

MVCommon

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Chapter 1

Mantis Vision: MVCommon

A collection of common utilities and services.

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Supported Platforms

Currently the module is ported to these platforms:

- Windows (x64),
- Linux (x64, arm64)
- MacOS (x64),
- Android (armeabi-v7a, arm64-v8a),
- iOS (arm64) and
- LuminOS.

Chapter 2

Release Notes

1.2.0

Initial version (as extracted from Mvx2 framework)

Module

- **1.2.0_M1** | introduced versioning to MVCommon libraries (in the form of [MVCommon::VersionInfo](#) class and [MVCommonVersion.h](#) file)
- **1.2.0_M2** | added [CUtil.h](#) file with C preprocessor utility macros

Build support

- **1.2.0_BS1** | added MVCommon's own MVCommonConfig.cmake file for cmake support
- **1.2.0_BS2** | added MVCommonNet's own MVCommonNetConfig.cmake and MVCommonNet_iOSConfig.cmake files for cmake support

Documentation

- **1.2.0_D1** | added MVCommon's own 'release notes' section to its documentation
- **1.2.0_D2** | switched documentation from xml-style comments to doxygen-style comments

2.0.0

Module

- **2.0.0_M1** | made default constructor and destructor of `NonAssignable` class protected, as there shall not exist objects of `NonAssignable` class itself
- **2.0.0_M2** | updated `libjpeg-turbo` 3rdparty dependency to version 2.0.2

Build support

- **2.0.0_BS1** | Android and LuminOS libraries size reduced by ~90%
- **2.0.0_BS2** | android API level raised from 19 to 21
- **2.0.0_BS3** | Linux and MacOS binaries do not consist of a versioned library file and a version-neutral symlink file anymore - the library file itself has version-neutral name

3.0.0

Module

- **3.0.0_M1** | introduced a protected `MVCommon::NativeObjectHolder::m_nativeObjectLock` field into the `MVCommon::NativeObjectHolder` instances in `MVCommonNet` to allow its derivatives to lock the held native object during asynchronous operations on them
- **3.0.0_M2** | fixed a bug of `MVCommon::NetLoggerSink` in `MVCommonNet` which prevented parallel logging via `.Net` sinks
- **3.0.0_M3** | fixed `MVCommon::BlockingCounter::WaitUntilValue()` and `MVCommon::BlockingCounter::WaitUntilValueFor()` which could miss a target counter value in case the counter's value was repeatedly updated too fast, and thus not ending the waiting
- **3.0.0_M4** | extended `MVCommon::BlockingCounter` with a support for blocking the execution until an arbitrary condition on the counter's value is passed:
 - introduced interface `MVCommon::IBlockingCounterCondition` and its derivative `MVCommon::BlockingCounterValueEquals`
 - introduced `MVCommon::BlockingCounter::WaitUntil()` and `MVCommon::BlockingCounter::WaitUntilFor()` functions,
 - introduced `MVCommon::NetBlockingCounterCondition` into `MVCommonNet`
- **3.0.0_M5** | refactored `MVCommon::ThreadPool` :
 - moved and renamed the `MVCommon/legacy/MVCommon/concurrency/ThreadPool.hpp` header file to `MVCommon/utils/threadpool/ThreadPool.h`,
 - replaced the `MVCommon::ThreadPool::Job` signature of jobs by an `MVCommon::IThreadPoolJob` interface,
 - introduced an `MVCommon::ThreadPool::WaitForAnUnoccupiedThread()` function,
 - refactored the implementation to support the new features,
 - introduced a `.Net` version of `MVCommon::ThreadPool` into `MVCommonNet`,
 - added a documentation section for the API
- **3.0.0_M6** | fixed `MVCommon::FileHelper::OpenFileReadOnly()` and `MVCommon::FileHelper::OpenFileForWriting()` utility functions which prevented concurrent reading from a file that is already open for writing or reading (affects only windows)

Build support

- **3.0.0_BS1** | CMake minimal required version increased from 3.9 to 3.14
 - updated `MVCommonConfig.cmake`, `MVCommonNetConfig.cmake` and `MVCommonNet_iOSConfig.cmake` scripts and their dependencies

4.0.0

Module

- **4.0.0_M1** | upgraded multiple internal dependencies with possible effect on:
 - [MVCommon::GuidAliasDatabase](#)
 - [MVCommon::Logger](#) and [MVCommon::ILoggerSink](#)
 - [MVCommon::FileHelper](#)

Build support

- **4.0.0_BS1** | from now on the windows libraries are compiled using msvc compiler version 142 (VS 2019)
- **4.0.0_BS2** | upgraded `cmake/toolchains/ios.cmake` toolchain file used for building for iOS platform

Documentation

- **4.0.0_D1** | introduced PDF documentation as an alternative to the HTML one:
 - `doc/MVCommon.pdf`
 - `doc/MVCommonNet.pdf`

Chapter 3

Hierarchical Index

3.1 Class Hierarchy

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

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public/MVCommon/logger/sinks/AppleSystemLoggerSink.h	??
public/MVCommon/logger/sinks/FileLoggerSink.h	??
public/MVCommon/logger/sinks/RedirectingLoggerSink.h	??
public/MVCommon/logger/sinks/StdOutLoggerSink.h	??
public/MVCommon/math/Math.h	??
public/MVCommon/math/Matrix4x4d.h	??
public/MVCommon/math/Matrix4x4f.h	??
public/MVCommon/math/Vector2d.h	??
public/MVCommon/math/Vector2f.h	??
public/MVCommon/math/Vector3d.h	??
public/MVCommon/math/Vector3f.h	??
public/MVCommon/math/Vector4d.h	??
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public/MVCommon/utils/threadpool/ SharedThreadPoolJobPtr.h	??
public/MVCommon/utils/threadpool/ ThreadPool.h	??

Chapter 6

Data Structure Documentation

6.1 MVCommon::AndroidSystemLoggerSink Class Reference

A logger sink implementation for logging log messages via Android system logging facility.

```
#include <AndroidSystemLoggerSink.h>
```

Inherits [MVCommon::ILoggerSink](#).

Public Member Functions

- MVCOMMON_API [AndroidSystemLoggerSink](#) ([LoggerLogLevel](#) logLevel=LoggerLogLevel::LLL_VERBOSE)
A constructor.
- MVCOMMON_API [~AndroidSystemLoggerSink](#) ()
A destructor.

Protected Member Functions

- virtual void [HandleLogEntry](#) ([LogEntry](#) const &logEntry) override
A callback executed when a new log entry is added.

Additional Inherited Members

6.1.1 Detailed Description

A logger sink implementation for logging log messages via Android system logging facility.

In case the sink is instantiated on a non-Android platform, log messages are not handled at all.

6.1.2 Constructor & Destructor Documentation

6.1.2.1 AndroidSystemLoggerSink()

```
MVCOMMON_API MVCommon::AndroidSystemLoggerSink::AndroidSystemLoggerSink (  
    LoggerLogLevel logLevel = LoggerLogLevel::LLL\_VERBOSE )
```

A constructor.

Parameters

<i>logLevel</i>	an initial log level (default value -> all log messages are processed)
-----------------	--

6.1.3 Member Function Documentation**6.1.3.1 HandleLogEntry()**

```
virtual void MVCommon::AndroidSystemLoggerSink::HandleLogEntry (
    LogEntry const & logEntry ) [override], [protected], [virtual]
```

A callback executed when a new log entry is added.

Parameters

<i>logEntry</i>	a new log entry
-----------------	-----------------

Implements [MVCommon::ILoggerSink](#).

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

- public/MVCommon/logger/sinks/AndroidSystemLoggerSink.h

6.2 MVCommon::AppleSystemLoggerSink Class Reference

A logger sink implementation for logging log messages via Apple system logging facility.

```
#include <AppleSystemLoggerSink.h>
```

Inherits [MVCommon::ILoggerSink](#).

Public Member Functions

- MVCOMMON_API [AppleSystemLoggerSink](#) ([LoggerLogLevel](#) logLevel=LoggerLogLevel::LLL_VERBOSE)
A constructor.
- MVCOMMON_API [~AppleSystemLoggerSink](#) ()
A destructor.

Protected Member Functions

- virtual void [HandleLogEntry](#) ([LogEntry](#) const &logEntry) override
A callback executed when a new log entry is added.

Additional Inherited Members

6.2.1 Detailed Description

A logger sink implementation for logging log messages via Apple system logging facility.

In case the sink is instantiated on a non-Apple platform (MacOS, iOS, ...), log messages are not handled at all.

6.2.2 Constructor & Destructor Documentation

6.2.2.1 AppleSystemLoggerSink()

```
MVCOMMON_API MVCommon::AppleSystemLoggerSink::AppleSystemLoggerSink (
    LoggerLogLevel logLevel = LoggerLogLevel::LLL\_VERBOSE )
```

A constructor.

Parameters

<i>logLevel</i>	an initial log level (default value -> all log messages are processed)
-----------------	--

6.2.3 Member Function Documentation

6.2.3.1 HandleLogEntry()

```
virtual void MVCommon::AppleSystemLoggerSink::HandleLogEntry (
    LogEntry const & logEntry ) [override], [protected], [virtual]
```

A callback executed when a new log entry is added.

Parameters

<i>logEntry</i>	a new log entry
-----------------	-----------------

Implements [MVCommon::ILoggerSink](#).

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

- public/MVCommon/logger/sinks/AppleSystemLoggerSink.h

6.3 MVCommon::BlockingCounter Class Reference

A counter with a feature of blocking a thread until the counter has a specific value.

```
#include <BlockingCounter.h>
```

Inherits NonAssignable.

Public Member Functions

- MVCOMMON_API [BlockingCounter](#) (int32_t initialValue=0, int32_t waitersCountHint=1)
A constructor.
- MVCOMMON_API [~BlockingCounter](#) ()
A destructor.
- MVCOMMON_API void [Increment](#) (int32_t change=1)
Increments the counter by a given value.
- MVCOMMON_API int32_t [Value](#) () const
Gets current value of the counter.
- MVCOMMON_API int32_t [WaitUntilValue](#) (int32_t targetValue) const
Blocks current thread until the counter reaches given value.
- MVCOMMON_API int32_t [WaitUntilValueFor](#) (int32_t targetValue, uint64_t milliseconds) const
Blocks current thread until the counter reaches given value or until a timeout expires.
- MVCOMMON_API int32_t [WaitUntil](#) (IBlockingCounterCondition &condition) const
Blocks current thread until the counter's value is accepted by a condition.
- MVCOMMON_API int32_t [WaitUntilFor](#) (IBlockingCounterCondition &condition, uint64_t milliseconds) const
Blocks current thread until the counter's value is accepted by a condition or until a timeout expires.
- MVCOMMON_API [BlockingCounter](#) & [operator+=](#) (int32_t change)
Increments the counter by a given value.

6.3.1 Detailed Description

A counter with a feature of blocking a thread until the counter has a specific value.

6.3.2 Constructor & Destructor Documentation

6.3.2.1 BlockingCounter()

```
MVCOMMON_API MVCommon::BlockingCounter::BlockingCounter (
    int32_t initialValue = 0,
    int32_t waitersCountHint = 1 )
```

A constructor.

Parameters

<i>initialValue</i>	an initial value of the counter
<i>waitersCountHint</i>	a hint about expected count of waiting threads - it allows an optimization of internal memory allocations made per each waiting call in cases when count of parallel waiters can be predicted. Special value 0 will result in allocations made every time, and <code>negative</code> hint value results in no deallocations (and thus maximum reusability of the memory) during the entire lifetime of the counter.

6.3.3 Member Function Documentation

6.3.3.1 Increment()

```
MVCOMMON_API void MVCommon::BlockingCounter::Increment (
    int32_t change = 1 )
```

Increments the counter by a given value.

Parameters

<i>change</i>	a change to increase the counter's value by (may be negative)
---------------	---

6.3.3.2 operator+=()

```
MVCOMMON_API BlockingCounter& MVCommon::BlockingCounter::operator+= (
    int32_t change )
```

Increments the counter by a given value.

Parameters

<i>change</i>	a change to increase the counter's value by (may be negative)
---------------	---

Returns

this counter

6.3.3.3 Value()

```
MVCOMMON_API int32_t MVCommon::BlockingCounter::Value ( ) const
```

Gets current value of the counter.

Returns

counter's value

6.3.3.4 WaitUntil()

```
MVCOMMON_API int32_t MVCommon::BlockingCounter::WaitUntil (
    IBlockingCounterCondition & condition ) const
```

Blocks current thread until the counter's value is accepted by a condition.

Parameters

<i>condition</i>	a condition that must pass in order to unblock the thread
------------------	---

Returns

the value which was accepted by the condition

6.3.3.5 WaitUntilFor()

```
MVCOMMON_API int32_t MVCommon::BlockingCounter::WaitUntilFor (
    IBlockingCounterCondition & condition,
    uint64_t milliseconds ) const
```

Blocks current thread until the counter's value is accepted by a condition or until a timeout expires.

Parameters

<i>condition</i>	a condition that must pass in order to unblock the thread
<i>milliseconds</i>	a timeout (in milliseconds) after which the current thread is unblocked at the latest

Returns

the value accepted by the condition when the counter reaches it before the timeout expires, current counter's value otherwise

6.3.3.6 WaitUntilValue()

```
MVCOMMON_API int32_t MVCommon::BlockingCounter::WaitUntilValue (
    int32_t targetValue ) const
```

Blocks current thread until the counter reaches given value.

Parameters

<i>targetValue</i>	a value the counter has to reach in order to unblock the thread
--------------------	---

Returns

the target value

6.3.3.7 WaitUntilValueFor()

```
MVCOMMON_API int32_t MVCommon::BlockingCounter::WaitUntilValueFor (
    int32_t targetValue,
    uint64_t milliseconds ) const
```

Blocks current thread until the counter reaches given value or until a timeout expires.

Parameters

<i>targetValue</i>	a value the counter has to reach in order to unblock the thread
<i>milliseconds</i>	a timeout (in milliseconds) after which the current thread is unblocked at the latest

Returns

the target value when the counter reaches it before the timeout expires, current counter's value otherwise

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

- public/MVCommon/utils/blockingcounter/BlockingCounter.h

6.4 MVCommon::BlockingCounterValueEquals Class Reference

A counter condition for checking equality of its value with a target value.

```
#include <BlockingCounterValueEquals.h>
```

Inherits [MVCommon::IBlockingCounterCondition](#).

Public Member Functions

- MVCOMMON_API [BlockingCounterValueEquals](#) (int32_t targetValue)
A constructor.
- virtual MVCOMMON_API bool [operator\(\)](#) (int32_t value) override
An operator executed for checking the condition with a value.

6.4.1 Detailed Description

A counter condition for checking equality of its value with a target value.

6.4.2 Constructor & Destructor Documentation

6.4.2.1 BlockingCounterValueEquals()

```
MVCOMMON_API MVCommon::BlockingCounterValueEquals::BlockingCounterValueEquals (
    int32_t targetValue )
```

A constructor.

Parameters

<i>targetValue</i>	a target value
--------------------	----------------

6.4.3 Member Function Documentation

6.4.3.1 operator>()

```
virtual MVCOMMON_API bool MVCommon::BlockingCounterValueEquals::operator() (
    int32_t value ) [override], [virtual]
```

An operator executed for checking the condition with a value.

Parameters

<i>value</i>	a value the condition is checked with
--------------	---------------------------------------

Returns

true in case the value is equal to the target value, false otherwise

Implements [MVCommon::IBlockingCounterCondition](#).

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

- public/MVCommon/utils/blockingcounter/BlockingCounterValueEquals.h

6.5 MVCommon::ByteArray Class Reference

An array of bytes.

```
#include <ByteArray.h>
```

Public Member Functions

- MVCOMMON_API [ByteArray](#) ()
A constructor.
- MVCOMMON_API [ByteArray](#) (uint8_t const *data, size_t size)
A constructor.
- MVCOMMON_API [ByteArray](#) (uint8_t byte, size_t count=1)
A constructor.
- MVCOMMON_API [ByteArray](#) ([ByteArray](#) const &other)
A copy constructor.
- MVCOMMON_API [ByteArray](#) ([ByteArray](#) &&other)
A move constructor.
- MVCOMMON_API [~ByteArray](#) ()
A destructor.
- MVCOMMON_API const uint8_t * [Data](#) () const
Gets a pointer to the array's internal continuous memory.
- MVCOMMON_API size_t [Size](#) () const
Gets size of the array.
- MVCOMMON_API void [Clear](#) ()
Empties the array.
- MVCOMMON_API [ByteArray](#) & [Push](#) ([ByteArray](#) const &other)
Pushes another array of bytes to the end of this array.
- MVCOMMON_API [ByteArray](#) & [Push](#) (uint8_t byte, size_t count=1)
Pushes an array of the same byte to the end of this array.
- MVCOMMON_API [ByteArray](#) & [Push](#) (uint8_t const *data, size_t size)
Pushes data to the end of this array.
- MVCOMMON_API uint8_t [Pop](#) ()
Pops and removes a single byte from the front of the array.
- MVCOMMON_API [ByteArray](#) [Pop](#) (size_t count)
Pops an array of bytes from the front of the array.
- MVCOMMON_API void [Skip](#) (size_t count=1)
Skips an array of bytes from the front of the array.
- MVCOMMON_API [ByteArray](#) [Subarray](#) (size_t startPos=0, size_t count=1)
Creates a subarray of bytes from the array, not removing the bytes from the original array.
- MVCOMMON_API uint8_t & [operator\[\]](#) (size_t pos)
Accesses a specific byte in the array.
- MVCOMMON_API const uint8_t & [operator\[\]](#) (size_t pos) const
Accesses a specific byte in the array.
- MVCOMMON_API [ByteArray](#) & [operator=](#) ([ByteArray](#) other)
An assignment operator.
- MVCOMMON_API [ByteArray](#) & [operator<<=](#) ([ByteArray](#) const &other)
Pushes another array of bytes to the end of this array.
- MVCOMMON_API [ByteArray](#) & [operator<<=](#) (uint8_t byte)
Pushes a byte to the end of this array.
- MVCOMMON_API [ByteArray](#) & [operator>>=](#) (uint8_t &byte)
Extracts a byte from the front of the array.

6.5.1 Detailed Description

An array of bytes.

The implementation maintains a continuous array (vector) of bytes (`uint8_t`), which is resized when necessary and under specific conditions for maximum efficiency. The array provides operations for pushing bytes to the end of the array and for popping them from the array's front, behaving thus like a queue. The difference from `std::queue` is that the array's internal storage is continuous.

6.5.2 Constructor & Destructor Documentation

6.5.2.1 `ByteArray()` [1/5]

```
MVCOMMON_API MVCommon::ByteArray::ByteArray ( )
```

A constructor.

Creates an empty array of bytes.

6.5.2.2 `ByteArray()` [2/5]

```
MVCOMMON_API MVCommon::ByteArray::ByteArray (
    uint8_t const * data,
    size_t size )
```

A constructor.

Parameters

<i>data</i>	a pointer to data to initialize the array with
<i>size</i>	a size of the data to initialize the array with

Creates an array of bytes initialized with the given data.

6.5.2.3 `ByteArray()` [3/5]

```
MVCOMMON_API MVCommon::ByteArray::ByteArray (
    uint8_t byte,
    size_t count = 1 )
```

A constructor.

Parameters

<i>byte</i>	a byte to initialize the array with
<i>count</i>	a count of bytes to initialize the array with

Creates an array of bytes containing the given amount of the same byte.

6.5.2.4 ByteArray() [4/5]

```
MVCOMMON_API MVCommon::ByteArray::ByteArray (
    ByteArray const & other )
```

A copy constructor.

Parameters

<i>other</i>	an array to make a copy of
--------------	----------------------------

6.5.2.5 ByteArray() [5/5]

```
MVCOMMON_API MVCommon::ByteArray::ByteArray (
    ByteArray && other )
```

A move constructor.

Parameters

<i>other</i>	an array to move
--------------	------------------

6.5.3 Member Function Documentation

6.5.3.1 Data()

```
MVCOMMON_API const uint8_t* MVCommon::ByteArray::Data ( ) const
```

Gets a pointer to the array's internal continuous memory.

Returns

a pointer to the array's memory

The call may return different pointers at different times, for example when some bytes were already popped. The returned pointer always points to the next byte that would be popped if such a call took place.

6.5.3.2 operator<<=() [1/2]

```
MVCOMMON_API ByteArray& MVCommon::ByteArray::operator<<= (
    ByteArray const & other )
```

Pushes another array of bytes to the end of this array.

Parameters

<i>other</i>	an array to push to this array
--------------	--------------------------------

Returns

this array

6.5.3.3 operator<<=() [2/2]

```
MVCOMMON_API ByteArray& MVCommon::ByteArray::operator<<= (
    uint8_t byte )
```

Pushes a byte to the end of this array.

Parameters

<i>byte</i>	a byte to push
-------------	----------------

Returns

this array

6.5.3.4 operator=()

```
MVCOMMON_API ByteArray& MVCommon::ByteArray::operator= (
    ByteArray other )
```

An assignment operator.

Replaces the array's content by a copy of another array's content.

Parameters

<i>other</i>	an array to copy the content from
--------------	-----------------------------------

Returns

this array

6.5.3.5 operator>>=()

```
MVCOMMON_API ByteArray& MVCommon::ByteArray::operator>>= (
    uint8_t & byte )
```

Extracts a byte from the front of the array.

Parameters

<i>byte</i>	a reference to byte to extract into
-------------	-------------------------------------

Returns

this array

Exceptions

<i>std::runtime_error</i>	raised when there are no data available in the array
---------------------------	--

6.5.3.6 operator[]() [1/2]

```
MVCOMMON_API uint8_t& MVCommon::ByteArray::operator[] (
    size_t pos )
```

Accesses a specific byte in the array.

Parameters

<i>pos</i>	an index of the byte to access
------------	--------------------------------

Returns

a reference to the byte of the array

No bounds checking is performed.

6.5.3.7 operator[]() [2/2]

```
MVCOMMON_API const uint8_t& MVCommon::ByteArray::operator[] (
    size_t pos ) const
```

Accesses a specific byte in the array.

Parameters

<i>pos</i>	an index of the byte to access
------------	--------------------------------

Returns

a reference to the byte of the array

No bounds checking is performed.

6.5.3.8 Pop() [1/2]

```
MVCOMMON_API uint8_t MVCommon::ByteArray::Pop ( )
```

Pops and removes a single byte from the front of the array.

Returns

the front byte

Exceptions

<code>std::runtime_error</code>	raised when there are no data available in the array
---------------------------------	--

6.5.3.9 Pop() [2/2]

```
MVCOMMON_API ByteArray MVCommon::ByteArray::Pop (
    size_t count )
```

Pops an array of bytes from the front of the array.

Parameters

<code>count</code>	a count of bytes to pop
--------------------	-------------------------

Returns

the array of bytes popped from the front

The call always succeeds, even when there is not enough bytes in the array. The returned array will in such case contain less bytes than requested.

6.5.3.10 Push() [1/3]

```
MVCOMMON_API ByteArray& MVCommon::ByteArray::Push (
    ByteArray const & other )
```

Pushes another array of bytes to the end of this array.

Parameters

<i>other</i>	an array to push to this array
--------------	--------------------------------

Returns

this array

6.5.3.11 Push() [2/3]

```
MVCOMMON_API ByteArray& MVCommon::ByteArray::Push (
    uint8_t byte,
    size_t count = 1 )
```

Pushes an array of the same byte to the end of this array.

Parameters

<i>byte</i>	a byte to push
<i>count</i>	a count of bytes to push

Returns

this array

6.5.3.12 Push() [3/3]

```
MVCOMMON_API ByteArray& MVCommon::ByteArray::Push (
    uint8_t const * data,
    size_t size )
```

Pushes data to the end of this array.

Parameters

<i>data</i>	a pointer to data to push
<i>size</i>	a size of the data to push

Returns

this array

6.5.3.13 Size()

```
MVCOMMON_API size_t MVCommon::ByteArray::Size ( ) const
```

Gets size of the array.

Returns

array's size

6.5.3.14 Skip()

```
MVCOMMON_API void MVCommon::ByteArray::Skip (
    size_t count = 1 )
```

Skips an array of bytes from the front of the array.

Parameters

<i>count</i>	a count of bytes to skip
--------------	--------------------------

The call always succeeds, even when there is not enough bytes in the array.

6.5.3.15 Subarray()

```
MVCOMMON_API ByteArray MVCommon::ByteArray::Subarray (
    size_t startPos = 0,
    size_t count = 1 )
```

Creates a subarray of bytes from the array, not removing the bytes from the original array.

Parameters

<i>startPos</i>	a position of the first byte
<i>count</i>	a count of bytes

Returns

the subarray of bytes

The call always succeeds, even when there is not enough bytes in the original array or when the starting position is outside of the valid range. The returned array will in such case contain less bytes than requested or even no bytes at all.

