Lib3MF

Open Source Toolkit for the 3D Manufacturing Format

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Contents

About this Library

Lib3MF is a C++ implementation of the 3D Manufacturing Format file standard.

As 3MF shall become an universal 3D Printing standard, its quick adoption is very important. This library shall lower all barriers of adoption to any possible user, let it be software providers, hardware providers, service providers or middleware tools.

Its aim is to offer an open source way to integrate 3MF reading and writing capabilities, as well as conversion and validation tools for input and output data. The 3MF Library shall provide a clean and easy-to-use API to speed up the development and keep integration costs at a minimum.

While the current code is primarily made for a Microsoft Visual Studio Environment, a lot of energy has been put into keeping it as platform independent as far as possible. For example, it compiles well with the GCC compiler, but there is some work left to recode a few platform specific functionalities, which are now covered by the WinRT platform (like XML parsing and ZIP compression). As described below, we are looking for contributors with extensive experience in this field.

To understand this documentation in full extent, it is important to have taken a look at the 3MF specification 1.0, available for free download at http://3mf.io/what-is-3mf/3mf-specification/.

For the source code of the library code, please visit https://github.com/3MFConsortium/lib3mf.

Example code can be found at https://github.com/3MFConsortium/lib3mf-examples.

For any hints, feedback or contributions, please contact lib3mf@netfabb.com.

General Architecture

The 3MF library API compiles into two different flavours, which are basically just bindings to the same class model:

(1) A COM-like DLL Interface, which exposes the same API as the COM Interface, but comes without the need for global CLSID registration. This allows to link the library natively to many unmanaged object-oriented languages (e.g. C++ or Delphi)
(2) A plain C Interface, which wraps the class structure of the API into pseudo-object-oriented. This works very well for C programs and other low level languages, as well as other operating systems.

In the first releases, the DLLs are only compiling in Microsoft Windows. Porting it to other platforms is planned. More information can be found in the corresponding headers in

(1) Include/Model/COM/NMR_COMInterfaces.h
(2) Include/Model/COM/NMR_COMFactory.h
(3) Include/Model/COM/NMR_DLLInterfaces.h

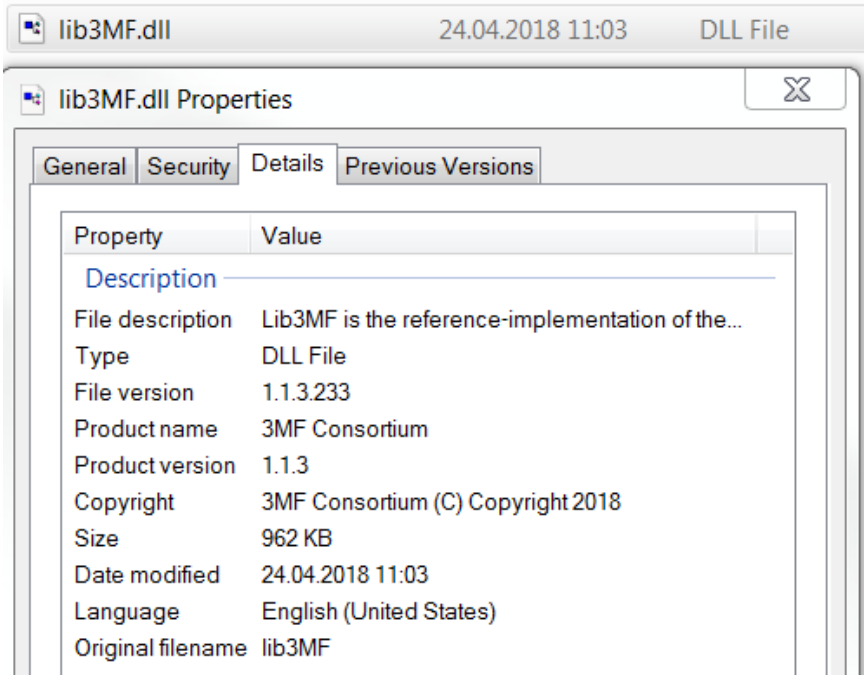
Versioning

The lib3MF library contains an internal version number, which should be checked by the consuming program when loading it (see Example applications).

Lib3MF follows a common, hierarchical schema for versioning:

lib3MF.major.minor.mirco.buildnumber

To identify lib3MF's version under windows, look for "File version" in DLL's details.



Both examples are for version 1.1.3, build 233 of lib3MF.

Lib3MF's API is stable in the following way:

- Lib3MF-libraries with different *major version* are not guaranteed to be compatible.
- Lib3MF-libraries with matching *major version* and different *minor versions* are backwards compatible:
  A consumer who compiled against the API of version A.B can safely use the binary of version A.C for C>=B.
  I.e., functions will not be removed within the range of a constant *major version*.
- Lib3MF-libraries with matching values of both *major* and *minor version* have an identical API.

Under Unix use a tool like objdumd to find out the so-name:

```
$$objdump -p lib3MF.so | grep SONAME
SONAME               lib3MF.so.1
```

This corresponds to the *major version* of the lib3MF. To find out the *minor* or *micro version*, use the `GetInterfaceVersion`-function of the library described below.

Examples

Currently, there are several examples which show how to use the library:

- *Cube*: a simple example how to create an empty 3MF document and add custom geometry to it.
- *Converter*: a simple program to convert 3MFs into (binary) STLs and back.
- *Components*: explains component handling in 3MF
- *ExtractInfo*: shows how to import a 3MF and navigate through the in memory representation of the model.
- *TextureCube*: demonstrates the handling of texures in 3MF and shows the usage of the progress callback of lib3MF.

Please note, that you might need a proper understanding of the 3MF Specification in order to get the most out of the example code.

COM Interfaces

For the 3MF Core spec, the following interfaces specify an in memory representation of the 3MF Document. For a detailed description, please refer to Include/Model/COM/NMR_COMInterfaces.h.

Interface	derived from	Description
ILib3MFBase	IUnknown	ILib3MFBase is a base interface, which serves as parent for all interfaces related to the 3MF Library
ILib3MFModelWriter	ILib3MFBase	ILib3MFModelWriter encapsulates a writer class for writing the model into a specific file type.
ILib3MFModelReader	ILib3MFBase	ILib3MFModelReader encapsulates a reader class for reading a model from a specific file type.
ILib3MFModelResource	ILib3MFBase	ILib3MFModelResource is a base interface for all 3MF Resources.
ILib3MFModelResourceIterator	ILib3MFBase	ILib3MFModelResourceIterator is a helper class to iterate through arbitrary lists of 3MF resources
ILib3MFPropertyHandler	ILib3MFBase	ILib3MFPropertyHandler encapsulates all methods for handling 3MF mesh properties.
ILib3MFDefaultPropertyHandler	ILib3MFBase	ILib3MFDefaultPropertyHandler encapsulates all methods for handling 3MF default object properties.
ILib3MFModelBaseMaterial	ILib3MFModelResource	ILib3MFModelBaseMaterial implements the Base Material Group Resources of a 3MF model stream, and allows direct access to the base material information
ILib3MFModelAttachment	ILib3MFBase	ILib3MFModelAttachment implements the Model Attachments of a 3MF model stream, and allows direct access to direct binary data.
ILib3MFModelTexture2D	ILib3MFModelResource	ILib3MFModelTexture2D implements the Texture2D Resources of a 3MF model stream, and allows direct access to the texture properties and the image data.

