# ARC Data Library libarcdata

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# Contents


**1 Deprecated List** **1**

**2 Module Index** **3**

2.1 Modules . . . 3

**3 Data Structure Index** **5**

3.1 Class Hierarchy . . . 5

**4 Data Structure Index** **7**

4.1 Data Structures . . . 7

**5 Module Documentation** **9**

5.1 ARC data library (libarcdata) . . . 9

5.1.1 Detailed Description . . . 10

5.1.2 Function Documentation . . . 11

5.1.2.1 operator<< . . . 11

**6 Data Structure Documentation** **13**

6.1 Arc::CacheParameters Struct Reference . . . 13

6.1.1 Detailed Description . . . 13

6.2 Arc::DataBuffer Class Reference . . . 14

6.2.1 Detailed Description . . . 17

6.2.2 Constructor & Destructor Documentation . . . 17

6.2.2.1 DataBuffer . . . 17

6.2.2.2 DataBuffer . . . 17

6.2.3 Member Function Documentation . . . 17

6.2.3.1 add . . . 17

6.2.3.2 buffer_size . . . 17

6.2.3.3 checksum_object . . . 17

6.2.3.4 checksum_valid . . . 18

6.2.3.5 eof_read . . . 18
6.2.3.6 eof_write . . . 18
6.2.3.7 error_read . . . 18
6.2.3.8 error_write . . . 18
6.2.3.9 for_read . . . 18
6.2.3.10 for_read . . . 19
6.2.3.11 for_write . . . 19
6.2.3.12 for_write . . . 19
6.2.3.13 is_notwritten . . . 19
6.2.3.14 is_notwritten . . . 20
6.2.3.15 is_read . . . 20
6.2.3.16 is_read . . . 20
6.2.3.17 is_written . . . 20
6.2.3.18 is_written . . . 21
6.2.3.19 operator[] . . . 21
6.2.3.20 set . . . 21
6.2.3.21 wait_any . . . 21
6.2.3.22 wait_for_read . . . 21
6.2.3.23 wait_for_write . . . 22
6.2.3.24 wait_used . . . 22
6.3 Arc::DataCallback Class Reference . . . 23
6.3.1 Detailed Description . . . 23
6.4 Arc::DataHandle Class Reference . . . 24
6.4.1 Detailed Description . . . 24
6.4.2 Member Function Documentation . . . 25
6.4.2.1 GetPoint . . . 25
6.5 Arc::DataMover Class Reference . . . 26
6.5.1 Detailed Description . . . 27
6.5.2 Member Typedef Documentation . . . 27
6.5.2.1 callback . . . 27
6.5.3 Member Function Documentation . . . 28
6.5.3.1 checks . . . 28
6.5.3.2 Delete . . . 28
6.5.3.3 set_default_max_inactivity_time . . . 28
6.5.3.4 set_default_min_average_speed . . . 28
6.5.3.5 set_default_min_speed . . . 28

6.5.3.6 set_preferred_pattern . . . 29
6.5.3.7 Transfer . . . 29
6.5.3.8 Transfer . . . 29
6.5.3.9 verbose . . . 30
6.6 Arc::DataPoint Class Reference . . . 31
6.6.1 Detailed Description . . . 38
6.6.2 Member Typedef Documentation . . . 38
6.6.2.1 Callback3rdParty . . . 38
6.6.3 Member Enumeration Documentation . . . 38
6.6.3.1 DataPointAccessLatency . . . 38
6.6.3.2 DataPointInfoType . . . 39
6.6.4 Constructor & Destructor Documentation . . . 39
6.6.4.1 DataPoint . . . 39
6.6.5 Member Function Documentation . . . 39
6.6.5.1 AddCheckSumObject . . . 39
6.6.5.2 AddLocation . . . 40
6.6.5.3 AddURLOptions . . . 40
6.6.5.4 Check . . . 40
6.6.5.5 CompareLocationMetadata . . . 40
6.6.5.6 CompareMeta . . . 41
6.6.5.7 CreateDirectory . . . 41
6.6.5.8 CurrentLocationMetadata . . . 41
6.6.5.9 FinishReading . . . 41
6.6.5.10 FinishWriting . . . 41
6.6.5.11 GetFailureReason . . . 42
6.6.5.12 List . . . 42
6.6.5.13 NextLocation . . . 42
6.6.5.14 Passive . . . 42
6.6.5.15 PostRegister . . . 43
6.6.5.16 PrepareReading . . . 43
6.6.5.17 PrepareWriting . . . 43
6.6.5.18 PreRegister . . . 44
6.6.5.19 PreUnregister . . . 44
6.6.5.20 Range . . . 44
6.6.5.21 ReadOutOfOrder . . . 45
6.6.5.22 Rename . . . 45

6.6.5.23 Resolve . . . 45
6.6.5.24 Resolve . . . 46
6.6.5.25 SetAdditionalChecks . . . 46
6.6.5.26 SetMeta . . . 46
6.6.5.27 SetSecure . . . 46
6.6.5.28 SetURL . . . 46
6.6.5.29 SortLocations . . . 47
6.6.5.30 StartReading . . . 47
6.6.5.31 StartWriting . . . 47
6.6.5.32 Stat . . . 48
6.6.5.33 Stat . . . 48
6.6.5.34 StopReading . . . 48
6.6.5.35 StopWriting . . . 49
6.6.5.36 Transfer3rdParty . . . 49
6.6.5.37 Transfer3rdParty . . . 49
6.6.5.38 TransferLocations . . . 50
6.6.5.39 Unregister . . . 50
6.7 Arc::DataPointDirect Class Reference . . . 51
6.7.1 Detailed Description . . . 53
6.7.2 Member Function Documentation . . . 53
6.7.2.1 AddCheckSumObject . . . 53
6.7.2.2 AddLocation . . . 53
6.7.2.3 CompareLocationMetadata . . . 54
6.7.2.4 CurrentLocationMetadata . . . 54
6.7.2.5 NextLocation . . . 54
6.7.2.6 Passive . . . 54
6.7.2.7 PostRegister . . . 55
6.7.2.8 PreRegister . . . 55
6.7.2.9 PreUnregister . . . 55
6.7.2.10 Range . . . 56
6.7.2.11 ReadOutOfOrder . . . 56
6.7.2.12 Resolve . . . 56
6.7.2.13 SetAdditionalChecks . . . 56
6.7.2.14 SetSecure . . . 57
6.7.2.15 SortLocations . . . 57
6.7.2.16 Unregister . . . 57

6.8 Arc::DataPointIndex Class Reference . . . 58
6.8.1 Detailed Description . . . 61
6.8.2 Member Function Documentation . . . 61
6.8.2.1 AddCheckSumObject . . . 61
6.8.2.2 AddLocation . . . 61
6.8.2.3 Check . . . 61
6.8.2.4 CompareLocationMetadata . . . 62
6.8.2.5 CurrentLocationMetadata . . . 62
6.8.2.6 FinishReading . . . 62
6.8.2.7 FinishWriting . . . 62
6.8.2.8 NextLocation . . . 62
6.8.2.9 Passive . . . 63
6.8.2.10 PrepareReading . . . 63
6.8.2.11 PrepareWriting . . . 63
6.8.2.12 Range . . . 64
6.8.2.13 ReadOutOfOrder . . . 64
6.8.2.14 SetAdditionalChecks . . . 64
6.8.2.15 SetSecure . . . 65
6.8.2.16 SortLocations . . . 65
6.8.2.17 StartReading . . . 65
6.8.2.18 StartWriting . . . 65
6.8.2.19 StopReading . . . 66
6.8.2.20 StopWriting . . . 66
6.8.2.21 TransferLocations . . . 66
6.9 Arc::DataSpeed Class Reference . . . 67
6.9.1 Detailed Description . . . 68
6.9.2 Member Typedef Documentation . . . 68
6.9.2.1 show_progress_t . . . 68
6.9.3 Constructor & Destructor Documentation . . . 69
6.9.3.1 DataSpeed . . . 69
6.9.3.2 DataSpeed . . . 69
6.9.4 Member Function Documentation . . . 69
6.9.4.1 set_max_inactivity_time . . . 69
6.9.4.2 set_min_average_speed . . . 69
6.9.4.3 set_min_speed . . . 69
6.9.4.4 set_progress_indicator . . . 70

6.9.4.5 transfer . . . 70
6.10 Arc::DataStatus Class Reference . . . 71
6.10.1 Detailed Description . . . 73
6.10.2 Member Enumeration Documentation . . . 73
6.10.2.1 DataStatusType . . . 73
6.10.3 Constructor & Destructor Documentation . . . 76
6.10.3.1 DataStatus . . . 76
6.10.3.2 DataStatus . . . 76
6.10.4 Member Function Documentation . . . 76
6.10.4.1 operator= . . . 76
6.10.4.2 Retryable . . . 76
6.11 Arc::FileCache Class Reference . . . 78
6.11.1 Detailed Description . . . 79
6.11.2 Constructor & Destructor Documentation . . . 79
6.11.2.1 FileCache . . . 79
6.11.2.2 FileCache . . . 80
6.11.2.3 FileCache . . . 80
6.11.3 Member Function Documentation . . . 80
6.11.3.1 AddDN . . . 80
6.11.3.2 CheckCreated . . . 81
6.11.3.3 CheckDN . . . 81
6.11.3.4 CheckValid . . . 81
6.11.3.5 File . . . 81
6.11.3.6 GetCreated . . . 82
6.11.3.7 GetValid . . . 82
6.11.3.8 Link . . . 82
6.11.3.9 Release . . . 83
6.11.3.10 SetValid . . . 83
6.11.3.11 Start . . . 83
6.11.3.12 Stop . . . 84
6.11.3.13 StopAndDelete . . . 84
6.12 Arc::FileCacheHash Class Reference . . . 85
6.12.1 Detailed Description . . . 85
6.13 Arc::FileInfo Class Reference . . . 86
6.13.1 Detailed Description . . . 88
6.13.2 Member Enumeration Documentation . . . 88

6.13.2.1 Type . . . . . 88
6.14 Arc::URLMap Class Reference . . . . . 89
6.14.1 Detailed Description . . . . . 89
6.14.2 Member Function Documentation . . . . . 89
6.14.2.1 add . . . . . 89
6.14.2.2 local . . . . . 90
6.14.2.3 map . . . . . 90

# Chapter 1

# 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 2

# Module Index

## 2.1 Modules

Here is a list of all modules:

ARC data library (libarcdata) . . . . . 9

# Chapter 3

# Data Structure Index

## 3.1 Class Hierarchy

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


Arc::CacheParameters . . . . . 13
Arc::DataBuffer . . . . . 14
Arc::DataCallback . . . . . 23
Arc::DataHandle . . . . . 24
Arc::DataMover . . . . . 26
Arc::DataPoint . . . . . 31
  Arc::DataPointDirect . . . . . 51
  Arc::DataPointIndex . . . . . 58
Arc::DataSpeed . . . . . 67
Arc::DataStatus . . . . . 71
Arc::FileCache . . . . . 78
Arc::FileCacheHash . . . . . 85
Arc::FileInfo . . . . . 86
Arc::URLMap . . . . . 89

# Chapter 4

# Data Structure Index

## 4.1 Data Structures

Here are the data structures with brief descriptions:


Arc::CacheParameters (Contains data on the parameters of a cache ) . . . . . 13
Arc::DataBuffer (Represents set of buffers ) . . . . . 14
Arc::DataCallback (Callbacks to be used when there is not enough space on the local filesystem ) 23
Arc::DataHandle (This class is a wrapper around the DataPoint class ) . . . . . 24
Arc::DataMover (DataMover provides an interface to transfer data between two DataPoints ) . . 26
Arc::DataPoint (A DataPoint represents a data resource and is an abstraction of a URL ) . . . . . 31
Arc::DataPointDirect (DataPointDirect represents "physical" data objects ) . . . . . 51
Arc::DataPointIndex (DataPointIndex represents "index" data objects, e.g. catalogs ) . . . . . 58
Arc::DataSpeed (Keeps track of average and instantaneous transfer speed ) . . . . . 67
Arc::DataStatus (Status code returned by many DataPoint methods ) . . . . . 71
Arc::FileCache (FileCache provides an interface to all cache operations ) . . . . . 78
Arc::FileCacheHash (FileCacheHash provides methods to make hashes from strings ) . . . . . 85
Arc::FileInfo (FileInfo stores information about files (metadata) ) . . . . . 86
Arc::URLMap (URLMap allows mapping certain patterns of URLs to other URLs ) . . . . . 89