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

- public/MVCommon/utils/ByteArray.h

6.6 MVCommon::ByteArrayHasher Struct Reference

A hasher for [ByteArray](#) objects so they can be used in unordered collections.

```
#include <ByteArray.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([ByteArray](#) const &byteArray) const
Calculates a hash value from the object.

6.6.1 Detailed Description

A hasher for [ByteArray](#) objects so they can be used in unordered collections.

6.6.2 Member Function Documentation

6.6.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::ByteArrayHasher::operator() (
    ByteArray const & byteArray ) const
```

Calculates a hash value from the object.

Parameters

<i>byteArray</i>	an object to calculate the hash value of
------------------	--

Returns

hash value of the object

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

- public/MVCommon/Utils/ByteArray.h

6.7 MVCommon::CameraParams Struct Reference

A data structure containing intrinsic and extrinsic parameters of cameras.

```
#include <CameraParams.h>
```

Public Member Functions

- MVCOMMON_API [CameraParams](#) (uint32_t width=0, uint32_t height=0, [Vector2f](#) F=[Vector2f](#)(1.0f, 1.0f))
A constructor.
- MVCOMMON_API [~CameraParams](#) ()
A destructor.
- MVCOMMON_API [String ToString](#) () const
Converts the camera params into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the camera params into a byte array.
- MVCOMMON_API void [NormalizePoint](#) ([Vector2f](#) &point) const
Normalizes a point coordinates using focal lengths and principal point offsets of camera.
- MVCOMMON_API void [NormalizePoint](#) ([Vector3f](#) &point) const
Normalizes a point x and y coordinates using focal lengths and principal point offsets of camera.
- MVCOMMON_API void [DenormalizePoint](#) ([Vector2f](#) &point) const
Denormalizes a point coordinates using focal lengths and principal point offsets of camera.
- MVCOMMON_API void [DenormalizePoint](#) ([Vector3f](#) &point) const
Denormalizes a point x and y coordinates using focal lengths and principal point offsets of camera.
- MVCOMMON_API void [UndistortPoint](#) ([Vector2f](#) &point) const
Transforms a point coordinates to compensate camera lens distortion.
- MVCOMMON_API void [UndistortPoint](#) ([Vector3f](#) &point) const
Transforms a point x and y coordinates to compensate camera lens distortion.
- MVCOMMON_API [CameraParams ScaleToResolution](#) (uint32_t targetWidth, uint32_t targetHeight) const
Creates a new camera params with focal lengths and principal point offsets scaled for a target resolution.

Static Public Member Functions

- static MVCOMMON_API [CameraParams FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes camera params from a byte array.

Data Fields

- uint32_t [width](#)
A width (in pixels).
- uint32_t [height](#)
A height (in pixels).
- [Vector2f](#) [F](#)
Focal lengths (in pixels) in x and y directions.
- [Vector2f](#) [C](#)
Principal point offsets (in pixels) in x and y directions.
- [Vector2f](#) [distortionC](#)
Principal point offsets for distortion operations (in pixels) in x and y directions.
- float [distortion](#) [5]
Distortion coefficients.
- [Vector3f](#) [translation](#)
Translation offset of the origin in the camera's coordinate system.
- [Matrix4x4f](#) [rotation](#)
Rotation matrix offset of the origin in the camera's coordinate system.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the camera params requires in a serialized form.

6.7.1 Detailed Description

A data structure containing intrinsic and extrinsic parameters of cameras.

6.7.2 Constructor & Destructor Documentation

6.7.2.1 CameraParams()

```
MVCOMMON_API MVCommon::CameraParams::CameraParams (
    uint32_t width = 0,
    uint32_t height = 0,
    Vector2f F = Vector2f(1.0f, 1.0f) )
```

A constructor.

Parameters

<i>width</i>	a width (in pixels)
<i>height</i>	a height (in pixels)
<i>F</i>	focal lengths (in pixels) in x and y directions

Constructs the camera params with default values - principal point offsets equal to [width/2, height/2], and distortion, translation and rotation set to identities.

6.7.3 Member Function Documentation

6.7.3.1 DenormalizePoint() [1/2]

```
MVCOMMON_API void MVCommon::CameraParams::DenormalizePoint (
    Vector2f & point ) const
```

Denormalizes a point coordinates using focal lengths and principal point offsets of camera.

Parameters

<i>point</i>	a point to denormalize
--------------	------------------------

6.7.3.2 DenormalizePoint() [2/2]

```
MVCOMMON_API void MVCommon::CameraParams::DenormalizePoint (
    Vector3f & point ) const
```

Denormalizes a point x and y coordinates using focal lengths and principal point offsets of camera.

Parameters

<i>point</i>	a point to denormalize
--------------	------------------------

6.7.3.3 FromRawBytes()

```
static MVCOMMON_API CameraParams MVCommon::CameraParams::FromRawBytes (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Deserializes camera params from a byte array.

Parameters

<i>bytes</i>	an array of camera params bytes
<i>consumeBytes</i>	determines whether bytes of the camera params shall be removed from the array

Returns

camera params

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array
------------------------------	---

6.7.3.4 NormalizePoint() [1/2]

```
MVCOMMON_API void MVCommon::CameraParams::NormalizePoint (
    Vector2f & point ) const
```

Normalizes a point coordinates using focal lengths and principal point offsets of camera.

Parameters

<i>point</i>	a point to normalize
--------------	----------------------

6.7.3.5 NormalizePoint() [2/2]

```
MVCOMMON_API void MVCommon::CameraParams::NormalizePoint (  
    Vector3f & point ) const
```

Normalizes a point x and y coordinates using focal lengths and principal point offsets of camera.

Parameters

<i>point</i>	a point to normalize
--------------	----------------------

6.7.3.6 ScaleToResolution()

```
MVCOMMON_API CameraParams MVCommon::CameraParams::ScaleToResolution (  
    uint32_t targetWidth,  
    uint32_t targetHeight ) const
```

Creates a new camera params with focal lengths and principal point offsets scaled for a target resolution.

Parameters

<i>targetWidth</i>	target width
<i>targetHeight</i>	target height

Returns

a new camera params

Vertical (y) and horizontal (x) elements are scaled independently. Distortion, translation and rotation are preserved in the new camera params.

6.7.3.7 ToRawBytes()

```
MVCOMMON_API void MVCommon::CameraParams::ToRawBytes (  
    ByteArray & bytes ) const
```

Serializes the camera params into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.7.3.8 ToString()

```
MVCOMMON_API String MVCommon::CameraParams::ToString ( ) const
```

Converts the camera params into a human-readable string.

Returns

the camera params string

6.7.3.9 UndistortPoint() [1/2]

```
MVCOMMON_API void MVCommon::CameraParams::UndistortPoint (
    Vector2f & point ) const
```

Transforms a point coordinates to compensate camera lens distortion.

Parameters

<i>point</i>	a point to undistort
--------------	----------------------

6.7.3.10 UndistortPoint() [2/2]

```
MVCOMMON_API void MVCommon::CameraParams::UndistortPoint (
    Vector3f & point ) const
```

Transforms a point x and y coordinates to compensate camera lens distortion.

Parameters

<i>point</i>	a point to undistort
--------------	----------------------

6.7.4 Field Documentation

6.7.4.1 distortionC

```
Vector2f MVCommon::CameraParams::distortionC
```

Principal point offsets for distortion operations (in pixels) in x and y directions.

Its value may be slightly different than the value of [C](#).

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

- public/MVCommon/data/CameraParams.h

6.8 MVCommon::CameraParamsHasher Struct Reference

A hasher for [CameraParams](#) objects so they can be used in unordered collections.

```
#include <CameraParams.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([CameraParams](#) const &cameraParams) const
Calculates a hash value from the object.

6.8.1 Detailed Description

A hasher for [CameraParams](#) objects so they can be used in unordered collections.

6.8.2 Member Function Documentation

6.8.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::CameraParamsHasher::operator() (
    CameraParams const & cameraParams ) const
```

Calculates a hash value from the object.

Parameters

<i>cameraParams</i>	an object to calculate the hash value of
---------------------	--

Returns

hash value of the object

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

- public/MVCommon/data/CameraParams.h

6.9 MVCommon::Color Struct Reference

An RGBA color.

```
#include <Color.h>
```

Public Member Functions

- MVCOMMON_API [Color](#) ()
A constructor of the black color.
- MVCOMMON_API [Color](#) (uint8_t redByte, uint8_t greenByte, uint8_t blueByte, uint8_t alphaByte=255)
A constructor.
- MVCOMMON_API [Color](#) (float red, float green, float blue, float alpha=1.0f)
A constructor.
- MVCOMMON_API [Color](#) ([Vector4f](#) const &color)
A constructor.
- MVCOMMON_API [~Color](#) ()
A destructor.
- MVCOMMON_API [String ToString](#) () const
Converts the color into a human-readable string.
- MVCOMMON_API [String ToRGB_HTMLString](#) () const
Converts the RGB part of the color into a HTML hexadecimal string in format #rrggbb.
- MVCOMMON_API uint8_t [GetRedByte](#) () const
Returns a red element byte value.
- MVCOMMON_API uint8_t [GetGreenByte](#) () const
Returns a green element byte value.
- MVCOMMON_API uint8_t [GetBlueByte](#) () const
Returns a blue element byte value.
- MVCOMMON_API uint8_t [GetAlphaByte](#) () const
Returns an alpha element byte value.
- MVCOMMON_API float [GetRed](#) () const
Returns a red element value in range <0.0, 1.0>.
- MVCOMMON_API float [GetGreen](#) () const
Returns a green element value in range <0.0, 1.0>.
- MVCOMMON_API float [GetBlue](#) () const
Returns a blue element value in range <0.0, 1.0>.
- MVCOMMON_API float [GetAlpha](#) () const
Returns an alpha element value in range <0.0, 1.0>.
- MVCOMMON_API void [SetValue](#) (uint8_t redByte, uint8_t greenByte, uint8_t blueByte, uint8_t alpha↵
Byte=255)
Sets value of the color.
- MVCOMMON_API void [SetValue](#) (float red, float green, float blue, float alpha=1.0f)
Sets value of the color.
- MVCOMMON_API void [SetValue](#) ([Vector4f](#) const &color)
Sets value of the color.
- MVCOMMON_API void [SetRedByte](#) (uint8_t redByte)
Sets red element byte value.
- MVCOMMON_API void [SetGreenByte](#) (uint8_t greenByte)
Sets green element byte value.
- MVCOMMON_API void [SetBlueByte](#) (uint8_t blueByte)
Sets blue element byte value.
- MVCOMMON_API void [SetAlphaByte](#) (uint8_t alphaByte)
Sets alpha element byte value.
- MVCOMMON_API void [SetRed](#) (float red)
Sets red element value in range <0.0, 1.0>.
- MVCOMMON_API void [SetGreen](#) (float green)
Sets green element value in range <0.0, 1.0>.

- MVCOMMON_API void [SetBlue](#) (float blue)
Sets blue element value in range <0.0, 1.0>.
- MVCOMMON_API void [SetAlpha](#) (float alpha)
Sets alpha element value in range <0.0, 1.0>.
- MVCOMMON_API uint8_t [GetRGBBrightnessByte](#) () const
Calculates an RGB brightness byte value of the color.
- MVCOMMON_API float [GetRGBBrightness](#) () const
Calculates an RGB brightness value of the color in range <0.0, 1.0>.

Static Public Member Functions

- static MVCOMMON_API [Color FromString](#) (String const &str)
Creates a color from a human-readable string.

6.9.1 Detailed Description

An RGBA color.

6.9.2 Constructor & Destructor Documentation

6.9.2.1 Color() [1/3]

```
MVCOMMON_API MVCommon::Color::Color (
    uint8_t redByte,
    uint8_t greenByte,
    uint8_t blueByte,
    uint8_t alphaByte = 255 )
```

A constructor.

Parameters

<i>redByte</i>	a red element byte value
<i>greenByte</i>	a green element byte value
<i>blueByte</i>	a blue element byte value
<i>alphaByte</i>	an alpha element byte value

6.9.2.2 Color() [2/3]

```
MVCOMMON_API MVCommon::Color::Color (
    float red,
```

```
float green,
float blue,
float alpha = 1.0f )
```

A constructor.

Parameters

<i>red</i>	a red element value in range <0.0, 1.0>
<i>green</i>	a green element value in range <0.0, 1.0>
<i>blue</i>	a blue element value in range <0.0, 1.0>
<i>alpha</i>	an alpha element value in range <0.0, 1.0>

6.9.2.3 Color() [3/3]

```
MVCOMMON_API MVCommon::Color::Color (
    Vector4f const & color )
```

A constructor.

Parameters

<i>color</i>	a vector containing color element values in range <0.0, 1.0> (x -> red, y -> green, z -> blue, w -> alpha)
--------------	--

6.9.3 Member Function Documentation

6.9.3.1 FromString()

```
static MVCOMMON_API Color MVCommon::Color::FromString (
    String const & str ) [static]
```

Creates a color from a human-readable string.

Parameters

<i>str</i>	a color string
------------	----------------

Returns

a color

6.9.3.2 GetAlpha()

```
MVCOMMON_API float MVCommon::Color::GetAlpha ( ) const
```

Returns an alpha element value in range <0.0, 1.0>.

Returns

an alpha element value

6.9.3.3 GetAlphaByte()

```
MVCOMMON_API uint8_t MVCommon::Color::GetAlphaByte ( ) const
```

Returns an alpha element byte value.

Returns

an alpha element byte value

6.9.3.4 GetBlue()

```
MVCOMMON_API float MVCommon::Color::GetBlue ( ) const
```

Returns a blue element value in range <0.0, 1.0>.

Returns

a blue element value

6.9.3.5 GetBlueByte()

```
MVCOMMON_API uint8_t MVCommon::Color::GetBlueByte ( ) const
```

Returns a blue element byte value.

Returns

a blue element byte value

6.9.3.6 GetGreen()

```
MVCOMMON_API float MVCommon::Color::GetGreen ( ) const
```

Returns a green element value in range <0.0, 1.0>.

Returns

a green element value

6.9.3.7 GetGreenByte()

```
MVCOMMON_API uint8_t MVCommon::Color::GetGreenByte ( ) const
```

Returns a green element byte value.

Returns

a green element byte value

6.9.3.8 GetRed()

```
MVCOMMON_API float MVCommon::Color::GetRed ( ) const
```

Returns a red element value in range <0.0, 1.0>.

Returns

a red element value

6.9.3.9 GetRedByte()

```
MVCOMMON_API uint8_t MVCommon::Color::GetRedByte ( ) const
```

Returns a red element byte value.

Returns

a red element byte value

6.9.3.10 GetRGBBrightness()

```
MVCOMMON_API float MVCommon::Color::GetRGBBrightness ( ) const
```

Calculates an RGB brightness value of the color in range <0.0, 1.0>.

Returns

an RGB brightness value

6.9.3.11 GetRGBBrightnessByte()

```
MVCOMMON_API uint8_t MVCommon::Color::GetRGBBrightnessByte ( ) const
```

Calculates an RGB brightness byte value of the color.

Returns

an RGB brightness byte value

6.9.3.12 SetAlpha()

```
MVCOMMON_API void MVCommon::Color::SetAlpha (
    float alpha )
```

Sets alpha element value in range <0.0, 1.0>.

Parameters

<i>alpha</i>	a new alpha element value
--------------	---------------------------

6.9.3.13 SetAlphaByte()

```
MVCOMMON_API void MVCommon::Color::SetAlphaByte (
    uint8_t alphaByte )
```

Sets alpha element byte value.

Parameters

<i>alphaByte</i>	a new alpha element byte value
------------------	--------------------------------

6.9.3.14 SetBlue()

```
MVCOMMON_API void MVCommon::Color::SetBlue (
    float blue )
```

Sets blue element value in range <0.0, 1.0>.

Parameters

<i>blue</i>	a new blue element value
-------------	--------------------------

6.9.3.15 SetBlueByte()

```
MVCOMMON_API void MVCommon::Color::SetBlueByte (
    uint8_t blueByte )
```

Sets blue element byte value.

Parameters

<i>blueByte</i>	a new blue element byte value
-----------------	-------------------------------

6.9.3.16 SetGreen()

```
MVCOMMON_API void MVCommon::Color::SetGreen (
    float green )
```

Sets green element value in range <0.0, 1.0>.

Parameters

<i>green</i>	a new green element value
--------------	---------------------------

6.9.3.17 SetGreenByte()

```
MVCOMMON_API void MVCommon::Color::SetGreenByte (
    uint8_t greenByte )
```

Sets green element byte value.

Parameters

<i>greenByte</i>	a new green element byte value
------------------	--------------------------------

6.9.3.18 SetRed()

```
MVCOMMON_API void MVCommon::Color::SetRed (
    float red )
```

Sets red element value in range <0.0, 1.0>.

Parameters

<i>red</i>	a new red element value
------------	-------------------------

6.9.3.19 SetRedByte()

```
MVCOMMON_API void MVCommon::Color::SetRedByte (
    uint8_t redByte )
```

Sets red element byte value.

Parameters

<i>redByte</i>	a new red element byte value
----------------	------------------------------

6.9.3.20 SetValue() [1/3]

```
MVCOMMON_API void MVCommon::Color::SetValue (
    float red,
    float green,
    float blue,
    float alpha = 1.0f )
```

Sets value of the color.

Parameters

<i>red</i>	a new red element value in range <0.0, 1.0>
<i>green</i>	a new green element value in range <0.0, 1.0>
<i>blue</i>	a new blue element value in range <0.0, 1.0>
<i>alpha</i>	a new alpha element value in range <0.0, 1.0>

6.9.3.21 SetValue() [2/3]

```
MVCOMMON_API void MVCommon::Color::SetValue (
    uint8_t redByte,
    uint8_t greenByte,
    uint8_t blueByte,
    uint8_t alphaByte = 255 )
```

Sets value of the color.

Parameters

<i>redByte</i>	a new red element byte value
<i>greenByte</i>	a new green element byte value
<i>blueByte</i>	a new blue element byte value
<i>alphaByte</i>	a new alpha element byte value

6.9.3.22 SetValue() [3/3]

```
MVCOMMON_API void MVCommon::Color::SetValue (
    Vector4f const & color )
```

Sets value of the color.

Parameters

<i>color</i>	a vector containing new color element values in range <0.0, 1.0> (x -> red, y -> green, z -> blue, w -> alpha)
--------------	--

6.9.3.23 ToRGB_HTMLString()

```
MVCOMMON_API String MVCommon::Color::ToRGB_HTMLString ( ) const
```

Converts the RGB part of the color into a HTML hexadecimal string in format #rrggbb.

Returns

the RGB HTML hexadecimal string

6.9.3.24 ToString()

```
MVCOMMON_API String MVCommon::Color::ToString ( ) const
```

Converts the color into a human-readable string.

Returns

the color string

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

- public/MVCommon/data/Color.h

6.10 MVCommon::ColorHasher Struct Reference

A hasher for [Color](#) objects so they can be used in unordered collections.

```
#include <Color.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Color](#) const &color) const
Calculates a hash value from the object.

6.10.1 Detailed Description

A hasher for [Color](#) objects so they can be used in unordered collections.

6.10.2 Member Function Documentation

6.10.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::ColorHasher::operator() (
    Color const & color ) const
```

Calculates a hash value from the object.

Parameters

<i>color</i>	an object to calculate the hash value of
--------------	--

Returns

hash value of the object

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

- public/MVCommon/data/Color.h

6.11 MVCommon::FileLoggerSink Class Reference

A logger sink implementation for logging into a file.

```
#include <FileLoggerSink.h>
```

Inherits [MVCommon::ILoggerSink](#).

Public Member Functions

- MVCOMMON_API [FileLoggerSink](#) ([MVCommon::String](#) const &path, [LoggerLogLevel](#) logLevel=LoggerLogLevel::LLL_VERBOSE)
A constructor.
- MVCOMMON_API [~FileLoggerSink](#) ()
A destructor.

Protected Member Functions

- virtual void [HandleLogEntry](#) ([LogEntry](#) const &logEntry) override
A callback executed when a new log entry is added.

Additional Inherited Members

6.11.1 Detailed Description

A logger sink implementation for logging into a file.

6.11.2 Constructor & Destructor Documentation

6.11.2.1 FileLoggerSink()

```
MVCOMMON_API MVCommon::FileLoggerSink::FileLoggerSink (
    MVCommon::String const & path,
    LoggerLogLevel logLevel = LoggerLogLevel::LLL\_VERBOSE )
```

A constructor.

Parameters

<i>path</i>	a path of the file
<i>logLevel</i>	an initial log level (default value -> all log messages are processed)

6.11.3 Member Function Documentation

6.11.3.1 HandleLogEntry()

```
virtual void MVCommon::FileLoggerSink::HandleLogEntry (
    LogEntry const & logEntry ) [override], [protected], [virtual]
```

A callback executed when a new log entry is added.

Parameters

<i>logEntry</i>	a new log entry
-----------------	-----------------

Implements [MVCommon::ILoggerSink](#).

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

- public/MVCommon/logger/sinks/FileLoggerSink.h

6.12 MVCommon::Guid Struct Reference

A globally-unique identifier implementation.

```
#include <Guid.h>
```

Public Member Functions

- MVCOMMON_API [Guid](#) ()
A constructor of a [Guid](#) with all bytes set to 0.
- MVCOMMON_API [Guid](#) ([Guid](#) const &other)
A copy constructor.
- MVCOMMON_API [Guid](#) ([Guid](#) &&other)
A move constructor.
- virtual MVCOMMON_API ~[Guid](#) ()
A destructor.
- MVCOMMON_API [String ToHexString](#) () const
Formats the [Guid](#) to hexadecimal 00000000-0000-0000-0000-000000000000 format.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Formats the [Guid](#) into a raw bytes array.
- MVCOMMON_API void [ToRfc4122](#) ([ByteArray](#) &bytes) const
Formats the [Guid](#) into RFC 4122 format.
- MVCOMMON_API bool [IsNil](#) () const
Checks whether the [Guid](#) is a Nil [Guid](#) (with all bytes set to 0).

Static Public Member Functions

- static MVCOMMON_API [Guid Nil](#) ()
Constructs a new Nil [Guid](#) (with all bytes set to 0).
- static MVCOMMON_API [Guid FromHexString](#) (String const &str)
Parses a string in hexadecimal format 00000000-0000-0000-0000-000000000000 into a [Guid](#).
- static MVCOMMON_API [Guid FromRawBytes](#) (ByteArray &bytes, bool consumeBytes=false)
Constructs a [Guid](#) using a raw bytes array (must contain 16 elements).
- static MVCOMMON_API [Guid FromRfc4122](#) (ByteArray &bytes, bool consumeBytes=false)
Constructs a [Guid](#) using an array of bytes in RFC 4122 format (must contain 16 elements).

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A constant indicating the size of raw bytes of the [Guid](#).
- static const MVCOMMON_API size_t [RFC4122_BYTES_SIZE](#)
A constant indicating the size of bytes in RFC 4122 format of the [Guid](#).

6.12.1 Detailed Description

A globally-unique identifier implementation.

6.12.2 Constructor & Destructor Documentation

6.12.2.1 [Guid\(\)](#) [1/2]

```
MVCOMMON_API MVCommon::Guid::Guid (
    Guid const & other )
```

A copy constructor.

Parameters

<i>other</i>	a Guid to make a copy of
--------------	--

6.12.2.2 [Guid\(\)](#) [2/2]

```
MVCOMMON_API MVCommon::Guid::Guid (
    Guid && other )
```

A move constructor.

Parameters

<i>other</i>	a Guid to move
--------------	--------------------------------

6.12.3 Member Function Documentation

6.12.3.1 FromHexString()

```
static MVCOMMON_API Guid MVCommon::Guid::FromHexString (  
    String const & str ) [static]
```

Parses a string in hexadecimal format 00000000-0000-0000-0000-000000000000 into a [Guid](#).

Parameters

<i>str</i>	a string to parse
------------	-------------------

Returns

a [Guid](#)

The input string must be at least 32 characters long (i.e. 32 hexa characters). It can optionally contain an opening and a closing bracket ('{' and '}') and 4 hyphens on specific positions of the string.

Exceptions

<i>std::invalid_argument</i>	raised when the format of the string is invalid and can not be parsed
------------------------------	---

6.12.3.2 FromRawBytes()

```
static MVCOMMON_API Guid MVCommon::Guid::FromRawBytes (  
    ByteArray & bytes,  
    bool consumeBytes = false ) [static]
```

Constructs a [Guid](#) using a raw bytes array (must contain 16 elements).

Parameters

<i>bytes</i>	an array of 16 bytes
<i>consumeBytes</i>	an indication whether the bytes of the array shall be consumed

Returns

a [Guid](#)

Exceptions

<code>std::invalid_argument</code>	raised when there are not enough bytes in the array
------------------------------------	---

6.12.3.3 FromRfc4122()

```
static MVCOMMON_API Guid MVCommon::Guid::FromRfc4122 (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Constructs a [Guid](#) using an array of bytes in RFC 4122 format (must contain 16 elements).