ILib3MFModelMeshObject	ILib3MFModelObjectResource	ILib3MFModelMeshObject encapsulates all methods for handling 3MF mesh objects.
ILib3MFModelComponent	ILib3MFBase	ILib3MFModelComponent encapsulates one component node of a 3MF component object.
ILib3MFModelComponentsObject	ILib3MFModelObjectResource	ILib3MFModelComponentsObject encapsulates all methods for handling 3MF component objects.
ILib3MFModelBuildItem	ILib3MFBase	ILib3MFModelBuildItem encapsulates all methods for handling 3MF build items.
ILib3MFModelBuildItemIterator	ILib3MFBase	ILib3MFModelBuildItemIterator is a helper class to iterate through arbitrary lists of 3MF build items.
ILib3MFModel	ILib3MFBase	ILib3MFModel is the basic instance owning all In-Memory elements of a 3MF file.
ILib3MFModelFactory	ILib3MFBase	ILib3MFModelFactory is a factory interface for ILib3MFModel
ILib3MFModelMeshBeamSet	ILib3MFBase	ILib3MFModelMeshBeamSet is a class that holds the references that contain to a beamset. It is part of the beamlattice extension to 3MF.
ILib3MFSlice	ILib3MFBase	ILib3MFSlice encapsulates all slice functionality for handling slices in 3mf
ILib3MFSliceStack	ILib3MFBase	ILib3MFSliceStack encapsulates all methods for handling slice stacks in 3MF

1.1. Plain C Interfaces

In order to address a wider user base, the object-oriented interfaces above are also compiled into a DLL for emulating pseudo objects in a procedural language. There are very valid use cases for it.

Please note, that this wrapper is a lot less type-safe than the COM interface.

Example: The following code in COM

```
pModel->QueryWriter („3mf“, &pModelWriter);
```

will be translated into

```
lib3mf_model_querywriter (pModel, „3mf“, &pModelWriter);
```

Moreover, the following type/interface in COM

```
LIB3MFINTERFACE(ILib3MFModel, ILib3MFBase, CLSID_Lib3MF_Model)
```

is translated to

```
typedef PLib3MFBase PLib3MFModel;
```

All these translations follow the same pattern. For more information, please compare the corresponding header files

(1) Include/Model/COM/NMR_DLLInterfaces.h
(2) Include/Model/COM/NMR_COMInterfaces.h

1.2. Class Reference – Core Specification

The following list shall give a short class overview of the library. The interfaces are all defined centrally in one header file. Please read Include/Model/COM/NMR_COMInterfaces.h for all details.

All Methods return a HRESULT defining the success of the operation. A successful operation always returns 0 (S_OK), and a windows error code otherwise. If no success is returned, the output parameters might be in an undefined state.

1. ILib3MFBase

ILib3MFBase is a base interface, which serves as parent for all interfaces related to the 3MF Library.

Parent interface: *IUnknown*

Method	Parameters	Description
`GetLastError`	`DWORD*` **`pErrorCode`**: returns error code `LPCSTR` **`pErrorMessage`**: Returns pointer to the error message string, NULL if no error.	Returns detailed information of the last known error an object method. The error information is available for every method returning a LIB3MF_FAILED constant.

2. ILib3MFModelWriter

ILib3MFModelWriter encapsulates a writer class for a writing the model into a specific file type. Current implementations include (binary) STL and 3MF.

Parent interface: *ILib3MFBase*

Method	Parameters	Description

WriteToFile	LPCWSTR **pwszFilename**: Filename to write into (UTF16 encoded)	Writes out the model as file. The file type is specified by the Model Writer class
WriteToFileUTF8	LPCSTR **pwszFilename**: Filename to write into (UTF8 encoded)	Writes out the model as file. The file type is specified by the Model Writer class
WriteToStream	IStream* **pStream**: IStream to write into	Writes out the model into a COM IStream. Only available on Windows.
WriteToCallback	void* **pWriteCallback**: Callback to call for writing a data chunk. void* **pSeekCallback**: Callback for seeking in the write data stream. void* **pUserData**: Userdata that is passed to the callback function	Writes out the model and passes the data to a provided callback function. The file type is specified by the Model Writer class
SetProgressCallback	void* **callback**: pointer to the callback function. If the callback returns "false" the original function call will be aborted and set the error NMR_USERABORTED. void* **userData**: pointer to arbitrary user data that is passed without modification to the callback.	Set the progress callback for calls to this writer

3. ILib3MFModelReader

ILib3MFModelReader encapsulates a reader class for reading a model from a specific file type. Current implementations include (binary) STL and 3MF.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
ReadFromFile	LPCWSTR **pwszFilename**: Filename to read from	Reads a model from a file. The file type is specified by the Model Reader class.
ReadFromFileUTF8	LPCSTR **pszFilename**: Filename to read from as UTF8 string	Reads a model from a file. The file type is specified by the Model Reader class.
ReadFromStream	IStream* **pStream**: IStream to read from	Reads a model from a COM IStream. Only available on Windows.
GetWarningCount	DWORD* **pnWarningCount**: filled with the count of the occurred warnings.	Returns warning and error count of the read process.
GetWarning	DWORD **nIndex**: Index of the Warning. Valid values are 0 to WarningCount – 1. DWORD* **pErrorCode**: filled with the error code of the warning LPWSTR **pwszBuffer**: filled with the error message, may be NULL	Returns warning and error information of the read process

	DWORD **cbBufferSize***:* size of pwszBuffer (including trailing 0). DWORD* **pcbNeededChars***:* filled with the count of the written bytes, or needed buffer size.	
SetStrictModeActive	BOOL **bStrictModeActive***:* flag whether strict mode is active or not.	Activates (deactivates) the strict mode of the reader. If active, all warnings are reported as errors. Otherwise, they are reported as warnings. By default, it is deactivated.
GetStrictModeActive	BOOL* **pbStrictModeActive***:* flag whether strict mode is active or not.	Queries the whether the strict mode of the reader is active or not
SetProgressCallback	void* **callback**: pointer to the callback function. If the callback returns "false" the original function call will be aborted and set the error NMR_USERABORTED. void* **userData**: pointer to arbitrary user data that is passed without modification to the callback.	Set the progress callback for calls to this reader

4. ILib3MFModelResource

ILib3MFModelResource is a base interface for all 3MF Resources.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
GetResourceID	DWORD* **pnResourceID**: Filled with the ID of the Resource Instance	Retrieves the ID of a Model Resource Instance

5. ILib3MFModelResourceIterator

ILib3MFModelResourceIterator is a helper class to iterate through arbitrary lists of 3MF resources.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
MoveNext	BOOL* **pbHasNext**: returns, if there is a resource to use	Iterates to the next resource in the list.
MovePrevious	BOOL* **pbHasPrevious**: returns, if there is a resource to use	Iterates to the previous resource in the list.
GetCurrent	ILib3MFModelResource** **ppResourceInstance**: returns the resource instance	Returns the resource the iterator points at.
Clone	ILib3MFModelResourceIterator** **ppIterator**: returns the cloned Iterator instance	Creates a new resource iterator with the same resource list.