# Chapter 5

# Module Documentation

## 5.1 ARC data library (libarcdata)

### Data Structures

- class Arc::DataBuffer

  *Represents set of buffers.*

- class Arc::DataCallback

  *Callbacks to be used when there is not enough space on the local filesystem.*

- class Arc::DataHandle

  *This class is a wrapper around the DataPoint class.*

- class Arc::DataMover

  *DataMover provides an interface to transfer data between two DataPoints.*

- class Arc::DataPoint

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

- class Arc::DataPointDirect

  *DataPointDirect represents "physical" data objects.*

- class Arc::DataPointIndex

  *DataPointIndex represents "index" data objects, e.g. catalogs.*

- class Arc::DataSpeed

  *Keeps track of average and instantaneous transfer speed.*

- class Arc::DataStatus

  *Status code returned by many DataPoint methods.*

- struct Arc::CacheParameters

  *Contains data on the parameters of a cache.*

- class Arc::FileCache

  *FileCache provides an interface to all cache operations.*

- class Arc::FileCacheHash

  *FileCacheHash provides methods to make hashes from strings.*

- class Arc::FileInfo

  *FileInfo stores information about files (metadata).*

- class Arc::URLMap

  *URLMap allows mapping certain patterns of URLs to other URLs.*

## Functions

- std::ostream & Arc::operator<< (std::ostream &o, const DataStatus &d)

  *Write a human-friendly readable string with all error information to o.*

### 5.1.1 Detailed Description

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 usable 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.

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.

- 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/

DataMover provides a simple high-level interface to copy files. Fine-grained control over data transfer is shown in the following example:

And the same example in python

### 5.1.2 Function Documentation

#### 5.1.2.1 std::ostream& Arc::operator<< (std::ostream & *o*, const DataStatus & *d*) [inline]

Write a human-friendly readable string with all error information to o.

# Chapter 6

# Data Structure Documentation

## 6.1 Arc::CacheParameters Struct Reference

Contains data on the parameters of a cache.

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

### 6.1.1 Detailed Description

Contains data on the parameters of a cache.

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

- FileCache.h

## 6.2 Arc::DataBuffer Class Reference

Represents set of buffers.

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

### Data Structures

- struct **buf_desc**

  *internal struct to describe status of every buffer*

- class **checksum_desc**

  *internal class with pointer to object to compute checksum*

### Public Member Functions

- operator bool () const

  *Returns true if DataBuffer object is initialized.*

- DataBuffer (unsigned int size=65536, int blocks=3)

  *Construct a new DataBuffer object.*

- DataBuffer (CheckSum *cksum, unsigned int size=65536, int blocks=3)

  *Construct a new DataBuffer object with checksum computation.*

- ~DataBuffer ()

  *Destructor.*

- bool set (CheckSum *cksum=NULL, unsigned int size=65536, int blocks=3)

  *Reinitialize buffers with different parameters.*

- int add (CheckSum *cksum)

  *Add a checksum object which will compute checksum of buffer.*

- char * operator[ ] (int n)

  *Direct access to buffer by number.*

- bool for_read (int &handle, unsigned int &length, bool wait)

  *Request buffer for READING INTO it.*

- bool for_read ()

  *Check if there are buffers which can be taken by for_read().*

- bool is_read (int handle, unsigned int length, unsigned long long int offset)

  *Informs object that data was read into buffer.*

- bool is_read (char *buf, unsigned int length, unsigned long long int offset)

  *Informs object that data was read into buffer.*

- bool for_write (int &handle, unsigned int &length, unsigned long long int &offset, bool wait)

  *Request buffer for WRITING FROM it.*

- bool for_write ()

  *Check if there are buffers which can be taken by for_write().*

- bool is_written (int handle)

  *Informs object that data was written from buffer.*

- bool is_written (char *buf)

  *Informs object that data was written from buffer.*

- bool is_notwritten (int handle)

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

- bool is_notwritten (char *buf)

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

- void eof_read (bool v)

  *Informs object if there will be no more request for 'read' buffers.*

- void eof_write (bool v)

  *Informs object if there will be no more request for 'write' buffers.*

- void error_read (bool v)

  *Informs object if error occurred on 'read' side.*

- void error_write (bool v)

  *Informs object if error occurred on 'write' side.*

- bool eof_read ()

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

- bool eof_write ()

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

- bool error_read ()

  *Returns true if object was informed about error on 'read' side.*

- bool error_write ()

  *Returns true if object was informed about error on 'write' side.*

- bool error_transfer ()

  *Returns true if transfer was slower than limits set in speed object.*

- bool error ()

  *Returns true if object was informed about error or internal error occurred.*

- bool wait_any ()

*Wait (max 60 sec.) till any action happens in object.*

- bool wait_used ()

  *Wait till there are no more used buffers left in object.*

- bool wait_for_read ()

  *Wait till no more buffers taken for "READING INTO" left in object.*

- bool wait_for_write ()

  *Wait till no more buffers taken for "WRITING FROM" left in object.*

- bool checksum_valid (int index) const

  *Returns true if the specified checksum was successfully computed.*

- bool checksum_valid () const

  *Returns true if the checksum was successfully computed.*

- const CheckSum * checksum_object (int index) const

  *Returns CheckSum object at specified index or NULL if index is not in list.*

- const CheckSum * checksum_object () const

  *Returns first checksum object in checksum list or NULL if list is empty.*

- bool wait_eof_read ()

  *Wait until end of transfer happens on 'read' side. Always returns true.*

- bool wait_read ()

  *Wait until end of transfer or error happens on 'read' side. Always returns true.*

- bool wait_eof_write ()

  *Wait until end of transfer happens on 'write' side. Always returns true.*

- bool wait_write ()

  *Wait until end of transfer or error happens on 'write' side. Always returns true.*

- bool wait_eof ()

  *Wait until end of transfer happens on any side. Always returns true.*

- unsigned long long int eof_position () const

  *Returns offset following last piece of data transferred.*

- unsigned int buffer_size () const

  *Returns size of buffer in object.*

## Data Fields

- DataSpeed speed

  *This object controls transfer speed.*

### 6.2.1 Detailed Description

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

### 6.2.2 Constructor & Destructor Documentation

#### 6.2.2.1 Arc::DataBuffer::DataBuffer (unsigned int *size* = 65536, int *blocks* = 3)

Construct a new DataBuffer object.

**Parameters:**

***size*** size of every buffer in bytes.

***blocks*** number of buffers.

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

Construct a new DataBuffer object with checksum computation.

**Parameters:**

***size*** size of every buffer in bytes.

***blocks*** number of buffers.

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

### 6.2.3 Member Function Documentation

#### 6.2.3.1 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 until DataBuffer itself.

**Returns:**

integer position in the list of checksum objects.

#### 6.2.3.2 unsigned int Arc::DataBuffer::buffer_size () const

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

#### 6.2.3.3 const CheckSum* Arc::DataBuffer::checksum_object (int *index*) const

Returns CheckSum object at specified index or NULL if index is not in list.

**Parameters:**

***index*** of the checksum in question.

#### 6.2.3.4 bool Arc::DataBuffer::checksum_valid (int *index*) const

Returns true if the specified checksum was successfully computed.

**Parameters:**

***index*** of the checksum in question.

**Returns:**

false if index is not in list

#### 6.2.3.5 void Arc::DataBuffer::eof_read (bool *v*)

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

**Parameters:**

***v*** true if no more requests.

#### 6.2.3.6 void Arc::DataBuffer::eof_write (bool *v*)

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

**Parameters:**

***v*** true if no more requests.

#### 6.2.3.7 void Arc::DataBuffer::error_read (bool *v*)

Informs object if error occurred on 'read' side.

**Parameters:**

***v*** true if error

#### 6.2.3.8 void Arc::DataBuffer::error_write (bool *v*)

Informs object if error occurred on 'write' side.

**Parameters:**

***v*** true if error

#### 6.2.3.9 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.

**Returns:**

true if buffers are available

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

Request buffer for READING INTO it. Should be called when data is being read from a source. The calling code should write data into the returned buffer and then call is_read().

**Parameters:**

***handle*** filled with buffer's number.

***length*** filled with 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.

#### 6.2.3.11 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.

**Returns:**

true if buffers are available

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

Request buffer for WRITING FROM it. Should be called when data is being written to a destination. The calling code should write the data contained in the returned buffer and then call is_written().

**Parameters:**

***handle*** returns buffer's number.

***length*** returns size of buffer

***offset*** returns buffer offset

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

**Returns:**

true on success 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.

#### 6.2.3.13 bool Arc::DataBuffer::is_notwritten (char * *buf*)

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

**Parameters:**

***buf*** - address of buffer

**Returns:**

true if buffer was successfully informed

#### 6.2.3.14 bool Arc::DataBuffer::is_notwritten (int *handle*)

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

**Parameters:**

***handle*** buffer's number.

**Returns:**

true if buffer was successfully informed

#### 6.2.3.15 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.

**Returns:**

true if buffer was successfully informed

#### 6.2.3.16 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.

**Returns:**

true if buffer was successfully informed 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.

#### 6.2.3.17 bool Arc::DataBuffer::is_written (char * *buf*)

Informs object that data was written from buffer.

**Parameters:**

***buf*** - address of buffer

**Returns:**

true if buffer was successfully informed

#### 6.2.3.18 bool Arc::DataBuffer::is_written (int *handle*)

Informs object that data was written from buffer.

**Parameters:**

***handle*** buffer's number.

**Returns:**

true if buffer was successfully informed

#### 6.2.3.19 char* Arc::DataBuffer::operator[ ] (int *n*)

Direct access to buffer by number.

**Parameters:**

***n*** buffer number

**Returns:**

buffer content

#### 6.2.3.20 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 until DataBuffer itself.

**Returns:**

true if buffers were successfully initialized

#### 6.2.3.21 bool Arc::DataBuffer::wait_any ()

Wait (max 60 sec.) till any action happens in object.

**Returns:**

true if action is eof on any side

#### 6.2.3.22 bool Arc::DataBuffer::wait_for_read ()

Wait till no more buffers taken for "READING INTO" left in object.

**Returns:**

true if an error occurred while waiting

#### 6.2.3.23 bool Arc::DataBuffer::wait_for_write ()

Wait till no more buffers taken for "WRITING FROM" left in object.

**Returns:**

true if an error occurred while waiting

#### 6.2.3.24 bool Arc::DataBuffer::wait_used ()

Wait till there are no more used buffers left in object.

**Returns:**

true if an error occurred while waiting

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

- DataBuffer.h

## 6.3 Arc::DataCallback Class Reference

Callbacks to be used when there is not enough space on the local filesystem.

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

### Public Member Functions

- DataCallback ()

  *Construct a new DataCallback.*

- virtual ~DataCallback ()

  *Empty destructor.*

- virtual bool cb (int)

  *Callback with int passed as parameter.*

- virtual bool cb (unsigned int)

  *Callback with unsigned int passed as parameter.*

- virtual bool cb (long long int)

  *Callback with long long int passed as parameter.*

- virtual bool cb (unsigned long long int)

  *Callback with unsigned long long int passed as parameter.*

### 6.3.1 Detailed Description

Callbacks to be used when there is not enough space on the local filesystem. If DataPoint::StartWriting() tries to pre-allocate disk space but finds that there is not enough to write the whole file, one of the 'cb' functions here will be called with the required space passed as a parameter. Users should define their own subclass of this class depending on how they wish to free up space. Each callback method should return true if the space was freed, false otherwise. This subclass should then be used as a parameter in StartWriting().

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

- DataCallback.h

## 6.4 Arc::DataHandle Class Reference

This class is a wrapper around the DataPoint class.