Parameters

<i>bytes</i>	an array of 16 bytes in RFC 4122 format
<i>consumeBytes</i>	an indication whether the bytes of the array shall be consumed

Returns

a [Guid](#)

Exceptions

<code>std::invalid_argument</code>	raised when there are not enough bytes in the array
------------------------------------	---

6.12.3.4 IsNil()

```
MVCOMMON_API bool MVCommon::Guid::IsNil ( ) const
```

Checks whether the [Guid](#) is a Nil [Guid](#) (with all bytes set to 0).

Returns

true when the [Guid](#) is a Nil [Guid](#)

6.12.3.5 Nil()

```
static MVCOMMON_API Guid MVCommon::Guid::Nil ( ) [static]
```

Constructs a new Nil [Guid](#) (with all bytes set to 0).

Returns

a Nil [Guid](#)

6.12.3.6 ToHexString()

```
MVCOMMON_API String MVCommon::Guid::ToHexString ( ) const
```

Formats the [Guid](#) to hexadecimal 00000000-0000-0000-0000-000000000000 format.

Returns

a string of 36 characters (32 for hexa characters and 4 for hyphens)

6.12.3.7 ToRawBytes()

```
MVCOMMON_API void MVCommon::Guid::ToRawBytes (
    ByteArray & bytes ) const
```

Formats the [Guid](#) into a raw bytes array.

Parameters

<i>bytes</i>	an array to store 16 raw bytes in
--------------	-----------------------------------

6.12.3.8 ToRfc4122()

```
MVCOMMON_API void MVCommon::Guid::ToRfc4122 (
    ByteArray & bytes ) const
```

Formats the [Guid](#) into RFC 4122 format.

Parameters

<i>bytes</i>	an array to store 16 raw bytes in RFC 4122 format in
--------------	--

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

- public/MVCommon/guid/Guid.h

6.13 MVCommon::GuidAliasDatabase Class Reference

A database of [Guid](#) aliases.

```
#include <GuidAliasDatabase.h>
```

Public Types

- typedef [GuidAliasDatabaseIterator](#) [Iterator](#)
An alternative type name declaration for [GuidAliasDatabaseIterator](#).

Public Member Functions

- MVCOMMON_API [GuidAliasDatabase](#) ()
A constructor.
- MVCOMMON_API [GuidAliasDatabase](#) ([GuidAliasDatabase](#) const &other)
A copy constructor.
- MVCOMMON_API [GuidAliasDatabase](#) ([GuidAliasDatabase](#) &&other)
A move constructor.
- virtual MVCOMMON_API ~[GuidAliasDatabase](#) ()
A destructor.
- MVCOMMON_API void [RegisterGuidAlias](#) ([MVCommon::Guid](#) const &guid, [MVCommon::String](#) const &alias)
Registers a new [Guid](#) alias.
- MVCOMMON_API void [UnregisterGuidAlias](#) ([MVCommon::Guid](#) const &guid)
Unregisters a [Guid](#) alias.
- MVCOMMON_API void [UnregisterGuidAlias](#) ([MVCommon::String](#) const &alias)
Unregisters a [Guid](#) alias.
- MVCOMMON_API bool [TryGetGuidAlias](#) ([MVCommon::Guid](#) const &guid, [MVCommon::String](#) &alias) const
Tries to get an alias registered for a given [Guid](#).
- MVCOMMON_API bool [TryGetGuidWithAlias](#) ([MVCommon::String](#) const &alias, [MVCommon::Guid](#) &guid) const
Tries to get a [Guid](#) with an alias registered.
- MVCOMMON_API [MVCommon::String](#) [GetGuidAlias](#) ([MVCommon::Guid](#) const &guid, [MVCommon::String](#) const &fallbackAlias="") const
Gets an alias registered for a given [Guid](#).
- MVCOMMON_API [MVCommon::Guid](#) [GetGuidWithAlias](#) ([MVCommon::String](#) const &alias, [MVCommon::Guid](#) const &fallbackGuid=[MVCommon::Guid::Nil](#)()) const
Gets a [Guid](#) with an alias registered.
- MVCOMMON_API bool [GuidRegistered](#) ([MVCommon::Guid](#) const &guid) const
Checks whether a [Guid](#) has already an alias registered.
- MVCOMMON_API bool [AliasRegistered](#) ([MVCommon::String](#) const &alias) const
Checks whether there already is a [Guid](#) with an alias registered.
- MVCOMMON_API [Iterator](#) [Begin](#) () const
Returns an iterator to the first entry of the database.
- MVCOMMON_API [Iterator](#) [End](#) () const
Returns an iterator to the last entry of the database.

6.13.1 Detailed Description

A database of [Guid](#) aliases.

The database keeps pairs of [Guid](#) and [String](#) alias objects and provides fast bi-directional mapping between them. Each [Guid](#) can only have a single alias assigned and each alias can only be assigned to a single [Guid](#).

6.13.2 Constructor & Destructor Documentation

6.13.2.1 GuidAliasDatabase() [1/2]

```
MVCOMMON_API MVCommon::GuidAliasDatabase::GuidAliasDatabase (
    GuidAliasDatabase const & other )
```

A copy constructor.

Parameters

<i>other</i>	a database to make a copy of
--------------	------------------------------

6.13.2.2 GuidAliasDatabase() [2/2]

```
MVCOMMON_API MVCommon::GuidAliasDatabase::GuidAliasDatabase (
    GuidAliasDatabase && other )
```

A move constructor.

Parameters

<i>other</i>	a database to move
--------------	--------------------

6.13.3 Member Function Documentation

6.13.3.1 AliasRegistered()

```
MVCOMMON_API bool MVCommon::GuidAliasDatabase::AliasRegistered (
    MVCommon::String const & alias ) const
```

Checks whether there already is a [Guid](#) with an alias registered.

Parameters

<i>alias</i>	an alias to check
--------------	-------------------

Returns

true in case there already is a [Guid](#) registered with the alias

6.13.3.2 Begin()

```
MVCOMMON_API Iterator MVCommon::GuidAliasDatabase::Begin ( ) const
```

Returns an iterator to the first entry of the database.

Returns

an iterator

The returned iterator is equal to [End\(\)](#) iterator when the database is empty.

6.13.3.3 End()

```
MVCOMMON_API Iterator MVCommon::GuidAliasDatabase::End ( ) const
```

Returns an iterator to the last entry of the database.

Returns

an iterator

6.13.3.4 GetGuidAlias()

```
MVCOMMON_API MVCommon::String MVCommon::GuidAliasDatabase::GetGuidAlias (
    MVCommon::Guid const & guid,
    MVCommon::String const & fallbackAlias = "" ) const
```

Gets an alias registered for a given [Guid](#).

Parameters

<i>guid</i>	a Guid to get the alias for
<i>fallbackAlias</i>	a string returned in case there is no alias registered for the Guid

Returns

an alias of the [Guid](#) or the fallback string in case there is none

6.13.3.5 GetGuidWithAlias()

```
MVCOMMON_API MVCommon::Guid MVCommon::GuidAliasDatabase::GetGuidWithAlias (
    MVCommon::String const & alias,
    MVCommon::Guid const & fallbackGuid = MVCommon::Guid::Nil() ) const
```

Gets a [Guid](#) with an alias registered.

Parameters

<i>alias</i>	an alias to look a Guid registered with for
<i>fallbackGuid</i>	a Guid returned in case there is no Guid registered with the alias

Returns

a [Guid](#) registered with the alias or fallback [Guid](#) in case there is none

6.13.3.6 GuidRegistered()

```
MVCOMMON_API bool MVCommon::GuidAliasDatabase::GuidRegistered (
    MVCommon::Guid const & guid ) const
```

Checks whether a [Guid](#) has already an alias registered.

Parameters

<i>guid</i>	a Guid to check
-------------	---------------------------------

Returns

true in case the [Guid](#) already has an alias registered

6.13.3.7 RegisterGuidAlias()

```
MVCOMMON_API void MVCommon::GuidAliasDatabase::RegisterGuidAlias (
    MVCommon::Guid const & guid,
    MVCommon::String const & alias )
```

Registers a new [Guid](#) alias.

Parameters

<i>guid</i>	a Guid to register alias for
<i>alias</i>	an alias of the Guid

Exceptions

<i>std::invalid_argument</i>	raised when there already is a different alias registered for the given Guid or the alias is already registered with another Guid
------------------------------	---

6.13.3.8 TryGetGuidAlias()

```
MVCOMMON_API bool MVCommon::GuidAliasDatabase::TryGetGuidAlias (
    MVCommon::Guid const & guid,
    MVCommon::String & alias ) const
```

Tries to get an alias registered for a given [Guid](#).

Parameters

<i>guid</i>	a Guid to get the alias for
<i>alias</i>	a target to store the alias to

Returns

true in case there is an alias registered for the [Guid](#)

6.13.3.9 TryGetGuidWithAlias()

```
MVCOMMON_API bool MVCommon::GuidAliasDatabase::TryGetGuidWithAlias (
    MVCommon::String const & alias,
    MVCommon::Guid & guid ) const
```

Tries to get a [Guid](#) with an alias registered.

Parameters

<i>alias</i>	an alias to look a Guid registered with for
<i>guid</i>	a target to store the Guid to

Returns

true in case there is a [Guid](#) registered with the alias

6.13.3.10 UnregisterGuidAlias() [1/2]

```
MVCOMMON_API void MVCommon::GuidAliasDatabase::UnregisterGuidAlias (
    MVCommon::Guid const & guid )
```

Unregisters a [Guid](#) alias.

Parameters

<i>guid</i>	a Guid to unregister alias of
-------------	---

6.13.3.11 UnregisterGuidAlias() [2/2]

```
MVCOMMON_API void MVCommon::GuidAliasDatabase::UnregisterGuidAlias (
    MVCommon::String const & alias )
```

Unregisters a [Guid](#) alias.

Parameters

<i>alias</i>	an alias to unregister
--------------	------------------------

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

- public/MVCommon/guid/GuidAliasDatabase.h

6.14 MVCommon::GuidAliasDatabaseIterator Class Reference

An iterator over elements of [GuidAliasDatabase](#) collections.

```
#include <GuidAliasDatabaseIterator.h>
```

Public Types

- using [ValueType](#) = [Pair](#)< [Guid](#) const, [String](#) const >
A type of iterated-over elements of [GuidAliasDatabase](#) collection.

Public Member Functions

- MVCOMMON_API [GuidAliasDatabaseIterator](#) ([GuidAliasDatabaseIterator](#) const &other)
A copy constructor.
- MVCOMMON_API [GuidAliasDatabaseIterator](#) ([GuidAliasDatabaseIterator](#) &&other)
A move constructor.
- virtual MVCOMMON_API ~[GuidAliasDatabaseIterator](#) ()

- A destructor.*
- MVCOMMON_API [GuidAliasDatabaseIterator](#) & operator++ ()
- A prefix incrementation operator.*
- MVCOMMON_API [GuidAliasDatabaseIterator](#) operator++ (int)
- A postfix incrementation operator.*
- MVCOMMON_API [ValueType](#) operator* () const
- Dereferences the iterator.*

6.14.1 Detailed Description

An iterator over elements of [GuidAliasDatabase](#) collections.

6.14.2 Constructor & Destructor Documentation

6.14.2.1 [GuidAliasDatabaseIterator](#)() [1/2]

```
MVCOMMON_API MVCommon::GuidAliasDatabaseIterator::GuidAliasDatabaseIterator (
    GuidAliasDatabaseIterator const & other )
```

A copy constructor.

Parameters

<i>other</i>	an iterator to make a copy of
--------------	-------------------------------

6.14.2.2 [GuidAliasDatabaseIterator](#)() [2/2]

```
MVCOMMON_API MVCommon::GuidAliasDatabaseIterator::GuidAliasDatabaseIterator (
    GuidAliasDatabaseIterator && other )
```

A move constructor.

Parameters

<i>other</i>	an iterator to move
--------------	---------------------

6.14.3 Member Function Documentation

6.14.3.1 operator*()

```
MVCOMMON_API ValueType MVCommon::GuidAliasDatabaseIterator::operator* ( ) const
```

Dereferences the iterator.

Returns

a pair of [Guid](#) and its alias

6.14.3.2 operator++() [1/2]

```
MVCOMMON_API GuidAliasDatabaseIterator& MVCommon::GuidAliasDatabaseIterator::operator++ ( )
```

A prefix incrementation operator.

Moves the iterator to the next element and returns this updated iterator.

Returns

this iterator after it was updated

6.14.3.3 operator++() [2/2]

```
MVCOMMON_API GuidAliasDatabaseIterator MVCommon::GuidAliasDatabaseIterator::operator++ (
    int )
```

A postfix incrementation operator.

Moves the iterator to the next element, but returns the original iterator.

Returns

the original unupdated iterator

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

- public/MVCommon/guid/GuidAliasDatabaseIterator.h

6.15 MVCommon::GuidHasher Struct Reference

A hasher for [Guid](#) objects so they can be used in unordered collections.

```
#include <Guid.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Guid](#) const &guid) const
Calculates a hash value from the object.

6.15.1 Detailed Description

A hasher for [Guid](#) objects so they can be used in unordered collections.

6.15.2 Member Function Documentation

6.15.2.1 [operator\(\)](#)()

```
MVCOMMON_API size_t MVCommon::GuidHasher::operator() (
    Guid const & guid ) const
```

Calculates a hash value from the object.

Parameters

guid	an object to calculate the hash value of
----------------------	--

Returns

hash value of the object

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

- public/MVCommon/guid/Guid.h

6.16 MVCommon::IBlockingCounterCondition Class Reference

An interface of conditions usable with blocking counters.

```
#include <IBlockingCounterCondition.h>
```

Inherited by [MVCommon::BlockingCounterValueEquals](#).

Public Member Functions

- virtual MVCOMMON_API [~IBlockingCounterCondition](#) ()
A destructor.
- virtual MVCOMMON_API bool [operator\(\)](#) (int32_t value)=0
An operator executed for checking the condition with a value.

6.16.1 Detailed Description

An interface of conditions usable with blocking counters.

6.16.2 Member Function Documentation

6.16.2.1 operator()

```
virtual MVCOMMON_API bool MVCommon::IBlockingCounterCondition::operator() (
    int32_t value ) [pure virtual]
```

An operator executed for checking the condition with a value.

Parameters

<i>value</i>	a value the condition is checked with
--------------	---------------------------------------

Returns

true in case the condition passes with the value, false otherwise

Implemented in [MVCommon::BlockingCounterValueEquals](#).

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

- public/MVCommon/utils/blockingcounter/IBlockingCounterCondition.h

6.17 MVCommon::ILoggerSink Class Reference

An interface of logger sinks.

```
#include <ILoggerSink.h>
```

Inherits NonAssignable.

Inherited by [MVCommon::AndroidSystemLoggerSink](#), [MVCommon::AppleSystemLoggerSink](#), [MVCommon::FileLoggerSink](#), [MVCommon::RedirectingLoggerSink](#), and [MVCommon::StdOutLoggerSink](#).

Public Member Functions

- MVCOMMON_API [ILoggerSink](#) ([LoggerLogLevel](#) logLevel=LoggerLogLevel::LLL_VERBOSE)
A constructor.
- virtual MVCOMMON_API [~ILoggerSink](#) ()
A destructor.
- MVCOMMON_API void [SetLogLevel](#) ([LoggerLogLevel](#) logLevel)
Changes log level of the sink for log messages filtering.
- MVCOMMON_API [LoggerLogLevel](#) [GetLogLevel](#) () const
Returns current log level of the sink.
- void [AddLogEntry](#) ([LogEntry](#) const &logEntry)
Adds a new log entry to the sink.

Static Public Member Functions

- static MVCOMMON_API [MVCommon::String](#) [TimestampToString](#) ([LogEntry::Timestamp](#) timestamp, bool includeDate=true)
A default formatter of timestamps usable in logger sink implementations.
- static MVCOMMON_API [MVCommon::String](#) [LogLevelToString](#) ([LogLevel](#) level, bool shortVersion=false)
A default formatter of log levels usable in logger sink implementations.

Protected Member Functions

- virtual MVCOMMON_API void [HandleLogEntry](#) ([LogEntry](#) const &logEntry)=0
A callback executed when a new log entry is added.

6.17.1 Detailed Description

An interface of logger sinks.

When a logger sink is attached to a logger, it will receive all log messages logged via that logger, assuming that the log message is not filtered by the sink's own log level setting.

6.17.2 Constructor & Destructor Documentation

6.17.2.1 ILoggerSink()

```
MVCOMMON_API MVCommon::ILoggerSink::ILoggerSink (
    LoggerLogLevel logLevel = LoggerLogLevel::LLL\_VERBOSE )
```

A constructor.

Parameters

<i>logLevel</i>	an initial log level (default value -> all log messages are processed)
-----------------	--

6.17.3 Member Function Documentation

6.17.3.1 AddLogEntry()

```
void MVCommon::ILoggerSink::AddLogEntry (
    LogEntry const & logEntry )
```

Adds a new log entry to the sink.

Parameters

<i>logEntry</i>	a new log entry
-----------------	-----------------

A log level of the entry is compared with log level of the sink so entries with lesser log levels than the sink's log level are ignored.

6.17.3.2 GetLogLevel()

```
MVCOMMON_API LoggerLogLevel MVCommon::ILoggerSink::GetLogLevel ( ) const
```

Returns current log level of the sink.

Returns

sink's log level

6.17.3.3 HandleLogEntry()

```
virtual MVCOMMON_API void MVCommon::ILoggerSink::HandleLogEntry (
    LogEntry const & logEntry ) [protected], [pure virtual]
```

A callback executed when a new log entry is added.

Parameters

<i>logEntry</i>	a new log entry
-----------------	-----------------

Implemented in [MVCommon::FileLoggerSink](#), [MVCommon::RedirectingLoggerSink](#), [MVCommon::AndroidSystemLoggerSink](#), [MVCommon::AppleSystemLoggerSink](#), and [MVCommon::StdOutLoggerSink](#).

6.17.3.4 LogLevelToString()

```
static MVCOMMON_API MVCommon::String MVCommon::ILoggerSink::LogLevelToString (
    LogLevel level,
    bool shortVersion = false ) [static]
```

A default formatter of log levels usable in logger sink implementations.

Parameters

<i>level</i>	a log level to format
<i>shortVersion</i>	indicates whether a short (single character) or a long (whole level name) version shall be used

Returns

a formatted log level

6.17.3.5 SetLogLevel()

```
MVCOMMON_API void MVCommon::ILoggerSink::SetLogLevel (
    LoggerLogLevel logLevel )
```

Changes log level of the sink for log messages filtering.

Parameters

<i>logLevel</i>	a new log level
-----------------	-----------------

6.17.3.6 TimestampToString()

```
static MVCOMMON_API MVCommon::String MVCommon::ILoggerSink::TimestampToString (
    LogEntry::Timestamp timestamp,
    bool includeDate = true ) [static]
```

A default formatter of timestamps usable in logger sink implementations.

A format of the resulting string is "1900-Jan-01 00:00:00.000" when date is included and "00:00:00.000" when date is ommited.

Parameters

<i>timestamp</i>	a timestamp to format
<i>includeDate</i>	indicates whether a date shall be included in the formatted string

Returns

a formatted timestamp

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

- public/MVCommon/logger/ILoggerSink.h

6.18 MVCommon::IThreadPoolJob Class Reference

An interface of thread pool jobs.

```
#include <IThreadPoolJob.h>
```

Public Member Functions

- virtual MVCOMMON_API [~IThreadPoolJob](#) ()
A destructor.
- virtual MVCOMMON_API void [operator\(\)](#) (uint32_t threadID)=0
The job-executing operator.

6.18.1 Detailed Description

An interface of thread pool jobs.

6.18.2 Member Function Documentation

6.18.2.1 [operator\(\)](#)()

```
virtual MVCOMMON_API void MVCommon::IThreadPoolJob::operator() (
    uint32_t threadID ) [pure virtual]
```

The job-executing operator.

Parameters

<i>threadID</i>	an ID of the thread that executes the job
-----------------	---

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

- public/MVCommon/utils/threadpool/IThreadPoolJob.h

6.19 MVCommon::LogEntry Struct Reference

A log entry data structure.

```
#include <LogEntry.h>
```

Public Types

- typedef uint64_t [Timestamp](#)
A type of log entry timestamps.
- typedef [MVCommon::String](#) [ThreadID](#)
A type of log entry thread IDs.

Public Member Functions

- `LogEntry` (`Timestamp` timestamp, `ThreadID` threadID, `LogLevel` level, `MVCommon::String` const &tag, `MVCommon::String` const &message)
A constructor.
- `MVCOMMON_API LogLevel GetLevel ()` const
Returns level of the log entry.
- `MVCOMMON_API MVCommon::String GetTag ()` const
Returns tag of the log entry.
- `MVCOMMON_API MVCommon::String GetMessage ()` const
Returns message of the log entry.
- `MVCOMMON_API Timestamp GetTimestamp ()` const
Returns timestamp of the log entry.
- `MVCOMMON_API ThreadID GetThreadID ()` const
Returns originating thread ID of the log entry.

6.19.1 Detailed Description

A log entry data structure.

6.19.2 Constructor & Destructor Documentation

6.19.2.1 LogEntry()

```
MVCommon::LogEntry::LogEntry (
    Timestamp timestamp,
    ThreadID threadID,
    LogLevel level,
    MVCommon::String const & tag,
    MVCommon::String const & message )
```

A constructor.

Parameters

<i>timestamp</i>	a timestamp (as number of milliseconds since the epoch - 1970-01-01 00:00:00.000)
<i>threadID</i>	a thread ID
<i>level</i>	a log level
<i>tag</i>	a log tag
<i>message</i>	a log message

6.19.3 Member Function Documentation

6.19.3.1 GetLevel()

```
MVCOMMON_API LogLevel MVCommon::LogEntry::GetLevel ( ) const
```

Returns level of the log entry.

Returns

log entry level

6.19.3.2 GetMessage()

```
MVCOMMON_API MVCommon::String MVCommon::LogEntry::GetMessage ( ) const
```

Returns message of the log entry.

Returns

log entry message

6.19.3.3 GetTag()

```
MVCOMMON_API MVCommon::String MVCommon::LogEntry::GetTag ( ) const
```

Returns tag of the log entry.

Returns

log entry tag

6.19.3.4 GetThreadID()

```
MVCOMMON_API ThreadID MVCommon::LogEntry::GetThreadID ( ) const
```

Returns originating thread ID of the log entry.

Returns

log entry thread ID

6.19.3.5 GetTimestamp()

```
MVCOMMON_API Timestamp MVCommon::LogEntry::GetTimestamp ( ) const
```

Returns timestamp of the log entry.

Timestamp is stored as number of milliseconds since the epoch - 1970-01-01 00:00:00.000.

Returns

log entry timestamp

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

- public/MVCommon/logger/LogEntry.h

6.20 MVCommon::Logger Class Reference

A logger.

```
#include <Logger.h>
```

Inherits NonAssignable.

Public Member Functions

- MVCOMMON_API [Logger](#) ([LoggerLogLevel](#) logLevel=[LoggerLogLevel::LLL_DEBUG](#))
A constructor.
- MVCOMMON_API [~Logger](#) ()
A destructor.
- MVCOMMON_API void [SetLogLevel](#) ([LoggerLogLevel](#) logLevel)
Changes log level of the logger for log messages filtering.
- MVCOMMON_API [LoggerLogLevel](#) [GetLogLevel](#) () const
Returns current log level of the logger.
- MVCOMMON_API void [AddLoggerSink](#) ([SharedLoggerSinkPtr](#) spLoggerSink)
Registers a logger sink.
- MVCOMMON_API void [RemoveLoggerSink](#) ([SharedLoggerSinkPtr](#) spLoggerSink)
Unregisters a logger sink.
- MVCOMMON_API void [RemoveAllLoggerSinks](#) ()
Unregisters all logger sinks.
- MVCOMMON_API void [LogMessage](#) ([LogLevel](#) level, char const *tag, char const *format,...)
Logs a new message.
- MVCOMMON_API void [LogMessage](#) ([LogEntry::Timestamp](#) timestamp, [LogEntry::ThreadID](#) threadID, [LogLevel](#) level, char const *tag, char const *format,...)
Logs a new message.

6.20.1 Detailed Description

A logger.

A logger receives requests for messages logging, filters them according to its log level setting and asynchronously pushes them to all attached logger sinks for customized handling.

6.20.2 Constructor & Destructor Documentation

6.20.2.1 Logger()

```
MVCOMMON_API MVCommon::Logger::Logger (
    LoggerLogLevel logLevel = LoggerLogLevel::LLL_DEBUG )
```

A constructor.

Parameters

<i>logLevel</i>	an initial log level (default value -> debug and higher level messages are processed)
-----------------	---

6.20.3 Member Function Documentation

6.20.3.1 AddLoggerSink()

```
MVCOMMON_API void MVCommon::Logger::AddLoggerSink (
    SharedLoggerSinkPtr spLoggerSink )
```

Registers a logger sink.

Parameters

<i>spLoggerSink</i>	a logger sink to register
---------------------	---------------------------

6.20.3.2 GetLogLevel()

```
MVCOMMON_API LoggerLogLevel MVCommon::Logger::GetLogLevel ( ) const
```

Returns current log level of the logger.

Returns

logger's log level

6.20.3.3 LogMessage() [1/2]

```
MVCOMMON_API void MVCommon::Logger::LogMessage (
    LogEntry::Timestamp timestamp,
    LogEntry::ThreadID threadID,
    LogLevel level,
    char const * tag,
    char const * format,
    ... )
```

Logs a new message.

Parameters

<i>timestamp</i>	a timestamp of the log message (as number of milliseconds since the epoch - 1970-01-01 00:00:00.000)
<i>threadID</i>	a thread ID of the log message
<i>level</i>	a level of the log message
<i>tag</i>	a tag of the log message
<i>format</i>	a C-style formatting directive of the message in case there are additional arguments

A log level of the entry is compared with log level of the sink so entries with lesser log levels than the sink's log level are ignored.

6.20.3.4 LogMessage() [2/2]

```
MVCOMMON_API void MVCommon::Logger::LogMessage (
    LogLevel level,
    char const * tag,
    char const * format,
    ... )
```

Logs a new message.

Parameters

<i>level</i>	a level of the log message
<i>tag</i>	a tag of the log message
<i>format</i>	a C-style formatting directive of the message in case there are additional arguments

A log level of the entry is compared with log level of the sink so entries with lesser log levels than the sink's log level are ignored.

Current time and the caller's thread is used for the log message.

6.20.3.5 RemoveLoggerSink()

```
MVCOMMON_API void MVCommon::Logger::RemoveLoggerSink (
    SharedLoggerSinkPtr spLoggerSink )
```

Unregisters a logger sink.

Parameters

<i>spLoggerSink</i>	a logger sink to unregister
---------------------	-----------------------------

6.20.3.6 SetLogLevel()

```
MVCOMMON_API void MVCommon::Logger::SetLogLevel (
    LoggerLogLevel logLevel )
```

Changes log level of the logger for log messages filtering.

Parameters

<i>logLevel</i>	a new log level
-----------------	-----------------

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

- public/MVCommon/logger/Logger.h

6.21 MVCommon::LoggerRegistry Class Reference

A global registry of loggers.

