

# Integrating HDF5 with SRB

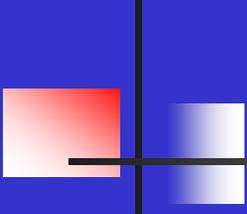
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## *Object-level Access to Remote Files*

*Peter Cao, NCSA*

*December 1, 2005*

Sponsored by **NLADR, NFS PACI** Project  
in Support of NCSA-SDSC Collaboration



# Outline

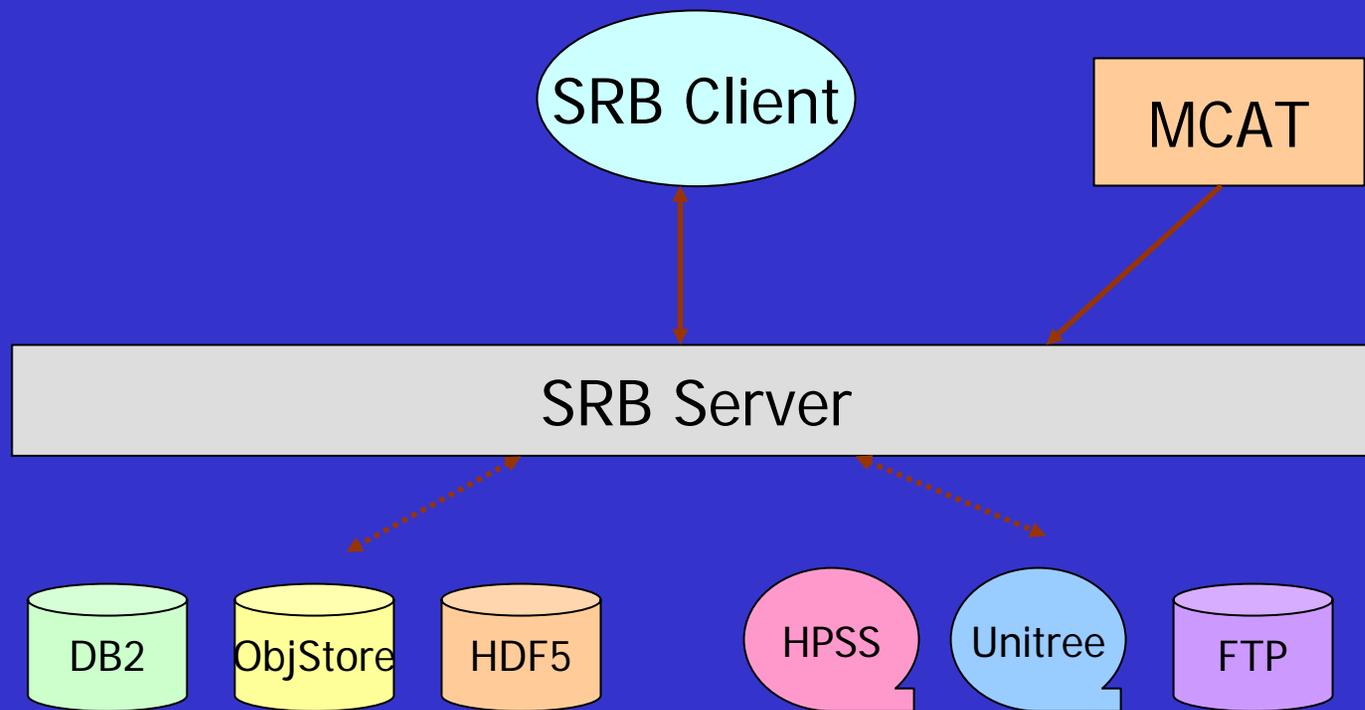
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- Introduction to the HDF-SRB project
- The HDF-SRB model
- SRB Support in HDFView

## *SRB*

- The SDSC Storage Resource Broker (**SRB**) is client-server middleware that provides a uniform interface for connecting to distributed data storage in multiple types of storage resources.

