ARC Data Library libarcdata

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Contents

Chapter 1

Summary of libarcdata

libarcdata is a library for access to data on the Grid. It provides a uniform interface to several types of Grid storage and catalogs using various protocols. The protocols useable on a given system depend on the packages installed. The interface can be used to read, write, list, transfer and delete data to and from storage systems and catalogs.

The library uses ARC's dynamic plugin mechanism to load plugins for specific protocols only when required at runtime. These plugins are called Data Manager Components (DMCs). The DataHandle class takes care of automatically loading the required DMC at runtime to create a DataPoint object representing a resource accessible through a given protocol. DataHandle should always be used instead of DataPoint directly.

DataMover provides a simple high-level interface to copy files. For more fine-grained control over data transfer see the examples in DataHandle.

To create a new DMC for a protocol which is not yet supported see the instruction and examples in the DataPoint class documentation. This documentation also gives a complete overview of the interface.

The following protocols are currently supported in standard distributions of ARC.

ARC (arc://) - Protocol to access the Chelonia storage system developed by ARC.

File (file://) - Regular local file system.

GridFTP (gsiftp://) - GridFTP is essentially the FTP protocol with GSI security. Regular FTP can also be used.

HTTP(S/G) (http://) - Hypertext Transfer Protocol. HTTP over SSL (HTTPS) and HTTP over GSI (HTTPG) are also supported.

LDAP (ldap://) - Lightweight Directory Access Protocol. LDAP is used in grids mainly to store information about grid services or resources rather than to store data itself.

LFC (lfc://) - The LCG File Catalog (LFC) is a replica catalog developed by CERN. It consists of a hierarchical namespace of grid files and each filename can be associated with one or more physical locations.

RLS (rls://) - The Replica Location Service (RLS) is a replica catalog developed by Globus. It maps filenames in a flat namespace to one or more physical locations, and can also store meta-information on each file.

SRM (srm://) - The Storage Resource Manager (SRM) protocol allows access to data distributed across physical storage through a unified namespace and management interface.

XRootd (root://) - Protocol for data access across large scale storage clusters. More information can be found at http://xrootd.slac.stanford.edu/

Chapter 2

Deprecated List

Global Arc::DataStatus::CacheErrorRetryable

Global Arc::DataStatus::CheckErrorRetryable

Global Arc::DataStatus::CreateDirectoryErrorRetryable

Global Arc::DataStatus::DeleteErrorRetryable

Global Arc::DataStatus::GenericErrorRetryable

Global Arc::DataStatus::ListErrorRetryable

Global Arc::DataStatus::ListNonDirError ListError with errno set to ENOTDIR should be used instead

Global Arc::DataStatus::PostRegisterErrorRetryable

Global Arc::DataStatus::PreRegisterErrorRetryable

Global Arc::DataStatus::ReadAcquireErrorRetryable

Global Arc::DataStatus::ReadErrorRetryable

Global Arc::DataStatus::ReadFinishErrorRetryable

Global Arc::DataStatus::ReadPrepareErrorRetryable

Global Arc::DataStatus::ReadResolveErrorRetryable

Global Arc::DataStatus::ReadStartErrorRetryable

Global Arc::DataStatus::ReadStopErrorRetryable

Global Arc::DataStatus::RenameErrorRetryable

Global Arc::DataStatus::StageErrorRetryable

Global Arc::DataStatus::StatErrorRetryable

Global Arc::DataStatus::StatNotPresentError StatError with errno set to ENOENT should be used instead

Global Arc::DataStatus::TransferErrorRetryable

Global Arc::DataStatus::UnregisterErrorRetryable

Global Arc::DataStatus::WriteAcquireErrorRetryable

Global Arc::DataStatus::WriteErrorRetryable

Global Arc::DataStatus::WriteFinishErrorRetryable

Global Arc::DataStatus::WritePrepareErrorRetryable

Global Arc::DataStatus::WriteResolveErrorRetryable

Global Arc::DataStatus::WriteStartErrorRetryable

Global Arc::DataStatus::WriteStopErrorRetryable

Chapter 3

Data Structure Index

3.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

Chapter 4

Data Structure Index

4.1 Data Structures

Here are the data structures with brief descriptions:

Chapter 5

Data Structure Documentation

5.1 Arc::CacheParameters Struct Reference

Contains data on the parameters of a cache.

`#include <FileCache.h>`

5.1.1 Detailed Description

Contains data on the parameters of a cache.

The documentation for this struct was generated from the following file:

- FileCache.h

5.2 Arc::DataBuffer Class Reference

Represents set of buffers.

`#include <DataBuffer.h>`

Data Structures

- struct **buf_desc**
- class **checksum_desc**

Public Member Functions

- operator bool () const
- DataBuffer (unsigned int size=65536, int blocks=3)
- DataBuffer (CheckSum *cksum, unsigned int size=65536, int blocks=3)
- ~DataBuffer ()
- bool set (CheckSum *cksum=NULL, unsigned int size=65536, int blocks=3)
- int add (CheckSum *cksum)
- char * operator[ ] (int n)
- bool for_read (int &handle, unsigned int &length, bool wait)
- bool for_read ()
- bool is_read (int handle, unsigned int length, unsigned long long int offset)
- bool is_read (char *buf, unsigned int length, unsigned long long int offset)
- bool for_write (int &handle, unsigned int &length, unsigned long long int &offset, bool wait)
- bool for_write ()
- bool is_written (int handle)
- bool is_written (char *buf)
- bool is_notwritten (int handle)
- bool is_notwritten (char *buf)
- void eof_read (bool v)
- void eof_write (bool v)
- void error_read (bool v)
- void error_write (bool v)
- bool eof_read ()
- bool eof_write ()
- bool error_read ()
- bool error_write ()
- bool error_transfer ()
- bool error ()
- bool wait_any ()
- bool wait_used ()
- bool wait_for_read ()
- bool wait_for_write ()
- bool checksum_valid () const
- const CheckSum * checksum_object () const
- bool wait_eof_read ()
- bool wait_read ()
- bool wait_eof_write ()
- bool wait_write ()

- bool wait_eof ()
- unsigned long long int eof_position () const
- unsigned int buffer_size () const

Data Fields

- DataSpeed speed

5.2.1 Detailed Description

Represents set of buffers. This class is used used during data transfer using DataPoint classes.

5.2.2 Constructor & Destructor Documentation

5.2.2.1 Arc::DataBuffer::DataBuffer (unsigned int *size* = `65536`, int *blocks* = `3`)

Contructor

Parameters:

size size of every buffer in bytes.

blocks number of buffers.

5.2.2.2 Arc::DataBuffer::DataBuffer (CheckSum * *cksum*, unsigned int *size* = `65536`, int *blocks* = `3`)

Contructor

Parameters:

size size of every buffer in bytes.

blocks number of buffers.

cksum object which will compute checksum. Should not be destroyed till DataBuffer itself.

5.2.3 Member Function Documentation

5.2.3.1 int Arc::DataBuffer::add (CheckSum * *cksum*)

Add a checksum object which will compute checksum of buffer.

Parameters:

cksum object which will compute checksum. Should not be destroyed till DataBuffer itself.

Returns:

integer position in the list of checksum objects.

5.2.3.2 unsigned int Arc::DataBuffer::buffer_size () const

Returns size of buffer in object. If not initialized then this number represents size of default buffer.

5.2.3.3 const CheckSum* Arc::DataBuffer::checksum_object () const

Returns CheckSum object specified in constructor, returns NULL if index is not in list.

Parameters:

index of the checksum in question.

5.2.3.4 bool Arc::DataBuffer::checksum_valid () const

Returns true if checksum was successfully computed, returns false if index is not in list.

Parameters:

index of the checksum in question.

5.2.3.5 bool Arc::DataBuffer::eof_read ()

Returns true if object was informed about end of transfer on 'read' side.

5.2.3.6 void Arc::DataBuffer::eof_read (bool *v*)

Informs object if there will be no more request for 'read' buffers. v true if no more requests.

5.2.3.7 bool Arc::DataBuffer::eof_write ()

Returns true if object was informed about end of transfer on 'write' side.

5.2.3.8 void Arc::DataBuffer::eof_write (bool *v*)

Informs object if there will be no more request for 'write' buffers. v true if no more requests.

5.2.3.9 bool Arc::DataBuffer::error ()

Returns true if object was informed about error or internal error occured.

5.2.3.10 void Arc::DataBuffer::error_read (bool *v*)

Informs object if error accured on 'read' side.

Parameters:

v true if error.

5.2.3.11 void Arc::DataBuffer::error_write (bool *v*)

Informs object if error accured on 'write' side.

Parameters:

v true if error.

5.2.3.12 bool Arc::DataBuffer::for_read ()

Check if there are buffers which can be taken by for_read(). This function checks only for buffers and does not take eof and error conditions into account.

5.2.3.13 bool Arc::DataBuffer::for_read (int & *handle*, unsigned int & *length*, bool *wait*)

Request buffer for READING INTO it.

Parameters:

handle returns buffer's number.

length returns size of buffer

wait if true and there are no free buffers, method will wait for one.

Returns:

true on success For python bindings pattern of this method is (bool, handle, length) for_read(wait). Here buffer for reading to be provided by external code and provided to DataBuffer object through is_read() method. Content of buffer must not exceed provided length.

5.2.3.14 bool Arc::DataBuffer::for_write ()

Check if there are buffers which can be taken by for_write(). This function checks only for buffers and does not take eof and error conditions into account.

5.2.3.15 bool Arc::DataBuffer::for_write (int & *handle*, unsigned int & *length*, unsigned long long int & *offset*, bool *wait*)

Request buffer for WRITING FROM it.

Parameters:

handle returns buffer's number.

length returns size of buffer

wait if true and there are no available buffers, method will wait for one. For python bindings pattern of this method is (bool, handle, length, offset, buffer) for_write(wait). Here buffer is string with content of buffer provided by DataBuffer object;

5.2.3.16 bool Arc::DataBuffer::is_notwritten (char * *buf*)

Informs object that data was NOT written from buffer (and releases buffer).

Parameters:

buf - address of buffer

5.2.3.17 bool Arc::DataBuffer::is_notwritten (int *handle*)

Informs object that data was NOT written from buffer (and releases buffer).

Parameters:

handle buffer's number.

5.2.3.18 bool Arc::DataBuffer::is_read (char * *buf*, unsigned int *length*, unsigned long long int *offset*)

Informs object that data was read into buffer.

Parameters:

buf - address of buffer

length amount of data.

offset offset in stream, file, etc.

5.2.3.19 bool Arc::DataBuffer::is_read (int *handle*, unsigned int *length*, unsigned long long int *offset*)

Informs object that data was read into buffer.

Parameters:

handle buffer's number.

length amount of data.

offset offset in stream, file, etc. For python bindings pattern of that method is bool is_-read(handle,buffer,offset). Here buffer is string containing content of buffer to be passed to DataBuffer object.

5.2.3.20 bool Arc::DataBuffer::is_written (char * *buf*)

Informs object that data was written from buffer.

Parameters:

buf - address of buffer

5.2.3.21 bool Arc::DataBuffer::is_written (int *handle*)

Informs object that data was written from buffer.

Parameters:

handle buffer's number.

5.2.3.22 bool Arc::DataBuffer::set (CheckSum * *cksum* = `NULL`, unsigned int *size* = `65536`, int *blocks* = `3`)

Reinitialize buffers with different parameters.

Parameters:

size size of every buffer in bytes.

blocks number of buffers.

cksum object which will compute checksum. Should not be destroyed till DataBuffer itself.