```
#include <LoggerRegistry.h>
```

Inherits NonAssignable.

Public Member Functions

- MVCOMMON_API [~LoggerRegistry](#) ()
A destructor.

- MVCOMMON_API void [RegisterLogger](#) (MVCommon::String const &loggerAlias, [SharedLoggerPtr](#) sp↔
Logger)
Registers a logger instance to the registry.
- MVCOMMON_API void [UnregisterLogger](#) (MVCommon::String const &loggerAlias)
Unregisters a logger registered with an alias from the registry.
- MVCOMMON_API [SharedLoggerPtr](#) [GetLogger](#) (MVCommon::String const &loggerAlias) const
Returns a logger registered with an alias.
- MVCOMMON_API void [ClearRegistry](#) ()
Clears the registry - removes all registered loggers.

Static Public Member Functions

- static MVCOMMON_API [LoggerRegistry](#) & [GetInstance](#) ()
Returns the only instance of the registry.

6.21.1 Detailed Description

A global registry of loggers.

Serves as a global accessor to [Logger](#) instances in cases where direct access is not possible.

6.21.2 Member Function Documentation

6.21.2.1 GetInstance()

```
static MVCOMMON_API LoggerRegistry& MVCommon::LoggerRegistry::GetInstance ( ) [static]
```

Returns the only instance of the registry.

Returns

the registry instance

6.21.2.2 GetLogger()

```
MVCOMMON_API SharedLoggerPtr MVCommon::LoggerRegistry::GetLogger (
    MVCommon::String const & loggerAlias ) const
```

Returns a logger registered with an alias.

Parameters

<i>loggerAlias</i>	an alias the logger to return is supposed to be registered with
--------------------	---

Returns

a logger with the alias or nullptr if there is none

6.21.2.3 RegisterLogger()

```
MVCOMMON_API void MVCommon::LoggerRegistry::RegisterLogger (
    MVCommon::String const & loggerAlias,
    SharedLoggerPtr spLogger )
```

Registers a logger instance to the registry.

Parameters

<i>loggerAlias</i>	an alias to register the logger with
<i>spLogger</i>	a logger to register

Replaces the previous logger registered with the same alias in case there was one.

6.21.2.4 UnregisterLogger()

```
MVCOMMON_API void MVCommon::LoggerRegistry::UnregisterLogger (
    MVCommon::String const & loggerAlias )
```

Unregisters a logger registered with an alias from the registry.

Parameters

<i>loggerAlias</i>	an alias to unregister a logger registered with
--------------------	---

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

- public/MVCommon/logger/LoggerRegistry.h

6.22 MVCommon::Math Class Reference

A utility class for math operations.

```
#include <Math.h>
```

Static Public Member Functions

- static MVCOMMON_API bool [AlmostEqual](#) (float val1, float val2, float precision=[SINGLE_EPSILON](#))
Compares two single-precision floating-point values with a tolerance.
- static MVCOMMON_API bool [AlmostEqual](#) (double val1, double val2, double precision=[DOUBLE_EPSILON](#))
Compares two double-precision floating-point values with a tolerance.
- template<class T >
static T [Clamp](#) (T const &value, T const &min, T const &max)
Clamps a value to a minimum-maximum range.

Static Public Attributes

- static const MVCOMMON_API float [SINGLE_EPSILON](#)
A smallest possible difference between two single-precision floating-point values.
- static const MVCOMMON_API double [DOUBLE_EPSILON](#)
A smallest possible difference between two double-precision floating-point values.

6.22.1 Detailed Description

A utility class for math operations.

6.22.2 Member Function Documentation

6.22.2.1 AlmostEqual() [1/2]

```
static MVCOMMON_API bool MVCommon::Math::AlmostEqual (
    double val1,
    double val2,
    double precision = DOUBLE\_EPSILON ) [static]
```

Compares two double-precision floating-point values with a tolerance.

Parameters

<i>val1</i>	a value to compare
<i>val2</i>	a value to compare
<i>precision</i>	a required precision

Returns

true in case the difference between the two values is less or equal than a very small value (epsilon)

6.22.2.2 AlmostEqual() [2/2]

```
static MVCOMMON_API bool MVCommon::Math::AlmostEqual (
    float val1,
    float val2,
    float precision = SINGLE_EPSILON ) [static]
```

Compares two single-precision floating-point values with a tolerance.

Parameters

<i>val1</i>	a value to compare
<i>val2</i>	a value to compare
<i>precision</i>	a required precision

Returns

true in case the difference between the two values is less or equal than a very small value (epsilon)

6.22.2.3 Clamp()

```
template<class T >
static T MVCommon::Math::Clamp (
    T const & value,
    T const & min,
    T const & max ) [inline], [static]
```

Clamps a value to a minimum-maximum range.

Template Parameters

<i>T</i>	a type of the values
----------	----------------------

Parameters

<i>value</i>	a value to clamp
<i>min</i>	a minimum value
<i>max</i>	a maximum value

Returns

a clamped value (in the given range)

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

- public/MVCommon/math/Math.h

6.23 MVCommon::Matrix4x4d Struct Reference

A 4x4 matrix with double-precision floating-point values.

```
#include <Matrix4x4d.h>
```

Public Member Functions

- MVCOMMON_API [Matrix4x4d](#) ()
A constructor of an identity matrix (with all elements on main diagonal set to 1 and the rest set to 0).
- MVCOMMON_API [Matrix4x4d](#) (double a00, double a01, double a02, double a03, double a10, double a11, double a12, double a13, double a20, double a21, double a22, double a23, double a30, double a31, double a32, double a33)
A constructor.
- MVCOMMON_API [Matrix4x4d](#) ([Vector4d](#) const &row0, [Vector4d](#) const &row1, [Vector4d](#) const &row2, [Vector4d](#) const &row3)
A constructor.
- MVCOMMON_API [String ToString](#) () const
Converts the matrix into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the matrix into a byte array.
- MVCOMMON_API void [ToRawElements](#) (double *elements) const
Serializes the matrix into an elements array.
- MVCOMMON_API [Matrix4x4d Transposed](#) () const
Creates a transposed matrix.
- MVCOMMON_API [Matrix4x4d Inverted](#) (bool &ok) const
Creates an inverted matrix.
- MVCOMMON_API [Matrix4x4d RotationTranslationMatrixInverted](#) () const
Creates an inverted matrix of a rotation-translation matrix.
- MVCOMMON_API [Vector4d](#) & [operator\[\]](#) (size_t pos)
Accesses a specific row in the matrix.
- MVCOMMON_API const [Vector4d](#) & [operator\[\]](#) (size_t pos) const
Accesses a specific row in the matrix.

Static Public Member Functions

- static MVCOMMON_API [Matrix4x4d FromString](#) ([String](#) const &str)
Creates a matrix from a human-readable string.
- static MVCOMMON_API [Matrix4x4d FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes matrix from a byte array.
- static MVCOMMON_API [Matrix4x4d FromRawElements](#) (double const *elements)
Deserializes matrix from an elements array.
- static MVCOMMON_API [Matrix4x4d CreateZero](#) ()
Creates a matrix with all elements set to zero.
- static MVCOMMON_API [Matrix4x4d CreateTranslation](#) ([Vector3d](#) const &translation)
Creates a translation matrix.
- static MVCOMMON_API [Matrix4x4d CreateScale](#) ([Vector3d](#) const &scale)
Creates a scaling matrix.
- static MVCOMMON_API [Matrix4x4d CreateRotationFromEulerAnglesZYX](#) ([Vector3d](#) const &eulerAngles)

- Creates a rotation matrix from Euler angles (in degrees) in eulerAngles.z -> eulerAngles.y -> eulerAngles.x order.*
- static MVCOMMON_API [Matrix4x4d CreateRotationAroundAxis](#) ([Vector3d](#) const &axis, double angle)
- Creates a rotation matrix from axis of rotation and an angle (in degrees).*
- static MVCOMMON_API [Matrix4x4d CreateRotationFromVersor](#) ([Versord](#) const &versor)
- Creates a rotation matrix from a versor.*
- static MVCOMMON_API [Matrix4x4d CreateOrtographic](#) (double left, double right, double bottom, double top, double near, double far)
- Creates a matrix for ortographic projection.*
- static MVCOMMON_API [Matrix4x4d CreatePerspective](#) (double fieldOfView, double aspectRatio, double near, double far)
- Creates a matrix for perspective projection.*
- static MVCOMMON_API [Matrix4x4d CreateLookAt](#) ([Vector3d](#) const &eyePosition, [Vector3d](#) const ¢er←Point, [Vector3d](#) const &upDirection)
- Creates a viewing transformation matrix.*

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
- A count of bytes the matrix requires in a serialized form.*

6.23.1 Detailed Description

A 4x4 matrix with double-precision floating-point values.

6.23.2 Constructor & Destructor Documentation

6.23.2.1 [Matrix4x4d\(\)](#) [1/2]

```
MVCOMMON_API MVCommon::Matrix4x4d::Matrix4x4d (
    double a00,
    double a01,
    double a02,
    double a03,
    double a10,
    double a11,
    double a12,
    double a13,
    double a20,
    double a21,
    double a22,
    double a23,
    double a30,
    double a31,
    double a32,
    double a33 )
```

A constructor.

Parameters

<i>a00</i>	an m[0][0] value
<i>a01</i>	an m[0][1] value
<i>a02</i>	an m[0][2] value
<i>a03</i>	an m[0][3] value
<i>a10</i>	an m[1][0] value
<i>a11</i>	an m[1][1] value
<i>a12</i>	an m[1][2] value
<i>a13</i>	an m[1][3] value
<i>a20</i>	an m[2][0] value
<i>a21</i>	an m[2][1] value
<i>a22</i>	an m[2][2] value
<i>a23</i>	an m[2][3] value
<i>a30</i>	an m[3][0] value
<i>a31</i>	an m[3][1] value
<i>a32</i>	an m[3][2] value
<i>a33</i>	an m[3][3] value

6.23.2.2 Matrix4x4d() [2/2]

```
MVCOMMON_API MVCommon::Matrix4x4d::Matrix4x4d (
    Vector4d const & row0,
    Vector4d const & row1,
    Vector4d const & row2,
    Vector4d const & row3 )
```

A constructor.

Parameters

<i>row0</i>	a row 0
<i>row1</i>	a row 1
<i>row2</i>	a row 2
<i>row3</i>	a row 3

6.23.3 Member Function Documentation**6.23.3.1 CreateLookAt()**

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreateLookAt (
    Vector3d const & eyePosition,
```

```
Vector3d const & centerPoint,  
Vector3d const & upDirection ) [static]
```

Creates a viewing transformation matrix.

Parameters

<i>eyePosition</i>	a position of the viewing camera
<i>centerPoint</i>	a point the camera is looking at
<i>upDirection</i>	an up-direction of the viewing camera

Returns

a viewing transformation matrix

The resulting 'look-at' matrix follows the same principle as OpenGL's `gluLookAt` utility function: the matrix maps the reference (center) point to the negative z axis and the eye position to the origin. similarly, the up direction projected onto the viewing plane is mapped to the positive y axis. The UP vector must not be parallel to the line of sight from the eye position to the reference point.

6.23.3.2 CreateOrtographic()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreateOrtographic (
    double left,
    double right,
    double bottom,
    double top,
    double near,
    double far ) [static]
```

Creates a matrix for ortographic projection.

Parameters

<i>left</i>	a left coordinate
<i>right</i>	a right coordinate
<i>bottom</i>	a bottom coordinate
<i>top</i>	a top coordinate
<i>near</i>	a near coordinate
<i>far</i>	a far coordinate

Returns

an ortographic-projection matrix

6.23.3.3 CreatePerspective()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreatePerspective (
    double fieldOfView,
    double aspectRatio,
    double near,
    double far ) [static]
```

Creates a matrix for perspective projection.

Parameters

<i>fieldOfView</i>	a field of view (in degrees)
<i>aspectRatio</i>	an aspect ratio
<i>near</i>	a near coordinate
<i>far</i>	a far coordinate

Returns

a perspective-projection matrix

6.23.3.4 CreateRotationAroundAxis()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreateRotationAroundAxis (
    Vector3d const & axis,
    double angle ) [static]
```

Creates a rotation matrix from axis of rotation and an angle (in degrees).

Parameters

<i>axis</i>	an axis of rotation
<i>angle</i>	an angle

Returns

a rotation matrix

6.23.3.5 CreateRotationFromEulerAnglesZYX()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreateRotationFromEulerAnglesZYX (
    Vector3d const & eulerAngles ) [static]
```

Creates a rotation matrix from Euler angles (in degrees) in eulerAngles.z -> eulerAngles.y -> eulerAngles.x order.

Parameters

<i>eulerAngles</i>	Euler angles of Z-Y-X rotation
--------------------	--------------------------------

Returns

a rotation matrix

6.23.3.6 CreateRotationFromVersor()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreateRotationFromVersor (
    Versord const & versor ) [static]
```

Creates a rotation matrix from a versor.

Parameters

<i>versor</i>	a versor describing rotation
---------------	------------------------------

Returns

a rotation matrix

6.23.3.7 CreateScale()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreateScale (
    Vector3d const & scale ) [static]
```

Creates a scaling matrix.

Parameters

<i>scale</i>	a vector describing the scale
--------------	-------------------------------

Returns

a scaling matrix

6.23.3.8 CreateTranslation()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreateTranslation (
    Vector3d const & translation ) [static]
```

Creates a translation matrix.

Parameters

<i>translation</i>	a vector describing the translation
--------------------	-------------------------------------

Returns

a translation matrix

6.23.3.9 CreateZero()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::CreateZero ( ) [static]
```

Creates a matrix with all elements set to zero.

Returns

a zero matrix

6.23.3.10 FromRawBytes()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::FromRawBytes (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Deserializes matrix from a byte array.

Parameters

<i>bytes</i>	an array of matrix bytes
<i>consumeBytes</i>	determines whether bytes of the matrix shall be removed from the array

Returns

a matrix

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array
------------------------------	---

6.23.3.11 FromRawElements()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::FromRawElements (
    double const * elements ) [static]
```

Deserializes matrix from an elements array.

Parameters

<i>elements</i>	an array of 4x4 elements
-----------------	--------------------------

Returns

a matrix

6.23.3.12 FromString()

```
static MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::FromString (
    String const & str ) [static]
```

Creates a matrix from a human-readable string.

Parameters

<i>str</i>	a matrix string
------------	-----------------

Returns

a matrix

6.23.3.13 Inverted()

```
MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::Inverted (
    bool & ok ) const
```

Creates an inverted matrix.

Parameters

<i>ok</i>	indicates whether the inverted matrix was successfully created, since it is not always possible to create one
-----------	---

Returns

an inverted matrix

6.23.3.14 operator[]() [1/2]

```
MVCOMMON_API Vector4d& MVCommon::Matrix4x4d::operator[] (
    size_t pos )
```

Accesses a specific row in the matrix.

Parameters

<i>pos</i>	an index of the row to access
------------	-------------------------------

Returns

a reference to the row of the matrix

Exceptions

<i>std::out_of_range</i>	raised when the index of the row is out of range (0-3)
--------------------------	--

6.23.3.15 operator[]() [2/2]

```
MVCOMMON_API const Vector4d& MVCommon::Matrix4x4d::operator[] (
    size_t pos ) const
```

Accesses a specific row in the matrix.

Parameters

<i>pos</i>	an index of the row to access
------------	-------------------------------

Returns

a reference to the row of the matrix

Exceptions

<i>std::out_of_range</i>	raised when the index of the row is out of range (0-3)
--------------------------	--

6.23.3.16 RotationTranslationMatrixInverted()

```
MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::RotationTranslationMatrixInverted ( ) const
```

Creates an inverted matrix of a rotation-translation matrix.

It is always possible to create an inverted matrix of a rotation-translation matrix and the algorithm is much simpler and more effective than generic inversion algorithm. However, it is up to user to know what matrices he calls the function on

- the function assumes the matrix is a rotation-translation matrix.

Returns

an inverted matrix

6.23.3.17 ToRawBytes()

```
MVCOMMON_API void MVCommon::Matrix4x4d::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the matrix into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.23.3.18 ToRawElements()

```
MVCOMMON_API void MVCommon::Matrix4x4d::ToRawElements (
    double * elements ) const
```

Serializes the matrix into an elements array.

Parameters

<i>elements</i>	an array of 4x4 elements
-----------------	--------------------------

6.23.3.19 ToString()

```
MVCOMMON_API String MVCommon::Matrix4x4d::ToString ( ) const
```

Converts the matrix into a human-readable string.

Returns

the matrix string

6.23.3.20 Transposed()

```
MVCOMMON_API Matrix4x4d MVCommon::Matrix4x4d::Transposed ( ) const
```

Creates a transposed matrix.

Returns

a transposed matrix

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

- public/MVCommon/math/Matrix4x4d.h

6.24 MVCommon::Matrix4x4dHasher Struct Reference

A hasher for [Matrix4x4d](#) objects so they can be used in unordered collections.

```
#include <Matrix4x4d.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Matrix4x4d](#) const &matrix) const
Calculates a hash value from the object.

6.24.1 Detailed Description

A hasher for [Matrix4x4d](#) objects so they can be used in unordered collections.

6.24.2 Member Function Documentation

6.24.2.1 [operator\(\)](#)()

```
MVCOMMON_API size_t MVCommon::Matrix4x4dHasher::operator() (
    Matrix4x4d const & matrix ) const
```

Calculates a hash value from the object.

Parameters

<i>matrix</i>	an object to calculate the hash value of
---------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Matrix4x4d.h

6.25 MVCommon::Matrix4x4f Struct Reference

A 4x4 matrix with single-precision floating-point values.

```
#include <Matrix4x4f.h>
```

Public Member Functions

- MVCOMMON_API [Matrix4x4f](#) ()
A constructor of an identity matrix (with all elements on main diagonal set to 1 and the rest set to 0).
- MVCOMMON_API [Matrix4x4f](#) (float a00, float a01, float a02, float a03, float a10, float a11, float a12, float a13, float a20, float a21, float a22, float a23, float a30, float a31, float a32, float a33)
A constructor.
- MVCOMMON_API [Matrix4x4f](#) ([Vector4f](#) const &row0, [Vector4f](#) const &row1, [Vector4f](#) const &row2, [Vector4f](#) const &row3)
A constructor.
- MVCOMMON_API [String ToString](#) () const
Converts the matrix into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the matrix into a byte array.
- MVCOMMON_API void [ToRawElements](#) (float *elements) const
Serializes the matrix into an elements array.
- MVCOMMON_API [Matrix4x4f Transposed](#) () const
Creates a transposed matrix.
- MVCOMMON_API [Matrix4x4f Inverted](#) (bool &ok) const
Creates an inverted matrix.
- MVCOMMON_API [Matrix4x4f RotationTranslationMatrixInverted](#) () const
Creates an inverted matrix of a rotation-translation matrix.
- MVCOMMON_API [Vector4f](#) & [operator\[\]](#) (size_t pos)
Accesses a specific row in the matrix.
- MVCOMMON_API const [Vector4f](#) & [operator\[\]](#) (size_t pos) const
Accesses a specific row in the matrix.

Static Public Member Functions

- static MVCOMMON_API [Matrix4x4f FromString](#) ([String](#) const &str)
Creates a matrix from a human-readable string.
- static MVCOMMON_API [Matrix4x4f FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes matrix from a byte array.
- static MVCOMMON_API [Matrix4x4f FromRawElements](#) (float const *elements)
Deserializes matrix from an elements array.
- static MVCOMMON_API [Matrix4x4f CreateZero](#) ()
Creates a matrix with all elements set to zero.
- static MVCOMMON_API [Matrix4x4f CreateTranslation](#) ([Vector3f](#) const &translation)
Creates a translation matrix.
- static MVCOMMON_API [Matrix4x4f CreateScale](#) ([Vector3f](#) const &scale)
Creates a scaling matrix.
- static MVCOMMON_API [Matrix4x4f CreateRotationFromEulerAnglesZYX](#) ([Vector3f](#) const &eulerAngles)
Creates a rotation matrix from Euler angles (in degrees) in eulerAngles.z -> eulerAngles.y -> eulerAngles.x order.
- static MVCOMMON_API [Matrix4x4f CreateRotationAroundAxis](#) ([Vector3f](#) const &axis, float angle)
Creates a rotation matrix from axis of rotation and an angle (in degrees).
- static MVCOMMON_API [Matrix4x4f CreateRotationFromVersor](#) ([Versor](#) const &versor)
Creates a rotation matrix from a versor.
- static MVCOMMON_API [Matrix4x4f CreateOrtographic](#) (float left, float right, float bottom, float top, float near, float far)
Creates a matrix for ortographic projection.

- static MVCOMMON_API [Matrix4x4f CreatePerspective](#) (float fieldOfView, float aspectRatio, float near, float far)
Creates a matrix for perspective projection.
- static MVCOMMON_API [Matrix4x4f CreateLookAt](#) ([Vector3f](#) const &eyePosition, [Vector3f](#) const ¢erPoint, [Vector3f](#) const &upDirection)
Creates a viewing transformation matrix.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the matrix requires in a serialized form.

6.25.1 Detailed Description

A 4x4 matrix with single-precision floating-point values.

6.25.2 Constructor & Destructor Documentation

6.25.2.1 [Matrix4x4f](#)() [1/2]

```
MVCOMMON_API MVCommon::Matrix4x4f::Matrix4x4f (
    float a00,
    float a01,
    float a02,
    float a03,
    float a10,
    float a11,
    float a12,
    float a13,
    float a20,
    float a21,
    float a22,
    float a23,
    float a30,
    float a31,
    float a32,
    float a33 )
```

A constructor.

Parameters

<i>a00</i>	an m[0][0] value
<i>a01</i>	an m[0][1] value
<i>a02</i>	an m[0][2] value
<i>a03</i>	an m[0][3] value
<i>a10</i>	an m[1][0] value
<i>a11</i>	an m[1][1] value

Parameters

<i>a12</i>	an m[1][2] value
<i>a13</i>	an m[1][3] value
<i>a20</i>	an m[2][0] value
<i>a21</i>	an m[2][1] value
<i>a22</i>	an m[2][2] value
<i>a23</i>	an m[2][3] value
<i>a30</i>	an m[3][0] value
<i>a31</i>	an m[3][1] value
<i>a32</i>	an m[3][2] value
<i>a33</i>	an m[3][3] value

6.25.2.2 Matrix4x4f() [2/2]

```
MVCOMMON_API MVCommon::Matrix4x4f::Matrix4x4f (
    Vector4f const & row0,
    Vector4f const & row1,
    Vector4f const & row2,
    Vector4f const & row3 )
```

A constructor.

Parameters

<i>row0</i>	a row 0
<i>row1</i>	a row 1
<i>row2</i>	a row 2
<i>row3</i>	a row 3

6.25.3 Member Function Documentation**6.25.3.1 CreateLookAt()**

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreateLookAt (
    Vector3f const & eyePosition,
    Vector3f const & centerPoint,
    Vector3f const & upDirection ) [static]
```

Creates a viewing transformation matrix.