## Architecture



Distributed Storage Resources: database system, archival storage system, file system, ftp

# Project Description

*Motivation*

SRB

Indexing and searching  
Distributed data system  
Access control

HDF5

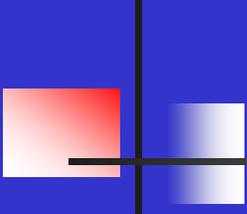
Large and diverse data  
High performance access  
Interactive and subsetting

High performance distributed data system

# Remote Data Access on SRB

## *Methods*

- Normal ways to access SRB:
  - Get the whole file: large files (100TB SCEC)
  - Use POSIX low level calls: low performance
- New way:
  - Implement proxy operations to access objects or parts of objects in one request



# Project Description

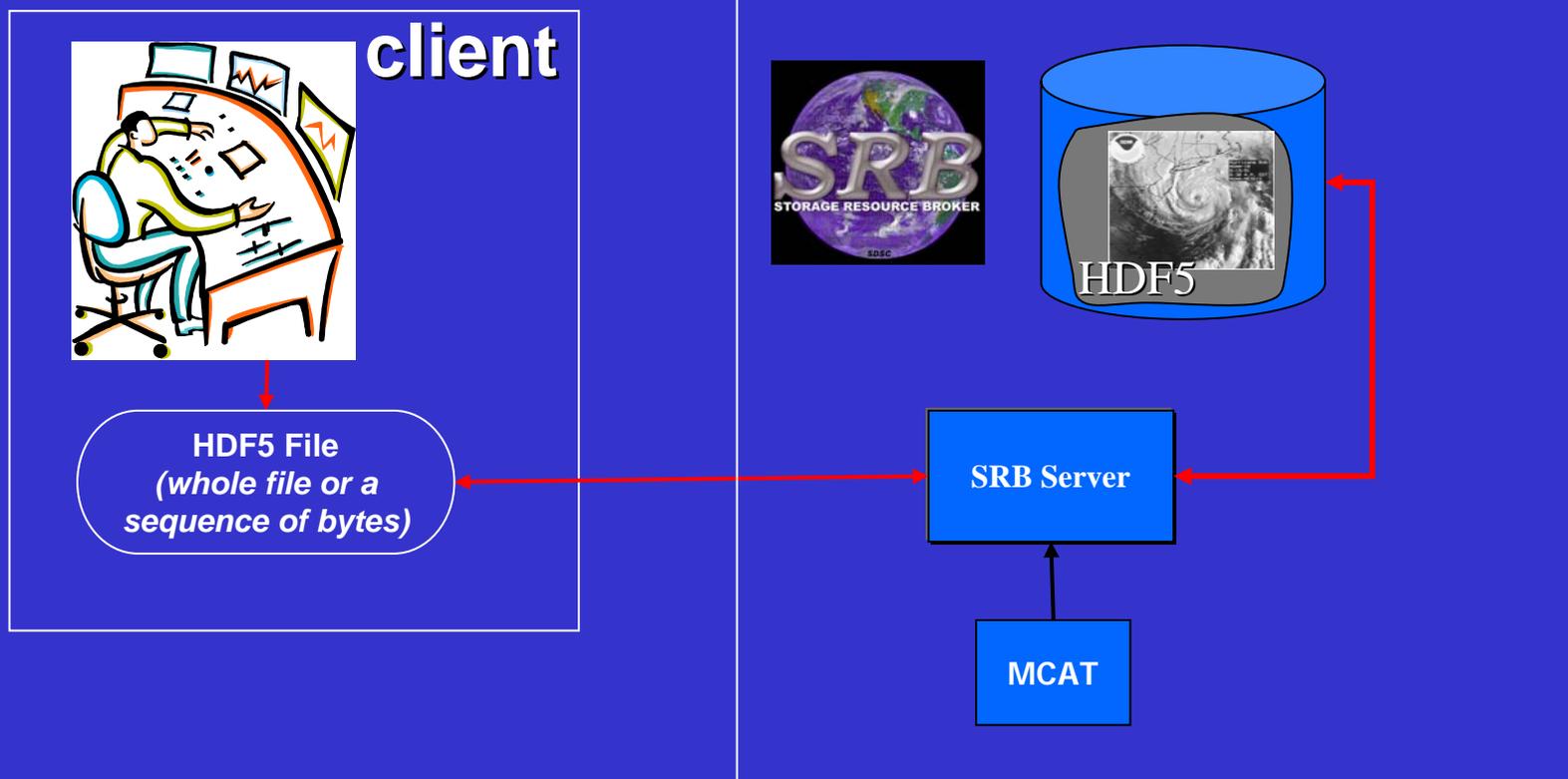
## *Goals*

Working prototype of client/server system for **object-level access** to HDF5 stored in the SRB

- Use SRB as middleware to transfer data between the server and client
- Use Object-level access for interactive and efficient access to part of the file