6. ILib3MFPropertyHandler

ILib3MFPropertyHandler encapsulates all methods for handling 3MF mesh properties.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
`RemoveProperty`	DWORD **`nIndex`**: Index of the triangle (0-based)	Removes all properties of a specific triangle.
`RemoveAllProperties`	-	Removes all properties of the triangle mesh.
`GetPropertyType`	DWORD **`nIndex`**: Index of the triangle (0-based) eModelPropertyType* **`pnPropertyType`**: Returns the property type of the triangle	Returns the property type of the specific triangle
`GetBaseMaterial`	DWORD **`nIndex`**: Index of the triangle (0-based) `ModelResourceID*` **`pnMaterialGroupID`**: returns the material group id, per triangle. A return group id of 0 means either no property at all or a non-material property. `ModelResourceIndex*` **`pnMaterialIndex`**: returns the material index, per triangle. Returns 0, if no base material is assigned.	Returns the base material of a specific triangle.
`GetBaseMaterialArray`	`ModelResourceID*` **`pnMaterialGroupIDs`**: will be filled with the material group ids of the triangles. Array must have trianglecount entries. A return group id of 0 means either no property at all or a non-material property. `ModelResourceIndex*` **`pnMaterialIndices`**: will be filled with the material group indices of the triangles. Array must have trianglecount entries.	Returns the base materials of all triangles. If a triangle property is not a material, the returned material group ID will be 0.
`SetBaseMaterial`	DWORD **`nIndex`**: Index of the triangle (0-based) `ModelResourceID` **`nMaterialGroupID`**: Group ID of the Material Group `ModelResourceIndex` **`nMaterialIndex`**: Index of the Material in the Group	Sets the material of a triangle to a specific single value. All other Triangle properties are removed. This must be a base material .
`SetBaseMaterialArray`	ModelResourceID* **`pnMaterialGroupIDs`**: array of the material Group IDs. Must have trianglecount entries. If a group ID of 0 is specified. ModelResourceIndex* **`pnMaterialIndices`**: array of the corresponding material indices. Must have trianglecount entries.	Sets the materials of all triangles to specific values.
`GetColor`	DWORD **`nIndex`**: Index of the triangle (0-based) `MODELMESH_TRIANGLECOLOR_SRGB*` **`pColor`**: returns the color values of the three nodes of the triangle. (#00000000) means no property or a different kind of property!	Returns the color of a specific triangle.
`GetColorArray`	`MODELMESH_TRIANGLECOLOR_SRGB*` **`pColors`**: returns the color values of the three nodes of each triangle. Must have at least trianglecount array entries.	Returns the color array of all triangles

SetSingleColor	DWORD **nIndex**: Index of the triangle (0-based) MODELMESHCOLOR_SRGB* **pColor**: new color value of the triangle. (#00000000) means no color property.	Sets the specific triangle to a single color. All other properties are removed. Mixing properties needs the property extension API.
SetSingleColorRGB	DWORD **nIndex**: Index of the triangle BYTE **bRed**: Red component of the color value BYTE **bGreen**: Green component of the color value BYTE **bBlue**: Blue component of the color value	Sets the specific triangle to a single color. All other properties are removed. Mixing properties needs the property extension API. Value range is from 0 to 255. Alpha will be 255.
SetSingleColorRGBA	DWORD **nIndex**: Index of the triangle (0-based) BYTE **bRed**: Red component of the color value BYTE **bGreen**: Green component of the color value BYTE **bBlue**: Blue component of the color value BYTE **bAlpha**: Alpha component of the color value	Sets the specific triangle to a single color. All other properties are removed. Mixing properties needs the property extension API. #00000000 means no color. Value range is from 0 to 255.
SetSingleColorFloatRGB	DWORD **nIndex**: Index of the triangle (0-based) FLOAT **fRed**: Red component of the color value FLOAT **fGreen**: Green component of the color value FLOAT **fBlue**: Blue component of the color value	Sets the specific triangle to a single color. All other properties are removed. Mixing properties needs the property extension API. Value range is from 0.0 to 1.0. Alpha value will be set to 1.0
SetSingleColorFloatRGBA	DWORD **nIndex**: Index of the triangle (0-based) FLOAT **fRed**: Red component of the color value FLOAT **fGreen**: Green component of the color value FLOAT **fBlue**: Blue component of the color value FLOAT **fAlpha**: Alpha component of the color value	Sets the specific triangle to a single color. All other properties are removed. Mixing properties needs the property extension API. #00000000 means no color. Value range is from 0.0 to 1.0
SetSingleColorArray	MODELMESHCOLOR_SRGB* **pColors**: new color values for the triangles. (#00000000) means no color property.. Must have at least trianglecount array entries.	Sets the (single) color of all triangles. All other properties are removed.
SetGradientColor	DWORD **nIndex**: Index of the triangle (0-based) MODELMESH_TRIANGLECOLOR_SRGB* **pColor**: new color values of the three nodes of the triangle. (#00000000) means no color property is set.	Sets the specific triangle to a color per vertex. All other properties are removed.
SetGradientColorArray	MODELMESH_TRIANGLECOLOR_SRGB* **pColors**: pColors returns the color values of the three nodes of each triangle. Must have at least trianglecount array entries. (#00000000) means no color property is set.	Sets the (gradient) color of all triangles. All other properties are removed.
GetTexture	DWORD **nIndex**: Index of the triangle (0-based) MODELMESHTEXTURE2D* **pTexture**: returns the UV texture values of the three nodes of the triangle. texture ID 0 means no property or a different kind of property.	Returns the 2D texture information of a specific triangle.
GetTextureArray	MODELMESHTEXTURE2D* **pTextures**: returns the UV texture values of the three nodes of all triangles. Must have at least trianglecount array entries.	Returns the 2D texture information of all triangles.
SetTexture	DWORD **nIndex**: Index of the triangle (0-based) MODELMESHTEXTURE2D* **pTexture**: new UV texture values of the three nodes of the triangle. texture ID 0 means no property or a different kind of property.	Sets the 2D texture information of a specific triangle.

SetTextureArray	MODELMESHTEXTURE2D* **pTexture**: new UV texture values of the three nodes of all triangles. Must have at least trianglecount array entries.	Sets the 2D texture information of all triangles.

7. ILib3MFDefaultPropertyHandler

ILib3MFDefaultPropertyHandler encapsulates all methods for handling 3MF default object properties.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
RemoveProperty	-	Removes the default property of the object.
GetPropertyType	eModelPropertyType* **pnPropertyType**: Returns the property type of the triangle	Returns the default property type of the object
GetBaseMaterial	ModelResourceID* **pnMaterialGroupID**: returns the material group id, per triangle. A return group id of 0 means either no property at all or a non-material property. ModelResourceIndex* **pnMaterialIndex**: returns the material index, per triangle. Returns 0, if no base material is assigned.	Returns the base material the object
SetBaseMaterial	ModelResourceID **nMaterialGroupID**: Group ID of the Material Group ModelResourceIndex **nMaterialIndex**: Index of the Material in the Group	Sets the material of an object to a specific single value. This must be a base material.
GetColor	MODELMESH_TRIANGLECOLOR_SRGB* **pColor**: returns the color values of the three nodes of the triangle. (#00000000) means no property or a different kind of property!	Returns the default property color of an object.
SetColor	MODELMESHCOLOR_SRGB* **pColor**: new color value of the triangle. (#00000000) means no color property.	Sets the default property of an object to a single color. Mixing properties needs the property extension API.
SetColorRGB	BYTE **bRed**: Red component of the color value BYTE **bGreen**: Green component of the color value BYTE **bBlue**: Blue component of the color value	Sets the default property of an object to a single color.
SetColorRGBA	BYTE **bRed**: Red component of the color value BYTE **bGreen**: Green component of the color value BYTE **bBlue**: Blue component of the color value BYTE **bAlpha**: Alpha component of the color value	ets the default property of an object to a single color.
SetFloatColorRGB	FLOAT **fRed**: Red component of the color value FLOAT **fGreen**: Green component of the color value FLOAT **fBlue**: Blue component of the color value	Sets the default property of an object to a single color.
SetFloatColorRGBA	FLOAT **fRed**: Red component of the color value FLOAT **fGreen**: Green component of the color value FLOAT **fBlue**: Blue component of the color value FLOAT f**Alpha**: Alpha component of the color value	Sets the default property of an object to a single color.
SetGradientColor	DWORD **nIndex**: Index of the triangle (0-based) MODELMESH_TRIANGLECOLOR_SRGB* **pColor**: new color values of the three nodes of the triangle. (#00000000) means no color property is set.	Sets the specific triangle to a color per vertex. All other properties are removed.
GetTexture	MODELMESHTEXTURE2D* **pTexture**: returns the UV texture values of the three nodes of the triangle. texture ID 0 means no property or a different kind of property.	Returns the default 2D texture information of an object.