Parameters

<i>eyePosition</i>	a position of the viewing camera
<i>centerPoint</i>	a point the camera is looking at
<i>upDirection</i>	an up-direction of the viewing camera

Returns

a viewing transformation matrix

The resulting 'look-at' matrix follows the same principle as OpenGL's `gluLookAt` utility function: the matrix maps the reference (center) point to the negative z axis and the eye position to the origin. similarly, the up direction projected onto the viewing plane is mapped to the positive y axis. The UP vector must not be parallel to the line of sight from the eye position to the reference point.

6.25.3.2 CreateOrtographic()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreateOrtographic (
    float left,
    float right,
    float bottom,
    float top,
    float near,
    float far ) [static]
```

Creates a matrix for ortographic projection.

Parameters

<i>left</i>	a left coordinate
<i>right</i>	a right coordinate
<i>bottom</i>	a bottom coordinate
<i>top</i>	a top coordinate
<i>near</i>	a near coordinate
<i>far</i>	a far coordinate

Returns

an ortographic-projection matrix

6.25.3.3 CreatePerspective()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreatePerspective (
    float fieldOfView,
    float aspectRatio,
    float near,
    float far ) [static]
```

Creates a matrix for perspective projection.

Parameters

<i>fieldOfView</i>	a field of view (in degrees)
<i>aspectRatio</i>	an aspect ratio
<i>near</i>	a near coordinate
<i>far</i>	a far coordinate

Returns

a perspective-projection matrix

6.25.3.4 CreateRotationAroundAxis()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreateRotationAroundAxis (
    Vector3f const & axis,
    float angle ) [static]
```

Creates a rotation matrix from axis of rotation and an angle (in degrees).

Parameters

<i>axis</i>	an axis of rotation
<i>angle</i>	an angle

Returns

a rotation matrix

6.25.3.5 CreateRotationFromEulerAnglesZYX()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreateRotationFromEulerAnglesZYX (
    Vector3f const & eulerAngles ) [static]
```

Creates a rotation matrix from Euler angles (in degrees) in *eulerAngles.z* -> *eulerAngles.y* -> *eulerAngles.x* order.

Parameters

<i>eulerAngles</i>	Euler angles of Z-Y-X rotation
--------------------	--------------------------------

Returns

a rotation matrix

6.25.3.6 CreateRotationFromVersor()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreateRotationFromVersor (
    Versorf const & versor ) [static]
```

Creates a rotation matrix from a versor.

Parameters

<i>versor</i>	a versor describing rotation
---------------	------------------------------

Returns

a rotation matrix

6.25.3.7 CreateScale()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreateScale (
    Vector3f const & scale ) [static]
```

Creates a scaling matrix.

Parameters

<i>scale</i>	a vector describing the scale
--------------	-------------------------------

Returns

a scaling matrix

6.25.3.8 CreateTranslation()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreateTranslation (
    Vector3f const & translation ) [static]
```

Creates a translation matrix.

Parameters

<i>translation</i>	a vector describing the translation
--------------------	-------------------------------------

Returns

a translation matrix

6.25.3.9 CreateZero()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::CreateZero ( ) [static]
```

Creates a matrix with all elements set to zero.

Returns

a zero matrix

6.25.3.10 FromRawBytes()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::FromRawBytes (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Deserializes matrix from a byte array.

Parameters

<i>bytes</i>	an array of matrix bytes
<i>consumeBytes</i>	determines whether bytes of the matrix shall be removed from the array

Returns

a matrix

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array
------------------------------	---

6.25.3.11 FromRawElements()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::FromRawElements (
    float const * elements ) [static]
```

Deserializes matrix from an elements array.

Parameters

<i>elements</i>	an array of 4x4 elements
-----------------	--------------------------

Returns

a matrix

6.25.3.12 FromString()

```
static MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::FromString (
    String const & str ) [static]
```

Creates a matrix from a human-readable string.

Parameters

<i>str</i>	a matrix string
------------	-----------------

Returns

a matrix

6.25.3.13 Inverted()

```
MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::Inverted (
    bool & ok ) const
```

Creates an inverted matrix.

Parameters

<i>ok</i>	indicates whether the inverted matrix was successfully created, since it is not always possible to create one
-----------	---

Returns

an inverted matrix

6.25.3.14 operator[]() [1/2]

```
MVCOMMON_API Vector4f& MVCommon::Matrix4x4f::operator[] (
    size_t pos )
```

Accesses a specific row in the matrix.

Parameters

<i>pos</i>	an index of the row to access
------------	-------------------------------

Returns

a reference to the row of the matrix

Exceptions

<code>std::out_of_range</code>	raised when the index of the row is out of range (0-3)
--------------------------------	--

6.25.3.15 operator[]() [2/2]

```
MVCOMMON_API const Vector4f& MVCommon::Matrix4x4f::operator[] (
    size_t pos ) const
```

Accesses a specific row in the matrix.

Parameters

<i>pos</i>	an index of the row to access
------------	-------------------------------

Returns

a reference to the row of the matrix

Exceptions

<code>std::out_of_range</code>	raised when the index of the row is out of range (0-3)
--------------------------------	--

6.25.3.16 RotationTranslationMatrixInverted()

```
MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::RotationTranslationMatrixInverted ( ) const
```

Creates an inverted matrix of a rotation-translation matrix.

It is always possible to create an inverted matrix of a rotation-translation matrix and the algorithm is much simpler and more effective than generic inversion algorithm. However, it is up to user to know what matrices he calls the function on

- the function assumes the matrix is a rotation-translation matrix.

Returns

an inverted matrix

6.25.3.17 ToRawBytes()

```
MVCOMMON_API void MVCommon::Matrix4x4f::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the matrix into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.25.3.18 ToRawElements()

```
MVCOMMON_API void MVCommon::Matrix4x4f::ToRawElements (
    float * elements ) const
```

Serializes the matrix into an elements array.

Parameters

<i>elements</i>	an array of 4x4 elements
-----------------	--------------------------

6.25.3.19 ToString()

```
MVCOMMON_API String MVCommon::Matrix4x4f::ToString ( ) const
```

Converts the matrix into a human-readable string.

Returns

the matrix string

6.25.3.20 Transposed()

```
MVCOMMON_API Matrix4x4f MVCommon::Matrix4x4f::Transposed ( ) const
```

Creates a transposed matrix.

Returns

a transposed matrix

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

- public/MVCommon/math/Matrix4x4f.h

6.26 MVCommon::Matrix4x4fHasher Struct Reference

A hasher for [Matrix4x4f](#) objects so they can be used in unordered collections.

```
#include <Matrix4x4f.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Matrix4x4f](#) const &matrix) const
Calculates a hash value from the object.

6.26.1 Detailed Description

A hasher for [Matrix4x4f](#) objects so they can be used in unordered collections.

6.26.2 Member Function Documentation

6.26.2.1 operator()

```
MVCOMMON_API size_t MVCommon::Matrix4x4fHasher::operator() (
    Matrix4x4f const & matrix ) const
```

Calculates a hash value from the object.

Parameters

<i>matrix</i>	an object to calculate the hash value of
---------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Matrix4x4f.h

6.27 MVCommon::Pair< TFirst, TSecond > Class Template Reference

A pair of values.

```
#include <Pair.h>
```

Public Types

- using [FirstType](#) = TFirst
A type of pair's first element.
- using [SecondType](#) = TSecond
A type of pair's second element.

Public Member Functions

- [Pair](#) (TFirst const &[first](#), TSecond const &[second](#))
A constructor.
- virtual [~Pair](#) ()
A destructor.

Data Fields

- TFirst [first](#)
A first value.
- TSecond [second](#)
A second value.

6.27.1 Detailed Description

```
template<typename TFirst, typename TSecond>
class MVCommon::Pair< TFirst, TSecond >
```

A pair of values.

Template Parameters

<i>TFirst</i>	a type of pair's first element
<i>TSecond</i>	a type of pair's second element

6.27.2 Constructor & Destructor Documentation

6.27.2.1 Pair()

```
template<typename TFirst , typename TSecond >
MVCommon::Pair< TFirst, TSecond >::Pair (
    TFirst const & first,
    TSecond const & second ) [inline]
```

A constructor.

Parameters

<i>first</i>	a first value
<i>second</i>	a second value

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

- public/MVCommon/utis/Pair.h

6.28 MVCommon::RedirectingLoggerSink Class Reference

A logger sink implementation for redirecting log messages to another logger.

```
#include <RedirectingLoggerSink.h>
```

Inherits [MVCommon::ILoggerSink](#).

Public Member Functions

- MVCOMMON_API [RedirectingLoggerSink](#) ([SharedLoggerPtr](#) spLogger, [LoggerLogLevel](#) logLevel=Logger↔LogLevel::LLL_VERBOSE)
A constructor.
- MVCOMMON_API [~RedirectingLoggerSink](#) ()
A destructor.

Protected Member Functions

- virtual void [HandleLogEntry](#) ([LogEntry](#) const &logEntry) override
A callback executed when a new log entry is added.

Additional Inherited Members

6.28.1 Detailed Description

A logger sink implementation for redirecting log messages to another logger.

All properties of log messages (timestamp, thread ID, ...) received from a logger are preserved when redirected to the target logger.

6.28.2 Constructor & Destructor Documentation

6.28.2.1 RedirectingLoggerSink()

```
MVCOMMON_API MVCommon::RedirectingLoggerSink::RedirectingLoggerSink (
    SharedLoggerPtr spLogger,
    LoggerLogLevel logLevel = LoggerLogLevel::LLL\_VERBOSE )
```

A constructor.

Parameters

<i>spLogger</i>	a logger to redirect log messages to
<i>logLevel</i>	an initial log level (default value -> all log messages are processed)

6.28.3 Member Function Documentation

6.28.3.1 HandleLogEntry()

```
virtual void MVCommon::RedirectingLoggerSink::HandleLogEntry (
    LogEntry const & logEntry ) [override], [protected], [virtual]
```

A callback executed when a new log entry is added.

Parameters

<i>logEntry</i>	a new log entry
-----------------	-----------------

Implements [MVCommon::ILoggerSink](#).

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

- public/MVCommon/logger/sinks/RedirectingLoggerSink.h

6.29 MVCommon::SharedGuidAliasDatabasePtr Class Reference

A shared smart-pointer to a guid alias database.

```
#include <SharedGuidAliasDatabasePtr.h>
```

Public Member Functions

- MVCOMMON_API [SharedGuidAliasDatabasePtr](#) ()
A constructor.
- MVCOMMON_API [SharedGuidAliasDatabasePtr](#) ([GuidAliasDatabase](#) *pGuidAliasDatabase)
A constructor.
- MVCOMMON_API [SharedGuidAliasDatabasePtr](#) ([SharedGuidAliasDatabasePtr](#) const &other)
A copy-constructor.
- MVCOMMON_API [~SharedGuidAliasDatabasePtr](#) ()
A destructor.
- MVCOMMON_API [SharedGuidAliasDatabasePtr](#) & operator= ([SharedGuidAliasDatabasePtr](#) const &other)
Makes the pointer point to a guid alias database pointed to by the other pointer.
- MVCOMMON_API [SharedGuidAliasDatabasePtr](#) & operator= ([GuidAliasDatabase](#) *pGuidAliasDatabase)

- Makes the pointer point to a guid alias database.*
 - MVCOMMON_API [operator bool](#) () const
 - Converts the pointer to a boolean value.*
 - MVCOMMON_API [GuidAliasDatabase](#) & [operator*](#) () const
 - 'Indirection' operator.*
 - MVCOMMON_API [GuidAliasDatabase](#) * [operator->](#) () const
 - 'Dereference' operator.*
 - MVCOMMON_API [GuidAliasDatabase](#) * [Get](#) () const
 - Returns a raw pointer to the pointed-to guid alias database.*

6.29.1 Detailed Description

A shared smart-pointer to a guid alias database.

Allows sharing of the same guid alias database object by multiple owners and automatically destroys guid alias database objects when no more pointers point to them.

6.29.2 Constructor & Destructor Documentation

6.29.2.1 SharedGuidAliasDatabasePtr() [1/3]

```
MVCOMMON_API MVCommon::SharedGuidAliasDatabasePtr::SharedGuidAliasDatabasePtr ( )
```

A constructor.

Initializes the pointer with nullptr.

6.29.2.2 SharedGuidAliasDatabasePtr() [2/3]

```
MVCOMMON_API MVCommon::SharedGuidAliasDatabasePtr::SharedGuidAliasDatabasePtr (
    GuidAliasDatabase * pGuidAliasDatabase )
```

A constructor.

Parameters

<i>pGuidAliasDatabase</i>	a guid alias database to share a pointer to
---------------------------	---

6.29.2.3 SharedGuidAliasDatabasePtr() [3/3]

```
MVCOMMON_API MVCommon::SharedGuidAliasDatabasePtr::SharedGuidAliasDatabasePtr (
    SharedGuidAliasDatabasePtr const & other )
```

A copy-constructor.

Parameters

<i>other</i>	other pointer to share a pointed-to guid alias database with
--------------	--

6.29.2.4 ~SharedGuidAliasDatabasePtr()

```
MVCOMMON_API MVCommon::SharedGuidAliasDatabasePtr::~~SharedGuidAliasDatabasePtr ( )
```

A destructor.

Destroys the pointed-to guid alias database if this was the last pointer pointing to it.

6.29.3 Member Function Documentation**6.29.3.1 Get()**

```
MVCOMMON_API GuidAliasDatabase* MVCommon::SharedGuidAliasDatabasePtr::Get ( ) const
```

Returns a raw pointer to the pointed-to guid alias database.

Returns

a raw pointer to the pointed-to guid alias database

6.29.3.2 operator bool()

```
MVCOMMON_API MVCommon::SharedGuidAliasDatabasePtr::operator bool ( ) const
```

Converts the pointer to a boolean value.

Returns

true in case the pointed-to guid alias database is not null

6.29.3.3 operator*()

```
MVCOMMON_API GuidAliasDatabase& MVCommon::SharedGuidAliasDatabasePtr::operator* ( ) const
```

'Indirection' operator.

Returns

a reference to the pointed-to guid alias database

6.29.3.4 operator->()

```
MVCOMMON_API GuidAliasDatabase* MVCommon::SharedGuidAliasDatabasePtr::operator-> ( ) const
```

'Dereference' operator.

Returns

a raw pointer to the pointed-to guid alias database

6.29.3.5 operator=() [1/2]

```
MVCOMMON_API SharedGuidAliasDatabasePtr& MVCommon::SharedGuidAliasDatabasePtr::operator= (
    GuidAliasDatabase * pGuidAliasDatabase )
```

Makes the pointer point to a guid alias database.

Destroys previously pointed-to guid alias database if this was the last pointer pointing to it.

Parameters

<i>pGuidAliasDatabase</i>	a guid alias database to point to
---------------------------	-----------------------------------

Returns

the pointer itself

6.29.3.6 operator=() [2/2]

```
MVCOMMON_API SharedGuidAliasDatabasePtr& MVCommon::SharedGuidAliasDatabasePtr::operator= (
    SharedGuidAliasDatabasePtr const & other )
```

Makes the pointer point to a guid alias database pointed to by the *other* pointer.

Destroys previously pointed-to guid alias database if this was the last pointer pointing to it.

Parameters

<i>other</i>	other pointer to share a pointed-to guid alias database with
--------------	--

Returns

the pointer itself

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

- public/MVCommon/guid/SharedGuidAliasDatabasePtr.h

6.30 MVCommon::SharedLoggerPtr Class Reference

A shared smart-pointer to a logger.

```
#include <SharedLoggerPtr.h>
```

Public Member Functions

- MVCOMMON_API [SharedLoggerPtr](#) ()
A constructor.
- MVCOMMON_API [SharedLoggerPtr](#) ([Logger](#) *pLogger)
A constructor.
- MVCOMMON_API [SharedLoggerPtr](#) ([SharedLoggerPtr](#) const &other)
A copy-constructor.
- MVCOMMON_API [~SharedLoggerPtr](#) ()
A destructor.
- MVCOMMON_API [SharedLoggerPtr](#) & [operator=](#) ([SharedLoggerPtr](#) const &other)
*Makes the pointer point to a logger pointed to by the *other* pointer.*
- MVCOMMON_API [SharedLoggerPtr](#) & [operator=](#) ([Logger](#) *pLogger)
Makes the pointer point to a logger.
- MVCOMMON_API [operator bool](#) () const
Converts the pointer to a boolean value.
- MVCOMMON_API [Logger](#) & [operator*](#) () const
'Indirection' operator.
- MVCOMMON_API [Logger](#) * [operator->](#) () const
'Dereference' operator.
- MVCOMMON_API [Logger](#) * [Get](#) () const
Returns a raw pointer to the pointed-to logger.

6.30.1 Detailed Description

A shared smart-pointer to a logger.

Allows sharing of the same logger object by multiple owners and automatically destroys logger objects when no more pointers point to them.

6.30.2 Constructor & Destructor Documentation

6.30.2.1 SharedLoggerPtr() [1/3]

```
MVCOMMON_API MVCommon::SharedLoggerPtr::SharedLoggerPtr ( )
```

A constructor.

Initializes the pointer with nullptr.

6.30.2.2 SharedLoggerPtr() [2/3]

```
MVCOMMON_API MVCommon::SharedLoggerPtr::SharedLoggerPtr (
    Logger * pLogger )
```

A constructor.

Parameters

<i>pLogger</i>	a logger to share a pointer to
----------------	--------------------------------

6.30.2.3 SharedLoggerPtr() [3/3]

```
MVCOMMON_API MVCommon::SharedLoggerPtr::SharedLoggerPtr (
    SharedLoggerPtr const & other )
```

A copy-constructor.

Parameters

<i>other</i>	other pointer to share a pointed-to logger with
--------------	---

6.30.2.4 ~SharedLoggerPtr()

```
MVCOMMON_API MVCommon::SharedLoggerPtr::~~SharedLoggerPtr ( )
```

A destructor.

Destroys the pointed-to logger if this was the last pointer pointing to it.

6.30.3 Member Function Documentation

6.30.3.1 Get()

```
MVCOMMON_API Logger* MVCommon::SharedLoggerPtr::Get ( ) const
```

Returns a raw pointer to the pointed-to logger.

Returns

a raw pointer to the pointed-to logger

6.30.3.2 operator bool()

```
MVCOMMON_API MVCommon::SharedLoggerPtr::operator bool ( ) const
```

Converts the pointer to a boolean value.

Returns

true in case the pointed-to logger is not null

6.30.3.3 operator*()

```
MVCOMMON_API Logger& MVCommon::SharedLoggerPtr::operator* ( ) const
```

'Indirection' operator.

Returns

a reference to the pointed-to logger

6.30.3.4 operator->()

```
MVCOMMON_API Logger* MVCommon::SharedLoggerPtr::operator-> ( ) const
```

'Dereference' operator.

Returns

a raw pointer to the pointed-to logger

6.30.3.5 operator=() [1/2]

```
MVCOMMON_API SharedLoggerPtr& MVCommon::SharedLoggerPtr::operator= (   
    Logger * pLogger )
```

Makes the pointer point to a logger.

Destroys previously pointed-to logger if this was the last pointer pointing to it.

Parameters

<i>pLogger</i>	a logger to point to
----------------	----------------------

Returns

the pointer itself

6.30.3.6 operator=() [2/2]

```
MVCOMMON_API SharedLoggerPtr& MVCommon::SharedLoggerPtr::operator= (
    SharedLoggerPtr const & other )
```

Makes the pointer point to a logger pointed to by the *other* pointer.

Destroys previously pointed-to logger if this was the last pointer pointing to it.

Parameters

<i>other</i>	other pointer to share a pointed-to logger with
--------------	---

Returns

the pointer itself

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

- public/MVCommon/logger/SharedLoggerPtr.h

6.31 MVCommon::SharedLoggerSinkPtr Class Reference

A shared smart-pointer to a logger sink.

```
#include <SharedLoggerSinkPtr.h>
```

Public Member Functions

- MVCOMMON_API [SharedLoggerSinkPtr](#) ()
A constructor.
- MVCOMMON_API [SharedLoggerSinkPtr](#) (ILoggerSink *pLoggerSink)
A constructor.
- MVCOMMON_API [SharedLoggerSinkPtr](#) (SharedLoggerSinkPtr const &other)
A copy-constructor.
- MVCOMMON_API [~SharedLoggerSinkPtr](#) ()

A destructor.

- MVCOMMON_API [SharedLoggerSinkPtr](#) & [operator=](#) ([SharedLoggerSinkPtr](#) const &other)

Makes the pointer point to a logger sink pointed to by the `other` pointer.

- MVCOMMON_API [SharedLoggerSinkPtr](#) & [operator=](#) ([ILoggerSink](#) *pLoggerSink)

Makes the pointer point to a logger sink.

- MVCOMMON_API [operator bool](#) () const

Converts the pointer to a boolean value.

- MVCOMMON_API [ILoggerSink](#) & [operator*](#) () const

'Indirection' operator.

- MVCOMMON_API [ILoggerSink](#) * [operator->](#) () const

'Dereference' operator.

- MVCOMMON_API [ILoggerSink](#) * [Get](#) () const

Returns a raw pointer to the pointed-to logger sink.

6.31.1 Detailed Description

A shared smart-pointer to a logger sink.

Allows sharing of the same logger sink object by multiple owners and automatically destroys logger sink objects when no more pointers point to them.

6.31.2 Constructor & Destructor Documentation

6.31.2.1 SharedLoggerSinkPtr() [1/3]

```
MVCOMMON_API MVCommon::SharedLoggerSinkPtr::SharedLoggerSinkPtr ( )
```

A constructor.

Initializes the pointer with nullptr.

6.31.2.2 SharedLoggerSinkPtr() [2/3]

```
MVCOMMON_API MVCommon::SharedLoggerSinkPtr::SharedLoggerSinkPtr (
    ILoggerSink * pLoggerSink )
```

A constructor.

Parameters

pLoggerSink	a logger sink to share a pointer to
-----------------------------	-------------------------------------

6.31.2.3 SharedLoggerSinkPtr() [3/3]

```
MVCOMMON_API MVCommon::SharedLoggerSinkPtr::SharedLoggerSinkPtr (
    SharedLoggerSinkPtr const & other )
```

A copy-constructor.

Parameters

<i>other</i>	other pointer to share a pointed-to logger sink with
--------------	--

6.31.2.4 ~SharedLoggerSinkPtr()

```
MVCOMMON_API MVCommon::SharedLoggerSinkPtr::~~SharedLoggerSinkPtr ( )
```

A destructor.

Destroys the pointed-to logger sink if this was the last pointer pointing to it.

6.31.3 Member Function Documentation

6.31.3.1 Get()

```
MVCOMMON_API ILoggerSink* MVCommon::SharedLoggerSinkPtr::Get ( ) const
```

Returns a raw pointer to the pointed-to logger sink.

Returns

a raw pointer to the pointed-to logger sink

6.31.3.2 operator bool()

```
MVCOMMON_API MVCommon::SharedLoggerSinkPtr::operator bool ( ) const
```

Converts the pointer to a boolean value.

Returns

true in case the pointed-to logger sink is not null

6.31.3.3 operator*()

```
MVCOMMON_API ILoggerSink& MVCommon::SharedLoggerSinkPtr::operator* ( ) const
```

'Indirection' operator.

Returns

a reference to the pointed-to logger sink

6.31.3.4 operator->()

```
MVCOMMON_API ILoggerSink* MVCommon::SharedLoggerSinkPtr::operator-> ( ) const
```

'Dereference' operator.

Returns

a raw pointer to the pointed-to logger sink

6.31.3.5 operator=() [1/2]

```
MVCOMMON_API SharedLoggerSinkPtr& MVCommon::SharedLoggerSinkPtr::operator= (
    ILoggerSink * pLoggerSink )
```

Makes the pointer point to a logger sink.

Destroys previously pointed-to logger sink if this was the last pointer pointing to it.

Parameters

<i>pLoggerSink</i>	a logger sink to point to
--------------------	---------------------------

Returns

the pointer itself

6.31.3.6 operator=() [2/2]

```
MVCOMMON_API SharedLoggerSinkPtr& MVCommon::SharedLoggerSinkPtr::operator= (
    SharedLoggerSinkPtr const & other )
```

Makes the pointer point to a logger sink pointed to by the *other* pointer.

Destroys previously pointed-to logger sink if this was the last pointer pointing to it.

Parameters

<i>other</i>	other pointer to share a pointed-to logger sink with
--------------	--

Returns

the pointer itself

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

- public/MVCommon/logger/SharedLoggerSinkPtr.h

6.32 MVCommon::SharedThreadPoolJobPtr Class Reference

A shared smart-pointer to a thread pool job.