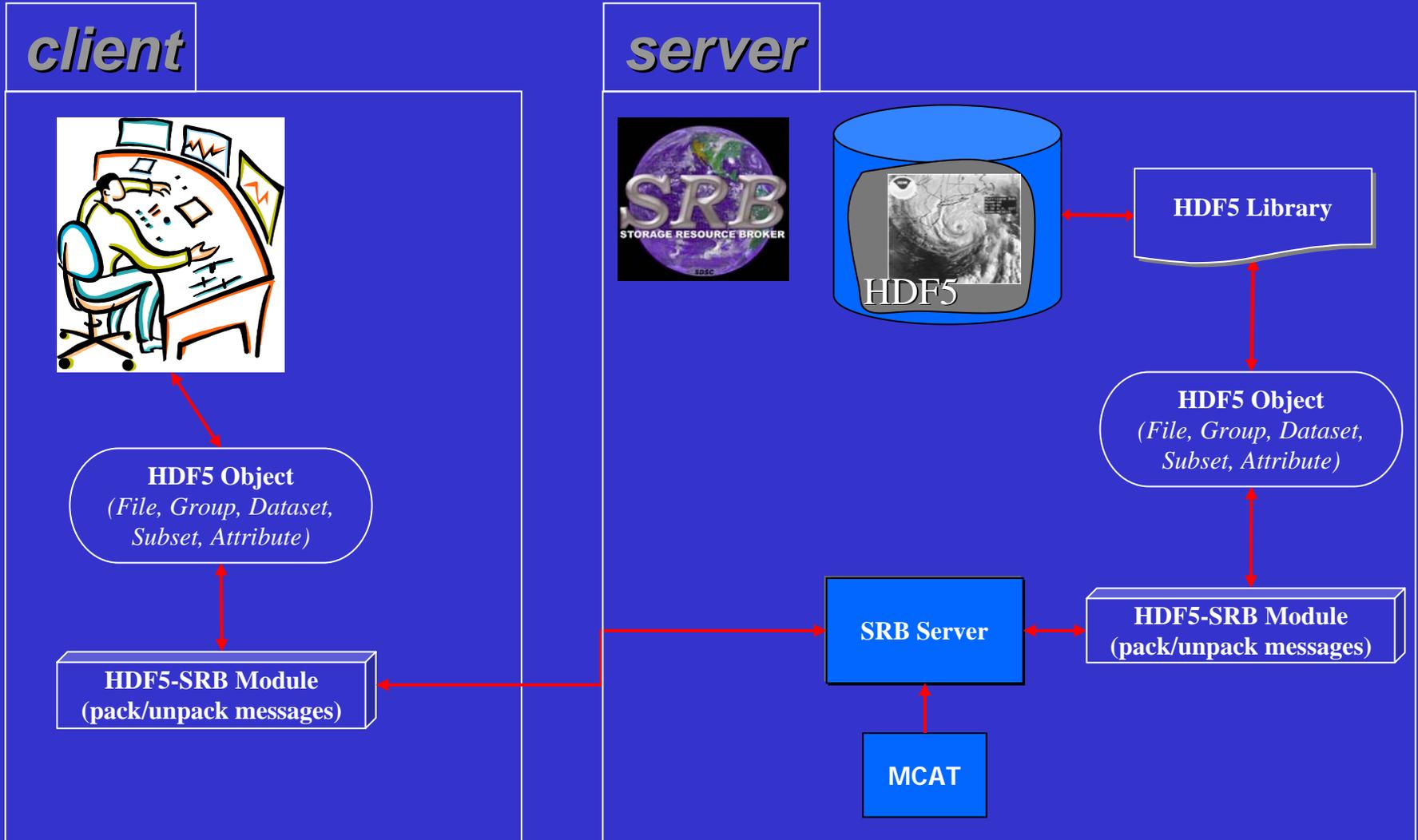
# Normal SRB File Access

## *Architecture*



# Object-level File Access

## Architecture



# Examples of File Access

I need to see the eye of Hurricane Bob!