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

### Public Member Functions

- DataHandle (const URL &url, const UserConfig &usercfg)
  *Construct a new DataHandle.*
- ~DataHandle ()
  *Destructor.*
- DataPoint * operator-> ()
  *Returns a pointer to a DataPoint object.*
- const DataPoint * operator-> () const
  *Returns a const pointer to a DataPoint object.*
- DataPoint & operator* ()
  *Returns a reference to a DataPoint object.*
- const DataPoint & operator* () const
  *Returns a const reference to a DataPoint object.*
- bool operator! () const
  *Returns true if the DataHandle is not valid.*
- operator bool () const
  *Returns true if the DataHandle is valid.*

### Static Public Member Functions

- static DataPoint * GetPoint (const URL &url, const UserConfig &usercfg)
  *Returns a pointer to new DataPoint object corresponding to URL.*

### 6.4.1 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 the main way to access remote data items and obtain information about them. To simply copy a whole file DataMover::Transfer() can be used. For partial file copy see the examples in ARC data library (libarcdata).

### 6.4.2 Member Function Documentation

#### 6.4.2.1 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 available scope of obtained DataPoint is undefined.

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

- DataHandle.h

## 6.5 Arc::DataMover Class Reference

DataMover provides an interface to transfer data between two DataPoints.

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

### Public Types

- typedef void(∗ callback )(DataMover ∗mover, DataStatus status, void ∗arg)

  *Callback function which can be passed to Transfer().*

### Public Member Functions

- DataMover ()

  *Constructor. Sets all transfer parameters to default values.*

- ∼DataMover ()

  *Destructor cancels transfer if active and waits for cancellation to finish.*

- DataStatus 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'.*

- 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)

  *Initiates transfer from 'source' to 'destination'.*

- DataStatus Delete (DataPoint &url, bool errcont=false)

  *Delete the file at url.*

- void Cancel ()

  *Cancel transfer, cleaning up any data written or registered.*

- bool verbose ()

  *Returns whether printing information about transfer status is activated.*

- void verbose (bool)

  *Set output of transfer status information during transfer.*

- void verbose (const std::string &prefix)

  *Set output of transfer status information during transfer.*

- bool retry ()

  *Returns whether transfer will be retried in case of failure.*

- void retry (bool)

  *Set if transfer will be retried in case of failure.*

- void secure (bool)

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

- void passive (bool)

  *Set if passive transfer should be used for FTP-like transfers.*

- void 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.*

- bool checks ()

  *Returns true if extra checks are made before transfer starts.*

- void checks (bool v)

  *Set if extra checks are made before transfer starts.*

- void set_default_min_speed (unsigned long long int min_speed, time_t min_speed_time)

  *Set minimal allowed transfer speed (default is 0) to 'min_speed'.*

- void set_default_min_average_speed (unsigned long long int min_average_speed)

  *Set minimal allowed average transfer speed.*

- void set_default_max_inactivity_time (time_t max_inactivity_time)

  *Set maximal allowed time for no data transfer.*

- void set_progress_indicator (DataSpeed::show_progress_t func=NULL)

  *Set function which is called every second during the transfer.*

- void set_preferred_pattern (const std::string &pattern)

  *Set a preferred pattern for ordering of replicas.*

### 6.5.1 Detailed Description

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

### 6.5.2 Member Typedef Documentation

#### 6.5.2.1 typedef void(∗ Arc::DataMover::callback)(DataMover ∗mover, DataStatus status, void ∗arg)

Callback function which can be passed to Transfer().

**Parameters:**

***mover*** this DataMover instance

***status*** result of the transfer

***arg*** arguments passed in 'arg' parameter of Transfer()

### 6.5.3 Member Function Documentation

#### 6.5.3.1 void Arc::DataMover::checks (bool *v*)

Set if extra checks are made before transfer starts. If turned on, extra checks are done before commencing the transfer, such as checking the existence of the source file and verifying consistency of metadata between index service and physical replica.

#### 6.5.3.2 DataStatus Arc::DataMover::Delete (DataPoint & *url*, bool *errcont* = `false`)

Delete the file at url. This method differs from DataPoint::Remove() in that for index services, it deletes all replicas in addition to removing the index entry.

**Parameters:**

***url*** file to delete

***errcont*** if true then replica information will be deleted from an index service even if deleting the physical replica fails

**Returns:**

DataStatus object with result of deletion

#### 6.5.3.3 void Arc::DataMover::set_default_max_inactivity_time (time_t *max_inactivity_time*) `[inline]`

Set maximal allowed time for no data transfer. For more information see description of DataSpeed class.

**Parameters:**

***max_inactivity_time*** maximum time in seconds which is allowed without any data transfer

#### 6.5.3.4 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.

**Parameters:**

***min_average_speed*** minimum average transfer rate over the whole transfer in bytes/second

#### 6.5.3.5 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.

**Parameters:**

***min_speed*** minimum transfer rate in bytes/second

***min_speed_time*** time in seconds over which min_speed is measured

#### 6.5.3.6 void Arc::DataMover::set_preferred_pattern (const std::string & *pattern*) [inline]

Set a preferred pattern for ordering of replicas. This pattern will be used in the case of an index service URL with multiple physical replicas and allows sorting of those replicas in order of preference. It consists of one or more patterns separated by a pipe character (|) listed in order of preference. If the dollar character ($) is used at the end of a pattern, the pattern will be matched to the end of the hostname of the replica. Example: "srm://myhost.org|.uk$|.ch$"

**Parameters:**

***pattern*** pattern on which to order replicas

#### 6.5.3.7 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'. An optional callback can be provided, in which case this method starts a separate thread for the transfer and returns immediately. The callback is called after the transfer finishes.

**Parameters:**

***source*** source DataPoint to read from.

***destination*** destination DataPoint to write to.

***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). If URL mapping is not needed the default constructor URLMap() can be used.

***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.

***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.

**Returns:**

DataStatus object with transfer result

#### 6.5.3.8 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'. An optional callback can be provided, in which case this method starts a separate thread for the transfer and returns immediately. The callback is called after the transfer finishes.

**Parameters:**

***source*** source DataPoint to read from.

***destination*** destination DataPoint to write to.

***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). If URL mapping is not needed the default constructor URLMap() can be used.

***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.

**Returns:**

DataStatus object with transfer result

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

Set output of transfer status information during transfer.

**Parameters:**

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

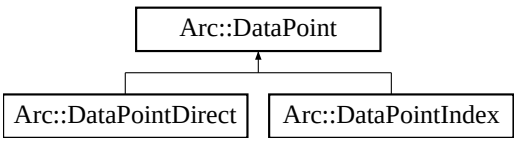
The documentation for this class was generated from the following file:

- DataMover.h

## 6.6 Arc::DataPoint Class Reference

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

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




### Public Types

- enum DataPointAccessLatency { ACCESS_LATENCY_ZERO, ACCESS_LATENCY_SMALL, ACCESS_LATENCY_LARGE }

  *Describes the latency to access this URL.*

- 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 }

  *Describes type of information about URL to request.*

- typedef void(∗ Callback3rdParty )(unsigned long long int bytes_transferred)

  *Callback for use in 3rd party transfer.*

### Public Member Functions

- virtual ~DataPoint ()

  *Destructor.*

- virtual const URL & GetURL () const

  *Returns the URL that was passed to the constructor.*

- virtual const UserConfig & GetUserConfig () const

  *Returns the UserConfig that was passed to the constructor.*

- virtual bool SetURL (const URL &url)

  *Assigns new URL.*

- virtual std::string str () const

  *Returns a string representation of the DataPoint.*

- virtual operator bool () const

  *Is DataPoint valid?*

- virtual bool operator! () const

  *Is DataPoint valid?*

- virtual DataStatus PrepareReading (unsigned int timeout, unsigned int &wait_time)

  *Prepare DataPoint for reading.*

- virtual DataStatus PrepareWriting (unsigned int timeout, unsigned int &wait_time)

  *Prepare DataPoint for writing.*

- virtual DataStatus StartReading (DataBuffer &buffer)=0

  *Start reading data from URL.*

- virtual DataStatus StartWriting (DataBuffer &buffer, DataCallback *space_cb=NULL)=0

  *Start writing data to URL.*

- virtual DataStatus StopReading ()=0

  *Stop reading.*

- virtual DataStatus StopWriting ()=0

  *Stop writing.*

- virtual DataStatus FinishReading (bool error=false)

  *Finish reading from the URL.*

- virtual DataStatus FinishWriting (bool error=false)

  *Finish writing to the URL.*

- virtual DataStatus Check (bool check_meta)=0

  *Query the DataPoint to check if object is accessible.*

- virtual DataStatus Remove ()=0

  *Remove/delete object at URL.*

- virtual DataStatus Stat (FileInfo &file, DataPointInfoType verb=INFO_TYPE_ALL)=0

  *Retrieve information about this object.*

- virtual DataStatus Stat (std::list< FileInfo > &files, const std::list< DataPoint * > &urls, DataPointInfoType verb=INFO_TYPE_ALL)=0

  *Retrieve information about several DataPoints.*

- virtual DataStatus List (std::list< FileInfo > &files, DataPointInfoType verb=INFO_TYPE_ALL)=0

  *List hierarchical content of this object.*

- virtual DataStatus CreateDirectory (bool with_parents=false)=0

  *Create a directory.*

- virtual DataStatus Rename (const URL &newurl)=0

  *Rename a URL.*

- virtual void ReadOutOfOrder (bool v)=0

  *Allow/disallow DataPoint to read data out of order.*

- virtual bool WriteOutOfOrder ()=0

  *Returns true if DataPoint supports receiving data out of order during writing.*

- virtual void SetAdditionalChecks (bool v)=0

  *Allow/disallow additional checks on a source DataPoint before transfer.*

- virtual bool GetAdditionalChecks () const =0

  *Returns true unless SetAdditionalChecks() was set to false.*

- virtual void SetSecure (bool v)=0

  *Allow/disallow heavy security (data encryption) during data transfer.*

- virtual bool GetSecure () const =0

  *Returns true if heavy security during data transfer is allowed.*

- virtual void Passive (bool v)=0

  *Set passive transfers for FTP-like protocols.*

- virtual DataStatus GetFailureReason (void) const

  *Returns reason of transfer failure, as reported by callbacks.*

- virtual void Range (unsigned long long int start=0, unsigned long long int end=0)=0

  *Set range of bytes to retrieve.*

- virtual DataStatus Resolve (bool source)=0

  *Resolves index service URL into list of ordinary URLs.*

- virtual DataStatus Resolve (bool source, const std::list< DataPoint * > &urls)=0

  *Resolves several index service URLs.*

- virtual bool Registered () const =0

  *Returns true if file is registered in indexing service (only known after Resolve()).*

- virtual DataStatus PreRegister (bool replication, bool force=false)=0

  *Index service pre-registration.*

- virtual DataStatus PostRegister (bool replication)=0

  *Index service post-registration.*

- virtual DataStatus PreUnregister (bool replication)=0

  *Index service pre-unregistration.*

- virtual DataStatus Unregister (bool all)=0

  *Index service unregistration.*

- virtual bool CheckSize () const

*Check if meta-information 'size' is available.*

- virtual void SetSize (const unsigned long long int val)
  *Set value of meta-information 'size'.*
- virtual unsigned long long int GetSize () const
  *Get value of meta-information 'size'.*
- virtual bool CheckCheckSum () const
  *Check if meta-information 'checksum' is available.*
- virtual void SetCheckSum (const std::string &val)
  *Set value of meta-information 'checksum'.*
- virtual const std::string & GetCheckSum () const
  *Get value of meta-information 'checksum'.*
- virtual const std::string DefaultCheckSum () const
  *Default checksum type (varies by protocol).*
- virtual bool CheckModified () const
  *Check if meta-information 'modification time' is available.*
- virtual void SetModified (const Time &val)
  *Set value of meta-information 'modification time'.*
- virtual const Time & GetModified () const
  *Get value of meta-information 'modification time'.*
- virtual bool CheckValid () const
  *Check if meta-information 'validity time' is available.*
- virtual void SetValid (const Time &val)
  *Set value of meta-information 'validity time'.*
- virtual const Time & GetValid () const
  *Get value of meta-information 'validity time'.*
- virtual void SetAccessLatency (const DataPointAccessLatency &latency)
  *Set value of meta-information 'access latency'.*
- virtual DataPointAccessLatency GetAccessLatency () const
  *Get value of meta-information 'access latency'.*
- virtual long long int BufSize () const =0
  *Get suggested buffer size for transfers.*
- virtual int BufNum () const =0
  *Get suggested number of buffers for transfers.*