```
#include <SharedThreadPoolJobPtr.h>
```

Public Member Functions

- MVCOMMON_API [SharedThreadPoolJobPtr](#) ()
A constructor.
- MVCOMMON_API [SharedThreadPoolJobPtr](#) (IThreadPoolJob *pJob)
A constructor.
- MVCOMMON_API [SharedThreadPoolJobPtr](#) (SharedThreadPoolJobPtr const &other)
A copy-constructor.
- MVCOMMON_API [~SharedThreadPoolJobPtr](#) ()
A destructor.
- MVCOMMON_API [SharedThreadPoolJobPtr](#) & operator= (SharedThreadPoolJobPtr const &other)
*Makes the pointer point to a thread pool job pointed to by the *other* pointer.*
- MVCOMMON_API [SharedThreadPoolJobPtr](#) & operator= (IThreadPoolJob *pJob)
Makes the pointer point to a thread pool job.
- MVCOMMON_API [operator bool](#) () const
Converts the pointer to a boolean value.
- MVCOMMON_API IThreadPoolJob & operator* () const
'Indirection' operator.
- MVCOMMON_API IThreadPoolJob * operator-> () const
'Dereference' operator.
- MVCOMMON_API IThreadPoolJob * Get () const
Returns a raw pointer to the pointed-to thread pool job.

6.32.1 Detailed Description

A shared smart-pointer to a thread pool job.

Allows sharing of the same job object by multiple owners and automatically destroys job objects when no more pointers point to them.

6.32.2 Constructor & Destructor Documentation

6.32.2.1 SharedThreadPoolJobPtr() [1/3]

```
MVCOMMON_API MVCommon::SharedThreadPoolJobPtr::SharedThreadPoolJobPtr ( )
```

A constructor.

Initializes the pointer with nullptr.

6.32.2.2 SharedThreadPoolJobPtr() [2/3]

```
MVCOMMON_API MVCommon::SharedThreadPoolJobPtr::SharedThreadPoolJobPtr (
    IThreadPoolJob * pJob )
```

A constructor.

Parameters

<i>pJob</i>	a thread pool job to share a pointer to
-------------	---

6.32.2.3 SharedThreadPoolJobPtr() [3/3]

```
MVCOMMON_API MVCommon::SharedThreadPoolJobPtr::SharedThreadPoolJobPtr (
    SharedThreadPoolJobPtr const & other )
```

A copy-constructor.

Parameters

<i>other</i>	other pointer to share a pointed-to thread pool job with
--------------	--

6.32.2.4 ~SharedThreadPoolJobPtr()

```
MVCOMMON_API MVCommon::SharedThreadPoolJobPtr::~~SharedThreadPoolJobPtr ( )
```

A destructor.

Destroys the pointed-to thread pool job if this was the last pointer pointing to it.

6.32.3 Member Function Documentation

6.32.3.1 Get()

```
MVCOMMON_API IThreadPoolJob* MVCommon::SharedThreadPoolJobPtr::Get ( ) const
```

Returns a raw pointer to the pointed-to thread pool job.

Returns

a raw pointer to the pointed-to job

6.32.3.2 operator bool()

```
MVCOMMON_API MVCommon::SharedThreadPoolJobPtr::operator bool ( ) const
```

Converts the pointer to a boolean value.

Returns

true in case the pointed-to thread pool job is not null

6.32.3.3 operator*()

```
MVCOMMON_API IThreadPoolJob& MVCommon::SharedThreadPoolJobPtr::operator* ( ) const
```

'Indirection' operator.

Returns

a reference to the pointed-to thread pool job

6.32.3.4 operator->()

```
MVCOMMON_API IThreadPoolJob* MVCommon::SharedThreadPoolJobPtr::operator-> ( ) const
```

'Dereference' operator.

Returns

a raw pointer to the pointed-to thread pool job

6.32.3.5 operator=() [1/2]

```
MVCOMMON_API SharedThreadPoolJobPtr& MVCommon::SharedThreadPoolJobPtr::operator= (
    IThreadPoolJob * pJob )
```

Makes the pointer point to a thread pool job.

Destroys previously pointed-to thread pool job if this was the last pointer pointing to it.

Parameters

<i>pJob</i>	a thread pool job to point to
-------------	-------------------------------

Returns

the pointer itself

6.32.3.6 operator=() [2/2]

```
MVCOMMON_API SharedThreadPoolJobPtr& MVCommon::SharedThreadPoolJobPtr::operator= (
    SharedThreadPoolJobPtr const & other )
```

Makes the pointer point to a thread pool job pointed to by the *other* pointer.

Destroys previously pointed-to thread pool job if this was the last pointer pointing to it.

Parameters

<i>other</i>	other pointer to share a pointed-to thread pool job with
--------------	--

Returns

the pointer itself

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

- public/MVCommon/utils/threadpool/SharedThreadPoolJobPtr.h

6.33 MVCommon::StdOutLoggerSink Class Reference

A logger sink implementation for logging into a standard output.

```
#include <StdOutLoggerSink.h>
```

Inherits [MVCommon::ILoggerSink](#).

Public Member Functions

- MVCOMMON_API [StdOutLoggerSink](#) (bool colorizeByLevel=false, [LoggerLogLevel](#) logLevel=LoggerLog↵
Level::LLL_VERBOSE)
 A constructor.
- MVCOMMON_API [~StdOutLoggerSink](#) ()
 A destructor.

Protected Member Functions

- virtual void [HandleLogEntry](#) ([LogEntry](#) const &logEntry) override
A callback executed when a new log entry is added.

Additional Inherited Members

6.33.1 Detailed Description

A logger sink implementation for logging into a standard output.

6.33.2 Constructor & Destructor Documentation

6.33.2.1 StdOutLoggerSink()

```
MVCOMMON_API MVCommon::StdOutLoggerSink::StdOutLoggerSink (
    bool colorizeByLevel = false,
    LoggerLogLevel logLevel = LoggerLogLevel::LLL\_VERBOSE )
```

A constructor.

Parameters

<i>colorizeByLevel</i>	determines whether log messages shall be colorized based on their level - actual behaviour depends on the console used
<i>logLevel</i>	an initial log level (default value -> all log messages are processed)

6.33.3 Member Function Documentation

6.33.3.1 HandleLogEntry()

```
virtual void MVCommon::StdOutLoggerSink::HandleLogEntry (
    LogEntry const & logEntry ) [override], [protected], [virtual]
```

A callback executed when a new log entry is added.

Parameters

<i>logEntry</i>	a new log entry
-----------------	-----------------

Implements [MVCommon::ILoggerSink](#).

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

- public/MVCommon/logger/sinks/StdOutLoggerSink.h

6.34 MVCommon::String Class Reference

A string implementation.

```
#include <String.h>
```

Public Member Functions

- MVCOMMON_API [String](#) (char const *cString="")
A constructor.
- MVCOMMON_API [String](#) ([String](#) const &other)
A copy constructor.
- MVCOMMON_API [String](#) ([String](#) &&other)
A move constructor.
- MVCOMMON_API [~String](#) ()
A destructor.
- MVCOMMON_API const char * [CStr](#) () const
Gets a C string.
- MVCOMMON_API size_t [Length](#) () const
Gets length of the string.
- MVCOMMON_API [String Substr](#) (size_t pos=0, size_t len=-1) const
Generates a substring of the string.

6.34.1 Detailed Description

A string implementation.

Manages lifetime of a string.

6.34.2 Constructor & Destructor Documentation

6.34.2.1 String() [1/3]

```
MVCOMMON_API MVCommon::String::String (
    char const * cString = "" )
```

A constructor.

Parameters

<i>cString</i>	a C string
----------------	------------

6.34.2.2 String() [2/3]

```
MVCOMMON_API MVCommon::String::String (  
    String const & other )
```

A copy constructor.

Parameters

<i>other</i>	a string to make a copy of
--------------	----------------------------

6.34.2.3 String() [3/3]

```
MVCOMMON_API MVCommon::String::String (  
    String && other )
```

A move constructor.

Parameters

<i>other</i>	a string to move
--------------	------------------

6.34.3 Member Function Documentation**6.34.3.1 CStr()**

```
MVCOMMON_API const char* MVCommon::String::CStr ( ) const
```

Gets a C string.

Returns

a pointer to the C string

6.34.3.2 Length()

```
MVCOMMON_API size_t MVCommon::String::Length ( ) const
```

Gets length of the string.

Returns

string's length

6.34.3.3 Substr()

```
MVCOMMON_API String MVCommon::String::Substr (
    size_t pos = 0,
    size_t len = -1 ) const
```

Generates a substring of the string.

Parameters

<i>pos</i>	a starting position of the string to generate the substring from
<i>len</i>	a length of the substring (special value -1 means the rest of the original string)

Returns

the string's substring

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

- public/MVCommon/utis/String.h

6.35 MVCommon::StringHasher Struct Reference

A hasher for [String](#) objects so they can be used in unordered collections.

```
#include <String.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([String](#) const &string) const
Calculates a hash value from the object.

6.35.1 Detailed Description

A hasher for [String](#) objects so they can be used in unordered collections.

6.35.2 Member Function Documentation

6.35.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::StringHasher::operator() (
    String const & string ) const
```

Calculates a hash value from the object.

Parameters

<i>string</i>	an object to calculate the hash value of
---------------	--

Returns

hash value of the object

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

- public/MVCommon/Utils/String.h

6.36 MVCommon::ThreadPool Class Reference

A pool of threads.

```
#include <ThreadPool.h>
```

Inherits NonAssignable.

Public Member Functions

- MVCOMMON_API [ThreadPool](#) (uint32_t threadsCount=1, int32_t waitersForUnoccupiedThreadsCount↔ Hint=1)
A constructor.
- MVCOMMON_API [~ThreadPool](#) ()
A destructor.
- MVCOMMON_API uint32_t [GetThreadsCount](#) () const
Gets the threads count.
- MVCOMMON_API bool [DoJob](#) (SharedThreadPoolJobPtr spJob)
Instructs the pool to execute a job on an unoccupied thread.
- MVCOMMON_API bool [HasUnoccupiedThreads](#) () const
Determines whether there are unoccupied threads available in the pool.
- MVCOMMON_API uint32_t [GetUnoccupiedThreadsCount](#) () const
Determines a count of unoccupied threads in the pool.
- MVCOMMON_API void [WaitForAnUnoccupiedThread](#) () const
Blocks current thread until there is at least one unoccupied thread in the pool.
- MVCOMMON_API void [ResetJobs](#) ()
Resets all jobs and threads executed by the pool.

6.36.1 Detailed Description

A pool of threads.

The pool maintains a fixed-size collection of threads usable for executing jobs. It hides the details about creation and maintenance of threads and about dispatching of jobs to them, allowing a user to focus on the jobs themselves.

6.36.2 Constructor & Destructor Documentation

6.36.2.1 ThreadPool()

```
MVCOMMON_API MVCommon::ThreadPool::ThreadPool (
    uint32_t threadsCount = 1,
    int32_t waitersForUnoccupiedThreadsCountHint = 1 )
```

A constructor.

Instantiates the threads.

Parameters

<i>threadsCount</i>	a count of threads the pool maintains
<i>waitersForUnoccupiedThreadsCountHint</i>	a hint about expected count of threads calling WaitForAnUnoccupiedThread - it allows an optimization of internal memory allocations made per each waiting call in cases when count of parallel waiters can be predicted. Special value 0 will result in allocations made every time, and negative hint value results in no deallocations (and thus maximum reusability of the memory) during the entire lifetime of the thread pool.

6.36.2.2 ~ThreadPool()

```
MVCOMMON_API MVCommon::ThreadPool::~~ThreadPool ( )
```

A destructor.

Shuts down all maintained threads and waits until they complete their execution.

6.36.3 Member Function Documentation

6.36.3.1 DoJob()

```
MVCOMMON_API bool MVCommon::ThreadPool::DoJob (
    SharedThreadPoolJobPtr spJob )
```

Instructs the pool to execute a job on an unoccupied thread.

Parameters

<i>spJob</i>	a job to execute
--------------	------------------

Returns

true in case there is an unoccupied thread that will execute the job, false otherwise

6.36.3.2 GetThreadsCount()

```
MVCOMMON_API uint32_t MVCommon::ThreadPool::GetThreadsCount ( ) const
```

Gets the threads count.

Returns

the count of threads in the pool

6.36.3.3 GetUnoccupiedThreadsCount()

```
MVCOMMON_API uint32_t MVCommon::ThreadPool::GetUnoccupiedThreadsCount ( ) const
```

Determines a count of unoccupied threads in the pool.

Returns

a count of currently unoccupied threads

6.36.3.4 HasUnoccupiedThreads()

```
MVCOMMON_API bool MVCommon::ThreadPool::HasUnoccupiedThreads ( ) const
```

Determines whether there are unoccupied threads available in the pool.

Returns

true if there is at least one unoccupied thread, false otherwise

6.36.3.5 ResetJobs()

```
MVCOMMON_API void MVCommon::ThreadPool::ResetJobs ( )
```

Resets all jobs and threads executed by the pool.

Waits until all jobs are completed, shuts down all the threads and reinitializes them.

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

- public/MVCommon/utils/threadpool/ThreadPool.h

6.37 MVCommon::Vector2d Struct Reference

A 2-dimensional vector with double-precision floating-point values.

```
#include <Vector2d.h>
```

Public Member Functions

- MVCOMMON_API [Vector2d](#) ()
A default constructor.
- MVCOMMON_API [Vector2d](#) (double *x*, double *y*)
A constructor.
- MVCOMMON_API [String ToString](#) () const
Converts the vector into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the vector into a byte array.
- MVCOMMON_API double [Length](#) () const
Gets a length of the vector.
- MVCOMMON_API [Vector2d Inverted](#) () const
Creates a vector with inverted dimensions (1/x).
- MVCOMMON_API [Vector2d Normalized](#) () const
Creates a normalized vector (with length equal to 1).
- MVCOMMON_API [Vector2d Abs](#) () const
Creates a vector with dimensions with absolute values of the original vector.
- MVCOMMON_API double & [operator\[\]](#) (size_t pos)
Accesses vector dimension value via index.
- MVCOMMON_API const double & [operator\[\]](#) (size_t pos) const
Accesses vector dimension value via index.

Static Public Member Functions

- static MVCOMMON_API [Vector2d FromString](#) ([String](#) const &str)
Creates a vector from a human-readable string.
- static MVCOMMON_API [Vector2d FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes vector from a byte array.
- static MVCOMMON_API double [Dot](#) ([Vector2d](#) const &lhs, [Vector2d](#) const &rhs)
Calculates a dot product of two vectors.

Data Fields

- double [x](#)
An x coordinate.
- double [y](#)
A y coordinate.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the vector requires in a serialized form.

6.37.1 Detailed Description

A 2-dimensional vector with double-precision floating-point values.

6.37.2 Constructor & Destructor Documentation

6.37.2.1 Vector2d()

```
MVCOMMON_API MVCommon::Vector2d::Vector2d (  
    double x,  
    double y )
```

A constructor.

Parameters

<i>x</i>	an x coordinate
<i>y</i>	a y coordinate

6.37.3 Member Function Documentation

6.37.3.1 Abs()

```
MVCOMMON_API Vector2d MVCommon::Vector2d::Abs ( ) const
```

Creates a vector with dimensions with absolute values of the original vector.

Returns

a vector with absolute-valued dimensions

6.37.3.2 Dot()

```
static MVCOMMON_API double MVCommon::Vector2d::Dot (  
    Vector2d const & lhs,  
    Vector2d const & rhs ) [static]
```

Calculates a dot product of two vectors.

Parameters

<i>lhs</i>	a first vector-operand
<i>rhs</i>	a second vector-operand

Returns

a dot product

6.37.3.3 FromRawBytes()

```
static MVCOMMON_API Vector2d MVCommon::Vector2d::FromRawBytes (  
    ByteArray & bytes,  
    bool consumeBytes = false ) [static]
```

Deserializes vector from a byte array.

Parameters

<i>bytes</i>	an array of vector bytes
<i>consumeBytes</i>	determines whether bytes of the vector shall be removed from the array

Returns

a vector

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array
------------------------------	---

6.37.3.4 FromString()

```
static MVCOMMON_API Vector2d MVCommon::Vector2d::FromString (  
    String const & str ) [static]
```

Creates a vector from a human-readable string.

Parameters

<i>str</i>	a vector string
------------	-----------------

Returns

a vector

6.37.3.5 Inverted()

```
MVCOMMON_API Vector2d MVCommon::Vector2d::Inverted ( ) const
```

Creates a vector with inverted dimensions (1/x).

Returns

an inverted vector

6.37.3.6 Length()

```
MVCOMMON_API double MVCommon::Vector2d::Length ( ) const
```

Gets a length of the vector.

Returns

vector's length

6.37.3.7 Normalized()

```
MVCOMMON_API Vector2d MVCommon::Vector2d::Normalized ( ) const
```

Creates a normalized vector (with length equal to 1).

Returns an unchanged vector in case its length is equal to 0.

Returns

a normalized vector

6.37.3.8 operator[]() [1/2]

```
MVCOMMON_API double& MVCommon::Vector2d::operator[] (
    size_t pos )
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-1)
--------------------------	---

6.37.3.9 operator[]() [2/2]

```
MVCOMMON_API const double& MVCommon::Vector2d::operator[] (
    size_t pos ) const
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-1)
--------------------------	---

6.37.3.10 ToRawBytes()

```
MVCOMMON_API void MVCommon::Vector2d::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the vector into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.37.3.11 ToString()

```
MVCOMMON_API String MVCommon::Vector2d::ToString ( ) const
```

Converts the vector into a human-readable string.

Returns

the vector string

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

- public/MVCommon/math/Vector2d.h

6.38 MVCommon::Vector2dHasher Struct Reference

A hasher for [Vector2d](#) objects so they can be used in unordered collections.

```
#include <Vector2d.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Vector2d](#) const &vector) const
Calculates a hash value from the object.

6.38.1 Detailed Description

A hasher for [Vector2d](#) objects so they can be used in unordered collections.

6.38.2 Member Function Documentation

6.38.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::Vector2dHasher::operator() (
    Vector2d const & vector ) const
```

Calculates a hash value from the object.

Parameters

<i>vector</i>	an object to calculate the hash value of
---------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Vector2d.h

6.39 MVCommon::Vector2f Struct Reference

A 2-dimensional vector with single-precision floating-point values.

```
#include <Vector2f.h>
```

Public Member Functions

- MVCOMMON_API [Vector2f](#) ()
A default constructor.
- MVCOMMON_API [Vector2f](#) (float x, float y)
A constructor.
- MVCOMMON_API [String ToString](#) () const
Converts the vector into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the vector into a byte array.
- MVCOMMON_API float [Length](#) () const
Gets a length of the vector.
- MVCOMMON_API [Vector2f Inverted](#) () const
Creates a vector with inverted dimensions (1/x).
- MVCOMMON_API [Vector2f Normalized](#) () const
Creates a normalized vector (with length equal to 1).
- MVCOMMON_API [Vector2f Abs](#) () const
Creates a vector with dimensions with absolute values of the original vector.
- MVCOMMON_API float & [operator\[\]](#) (size_t pos)
Accesses vector dimension value via index.
- MVCOMMON_API const float & [operator\[\]](#) (size_t pos) const
Accesses vector dimension value via index.

Static Public Member Functions

- static MVCOMMON_API [Vector2f FromString](#) ([String](#) const &str)
Creates a vector from a human-readable string.
- static MVCOMMON_API [Vector2f FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes vector from a byte array.
- static MVCOMMON_API float [Dot](#) ([Vector2f](#) const &lhs, [Vector2f](#) const &rhs)
Calculates a dot product of two vectors.

Data Fields

- float [x](#)
An x coordinate.
- float [y](#)
A y coordinate.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the vector requires in a serialized form.

6.39.1 Detailed Description

A 2-dimensional vector with single-precision floating-point values.

6.39.2 Constructor & Destructor Documentation

6.39.2.1 Vector2f()

```
MVCOMMON_API MVCommon::Vector2f::Vector2f (  
    float x,  
    float y )
```

A constructor.

Parameters

<i>x</i>	an x coordinate
<i>y</i>	a y coordinate

6.39.3 Member Function Documentation

6.39.3.1 Abs()

```
MVCOMMON_API Vector2f MVCommon::Vector2f::Abs ( ) const
```

Creates a vector with dimensions with absolute values of the original vector.

Returns

a vector with absolute-valued dimensions

6.39.3.2 Dot()

```
static MVCOMMON_API float MVCommon::Vector2f::Dot (  
    Vector2f const & lhs,  
    Vector2f const & rhs ) [static]
```

Calculates a dot product of two vectors.

Parameters

<i>lhs</i>	a first vector-operand
<i>rhs</i>	a second vector-operand

Returns

a dot product

6.39.3.3 FromRawBytes()

```
static MVCOMMON_API Vector2f MVCommon::Vector2f::FromRawBytes (  
    ByteArray & bytes,  
    bool consumeBytes = false ) [static]
```

Deserializes vector from a byte array.

Parameters

<i>bytes</i>	an array of vector bytes
<i>consumeBytes</i>	determines whether bytes of the vector shall be removed from the array

Returns

a vector

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array
------------------------------	---

6.39.3.4 FromString()

```
static MVCOMMON_API Vector2f MVCommon::Vector2f::FromString (  
    String const & str ) [static]
```

Creates a vector from a human-readable string.

Parameters

<i>str</i>	a vector string
------------	-----------------

Returns

a vector

6.39.3.5 Inverted()

```
MVCOMMON_API Vector2f MVCommon::Vector2f::Inverted ( ) const
```

Creates a vector with inverted dimensions (1/x).

Returns

an inverted vector

6.39.3.6 Length()

```
MVCOMMON_API float MVCommon::Vector2f::Length ( ) const
```

Gets a length of the vector.

Returns

vector's length

6.39.3.7 Normalized()

```
MVCOMMON_API Vector2f MVCommon::Vector2f::Normalized ( ) const
```

Creates a normalized vector (with length equal to 1).

Returns an unchanged vector in case its length is equal to 0.

Returns

a normalized vector

6.39.3.8 operator[]() [1/2]

```
MVCOMMON_API float& MVCommon::Vector2f::operator[] (
    size_t pos )
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-1)
--------------------------	---

6.39.3.9 operator[]() [2/2]

```
MVCOMMON_API const float& MVCommon::Vector2f::operator[] (
    size_t pos ) const
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-1)
--------------------------	---

6.39.3.10 ToRawBytes()

```
MVCOMMON_API void MVCommon::Vector2f::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the vector into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.39.3.11 ToString()

```
MVCOMMON_API String MVCommon::Vector2f::ToString ( ) const
```

Converts the vector into a human-readable string.

Returns

the vector string

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

- public/MVCommon/math/Vector2f.h

6.40 MVCommon::Vector2fHasher Struct Reference

A hasher for [Vector2f](#) objects so they can be used in unordered collections.

```
#include <Vector2f.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Vector2f](#) const &vector) const
Calculates a hash value from the object.

6.40.1 Detailed Description

A hasher for [Vector2f](#) objects so they can be used in unordered collections.

6.40.2 Member Function Documentation

6.40.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::Vector2fHasher::operator() (
    Vector2f const & vector ) const
```

Calculates a hash value from the object.

Parameters

<i>vector</i>	an object to calculate the hash value of
---------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Vector2f.h

6.41 MVCommon::Vector3d Struct Reference

A 3-dimensional vector with double-precision floating-point values.

```
#include <Vector3d.h>
```

Public Member Functions

- MVCOMMON_API [Vector3d](#) ()
A default constructor.
- MVCOMMON_API [Vector3d](#) (double [x](#), double [y](#), double [z](#))
A constructor.
- MVCOMMON_API [Vector3d](#) ([Vector2d](#) const &vector2, double [z](#)=0.0)
A constructor.
- MVCOMMON_API [String ToString](#) () const
Converts the vector into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the vector into a byte array.
- MVCOMMON_API double [Length](#) () const
Gets a length of the vector.
- MVCOMMON_API [Vector3d Inverted](#) () const
Creates a vector with inverted dimensions (1/x).
- MVCOMMON_API [Vector3d Normalized](#) () const
Creates a normalized vector (with length equal to 1).
- MVCOMMON_API [Vector3d Abs](#) () const
Creates a vector with dimensions with absolute values of the original vector.
- MVCOMMON_API [Vector2d GetXY](#) () const
Extracts x and y coordinates as a 2-dimensional vector.
- MVCOMMON_API double & [operator\[\]](#) (size_t pos)
Accesses vector dimension value via index.
- MVCOMMON_API const double & [operator\[\]](#) (size_t pos) const
Accesses vector dimension value via index.

Static Public Member Functions

- static MVCOMMON_API [Vector3d FromString](#) ([String](#) const &str)
Creates a vector from a human-readable string.
- static MVCOMMON_API [Vector3d FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes vector from a byte array.
- static MVCOMMON_API double [Dot](#) ([Vector3d](#) const &lhs, [Vector3d](#) const &rhs)
Calculates a dot product of two vectors.
- static MVCOMMON_API [Vector3d Cross](#) ([Vector3d](#) const &lhs, [Vector3d](#) const &rhs)
Calculates a cross product of two vectors.

Data Fields

- double [x](#)
An x coordinate.
- double [y](#)
A y coordinate.
- double [z](#)
A z coordinate.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the vector requires in a serialized form.

6.41.1 Detailed Description

A 3-dimensional vector with double-precision floating-point values.

6.41.2 Constructor & Destructor Documentation

6.41.2.1 Vector3d() [1/2]

```
MVCOMMON_API MVCommon::Vector3d::Vector3d (  
    double x,  
    double y,  
    double z )
```

A constructor.

Parameters

x	an x coordinate
y	a y coordinate
z	a z coordinate

6.41.2.2 Vector3d() [2/2]

```
MVCOMMON_API MVCommon::Vector3d::Vector3d (  
    Vector2d const & vector2,  
    double z = 0.0 )
```

A constructor.

Parameters

<i>vector2</i>	a 2-dimensional vector whose x and y coordinates will be grabbed
<i>z</i>	a z coordinate

6.41.3 Member Function Documentation

6.41.3.1 Abs()

```
MVCOMMON_API Vector3d MVCommon::Vector3d::Abs ( ) const
```

Creates a vector with dimensions with absolute values of the original vector.

Returns

a vector with absolute-valued dimensions

6.41.3.2 Cross()

```
static MVCOMMON_API Vector3d MVCommon::Vector3d::Cross (
    Vector3d const & lhs,
    Vector3d const & rhs ) [static]
```

Calculates a cross product of two vectors.

Parameters

<i>lhs</i>	a left-hand-side vector-operand
<i>rhs</i>	a right-hand-side vector-operand

Returns

a vector representing the cross product

6.41.3.3 Dot()

```
static MVCOMMON_API double MVCommon::Vector3d::Dot (
    Vector3d const & lhs,
    Vector3d const & rhs ) [static]
```

Calculates a dot product of two vectors.

Parameters

<i>lhs</i>	a first vector-operand
<i>rhs</i>	a second vector-operand

Returns

a dot product

6.41.3.4 FromRawBytes()

```
static MVCOMMON_API Vector3d MVCommon::Vector3d::FromRawBytes (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Deserializes vector from a byte array.

