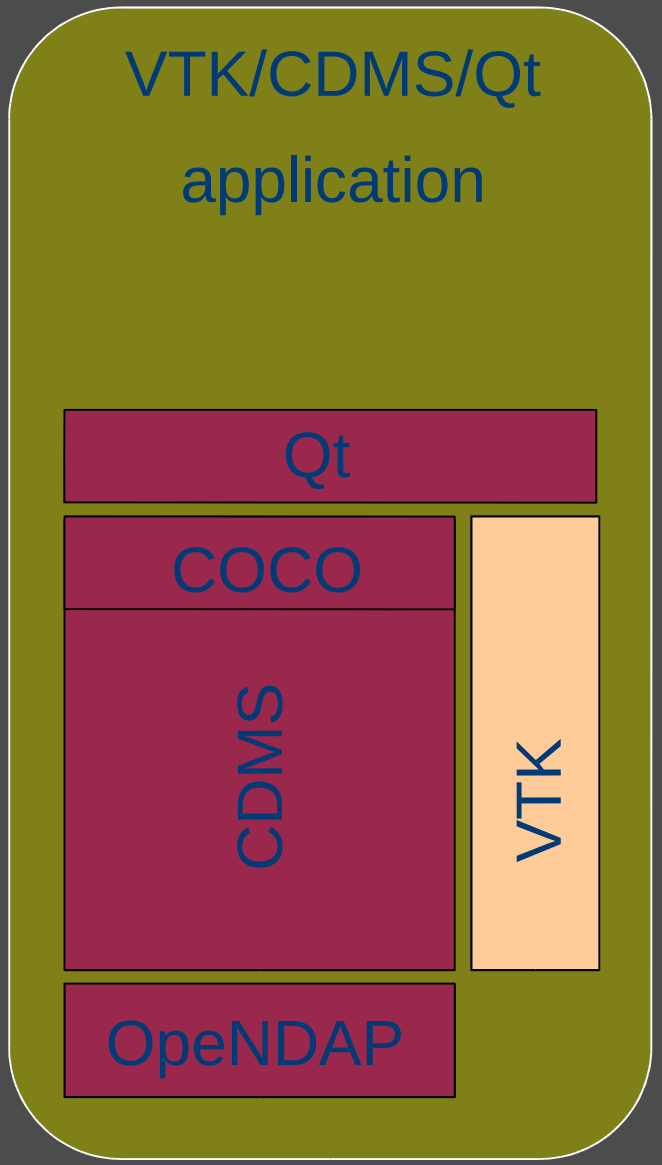


Visualisation Toolkit

- Advanced library for: computer graphics, visualization and image processing
- Object-oriented software framework
- Open source and binaries available for all common platforms
- Software interfaces for: C++, Python, Java and Tcl