- virtual bool Cache () const
  *Returns true if file is cacheable.*
- virtual bool Local () const =0
  *Returns true if file is local, e.g.* `file://` *urls.*
- virtual bool ReadOnly () const =0
  *Returns true if file is readonly.*
- virtual int GetTries () const
  *Returns number of retries left.*
- virtual void SetTries (const int n)
  *Set number of retries.*
- virtual void NextTry ()
  *Decrease number of retries left.*
- virtual bool RequiresCredentials () const
  *Returns true if some kind of credentials are needed to use this DataPoint.*
- virtual bool IsIndex () const =0
  *Check if URL is an Indexing Service.*
- virtual bool IsStageable () const
  *Check if URL should be staged or queried for Transport URL (TURL).*
- virtual bool AcceptsMeta () const =0
  *Check if endpoint can have any use from meta information.*
- virtual bool ProvidesMeta () const =0
  *Check if endpoint can provide at least some meta information directly.*
- virtual void SetMeta (const DataPoint &p)
  *Copy meta information from another object.*
- virtual bool CompareMeta (const DataPoint &p) const
  *Compare meta information from another object.*
- virtual std::vector< URL > TransferLocations () const
  *Returns physical file(s) to read/write, if different from CurrentLocation().*
- virtual const URL & CurrentLocation () const =0
  *Returns current (resolved) URL.*
- virtual const std::string & CurrentLocationMetadata () const =0
  *Returns meta information used to create current URL.*
- virtual DataPoint * CurrentLocationHandle () const =0
  *Returns a pointer to the DataPoint representing the current location.*

- virtual DataStatus CompareLocationMetadata () const =0

  *Compare metadata of DataPoint and current location.*

- virtual bool NextLocation ()=0

  *Switch to next location in list of URLs.*

- virtual bool LocationValid () const =0

  *Returns false no more locations are left and out of retries.*

- virtual bool LastLocation ()=0

  *Returns true if the current location is the last.*

- virtual bool HaveLocations () const =0

  *Returns true if number of resolved URLs is not 0.*

- virtual DataStatus AddLocation (const URL &url, const std::string &meta)=0

  *Add URL representing physical replica to list of locations.*

- virtual DataStatus RemoveLocation ()=0

  *Remove current URL from list.*

- virtual DataStatus RemoveLocations (const DataPoint &p)=0

  *Remove locations present in another DataPoint object.*

- virtual DataStatus ClearLocations ()=0

  *Remove all locations.*

- virtual int AddCheckSumObject (CheckSum *cksum)=0

  *Add a checksum object which will compute checksum during data transfer.*

- virtual const CheckSum * GetCheckSumObject (int index) const =0

  *Get CheckSum object at given position in list.*

- virtual void SortLocations (const std::string &pattern, const URLMap &url_map)=0

  *Sort locations according to the specified pattern and URLMap.*

- virtual void AddURLOptions (const std::map< std::string, std::string > &options)

  *Add URL options to this DataPoint's URL object.*

## Static Public Member Functions

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

  *Perform third party transfer.*

## Protected Member Functions

- DataPoint (const URL &url, const UserConfig &usercfg, PluginArgument *parg)

  *Constructor.*

- virtual DataStatus Transfer3rdParty (const URL &source, const URL &destination, Callback3rdParty callback=NULL)

  *Perform third party transfer.*

## Protected Attributes

- URL url

  *URL supplied in constructor.*

- const UserConfig usercfg

  *UserConfig supplied in constructor.*

- unsigned long long int size

  *Size of object represented by DataPoint.*

- std::string checksum

  *Checksum of object represented by DataPoint.*

- Time modified

  *Modification time of object represented by DataPoint.*

- Time valid

  *Validity time of object represented by DataPoint.*

- DataPointAccessLatency access_latency

  *Access latency of object represented by DataPoint.*

- int triesleft

  *Retries left for data transfer.*

- DataStatus failure_code

  *Result of data read/write carried out in separate thread.*

- bool cache

  *Whether this DataPoint is cacheable.*

- bool stageable

  *Whether this DataPoint requires staging.*

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

  *Valid URL options. Subclasses should add their own specific options to this list.*

### Static Protected Attributes

- static Logger logger

  *Logger object.*

## 6.6.1 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. Examples of how to use DataPoint methods are shown in the DataHandle documentation.

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 skeleton implementation of a new DMC for protocol MyProtocol which represents a physical resource accessible through protocol my://

## 6.6.2 Member Typedef Documentation

### 6.6.2.1 typedef void(∗ Arc::DataPoint::Callback3rdParty)(unsigned long long int bytes_transferred)

Callback for use in 3rd party transfer. Will be called periodically during the transfer with the number of bytes transferred so far.

**Parameters:**

***bytes_transferred*** the number of bytes transferred so far

## 6.6.3 Member Enumeration Documentation

### 6.6.3.1 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.

#### 6.6.3.2 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.

### 6.6.4 Constructor & Destructor Documentation

#### 6.6.4.1 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

***parg*** plugin argument

### 6.6.5 Member Function Documentation

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

Add a checksum object which will compute checksum during data transfer.

**Parameters:**

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

**Returns:**

integer position in the list of checksum objects.

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

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

Add URL representing physical replica to list of locations.

**Parameters:**

***url*** Location URL to add.

***meta*** Location meta information.

**Returns:**

LocationAlreadyExistsError if location already exists, otherwise success

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

#### 6.6.5.3 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 specific DataPoint instance will not be added.

**Parameters:**

***options*** map of option, value pairs

#### 6.6.5.4 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.

**Parameters:**

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

**Returns:**

success if the object is accessible by the caller.

Implemented in Arc::DataPointIndex.

#### 6.6.5.5 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.

#### 6.6.5.6 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.

#### 6.6.5.7 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. The access control on the new directories is protocol-specific and may vary depending on protocol.

**Parameters:**

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

**Returns:**

success if the directory was created

#### 6.6.5.8 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.

#### 6.6.5.9 virtual DataStatus Arc::DataPoint::FinishReading (bool *error* = false) [virtual]

Finish reading from the URL. Must be called after transfer of physical file has completed 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.

**Returns:**

success if source was released properly

Reimplemented in Arc::DataPointIndex.

#### 6.6.5.10 virtual DataStatus Arc::DataPoint::FinishWriting (bool *error* = false) [virtual]

Finish writing to the URL. Must be called after transfer of physical file has completed 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, for example cleaning the file from the storage

**Returns:**

success if destination was released properly

Reimplemented in Arc::DataPointIndex.

#### 6.6.5.11 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.

#### 6.6.5.12 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 and put into files. If the DataPoint is file- like an error will be returned.

**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.

**Returns:**

success if DataPoint is a directory-like object and could be listed.

#### 6.6.5.13 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.

#### 6.6.5.14 virtual void Arc::DataPoint::Passive (bool *v*) [pure virtual]

Set passive transfers for FTP-like protocols.

**Parameters:**

***v*** true if passive should be used.

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

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

Index service post-registration. Used for same purpose as PreRegister. Should be called after actual transfer of file successfully finished to finalise registration in an index service.

**Parameters:**

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

**Returns:**

success if post-registration succeeded

Implemented in Arc::DataPointDirect.

#### 6.6.5.16 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.

**Returns:**

Status of the operation

Reimplemented in Arc::DataPointIndex.

#### 6.6.5.17 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.

**Returns:**

Status of the operation

Reimplemented in Arc::DataPointIndex.

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

Index service pre-registration. 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 the 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.

**Returns:**

success if pre-registration succeeded

Implemented in Arc::DataPointDirect.

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

Index service pre-unregistration. 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 the same name.

**Returns:**

success if pre-unregistration succeeded

Implemented in Arc::DataPointDirect.

#### 6.6.5.20 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. Both start and end bytes are included in the range, i.e. start - end + 1 bytes will be read.

**Parameters:**

***start*** byte to start from

***end*** byte to end at

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

#### 6.6.5.21 virtual void Arc::DataPoint::ReadOutOfOrder (bool *v*) [pure virtual]

Allow/disallow DataPoint to read data out of order. If set to true then data may be read from source out of order or in parallel from multiple threads. For a transfer between two DataPoints this should only be set to true if WriteOutOfOrder() returns true for the destination. Only certain protocols support this option.

**Parameters:**

***v*** true if allowed (default is false).

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

#### 6.6.5.22 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

**Returns:**

success if the object was renamed

#### 6.6.5.23 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.

**Returns:**

success if any DataPoint was successfully resolved

#### 6.6.5.24 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 if possible. Resolve should be called for both source and destination URLs before a transfer. If source is true an error is returned if the file does not exist.

**Parameters:**

***source*** true if DataPoint object represents source of information.

**Returns:**

success if DataPoint was successfully resolved

Implemented in Arc::DataPointDirect.

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

Allow/disallow additional checks on a source DataPoint before transfer. If set to true, extra checks will be performed in DataMover::Transfer() before data transfer starts on for example existence of the source file (and probably other checks too).

**Parameters:**

***v*** true if allowed (default is true).

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

#### 6.6.5.26 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.

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

Allow/disallow heavy security (data encryption) during data transfer.

**Parameters:**

***v*** true if allowed (default depends on protocol).

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

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

Assigns new URL. The main purpose of this method is to reuse an existing connection for accessing a different object on the same server. The DataPoint implementation does not have to implement this method. If the supplied URL is not suitable or method is not implemented false is returned.

**Parameters:**

***url*** New URL

**Returns:**

true if switching to new URL is supported and succeeded

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

Sort locations according to the specified pattern and URLMap. See DataMover::set_preferred_pattern for a more detailed explanation of pattern matching. Locations present in url_map are preferred over others.

**Parameters:**

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

***url_map*** map of URLs to local URLs

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

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

Start reading data from URL. A separate thread to transfer data will be created. No other operation can be performed while reading is in progress. Progress of the transfer should be followed using the DataBuffer object.

**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 explicitly to release buffer it will be released in destructor of DataPoint which also usually calls StopReading().

**Returns:**

success if a thread was successfully started to start reading

Implemented in Arc::DataPointIndex.

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

Start writing data to URL. A separate thread to transfer data will be created. No other operation can be performed while writing is in progress. Progress of the transfer should be followed using the DataBuffer object.

**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 explicitly 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.

**Returns:**

success if a thread was successfully started to start writing

Implemented in Arc::DataPointIndex.

#### 6.6.5.32 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 and this can be used as a check for bulk support.

**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 list 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.

**Returns:**

success if any information could be retrieved for any DataPoint

#### 6.6.5.33 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.

**Returns:**

success if any information could be retrieved

#### 6.6.5.34 virtual DataStatus Arc::DataPoint::StopReading () `[pure virtual]`

Stop reading. Must be called after corresponding StartReading() method, either after all data is transferred or to cancel transfer. Use buffer object to find out when data is transferred.

**Returns:**

outcome of stopping reading (not outcome of transfer itself)

Implemented in Arc::DataPointIndex.

#### 6.6.5.35 virtual DataStatus Arc::DataPoint::StopWriting () [pure virtual]

Stop writing. Must be called after corresponding StartWriting() method, either after all data is transferred or to cancel transfer. Use buffer object to find out when data is transferred.

**Returns:**

outcome of stopping writing (not outcome of transfer itself)

Implemented in Arc::DataPointIndex.

#### 6.6.5.36 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

**Returns:**

outcome of transfer

#### 6.6.5.37 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

**Returns:**

outcome of transfer

#### 6.6.5.38 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.

#### 6.6.5.39 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 in CurrentLocation() is unregistered.

**Returns:**

success if unregistration succeeded

Implemented in Arc::DataPointDirect.

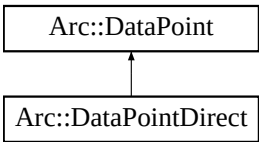
The documentation for this class was generated from the following file:

- DataPoint.h

# 6.7 Arc::DataPointDirect Class Reference

DataPointDirect represents "physical" data objects.