	FLOAT * **pfU**: Returns the default U value of the object. FLOAT * **pfV**: Returns the default V value of the object.	
SetTexture	MODELMESHTEXTURE2D* **pTexture**: new UV texture values of the three nodes of the triangle. texture ID 0 means no property or a different kind of property. FLOAT **fU**: Sets the default U value of the object. FLOAT **fV**: Sets the default V value of the object.	Sets the default 2D texture information of an object.

8. ILib3MFModelObjectResource

ILib3MFModelObjectResource is a base interface for all 3MF Object Resources, i.e. Mesh Objects and Component Objects.

Parent interface: *ILib3MFModelResource*

Method	Parameters	Description
GetType	DWORD* **pObjectType**: returns object type constant. See ModelTypes.h for more information.	Retrieves an object's type.
SetType	DWORD **ObjectType***:* object type constant. See ModelTypes.h for more information	Sets an object's type.
GetName	LPWSTR **pwszBuffer***:* buffer to fill ULONG **cbBufferSize***:* size of buffer to fill. needs to be at least string length + 1 ULONG* **pcbNeededChars***:* returns needed characters in buffer	Retrieves an object's name string.
SetName	LPCWSTR **pwszName***:* new name of the object. (e.g. "Car")	Sets an object's name string.
GetNameUTF8	LPSTR **pszBuffer***:* buffer to fill ULONG **cbBufferSize***:* size of buffer to fill. needs to be at least string length + 1 ULONG* **pcbNeededChars***:* returns needed characters in buffer	Retrieves an object's name string in UTF8.
SetNameUTF8	LPCSTR **pszName***:* new name of the object. (e.g. "Car")	Sets an object's name string in UTF8.
SetPartNumber	LPCWSTR **pwszPartNumber***:* new part number string for referencing parts from an outside context.	Sets an object's part number string.
SetPartNumberUTF8	LPCWSTR **pszPartNumber***:* new part number string for referencing parts from an outside context.	Sets an object's part number string in UTF8
GetPartNumber	LPWSTR **pwszBuffer***:* buffer to fill ULONG **cbBufferSize***:* size of buffer to fill. needs to be at least string length + 1	Retrieves an object's oartnumber string.

	ULONG* **pcbNeededChars***:* returns needed characters in buffer	
GetPartNumberUTF8	LPSTR **pszBuffer***:* buffer to fill ULONG **cbBufferSize***:* size of buffer to fill. needs to be at least string length + 1 ULONG* **pcbNeededChars***:* returns needed characters in buffer	Retrieves an object's oartnumber string in UTF8.
IsMeshObject	BOOL* **pbIsMeshObject**: returns, if the object is a mesh object	Retrieves, if an object is a mesh object
IsComponentsObject	BOOL* **pbIsComponentObject**: returns, if the object is a components object	Retrieves, if an object is a component object
IsValidObject	BOOL* **pbIsValid**: returns, if the object is a valid object description.	Retrieves, if the object is valid according to the core spec. For mesh objects, we distinguish between the type attribute of the object: • In case of object type "other", this always means "false" • In case of object type "support", this always means "true" • In case of object type "model", this means, if the mesh suffices all requirements of the core spec chapter 4.1 A component objects is valid if and only if it contains at least one component - and all child components are valid objects.
CreateDefaultPropertyHandler	ILib3MFDefaultPropertyHandler * **ppPropertyHandler**: returns a default property handler instance for the object	creates a default property handler for the object
CreateDefaultMultiPropertyHandler	ILib3MFDefaultMultiPropertyHandler * **ppPropertyHandler**: returns a default property handler instance for the object	creates a default property handler for a specific multiproperty channel of an object
GetThumbnailPathUTF8	LPSTR* **pszBuffer**: buffer to fill ULONG **cbBufferSize**: size of the buffer to fill. needs to be at least string length + 1	Retrieves the path used as thumbnail for an object (UTF8).

	ULONG* **pcbNeededChars**: returns needed characters in buffer	Returns "" if none is set
SetThumbnailPathUTF8	LPCSTR* **pszName**: pszPath path where to look for the thumbnail (e.g. "/Textures/thumbnail.png"). Call will NULL to clear the thumbnail.	Sets an object's thumbnail package path (UTF8)

9. ILib3MFModelBaseMaterial

ILib3MFModelBaseMaterial implements the Base Material Group Resources of a 3MF model stream, and allows direct access to the base material information.

Parent interface: *ILib3MFModelResource*

Method	Parameters	Description
GetCount	DWORD* **pcbCount**: returns the count of base materials.	Retrieves the count of base materials in the material group.
AddMaterial	LPCWSTR **pwszName**: new name of the base material. (e.g. "ABS red") BYTE **bRed**: New red value of display color (0-255) BYTE **bGreen**: New red value of display color (0-255) BYTE **bBlue**: New red value of display color (0-255) DWORD* **pnResourceIndex**: returns new Index of the material in the material group	Adds a new material to the material group
RemoveMaterial	DWORD **nIndex**: Index of the material in the material group	Removes a material from the material group
GetName	DWORD **nIndex**: Index of the material in the material group LPWSTR **pwszBuffer**: buffer to fill ULONG **cbBufferSize**: size of buffer to fill. needs to be at least string length + 1 ULONG* **pcbNeededChars** returns needed characters in buffer	Retrieves a base material's name
SetName	DWORD **nIndex**: Index of the material in the material group LPCWSTR **pwszName**: new name of the base material. (e.g. "ABS red")	Sets a base material's name
SetDisplayColorRGB	DWORD **nIndex**: Index of the material in the material group BYTE **bRed**: New red value (0-255) BYTE **bGreen**: New red value (0-255) BYTE **bBlue**: New blue value (0-255)	Sets a base material's display color. Alpha is set to 255.
SetDisplayColorRGBA	DWORD **nIndex**: Index of the material in the material group BYTE **bRed**: New red value (0-255) BYTE **bGreen**: New red value (0-255) BYTE **bBlue**: New blue value (0-255)	Sets a base material's display color.

	BYTE **bAlpha**: New alpha value (0-255)	
SetDisplayColorFloatRGB	DWORD **nIndex**: Index of the material in the material group FLOAT **bRed**: New red value (0.0-1.0) FLOAT **bGreen**: New red value (0.0-1.0) FLOAT **bBlue**: New blue value (0.0-1.0)	Sets a base material's display color. Alpha is set to 1.0.
SetDisplayColorFloatRGBA	DWORD nIndex: Index of the material in the material group FLOAT **bRed**: New red value (0.0-1.0) FLOAT **bGreen**: New red value (0.0-1.0) FLOAT **bBlue**: New blue value (0.0-1.0) FLOAT **bAlpha**: New alpha value (0.0-1.0)	Sets a base material's display color.
GetDisplayColor	DWORD **nIndex**: Index of the material in the material group BYTE* **pbRed**: Returns red value (0-255) BYTE* **pbGreen**: Returns green value (0-255) BYTE* **pbBlue**: Returns blue value (0-255) BYTE* **pbAlpha**: Returns alpha value (0-255)	Returns a base material's display color.