Paraview

- Open Source application using VTK



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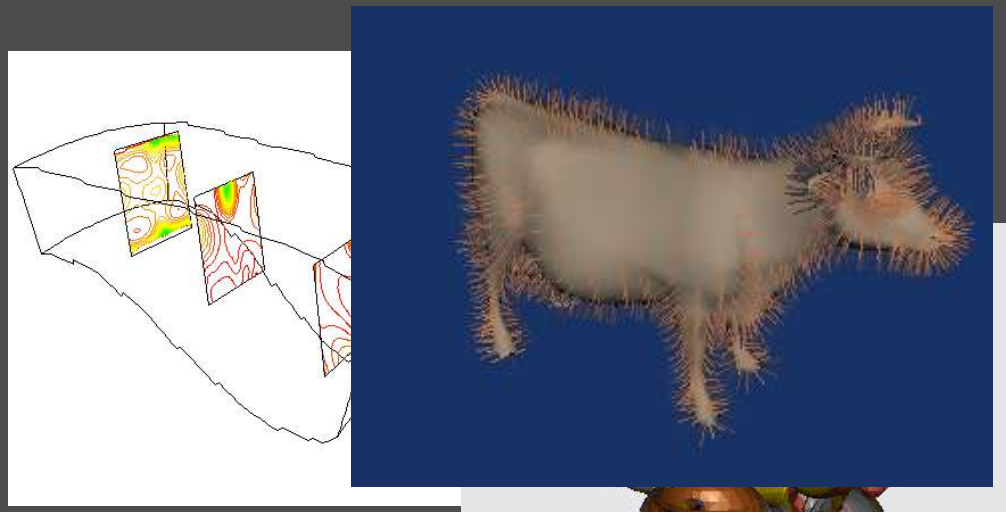
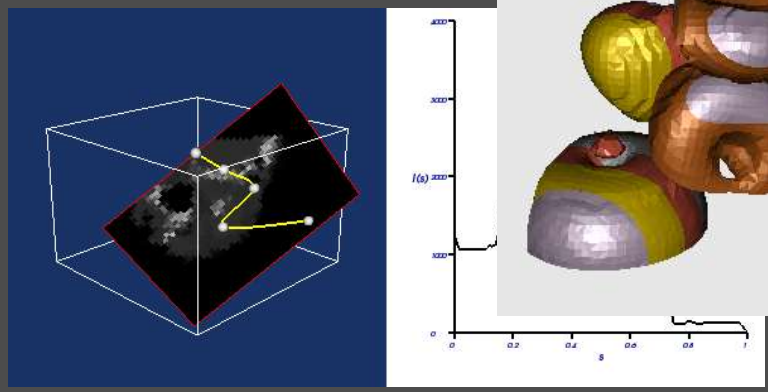
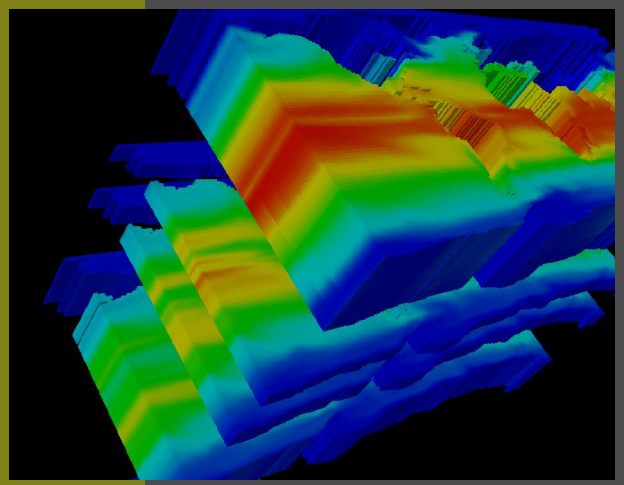