5.2.3.23 bool Arc::DataBuffer::wait_any ()

Wait (max 60 sec.) till any action happens in object. Returns true if action is eof on any side.

The documentation for this class was generated from the following file:

- DataBuffer.h

5.3 Arc::DataCallback Class Reference

This class is used by DataHandle to report missing space on local filesystem.

`#include <DataCallback.h>`

5.3.1 Detailed Description

This class is used by DataHandle to report missing space on local filesystem. One of 'cb' functions here will be called if operation initiated by DataHandle::StartReading runs out of disk space.

The documentation for this class was generated from the following file:

- DataCallback.h

5.4 Arc::DataHandle Class Reference

This class is a wrapper around the DataPoint class.

`#include <DataHandle.h>`

Public Member Functions

- DataHandle (const URL &url, const UserConfig &usercfg)
- ~DataHandle ()
- DataPoint * operator-> ()
- const DataPoint * operator-> () const
- DataPoint & operator* ()
- const DataPoint & operator* () const
- bool operator! () const
- operator bool () const

Static Public Member Functions

- static DataPoint * GetPoint (const URL &url, const UserConfig &usercfg)

5.4.1 Detailed Description

This class is a wrapper around the DataPoint class. It simplifies the construction, use and destruction of DataPoint objects and should be used instead of DataPoint classes directly. The appropriate DataPoint subclass is created automatically and stored internally in DataHandle. A DataHandle instance can be thought of as a pointer to the DataPoint instance and the DataPoint can be accessed through the usual dereference operators. A DataHandle cannot be copied.

This class is main way to access remote data items and obtain information about them. Below is an example of accessing last 512 bytes of files stored at GridFTP server. To simply copy a whole file DataMover::Transfer() can be used.

```
#include <iostream>
#include <arc/data/DataPoint.h>
#include <arc/data/DataHandle.h>
#include <arc/data/DataBuffer.h>

using namespace Arc;

int main(void) {
  #define DESIRED_SIZE 512
  Arc::UserConfig usercfg;
  URL url("gsiftp://localhost/files/file_test_21");
  DataPoint* handle = DataHandle::GetPoint(url,usercfg);
  if(!handle) {
    std::cerr<<"Unsupported URL protocol or malformed URL"<<std::endl;
    return -1;
  };
  FileInfo info;
  if(!handle->Stat(info)) {
    std::cerr<<"Failed Stat"<<std::endl;
    return -1;
  };
  unsigned long long int fsize = handle->GetSize();
  if(fsize == (unsigned long long int)-1) {
```

```
    std::cerr<<"file size is not available"<<std::endl;
    return -1;
  };
  if(fsize == 0) {
    std::cerr<<"file is empty"<<std::endl;
    return -1;
  };
  unsigned long long int foffset;
  if(fsize > DESIRED_SIZE) {
    handle->Range(fsize-DESIRED_SIZE,fsize-1);
  };
  unsigned int wto;
  DataBuffer buffer;
  if(!handle->PrepareReading(10,wto)) {
    std::cerr<<"Failed PrepareReading"<<std::endl;
    return -1;
  };
  if(!handle->StartReading(buffer)) {
    std::cerr<<"Failed StopReading"<<std::endl;
    return -1;
  };
  for(;;) {
    int n;
    unsigned int length;
    unsigned long long int offset;
    if(!buffer.for_write(n,length,offset,true)) {
      break;
    };
    std::cout<<"BUFFER: "<<offset<<": "<<length<<" :"<<std::string((const char*)
     (buffer[n]),length)<<std::endl;
    buffer.is_written(n);
  };
  if(buffer.error()) {
    std::cerr<<"Transfer failed"<<std::endl;
  };
  handle->StopReading();
  handle->FinishReading();
  return 0;
}
```

And the same example in python

```
import arc

desired_size = 512
usercfg = arc.UserConfig()
url = arc.URL("gsiftp://localhost/files/file_test_21")
handle = arc.DataHandle.GetPoint(url,usercfg)
info = arc.FileInfo("")
handle.Stat(info)
print "Name: ", info.GetName()
fsize = info.GetSize()
if fsize > desired_size:
    handle.Range(fsize-desired_size,fsize-1)
buffer = arc.DataBuffer()
res, wto = handle.PrepareReading(10)
handle.StartReading(buffer)
while True:
    n = 0
    length = 0
    offset = 0
    ( r, n, length, offset, buf) = buffer.for_write(True)
    if not r: break
    print "BUFFER: ", offset, ": ", length, " :", buf
    buffer.is_written(n);
```

5.4.2 Member Function Documentation

5.4.2.1 static DataPoint* Arc::DataHandle::GetPoint (const URL & *url*, const UserConfig & *usercfg*) [inline, static]

Returns a pointer to new DataPoint object corresponding to URL. This static method is mostly for bindings to other languages and if availability scope of obtained DataPoint is undefined.

The documentation for this class was generated from the following file:

- DataHandle.h

5.5 Arc::DataMover Class Reference

DataMover provides an interface to transfer data between two DataPoints.

`#include <DataMover.h>`

Public Member Functions

- DataMover ()
- ~DataMover ()
- DataStatus Transfer (DataPoint &source, DataPoint &destination, FileCache &cache, const URLMap &map, callback cb=NULL, void *arg=NULL, const char *prefix=NULL)
- DataStatus Transfer (DataPoint &source, DataPoint &destination, FileCache &cache, const URLMap &map, unsigned long long int min_speed, time_t min_speed_time, unsigned long long int min_average_speed, time_t max_inactivity_time, callback cb=NULL, void *arg=NULL, const char *prefix=NULL)
- DataStatus Delete (DataPoint &url, bool errcont=false)
- void Cancel ()
- bool verbose ()
- void verbose (bool)
- void verbose (const std::string &prefix)
- bool retry ()
- void retry (bool)
- void secure (bool)
- void passive (bool)
- void force_to_meta (bool)
- bool checks ()
- void checks (bool v)
- void set_default_min_speed (unsigned long long int min_speed, time_t min_speed_time)
- void set_default_min_average_speed (unsigned long long int min_average_speed)
- void set_default_max_inactivity_time (time_t max_inactivity_time)
- void set_progress_indicator (DataSpeed::show_progress_t func=NULL)
- void set_preferred_pattern (const std::string &pattern)

5.5.1 Detailed Description

DataMover provides an interface to transfer data between two DataPoints. Its main action is represented by Transfer methods

5.5.2 Member Function Documentation

5.5.2.1 void Arc::DataMover::checks (bool *v*)

Set if to make check for existence of remote file (and probably other checks too) before initiating 'reading' and 'writing' operations.

Parameters:

v true if allowed (default is true).

5.5.2.2 bool Arc::DataMover::checks ()

Check if check for existence of remote file is done before initiating 'reading' and 'writing' operations.

5.5.2.3 void Arc::DataMover::force_to_meta (bool)

Set if file should be transferred and registered even if such LFN is already registered and source is not one of registered locations.

5.5.2.4 void Arc::DataMover::secure (bool)

Set if high level of security (encryption) will be used during transfer if available.

5.5.2.5 void Arc::DataMover::set_default_max_inactivity_time (time_t *max_inactivity_time*) [inline]

Set maximal allowed time for waiting for any data. For more information see description of DataSpeed class.

5.5.2.6 void Arc::DataMover::set_default_min_average_speed (unsigned long long int *min_average_speed*) [inline]

Set minimal allowed average transfer speed (default is 0 averaged over whole time of transfer. For more information see description of DataSpeed class.

5.5.2.7 void Arc::DataMover::set_default_min_speed (unsigned long long int *min_speed*, time_t *min_speed_time*) [inline]

Set minimal allowed transfer speed (default is 0) to 'min_speed'. If speed drops below for time longer than 'min_speed_time' error is raised. For more information see description of DataSpeed class.

5.5.2.8 DataStatus Arc::DataMover::Transfer (DataPoint & *source*, DataPoint & *destination*, FileCache & *cache*, const URLMap & *map*, unsigned long long int *min_speed*, time_t *min_speed_time*, unsigned long long int *min_average_speed*, time_t *max_inactivity_time*, callback *cb* = NULL, void * *arg* = NULL, const char * *prefix* = NULL)

Initiates transfer from 'source' to 'destination'.

Parameters:

min_speed minimal allowed current speed.

min_speed_time time for which speed should be less than 'min_speed' before transfer fails.

min_average_speed minimal allowed average speed.

max_inactivity_time time for which should be no activity before transfer fails.

5.5.2.9 DataStatus Arc::DataMover::Transfer (DataPoint & *source*, DataPoint & *destination*, FileCache & *cache*, const URLMap & *map*, callback *cb* = NULL, void * *arg* = NULL, const char * *prefix* = NULL)

Initiates transfer from 'source' to 'destination'.

Parameters:

source source URL.

destination destination URL.

cache controls caching of downloaded files (if destination url is "file://"). If caching is not needed default constructor FileCache() can be used.

map URL mapping/conversion table (for 'source' URL).

cb if not NULL, transfer is done in separate thread and 'cb' is called after transfer completes/fails.

arg passed to 'cb'.

prefix if 'verbose' is activated this information will be printed before each line representing current transfer status.

5.5.2.10 void Arc::DataMover::verbose (const std::string & *prefix*)

Activate printing information about transfer status.

Parameters:

prefix use this string if 'prefix' in DataMover::Transfer is NULL.

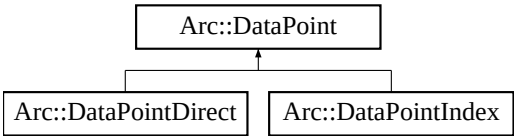
The documentation for this class was generated from the following file:

- DataMover.h

5.6 Arc::DataPoint Class Reference

A DataPoint represents a data resource and is an abstraction of a URL.