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




## Public Member Functions

- virtual bool IsIndex () const

  *Check if URL is an Indexing Service.*

- virtual bool IsStageable () const

  *Check if URL should be staged or queried for Transport URL (TURL).*

- virtual long long int BufSize () const

  *Get suggested buffer size for transfers.*

- virtual int BufNum () const

  *Get suggested number of buffers for transfers.*

- virtual bool Local () const

  *Returns true if file is local, e.g.* `file://` *urls.*

- virtual bool ReadOnly () const

  *Returns true if file is readonly.*

- virtual void ReadOutOfOrder (bool v)

  *Allow/disallow DataPoint to read data out of order.*

- virtual bool WriteOutOfOrder ()

  *Returns true if DataPoint supports receiving data out of order during writing.*

- virtual void SetAdditionalChecks (bool v)

  *Allow/disallow additional checks on a source DataPoint before transfer.*

- virtual bool GetAdditionalChecks () const

  *Returns true unless SetAdditionalChecks() was set to false.*

- virtual void SetSecure (bool v)

  *Allow/disallow heavy security (data encryption) during data transfer.*

- virtual bool GetSecure () const

  *Returns true if heavy security during data transfer is allowed.*

- virtual void Passive (bool v)
  *Set passive transfers for FTP-like protocols.*
- virtual void Range (unsigned long long int start=0, unsigned long long int end=0)
  *Set range of bytes to retrieve.*
- virtual int AddCheckSumObject (CheckSum *cksum)
  *Add a checksum object which will compute checksum during data transfer.*
- virtual const CheckSum * GetCheckSumObject (int index) const
  *Get CheckSum object at given position in list.*
- virtual DataStatus Resolve (bool source)
  *Resolves index service URL into list of ordinary URLs.*
- virtual bool Registered () const
  *Returns true if file is registered in indexing service (only known after Resolve()).*
- virtual DataStatus PreRegister (bool replication, bool force=false)
  *Index service pre-registration.*
- virtual DataStatus PostRegister (bool replication)
  *Index service post-registration.*
- virtual DataStatus PreUnregister (bool replication)
  *Index service pre-unregistration.*
- virtual DataStatus Unregister (bool all)
  *Index service unregistration.*
- virtual bool AcceptsMeta () const
  *Check if endpoint can have any use from meta information.*
- virtual bool ProvidesMeta () const
  *Check if endpoint can provide at least some meta information directly.*
- virtual const URL & CurrentLocation () const
  *Returns current (resolved) URL.*
- virtual DataPoint * CurrentLocationHandle () const
  *Returns a pointer to the DataPoint representing the current location.*
- virtual const std::string & CurrentLocationMetadata () const
  *Returns meta information used to create current URL.*
- virtual DataStatus CompareLocationMetadata () const
  *Compare metadata of DataPoint and current location.*
- virtual bool NextLocation ()
  *Switch to next location in list of URLs.*

- virtual bool LocationValid () const

  *Returns false no more locations are left and out of retries.*

- virtual bool HaveLocations () const

  *Returns true if number of resolved URLs is not 0.*

- virtual bool LastLocation ()

  *Returns true if the current location is the last.*

- virtual DataStatus AddLocation (const URL &url, const std::string &meta)

  *Add URL representing physical replica to list of locations.*

- virtual DataStatus RemoveLocation ()

  *Remove current URL from list.*

- virtual DataStatus ClearLocations ()

  *Remove all locations.*

- virtual void SortLocations (const std::string &, const URLMap &)

  *Sort locations according to the specified pattern and URLMap.*

### 6.7.1 Detailed Description

DataPointDirect represents "physical" data objects. This class should never be used directly, instead inherit from it to provide a class for a specific access protocol.

### 6.7.2 Member Function Documentation

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

Add a checksum object which will compute checksum during data transfer.

**Parameters:**

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

**Returns:**

integer position in the list of checksum objects.

Implements Arc::DataPoint.

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

Add URL representing physical replica to list of locations.

**Parameters:**

***url*** Location URL to add.

***meta*** Location meta information.

**Returns:**

LocationAlreadyExistsError if location already exists, otherwise success

Implements Arc::DataPoint.

#### 6.7.2.3 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.

#### 6.7.2.4 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.

#### 6.7.2.5 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.

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

Set passive transfers for FTP-like protocols.

**Parameters:**

***v*** true if passive should be used.

Implements Arc::DataPoint.

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

Index service post-registration. Used for same purpose as PreRegister. Should be called after actual transfer of file successfully finished to finalise registration in an index service.

**Parameters:**

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

**Returns:**

success if post-registration succeeded

Implements Arc::DataPoint.

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

Index service pre-registration. 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 the 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.

**Returns:**

success if pre-registration succeeded

Implements Arc::DataPoint.

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

Index service pre-unregistration. 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 the same name.

**Returns:**

success if pre-unregistration succeeded

Implements Arc::DataPoint.

#### 6.7.2.10 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. Both start and end bytes are included in the range, i.e. start - end + 1 bytes will be read.

**Parameters:**

***start*** byte to start from

***end*** byte to end at

Implements Arc::DataPoint.

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

Allow/disallow DataPoint to read data out of order. If set to true then data may be read from source out of order or in parallel from multiple threads. For a transfer between two DataPoints this should only be set to true if WriteOutOfOrder() returns true for the destination. Only certain protocols support this option.

**Parameters:**

***v*** true if allowed (default is false).

Implements Arc::DataPoint.

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

Resolves index service URL into list of ordinary URLs. Also obtains meta information about the file if possible. Resolve should be called for both source and destination URLs before a transfer. If source is true an error is returned if the file does not exist.

**Parameters:**

***source*** true if DataPoint object represents source of information.

**Returns:**

success if DataPoint was successfully resolved

Implements Arc::DataPoint.

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

Allow/disallow additional checks on a source DataPoint before transfer. If set to true, extra checks will be performed in DataMover::Transfer() before data transfer starts on for example existence of the source file (and probably other checks too).

**Parameters:**

***v*** true if allowed (default is true).

Implements Arc::DataPoint.

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

Allow/disallow heavy security (data encryption) during data transfer.

**Parameters:**

***v*** true if allowed (default depends on protocol).

Implements Arc::DataPoint.

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

Sort locations according to the specified pattern and URLMap. See DataMover::set_preferred_pattern for a more detailed explanation of pattern matching. Locations present in url_map are preferred over others.

**Parameters:**

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

***url_map*** map of URLs to local URLs

Implements Arc::DataPoint.

#### 6.7.2.16 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 in CurrentLocation() is unregistered.

**Returns:**

success if unregistration succeeded

Implements Arc::DataPoint.

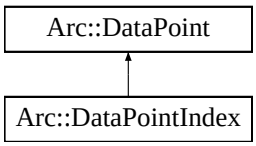
The documentation for this class was generated from the following file:

- DataPointDirect.h

## 6.8 Arc::DataPointIndex Class Reference

DataPointIndex represents "index" data objects, e.g. catalogs.

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




### Public Member Functions

- virtual const URL & CurrentLocation () const

  *Returns current (resolved) URL.*

- virtual const std::string & CurrentLocationMetadata () const

  *Returns meta information used to create current URL.*

- virtual DataPoint * CurrentLocationHandle () const

  *Returns a pointer to the DataPoint representing the current location.*

- virtual DataStatus CompareLocationMetadata () const

  *Compare metadata of DataPoint and current location.*

- virtual bool NextLocation ()

  *Switch to next location in list of URLs.*

- virtual bool LocationValid () const

  *Returns false no more locations are left and out of retries.*

- virtual bool HaveLocations () const

  *Returns true if number of resolved URLs is not 0.*

- virtual bool LastLocation ()

  *Returns true if the current location is the last.*

- virtual DataStatus RemoveLocation ()

  *Remove current URL from list.*

- virtual DataStatus ClearLocations ()

  *Remove all locations.*

- virtual DataStatus AddLocation (const URL &url, const std::string &meta)

  *Add URL representing physical replica to list of locations.*

- virtual void SortLocations (const std::string &pattern, const URLMap &url_map)

  *Sort locations according to the specified pattern and URLMap.*

- virtual bool IsIndex () const
  *Check if URL is an Indexing Service.*
- virtual bool IsStageable () const
  *Check if URL should be staged or queried for Transport URL (TURL).*
- virtual bool AcceptsMeta () const
  *Check if endpoint can have any use from meta information.*
- virtual bool ProvidesMeta () const
  *Check if endpoint can provide at least some meta information directly.*
- virtual void SetCheckSum (const std::string &val)
  *Set value of meta-information 'checksum'.*
- virtual void SetSize (const unsigned long long int val)
  *Set value of meta-information 'size'.*
- virtual bool Registered () const
  *Returns true if file is registered in indexing service (only known after Resolve()).*
- virtual void SetTries (const int n)
  *Set number of retries.*
- virtual long long int BufSize () const
  *Get suggested buffer size for transfers.*
- virtual int BufNum () const
  *Get suggested number of buffers for transfers.*
- virtual bool Local () const
  *Returns true if file is local, e.g.* `file://` *urls.*
- virtual bool ReadOnly () const
  *Returns true if file is readonly.*
- virtual DataStatus PrepareReading (unsigned int timeout, unsigned int &wait_time)
  *Prepare DataPoint for reading.*
- virtual DataStatus PrepareWriting (unsigned int timeout, unsigned int &wait_time)
  *Prepare DataPoint for writing.*
- virtual DataStatus StartReading (DataBuffer &buffer)
  *Start reading data from URL.*
- virtual DataStatus StartWriting (DataBuffer &buffer, DataCallback *space_cb=NULL)
  *Start writing data to URL.*
- virtual DataStatus StopReading ()
  *Stop reading.*

- virtual DataStatus StopWriting ()
  *Stop writing.*
- virtual DataStatus FinishReading (bool error=false)
  *Finish reading from the URL.*
- virtual DataStatus FinishWriting (bool error=false)
  *Finish writing to the URL.*
- virtual std::vector< URL > TransferLocations () const
  *Returns physical file(s) to read/write, if different from CurrentLocation().*
- virtual DataStatus Check (bool check_meta)
  *Query the DataPoint to check if object is accessible.*
- virtual DataStatus Remove ()
  *Remove/delete object at URL.*
- virtual void ReadOutOfOrder (bool v)
  *Allow/disallow DataPoint to read data out of order.*
- virtual bool WriteOutOfOrder ()
  *Returns true if DataPoint supports receiving data out of order during writing.*
- virtual void SetAdditionalChecks (bool v)
  *Allow/disallow additional checks on a source DataPoint before transfer.*
- virtual bool GetAdditionalChecks () const
  *Returns true unless SetAdditionalChecks() was set to false.*
- virtual void SetSecure (bool v)
  *Allow/disallow heavy security (data encryption) during data transfer.*
- virtual bool GetSecure () const
  *Returns true if heavy security during data transfer is allowed.*
- virtual DataPointAccessLatency GetAccessLatency () const
  *Get value of meta-information 'access latency'.*
- virtual void Passive (bool v)
  *Set passive transfers for FTP-like protocols.*
- virtual void Range (unsigned long long int start=0, unsigned long long int end=0)
  *Set range of bytes to retrieve.*
- virtual int AddCheckSumObject (CheckSum *cksum)
  *Add a checksum object which will compute checksum during data transfer.*
- virtual const CheckSum * GetCheckSumObject (int index) const
  *Get CheckSum object at given position in list.*

### 6.8.1 Detailed Description

DataPointIndex represents "index" data objects, e.g. catalogs. This class should never be used directly, instead inherit from it to provide a class for a specific indexing service.

### 6.8.2 Member Function Documentation

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

Add a checksum object which will compute checksum during data transfer.

**Parameters:**

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

**Returns:**

integer position in the list of checksum objects.

Implements Arc::DataPoint.

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

Add URL representing physical replica to list of locations.

**Parameters:**

***url*** Location URL to add.

***meta*** Location meta information.

**Returns:**

LocationAlreadyExistsError if location already exists, otherwise success

Implements Arc::DataPoint.