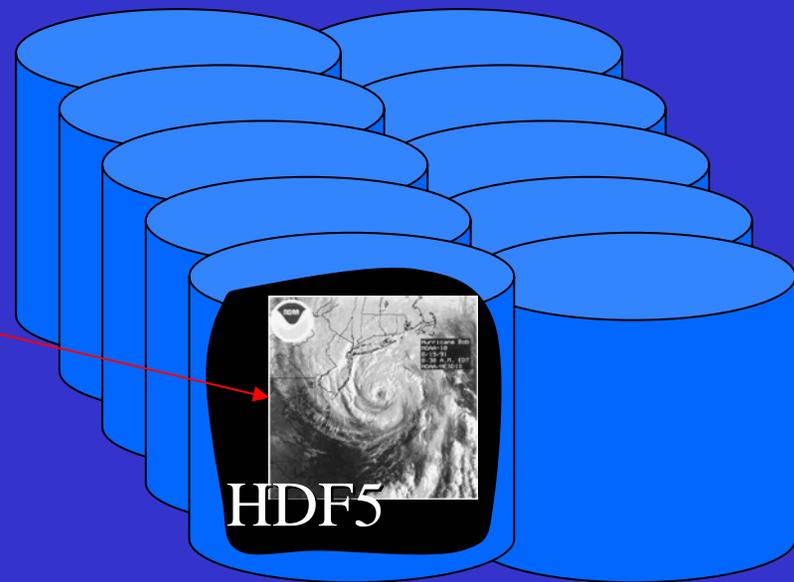


# Examples of File Access

*Whole file transfer*



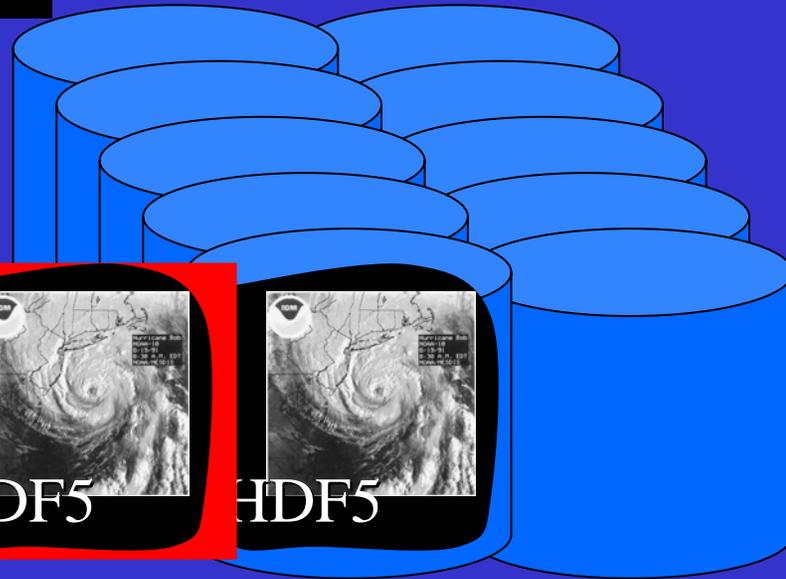
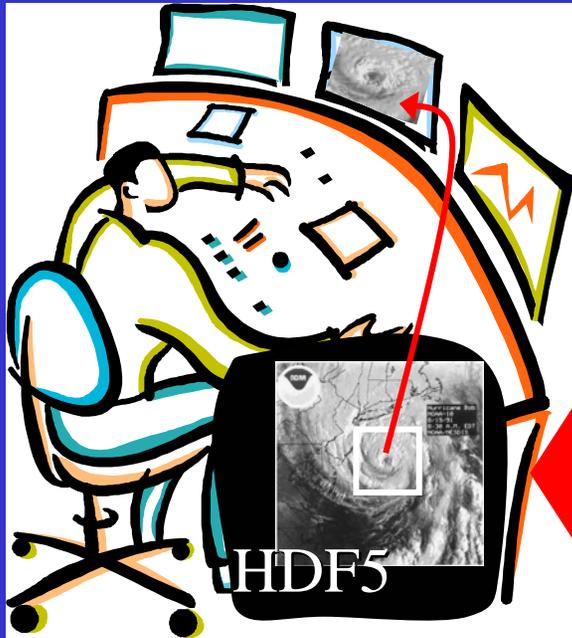
Get the file



# Examples of File Access

*Whole file*

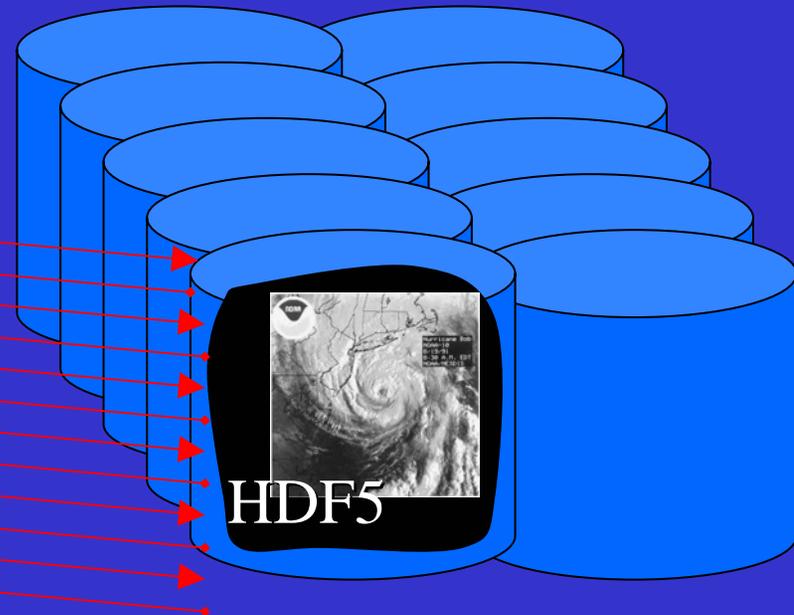
*transfer*



**Transfer large image – slow!**

### API

I need to see the eye of Hurricane Bob!