10. ILib3MFModelAttachment

ILib3MFModelAttachment implements the Model Attachments of a 3MF model stream, and allows direct access to direct binary data.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
GetPath	LPWSTR **pwszBuffer**: buffer to fill ULONG **cbBufferSize**: size of buffer to fill. needs to be at least string length + 1. ULONG* **pcbNeededChars**: returns needed characters in buffer	Retrieves a attachment's package path
SetPath	LPCWSTR **pwszPath**: new path of the attachment. (e.g. "/Textures/logo.png")	Sets a attachment's package path
GetRelationshipType	LPWSTR **pwszBuffer**: buffer to fill ULONG **cbBufferSize**: size of buffer to fill. needs to be at least string length + 1. ULONG* **pcbNeededChars**: returns needed characters in buffer	Retrieves a attachment's package relationship type
SetRelationshipType	LPCWSTR **pwszRelationShipType**: new relationship type attachment. (e.g. "/Data/data.xml")	Sets a attachment's package relationship type
GetStreamSize	ULONG64 **pcbStreamSize**: Returns the stream size	Retrieves the size of the attachment stream.
WriteToFile	LPCWSTR **pwszFilename**: Filename to write into	Writes out the attachment as file.
WriteToBuffer	BYTE **pBuffer**: Buffer to write into ULONG64 **cbBufferSize**: Size of the buffer in bytes	Writes out the attachment into a buffer. Buffer size must be at least the size of the stream.
WriteToStream	IStream **pStream**: IStream to write into.	Writes out the attachment into a COM IStream. Only available on Windows.
WriteToCallback	VOID* **pWriteCallback**: Callback to call for writing a data chunk.	Writes out the attachment and passes the data to a provided

	VOID* **pUserData**: Userdata that is passed to the callback function	callback function. The file type is specified by the Model Writer class
ReadFromFile	LPCWSTR **pwszFilename**: Filename to read from	Reads a attachment from a file.
ReadFromBuffer	BYTE* **pBuffer**: Buffer to read from ULONG64 **cbBufferSize**: Size of the buffer in bytes	Reads a attachment from a memory buffer.
ReadFromStream	IStream **pStream**: IStream to read from	Reads a attachment from a COM IStream. Only available on Windows.

11. ILib3MFModelTexture2D

ILib3MFModelTexture2D implements the Texture2D Resources of a 3MF model stream, and allows direct access to the texture properties and the image data.

Parent interface: *ILib3MFModelResource*

Method	Parameters	Description
GetPath	LPWSTR **pwszBuffer***:* buffer to fill ULONG **cbBufferSize***:* size of buffer to fill. needs to be at least string length + 1 ULONG* **pcbNeededChars***:* returns needed characters in buffer	Retrieves a texture's package path.
SetPath	ILib3MFModelAttachment **ppTextureAttachment**: new path of the texture. (e.g. "/Textures/logo.png")	Sets a texture's package path.
GetAttachment	LPCWSTR **pwszPath**: new	Retrieves the attachment located at the path of the texture
SetAttachment	ILib3MFModelAttachment* **pTextureAttachment**: attachment that holds the texture's image information	Sets the texture's package path to the path of the attachment.
GetContentType	eModelTexture2DType* **peContentType**: returns content type enum	Retrieves a texture's content type
SetContentType	eModelTexture2DType **eContentType**: new Content Type	Sets a texture's content type
GetBox2D	FLOAT* **pfU**: returns the U value of the texture FLOAT* **pfV**: returns the V value of the texture FLOAT* **pfWidth**: returns the Width value of the texture FLOAT* **pfHeight**: returns the Height value of the texture	Retrieves a texture's box2D coordinates.
SetBox2D	FLOAT **fU**: the new U value of the texture FLOAT **fV**: the new V value of the texture FLOAT **fWidth**: the new Width value of the texture FLOAT **fHeight**: the new Height value of the texture	Sets a texture's box2D coordinates.

ClearBox2D	-	Clears a texture's box2D coordinates.
GetStreamSize	ULONG64* **pcbStreamSize**: Returns the stream size	Retrieves the size of the texture stream.
WriteToFile	LPCWSTR **pwszFilename**: Filename to write into	Writes out the texture as file.
WriteToBuffer	BYTE* **pBuffer**: Buffer to write into ULONG64 **cbBufferSize**: Size of the buffer in bytes	Writes out the texture into a buffer. Buffer size must be at least the size of the stream.
WriteToStream	IStream* **pStream**: IStream to write into.	Writes out the texture into a COM IStream. Only available on Windows.
WriteToCallback	void* **pWriteCallback**: Callback pointer to call for writing a data chunk. void* **pUserData**: Userdata that is passed to the callback function	Writes out the texture and passes the data to a provided callback function.
ReadFromFile	LPCWSTR pwszFilename: Filename to read from	Reads a texture from a file.
ReadFromBuffer	BYTE * **pBuffer**: Buffer to read from ULONG64 **cbBufferSize**: Size of the buffer in bytes	Reads a texture from a memory buffer.
ReadFromStream	IStream * **pStream**: IStream to read from	Reads a texture from a COM IStream. Only available on Windows.

12. ILib3MFModelMeshObject

ILib3MFModelMeshObject encapsulates all methods for handling 3MF mesh objects.

Parent interface: *ILib3MFModelObjectResource*

Method	Parameters	Description
GetVertexCount	DWORD* **pnVertexCount**: filled with the vertex count	Returns the vertex count of a mesh object.
GetTriangleCount	DWORD* **pnTriangleCount**: filled with the triangle count	Returns the triangle count of a mesh object.
GetVertex	DWORD **nIndex**: Index of the vertex (0 to vertexcount - 1) MODELMESHVERTEX* **pVertex**: filled with the vertex coordinates	Returns coordinates of a single vertex of a mesh object.
SetVertex	DWORD **nIndex**: Index of the vertex (0 to vertexcount - 1) MODELMESHVERTEX* **pVertex**: contains the vertex coordinates	Sets the coordinates of a single vertex of a mesh object.
AddVertex	MODELMESHVERTEX* **pVertex**: contains the vertex coordinates	Adds a single vertex to a mesh object.

	DWORD* **pnIndex**: filled with the new Index of the vertex	
GetTriangle	DWORD **nIndex**: Index of the triangle (0 to trianglecount - 1) MODELMESHTRIANGLE* **pTriangle**: filled with the triangle indices	Returns indices of a single triangle of a mesh object.
SetTriangle	DWORD **nIndex***:* Index of the triangle (0 to trianglecount - 1) MODELMESHTRIANGLE* **pTriangle**: contains the triangle indices	Sets the indices of a single triangle of a mesh object
AddTriangle	MODELMESHTRIANGLE* **pTriangle**: contains the triangle indices DWORD* **pnIndex**: filled with the new Index of the vertex	Adds a single triangle to a mesh object.
GetVertices	MODELMESHVERTEX* **pVertices**: buffer filled with the vertex coordinates DWORD **nBufferSize**: size of the buffer in elements, must be at least vertexcount DWORD* **pnVertexCount**: returns how many vertices have been written	Retrieves all vertex coordinates of a mesh object.
GetTriangleIndices	MODELMESHTRIANGLE* **pIndices**: buffer filled with the triangle indices DWORD **nBufferSize**: size of the buffer in elements, must be at least trianglecount DWORD* **pnTriangleCount**: returns how many triangles have been written	Retrieves all triangle indices of a mesh object.
SetGeometry	MODELMESHVERTEX* **pVertices**: Array of vertex coordinates DWORD **nVertexCount**: Size of the vertex array MODELMESHTRIANGLE* **pTriangles**: Array of triangle indices DWORD **nTriangleCount**: Size of the triangle array	Sets the whole geometry of a mesh object.
CreatePropertyHandler	ILib3MFPropertyHandler** **ppPropertyHandler**: returns a property handler instance for the mesh.	creates a property handler for the mesh
CreateMultiPropertyHandler	DWORD **nChannel**: Channel Index ILib3MFPropertyHandler** **ppPropertyHandler**: returns a property handler instance for the mesh.	creates a property handler for a specific multiproperty channel of a mesh
IsManifoldAndOriented	BOOL* **pbIsOrientedAndManifold**: returns, if the object is oriented and manifold	Retrieves, if an object describes a topologically oriented and manifold mesh, according to the core spec

13. ILib3MFModelComponent

ILib3MFModelComponent encapsulates one component node of a 3MF component object. It links to other object resources of the same model.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
`GetObjectResourceID`	`DWORD*` **`pnResourceID`**: returns the associated resource ID	Returns the associated resource ID of the component.
`GetObjectResource`	`ILib3MFModelObjectResource**` **`ppResource`**: returns the associated resource instance	Returns the associated resource Instance of the component.
`GetTransform`	`MODELTRANSFORM*` **`pmTransformation`**: filled with the component transformation matrix.	Returns the transformation matrix of the component.
`SetTransform`	`MODELTRANSFORM*` **`pmTransformation`**: new transformation matrix	Sets the transformation matrix of the component.
`HasTransform`	`BOOL*` **`pbHasTransform`**: if true is returned, the transformation is not equal to the identity	Returns, if the component has a different transformation than the identity matrix.