#### 6.8.2.3 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.

**Parameters:**

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

**Returns:**

success if the object is accessible by the caller.

Implements Arc::DataPoint.

#### 6.8.2.4 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.

#### 6.8.2.5 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.

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

Finish reading from the URL. Must be called after transfer of physical file has completed 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.

**Returns:**

success if source was released properly

Reimplemented from Arc::DataPoint.

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

Finish writing to the URL. Must be called after transfer of physical file has completed 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, for example cleaning the file from the storage

**Returns:**

success if destination was released properly

Reimplemented from Arc::DataPoint.

#### 6.8.2.8 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.

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

Set passive transfers for FTP-like protocols.

**Parameters:**

***v*** true if passive should be used.

Implements Arc::DataPoint.

#### 6.8.2.10 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.

**Returns:**

Status of the operation

Reimplemented from Arc::DataPoint.

#### 6.8.2.11 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.

**Returns:**

Status of the operation

Reimplemented from Arc::DataPoint.

#### 6.8.2.12 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. Both start and end bytes are included in the range, i.e. start - end + 1 bytes will be read.

**Parameters:**

***start*** byte to start from

***end*** byte to end at

Implements Arc::DataPoint.

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

Allow/disallow DataPoint to read data out of order. If set to true then data may be read from source out of order or in parallel from multiple threads. For a transfer between two DataPoints this should only be set to true if WriteOutOfOrder() returns true for the destination. Only certain protocols support this option.

**Parameters:**

***v*** true if allowed (default is false).

Implements Arc::DataPoint.

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

Allow/disallow additional checks on a source DataPoint before transfer. If set to true, extra checks will be performed in DataMover::Transfer() before data transfer starts on for example existence of the source file (and probably other checks too).

**Parameters:**

***v*** true if allowed (default is true).

Implements Arc::DataPoint.

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

Allow/disallow heavy security (data encryption) during data transfer.

**Parameters:**

***v*** true if allowed (default depends on protocol).

Implements Arc::DataPoint.

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

Sort locations according to the specified pattern and URLMap. See DataMover::set_preferred_pattern for a more detailed explanation of pattern matching. Locations present in url_map are preferred over others.

**Parameters:**

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

***url_map*** map of URLs to local URLs

Implements Arc::DataPoint.

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

Start reading data from URL. A separate thread to transfer data will be created. No other operation can be performed while reading is in progress. Progress of the transfer should be followed using the DataBuffer object.

**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 explicitly to release buffer it will be released in destructor of DataPoint which also usually calls StopReading().

**Returns:**

success if a thread was successfully started to start reading

Implements Arc::DataPoint.

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

Start writing data to URL. A separate thread to transfer data will be created. No other operation can be performed while writing is in progress. Progress of the transfer should be followed using the DataBuffer object.

**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 explicitly 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.

**Returns:**

success if a thread was successfully started to start writing

Implements Arc::DataPoint.

#### 6.8.2.19 virtual DataStatus Arc::DataPointIndex::StopReading () [virtual]

Stop reading. Must be called after corresponding StartReading() method, either after all data is transferred or to cancel transfer. Use buffer object to find out when data is transferred.

**Returns:**

outcome of stopping reading (not outcome of transfer itself)

Implements Arc::DataPoint.

#### 6.8.2.20 virtual DataStatus Arc::DataPointIndex::StopWriting () [virtual]

Stop writing. Must be called after corresponding StartWriting() method, either after all data is transferred or to cancel transfer. Use buffer object to find out when data is transferred.

**Returns:**

outcome of stopping writing (not outcome of transfer itself)

Implements Arc::DataPoint.

#### 6.8.2.21 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.

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

- DataPointIndex.h

## 6.9 Arc::DataSpeed Class Reference

Keeps track of average and instantaneous transfer speed.

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

### Public Types

- typedef void(∗ show_progress_t )(FILE ∗o, const char ∗s, unsigned int t, unsigned long long int all, unsigned long long int max, double instant, double average)

  *Callback for output of transfer status.*

### Public Member Functions

- DataSpeed (time_t base=DATASPEED_AVERAGING_PERIOD)

  *Constructor.*

- 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.*

- ∼DataSpeed ()

  *Destructor.*

- void verbose (bool val)

  *Set true to activate printing transfer information during transfer.*

- void verbose (const std::string &prefix)

  *Activate printing transfer information using 'prefix' at the beginning of every string.*

- bool verbose ()

  *Check if speed information is going to be printed.*

- void set_min_speed (unsigned long long int min_speed, time_t min_speed_time)

  *Set minimal allowed speed in bytes per second.*

- void set_min_average_speed (unsigned long long int min_average_speed)

  *Set minimal average speed in bytes per second.*

- void set_max_inactivity_time (time_t max_inactivity_time)

  *Set inactivity timeout.*

- time_t get_max_inactivity_time ()

  *Get inactivity timeout.*

- void set_base (time_t base_=DATASPEED_AVERAGING_PERIOD)

  *Set averaging time period (default 1 minute).*

- void set_max_data (unsigned long long int max=0)

*Set amount of data (in bytes) to be transferred. Used in verbose messages.*

- void set_progress_indicator (show_progress_t func=NULL)
  *Specify an external function to print verbose messages.*
- void reset ()
  *Reset all counters and triggers.*
- bool transfer (unsigned long long int n=0)
  *Inform object that an amount of data has been transferred.*
- void hold (bool disable)
  *Turn and off off speed control.*
- bool min_speed_failure ()
  *Check if minimal speed error was triggered.*
- bool min_average_speed_failure ()
  *Check if minimal average speed error was triggered.*
- bool max_inactivity_time_failure ()
  *Check if maximal inactivity time error was triggered.*
- unsigned long long int transferred_size ()
  *Returns number of bytes transferred so far (this object knows about).*

### 6.9.1 Detailed Description

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

### 6.9.2 Member Typedef Documentation

#### 6.9.2.1 typedef void(∗ Arc::DataSpeed::show_progress_t)(FILE ∗o, const char ∗s, unsigned int t, unsigned long long int all, unsigned long long int max, double instant, double average)

Callback for output of transfer status. A function with this signature can be passed to set_progress_indicator() to enable user-defined output of transfer progress.

**Parameters:**

***o*** FILE object connected to stderr

***s*** prefix set in verbose(const std::string&)

***t*** time in seconds since the start of the transfer

***all*** number of bytes transferred so far

***max*** total amount of bytes to be transferred (set in set_max_data())

***instant*** instantaneous transfer rate in bytes per second

***average*** average transfer rate in bytes per second

## 6.9.3 Constructor & Destructor Documentation

### 6.9.3.1 Arc::DataSpeed::DataSpeed (time_t *base* = DATASPEED_AVERAGING_PERIOD)

Constructor.

**Parameters:**

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

### 6.9.3.2 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:**

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

***min_speed_time*** time over which to calculate min_speed.

***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, error is triggered.

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

## 6.9.4 Member Function Documentation

### 6.9.4.1 void Arc::DataSpeed::set_max_inactivity_time (time_t *max_inactivity_time*)

Set inactivity timeout.

**Parameters:**

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

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

Set minimal average speed in bytes per second.

**Parameters:**

***min_average_speed*** minimal average speed (bytes per second) to trigger error. Averaged over whole current transfer time.

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

Set minimal allowed speed in bytes per second.

**Parameters:**

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

***min_speed_time*** time over which to calculate min_speed.

#### 6.9.4.4 void Arc::DataSpeed::set_progress_indicator (show_progress_t *func* = NULL)

Specify an external function to print verbose messages. If not specified an internal function is used.

**Parameters:**

***func*** pointer to function which prints information.

#### 6.9.4.5 bool Arc::DataSpeed::transfer (unsigned long long int *n* = 0)

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

**Parameters:**

***n*** amount of data transferred in bytes.

**Returns:**

false if transfer rate is below limits

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

- DataSpeed.h

## 6.10 Arc::DataStatus Class Reference

Status code returned by many DataPoint methods.

`#include <arc/data/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 }

  *Status codes.*

## Public Member Functions

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

  *Constructor to use when errno-like information is not available.*

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

  *Construct a new DataStatus with errno and optional text description.*

- DataStatus ()

  *Construct a new DataStatus with fields initialised to success states.*

- bool operator== (const DataStatusType &s)

  *Returns true if this status type matches s.*

- bool operator== (const DataStatus &s)

  *Returns true if this status type matches the status type of s.*

- bool operator!= (const DataStatusType &s)

  *Returns true if this status type does not match s.*

- bool operator!= (const DataStatus &s)

  *Returns true if this status type does not match the status type of s.*

- DataStatus operator= (const DataStatusType &s)

  *Assignment operator.*

- bool operator! () const

  *Returns true if status type is not a success value.*

- operator bool () const

  *Returns true if status type is a success value.*

- bool Passed () const

  *Returns true if no error occurred.*

- bool Retryable () const

  *Returns true if the error was temporary and could be retried.*

- void SetErrno (int error_no)

  *Set the error number.*

- int GetErrno () const

  *Get the error number.*

- std::string GetStrErrno () const

  *Get text description of the error number.*

- void SetDesc (const std::string &d)

  *Set a detailed description of the status, removing trailing new line if present.*

- std::string GetDesc () const

  *Get a detailed description of the status.*

- operator std::string (void) const

  *Returns a human-friendly readable string with all error information.*

### 6.10.1 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.

### 6.10.2 Member Enumeration Documentation

#### 6.10.2.1 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***

### 6.10.3 Constructor & Destructor Documentation

#### 6.10.3.1 Arc::DataStatus::DataStatus (const DataStatusType & *status*, std::string *desc* = "") [inline]

Constructor to use when errno-like information is not available.

**Parameters:**

***status*** error location

***desc*** error description

References Passed().

#### 6.10.3.2 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.

**Parameters:**

***status*** error location

***error_no*** errno

***desc*** error description

### 6.10.4 Member Function Documentation

#### 6.10.4.1 DataStatus Arc::DataStatus::operator= (const DataStatusType & *s*) [inline]

Assignment operator. Sets status type to s and errno to EARCOTHER if s is an error state.

References Passed().

#### 6.10.4.2 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, EARCCHECKSUM and EARCOTHER.

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

- DataStatus.h

## 6.11 Arc::FileCache Class Reference

FileCache provides an interface to all cache operations.

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

### Public Member Functions

- FileCache (const std::string &cache_path, const std::string &id, uid_t job_uid, gid_t job_gid)

  *Create a new FileCache instance with one cache directory.*

- 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.*

- 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.*

- FileCache ()

  *Default constructor. Invalid cache.*

- bool 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.*

- bool Stop (const std::string &url)

  *Stop the cache after a file was downloaded.*

- bool StopAndDelete (const std::string &url)

  *Stop the cache after a file was downloaded and delete the cache file.*

- std::string File (const std::string &url)

  *Get the cache filename for the given URL.*

- bool 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.*

- bool Release () const

  *Release cache files used in this cache.*

- bool AddDN (const std::string &url, const std::string &DN, const Time &expiry_time)

  *Store a DN in the permissions cache for the given url.*

- bool CheckDN (const std::string &url, const std::string &DN)

  *Check if a DN exists in the permission cache and is still valid for the given url.*

- bool CheckCreated (const std::string &url)

*Check if it is possible to obtain the creation time of a cache file.*

- Time GetCreated (const std::string &url)

  *Get the creation time of a cached file.*

- bool CheckValid (const std::string &url)

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

- Time GetValid (const std::string &url)

  *Get expiry time of a cached file.*

- bool SetValid (const std::string &url, const Time &val)

  *Set expiry time of a cache file.*

- operator bool ()

  *Returns true if object is useable.*

- bool operator== (const FileCache &a)

  *Returns true if all attributes are equal.*

### 6.11.1 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).

### 6.11.2 Constructor & Destructor Documentation

#### 6.11.2.1 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 with one cache directory.

**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

#### 6.11.2.2 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

#### 6.11.2.3 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

### 6.11.3 Member Function Documentation

#### 6.11.3.1 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

**Returns:**

true if the DN was successfully added

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

Check if it is possible to obtain the creation time of a cache file.

**Parameters:**

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

**Returns:**

true if the file exists in the cache, since the creation time is the creation time of the cache file.