# Examples of File Access

*SRB POSIX*

*API*



Open file  
file's open  
find image  
image found  
open image  
image open



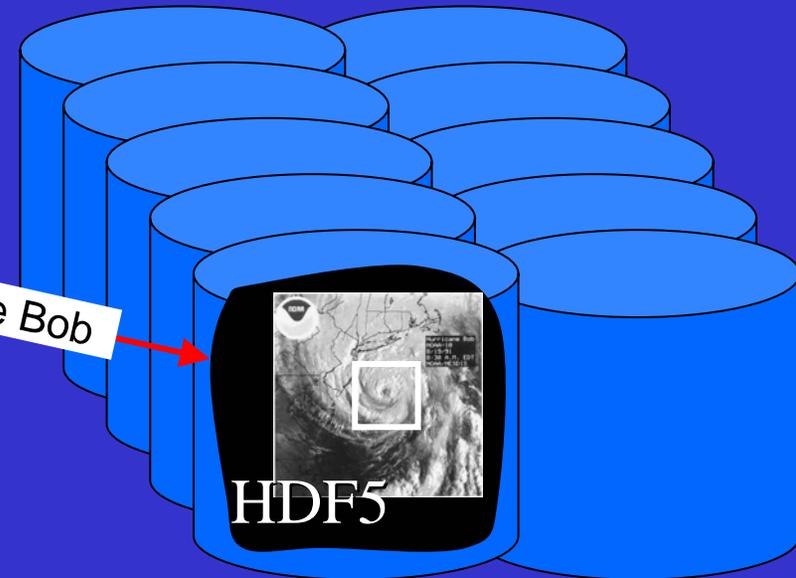
**Many small messages – slow and complex!**