14. ILib3MFModelComponentsObject

ILib3MFModelComponentsObject encapsulates all methods for handling 3MF component objects.

Parent interface: *ILib3MFModelObjectResource*

Method	Parameters	Description
`AddComponent`	`ILib3MFModelObjectResource*` **`pObject`**: object to add as component. May not lead to circular references! `MODELTRANSFORM*` **`pmTransform`**: optional transform matrix for the component `ILib3MFModelComponent**` **`ppComponent`**: returns new component instance	Adds a new component to a component object.
`GetComponent`	`DWORD` **`nIndex`**: index of the component to retrieve (0 to componentcount - 1) `ILib3MFModelComponent**` **`ppComponent`**: retrieves component instance	Retrieves a component from a component object.
`GetComponentCount`	`DWORD*` **`pComponentCount`**: returns the component count	Retrieves the component count of a component object.

15. ILib3MFModelBuildItem

ILib3MFModelBuildItem encapsulates all methods for handling 3MF build items.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
GetObjectResourceID	DWORD* **pnID**: returns the associated resource ID	Retrieves the object resource associated to a build item.
GetObjectResource	ILib3MFModelObjectResource** **ppResource**: returns the associated resource instance	Returns the associated resource Instance of the build item.
GetObjectTransform	MODELTRANSFORM* **pmTransformation**: filled with the component transformation matrix.	Returns the transformation matrix of the build item.
SetObjectTransform	MODELTRANSFORM* **pmTransformation**: new transformation matrix	Sets the transformation matrix of the build item.
HasObjectTransform	BOOL* **pbHasTransform**: if true is returned, the transformation is not equal to the identity	Returns, if the build item has a different transformation than the identity matrix.
GetPartNumber	LPWSTR **pwszBuffer**: buffer to fill ULONG **cbBufferSize**: size of buffer to fill. needs to be at least string length + 1. ULONG* **pcbNeededChars**: returns needed characters in buffer	Retrieves a build item's part number string.
GetPartNumberUTF8	LPSTR **pszBuffer**: buffer to fill ULONG **cbBufferSize**: size of buffer to fill. needs to be at least string length + 1. ULONG* **pcbNeededChars**: returns needed characters in buffer	Retrieves a build item's part number string in UTF8.
SetPartNumber	LPCWSTR **pwszPartNumber**: new part number string for referencing parts from the outside world.	Sets a build item's part number string
SetPartNumberUTF8	LPCSTR **pszPartNumber**: new part number string for referencing parts from the outside world.	Sets a build item's part number string in UTF8
GetHandle	DWORD* **pHandle:** returns the handle	Retrieves an internal handle of the build item. This 32bit number is unique throughout the model, but only valid for in-memory use of this instance.

16. ILib3MFModelBuildItemIterator

ILib3MFModelBuildItemIterator is a helper class to iterate through arbitrary lists of 3MF build items.

Parent interface: *ILib3MFBase*

Method	Parameters	Description

MoveNext	BOOL* **pbHasNext**: returns, if there is a build item to use	Iterates to the next build item in the list.
MovePrevious	BOOL* **pbHasPrevious**: returns, if there is a build item to use	Iterates to the previous build item in the list.
GetCurrent	ILib3MFModelBuildItem** **ppBuildItemInstance**: returns the build item instance	Returns the build item the iterator points at.
Clone	ILib3MFModelBuildItemIterator** **ppIterator**: returns the cloned Iterator instance	Creates a new build item iterator with the same build item list.

17. ILib3MFModel

ILib3MFModel is the basic instance owning all In-Memory elements of a 3MF file.
Parent interface: *ILib3MFBase*

Method	Parameters	Description
SetUnit	DWORD **Unit**: enum value for the model unit (see NMR_ModelTypes.h for details)	sets the units of a model
GetUnit	DWORD* **pUnit**: enum value for the model unit (see NMR_ModelTypes.h for details)	retrieves the units of a model
SetLanguage	LPCWSTR **pwszLanguage**: Language string identifier	sets the language of a model
SetLanguageUTF8	LPCSTR **pszLanguage**: Language string identifier	sets the language of a model (UTF8)
GetLanguage	LPWSTR **pwszBuffer**: buffer to fill ULONG **cbBufferSize**: size of buffer to fill. needs to be at least string length + 1. ULONG* **pcbNeededChars**: returns needed characters in buffer	retrieves the language of a model
GetLanguageUTF8	LPSTR **pszBuffer**: buffer to fill ULONG **cbBufferSize**: size of buffer to fill. needs to be at least string length + 1. ULONG* **pcbNeededChars**: returns needed characters in buffer	retrieves the language of a model (UTF8)
QueryWriter	LPCWSTR **pwszWriterClass**: string identifier for the file (currently "stl" and "3mf") ILib3MFModelWriter** **ppWriter**: returns the writer instance	creates a model writer instance for a specific file type
QueryReader	LPCWSTR **pwszReaderClass**: string identifier for the file (currently "stl" and "3mf") ILib3MFModelReader ** **ppReader**: returns the reader instance	creates a model reader instance for a specific file type
GetResourceByID	DWORD **nResourceID**: Resource ID	finds a model resource by its id

	ILib3MFModelResource** **ppResource**: returns the resource instance	
GetTexture2DByID	DWORD **nResourceID**: Resource ID ILib3MFModelTexture2D** **ppTexture**: returns the texture resource instance	finds a model 2d texture by its id
GetBaseMaterialByID	DWORD **nResourceID**: Resource ID ILib3MFModelBaseMaterial** **ppMaterial**: returns the base material instance	finds a base material by its id
GetMeshObjectByID	DWORD **nResourceID**: Resource ID ILib3MFModelMeshObject ** **ppMeshObject**: returns the resource instance	finds a mesh object resource by its id
GetComponentsObjectByID	DWORD **nResourceID**: Resource ID ILib3MFModelComponentsObject** **ppComponentsObject**: returns the resource instance	finds a components object resource by its id
GetBuildItems	ILib3MFModelBuildItemIterator** **ppIterator**: returns the iterator instance	creates a build item iterator instance with all build items
GetResources	ILib3MFModelResourceIterator** **ppIterator**: returns the iterator instance	creates a resource iterator instance with all resources
GetObjects	ILib3MFModelResourceIterator** **ppIterator**: returns the iterator instance	creates a resource iterator instance with all object resources
GetMeshObjects	ILib3MFModelResourceIterator** **ppIterator**: returns the iterator instance	creates a resource iterator instance with all mesh object resources
GetComponentsObjects	ILib3MFModelResourceIterator** **ppIterator**: returns the iterator instance	creates a resource iterator instance with all component object resources
Get2DTextures	ILib3MFModelResourceIterator** **ppIterator**: returns the iterator instance	creates a resource iterator instance with all 2D texture resources
GetBaseMaterials	ILib3MFModelResourceIterator** **ppIterator**: returns the iterator instance	creates a resource iterator instance with all base material resources
MergeToModel	ILib3MFModel** **ppMergedModel**: returns the merged model instance	merges all components and objects which are referenced by a build item. The memory is duplicated and a new model is created.
AddMeshObject	ILib3MFModelMeshObject** **ppMeshObject**: returns the mesh object instance	adds an empty mesh object to the model
AddComponentsObject	ILib3MFModelComponentsObject** **ppComponentsObject**: ppComponentsObject returns the component object instance	adds an empty component object to the model