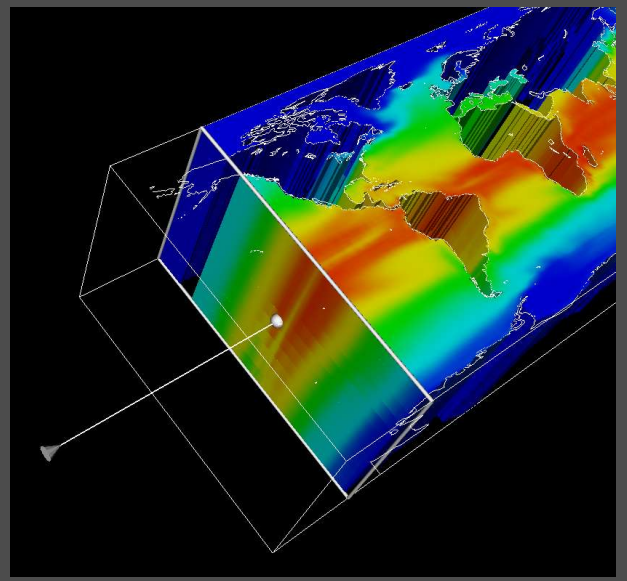


ParaView
Parallel Visualization Application

Paraview

- Open Source application using VTK





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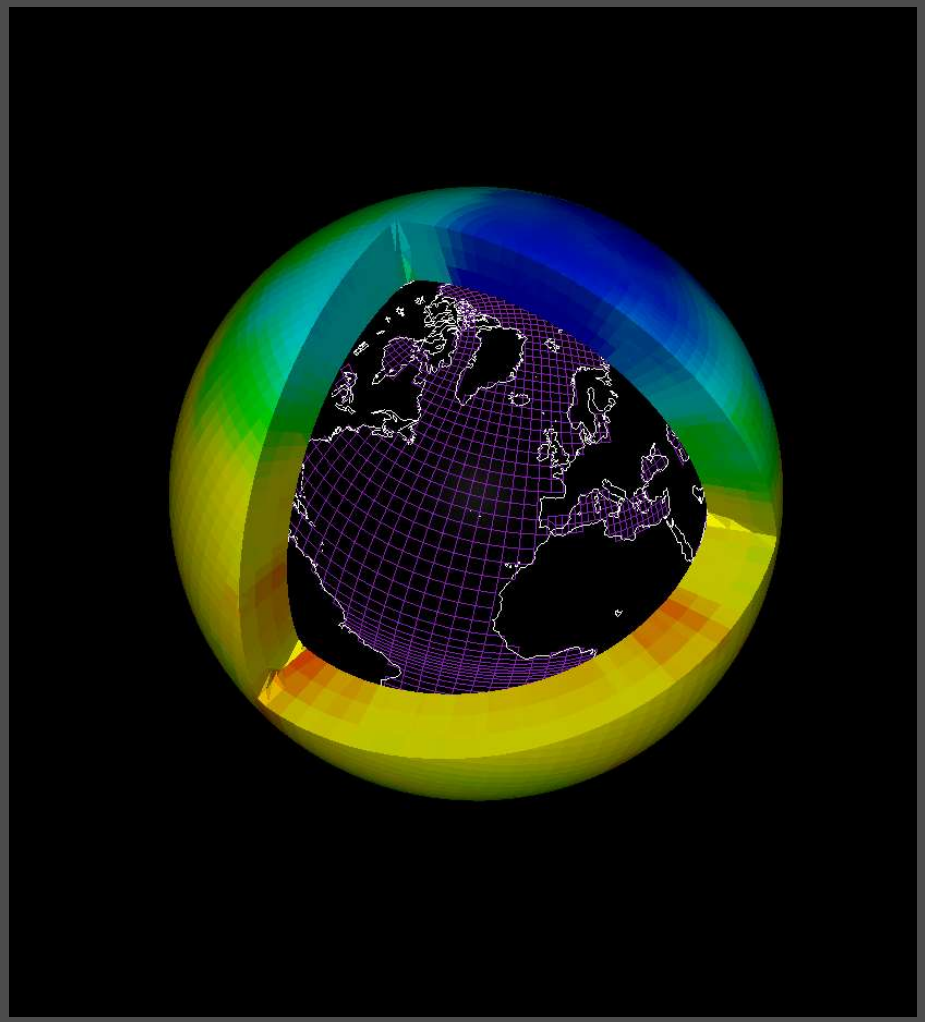