`#include <DataPoint.h>`Inheritance diagram for Arc::DataPoint::



Public Types

- enum DataPointAccessLatency { ACCESS_LATENCY_ZERO, ACCESS_LATENCY_SMALL, ACCESS_LATENCY_LARGE }
- enum DataPointInfoType {

  INFO_TYPE_MINIMAL = 0, INFO_TYPE_NAME = 1, INFO_TYPE_TYPE = 2, INFO_TYPE_-TIMES = 4,

  INFO_TYPE_CONTENT = 8, INFO_TYPE_ACCESS = 16, INFO_TYPE_STRUCT = 32, INFO_-TYPE_REST = 64,

  INFO_TYPE_ALL = 127 }
- typedef void(∗ Callback3rdParty)(unsigned long long int bytes_transferred)

Public Member Functions

- virtual ~DataPoint ()
- virtual const URL & GetURL () const
- virtual const UserConfig & GetUserConfig () const
- virtual bool SetURL (const URL &url)
- virtual std::string str () const
- virtual operator bool () const
- virtual bool operator! () const
- virtual DataStatus PrepareReading (unsigned int timeout, unsigned int &wait_time)
- virtual DataStatus PrepareWriting (unsigned int timeout, unsigned int &wait_time)
- virtual DataStatus StartReading (DataBuffer &buffer)=0
- virtual DataStatus StartWriting (DataBuffer &buffer, DataCallback ∗space_cb=NULL)=0
- virtual DataStatus StopReading ()=0
- virtual DataStatus StopWriting ()=0
- virtual DataStatus FinishReading (bool error=false)
- virtual DataStatus FinishWriting (bool error=false)
- virtual DataStatus Check (bool check_meta)=0
- virtual DataStatus Remove ()=0
- virtual DataStatus Stat (FileInfo &file, DataPointInfoType verb=INFO_TYPE_ALL)=0
- virtual DataStatus Stat (std::list< FileInfo > &files, const std::list< DataPoint ∗ > &urls, Data-PointInfoType verb=INFO_TYPE_ALL)=0
- virtual DataStatus List (std::list< FileInfo > &files, DataPointInfoType verb=INFO_TYPE_ALL)=0
- virtual DataStatus CreateDirectory (bool with_parents=false)=0
- virtual DataStatus Rename (const URL &newurl)=0

- virtual void ReadOutOfOrder (bool v)=0
- virtual bool WriteOutOfOrder ()=0
- virtual void SetAdditionalChecks (bool v)=0
- virtual bool GetAdditionalChecks () const =0
- virtual void SetSecure (bool v)=0
- virtual bool GetSecure () const =0
- virtual void Passive (bool v)=0
- virtual DataStatus GetFailureReason (void) const
- virtual void Range (unsigned long long int start=0, unsigned long long int end=0)=0
- virtual DataStatus Resolve (bool source)=0
- virtual DataStatus Resolve (bool source, const std::list< DataPoint * > &urls)=0
- virtual bool Registered () const =0
- virtual DataStatus PreRegister (bool replication, bool force=false)=0
- virtual DataStatus PostRegister (bool replication)=0
- virtual DataStatus PreUnregister (bool replication)=0
- virtual DataStatus Unregister (bool all)=0
- virtual bool CheckSize () const
- virtual void SetSize (const unsigned long long int val)
- virtual unsigned long long int GetSize () const
- virtual bool CheckCheckSum () const
- virtual void SetCheckSum (const std::string &val)
- virtual const std::string & GetCheckSum () const
- virtual const std::string DefaultCheckSum () const
- virtual bool CheckCreated () const
- virtual void SetCreated (const Time &val)
- virtual const Time & GetCreated () const
- virtual bool CheckValid () const
- virtual void SetValid (const Time &val)
- virtual const Time & GetValid () const
- virtual void SetAccessLatency (const DataPointAccessLatency &latency)
- virtual DataPointAccessLatency GetAccessLatency () const
- virtual long long int BufSize () const =0
- virtual int BufNum () const =0
- virtual bool Cache () const
- virtual bool Local () const =0
- virtual int GetTries () const
- virtual void SetTries (const int n)
- virtual void NextTry (void)
- virtual bool IsIndex () const =0
- virtual bool IsStageable () const
- virtual bool AcceptsMeta () const =0
- virtual bool ProvidesMeta () const =0
- virtual void SetMeta (const DataPoint &p)
- virtual bool CompareMeta (const DataPoint &p) const
- virtual std::vector< URL > TransferLocations () const
- virtual const URL & CurrentLocation () const =0
- virtual const std::string & CurrentLocationMetadata () const =0
- virtual DataPoint * CurrentLocationHandle () const =0
- virtual DataStatus CompareLocationMetadata () const =0
- virtual bool NextLocation ()=0

- virtual bool LocationValid () const =0
- virtual bool LastLocation ()=0
- virtual bool HaveLocations () const =0
- virtual DataStatus AddLocation (const URL &url, const std::string &meta)=0
- virtual DataStatus RemoveLocation ()=0
- virtual DataStatus RemoveLocations (const DataPoint &p)=0
- virtual DataStatus ClearLocations ()=0
- virtual int AddCheckSumObject (CheckSum *cksum)=0
- virtual const CheckSum * GetCheckSumObject (int index) const =0
- virtual void SortLocations (const std::string &pattern, const URLMap &url_map)=0
- virtual void AddURLOptions (const std::map< std::string, std::string > &options)

Static Public Member Functions

- static DataStatus Transfer3rdParty (const URL &source, const URL &destination, const UserConfig &usercfg, Callback3rdParty callback=NULL)

Protected Member Functions

- DataPoint (const URL &url, const UserConfig &usercfg, PluginArgument *parg)
- virtual DataStatus Transfer3rdParty (const URL &source, const URL &destination, Callback3rdParty callback=NULL)

Protected Attributes

- std::set< std::string > valid_url_options

5.6.1 Detailed Description

A DataPoint represents a data resource and is an abstraction of a URL. DataPoint uses ARC's Plugin mechanism to dynamically load the required Data Manager Component (DMC) when necessary. A DMC typically defines a subclass of DataPoint (e.g. DataPointHTTP) and is responsible for a specific protocol (e.g. http). DataPoints should not be used directly, instead the DataHandle wrapper class should be used, which automatically loads the correct DMC.

DataPoint defines methods for access to the data resource. To transfer data between two DataPoints, DataMover::Transfer() can be used.

There are two subclasses of DataPoint, DataPointDirect and DataPointIndex. None of these three classes can be instantiated directly. DataPointDirect and its subclasses handle "physical" resources through protocols such as file, http and gsiftp. These classes implement methods such as StartReading() and StartWriting(). DataPointIndex and its subclasses handle resources such as indexes and catalogs and implement methods like Resolve() and PreRegister().

When creating a new DMC, a subclass of either DataPointDirect or DataPointIndex should be created, and the appropriate methods implemented. DataPoint itself has no direct external dependencies, but plugins may rely on third-party components. The new DMC must also add itself to the list of available plugins and provide an Instance() method which returns a new instance of itself, if the supplied arguments are valid for the protocol. Here is an example implementation of a new DMC for protocol MyProtocol which represents a physical resource accessible through protocol my://

```
#include <arc/data/DataPointDirect.h>

namespace Arc {

class DataPointMyProtocol : public DataPointDirect {
 public:
  DataPointMyProtocol(const URL& url, const UserConfig& usercfg);
  static Plugin* Instance(PluginArgument *arg);
  virtual DataStatus StartReading(DataBuffer& buffer);
  ...
};

DataPointMyProtocol::DataPointMyProtocol(const URL& url, const UserConfig& userc
     fg) {
  ...
}

DataPointMyProtocol::StartReading(DataBuffer& buffer) { ... }

...

Plugin* DataPointMyProtocol::Instance(PluginArgument *arg) {
  DataPointPluginArgument *dmcarg = dynamic_cast<DataPointPluginArgument*>(arg);

  if (!dmcarg)
    return NULL;
  if (((const URL &)(*dmcarg)).Protocol() != "my")
    return NULL;
  return new DataPointMyProtocol(*dmcarg, *dmcarg);
}

} // namespace Arc

Arc::PluginDescriptor PLUGINS_TABLE_NAME[] = {
  { "my", "HED:DMC", 0, &Arc::DataPointMyProtocol::Instance },
  { NULL, NULL, 0, NULL }
};
```

5.6.2 Member Enumeration Documentation

5.6.2.1 enum Arc::DataPoint::DataPointAccessLatency

Describes the latency to access this URL. For now this value is one of a small set specified by the enumeration. In the future with more sophisticated protocols or information it could be replaced by a more fine-grained list of possibilities such as an int value.

Enumerator:

ACCESS_LATENCY_ZERO URL can be accessed instantly.

ACCESS_LATENCY_SMALL URL has low (but non-zero) access latency, for example staged from disk.

ACCESS_LATENCY_LARGE URL has a large access latency, for example staged from tape.

5.6.2.2 enum Arc::DataPoint::DataPointInfoType

Describes type of information about URL to request.

Enumerator:

INFO_TYPE_MINIMAL Whatever protocol can get with no additional effort.

INFO_TYPE_NAME Only name of object (relative).

INFO_TYPE_TYPE Type of object - currently file or dir.

INFO_TYPE_TIMES Timestamps associated with object.

INFO_TYPE_CONTENT Metadata describing content, like size, checksum, etc.

INFO_TYPE_ACCESS Access control - ownership, permission, etc.

INFO_TYPE_STRUCT Fine structure - replicas, transfer locations, redirections.

INFO_TYPE_REST All the other parameters.

INFO_TYPE_ALL All the parameters.

5.6.3 Constructor & Destructor Documentation

5.6.3.1 Arc::DataPoint::DataPoint (const URL & *url*, const UserConfig & *usercfg*, PluginArgument * *parg*) [protected]

Constructor. Constructor is protected because DataPoints should not be created directly. Subclasses should however call this in their constructors to set various common attributes.

Parameters:

url The URL representing the DataPoint

usercfg User configuration object

5.6.4 Member Function Documentation

5.6.4.1 virtual int Arc::DataPoint::AddCheckSumObject (CheckSum * *cksum*) [pure virtual]

Add a checksum object which will compute checksum during transmission.

Parameters:

cksum object which will compute checksum. Should not be destroyed till DataPointer itself.

Returns:

integer position in the list of checksum objects.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.2 virtual DataStatus Arc::DataPoint::AddLocation (const URL & *url*, const std::string & *meta*) [pure virtual]

Add URL to list.

Parameters:

url Location URL to add.

meta Location meta information.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.3 virtual void Arc::DataPoint::AddURLOptions (const std::map< std::string, std::string > & *options*) [virtual]

Add URL options to this DataPoint's URL object. Invalid options for the DataPoint instance will not be added.

5.6.4.4 virtual DataStatus Arc::DataPoint::Check (bool *check_meta*) [pure virtual]

Query the DataPoint to check if object is accessible. If check_meta is true this method will also try to provide meta information about the object. Note that for many protocols an access check also provides meta information and so check_meta may have no effect. This method returns a positive response if the object is accessible by the caller.

Parameters:

check_meta If true then the method will try to retrieve meta data during the check.

Implemented in Arc::DataPointIndex.

5.6.4.5 virtual DataStatus Arc::DataPoint::CompareLocationMetadata () const [pure virtual]

Compare metadata of DataPoint and current location. Returns inconsistency error or error encountered during operation, or success

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.6 virtual bool Arc::DataPoint::CompareMeta (const DataPoint & *p*) const [virtual]

Compare meta information from another object. Undefined values are not used for comparison.

Parameters:

p object to which to compare.

5.6.4.7 virtual DataStatus Arc::DataPoint::CreateDirectory (bool *with_parents* = false) [pure virtual]

Create a directory. If the protocol supports it, this method creates the last directory in the path to the URL. It assumes the last component of the path is a file-like object and not a directory itself, unless the path ends in a directory separator. If with_parents is true then all missing parent directories in the path will also be created.

Parameters:

with_parents If true then all missing directories in the path are created

5.6.4.8 virtual const std::string& Arc::DataPoint::CurrentLocationMetadata () const [pure virtual]

Returns meta information used to create current URL. Usage differs between different indexing services.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.9 virtual DataStatus Arc::DataPoint::FinishReading (bool *error* = `false`) `[virtual]`

Finish reading from the URL. Must be called after transfer of physical file has completed and if PrepareReading() was called, to free resources, release requests that were made during preparation etc.

Parameters:

error If true then action is taken depending on the error.

Reimplemented in Arc::DataPointIndex.

5.6.4.10 virtual DataStatus Arc::DataPoint::FinishWriting (bool *error* = `false`) `[virtual]`

Finish writing to the URL. Must be called after transfer of physical file has completed and if PrepareWriting() was called, to free resources, release requests that were made during preparation etc.

Parameters:

error If true then action is taken depending on the error.

Reimplemented in Arc::DataPointIndex.

5.6.4.11 virtual DataStatus Arc::DataPoint::GetFailureReason (void) const `[virtual]`

Returns reason of transfer failure, as reported by callbacks. This could be different from the failure returned by the methods themselves.