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

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

**Parameters:**

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

**Returns:**

true if the DN exists and is still valid

#### 6.11.3.4 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

**Returns:**

true if an expiry time exists

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

Get the cache filename for the given URL.

**Parameters:**

***url*** the URL to look for in the cache

**Returns:**

the full pathname of the file in the cache which corresponds to the given url.

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

Get the creation time of a cached file.

**Parameters:**

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

**Returns:**

creation time of the file or 0 if the cache file does not exist

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

Get expiry time of a cached file.

**Parameters:**

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

**Returns:**

the expiry time or 0 if none is available

#### 6.11.3.8 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, try_again is set to true and Link() returns false. 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

**Returns:**

true if linking succeeded, false if an error occurred or the file was locked or modified by another process during linking

#### 6.11.3.9 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.

**Returns:**

false if any directory fails to be deleted

#### 6.11.3.10 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

**Returns:**

true if the expiry time was successfully set

#### 6.11.3.11 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(). Start() 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.

**Returns:**

true if file is available or ready to be downloaded, false if the file is already locked or preparing the cache failed.

#### 6.11.3.12 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 actually downloaded the file. It must not be called if the file was already available.

**Parameters:**

***url*** the url of the file that was downloaded

**Returns:**

true if the lock was successfully released.

#### 6.11.3.13 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 downloaded the file.

**Parameters:**

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

**Returns:**

true if the cache file and lock were successfully removed.

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

- FileCache.h

## 6.12 Arc::FileCacheHash Class Reference

FileCacheHash provides methods to make hashes from strings.

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

### Static Public Member Functions

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

  *Return a hash of the given URL, according to the current hash scheme.*

- static int maxLength ()

  *Return the maximum length of a hash string.*

### 6.12.1 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

## 6.13 Arc::FileInfo Class Reference

FileInfo stores information about files (metadata).

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

### Public Types

- enum Type { file_type_unknown = 0, file_type_file = 1, file_type_dir = 2 }
  *Type of file object.*

### Public Member Functions

- FileInfo (const std::string &name="")
  *Construct a new FileInfo with optional name (file path).*
- const std::string & GetName () const
  *Returns the name (file path) of the file.*
- std::string GetLastName () const
  *Returns the last component of the file name (like the "basename" command).*
- void SetName (const std::string &n)
  *Set name of the file (file path).*
- const std::list< URL > & GetURLs () const
  *Returns the list of file replicas (for index services).*
- void AddURL (const URL &u)
  *Add a replica to this file.*
- bool CheckSize () const
  *Check if file size is known.*
- unsigned long long int GetSize () const
  *Returns file size.*
- void SetSize (const unsigned long long int s)
  *Set file size.*
- bool CheckCheckSum () const
  *Check if checksum is known.*
- const std::string & GetCheckSum () const
  *Returns checksum.*
- void SetCheckSum (const std::string &c)
  *Set checksum.*

- bool CheckModified () const
  *Check if modified time is known.*
- Time GetModified () const
  *Returns modified time.*
- void SetModified (const Time &t)
  *Set modified time.*
- bool CheckValid () const
  *Check if validity time is known.*
- Time GetValid () const
  *Returns validity time.*
- void SetValid (const Time &t)
  *Set validity time.*
- bool CheckType () const
  *Check if file type is known.*
- Type GetType () const
  *Returns file type.*
- void SetType (const Type t)
  *Set file type.*
- bool CheckLatency () const
  *Check if access latency is known.*
- std::string GetLatency () const
  *Returns access latency.*
- void SetLatency (const std::string l)
  *Set access latency.*
- std::map< std::string, std::string > GetMetaData () const
  *Returns map of generic metadata.*
- void SetMetaData (const std::string att, const std::string val)
  *Set an attribute of generic metadata.*
- bool operator< (const FileInfo &f) const
  *Returns true if this file's name is before f's name alphabetically.*
- operator bool () const
  *Returns true if file name is defined.*
- bool operator! () const
  *Returns true if file name is not defined.*

### 6.13.1 Detailed Description

FileInfo stores information about files (metadata). Set/Get methods exist for "standard" metadata such as name, size and modification time, and there is a generic key-value map for protocol-specific attributes. The Set methods always set the corresponding entry in the generic map, so there is no need for a caller make two calls, for example SetSize(1) followed by SetMetaData("size", "1").

### 6.13.2 Member Enumeration Documentation

#### 6.13.2.1 enum Arc::FileInfo::Type

Type of file object.

**Enumerator:**

***file_type_unknown*** Unknown.

***file_type_file*** File-type.

***file_type_dir*** Directory-type.

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

- FileInfo.h

## 6.14 Arc::URLMap Class Reference

URLMap allows mapping certain patterns of URLs to other URLs.

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

### Data Structures

- class **map_entry**

### Public Member Functions

- URLMap ()

  *Construct an empty URLMap.*

- bool map (URL &url) const

  *Map a URL if possible.*

- bool local (const URL &url) const

  *Check if a mapping exists for a URL.*

- void add (const URL &templ, const URL &repl, const URL &accs=URL())

  *Add an entry to the URLMap.*

- operator bool () const

  *Returns true if the URLMap is not empty.*

- bool operator! () const

  *Returns true if the URLMap is empty.*

### 6.14.1 Detailed Description

URLMap allows mapping certain patterns of URLs to other URLs. A URLMap can be used if certain URLs can be more efficiently accessed by other means on a certain site. For example a GridFTP storage element may be mounted as a local file system and so a map can be made from a gsiftp:// URL to a local file path.

### 6.14.2 Member Function Documentation

#### 6.14.2.1 void Arc::URLMap::add (const URL & *templ*, const URL & *repl*, const URL & *accs* = `URL()`)

Add an entry to the URLMap. All URLs matching templ will have the templ part replaced by repl.

**Parameters:**

***templ*** template to replace, for example gsiftp://se.org/files

***repl*** replacement for template, for example /export/grid/files

***accs*** replacement path if it differs in the place the file will actually be accessed (e.g. on worker nodes), for example /mount/grid/files

#### 6.14.2.2 bool Arc::URLMap::local (const URL & *url*) const

Check if a mapping exists for a URL. Checks to see if a URL will be mapped but does not do the mapping.

**Parameters:**

***url*** URL to check

**Returns:**

true if a mapping exists for this URL

#### 6.14.2.3 bool Arc::URLMap::map (URL & *url*) const

Map a URL if possible. If the given URL matches any template it will be changed to the mapped URL. Additionally, if the mapped URL is a local file, a permission check is done by attempting to open the file. If a different access path is specified for this URL the URL will be changed to link://accesspath. To check if a URL will be mapped without changing it local() can be used.

**Parameters:**

***url*** URL to check

**Returns:**

true if the URL was mapped to a new URL, false if it was not mapped or an error occurred during mapping

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

- URLMap.h

# Index


ACCESS_LATENCY_LARGE
    Arc::DataPoint, 39
ACCESS_LATENCY_SMALL
    Arc::DataPoint, 38
ACCESS_LATENCY_ZERO
    Arc::DataPoint, 38
add
    Arc::DataBuffer, 17
    Arc::URLMap, 89
AddCheckSumObject
    Arc::DataPoint, 39
    Arc::DataPointDirect, 53
    Arc::DataPointIndex, 61
AddDN
    Arc::FileCache, 80
AddLocation
    Arc::DataPoint, 39
    Arc::DataPointDirect, 53
    Arc::DataPointIndex, 61
AddURLOptions
    Arc::DataPoint, 40
ARC data library (libarcdata), 9
Arc::CacheParameters, 13
Arc::DataBuffer, 14
    add, 17
    buffer_size, 17
    checksum_object, 17
    checksum_valid, 17
    DataBuffer, 17
    eof_read, 18
    eof_write, 18
    error_read, 18
    error_write, 18
    for_read, 18
    for_write, 19
    is_notwritten, 19
    is_read, 20
    is_written, 20
    set, 21
    wait_any, 21
    wait_for_read, 21
    wait_for_write, 21
    wait_used, 22
Arc::DataCallback, 23
Arc::DataHandle, 24
    GetPoint, 25
Arc::DataMover, 26
    callback, 27
    checks, 28
    Delete, 28
    set_default_max_inactivity_time, 28
    set_default_min_average_speed, 28
    set_default_min_speed, 28
    set_preferred_pattern, 28
    Transfer, 29
    verbose, 30
Arc::DataPoint, 31
    ACCESS_LATENCY_LARGE, 39
    ACCESS_LATENCY_SMALL, 38
    ACCESS_LATENCY_ZERO, 38
    AddCheckSumObject, 39
    AddLocation, 39
    AddURLOptions, 40
    Callback3rdParty, 38
    Check, 40
    CompareLocationMetadata, 40
    CompareMeta, 40
    CreateDirectory, 41
    CurrentLocationMetadata, 41
    DataPoint, 39
    DataPointAccessLatency, 38
    DataPointInfoType, 39
    FinishReading, 41
    FinishWriting, 41
    GetFailureReason, 42
    INFO_TYPE_ACCESS, 39
    INFO_TYPE_ALL, 39
    INFO_TYPE_CONTENT, 39
    INFO_TYPE_MINIMAL, 39
    INFO_TYPE_NAME, 39
    INFO_TYPE_REST, 39
    INFO_TYPE_STRUCT, 39
    INFO_TYPE_TIMES, 39
    INFO_TYPE_TYPE, 39
    List, 42
    NextLocation, 42
    Passive, 42
    PostRegister, 42
    PrepareReading, 43
    PrepareWriting, 43

PreRegister, 44
PreUnregister, 44
Range, 44
ReadOutOfOrder, 45
Rename, 45
Resolve, 45
SetAdditionalChecks, 46
SetMeta, 46
SetSecure, 46
SetURL, 46
SortLocations, 47
StartReading, 47
StartWriting, 47
Stat, 48
StopReading, 48
StopWriting, 49
Transfer3rdParty, 49
TransferLocations, 49
Unregister, 50
Arc::DataPointDirect, 51
AddCheckSumObject, 53
AddLocation, 53
CompareLocationMetadata, 54
CurrentLocationMetadata, 54
NextLocation, 54
Passive, 54
PostRegister, 54
PreRegister, 55
PreUnregister, 55
Range, 55
ReadOutOfOrder, 56
Resolve, 56
SetAdditionalChecks, 56
SetSecure, 56
SortLocations, 57
Unregister, 57
Arc::DataPointIndex, 58
AddCheckSumObject, 61
AddLocation, 61
Check, 61
CompareLocationMetadata, 61
CurrentLocationMetadata, 62
FinishReading, 62
FinishWriting, 62
NextLocation, 62
Passive, 63
PrepareReading, 63
PrepareWriting, 63
Range, 64
ReadOutOfOrder, 64
SetAdditionalChecks, 64
SetSecure, 64
SortLocations, 65
StartReading, 65
StartWriting, 65
StopReading, 66
StopWriting, 66
TransferLocations, 66
Arc::DataSpeed, 67
DataSpeed, 69
set_max_inactivity_time, 69
set_min_average_speed, 69
set_min_speed, 69
set_progress_indicator, 70
show_progress_t, 68
transfer, 70
Arc::DataStatus, 71
CacheError, 73
CacheErrorRetryable, 75
CheckError, 74
CheckErrorRetryable, 75
CreateDirectoryError, 74
CreateDirectoryErrorRetryable, 76
CredentialsExpiredError, 74
DataStatus, 76
DataStatusType, 73
DeleteError, 74
DeleteErrorRetryable, 75
GenericError, 74
GenericErrorRetryable, 76
InconsistentMetadataError, 74
IsReadingError, 74
IsWritingError, 74
ListError, 74
ListErrorRetryable, 75
ListNonDirError, 74
LocationAlreadyExistsError, 74
NoLocationError, 74
NotInitializedError, 74
NotSupportedForDirectDataPointsError, 74
operator=, 76
PostRegisterError, 73
PostRegisterErrorRetryable, 75
PreRegisterError, 73
PreRegisterErrorRetryable, 75
ReadAcquireError, 73
ReadAcquireErrorRetryable, 74
ReadError, 73
ReadErrorRetryable, 75
ReadFinishError, 74
ReadFinishErrorRetryable, 75
ReadPrepareError, 74
ReadPrepareErrorRetryable, 75
ReadPrepareWait, 74
ReadResolveError, 73
ReadResolveErrorRetryable, 74
ReadStartError, 73
ReadStartErrorRetryable, 74