AddTexture2DFromAttachment	ILib3MFModelAttachment* **pTextureAttachment**: attachment containing the image data ILib3MFModelTexture2D ** **ppTextureInstance**: returns the new texture instance	adds a texture2d resource to the model. Its path is given by that of an existing attachment.
AddTexture2D	LPCWSTR **pwszPath**: Package path of the texture ILib3MFModelTexture2D ** **ppTextureInstance**: returns the new texture instance	adds a texture2d resource to the model.
AddTexture2DUTF8	LPCSTR **pszPath**: Package path of the texture ILib3MFModelTexture2D ** **ppTextureInstance**: returns the new texture instance	adds a texture2d resource to the model (UTF8).
AddBaseMaterialGroup	ILib3MFModelBaseMaterial** **ppBaseMaterialInstance**: returns the new base material instance	adds an empty basematerials resource to the model
AddBuildItem	ILib3MFModelObjectResource** **pObject**: Object instance associated with the build item MODELTRANSFORM* **pTransform**: Transformation matrix to be used ILib3MFModelBuildItem** **ppBuildItem**: returns the build item instance	adds a build item to the model
GetPackageThumbnail Attachment	ILib3MFModelObjectResource** **pObject**: Object instance associated with the build item MODELTRANSFORM* **pTransform**: Transformation matrix to be used ILib3MFModelBuildItem** **ppBuildItem**: returns the build item instance	Get the attachment to the OPC package containing the package thumbnail
RemovePackageThumbnail Attachment		Remove the attachment to the OPC package containing the package thumbnail

18. ILib3MFModelFactory

ILib3MFModelFactory is the global factory class for model instances.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
CreateModel	ILib3MFModel** **ppModel**: returns created model instance	creates an empty model instance

GetSpecVersion	DWORD* **pMajorVersion**: returns the major version of the specification DWORD* **pMinorVersion**: returns the major version of the specification	retrieves the current version of the 3MF implementation and specification
GetInterfaceVersion	DWORD* **pInterfaceVersionMajor**: returns the major version of the shared library DWORD* **pInterfaceVersionMinor**: returns the minor version of the shared library DWORD* **pInterfaceVersionMicro**: returns the micro version of the shared library	retrieves the current interface version of the library (build version) this version will increment with each release of the library, and should be used to ensure API compatibility. (See …)
QueryExtension	LPCWSTR* **pwszExtensionUrl**: pwszExtensionUrl URL of extension to check BOOL* **pbIsSupported**: returns whether the extension is supported or not DWORD * **pExtensionInterfaceVersion**: pInterfaceVersion returns the interface version of of the extensions (if extension is supported)	checks whether a extension is supported by the DLL and which version of the interface is used. This extension version will increment with each change of the API of the extension and may be used to ensure API compatibility.
QueryExtensionUTF8	LPCSTR* **pszExtensionUrl**: pwszExtensionUrl URL of extension to check (UTF8) BOOL* **pbIsSupported**: returns whether the extension is supported or not DWORD * **pExtensionInterfaceVersion**: pInterfaceVersion returns the interface version of of the extensions (if extension is supported)	checks whether a extension is supported by the DLL and which version of the interface is used. This extension version will increment with each change of the API of the extension and may be used to ensure API compatibility.
RetrieveProgressMessage	int **progressIdentifier**: the progress identifier that is passed to the callback function LPCSTR* **progressMessage**: English text for the progress identifier	Return an English text for a progress identifier Note: this is the only function you can call from your callback function.

1.3. Class Reference – BeamLattice specification

The following list gives an overview of the classes that implement the beamlattice specification. Moreover, it explains the functionality added to core-specification classes.

14. ILib3MFModelMeshObject (continuation)

Method	Parameters	Description
GetBeamLatticeMinLength	DOUBLE* **pdMinLength**: minlength of the beamlattice	Returns the minimal member length for the beamlattice
SetBeamLatticeMinLength	DOUBLE **dMinLength**: minlength of the beamlattice	Sets the the minimal member length for the beamlattice
GetBeamLatticeRadius	DOUBLE* **pdRadius**: default radius of the beams in the beamlattice	Returns the default radius for the beamlattice
SetBeamLatticeRadius	DOUBLE **dRadius**: default radius of the beams in the beamlattice	Sets the default radius for the beamlattice

GetBeamLatticeCapMode	eModelBeamLatticeCapMode* **peCapMode**: default eModelBeamLatticeCapMode of the beamlattice (MODELBEAMLATTICECAPMODE_SPHERE, MODELBEAMLATTICECAPMODE_HEMISPHERE, MODELBEAMLATTICECAPMODE_BUTT)	Returns the default capping mode for the beamlattice
SetBeamLatticeCapMode	eModelBeamLatticeCapMode **eCapMode**: default eModelBeamLatticeCapMode of the beamlattice	Sets the default capping mode for the beamlattice
GetBeamLatticeClipping	eModelBeamLatticeClipMode* **peClipMode**: default eModelBeamLatticeClipMode of the beamlattice (MODELBEAMLATTICECLIPMODE_NONE, MODELBEAMLATTICECLIPMODE_INSIDE, MODELBEAMLATTICECLIPMODE_OUTSIDE) DWORD* **pnRessourceID:** filled with the resourceID of the clipping mesh-object or a undefined value if pClipMode is MODELBEAMLATTICECLIPMODE_NONE	Returns the clipping mode and the clipping-mesh for the beamlattice of this mesh
SetBeamLatticeClipping	eModelBeamLatticeClipMode **eClipMode**: default eModelBeamLatticeCapMode of the beamlattice DOUBLE **nRessourceID** the resourceID of the clipping mesh-object. This mesh-object has to be defined before setting the Clipping	Sets the clipping mode and the clipping-mesh for the beamlattice of this mesh
GetBeamLatticeRepresentation	BOOL* **pbHasRepresentation**: flag whether the beamlattice has a representation mesh. DWORD* **pnRessourceID:** filled with the resourceID of the representation mesh-object.	Returns the representation-mesh for the beamlattice of this mesh
SetBeamLatticeRepresentation	DOUBLE **nRessourceID** the resourceID of the representation mesh-object. This mesh-object has to be defined before setting the representation mesh. Set "0" to unset the representation mesh.	S ets the representation-mesh for the beamlattice of this mesh
GetBeamCount	DWORD* **pnBeamCount**: filled with the beam count	Returns the beam count of a mesh object
GetBeam	DWORD **nIndex**: Index of the beam (0 to beamcount - 1) MODELMESHBEAM * **pBeam**: filled with the node indices, radii and capmodes	Returns indices of a single beam of a mesh object
SetBeam	DWORD **nIndex**: Index of the beam (0 to beamcount - 1) MODELMESHBEAM * **pBeam**: contains the node indices, radii and capmodes	Sets the indices, radii and capmodes of a single beam of a mesh object
AddBeam	MODELMESHBEAM * **pBeam**: contains the node indices, radii and capmodes DWORD* **nIndex**: filled with the new Index of the beam	Adds a single beam to a mesh object
SetBeamIndices	MODELMESHBEAM * **pIndices**: buffer with the beam indices DWORD **nBufferSize**: size of the buffer in elements	Sets all beam indices, radii and capmodes of a mesh object
GetBeamIndices	MODELMESHBEAM * **pIndices**: buffer filled with the beam indices DWORD **nBufferSize**: size of the buffer in elements, must be at least beam count DWORD* **pnBeamCount**: returns how many beams have been written	Retrieves all beam indices of a mesh object