5.6.4.12 virtual DataStatus Arc::DataPoint::List (std::list< FileInfo > & *files*, DataPointInfoType *verb* = `INFO_TYPE_ALL`) `[pure virtual]`

List hierarchical content of this object. If the DataPoint represents a directory or something similar its contents will be listed.

Parameters:

files will contain list of file names and requested attributes. There may be more attributes than requested. There may be less if object can't provide particular information.

verb defines attribute types which method must try to retrieve. It is not a failure if some attributes could not be retrieved due to limitation of protocol or access control.

5.6.4.13 virtual bool Arc::DataPoint::NextLocation () `[pure virtual]`

Switch to next location in list of URLs. At last location switch to first if number of allowed retries is not exceeded. Returns false if no retries left.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.14 virtual void Arc::DataPoint::Passive (bool *v*) `[pure virtual]`

Request passive transfers for FTP-like protocols.

Parameters:

true to request.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.15 virtual DataStatus Arc::DataPoint::PostRegister (bool *replication*) [pure virtual]

Index Service postregistration. Used for same purpose as PreRegister. Should be called after actual transfer of file successfully finished.

Parameters:

replication if true, the file is being replicated between two locations registered in Indexing Service under same name.

Implemented in Arc::DataPointDirect.

5.6.4.16 virtual DataStatus Arc::DataPoint::PrepareReading (unsigned int *timeout*, unsigned int & *wait_time*) [virtual]

Prepare DataPoint for reading. This method should be implemented by protocols which require preparation or staging of physical files for reading. It can act synchronously or asynchronously (if protocol supports it). In the first case the method will block until the file is prepared or the specified timeout has passed. In the second case the method can return with a ReadPrepareWait status before the file is prepared. The caller should then wait some time (a hint from the remote service may be given in wait_time) and call PrepareReading() again to poll for the preparation status, until the file is prepared. In this case it is also up to the caller to decide when the request has taken too long and if so cancel it by calling FinishReading(). When file preparation has finished, the physical file(s) to read from can be found from TransferLocations().

Parameters:

timeout If non-zero, this method will block until either the file has been prepared successfully or the timeout has passed. A zero value means that the caller would like to call and poll for status.

wait_time If timeout is zero (caller would like asynchronous operation) and ReadPrepareWait is returned, a hint for how long to wait before a subsequent call may be given in wait_time.

Reimplemented in Arc::DataPointIndex.

5.6.4.17 virtual DataStatus Arc::DataPoint::PrepareWriting (unsigned int *timeout*, unsigned int & *wait_time*) [virtual]

Prepare DataPoint for writing. This method should be implemented by protocols which require preparation of physical files for writing. It can act synchronously or asynchronously (if protocol supports it). In the first case the method will block until the file is prepared or the specified timeout has passed. In the second case the method can return with a WritePrepareWait status before the file is prepared. The caller should then wait some time (a hint from the remote service may be given in wait_time) and call PrepareWriting() again to poll for the preparation status, until the file is prepared. In this case it is also up to the caller to decide when the request has taken too long and if so cancel or abort it by calling FinishWriting(true). When file preparation has finished, the physical file(s) to write to can be found from TransferLocations().

Parameters:

timeout If non-zero, this method will block until either the file has been prepared successfully or the timeout has passed. A zero value means that the caller would like to call and poll for status.

wait_time If timeout is zero (caller would like asynchronous operation) and WritePrepareWait is returned, a hint for how long to wait before a subsequent call may be given in wait_time.

Reimplemented in Arc::DataPointIndex.

5.6.4.18 virtual DataStatus Arc::DataPoint::PreRegister (bool *replication*, bool *force* = `false`) `[pure virtual]`

Index service preregistration. This function registers the physical location of a file into an indexing service. It should be called ∗before∗ the actual transfer to that location happens.

Parameters:

replication if true, the file is being replicated between two locations registered in the indexing service under same name.

force if true, perform registration of a new file even if it already exists. Should be used to fix failures in Indexing Service.

Implemented in Arc::DataPointDirect.

5.6.4.19 virtual DataStatus Arc::DataPoint::PreUnregister (bool *replication*) `[pure virtual]`

Index Service preunregistration. Should be called if file transfer failed. It removes changes made by PreRegister.

Parameters:

replication if true, the file is being replicated between two locations registered in Indexing Service under same name.

Implemented in Arc::DataPointDirect.

5.6.4.20 virtual bool Arc::DataPoint::ProvidesMeta () const `[pure virtual]`

If endpoint can provide at least some meta information directly.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.21 virtual void Arc::DataPoint::Range (unsigned long long int *start* = `0`, unsigned long long int *end* = `0`) `[pure virtual]`

Set range of bytes to retrieve. Default values correspond to whole file.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.22 virtual void Arc::DataPoint::ReadOutOfOrder (bool *v*) `[pure virtual]`

Allow/disallow DataPoint to produce scattered data during reading∗ operation.

Parameters:

v true if allowed (default is false).

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.23 virtual bool Arc::DataPoint::Registered () const [pure virtual]

Check if file is registered in Indexing Service. Proper value is obtainable only after Resolve.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.24 virtual DataStatus Arc::DataPoint::Rename (const URL & *newurl*) [pure virtual]

Rename a URL. This method renames the file or directory specified in the constructor to the new name specified in newurl. It only performs namespace operations using the paths of the two URLs and in general ignores any differences in protocol and host between them. It is assumed that checks that the URLs are consistent are done by the caller of this method. This method does not do any data transfer and is only implemented for protocols which support renaming as an atomic namespace operation.

Parameters:

newurl The new name for the URL

5.6.4.25 virtual DataStatus Arc::DataPoint::Resolve (bool *source*, const std::list< DataPoint * > & *urls*) [pure virtual]

Resolves several index service URLs. Can use bulk calls if protocol allows. The protocols and hosts of all the DataPoints in urls must be the same and the same as this DataPoint's protocol and host. This method can be called on any of the urls, for example urls.front()->Resolve(true, urls);

Parameters:

source true if DataPoint objects represent source of information

urls List of DataPoints to resolve. Protocols and hosts must match and match this DataPoint's protocol and host.

5.6.4.26 virtual DataStatus Arc::DataPoint::Resolve (bool *source*) [pure virtual]

Resolves index service URL into list of ordinary URLs. Also obtains meta information about the file.

Parameters:

source true if DataPoint object represents source of information.

Implemented in Arc::DataPointDirect.

5.6.4.27 virtual void Arc::DataPoint::SetAdditionalChecks (bool *v*) [pure virtual]

Allow/disallow additional checks. Check for existence of remote file (and probably other checks too) before initiating reading and writing operations.

Parameters:

v true if allowed (default is true).

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.28 virtual void Arc::DataPoint::SetMeta (const DataPoint & *p*) [virtual]

Copy meta information from another object. Already defined values are not overwritten.

Parameters:

p object from which information is taken.

5.6.4.29 virtual void Arc::DataPoint::SetSecure (bool *v*) [pure virtual]

Allow/disallow heavy security during data transfer.

Parameters:

v true if allowed (default depends on protocol).

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.30 virtual bool Arc::DataPoint::SetURL (const URL & *url*) [virtual]

Assigns new URL. Main purpose of this method is to reuse existing connection for accessing different object at same server. Implementation does not have to implement this method. If supplied URL is not suitable or method is not implemented false is returned.

5.6.4.31 virtual void Arc::DataPoint::SortLocations (const std::string & *pattern*, const URLMap & *url_map*) [pure virtual]

Sort locations according to the specified pattern.

Parameters:

pattern a set of strings, separated by |, to match against.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.4.32 virtual DataStatus Arc::DataPoint::StartReading (DataBuffer & *buffer*) [pure virtual]

Start reading data from URL. Separate thread to transfer data will be created. No other operation can be performed while reading is in progress.

Parameters:

buffer operation will use this buffer to put information into. Should not be destroyed before StopReading() was called and returned. If StopReading() is not called explicitely to release buffer it will be released in destructor of DataPoint which also usually calls StopReading().

Implemented in Arc::DataPointIndex.

5.6.4.33 virtual DataStatus Arc::DataPoint::StartWriting (DataBuffer & *buffer*, DataCallback * *space_cb* = NULL) [pure virtual]

Start writing data to URL. Separate thread to transfer data will be created. No other operation can be performed while writing is in progress.

Parameters:

buffer operation will use this buffer to get information from. Should not be destroyed before StopWriting() was called and returned. If StopWriting() is not called explicitely to release buffer it will be released in destructor of DataPoint which also usually calls StopWriting().

space_cb callback which is called if there is not enough space to store data. May not implemented for all protocols.

Implemented in Arc::DataPointIndex.

5.6.4.34 virtual DataStatus Arc::DataPoint::Stat (std::list< FileInfo > & *files*, const std::list< DataPoint * > & *urls*, DataPointInfoType *verb* = INFO_TYPE_ALL) [pure virtual]

Retrieve information about several DataPoints. If a DataPoint represents a directory or something similar, information about the object itself and not its contents will be obtained. This method can use bulk operations if the protocol supports it. The protocols and hosts of all the DataPoints in urls must be the same and the same as this DataPoint's protocol and host. This method can be called on any of the urls, for example urls.front()->Stat(files, urls); Calling this method with an empty list of urls returns success if the protocol supports bulk Stat, and an error if it does not.

Parameters:

files will contain objects' names and requested attributes. There may be more attributes than requested. There may be less if objects can't provide particular information. The order of this vector matches the order of urls. If a stat of any url fails then the corresponding FileInfo in this list will evaluate to false.

urls list of DataPoints to stat. Protocols and hosts must match and match this DataPoint's protocol and host.

verb defines attribute types which method must try to retrieve. It is not a failure if some attributes could not be retrieved due to limitation of protocol or access control.

5.6.4.35 virtual DataStatus Arc::DataPoint::Stat (FileInfo & *file*, DataPointInfoType *verb* = INFO_TYPE_ALL) [pure virtual]

Retrieve information about this object. If the DataPoint represents a directory or something similar, information about the object itself and not its contents will be obtained.

Parameters:

file will contain object name and requested attributes. There may be more attributes than requested. There may be less if object can't provide particular information.

verb defines attribute types which method must try to retrieve. It is not a failure if some attributes could not be retrieved due to limitation of protocol or access control.

5.6.4.36 virtual DataStatus Arc::DataPoint::StopReading () [pure virtual]

Stop reading. Must be called after corresponding start_reading method, either after all data is transferred or to cancel transfer. Use buffer object to find out when data is transferred. Must return failure if any happened during transfer.

Implemented in Arc::DataPointIndex.

5.6.4.37 virtual DataStatus Arc::DataPoint::StopWriting () [pure virtual]

Stop writing. Must be called after corresponding start_writing method, either after all data is transferred or to cancel transfer. Use buffer object to find out when data is transferred. Must return failure if any happened during transfer.

Implemented in Arc::DataPointIndex.

5.6.4.38 virtual DataStatus Arc::DataPoint::Transfer3rdParty (const URL & *source*, const URL & *destination*, Callback3rdParty *callback* = NULL) [protected, virtual]

Perform third party transfer. This method is protected because the static version should be used instead to load the correct DMC plugin for third party transfer.