# Examples of File Access

*Object level*



Get me the eye of hurricane Bob

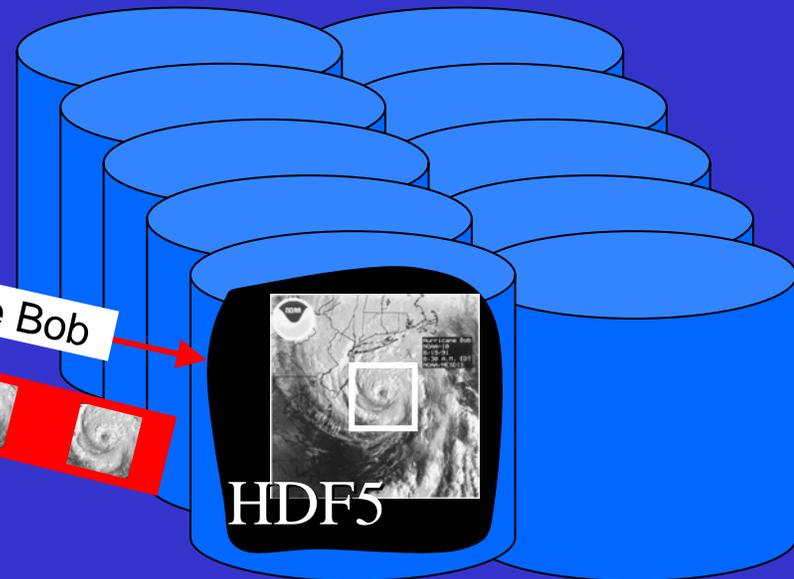


# Examples of File Access

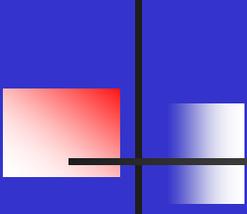
*Object level*



Get me the eye of hurricane Bob



**One request & small image – fast & simple!**



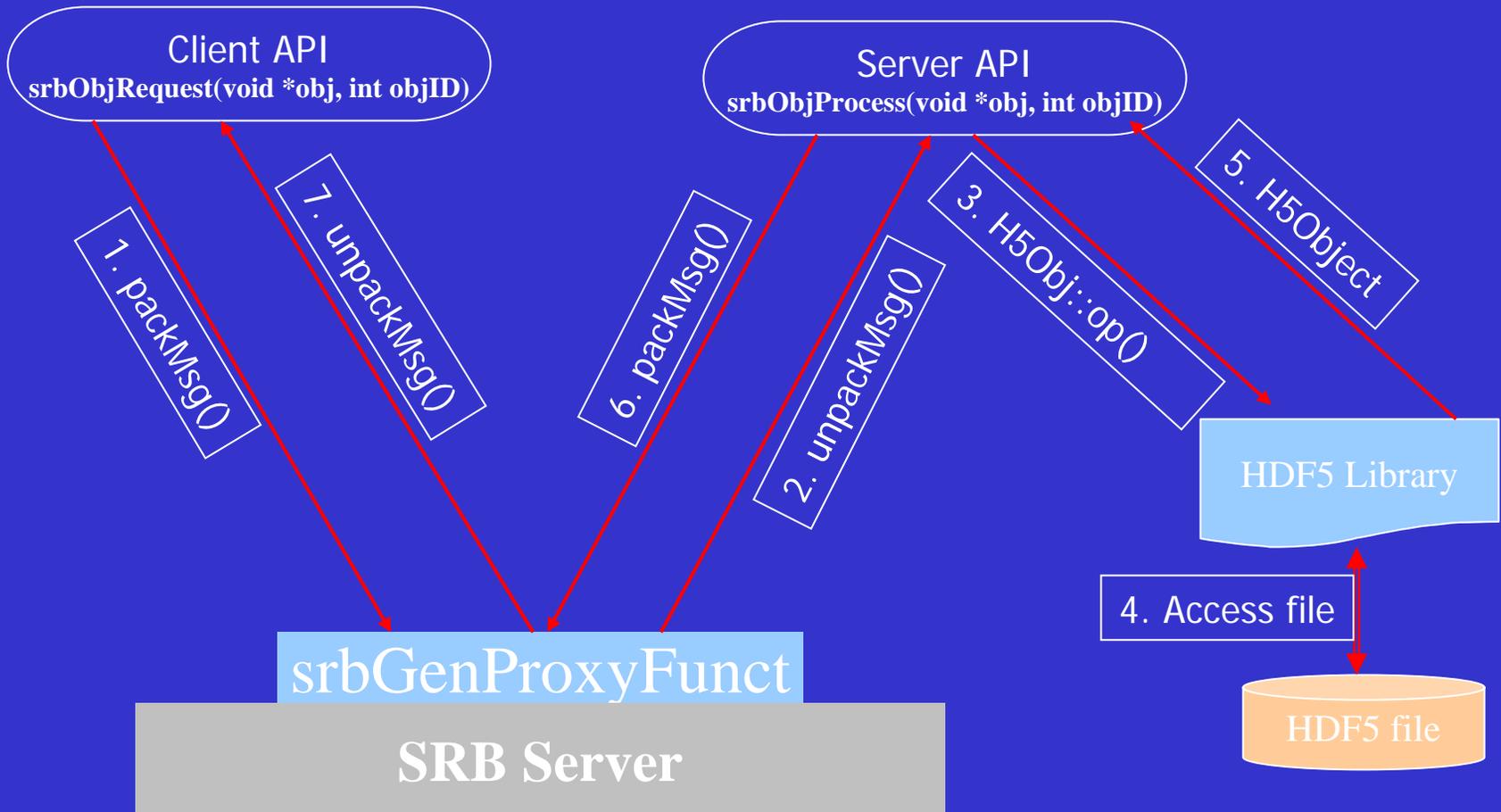
# HDF5-SRB Model

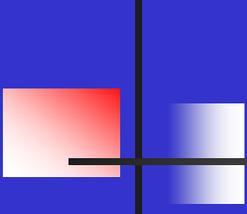
## *New objects/APIs*

- A new set data objects
  - H5File, H5Group, H5Dataset, H5Datatype, etc
  - Encapsulated client requests and server results
- Enhanced SRB APIs
  - Pack/Unpack routines (exchange data between byte stream and structure) to handle complicated struct – string, pointers, pointers to arrays, arrays of pointers, etc
  - New srbGenProxyFunct (general Proxy Function) handles other types of request besides HDF5