GetBeamSetCount	DWORD* **pnBeamSetCount**: filled with the beamset count	Returns the number of beamsets of a mesh object
AddBeamSet	ILib3MFModelMeshBeamSet** **ppBeamSet**: pointer to the new beamset	Adds an empty beamset to a mesh object
GetBeamSet	DWORD **nIndex**: index of the requested beamset (0 ... beamsetcount-1) ILib3MFModelMeshBeamSet** **ppBeamSet**: pointer to the requested beamset	Returns a beamset of a mesh object

21. ILib3MFModelMeshBeamSet

ILib3MFModelMeshBeamSet is a class that holds the references that contain to a beamset.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
SetName	LPCWSTR* **pwszName**: new name of the BeamSet as UTF16 string. (e.g. "Car")	Sets a beamset's name string
SetIdentifier	LPCWSTR* **pwszIdentifier**: new identifier of the BeamSet as UTF16 string. (e.g. "Car")	Sets a beamset's identifier string
GetNameUTF8	LPSTR **pszBuffer***:* buffer to fill ULONG **cbBufferSize***:* size of buffer to fill. needs to be at least string length + 1 ULONG* **pcbNeededChars***:* returns needed characters in buffer	Retrieves a BeamSet's name string (UTF8)
GetIdentifierUTF8	LPSTR **pszBuffer***:* buffer to fill ULONG **cbBufferSize***:* size of buffer to fill. needs to be at least string length + 1 ULONG* **pcbNeededChars***:* returns needed characters in buffer	Retrieves a BeamSet's identifier string (UTF8)
GetRefCount	DWORD* **pnCount***:* returns the reference count	Retrieves the reference count of a BeamSet
SetRefs	DWORD* **pRefs***:* buffer containing the indices of all beams in this beamset DWORD **nRefCount***:* number of references to be set	Sets the references of a BeamSet
GetRefs	DWORD* **pRefs***:* buffer filled with beam references (indices of beams) DWORD **nBufferSize***:* size of the buffer in elements, must be at least refcount DWORD* **pnRefCount***:* returns how many references have been written	Retrieves all references of a BeamSet

1.4. Class Reference – Slice-specification

ILib3MFModelMeshBeamSet is a class that holds the references that contain to a beamset.

Parent interface: *ILib3MFBase*

14. ILib3MFModelMeshObject (continuation)

Method	Parameters	Description
SetSliceStackId	DWORD **nSliceStackId**: id of the slice stack to link	Link the mesh object to a slice stack
GetSliceStackId	DWORD* **nSliceStackId**: id of the slice stack that is linked to the Mesh	Returns to which slice stack the mesh is linked

19. ILib3MFModel (continuation)

Method	Parameters	Description
AddSliceStack	FLOAT **nBottomZ**: Model instance to add slicestack to ILib3MFSliceStack* **ppSliceStack**: returns the new slice stack object	Adds a slicestack to a model

20. ILib3MFSlice

ILib3MFSlice encapsulates all slice functionality for handling slices in 3mf.

Parent interface: *ILib3MFBase*

Method	Parameters	Description
AddVertex	MODELSLICEVERTEX* **pVertex**: holds the vertex coordinates DWORD* **pnIndex**: returns the index of the vertex. Needed to reference the vertex later on in a polygon	Add a single vertex to a slice
BeginPolygon	DWORD* **pnIndex**: index of the newly created polygon	Begin a polygon
AddPolygonIndices	DWORD **nPolygonIndex**: index of the polygon to add the indices to DWORD* **pnVertexIndices**: array of the indices for the polygon DWORD **nBufferSize**: number of elements in the vertex array DWORD* **nPolygonVertexIndex**: returns the start index of the added indices	Add indices to a polygon
GetPolygonCount	DWORD* **pnPolygonCount**: returns the number of polygons in the slice	Get the number of polygons in the slice
GetVertexCount	DWORD* **pnVertexCount**: returns the number of vertices in the slice	Get the number of vertices in the slice
GetTopZ	FLOAT* **pfTopZ**: returns the upper Z coordinate of the slice	Get the upper Z coordinate of the slice
GetIndexCountOfPolygon	DWORD **nPolygonIndex**: the index of the polygon DWORD* **pnPolygonCount**: returns the number of indices in a polygon of the slice	Get the number of indices of a polygon in the slice
GetPolygonIndices	DWORD **nPolygonIndex**: the index of the polygon to query DWORD* **pPolygonIndices**: an array to be filled with the polygon indices	Get the indices of a polygon

	DWORD **nBufferCount**: number of elements in "pPolygonIndeces". Should match the number of indices in the polygon (GetIndexCountOfPolygon), if less not all indices are returned, if greater memory is wasted	
GetVertex	DWORD **nIndex**: index of the vertex to getMODELSLICEVERTEX* **pVertex**: MODELSLICEVERTEX structure to be filled	Get a vertex of the slice

21. ILib3MFSliceStack

ILib3MFSliceStack encapsulates all methods for handling slice stacks in 3MF.

Parent interface: *ILib3MFModelResource*

Method	Parameters	Description
AddSlice	FLOAT **fTopZ**: upper Z coordinate of the slice ILib3MFSlice** **ppSliceObject**: the newly created slice object	Adds a slice to the slicestack
GetSlice	DWORD **nSliceIndex**: the index of the slice to query ILib3MFSlice** **ppSliceObject**: returns the slice	Query a slice from the slice stack
GetSliceCount	DWORD* **pnSliceCount**: returns the number of slices on the slice stack	Get the number of slices on the slice stack
GetBottomZ	FLOAT* **pfBottomZ**: the lower Z-Coordinate the slice stack	Get the lower Z-Coordinate of the slice stack
GetSliceStackId	DWORD* **pnSliceStackId**: returns the slice stack id	Obtain the slice stack id
GetResourceID	DWORD* **pnResourceID**: returns the resource id	Get the resource id of the slice stack
SetSliceRef	LPWSTR **pwszSliceRef**: the name of the entity for the slice stack	Set the reference of the slice stack, i.e. the slice stack will be stored in a separate entity within the 3mf file
GetSliceRef	LPWSTR **pwszSliceRef**: string for the slice reference DWORD **nBufferSize**: length of the string passed in pwszSliceRef DWORD* **pnNeededChars**: number of characters needed to store the slice reference	Get the reference of the slice stack, i.e. the slice stack is stored in a separate entity within the 3mf file

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Contributors

The current code base is maintained by the 3MF consortium, and is assembled with contributions from the following consortium members:

- Autodesk Inc., San Rafael, CA
- Microsoft Corporation, Redmond, WA
- netfabb GmbH, Lupburg, Germany

The development has just begun. We invite everyone interested to contribute test results, bug reports, suggestions or code contributions under the simplified BSD License. We are actively looking for testers on all different platforms and in all different programming languages.

If you are making language bindings for your favourite language, we plead with you to release it public into the Lib3MF repository, as this will enable others to spread the format in an easy way.

The current version of this document and the library code can be obtained from github at https://github.com/3MFConsortium/lib3mf.

For more information, contact the 3MF Working Group at http://3mf.io or send a mail to lib3mf@netfabb.com.

Open API Points and Roadmap

- Remove Components from ComponentsObjects
- Remove Build Items from Model
- Signature support
- Metadata checking (partially)
- Component Dependency Checking
- ID Reference Checking
- Texture TileStyle
- Transformations with negative determinant