Parameters:

source Source URL to pull data from

destination Destination URL which pulls data to itself

callback Optional monitoring callback

5.6.4.39 static DataStatus Arc::DataPoint::Transfer3rdParty (const URL & *source*, const URL & *destination*, const UserConfig & *usercfg*, Callback3rdParty *callback* = NULL) [static]

Perform third party transfer. Credentials are delegated to the destination and it pulls data from the source, i.e. data flows directly between source and destination instead of through the client. A callback function can be supplied to monitor progress. This method blocks until the transfer is complete. It is static because third party transfer requires different DMC plugins than those loaded by DataHandle for the same protocol. The third party transfer plugins are loaded internally in this method.

Parameters:

source Source URL to pull data from

destination Destination URL which pulls data to itself

usercfg Configuration information

callback Optional monitoring callback

5.6.4.40 virtual std::vector<URL> Arc::DataPoint::TransferLocations () const [virtual]

Returns physical file(s) to read/write, if different from CurrentLocation(). To be used with protocols which re-direct to different URLs such as Transport URLs (TURLs). The list is initially filled by PrepareReading and PrepareWriting. If this list is non-empty then real transfer should use a URL from this list. It is

up to the caller to choose the best URL and instantiate new DataPoint for handling it. For consistency protocols which do not require redirections return original URL. For protocols which need redirection calling StartReading and StartWriting will use first URL in the list.

Reimplemented in Arc::DataPointIndex.

5.6.4.41 virtual DataStatus Arc::DataPoint::Unregister (bool *all*) [pure virtual]

Index Service unregistration. Remove information about file registered in Indexing Service.

Parameters:

all if true, information about file itself is (LFN) is removed. Otherwise only particular physical instance is unregistered.

Implemented in Arc::DataPointDirect.

5.6.4.42 virtual bool Arc::DataPoint::WriteOutOfOrder () [pure virtual]

Returns true if URL can accept scattered data for ∗writing∗ operation.

Implemented in Arc::DataPointDirect, and Arc::DataPointIndex.

5.6.5 Field Documentation

5.6.5.1 std::set<std::string> Arc::DataPoint::valid_url_options [protected]

Subclasses should add their own specific options to this list

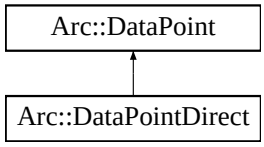
The documentation for this class was generated from the following file:

- DataPoint.h

5.7 Arc::DataPointDirect Class Reference

This is a kind of generalized file handle.

`#include <DataPointDirect.h>`Inheritance diagram for Arc::DataPointDirect::



Public Member Functions

- virtual bool IsIndex () const
- virtual bool IsStageable () const
- virtual long long int BufSize () const
- virtual int BufNum () const
- virtual bool Local () const
- virtual void ReadOutOfOrder (bool v)
- virtual bool WriteOutOfOrder ()
- virtual void SetAdditionalChecks (bool v)
- virtual bool GetAdditionalChecks () const
- virtual void SetSecure (bool v)
- virtual bool GetSecure () const
- virtual void Passive (bool v)
- virtual void Range (unsigned long long int start=0, unsigned long long int end=0)
- virtual int AddCheckSumObject (CheckSum *cksum)
- virtual const CheckSum * GetCheckSumObject (int index) const
- virtual DataStatus Resolve (bool source)
- virtual bool Registered () const
- virtual DataStatus PreRegister (bool replication, bool force=false)
- virtual DataStatus PostRegister (bool replication)
- virtual DataStatus PreUnregister (bool replication)
- virtual DataStatus Unregister (bool all)
- virtual bool AcceptsMeta () const
- virtual bool ProvidesMeta () const
- virtual const URL & CurrentLocation () const
- virtual DataPoint * CurrentLocationHandle () const
- virtual const std::string & CurrentLocationMetadata () const
- virtual DataStatus CompareLocationMetadata () const
- virtual bool NextLocation ()
- virtual bool LocationValid () const
- virtual bool HaveLocations () const
- virtual bool LastLocation ()
- virtual DataStatus AddLocation (const URL &url, const std::string &meta)
- virtual DataStatus RemoveLocation ()
- virtual DataStatus ClearLocations ()
- virtual void SortLocations (const std::string &, const URLMap &)

5.7.1 Detailed Description

This is a kind of generalized file handle. Differently from file handle it does not support operations read() and write(). Instead it initiates operation and uses object of class DataBuffer to pass actual data. It also provides other operations like querying parameters of remote object. It is used by higher-level classes DataMove and DataMovePar to provide data transfer service for application.

5.7.2 Member Function Documentation

5.7.2.1 virtual int Arc::DataPointDirect::AddCheckSumObject (CheckSum * *cksum*) [virtual]

Add a checksum object which will compute checksum during transmission.

Parameters:

cksum object which will compute checksum. Should not be destroyed till DataPointer itself.

Returns:

integer position in the list of checksum objects.

Implements Arc::DataPoint.

5.7.2.2 virtual DataStatus Arc::DataPointDirect::AddLocation (const URL & *url*, const std::string & *meta*) [virtual]

Add URL to list.

Parameters:

url Location URL to add.

meta Location meta information.

Implements Arc::DataPoint.

5.7.2.3 virtual DataStatus Arc::DataPointDirect::CompareLocationMetadata () const [virtual]

Compare metadata of DataPoint and current location. Returns inconsistency error or error encountered during operation, or success

Implements Arc::DataPoint.

5.7.2.4 virtual const std::string& Arc::DataPointDirect::CurrentLocationMetadata () const [virtual]

Returns meta information used to create current URL. Usage differs between different indexing services.

Implements Arc::DataPoint.

5.7.2.5 virtual bool Arc::DataPointDirect::NextLocation () [virtual]

Switch to next location in list of URLs. At last location switch to first if number of allowed retries is not exceeded. Returns false if no retries left.

Implements Arc::DataPoint.

5.7.2.6 virtual void Arc::DataPointDirect::Passive (bool *v*) [virtual]

Request passive transfers for FTP-like protocols.

Parameters:

true to request.

Implements Arc::DataPoint.

5.7.2.7 virtual DataStatus Arc::DataPointDirect::PostRegister (bool *replication*) [virtual]

Index Service postregistration. Used for same purpose as PreRegister. Should be called after actual transfer of file successfully finished.

Parameters:

replication if true, the file is being replicated between two locations registered in Indexing Service under same name.

Implements Arc::DataPoint.

5.7.2.8 virtual DataStatus Arc::DataPointDirect::PreRegister (bool *replication*, bool *force* = false) [virtual]

Index service preregistration. This function registers the physical location of a file into an indexing service. It should be called ∗before∗ the actual transfer to that location happens.

Parameters:

replication if true, the file is being replicated between two locations registered in the indexing service under same name.

force if true, perform registration of a new file even if it already exists. Should be used to fix failures in Indexing Service.

Implements Arc::DataPoint.

5.7.2.9 virtual DataStatus Arc::DataPointDirect::PreUnregister (bool *replication*) [virtual]

Index Service preunregistration. Should be called if file transfer failed. It removes changes made by PreRegister.

Parameters:

replication if true, the file is being replicated between two locations registered in Indexing Service under same name.

Implements Arc::DataPoint.

5.7.2.10 virtual bool Arc::DataPointDirect::ProvidesMeta () const [virtual]

If endpoint can provide at least some meta information directly.

Implements Arc::DataPoint.

5.7.2.11 virtual void Arc::DataPointDirect::Range (unsigned long long int *start* = 0, unsigned long long int *end* = 0) [virtual]

Set range of bytes to retrieve. Default values correspond to whole file.

Implements Arc::DataPoint.

5.7.2.12 virtual void Arc::DataPointDirect::ReadOutOfOrder (bool *v*) [virtual]

Allow/disallow DataPoint to produce scattered data during reading∗ operation.

Parameters:

v true if allowed (default is false).

Implements Arc::DataPoint.

5.7.2.13 virtual bool Arc::DataPointDirect::Registered () const [virtual]

Check if file is registered in Indexing Service. Proper value is obtainable only after Resolve.

Implements Arc::DataPoint.

5.7.2.14 virtual DataStatus Arc::DataPointDirect::Resolve (bool *source*) [virtual]

Resolves index service URL into list of ordinary URLs. Also obtains meta information about the file.

Parameters:

source true if DataPoint object represents source of information.

Implements Arc::DataPoint.

5.7.2.15 virtual void Arc::DataPointDirect::SetAdditionalChecks (bool *v*) [virtual]

Allow/disallow additional checks. Check for existence of remote file (and probably other checks too) before initiating reading and writing operations.

Parameters:

v true if allowed (default is true).

Implements Arc::DataPoint.

5.7.2.16 virtual void Arc::DataPointDirect::SetSecure (bool *v*) [virtual]

Allow/disallow heavy security during data transfer.

Parameters:

v true if allowed (default depends on protocol).

Implements Arc::DataPoint.

5.7.2.17 virtual void Arc::DataPointDirect::SortLocations (const std::string & *pattern*, const URLMap & *url_map*) [inline, virtual]

Sort locations according to the specified pattern.

Parameters:

pattern a set of strings, separated by |, to match against.

Implements Arc::DataPoint.

5.7.2.18 virtual DataStatus Arc::DataPointDirect::Unregister (bool *all*) [virtual]

Index Service unregistration. Remove information about file registered in Indexing Service.

Parameters:

all if true, information about file itself is (LFN) is removed. Otherwise only particular physical instance is unregistered.

Implements Arc::DataPoint.

5.7.2.19 virtual bool Arc::DataPointDirect::WriteOutOfOrder () [virtual]

Returns true if URL can accept scattered data for ∗writing∗ operation.

Implements Arc::DataPoint.

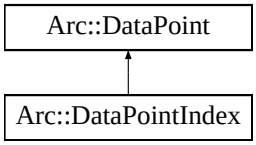
The documentation for this class was generated from the following file:

- DataPointDirect.h

5.8 Arc::DataPointIndex Class Reference

Complements DataPoint with attributes common for Indexing Service URLs.

`#include <DataPointIndex.h>`Inheritance diagram for Arc::DataPointIndex::



Public Member Functions

- virtual const URL & CurrentLocation () const
- virtual const std::string & CurrentLocationMetadata () const
- virtual DataPoint * CurrentLocationHandle () const
- virtual DataStatus CompareLocationMetadata () const
- virtual bool NextLocation ()
- virtual bool LocationValid () const
- virtual bool HaveLocations () const
- virtual bool LastLocation ()
- virtual DataStatus RemoveLocation ()
- virtual DataStatus ClearLocations ()
- virtual DataStatus AddLocation (const URL &url, const std::string &meta)
- virtual void SortLocations (const std::string &pattern, const URLMap &url_map)
- virtual bool IsIndex () const
- virtual bool IsStageable () const
- virtual bool AcceptsMeta () const
- virtual bool ProvidesMeta () const
- virtual void SetCheckSum (const std::string &val)
- virtual void SetSize (const unsigned long long int val)
- virtual bool Registered () const
- virtual void SetTries (const int n)
- virtual long long int BufSize () const
- virtual int BufNum () const
- virtual bool Local () const
- virtual DataStatus PrepareReading (unsigned int timeout, unsigned int &wait_time)
- virtual DataStatus PrepareWriting (unsigned int timeout, unsigned int &wait_time)
- virtual DataStatus StartReading (DataBuffer &buffer)
- virtual DataStatus StartWriting (DataBuffer &buffer, DataCallback *space_cb=NULL)
- virtual DataStatus StopReading ()
- virtual DataStatus StopWriting ()
- virtual DataStatus FinishReading (bool error=false)
- virtual DataStatus FinishWriting (bool error=false)
- virtual std::vector< URL > TransferLocations () const
- virtual DataStatus Check (bool check_meta)
- virtual DataStatus Remove ()
- virtual void ReadOutOfOrder (bool v)
- virtual bool WriteOutOfOrder ()

- virtual void SetAdditionalChecks (bool v)
- virtual bool GetAdditionalChecks () const
- virtual void SetSecure (bool v)
- virtual bool GetSecure () const
- virtual DataPointAccessLatency GetAccessLatency () const
- virtual void Passive (bool v)
- virtual void Range (unsigned long long int start=0, unsigned long long int end=0)
- virtual int AddCheckSumObject (CheckSum *cksum)
- virtual const CheckSum * GetCheckSumObject (int index) const

5.8.1 Detailed Description

Complements DataPoint with attributes common for Indexing Service URLs. It should never be used directly. Instead inherit from it to provide a class for specific a Indexing Service.