- Qt Designer, Qt's visual design tool

VTK/CDMS/Qt application

Use PyQt user interface compiler:
> pyuic -x file.ui > file.py

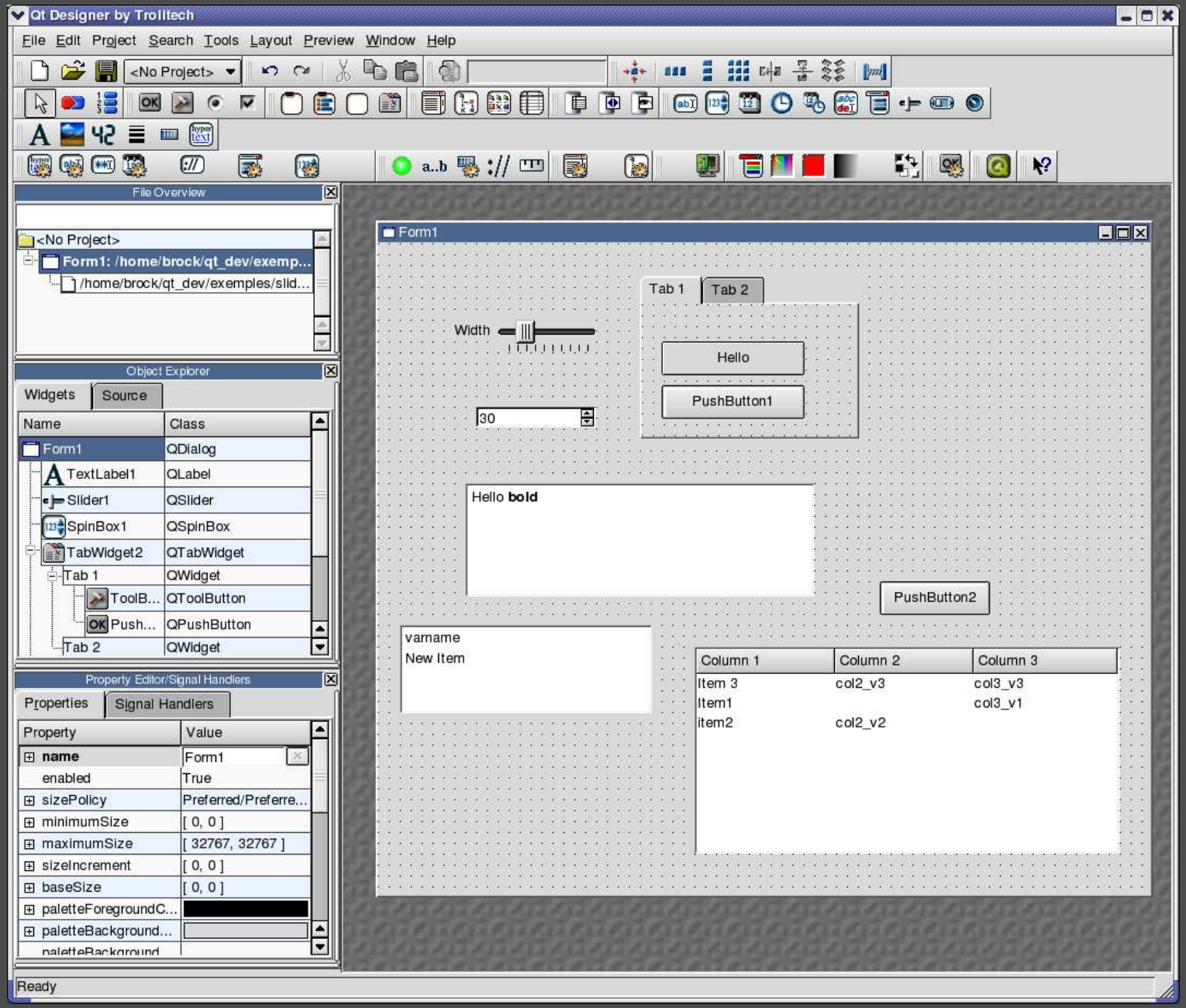
Qt

COCO

CDMS

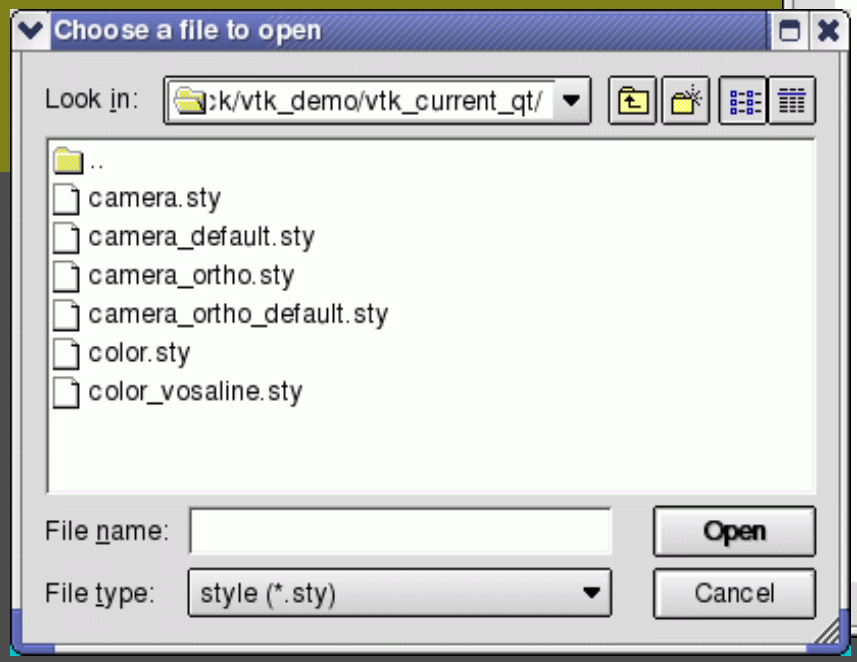
VTK

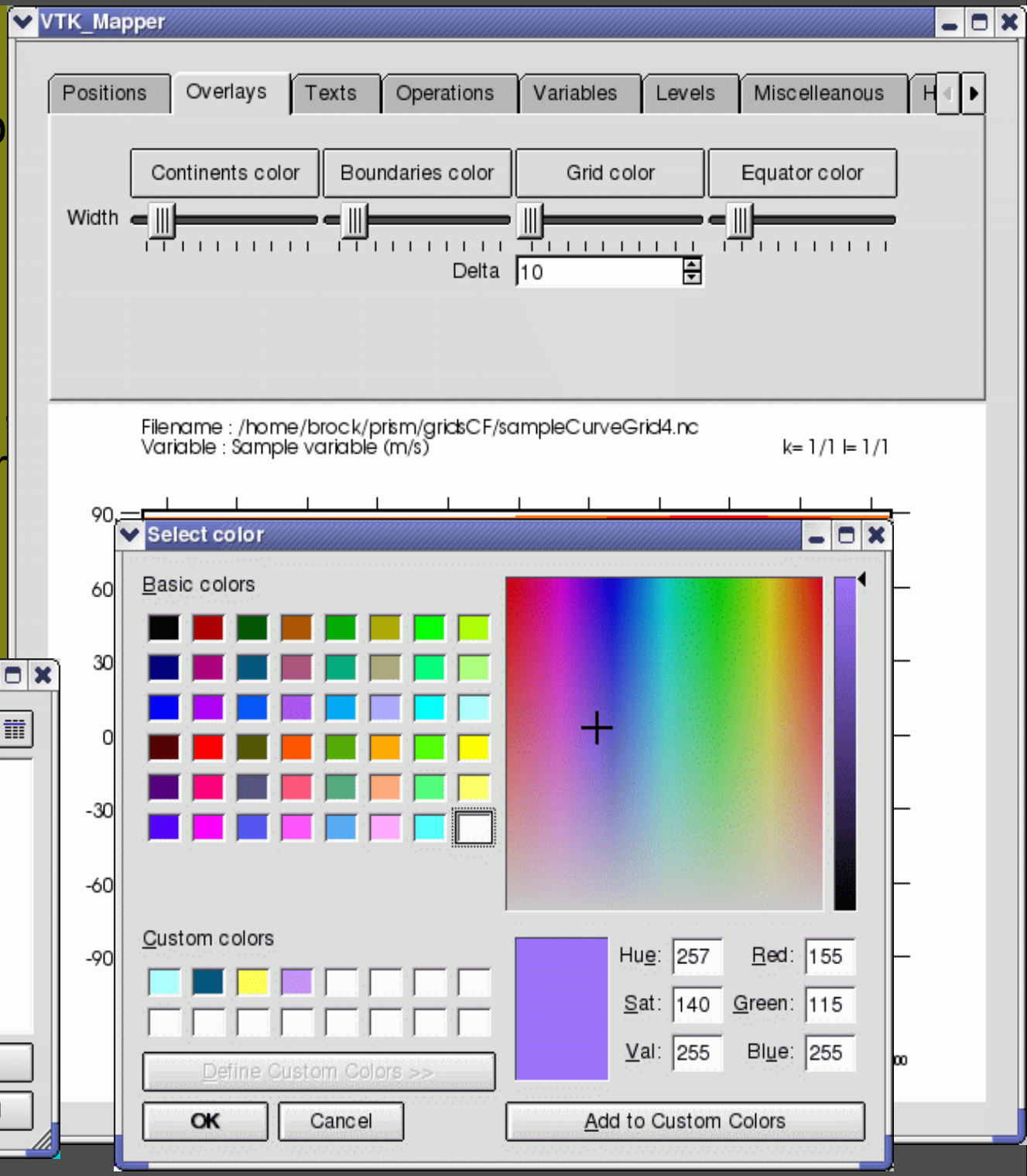
OpeNDAP



Qt C++ Toolkit

- Developpment of multiplatfo GUI applications with its *«write once, compile anywhere»* concept
- Rich set of widgets (buttons, scroll bars,etc) that cater for most situations
- Python bindings with PyQt





- CDAT 4.0 beta3
  - CDMS
    - Read/Save CF netCDF files(rectilinear, cirvilinear, generic grids)
    - Access DODS server
    - Make calculations
- Mesa 6.0
  - Offscreen rendering
- VTK 4.4
  - Make polygons plots
  - Make isocontours, isofilled plots
  - Capture image to PNG
  - Convert GL to PDF, EPS
- Qt Tookit
  - PyQt
  - Qt Designer

- Compilation of Mesa 6.0

```
> make linux-x86
```

- Compilation of CDAT 4.0 beta3

```
> express_install /home/user/cdat-4.0b3

> /home/user/bin/python ./install.py --force
```

- Compilation of VTK (interim release 4.4)