# HDF5-SRB Model

## Data Flow





# Running Server/Client

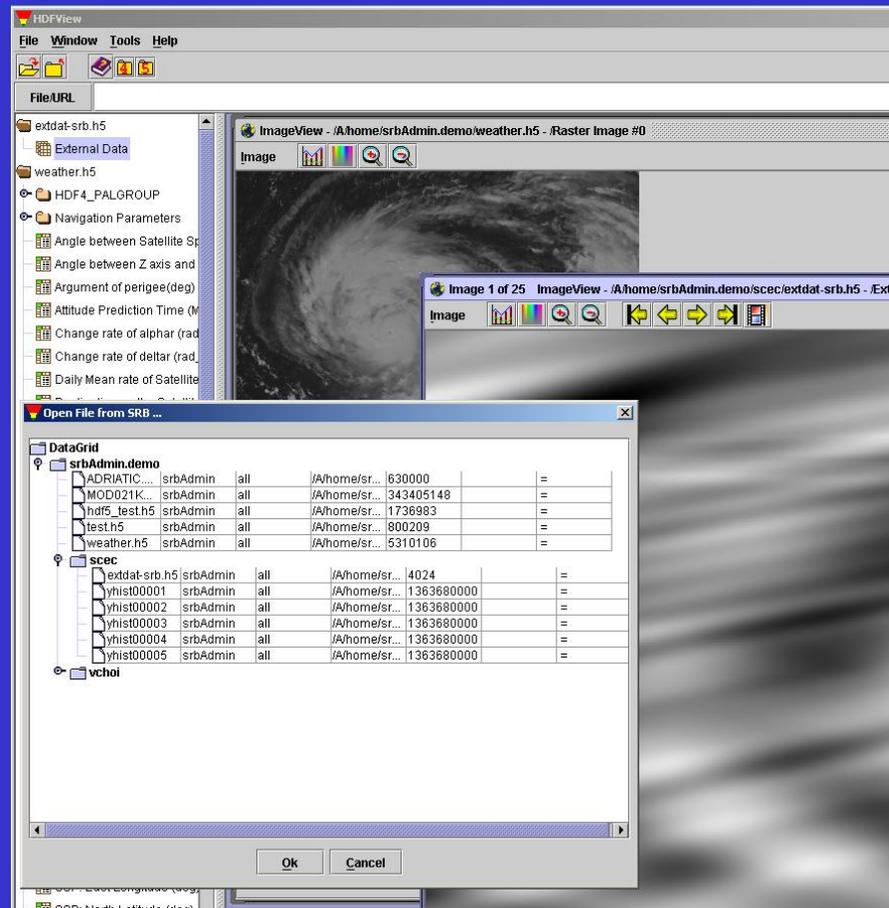
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- A SRB server that supports HDF5
  - ❑ HDF5 library and other external libraries (SZIP, ZLIB)
  - ❑ A SRB version 3.4 or later from <http://www.sdsc.edu/srb/>
  - ❑ Follow instruction on how to run SRB server from UG packed with SRB source release or online at <http://hdf.ncsa.uiuc.edu/hdf-srb-html/HDF-SRB-UG.html>
- Any client application that implements HDF5-SRB Objects
  - ❑ No HDF5 library is required on the client
  - ❑ Example client application: HDFView 2.3 or above

# Short Demo

*HDFView*

- Support Windows and Linux
- May support **SGI, AIX** if there is new funding



# Future Work?

- Writing capabilities: the current HDF-SRB implementation only supports read-only operations. We propose to add write functionality so that users will be able to create new files and data objects, and to modify data content and attributes.
- Better support for complex datatypes such as compound datatype and variable length datatype
- Support for HDF5 indexing and ingesting HDF5 metadata, which will enable users to access HDF5 objects directly through MCAT
- Support for files across different servers (or SRB federation)
- More features for HDFView: compared to its local file-handling capabilities, the current version of HDFView has very limited features for remote file access on an SRB server.

# Question / Comments?