5.8.2 Member Function Documentation

5.8.2.1 virtual int Arc::DataPointIndex::AddCheckSumObject (CheckSum * *cksum*) [virtual]

Add a checksum object which will compute checksum during transmission.

Parameters:

cksum object which will compute checksum. Should not be destroyed till DataPointer itself.

Returns:

integer position in the list of checksum objects.

Implements Arc::DataPoint.

5.8.2.2 virtual DataStatus Arc::DataPointIndex::AddLocation (const URL & *url*, const std::string & *meta*) [virtual]

Add URL to list.

Parameters:

url Location URL to add.

meta Location meta information.

Implements Arc::DataPoint.

5.8.2.3 virtual DataStatus Arc::DataPointIndex::Check (bool *check_meta*) [virtual]

Query the DataPoint to check if object is accessible. If check_meta is true this method will also try to provide meta information about the object. Note that for many protocols an access check also provides meta information and so check_meta may have no effect. This method returns a positive response if the object is accessible by the caller.

Parameters:

check_meta If true then the method will try to retrieve meta data during the check.

Implements Arc::DataPoint.

5.8.2.4 virtual DataStatus Arc::DataPointIndex::CompareLocationMetadata () const [virtual]

Compare metadata of DataPoint and current location. Returns inconsistency error or error encountered during operation, or success

Implements Arc::DataPoint.

5.8.2.5 virtual const std::string& Arc::DataPointIndex::CurrentLocationMetadata () const [virtual]

Returns meta information used to create current URL. Usage differs between different indexing services.

Implements Arc::DataPoint.

5.8.2.6 virtual DataStatus Arc::DataPointIndex::FinishReading (bool *error* = false) [virtual]

Finish reading from the URL. Must be called after transfer of physical file has completed and if PrepareReading() was called, to free resources, release requests that were made during preparation etc.

Parameters:

error If true then action is taken depending on the error.

Reimplemented from Arc::DataPoint.

5.8.2.7 virtual DataStatus Arc::DataPointIndex::FinishWriting (bool *error* = false) [virtual]

Finish writing to the URL. Must be called after transfer of physical file has completed and if PrepareWriting() was called, to free resources, release requests that were made during preparation etc.

Parameters:

error If true then action is taken depending on the error.

Reimplemented from Arc::DataPoint.

5.8.2.8 virtual bool Arc::DataPointIndex::NextLocation () [virtual]

Switch to next location in list of URLs. At last location switch to first if number of allowed retries is not exceeded. Returns false if no retries left.

Implements Arc::DataPoint.

5.8.2.9 virtual void Arc::DataPointIndex::Passive (bool *v*) [virtual]

Request passive transfers for FTP-like protocols.

Parameters:

true to request.

Implements Arc::DataPoint.

5.8.2.10 virtual DataStatus Arc::DataPointIndex::PrepareReading (unsigned int *timeout*, unsigned int & *wait_time*) [virtual]

Prepare DataPoint for reading. This method should be implemented by protocols which require preparation or staging of physical files for reading. It can act synchronously or asynchronously (if protocol supports it). In the first case the method will block until the file is prepared or the specified timeout has passed. In the second case the method can return with a ReadPrepareWait status before the file is prepared. The caller should then wait some time (a hint from the remote service may be given in wait_time) and call PrepareReading() again to poll for the preparation status, until the file is prepared. In this case it is also up to the caller to decide when the request has taken too long and if so cancel it by calling FinishReading(). When file preparation has finished, the physical file(s) to read from can be found from TransferLocations().

Parameters:

timeout If non-zero, this method will block until either the file has been prepared successfully or the timeout has passed. A zero value means that the caller would like to call and poll for status.

wait_time If timeout is zero (caller would like asynchronous operation) and ReadPrepareWait is returned, a hint for how long to wait before a subsequent call may be given in wait_time.

Reimplemented from Arc::DataPoint.

5.8.2.11 virtual DataStatus Arc::DataPointIndex::PrepareWriting (unsigned int *timeout*, unsigned int & *wait_time*) [virtual]

Prepare DataPoint for writing. This method should be implemented by protocols which require preparation of physical files for writing. It can act synchronously or asynchronously (if protocol supports it). In the first case the method will block until the file is prepared or the specified timeout has passed. In the second case the method can return with a WritePrepareWait status before the file is prepared. The caller should then wait some time (a hint from the remote service may be given in wait_time) and call PrepareWriting() again to poll for the preparation status, until the file is prepared. In this case it is also up to the caller to decide when the request has taken too long and if so cancel or abort it by calling FinishWriting(true). When file preparation has finished, the physical file(s) to write to can be found from TransferLocations().

Parameters:

timeout If non-zero, this method will block until either the file has been prepared successfully or the timeout has passed. A zero value means that the caller would like to call and poll for status.

wait_time If timeout is zero (caller would like asynchronous operation) and WritePrepareWait is returned, a hint for how long to wait before a subsequent call may be given in wait_time.

Reimplemented from Arc::DataPoint.

5.8.2.12 virtual bool Arc::DataPointIndex::ProvidesMeta () const [virtual]

If endpoint can provide at least some meta information directly.

Implements Arc::DataPoint.

5.8.2.13 virtual void Arc::DataPointIndex::Range (unsigned long long int *start* = 0, unsigned long long int *end* = 0) [virtual]

Set range of bytes to retrieve. Default values correspond to whole file.

Implements Arc::DataPoint.

5.8.2.14 virtual void Arc::DataPointIndex::ReadOutOfOrder (bool *v*) [virtual]

Allow/disallow DataPoint to produce scattered data during reading∗ operation.

Parameters:

v true if allowed (default is false).

Implements Arc::DataPoint.

5.8.2.15 virtual bool Arc::DataPointIndex::Registered () const [virtual]

Check if file is registered in Indexing Service. Proper value is obtainable only after Resolve.

Implements Arc::DataPoint.

5.8.2.16 virtual void Arc::DataPointIndex::SetAdditionalChecks (bool *v*) [virtual]

Allow/disallow additional checks. Check for existence of remote file (and probably other checks too) before initiating reading and writing operations.

Parameters:

v true if allowed (default is true).

Implements Arc::DataPoint.

5.8.2.17 virtual void Arc::DataPointIndex::SetSecure (bool *v*) [virtual]

Allow/disallow heavy security during data transfer.

Parameters:

v true if allowed (default depends on protocol).

Implements Arc::DataPoint.

5.8.2.18 virtual void Arc::DataPointIndex::SortLocations (const std::string & *pattern*, const URLMap & *url_map*) [virtual]

Sort locations according to the specified pattern.

Parameters:

pattern a set of strings, separated by |, to match against.

Implements Arc::DataPoint.

5.8.2.19 virtual DataStatus Arc::DataPointIndex::StartReading (DataBuffer & *buffer*) [virtual]

Start reading data from URL. Separate thread to transfer data will be created. No other operation can be performed while reading is in progress.

Parameters:

buffer operation will use this buffer to put information into. Should not be destroyed before StopReading() was called and returned. If StopReading() is not called explicitely to release buffer it will be released in destructor of DataPoint which also usually calls StopReading().

Implements Arc::DataPoint.

5.8.2.20 virtual DataStatus Arc::DataPointIndex::StartWriting (DataBuffer & *buffer*, DataCallback * *space_cb* = NULL) [virtual]

Start writing data to URL. Separate thread to transfer data will be created. No other operation can be performed while writing is in progress.

Parameters:

buffer operation will use this buffer to get information from. Should not be destroyed before StopWriting() was called and returned. If StopWriting() is not called explicitely to release buffer it will be released in destructor of DataPoint which also usually calls StopWriting().

space_cb callback which is called if there is not enough space to store data. May not implemented for all protocols.

Implements Arc::DataPoint.

5.8.2.21 virtual DataStatus Arc::DataPointIndex::StopReading () [virtual]

Stop reading. Must be called after corresponding start_reading method, either after all data is transferred or to cancel transfer. Use buffer object to find out when data is transferred. Must return failure if any happened during transfer.

Implements Arc::DataPoint.

5.8.2.22 virtual DataStatus Arc::DataPointIndex::StopWriting () [virtual]

Stop writing. Must be called after corresponding start_writing method, either after all data is transferred or to cancel transfer. Use buffer object to find out when data is transferred. Must return failure if any happened during transfer.

Implements Arc::DataPoint.

5.8.2.23 virtual std::vector<URL> Arc::DataPointIndex::TransferLocations () const [virtual]

Returns physical file(s) to read/write, if different from CurrentLocation(). To be used with protocols which re-direct to different URLs such as Transport URLs (TURLs). The list is initially filled by PrepareReading and PrepareWriting. If this list is non-empty then real transfer should use a URL from this list. It is up to the caller to choose the best URL and instantiate new DataPoint for handling it. For consistency protocols which do not require redirections return original URL. For protocols which need redirection calling StartReading and StartWriting will use first URL in the list.

Reimplemented from Arc::DataPoint.

5.8.2.24 virtual bool Arc::DataPointIndex::WriteOutOfOrder () [virtual]

Returns true if URL can accept scattered data for ∗writing∗ operation.

Implements Arc::DataPoint.

The documentation for this class was generated from the following file:

- DataPointIndex.h

5.9 Arc::DataPointLoader Class Reference

Class used by DataHandle to load the required DMC.

`#include <DataPoint.h>`

5.9.1 Detailed Description

Class used by DataHandle to load the required DMC.

The documentation for this class was generated from the following file:

- DataPoint.h

5.10 Arc::DataPointPluginArgument Class Reference

Class representing the arguments passed to DMC plugins.

`#include <DataPoint.h>`

5.10.1 Detailed Description

Class representing the arguments passed to DMC plugins.

The documentation for this class was generated from the following file:

- DataPoint.h

5.11 Arc::DataSpeed Class Reference

Keeps track of average and instantaneous transfer speed.

`#include <DataSpeed.h>`

Public Member Functions

- DataSpeed (time_t base=DATASPEED_AVERAGING_PERIOD)
- DataSpeed (unsigned long long int min_speed, time_t min_speed_time, unsigned long long int min_average_speed, time_t max_inactivity_time, time_t base=DATASPEED_AVERAGING_PERIOD)
- ~DataSpeed (void)
- void verbose (bool val)
- void verbose (const std::string &prefix)
- bool verbose (void)
- void set_min_speed (unsigned long long int min_speed, time_t min_speed_time)
- void set_min_average_speed (unsigned long long int min_average_speed)
- void set_max_inactivity_time (time_t max_inactivity_time)
- time_t get_max_inactivity_time ()
- void set_base (time_t base_=DATASPEED_AVERAGING_PERIOD)
- void set_max_data (unsigned long long int max=0)
- void set_progress_indicator (show_progress_t func=NULL)
- void reset (void)
- bool transfer (unsigned long long int n=0)
- void hold (bool disable)
- bool min_speed_failure ()
- bool min_average_speed_failure ()
- bool max_inactivity_time_failure ()
- unsigned long long int transferred_size (void)

5.11.1 Detailed Description

Keeps track of average and instantaneous transfer speed. Also detects data transfer inactivity and other transfer timeouts.