```
> ccmake
...
OPENGL_INCLUDE_DIR              /home/user1/Mesa-6.0/include/GL
OPENGL_gl_LIBRARY               /home/user1/Mesa-6.0/lib/libGL.so
OPENGL_glu_LIBRARY              /home/user1/Mesa-6.0/lib/libGLU.so
OPENGL_xmesa_INCLUDE_DIR        /home/user1/Mesa-6.0/include/GL
OSMESA_INCLUDE_DIR              /home/user1/Mesa-6.0/include/GL
OSMESA_LIBRARY                  /home/user1/Mesa-6.0/lib/libOSMesa.so
...
VTK_OPENGL_HAS_OSMESA           ON
...
VTK_USE_MANGLED_MESA            OFF
...
VTK_USE_GL2PS                   ON
...
```

- CDMS
  - Grid types
  - Grid and mesh information methods
    - *getGrid()*, *getMesh()*
  - Conversion methods
    - Rectiliner --> Curvilinear with *toCurveGrid()*
    - Curvilinear --> Generic with *toGenericGrid()*
  - See documentation of CDMS 4.0

CDMS defines a rich set of grid types to represent the variety of coordinate systems used in climate model applications. Grids can be categorized as *rectangular* or *nonrectangular*.

- A *rectangular* grid has latitude and longitude axes that are one-dimensional, with strictly monotonic values. The grid is essentially the Cartesian product of the axes. If either criterion is not met, the grid is *nonrectangular*.

CDMS supports two types of nonrectangular grid:

- A *curvilinear* grid consists of a latitude and longitude axis, each of which is a two-dimensional coordinate axis. Curvilinear grids are often used in ocean model applications.
- A *generic* grid consists of a latitude and longitude axis, each of which is an *auxiliary* one-dimensional coordinate axis. An auxiliary axis has values that are not necessarily monotonic. As the name suggests, generic grids can represent virtually any type of grid. However, it is more difficult to determine adjacency relationships between grid points.

```
>>> import cdms
>>> f = cdms.open('clt.nc')
>>> clt = f('clt')
>>> rectgrid = clt.getGrid()
>>> rectgrid.shape
(46, 72)
>>> curvegrid = rectgrid.toCurveGrid()
>>> curvegrid
<TransientCurveGrid, id: grid_1, shape: (46, 72)>
>>> genericgrid = curvegrid.toGenericGrid()
>>> genericgrid
<TransientGenericGrid, id: grid_1, shape: (3312,)>
>>>
```