Parameters

<i>bytes</i>	an array of vector bytes
<i>consumeBytes</i>	determines whether bytes of the vector shall be removed from the array

Returns

a vector

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array
------------------------------	---

6.41.3.5 FromString()

```
static MVCOMMON_API Vector3d MVCommon::Vector3d::FromString (
    String const & str ) [static]
```

Creates a vector from a human-readable string.

Parameters

<i>str</i>	a vector string
------------	-----------------

Returns

a vector

6.41.3.6 GetXY()

```
MVCOMMON_API Vector2d MVCommon::Vector3d::GetXY ( ) const
```

Extracts x and y coordinates as a 2-dimensional vector.

Returns

a 2-dimensional vector

6.41.3.7 Inverted()

```
MVCOMMON_API Vector3d MVCommon::Vector3d::Inverted ( ) const
```

Creates a vector with inverted dimensions (1/x).

Returns

an inverted vector

6.41.3.8 Length()

```
MVCOMMON_API double MVCommon::Vector3d::Length ( ) const
```

Gets a length of the vector.

Returns

vector's length

6.41.3.9 Normalized()

```
MVCOMMON_API Vector3d MVCommon::Vector3d::Normalized ( ) const
```

Creates a normalized vector (with length equal to 1).

Returns an unchanged vector in case its length is equal to 0.

Returns

a normalized vector

6.41.3.10 operator[]() [1/2]

```
MVCOMMON_API double& MVCommon::Vector3d::operator[] (
    size_t pos )
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-2)
--------------------------	---

6.41.3.11 operator[]() [2/2]

```
MVCOMMON_API const double& MVCommon::Vector3d::operator[] (
    size_t pos ) const
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-2)
--------------------------	---

6.41.3.12 ToRawBytes()

```
MVCOMMON_API void MVCommon::Vector3d::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the vector into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.41.3.13 ToString()

```
MVCOMMON_API String MVCommon::Vector3d::ToString ( ) const
```

Converts the vector into a human-readable string.

Returns

the vector string

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

- public/MVCommon/math/Vector3d.h

6.42 MVCommon::Vector3dHasher Struct Reference

A hasher for [Vector3d](#) objects so they can be used in unordered collections.

```
#include <Vector3d.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Vector3d](#) const &vector) const
Calculates a hash value from the object.

6.42.1 Detailed Description

A hasher for [Vector3d](#) objects so they can be used in unordered collections.

6.42.2 Member Function Documentation

6.42.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::Vector3dHasher::operator() (
    Vector3d const & vector ) const
```

Calculates a hash value from the object.

Parameters

<i>vector</i>	an object to calculate the hash value of
---------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Vector3d.h

6.43 MVCommon::Vector3f Struct Reference

A 3-dimensional vector with single-precision floating-point values.

```
#include <Vector3f.h>
```

Public Member Functions

- MVCOMMON_API [Vector3f](#) ()
A default constructor.
- MVCOMMON_API [Vector3f](#) (float [x](#), float [y](#), float [z](#))
A constructor.
- MVCOMMON_API [Vector3f](#) ([Vector2f](#) const &vector2, float [z](#)=0.0f)
A constructor.
- MVCOMMON_API [String](#) [ToString](#) () const
Converts the vector into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the vector into a byte array.
- MVCOMMON_API float [Length](#) () const
Gets a length of the vector.
- MVCOMMON_API [Vector3f](#) [Inverted](#) () const
Creates a vector with inverted dimensions (1/x).
- MVCOMMON_API [Vector3f](#) [Normalized](#) () const
Creates a normalized vector (with length equal to 1).
- MVCOMMON_API [Vector3f](#) [Abs](#) () const
Creates a vector with dimensions with absolute values of the original vector.
- MVCOMMON_API [Vector2f](#) [GetXY](#) () const
Extracts x and y coordinates as a 2-dimensional vector.
- MVCOMMON_API float & [operator\[\]](#) (size_t pos)
Accesses vector dimension value via index.
- MVCOMMON_API const float & [operator\[\]](#) (size_t pos) const
Accesses vector dimension value via index.

Static Public Member Functions

- static MVCOMMON_API [Vector3f](#) [FromString](#) ([String](#) const &str)
Creates a vector from a human-readable string.
- static MVCOMMON_API [Vector3f](#) [FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes vector from a byte array.
- static MVCOMMON_API float [Dot](#) ([Vector3f](#) const &lhs, [Vector3f](#) const &rhs)
Calculates a dot product of two vectors.
- static MVCOMMON_API [Vector3f](#) [Cross](#) ([Vector3f](#) const &lhs, [Vector3f](#) const &rhs)
Calculates a cross product of two vectors.

Data Fields

- float [x](#)
An x coordinate.
- float [y](#)
A y coordinate.
- float [z](#)
A z coordinate.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the vector requires in a serialized form.

6.43.1 Detailed Description

A 3-dimensional vector with single-precision floating-point values.

6.43.2 Constructor & Destructor Documentation

6.43.2.1 [Vector3f\(\)](#) [1/2]

```
MVCOMMON_API MVCommon::Vector3f::Vector3f (
    float x,
    float y,
    float z )
```

A constructor.

Parameters

x	an x coordinate
y	a y coordinate
z	a z coordinate

6.43.2.2 [Vector3f\(\)](#) [2/2]

```
MVCOMMON_API MVCommon::Vector3f::Vector3f (
    Vector2f const & vector2,
    float z = 0.0f )
```

A constructor.

Parameters

<i>vector2</i>	a 2-dimensional vector whose x and y coordinates will be grabbed
<i>z</i>	a z coordinate

6.43.3 Member Function Documentation

6.43.3.1 Abs()

```
MVCOMMON_API Vector3f MVCommon::Vector3f::Abs ( ) const
```

Creates a vector with dimensions with absolute values of the original vector.

Returns

a vector with absolute-valued dimensions

6.43.3.2 Cross()

```
static MVCOMMON_API Vector3f MVCommon::Vector3f::Cross (
    Vector3f const & lhs,
    Vector3f const & rhs ) [static]
```

Calculates a cross product of two vectors.

Parameters

<i>lhs</i>	a left-hand-side vector-operand
<i>rhs</i>	a right-hand-side vector-operand

Returns

a vector representing the cross product

6.43.3.3 Dot()

```
static MVCOMMON_API float MVCommon::Vector3f::Dot (
    Vector3f const & lhs,
    Vector3f const & rhs ) [static]
```

Calculates a dot product of two vectors.

Parameters

<i>lhs</i>	a first vector-operand
<i>rhs</i>	a second vector-operand

Returns

a dot product

6.43.3.4 FromRawBytes()

```
static MVCOMMON_API Vector3f MVCommon::Vector3f::FromRawBytes (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Deserializes vector from a byte array.

Parameters

<i>bytes</i>	an array of vector bytes
<i>consumeBytes</i>	determines whether bytes of the vector shall be removed from the array

Returns

a vector

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array
------------------------------	---

6.43.3.5 FromString()

```
static MVCOMMON_API Vector3f MVCommon::Vector3f::FromString (
    String const & str ) [static]
```

Creates a vector from a human-readable string.

Parameters

<i>str</i>	a vector string
------------	-----------------

Returns

a vector

6.43.3.6 GetXY()

```
MVCOMMON_API Vector2f MVCommon::Vector3f::GetXY ( ) const
```

Extracts x and y coordinates as a 2-dimensional vector.

Returns

a 2-dimensional vector

6.43.3.7 Inverted()

```
MVCOMMON_API Vector3f MVCommon::Vector3f::Inverted ( ) const
```

Creates a vector with inverted dimensions (1/x).

Returns

an inverted vector

6.43.3.8 Length()

```
MVCOMMON_API float MVCommon::Vector3f::Length ( ) const
```

Gets a length of the vector.

Returns

vector's length

6.43.3.9 Normalized()

```
MVCOMMON_API Vector3f MVCommon::Vector3f::Normalized ( ) const
```

Creates a normalized vector (with length equal to 1).

Returns an unchanged vector in case its length is equal to 0.

Returns

a normalized vector

6.43.3.10 operator[]() [1/2]

```
MVCOMMON_API float& MVCommon::Vector3f::operator[] (
    size_t pos )
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-2)
--------------------------	---

6.43.3.11 operator[]() [2/2]

```
MVCOMMON_API const float& MVCommon::Vector3f::operator[] (
    size_t pos ) const
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-2)
--------------------------	---

6.43.3.12 ToRawBytes()

```
MVCOMMON_API void MVCommon::Vector3f::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the vector into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.43.3.13 ToString()

```
MVCOMMON_API String MVCommon::Vector3f::ToString ( ) const
```

Converts the vector into a human-readable string.

Returns

the vector string

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

- public/MVCommon/math/Vector3f.h

6.44 MVCommon::Vector3fHasher Struct Reference

A hasher for [Vector3f](#) objects so they can be used in unordered collections.

```
#include <Vector3f.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Vector3f](#) const &vector) const
Calculates a hash value from the object.

6.44.1 Detailed Description

A hasher for [Vector3f](#) objects so they can be used in unordered collections.

6.44.2 Member Function Documentation

6.44.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::Vector3fHasher::operator() (
    Vector3f const & vector ) const
```

Calculates a hash value from the object.

Parameters

<i>vector</i>	an object to calculate the hash value of
---------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Vector3f.h

6.45 MVCommon::Vector4d Struct Reference

A 4-dimensional vector with double-precision floating-point values.

```
#include <Vector4d.h>
```

Public Member Functions

- MVCOMMON_API [Vector4d](#) ()
A default constructor.
- MVCOMMON_API [Vector4d](#) (double *x*, double *y*, double *z*, double *w*)
A constructor.
- MVCOMMON_API [Vector4d](#) ([Vector3d](#) const &vector3, double *w*=0.0)
A constructor.
- MVCOMMON_API [String ToString](#) () const
Converts the vector into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the vector into a byte array.
- MVCOMMON_API double [Length](#) () const
Gets a length of the vector.
- MVCOMMON_API [Vector4d Inverted](#) () const
Creates a vector with inverted dimensions (1/x).
- MVCOMMON_API [Vector4d Normalized](#) () const
Creates a normalized vector (with length equal to 1).
- MVCOMMON_API [Vector4d Abs](#) () const
Creates a vector with dimensions with absolute values of the original vector.
- MVCOMMON_API [Vector3d GetXYZ](#) () const
Extracts x, y and z coordinates as a 3-dimensional vector.
- MVCOMMON_API double & [operator\[\]](#) (size_t pos)
Accesses vector dimension value via index.
- MVCOMMON_API const double & [operator\[\]](#) (size_t pos) const
Accesses vector dimension value via index.

Static Public Member Functions

- static MVCOMMON_API [Vector4d FromString](#) ([String](#) const &str)
Creates a vector from a human-readable string.
- static MVCOMMON_API [Vector4d FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes vector from a byte array.
- static MVCOMMON_API double [Dot](#) ([Vector4d](#) const &lhs, [Vector4d](#) const &rhs)
Calculates a dot product of two vectors.

Data Fields

- double [x](#)
An x coordinate.
- double [y](#)
A y coordinate.
- double [z](#)
A z coordinate.
- double [w](#)
A w coordinate.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the vector requires in a serialized form.

6.45.1 Detailed Description

A 4-dimensional vector with double-precision floating-point values.

6.45.2 Constructor & Destructor Documentation

6.45.2.1 Vector4d() [1/2]

```
MVCOMMON_API MVCommon::Vector4d::Vector4d (
    double x,
    double y,
    double z,
    double w )
```

A constructor.

Parameters

<i>x</i>	an x coordinate
<i>y</i>	a y coordinate
<i>z</i>	a z coordinate
<i>w</i>	a w coordinate

6.45.2.2 Vector4d() [2/2]

```
MVCOMMON_API MVCommon::Vector4d::Vector4d (
    Vector3d const & vector3,
    double w = 0.0 )
```

A constructor.

Parameters

<i>vector3</i>	a 3-dimensional vector whose x, y and z coordinates will be grabbed
<i>w</i>	a w coordinate

6.45.3 Member Function Documentation

6.45.3.1 Abs()

```
MVCOMMON_API Vector4d MVCommon::Vector4d::Abs ( ) const
```

Creates a vector with dimensions with absolute values of the original vector.

Returns

a vector with absolute-valued dimensions

6.45.3.2 Dot()

```
static MVCOMMON_API double MVCommon::Vector4d::Dot (
    Vector4d const & lhs,
    Vector4d const & rhs ) [static]
```

Calculates a dot product of two vectors.

Parameters

<i>lhs</i>	a first vector-operand
<i>rhs</i>	a second vector-operand

Returns

a dot product

6.45.3.3 FromRawBytes()

```
static MVCOMMON_API Vector4d MVCommon::Vector4d::FromRawBytes (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Deserializes vector from a byte array.

Parameters

<i>bytes</i>	an array of vector bytes
<i>consumeBytes</i>	determines whether bytes of the vector shall be removed from the array

Returns

a vector

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array
------------------------------	---

6.45.3.4 FromString()

```
static MVCOMMON_API Vector4d MVCommon::Vector4d::FromString (  
    String const & str ) [static]
```

Creates a vector from a human-readable string.

Parameters

<i>str</i>	a vector string
------------	-----------------

Returns

a vector

6.45.3.5 GetXYZ()

```
MVCOMMON_API Vector3d MVCommon::Vector4d::GetXYZ ( ) const
```

Extracts x, y and z coordinates as a 3-dimensional vector.

Returns

a 3-dimensional vector

6.45.3.6 Inverted()

```
MVCOMMON_API Vector4d MVCommon::Vector4d::Inverted ( ) const
```

Creates a vector with inverted dimensions (1/x).

Returns

an inverted vector

6.45.3.7 Length()

```
MVCOMMON_API double MVCommon::Vector4d::Length ( ) const
```

Gets a length of the vector.

Returns

vector's length

6.45.3.8 Normalized()

```
MVCOMMON_API Vector4d MVCommon::Vector4d::Normalized ( ) const
```

Creates a normalized vector (with length equal to 1).

Returns an unchanged vector in case its length is equal to 0.

Returns

a normalized vector

6.45.3.9 operator[]() [1/2]

```
MVCOMMON_API double& MVCommon::Vector4d::operator[] (
    size_t pos )
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<code>std::out_of_range</code>	raised when index is out of range (0-3)
--------------------------------	---

6.45.3.10 operator[]() [2/2]

```
MVCOMMON_API const double& MVCommon::Vector4d::operator[] (
    size_t pos ) const
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<code>std::out_of_range</code>	raised when index is out of range (0-3)
--------------------------------	---

6.45.3.11 ToRawBytes()

```
MVCOMMON_API void MVCommon::Vector4d::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the vector into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.45.3.12 ToString()

```
MVCOMMON_API String MVCommon::Vector4d::ToString ( ) const
```

Converts the vector into a human-readable string.

Returns

the vector string

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

- public/MVCommon/math/Vector4d.h

6.46 MVCommon::Vector4dHasher Struct Reference

A hasher for [Vector4d](#) objects so they can be used in unordered collections.

```
#include <Vector4d.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Vector4d](#) const &vector) const
Calculates a hash value from the object.

6.46.1 Detailed Description

A hasher for [Vector4d](#) objects so they can be used in unordered collections.

6.46.2 Member Function Documentation

6.46.2.1 operator()()

```
MVCOMMON_API size_t MVCommon::Vector4dHasher::operator() (  
    Vector4d const & vector ) const
```

Calculates a hash value from the object.

Parameters

<i>vector</i>	an object to calculate the hash value of
---------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Vector4d.h

6.47 MVCommon::Vector4f Struct Reference

A 4-dimensional vector with single-precision floating-point values.

```
#include <Vector4f.h>
```

Public Member Functions

- MVCOMMON_API [Vector4f](#) ()
A default constructor.
- MVCOMMON_API [Vector4f](#) (float [x](#), float [y](#), float [z](#), float [w](#))
A constructor.
- MVCOMMON_API [Vector4f](#) ([Vector3f](#) const &vector3, float [w](#)=0.0f)
A constructor.
- MVCOMMON_API [String ToString](#) () const
Converts the vector into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) ([ByteArray](#) &bytes) const
Serializes the vector into a byte array.
- MVCOMMON_API float [Length](#) () const
Gets a length of the vector.
- MVCOMMON_API [Vector4f Inverted](#) () const
Creates a vector with inverted dimensions (1/x).
- MVCOMMON_API [Vector4f Normalized](#) () const
Creates a normalized vector (with length equal to 1).
- MVCOMMON_API [Vector4f Abs](#) () const
Creates a vector with dimensions with absolute values of the original vector.
- MVCOMMON_API [Vector3f GetXYZ](#) () const
Extracts x, y and z coordinates as a 3-dimensional vector.
- MVCOMMON_API float & [operator\[\]](#) (size_t pos)
Accesses vector dimension value via index.
- MVCOMMON_API const float & [operator\[\]](#) (size_t pos) const
Accesses vector dimension value via index.

Static Public Member Functions

- static MVCOMMON_API [Vector4f FromString](#) ([String](#) const &str)
Creates a vector from a human-readable string.
- static MVCOMMON_API [Vector4f FromRawBytes](#) ([ByteArray](#) &bytes, bool consumeBytes=false)
Deserializes vector from a byte array.
- static MVCOMMON_API float [Dot](#) ([Vector4f](#) const &lhs, [Vector4f](#) const &rhs)
Calculates a dot product of two vectors.

Data Fields

- float [x](#)
An x coordinate.
- float [y](#)
A y coordinate.
- float [z](#)
A z coordinate.
- float [w](#)
A w coordinate.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the vector requires in a serialized form.

6.47.1 Detailed Description

A 4-dimensional vector with single-precision floating-point values.

6.47.2 Constructor & Destructor Documentation

6.47.2.1 Vector4f() [1/2]

```
MVCOMMON_API MVCommon::Vector4f::Vector4f (
    float x,
    float y,
    float z,
    float w )
```

A constructor.

Parameters

<i>x</i>	an x coordinate
<i>y</i>	a y coordinate
<i>z</i>	a z coordinate
<i>w</i>	a w coordinate

6.47.2.2 Vector4f() [2/2]

```
MVCOMMON_API MVCommon::Vector4f::Vector4f (
    Vector3f const & vector3,
    float w = 0.0f )
```

A constructor.

Parameters

<i>vector3</i>	a 3-dimensional vector whose x, y and z coordinates will be grabbed
<i>w</i>	a w coordinate

6.47.3 Member Function Documentation

6.47.3.1 Abs()

```
MVCOMMON_API Vector4f MVCommon::Vector4f::Abs ( ) const
```

Creates a vector with dimensions with absolute values of the original vector.

Returns

a vector with absolute-valued dimensions

6.47.3.2 Dot()

```
static MVCOMMON_API float MVCommon::Vector4f::Dot (
    Vector4f const & lhs,
    Vector4f const & rhs ) [static]
```

Calculates a dot product of two vectors.

Parameters

<i>lhs</i>	a first vector-operand
<i>rhs</i>	a second vector-operand

Returns

a dot product

6.47.3.3 FromRawBytes()

```
static MVCOMMON_API Vector4f MVCommon::Vector4f::FromRawBytes (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Deserializes vector from a byte array.

Parameters

<i>bytes</i>	an array of vector bytes
<i>consumeBytes</i>	determines whether bytes of the vector shall be removed from the array

Returns

a vector

Exceptions

<code>std::invalid_argument</code>	raised when there are not enough bytes in the array
------------------------------------	---

6.47.3.4 FromString()

```
static MVCOMMON_API Vector4f MVCommon::Vector4f::FromString (
    String const & str ) [static]
```

Creates a vector from a human-readable string.

Parameters

<code>str</code>	a vector string
------------------	-----------------

Returns

a vector

6.47.3.5 GetXYZ()

```
MVCOMMON_API Vector3f MVCommon::Vector4f::GetXYZ ( ) const
```

Extracts x, y and z coordinates as a 3-dimensional vector.

Returns

a 3-dimensional vector

6.47.3.6 Inverted()

```
MVCOMMON_API Vector4f MVCommon::Vector4f::Inverted ( ) const
```

Creates a vector with inverted dimensions (1/x).

Returns

an inverted vector

6.47.3.7 Length()

```
MVCOMMON_API float MVCommon::Vector4f::Length ( ) const
```

Gets a length of the vector.

Returns

vector's length

6.47.3.8 Normalized()

```
MVCOMMON_API Vector4f MVCommon::Vector4f::Normalized ( ) const
```

Creates a normalized vector (with length equal to 1).

Returns an unchanged vector in case its length is equal to 0.

Returns

a normalized vector

6.47.3.9 operator[]() [1/2]

```
MVCOMMON_API float& MVCommon::Vector4f::operator[] (
    size_t pos )
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-3)
--------------------------	---

6.47.3.10 operator[]() [2/2]

```
MVCOMMON_API const float& MVCommon::Vector4f::operator[] (
    size_t pos ) const
```

Accesses vector dimension value via index.

Parameters

<i>pos</i>	an index of the dimension to access
------------	-------------------------------------

Returns

a reference to the dimension value

Exceptions

<i>std::out_of_range</i>	raised when index is out of range (0-3)
--------------------------	---

6.47.3.11 ToRawBytes()

```
MVCOMMON_API void MVCommon::Vector4f::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the vector into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.47.3.12 ToString()

```
MVCOMMON_API String MVCommon::Vector4f::ToString ( ) const
```

Converts the vector into a human-readable string.

Returns

the vector string

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

- public/MVCommon/math/Vector4f.h

6.48 MVCommon::Vector4fHasher Struct Reference

A hasher for [Vector4f](#) objects so they can be used in unordered collections.

```
#include <Vector4f.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Vector4f](#) const &vector) const
Calculates a hash value from the object.

6.48.1 Detailed Description

A hasher for [Vector4f](#) objects so they can be used in unordered collections.

6.48.2 Member Function Documentation

6.48.2.1 [operator\(\)](#)

```
MVCOMMON_API size_t MVCommon::Vector4fHasher::operator() (  
    Vector4f const & vector ) const
```

Calculates a hash value from the object.

Parameters

vector	an object to calculate the hash value of
------------------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Vector4f.h

6.49 MVCommon::VersionInfo Struct Reference

A structure holding module version information.

```
#include <VersionInfo.h>
```

Public Member Functions

- MVCOMMON_API [VersionInfo](#) (uint32_t [major](#)=0, uint32_t [minor](#)=0, uint32_t [patch](#)=0)
A constructor.
- MVCOMMON_API [MVCommon::String ToString](#) () const
Converts the version info into a string with format 'major.minor.patch'.

Data Fields

- uint32_t [major](#)
Most-significant version component.
- uint32_t [minor](#)
Medium-significant version component.
- uint32_t [patch](#)
Least-significant version component.

6.49.1 Detailed Description

A structure holding module version information.

6.49.2 Constructor & Destructor Documentation

6.49.2.1 VersionInfo()

```
MVCOMMON_API MVCommon::VersionInfo::VersionInfo (
    uint32_t major = 0,
    uint32_t minor = 0,
    uint32_t patch = 0 )
```

A constructor.

Parameters

<i>major</i>	most-significant version component
<i>minor</i>	medium-significant version component
<i>patch</i>	least-significant version component

6.49.3 Member Function Documentation

6.49.3.1 ToString()

```
MVCOMMON_API MVCommon::String MVCommon::VersionInfo::ToString ( ) const
```

Converts the version info into a string with format 'major.minor.patch'.