5.11.2 Constructor & Destructor Documentation

5.11.2.1 Arc::DataSpeed::DataSpeed (time_t *base* = `DATASPEED_AVERAGING_PERIOD`)

Constructor

Parameters:

base time period used to average values (default 1 minute).

5.11.2.2 Arc::DataSpeed::DataSpeed (unsigned long long int *min_speed*, time_t *min_speed_time*, unsigned long long int *min_average_speed*, time_t *max_inactivity_time*, time_t *base* = DATASPEED_AVERAGING_PERIOD)

Constructor

Parameters:

base time period used to average values (default 1 minute).

min_speed minimal allowed speed (Butes per second). If speed drops and holds below threshold for min_speed_time_ seconds error is triggered.

min_speed_time

min_average_speed_ minimal average speed (Bytes per second) to trigger error. Averaged over whole current transfer time.

max_inactivity_time - if no data is passing for specified amount of time (seconds), error is triggered.

5.11.3 Member Function Documentation

5.11.3.1 void Arc::DataSpeed::hold (bool *disable*)

Turn off speed control.

Parameters:

disable true to turn off.

5.11.3.2 void Arc::DataSpeed::set_base (time_t *base_* = DATASPEED_AVERAGING_PERIOD)

Set averaging time period.

Parameters:

base time period used to average values (default 1 minute).

5.11.3.3 void Arc::DataSpeed::set_max_data (unsigned long long int *max* = 0)

Set amount of data to be transferred. Used in verbose messages.

Parameters:

max amount of data in bytes.

5.11.3.4 void Arc::DataSpeed::set_max_inactivity_time (time_t *max_inactivity_time*)

Set inactivity tiemout.

Parameters:

max_inactivity_time - if no data is passing for specified amount of time (seconds), error is triggered.

5.11.3.5 void Arc::DataSpeed::set_min_average_speed (unsigned long long int *min_average_speed*)

Set minmal avaerage speed.

Parameters:

min_average_speed_ minimal average speed (Bytes per second) to trigger error. Averaged over whole current transfer time.

5.11.3.6 void Arc::DataSpeed::set_min_speed (unsigned long long int *min_speed*, time_t *min_speed_time*)

Set minimal allowed speed.

Parameters:

min_speed minimal allowed speed (Butes per second). If speed drops and holds below threshold for min_speed_time_ seconds error is triggered.

min_speed_time

5.11.3.7 void Arc::DataSpeed::set_progress_indicator (show_progress_t *func* = `NULL`)

Specify which external function will print verbose messages. If not specified internal one is used.

Parameters:

pointer to function which prints information.

5.11.3.8 bool Arc::DataSpeed::transfer (unsigned long long int *n* = `0`)

Inform object, about amount of data has been transferred. All errors are triggered by this method. To make them work application must call this method periodically even with zero value.

Parameters:

n amount of data transferred (bytes).

5.11.3.9 void Arc::DataSpeed::verbose (const std::string & *prefix*)

Print information about current speed and amout of data.

Parameters:

'prefix' add this string at the beginning of every string.

5.11.3.10 void Arc::DataSpeed::verbose (bool *val*)

Activate printing information about current time speeds, amount of transferred data.

The documentation for this class was generated from the following file:

- DataSpeed.h

5.12 Arc::DataStatus Class Reference

Status code returned by many DataPoint methods.

`#include <DataStatus.h>`

Public Types

- enum DataStatusType {

  Success, ReadAcquireError, WriteAcquireError, ReadResolveError,

  WriteResolveError, ReadStartError, WriteStartError, ReadError,

  WriteError, TransferError, ReadStopError, WriteStopError,

  PreRegisterError, PostRegisterError, UnregisterError, CacheError,

  CredentialsExpiredError, DeleteError, NoLocationError, LocationAlreadyExistsError,

  NotSupportedForDirectDataPointsError, UnimplementedError, IsReadingError, IsWritingError,

  CheckError, ListError, ListNonDirError, StatError,

  StatNotPresentError, NotInitializedError, SystemError, StageError,

  InconsistentMetadataError, ReadPrepareError, ReadPrepareWait, WritePrepareError,

  WritePrepareWait, ReadFinishError, WriteFinishError, CreateDirectoryError,

  RenameError, SuccessCached, SuccessCancelled, GenericError,

  UnknownError, ReadAcquireErrorRetryable = DataStatusRetryableBase+ReadAcquireError, WriteAcquireErrorRetryable = DataStatusRetryableBase+WriteAcquireError, ReadResolveErrorRetryable = DataStatusRetryableBase+ReadResolveError,

  WriteResolveErrorRetryable = DataStatusRetryableBase+WriteResolveError, ReadStartErrorRetryable = DataStatusRetryableBase+ReadStartError, WriteStartErrorRetryable = DataStatusRetryableBase+WriteStartError, ReadErrorRetryable = DataStatusRetryableBase+ReadError,

  WriteErrorRetryable = DataStatusRetryableBase+WriteError, TransferErrorRetryable = DataStatusRetryableBase+TransferError, ReadStopErrorRetryable = DataStatusRetryableBase+ReadStopError, WriteStopErrorRetryable = DataStatusRetryableBase+WriteStopError,

  PreRegisterErrorRetryable = DataStatusRetryableBase+PreRegisterError, PostRegisterErrorRetryable = DataStatusRetryableBase+PostRegisterError, UnregisterErrorRetryable = DataStatusRetryableBase+UnregisterError, CacheErrorRetryable = DataStatusRetryableBase+CacheError,

  DeleteErrorRetryable = DataStatusRetryableBase+DeleteError, CheckErrorRetryable = DataStatusRetryableBase+CheckError, ListErrorRetryable = DataStatusRetryableBase+ListError, StatErrorRetryable = DataStatusRetryableBase+StatError,

  StageErrorRetryable = DataStatusRetryableBase+StageError, ReadPrepareErrorRetryable = DataStatusRetryableBase+ReadPrepareError, WritePrepareErrorRetryable = DataStatusRetryableBase+WritePrepareError, ReadFinishErrorRetryable = DataStatusRetryableBase+ReadFinishError,

  WriteFinishErrorRetryable = DataStatusRetryableBase+WriteFinishError, CreateDirectoryErrorRetryable = DataStatusRetryableBase+CreateDirectoryError, RenameErrorRetryable = DataStatusRetryableBase+RenameError, GenericErrorRetryable = DataStatusRetryableBase+GenericError }

Public Member Functions

- DataStatus (const DataStatusType &status, std::string desc="")
- DataStatus (const DataStatusType &status, int error_no, const std::string &desc="")

- DataStatus ()
- bool Passed () const
- bool Retryable () const
- void SetErrNo (int error_no)
- int GetErrno () const
- std::string GetStrErrno () const
- void SetDesc (const std::string &d)
- std::string GetDesc () const
- operator std::string (void) const

5.12.1 Detailed Description

Status code returned by many DataPoint methods. A class to be used for return types of all major data handling methods. It describes the outcome of the method and contains three fields: DataStatusType describes in which operation the error occurred, Errno describes why the error occurred and desc gives more detail if available. Errno is an integer corresponding to error codes defined in errno.h plus additional ARC-specific error codes defined here.

For those DataPoints which natively support errno, it is safe to use code like

```
DataStatus s = someMethod();
if (!s) {
  logger.msg(ERROR, "someMethod failed: %s", StrError(errno));
  return DataStatus(DataStatus::ReadError, errno);
}
```

since logger.msg() does not call any system calls that modify errno.

5.12.2 Member Enumeration Documentation

5.12.2.1 enum Arc::DataStatus::DataStatusType

Status codes. These codes describe in which operation an error occurred. Retryable error codes are deprecated - the corresponding non-retryable error code should be used with errno set to a retryable value.

Enumerator:

Success Operation completed successfully.

ReadAcquireError Source is bad URL or can't be used due to some reason.

WriteAcquireError Destination is bad URL or can't be used due to some reason.

ReadResolveError Resolving of index service URL for source failed.

WriteResolveError Resolving of index service URL for destination failed.

ReadStartError Can't read from source.

WriteStartError Can't write to destination.

ReadError Failed while reading from source.

WriteError Failed while writing to destination.

TransferError Failed while transfering data (mostly timeout).

ReadStopError Failed while finishing reading from source.

WriteStopError Failed while finishing writing to destination.

PreRegisterError First stage of registration of index service URL failed.

PostRegisterError Last stage of registration of index service URL failed.

UnregisterError Unregistration of index service URL failed.

CacheError Error in caching procedure.

CredentialsExpiredError Error due to provided credentials are expired.

DeleteError Error deleting location or URL.

NoLocationError No valid location available.

LocationAlreadyExistsError No valid location available.

NotSupportedForDirectDataPointsError Operation has no sense for this kind of URL.

UnimplementedError Feature is unimplemented.

IsReadingError DataPoint is already reading.

IsWritingError DataPoint is already writing.

CheckError Access check failed.

ListError Directory listing failed.

Deprecated

ListNonDirError ListError with errno set to ENOTDIR should be used instead

StatError File/dir stating failed.

Deprecated

StatNotPresentError StatError with errno set to ENOENT should be used instead

NotInitializedError Object initialization failed.

SystemError Error in OS.

StageError Staging error.

InconsistentMetadataError Inconsistent metadata.

ReadPrepareError Can't prepare source.

ReadPrepareWait Wait for source to be prepared.

WritePrepareError Can't prepare destination.

WritePrepareWait Wait for destination to be prepared.

ReadFinishError Can't finish source.

WriteFinishError Can't finish destination.

CreateDirectoryError Can't create directory.

RenameError Can't rename URL.

SuccessCached Data was already cached.

SuccessCancelled Operation was cancelled successfully.

GenericError General error which doesn't fit any other error.

UnknownError Undefined.

Deprecated

ReadAcquireErrorRetryable

Deprecated

WriteAcquireErrorRetryable

Deprecated

ReadResolveErrorRetryable

Deprecated

WriteResolveErrorRetryable

Deprecated

ReadStartErrorRetryable

Deprecated

WriteStartErrorRetryable

Deprecated

ReadErrorRetryable

Deprecated

WriteErrorRetryable

Deprecated

TransferErrorRetryable

Deprecated

ReadStopErrorRetryable

Deprecated

WriteStopErrorRetryable

Deprecated

PreRegisterErrorRetryable

Deprecated

PostRegisterErrorRetryable

Deprecated

UnregisterErrorRetryable

Deprecated

CacheErrorRetryable

Deprecated

DeleteErrorRetryable

Deprecated

CheckErrorRetryable

Deprecated

ListErrorRetryable

Deprecated

StatErrorRetryable

Deprecated

StageErrorRetryable

Deprecated

ReadPrepareErrorRetryable

Deprecated

WritePrepareErrorRetryable

Deprecated

ReadFinishErrorRetryable

Deprecated

WriteFinishErrorRetryable

Deprecated

CreateDirectoryErrorRetryable

Deprecated

RenameErrorRetryable

Deprecated

GenericErrorRetryable

5.12.3 Constructor & Destructor Documentation

5.12.3.1 Arc::DataStatus::DataStatus (const DataStatusType & *status*, int *error_no*, const std::string & *desc* = "") [inline]

Construct a new DataStatus with errno and optional text description. If the status is an error condition then error_no must be set to a non-zero value

5.12.4 Member Function Documentation

5.12.4.1 bool Arc::DataStatus::Retryable () const

Returns true if the error was temporary and could be retried. Retryable error numbers are EAGAIN, EBUSY, ETIMEDOUT, EARCSVCTMP, EARCTRANSFERTIMEOUT and EARCCHECKSUM.