ReadStopError, 73
ReadStopErrorRetryable, 75
RenameError, 74
RenameErrorRetryable, 76
Retryable, 76
StageError, 74
StageErrorRetryable, 75
StatError, 74
StatErrorRetryable, 75
StatNotPresentError, 74
Success, 73
SuccessCached, 74
SuccessCancelled, 74
SystemError, 74
TransferError, 73
TransferErrorRetryable, 75
UnimplementedError, 74
UnknownError, 74
UnregisterError, 73
UnregisterErrorRetryable, 75
WriteAcquireError, 73
WriteAcquireErrorRetryable, 74
WriteError, 73
WriteErrorRetryable, 75
WriteFinishError, 74
WriteFinishErrorRetryable, 75
WritePrepareError, 74
WritePrepareErrorRetryable, 75
WritePrepareWait, 74
WriteResolveError, 73
WriteResolveErrorRetryable, 74
WriteStartError, 73
WriteStartErrorRetryable, 75
WriteStopError, 73
WriteStopErrorRetryable, 75
Arc::FileCache, 78
AddDN, 80
CheckCreated, 81
CheckDN, 81
CheckValid, 81
File, 81
FileCache, 79, 80
GetCreated, 81
GetValid, 82
Link, 82
Release, 83
SetValid, 83
Start, 83
Stop, 83
StopAndDelete, 84
Arc::FileCacheHash, 85
Arc::FileInfo, 86
file_type_dir, 88
file_type_file, 88
file_type_unknown, 88
Type, 88
Arc::URLMap, 89
add, 89
local, 90
map, 90

buffer_size
Arc::DataBuffer, 17

CacheError
Arc::DataStatus, 73
CacheErrorRetryable
Arc::DataStatus, 75
callback
Arc::DataMover, 27
Callback3rdParty
Arc::DataPoint, 38
Check
Arc::DataPoint, 40
Arc::DataPointIndex, 61
CheckCreated
Arc::FileCache, 81
CheckDN
Arc::FileCache, 81
CheckError
Arc::DataStatus, 74
CheckErrorRetryable
Arc::DataStatus, 75
checks
Arc::DataMover, 28
checksum_object
Arc::DataBuffer, 17
checksum_valid
Arc::DataBuffer, 17
CheckValid
Arc::FileCache, 81
CompareLocationMetadata
Arc::DataPoint, 40
Arc::DataPointDirect, 54
Arc::DataPointIndex, 61
CompareMeta
Arc::DataPoint, 40
CreateDirectory
Arc::DataPoint, 41
CreateDirectoryError
Arc::DataStatus, 74
CreateDirectoryErrorRetryable
Arc::DataStatus, 76
CredentialsExpiredError
Arc::DataStatus, 74
CurrentLocationMetadata
Arc::DataPoint, 41
Arc::DataPointDirect, 54

Arc::DataPointIndex, 62

data
operator<<, 11
DataBuffer
Arc::DataBuffer, 17
DataPoint
Arc::DataPoint, 39
DataPointAccessLatency
Arc::DataPoint, 38
DataPointInfoType
Arc::DataPoint, 39
DataSpeed
Arc::DataSpeed, 69
DataStatus
Arc::DataStatus, 76
DataStatusType
Arc::DataStatus, 73
Delete
Arc::DataMover, 28
DeleteError
Arc::DataStatus, 74
DeleteErrorRetryable
Arc::DataStatus, 75

eof_read
Arc::DataBuffer, 18
eof_write
Arc::DataBuffer, 18
error_read
Arc::DataBuffer, 18
error_write
Arc::DataBuffer, 18

File
Arc::FileCache, 81
file_type_dir
Arc::FileInfo, 88
file_type_file
Arc::FileInfo, 88
file_type_unknown
Arc::FileInfo, 88
FileCache
Arc::FileCache, 79, 80
FinishReading
Arc::DataPoint, 41
Arc::DataPointIndex, 62
FinishWriting
Arc::DataPoint, 41
Arc::DataPointIndex, 62
for_read
Arc::DataBuffer, 18
for_write
Arc::DataBuffer, 19

GenericError
Arc::DataStatus, 74
GenericErrorRetryable
Arc::DataStatus, 76
GetCreated
Arc::FileCache, 81
GetFailureReason
Arc::DataPoint, 42
GetPoint
Arc::DataHandle, 25
GetValid
Arc::FileCache, 82

InconsistentMetadataError
Arc::DataStatus, 74
INFO_TYPE_ACCESS
Arc::DataPoint, 39
INFO_TYPE_ALL
Arc::DataPoint, 39
INFO_TYPE_CONTENT
Arc::DataPoint, 39
INFO_TYPE_MINIMAL
Arc::DataPoint, 39
INFO_TYPE_NAME
Arc::DataPoint, 39
INFO_TYPE_REST
Arc::DataPoint, 39
INFO_TYPE_STRUCT
Arc::DataPoint, 39
INFO_TYPE_TIMES
Arc::DataPoint, 39
INFO_TYPE_TYPE
Arc::DataPoint, 39
is_notwritten
Arc::DataBuffer, 19
is_read
Arc::DataBuffer, 20
is_written
Arc::DataBuffer, 20
IsReadingError
Arc::DataStatus, 74
IsWritingError
Arc::DataStatus, 74

Link
Arc::FileCache, 82
List
Arc::DataPoint, 42
ListError
Arc::DataStatus, 74
ListErrorRetryable
Arc::DataStatus, 75
ListNonDirError
Arc::DataStatus, 74

local
Arc::URLMap, 90
LocationAlreadyExistsError
Arc::DataStatus, 74

map
Arc::URLMap, 90

NextLocation
Arc::DataPoint, 42
Arc::DataPointDirect, 54
Arc::DataPointIndex, 62
NoLocationError
Arc::DataStatus, 74
NotInitializedError
Arc::DataStatus, 74
NotSupportedForDirectDataPointsError
Arc::DataStatus, 74

operator<<
data, 11
operator=
Arc::DataStatus, 76

Passive
Arc::DataPoint, 42
Arc::DataPointDirect, 54
Arc::DataPointIndex, 63
PostRegister
Arc::DataPoint, 42
Arc::DataPointDirect, 54
PostRegisterError
Arc::DataStatus, 73
PostRegisterErrorRetryable
Arc::DataStatus, 75
PrepareReading
Arc::DataPoint, 43
Arc::DataPointIndex, 63
PrepareWriting
Arc::DataPoint, 43
Arc::DataPointIndex, 63
PreRegister
Arc::DataPoint, 44
Arc::DataPointDirect, 55
PreRegisterError
Arc::DataStatus, 73
PreRegisterErrorRetryable
Arc::DataStatus, 75
PreUnregister
Arc::DataPoint, 44
Arc::DataPointDirect, 55

Range
Arc::DataPoint, 44
Arc::DataPointDirect, 55
Arc::DataPointIndex, 64
ReadAcquireError
Arc::DataStatus, 73
ReadAcquireErrorRetryable
Arc::DataStatus, 74
ReadError
Arc::DataStatus, 73
ReadErrorRetryable
Arc::DataStatus, 75
ReadFinishError
Arc::DataStatus, 74
ReadFinishErrorRetryable
Arc::DataStatus, 75
ReadOutOfOrder
Arc::DataPoint, 45
Arc::DataPointDirect, 56
Arc::DataPointIndex, 64
ReadPrepareError
Arc::DataStatus, 74
ReadPrepareErrorRetryable
Arc::DataStatus, 75
ReadPrepareWait
Arc::DataStatus, 74
ReadResolveError
Arc::DataStatus, 73
ReadResolveErrorRetryable
Arc::DataStatus, 74
ReadStartError
Arc::DataStatus, 73
ReadStartErrorRetryable
Arc::DataStatus, 74
ReadStopError
Arc::DataStatus, 73
ReadStopErrorRetryable
Arc::DataStatus, 75
Release
Arc::FileCache, 83
Rename
Arc::DataPoint, 45
RenameError
Arc::DataStatus, 74
RenameErrorRetryable
Arc::DataStatus, 76
Resolve
Arc::DataPoint, 45
Arc::DataPointDirect, 56
Retryable
Arc::DataStatus, 76

set
Arc::DataBuffer, 21
set_default_max_inactivity_time
Arc::DataMover, 28
set_default_min_average_speed

Arc::DataMover, 28
set_default_min_speed
Arc::DataMover, 28
set_max_inactivity_time
Arc::DataSpeed, 69
set_min_average_speed
Arc::DataSpeed, 69
set_min_speed
Arc::DataSpeed, 69
set_preferred_pattern
Arc::DataMover, 28
set_progress_indicator
Arc::DataSpeed, 70
SetAdditionalChecks
Arc::DataPoint, 46
Arc::DataPointDirect, 56
Arc::DataPointIndex, 64
SetMeta
Arc::DataPoint, 46
SetSecure
Arc::DataPoint, 46
Arc::DataPointDirect, 56
Arc::DataPointIndex, 64
SetURL
Arc::DataPoint, 46
SetValid
Arc::FileCache, 83
show_progress_t
Arc::DataSpeed, 68
SortLocations
Arc::DataPoint, 47
Arc::DataPointDirect, 57
Arc::DataPointIndex, 65
StageError
Arc::DataStatus, 74
StageErrorRetryable
Arc::DataStatus, 75
Start
Arc::FileCache, 83
StartReading
Arc::DataPoint, 47
Arc::DataPointIndex, 65
StartWriting
Arc::DataPoint, 47
Arc::DataPointIndex, 65
Stat
Arc::DataPoint, 48
StatError
Arc::DataStatus, 74
StatErrorRetryable
Arc::DataStatus, 75
StatNotPresentError
Arc::DataStatus, 74
Stop
Arc::FileCache, 83
StopAndDelete
Arc::FileCache, 84
StopReading
Arc::DataPoint, 48
Arc::DataPointIndex, 66
StopWriting
Arc::DataPoint, 49
Arc::DataPointIndex, 66
Success
Arc::DataStatus, 73
SuccessCached
Arc::DataStatus, 74
SuccessCancelled
Arc::DataStatus, 74
SystemError
Arc::DataStatus, 74

Transfer
Arc::DataMover, 29
transfer
Arc::DataSpeed, 70
Transfer3rdParty
Arc::DataPoint, 49
TransferError
Arc::DataStatus, 73
TransferErrorRetryable
Arc::DataStatus, 75
TransferLocations
Arc::DataPoint, 49
Arc::DataPointIndex, 66
Type
Arc::FileInfo, 88

UnimplementedError
Arc::DataStatus, 74
UnknownError
Arc::DataStatus, 74
Unregister
Arc::DataPoint, 50
Arc::DataPointDirect, 57
UnregisterError
Arc::DataStatus, 73
UnregisterErrorRetryable
Arc::DataStatus, 75

verbose
Arc::DataMover, 30

wait_any
Arc::DataBuffer, 21
wait_for_read
Arc::DataBuffer, 21
wait_for_write

Arc::DataBuffer, 21
wait_used
Arc::DataBuffer, 22
WriteAcquireError
Arc::DataStatus, 73
WriteAcquireErrorRetryable
Arc::DataStatus, 74
WriteError
Arc::DataStatus, 73
WriteErrorRetryable
Arc::DataStatus, 75
WriteFinishError
Arc::DataStatus, 74
WriteFinishErrorRetryable
Arc::DataStatus, 75
WritePrepareError
Arc::DataStatus, 74
WritePrepareErrorRetryable
Arc::DataStatus, 75
WritePrepareWait
Arc::DataStatus, 74
WriteResolveError
Arc::DataStatus, 73
WriteResolveErrorRetryable
Arc::DataStatus, 74
WriteStartError
Arc::DataStatus, 73
WriteStartErrorRetryable
Arc::DataStatus, 75
WriteStopError
Arc::DataStatus, 73
WriteStopErrorRetryable
Arc::DataStatus, 75