Returns

a string containing version

6.49.4 Field Documentation

6.49.4.1 major

```
uint32_t MVCommon::VersionInfo::major
```

Most-significant version component.

Difference indicates binary-incompatibility.

6.49.4.2 minor

```
uint32_t MVCommon::VersionInfo::minor
```

Medium-significant version component.

Increased whenever a new official version is released.

6.49.4.3 patch

```
uint32_t MVCommon::VersionInfo::patch
```

Least-significant version component.

Increased whenever an officially released version is patched and re-released.

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

- public/MVCommon/utis/[VersionInfo.h](#)

6.50 MVCommon::VersionInfoHasher Struct Reference

A hasher for [VersionInfo](#) objects so they can be used in unordered collections.

```
#include <VersionInfo.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([VersionInfo](#) const &versionInfo) const
Calculates a hash value from the object.

6.50.1 Detailed Description

A hasher for [VersionInfo](#) objects so they can be used in unordered collections.

6.50.2 Member Function Documentation

6.50.2.1 [operator\(\)](#)()

```
MVCOMMON_API size_t MVCommon::VersionInfoHasher::operator() (
    VersionInfo const & versionInfo ) const
```

Calculates a hash value from the object.

Parameters

<i>versionInfo</i>	an object to calculate the hash value of
--------------------	--

Returns

hash value of the object

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

- public/MVCommon/utis/[VersionInfo.h](#)

6.51 MVCommon::Versord Struct Reference

A rotational quaternion (i.e. versor) with double-precision floating-point values.

```
#include <Versord.h>
```

Public Member Functions

- MVCOMMON_API [Versord](#) ()
A constructor of an identity versor (i.e. no rotation).
- MVCOMMON_API [String ToString](#) () const
Converts the versor into a human-readable string.

- MVCOMMON_API void [ToRawBytes](#) (ByteArray &bytes) const
Serializes the versor into a byte array.
- MVCOMMON_API [Vector4d ToElementsVector](#) () const
Converts the versor into a vector with values of versor's internal elements.
- MVCOMMON_API void [ToRawElements](#) (double *elements) const
Serializes the versor into an elements array.
- MVCOMMON_API [Versord Inverted](#) () const
Creates an inverted versor.
- MVCOMMON_API [Vector3d ToEulerAnglesZYX](#) () const
Converts the versor to Euler angles (in degrees) in z -> y -> x order.

Static Public Member Functions

- static MVCOMMON_API [Versord FromString](#) (String const &str)
Creates a versor from a human-readable string.
- static MVCOMMON_API [Versord FromRawBytes](#) (ByteArray &bytes, bool consumeBytes=false)
Deserializes versor from a byte array.
- static MVCOMMON_API [Versord FromElementsVector](#) (Vector4d const &elements)
Creates a versor from a vector with values of versor's internal elements.
- static MVCOMMON_API [Versord FromRawElements](#) (double const *elements)
Deserializes versor from an elements array.
- static MVCOMMON_API [Versord CreateRotationAroundAxis](#) (Vector3d const &axis, double angle)
Creates a versor from axis of rotation and an angle (in degrees).
- static MVCOMMON_API [Versord CreateRotationFromMatrix](#) (Matrix4x4d const &matrix)
Creates a versor from a rotational part of transformation matrix.
- static MVCOMMON_API [Versord CreateRotationFromEulerAnglesZYX](#) (Vector3d const &eulerAngles)
Creates a versor from Euler angles (in degrees) in eulerAngles.z -> eulerAngles.y -> eulerAngles.x order.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the versor requires in a serialized form.

6.51.1 Detailed Description

A rotational quaternion (i.e. versor) with double-precision floating-point values.

6.51.2 Member Function Documentation

6.51.2.1 CreateRotationAroundAxis()

```
static MVCOMMON_API Versord MVCommon::Versord::CreateRotationAroundAxis (
    Vector3d const & axis,
    double angle ) [static]
```

Creates a versor from axis of rotation and an angle (in degrees).

Parameters

<i>axis</i>	an axis of rotation
<i>angle</i>	an angle

Returns

a versor

6.51.2.2 CreateRotationFromEulerAnglesZYX()

```
static MVCOMMON_API Versord MVCommon::Versord::CreateRotationFromEulerAnglesZYX (  
    Vector3d const & eulerAngles ) [static]
```

Creates a versor from Euler angles (in degrees) in *eulerAngles.z* -> *eulerAngles.y* -> *eulerAngles.x* order.

Parameters

<i>eulerAngles</i>	Euler angles of Z-Y-X rotation
--------------------	--------------------------------

Returns

a versor

6.51.2.3 CreateRotationFromMatrix()

```
static MVCOMMON_API Versord MVCommon::Versord::CreateRotationFromMatrix (  
    Matrix4x4d const & matrix ) [static]
```

Creates a versor from a rotational part of transformation matrix.

Parameters

<i>matrix</i>	a matrix to extract the rotation from
---------------	---------------------------------------

Returns

a versor

6.51.2.4 FromElementsVector()

```
static MVCOMMON_API Versord MVCommon::Versord::FromElementsVector (  
    Vector4d const & elements ) [static]
```

Creates a versor from a vector with values of versor's internal elements.

Parameters

<i>elements</i>	a vector with versor's internal elements
-----------------	--

Returns

a versor

Exceptions

<i>std::invalid_argument</i>	raied when the vector does not represent a rotational quaternion
------------------------------	--

6.51.2.5 FromRawBytes()

```
static MVCOMMON_API Versord MVCommon::Versord::FromRawBytes (  
    ByteArray & bytes,  
    bool consumeBytes = false ) [static]
```

Deserializes versor from a byte array.

Parameters

<i>bytes</i>	an array of versor bytes
<i>consumeBytes</i>	determines whether bytes of the versor shall be removed from the array

Returns

a versor

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array or the bytes do not represent a rotational quaternion
------------------------------	---

6.51.2.6 FromRawElements()

```
static MVCOMMON_API Versord MVCommon::Versord::FromRawElements (  
    double const * elements ) [static]
```

Deserializes versor from an elements array.

Parameters

<i>elements</i>	an array of 4 elements
-----------------	------------------------

Returns

a versor

Exceptions

<i>std::invalid_argument</i>	raied when the elements do not represent a rotational quaternion
------------------------------	--

6.51.2.7 FromString()

```
static MVCOMMON_API Versord MVCommon::Versord::FromString (  
    String const & str ) [static]
```

Creates a versor from a human-readable string.

Parameters

<i>str</i>	a versor string
------------	-----------------

Returns

a versor

Exceptions

<i>std::invalid_argument</i>	raied when the string does not represent a rotational quaternion
------------------------------	--

6.51.2.8 Inverted()

```
MVCOMMON_API Versord MVCommon::Versord::Inverted ( ) const
```

Creates an inverted versor.

Returns

an inverted versor

6.51.2.9 ToElementsVector()

```
MVCOMMON_API Vector4d MVCommon::Versord::ToElementsVector ( ) const
```

Converts the versor into a vector with values of versor's internal elements.

Returns

a vector of versor's elements

6.51.2.10 ToEulerAnglesZYX()

```
MVCOMMON_API Vector3d MVCommon::Versord::ToEulerAnglesZYX ( ) const
```

Converts the versor to Euler angles (in degrees) in z -> y -> x order.

Returns

Euler angles of Z-Y-X rotation

6.51.2.11 ToRawBytes()

```
MVCOMMON_API void MVCommon::Versord::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the versor into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.51.2.12 ToRawElements()

```
MVCOMMON_API void MVCommon::Versord::ToRawElements (
    double * elements ) const
```

Serializes the versor into an elements array.

Parameters

<i>elements</i>	an array of 4 elements
-----------------	------------------------

6.51.2.13 ToString()

```
MVCOMMON_API String MVCommon::Versord::ToString ( ) const
```

Converts the versor into a human-readable string.

Returns

the versor string

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

- public/MVCommon/math/Versord.h

6.52 MVCommon::VersordHasher Struct Reference

A hasher for [Versord](#) objects so they can be used in unordered collections.

```
#include <Versord.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Versord](#) const &versor) const
Calculates a hash value from the object.

6.52.1 Detailed Description

A hasher for [Versord](#) objects so they can be used in unordered collections.

6.52.2 Member Function Documentation

6.52.2.1 operator()

```
MVCOMMON_API size_t MVCommon::VersordHasher::operator() (
    Versord const & versor ) const
```

Calculates a hash value from the object.

Parameters

<code>versorf</code>	an object to calculate the hash value of
----------------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Versord.h

6.53 MVCommon::Versorf Struct Reference

A rotational quaternion (i.e. versorf) with single-precision floating-point values.

```
#include <Versorf.h>
```

Public Member Functions

- MVCOMMON_API [Versorf](#) ()
A constructor of an identity versorf (i.e. no rotation).
- MVCOMMON_API [String ToString](#) () const
Converts the versorf into a human-readable string.
- MVCOMMON_API void [ToRawBytes](#) (ByteArray &bytes) const
Serializes the versorf into a byte array.
- MVCOMMON_API [Vector4f ToElementsVector](#) () const
Converts the versorf into a vector with values of versorf's internal elements.
- MVCOMMON_API void [ToRawElements](#) (float *elements) const
Serializes the versorf into an elements array.
- MVCOMMON_API [Versorf Inverted](#) () const
Creates an inverted versorf.
- MVCOMMON_API [Vector3f ToEulerAnglesZYX](#) () const
Converts the versorf to Euler angles (in degrees) in z -> y -> x order.

Static Public Member Functions

- static MVCOMMON_API [Versorf FromString](#) (String const &str)
Creates a versorf from a human-readable string.
- static MVCOMMON_API [Versorf FromRawBytes](#) (ByteArray &bytes, bool consumeBytes=false)
Deserializes versorf from a byte array.
- static MVCOMMON_API [Versorf FromElementsVector](#) (Vector4f const &elements)
Creates a versorf from a vector with values of versorf's internal elements.
- static MVCOMMON_API [Versorf FromRawElements](#) (float const *elements)
Deserializes versorf from an elements array.
- static MVCOMMON_API [Versorf CreateRotationAroundAxis](#) (Vector3f const &axis, float angle)
Creates a versorf from axis of rotation and an angle (in degrees).
- static MVCOMMON_API [Versorf CreateRotationFromMatrix](#) (Matrix4x4f const &matrix)
Creates a versorf from a rotational part of transformation matrix.
- static MVCOMMON_API [Versorf CreateRotationFromEulerAnglesZYX](#) (Vector3f const &eulerAngles)
Creates a versorf from Euler angles (in degrees) in eulerAngles.z -> eulerAngles.y -> eulerAngles.x order.

Static Public Attributes

- static const MVCOMMON_API size_t [RAW_BYTES_SIZE](#)
A count of bytes the versor requires in a serialized form.

6.53.1 Detailed Description

A rotational quaternion (i.e. versor) with single-precision floating-point values.

6.53.2 Member Function Documentation

6.53.2.1 CreateRotationAroundAxis()

```
static MVCOMMON_API Versorf MVCommon::Versorf::CreateRotationAroundAxis (  
    Vector3f const & axis,  
    float angle ) [static]
```

Creates a versor from axis of rotation and an angle (in degrees).

Parameters

<i>axis</i>	an axis of rotation
<i>angle</i>	an angle

Returns

a versor

6.53.2.2 CreateRotationFromEulerAnglesZYX()

```
static MVCOMMON_API Versorf MVCommon::Versorf::CreateRotationFromEulerAnglesZYX (  
    Vector3f const & eulerAngles ) [static]
```

Creates a versor from Euler angles (in degrees) in eulerAngles.z -> eulerAngles.y -> eulerAngles.x order.

Parameters

<i>eulerAngles</i>	Euler angles of Z-Y-X rotation
--------------------	--------------------------------

Returns

a versor

6.53.2.3 CreateRotationFromMatrix()

```
static MVCOMMON_API Versorf MVCommon::Versorf::CreateRotationFromMatrix (
    Matrix4x4f const & matrix ) [static]
```

Creates a versor from a rotational part of transformation matrix.

Parameters

<i>matrix</i>	a matrix to extract the rotation from
---------------	---------------------------------------

Returns

a versor

6.53.2.4 FromElementsVector()

```
static MVCOMMON_API Versorf MVCommon::Versorf::FromElementsVector (
    Vector4f const & elements ) [static]
```

Creates a versor from a vector with values of versor's internal elements.

Parameters

<i>elements</i>	a vector with versor's internal elements
-----------------	--

Returns

a versor

Exceptions

<i>std::invalid_argument</i>	raied when the vector does not represent a rotational quaternion
------------------------------	--

6.53.2.5 FromRawBytes()

```
static MVCOMMON_API Versorf MVCommon::Versorf::FromRawBytes (
    ByteArray & bytes,
    bool consumeBytes = false ) [static]
```

Deserializes versor from a byte array.

Parameters

<i>bytes</i>	an array of versor bytes
<i>consumeBytes</i>	determines whether bytes of the versor shall be removed from the array

Returns

a versor

Exceptions

<i>std::invalid_argument</i>	raised when there are not enough bytes in the array or the bytes do not represent a rotational quaternion
------------------------------	---

6.53.2.6 FromRawElements()

```
static MVCOMMON_API Versorf MVCommon::Versorf::FromRawElements (
    float const * elements ) [static]
```

Deserializes versor from an elements array.

Parameters

<i>elements</i>	an array of 4 elements
-----------------	------------------------

Returns

a versor

Exceptions

<i>std::invalid_argument</i>	raied when the elements do not represent a rotational quaternion
------------------------------	--

6.53.2.7 FromString()

```
static MVCOMMON_API Versorf MVCommon::Versorf::FromString (
    String const & str ) [static]
```

Creates a versor from a human-readable string.

Parameters

<i>str</i>	a versor string
------------	-----------------

Returns

a versor

Exceptions

<code>std::invalid_argument</code>	raied when the string does not represent a rotational quaternion
------------------------------------	--

6.53.2.8 Inverted()

```
MVCOMMON_API Versorf MVCommon::Versorf::Inverted ( ) const
```

Creates an inverted versor.

Returns

an inverted versor

6.53.2.9 ToElementsVector()

```
MVCOMMON_API Vector4f MVCommon::Versorf::ToElementsVector ( ) const
```

Converts the versor into a vector with values of versor's internal elements.

Returns

a vector of versor's elements

6.53.2.10 ToEulerAnglesZYX()

```
MVCOMMON_API Vector3f MVCommon::Versorf::ToEulerAnglesZYX ( ) const
```

Converts the versor to Euler angles (in degrees) in z -> y -> x order.

Returns

Euler angles of Z-Y-X rotation

6.53.2.11 ToRawBytes()

```
MVCOMMON_API void MVCommon::Versorf::ToRawBytes (
    ByteArray & bytes ) const
```

Serializes the versor into a byte array.

Parameters

<i>bytes</i>	a byte array to serialize into
--------------	--------------------------------

6.53.2.12 ToRawElements()

```
MVCOMMON_API void MVCommon::Versorf::ToRawElements (
    float * elements ) const
```

Serializes the versor into an elements array.

Parameters

<i>elements</i>	an array of 4 elements
-----------------	------------------------

6.53.2.13 ToString()

```
MVCOMMON_API String MVCommon::Versorf::ToString ( ) const
```

Converts the versor into a human-readable string.

Returns

the versor string

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

- public/MVCommon/math/Versorf.h

6.54 MVCommon::VersorfHasher Struct Reference

A hasher for [Versorf](#) objects so they can be used in unordered collections.

```
#include <Versorf.h>
```

Public Member Functions

- MVCOMMON_API size_t [operator\(\)](#) ([Versorf](#) const &versor) const
Calculates a hash value from the object.

6.54.1 Detailed Description

A hasher for [Versorf](#) objects so they can be used in unordered collections.

6.54.2 Member Function Documentation

6.54.2.1 operator()

```
MVCOMMON_API size_t MVCommon::VersorfHasher::operator() (
    Versorf const & versorf ) const
```

Calculates a hash value from the object.

Parameters

versorf	an object to calculate the hash value of
-------------------------	--

Returns

hash value of the object

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

- public/MVCommon/math/Versorf.h

6.55 MVCommon::WeakLoggerPtr Class Reference

A weak smart-pointer to a logger.

```
#include <WeakLoggerPtr.h>
```

Public Member Functions

- MVCOMMON_API [WeakLoggerPtr](#) ()
A constructor.
- MVCOMMON_API [WeakLoggerPtr](#) ([SharedLoggerPtr](#) spPtr)
A constructor.
- MVCOMMON_API [WeakLoggerPtr](#) ([WeakLoggerPtr](#) const &other)
A copy-constructor.
- MVCOMMON_API [~WeakLoggerPtr](#) ()
A destructor.
- MVCOMMON_API [WeakLoggerPtr](#) & operator= ([WeakLoggerPtr](#) const &other)
*Makes the pointer point to a logger pointed to by the *other* pointer.*

- MVCOMMON_API [WeakLoggerPtr](#) & operator= (SharedLoggerPtr spPtr)
Links the pointer to a shared smart-pointer.
- MVCOMMON_API void [Reset](#) ()
Resets the pointer to not point to any logger (i.e. nullptr).
- MVCOMMON_API bool [Expired](#) () const
Determines whether the pointed-to logger still exists, e.g. when there are no more shared smart-pointers pointing to it.
- MVCOMMON_API [SharedLoggerPtr Lock](#) () const
Creates a new shared smart-pointer pointing to a logger pointed to by the pointer, increasing thus number of shared smart-pointers pointing to it.

6.55.1 Detailed Description

A weak smart-pointer to a logger.

Allows access to a logger object whose lifetime is maintained by a [SharedLoggerPtr](#) smart-pointers, but does not influence the lifetime itself.

6.55.2 Constructor & Destructor Documentation

6.55.2.1 WeakLoggerPtr() [1/3]

```
MVCOMMON_API MVCommon::WeakLoggerPtr::WeakLoggerPtr ( )
```

A constructor.

Initializes the pointer with nullptr.

6.55.2.2 WeakLoggerPtr() [2/3]

```
MVCOMMON_API MVCommon::WeakLoggerPtr::WeakLoggerPtr (
    SharedLoggerPtr spPtr )
```

A constructor.

Parameters

<i>spPtr</i>	a shared smart-pointer to be linked to
--------------	--

6.55.2.3 WeakLoggerPtr() [3/3]

```
MVCOMMON_API MVCommon::WeakLoggerPtr::WeakLoggerPtr (
    WeakLoggerPtr const & other )
```


A copy-constructor.

Parameters

<i>other</i>	other pointer to share a pointed-to logger with
--------------	---

6.55.3 Member Function Documentation

6.55.3.1 Expired()

```
MVCOMMON_API bool MVCommon::WeakLoggerPtr::Expired ( ) const
```

Determines whether the pointed-to logger still exists, e.g. when there are no more shared smart-pointers pointing to it.

Returns

true if the pointed-to logger does not exist anymore

6.55.3.2 Lock()

```
MVCOMMON_API SharedLoggerPtr MVCommon::WeakLoggerPtr::Lock ( ) const
```

Creates a new shared smart-pointer pointing to a logger pointed to by the pointer, increasing thus number of shared smart-pointers pointing to it.

Returns

shared smart-pointer pointing to the pointer-to logger or nullptr in case the pointer has expired already

6.55.3.3 operator=() [1/2]

```
MVCOMMON_API WeakLoggerPtr& MVCommon::WeakLoggerPtr::operator= (
    SharedLoggerPtr spPtr )
```

Links the pointer to a shared smart-pointer.

Parameters

<i>spPtr</i>	a shared smart-pointer to be linked to
--------------	--

Returns

the pointer itself

6.55.3.4 operator=() [2/2]

```
MVCOMMON_API WeakLoggerPtr& MVCommon::WeakLoggerPtr::operator= (
    WeakLoggerPtr const & other )
```

Makes the pointer point to a logger pointed to by the `other` pointer.

Parameters

<i>other</i>	other pointer to share a pointed-to logger with
--------------	---

Returns

the pointer itself

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

- public/MVCommon/logger/WeakLoggerPtr.h

Chapter 7

File Documentation

7.1 public/MVCommon/CUtil.h File Reference

Macros

- `#define MV_VALUE_TO_STR(x) #x`
A macro for converting a value into a string literal.

7.1.1 Macro Definition Documentation

7.1.1.1 MV_VALUE_TO_STR

```
#define MV_VALUE_TO_STR(  
    x ) #x
```

A macro for converting a value into a string literal.

Example:

```
char const * string_literal = MV_VALUE_TO_STR_LITERAL(5);  
// preceding line is processed into:  
// char const * string_literal = "5";
```

7.2 public/MVCommon/guid/GuidGenerator.h File Reference

```
#include "Guid.h"
```

Functions

- MVCOMMON_API Guid [MVCommon::GuidGenerator::GenerateGuid](#) (Guid const &guidNamespace, String const &seed)
Generates a [Guid](#) based on another [Guid](#) (a namespace) and a string seed.
- MVCOMMON_API Guid [MVCommon::GuidGenerator::GenerateGuid](#) (String const &seed)
Generates a [Guid](#) based on a string seed.

7.2.1 Function Documentation

7.2.1.1 GenerateGuid() [1/2]

```
MVCOMMON_API Guid MVCommon::GuidGenerator::GenerateGuid (
    Guid const & guidNamespace,
    String const & seed )
```

Generates a Guid based on another Guid (a namespace) and a string seed.

Using the same Guid namespace and the same seed will always produce the same generated Guid.

Parameters

<i>guidNamespace</i>	a Guid in the role of a namespace (ancestor) for the new Guid
<i>seed</i>	a seed for the new Guid generation

Returns

generated Guid

7.2.1.2 GenerateGuid() [2/2]

```
MVCOMMON_API Guid MVCommon::GuidGenerator::GenerateGuid (
    String const & seed )
```

Generates a Guid based on a string seed.

Using the same seed will always produce the same generated Guid.

Parameters

<i>seed</i>	a seed for the new Guid generation
-------------	------------------------------------

Returns

generated Guid

7.3 public/MVCommon/logger/LoggerLogLevel.h File Reference

```
#include "LogLevel.h"
```

Enumerations

- enum `MVCommon::LoggerLogLevel` {
`MVCommon::LLL_SILENT` = 0, `MVCommon::LLL_CRITICAL` = LL_CRITICAL, `MVCommon::LLL_ERROR` = LL_ERROR, `MVCommon::LLL_WARNING` = LL_WARNING,
`MVCommon::LLL_INFO` = LL_INFO, `MVCommon::LLL_DEBUG` = LL_DEBUG, `MVCommon::LLL_VERBOSE` = LL_VERBOSE }

An enumeration of logger log levels for filtering log messages.

7.3.1 Enumeration Type Documentation

7.3.1.1 LoggerLogLevel

```
enum MVCommon::LoggerLogLevel
```

An enumeration of logger log levels for filtering log messages.

Only log messages that are classified with higher log level than the logger is set to are actually logged.

Enumerator

LLL_SILENT	No log messages are logged.
LLL_CRITICAL	Only critical log messages are logged.
LLL_ERROR	Only error or higher level log messages are logged.
LLL_WARNING	Only warning and higher level log messages are logged.
LLL_INFO	Only info and higher level log messages are logged.
LLL_DEBUG	Only debug and higher level log messages are logged.
LLL_VERBOSE	All log messages are logged.

7.4 public/MVCommon/logger/LogLevel.h File Reference

Enumerations

- enum `MVCommon::LogLevel` {
`MVCommon::LL_CRITICAL` = 1, `MVCommon::LL_ERROR` = 2, `MVCommon::LL_WARNING` = 3,
`MVCommon::LL_INFO` = 4,
`MVCommon::LL_DEBUG` = 5, `MVCommon::LL_VERBOSE` = 6 }

An enumeration of log levels.

7.4.1 Enumeration Type Documentation

7.4.1.1 LogLevel

enum `MVCommon::LogLevel`

An enumeration of log levels.

Enumerator

LL_CRITICAL	A critical message log level.
LL_ERROR	An error message log level.
LL_WARNING	A warning message log level.
LL_INFO	An info message log level.
LL_DEBUG	A debug message log level.
LL_VERBOSE	A verbose message log level.

7.5 public/MVCommon/MVCommonVersion.h File Reference

```
#include "utils/VersionInfo.h"
```

Macros

- `#define MVCOMMON_VERSION_MAJOR 4`
Current value of the most-significant MVCommon version component.
- `#define MVCOMMON_VERSION_MINOR 0`
Current value of the medium-significant MVCommon version component.
- `#define MVCOMMON_VERSION_PATCH 1`
Current value of the least-significant MVCommon version component.

Variables

- `const VersionInfo MVCommon::MVCOMMON_VERSION = { 4 , 0 , 1 }`
An MVCommon version.

7.6 public/MVCommon/utils/VersionInfo.h File Reference

```
#include <MVCommon/MVCommonAPI.h>
#include <MVCommon/Memory.h>
#include "String.h"
```

Data Structures

- struct `MVCommon::VersionInfo`
A structure holding module version information.
- struct `MVCommon::VersionInfoHasher`
A hasher for `VersionInfo` objects so they can be used in unordered collections.

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