The documentation for this class was generated from the following file:

- DataStatus.h

5.13 Arc::FileCache Class Reference

FileCache provides an interface to all cache operations.

`#include <FileCache.h>`

Public Member Functions

- FileCache (const std::string &cache_path, const std::string &id, uid_t job_uid, gid_t job_gid)
- FileCache (const std::vector< std::string > &caches, const std::string &id, uid_t job_uid, gid_t job_gid)
- FileCache (const std::vector< std::string > &caches, const std::vector< std::string > &remote_caches, const std::vector< std::string > &draining_caches, const std::string &id, uid_t job_uid, gid_t job_gid)
- FileCache ()
- bool Start (const std::string &url, bool &available, bool &is_locked, bool use_remote=true, bool delete_first=false)
- bool Stop (const std::string &url)
- bool StopAndDelete (const std::string &url)
- std::string File (const std::string &url)
- bool Link (const std::string &link_path, const std::string &url, bool copy, bool executable, bool holding_lock, bool &try_again)
- bool Release () const
- bool AddDN (const std::string &url, const std::string &DN, const Time &expiry_time)
- bool CheckDN (const std::string &url, const std::string &DN)
- bool CheckCreated (const std::string &url)
- Time GetCreated (const std::string &url)
- bool CheckValid (const std::string &url)
- Time GetValid (const std::string &url)
- bool SetValid (const std::string &url, const Time &val)
- operator bool ()
- bool operator== (const FileCache &a)

5.13.1 Detailed Description

FileCache provides an interface to all cache operations. When it is decided a file should be downloaded to the cache, Start() should be called, so that the cache file can be prepared and locked if necessary. If the file is already available it is not locked and Link() can be called immediately to create a hard link to a per-job directory in the cache and then soft link, or copy the file directly to the session directory so it can be accessed from the user's job. If the file is not available, Start() will lock it, then after downloading Link() can be called. Stop() must then be called to release the lock. If the transfer failed, StopAndDelete() can be called to clean up the cache file. After a job has finished, Release() should be called to remove the hard links created for that job.

Cache files are locked for writing using the FileLock class, which creates a lock file with the '.lock' suffix next to the cache file. If Start() is called and the cache file is not already available, it creates this lock and Stop() must be called to release it. All processes calling Start() must wait until they successfully obtain the lock before downloading can begin.

The cache directory(ies) and the optional directory to link to when the soft-links are made are set in the constructor. The names of cache files are formed from an SHA-1 hash of the URL to cache. To

ease the load on the file system, the cache files are split into subdirectories based on the first two characters in the hash. For example the file with hash 76f11edda169848038efbd9fa3df5693 is stored in 76/f11edda169848038efbd9fa3df5693. A cache filename can be found by passing the URL to Find(). For more information on the structure of the cache, see the ARC Computing Element System Administrator Guide (NORDUGRID-MANUAL-20).

5.13.2 Constructor & Destructor Documentation

5.13.2.1 Arc::FileCache::FileCache (const std::string & *cache_path*, const std::string & *id*, uid_t *job_uid*, gid_t *job_gid*)

Create a new FileCache instance.

Parameters:

cache_path The format is "cache_dir[link_path]". path is the path to the cache directory and the optional link_path is used to create a link in case the cache directory is visible under a different name during actual usage. When linking from the session dir this path is used instead of cache_-path.

id the job id. This is used to create the per-job dir which the job's cache files will be hard linked from

job_uid owner of job. The per-job dir will only be readable by this user

job_gid owner group of job

5.13.2.2 Arc::FileCache::FileCache (const std::vector< std::string > & *caches*, const std::string & *id*, uid_t *job_uid*, gid_t *job_gid*)

Create a new FileCache instance with multiple cache dirs

Parameters:

caches a vector of strings describing caches. The format of each string is "cache_dir[link_path]".

id the job id. This is used to create the per-job dir which the job's cache files will be hard linked from

job_uid owner of job. The per-job dir will only be readable by this user

job_gid owner group of job

5.13.2.3 Arc::FileCache::FileCache (const std::vector< std::string > & *caches*, const std::vector< std::string > & *remote_caches*, const std::vector< std::string > & *draining_caches*, const std::string & *id*, uid_t *job_uid*, gid_t *job_gid*)

Create a new FileCache instance with multiple cache dirs, remote caches and draining cache directories.

Parameters:

caches a vector of strings describing caches. The format of each string is "cache_dir[link_path]".

remote_caches Same format as caches. These are the paths to caches which are under the control of other Grid Managers and are read-only for this process.

draining_caches Same format as caches. These are the paths to caches which are to be drained.

id the job id. This is used to create the per-job dir which the job's cache files will be hard linked from

job_uid owner of job. The per-job dir will only be readable by this user

job_gid owner group of job

5.13.3 Member Function Documentation

5.13.3.1 bool Arc::FileCache::AddDN (const std::string & *url*, const std::string & *DN*, const Time & *expiry_time*)

Store a DN in the permissions cache for the given url. Add the given DN to the list of cached DNs with the given expiry time.

Parameters:

url the url corresponding to the cache file to which we want to add a cached DN

DN the DN of the user

expiry_time the expiry time of this DN in the DN cache

5.13.3.2 bool Arc::FileCache::CheckCreated (const std::string & *url*)

Check if it is possible to obtain the creation time of a cache file. Returns true if the file exists in the cache, since the creation time is the creation time of the cache file.

Parameters:

url the url corresponding to the cache file for which we want to know if the creation date exists

5.13.3.3 bool Arc::FileCache::CheckDN (const std::string & *url*, const std::string & *DN*)

Check if a DN exists in the permission cache for the given url. Check if the given DN is cached for authorisation.

Parameters:

url the url corresponding to the cache file for which we want to check the cached DN

DN the DN of the user

5.13.3.4 bool Arc::FileCache::CheckValid (const std::string & *url*)

Check if there is an expiry time of the given url in the cache.

Parameters:

url the url corresponding to the cache file for which we want to know if the expiration time exists

5.13.3.5 std::string Arc::FileCache::File (const std::string & *url*)

Get the cache filename for the given URL. Returns the full pathname of the file in the cache which corresponds to the given url.

Parameters:

url the URL to look for in the cache

5.13.3.6 Time Arc::FileCache::GetCreated (const std::string & *url*)

Get the creation time of a cached file. If the cache file does not exist, 0 is returned.

Parameters:

url the url corresponding to the cache file for which we want to know the creation date

5.13.3.7 Time Arc::FileCache::GetValid (const std::string & *url*)

Get expiry time of a cached file. If the time is not available, a time equivalent to 0 is returned.

Parameters:

url the url corresponding to the cache file for which we want to know the expiry time

5.13.3.8 bool Arc::FileCache::Link (const std::string & *link_path*, const std::string & *url*, bool *copy*, bool *executable*, bool *holding_lock*, bool & *try_again*)

Link a cache file to the place it will be used. Create a hard-link to the per-job dir from the cache dir, and then a soft-link from here to the session directory. This is effectively 'claiming' the file for the job, so even if the original cache file is deleted, eg by some external process, the hard link still exists until it is explicitly released by calling Release().

If cache_link_path is set to "." or copy or executable is true then files will be copied directly to the session directory rather than linked.

After linking or copying, the cache file is checked for the presence of a write lock, and whether the modification time has changed since linking started (in case the file was locked, modified then released during linking). If either of these are true the links created during Link() are deleted and try_again is set to true. The caller should then go back to Start(). If the caller has obtained a write lock from Start() and then downloaded the file, it should set holding_lock to true, in which case none of the above checks are performed.

The session directory is accessed under the uid and gid passed in the constructor.

Parameters:

link_path path to the session dir for soft-link or new file

url url of file to link to or copy

copy If true the file is copied rather than soft-linked to the session dir

executable If true then file is copied and given execute permissions in the session dir

holding_lock Should be set to true if the caller already holds the lock

try_again If after linking the cache file was found to be locked, deleted or modified, then try_again is set to true

5.13.3.9 bool Arc::FileCache::Release () const

Release cache files used in this cache. Release claims on input files for the job specified by id. For each cache directory the per-job directory with the hard-links will be deleted.

5.13.3.10 bool Arc::FileCache::SetValid (const std::string & *url*, const Time & *val*)

Set expiry time of a cache file.

Parameters:

url the url corresponding to the cache file for which we want to set the expiry time

val expiry time

5.13.3.11 bool Arc::FileCache::Start (const std::string & *url*, bool & *available*, bool & *is_locked*, bool *use_remote* = `true`, bool *delete_first* = `false`)

Start preparing to cache the file specified by url. Start() returns true if the file was successfully prepared. The available parameter is set to true if the file already exists and in this case Link() can be called immediately. If available is false the caller should write the file and then call Link() followed by Stop(). It returns false if it was unable to prepare the cache file for any reason. In this case the is_locked parameter should be checked and if it is true the file is locked by another process and the caller should try again later.

Parameters:

url url that is being downloaded

available true on exit if the file is already in cache

is_locked true on exit if the file is already locked, ie cannot be used by this process

use_remote Whether to look to see if the file exists in a remote cache. Can be set to false if for example a forced download to cache is desired.

delete_first If true then any existing cache file is deleted.

5.13.3.12 bool Arc::FileCache::Stop (const std::string & *url*)

Stop the cache after a file was downloaded. This method (or stopAndDelete) must be called after file was downloaded or download failed, to release the lock on the cache file. Stop() does not delete the cache file. It returns false if the lock file does not exist, or another pid was found inside the lock file (this means another process took over the lock so this process must go back to Start()), or if it fails to delete the lock file. It must only be called if the caller holds the writing lock.

Parameters:

url the url of the file that was downloaded

5.13.3.13 bool Arc::FileCache::StopAndDelete (const std::string & *url*)

Stop the cache after a file was downloaded and delete the cache file. Release the cache file and delete it, because for example a failed download left an incomplete copy. This method also deletes the meta file which contains the url corresponding to the cache file. The logic of the return value is the same as Stop(). It must only be called if the caller holds the writing lock.

Parameters:

url the url corresponding to the cache file that has to be released and deleted

The documentation for this class was generated from the following file:

- FileCache.h

5.14 Arc::FileCacheHash Class Reference

FileCacheHash provides methods to make hashes from strings.

`#include <FileCacheHash.h>`

Static Public Member Functions

- static std::string getHash (std::string url)
- static int maxLength ()

5.14.1 Detailed Description

FileCacheHash provides methods to make hashes from strings. Currently the SHA-1 hash from the openssl library is used.

The documentation for this class was generated from the following file:

- FileCacheHash.h

5.15 Arc::FileInfo Class Reference

FileInfo stores information about files (metadata).

`#include <FileInfo.h>`

5.15.1 Detailed Description

FileInfo stores information about files (metadata).

The documentation for this class was generated from the following file:

- FileInfo.h

5.16 Arc::URLMap Class Reference

Data Structures

- class **map_entry**

The documentation for this class was generated from the following file:

- URLMap.h

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