Trace Objects

Introduction

Use the **Trace** module to selectively produce trace output on a global and/or per-object basis for your application. You can specify the types of trace output when an application is linked, or dynamically (by using a debugger).

NOTE: **You can also define your own trace function, using** meiPlatformTraceFunction(...) **For example, you could define your own function to send traces to a circular memory buffer.**

The format of the trace output is determined by **printf(...)**-like trace macros located in MPI library source. The trace macros are of the form **meiTrace#(mask, format, arg ...)**, where ***format*** and the ***args*** determine the trace output, and where **#** indicates the total number of arguments following the ***format*** argument (because macros cannot take variable numbers of arguments).

The placement and content of the **meiTrace(...)** macros in the MPI library source is the responsibility of whomever maintains the library. Because trace can be added as desired, it is often useful to leave trace statements in the library source code rather than remove them, as is similarly done with debug printf(...) statements. It is also useful to define per-object trace output types so that the volume of trace output is set to a manageable level.

The Trace module interface is declared in the **XMP\include\trace.h** header file. In order for your application to use Trace functions, you must build your application with the MEI_TRACE conditional-compile symbol defined.

NOTE: **Debug and DebugSingle are the only MPI library configurations that will produce trace output.**

To install trace, simply install the DLL for either the Debug or DebugSingle configuration. The Debug and DebugSingle configurations of the MPI library are built with the MEI_TRACE compile-time symbol defined.

By default, trace output is sent to standard error. However, to send trace output to a file, your application can call the meiTraceFile(char *fileName) function.

To obtain the current global trace mask, call meiTraceGet(...).
To modify the global trace mask, call meiTraceSet(...).

To obtain an object's trace mask, call meiObjectTraceGet(...) (defined in stdmei.h).
To modify an object's trace mask, call meiObjectTraceSet(...).

Trace Masks | Global Trace Outputs | Per-Object Trace Outputs

Methods

Configuration and Information Methods

meiTrace**Eol**	Set the end-of-line character to be used by Trace
meiTrace**File**	Send trace output to a file
meiTrace**Function**	sets function used to display a trace buffer
meiTrace**Get**	Get global trace mask
meiTrace**MaskBits**	Convert the trace mask into an array of trace bits.
meiTrace**Msg**	Convert the message identification value into a string.
meiTrace**MsgFunction**	Set a module's trace message function.
meiTrace**Set**	Set global trace mask

Data Types

MEITrace
MEITrace**Function**
MEITrace**Mask**
MEITrace**MsgFunction**

Constants

MEITrace**MaskGLOBAL**

meiPlatformTraceFunction

Declaration

```
MEITraceFunction meiPlatformTraceFunction(MEITraceFunction traceFunction)
```

Required Header: stdmei.h

Description

meiPlatformTraceFunction displays the trace output using ***traceFunction***, and replaces the internal function that was called by meiPlatformTrace(...) to display the trace output. Use *PlatformTraceFunction* to enable your application to take control of the display of trace output.

Return Values	
the previous *traceFunction*	if there is a previous function
NULL	if no ***traceFunction*** has been specified (the default trace function is used)

See Also

meiPlatformTrace

meiTraceFile

Declaration

```
long meiTraceFile(const char *fileName)
```

Required Header: stdmei.h

Description

meiTraceFile causes trace output to be sent to the file ***fileName***. By default, trace output goes to standard output. Note that if ***fileName*** is Null, trace output still goes to standard output.

Return Values	
MPIMessageOK	if *TraceFile* successfully causes trace output to be sent to the file

See Also

meiTraceGet

Declaration

```
MEITraceMask meiTraceGet(void)
```

Required Header: stdmei.h

Description

meiTraceGet returns the current global trace mask for the application.

Returns
The global trace mask

See Also

meiTraceSet

meiTraceSet

Declaration

```
MEITraceMask meiTraceSet(MEITraceMask mask)
```

Required Header: stdmei.h

Description

meiTraceSet sets the global trace mask to ***mask***.

If "traceMask" is	Then
MEITraceALL	all global categories of trace will be enabled
MEITraceNONE	all categories of trace will be disabled

Returns
The value of the previous *global trace mask*

See Also

meiTraceGet

meiObjectTraceGet / meiObjectTraceGET

Declaration: meiObjectTraceGet

```
long meiObjectTraceGet(MPIHandle    handle,
                       MEITraceMask *traceMask)
```

Required Header: stdmei.h

Description

meiObjectTraceGet gets an Object's trace mask and writes it to the value pointed to by traceMask.

handle	a handle to an object
***traceMask**	a pointer to the value of an object's trace mask

Return Values	
MPIMessageOK	if *ObjectTraceGet* successfully gets the trace mask for an object.

Declaration: meiObjectTraceGET

```
#define  meiObjectTraceGET(object) (((MEIObject)(object))->trace)
```

Required Header: stdmei.h

Description

meiObjectTraceGET gets the object's global trace mask.

See Also

meiObjectTraceSET | meiObjectTraceSet

meiObjectTraceSet / meiObjectTraceSET

Declaration: meiObjectTraceSet

```
long meiObjectTraceSet(MPIHandle    handle,
                       MEITraceMask traceMask)
```

Required Header: stdmei.h

Description

meiObjectTraceSet sets an Object's trace mask to the value specified by ***traceMask***.

handle	a handle to an object
traceMask	the value of an object's trace mask

Return Values	
MPIMessageOK	if *ObjectTraceSet* successfully sets the trace mask for an object.

Declaration: meiObjectTraceSET

```
#define  meiObjectTraceSET(object,mask)
                         (((MEIObject)(object))->trace = (mask))
```

Required Header: stdmei.h

Description

meiObjectTraceSET sets the object's global trace mask.

See Also

meiObjectTraceGET | meiObjectTraceGet

meiTraceEol

Declaration

```
char meiTraceEol(char eol)
```

Required Header: stdmei.h

Description

meiTraceEol function simply calls **meiPlatformTraceEol(...)**, which sets the end-of-line character that will be used by meiPlatformTrace(...). By default, meiPlatformTrace(...) will append a newline character ('\n') to the messages that it displays. The **meiPlatformTraceEol(...)** function allows your application to set the default end-of-line character.

Returns
The previous end-of-line character used by meiPlatformTrace(...)

See Also

meiPlatformTrace | meiPlatformTraceEol

meiTraceFunction

Declaration

```
MEITraceFunction meiTraceFunction(MEITraceFunction traceFunction)
```

Required Header: stdmei.h

Description

meiTraceFunction sets the function used to display a trace buffer.

Front end to meiPlatformTraceFunction(). If traceFunction is NULL (default), then trace functions is fprintf(MEIPlatformTraceSTREAM) (default stdout).

Return Values	
handle	to previous Trace function
NULL	otherwise

See Also

meiTraceMaskBits

Declaration

```
long meiTraceMaskBits(long    mask,
                      long    *bitCount,
                      long    *bit);
```

Required Header: stdmei.h

Description

meiTraceMaskBits converts the trace mask into an array of trace bits and the length of the array.

mask	A bit mask of enumerated trace bits.
***bitCount**	A pointer to a long containing the number of trace bits enabled in the mask. This value is also the length of the bit array.
***bit**	A pointer to an array of longs containing the enumerated trace bits. Each array member contains one trace bit enumerated value.

See Also

MEITrace | meiTraceGet | meiTraceSet

meiTraceMsg

Declaration

```
const char *meiTraceMsg(long    messageId,
                        char    *messageText);
```

Required Header: stdmei.h

Description

meiTraceMsg converts the message identification value into a string pointed to by ***messageText***.

messageId	a message identification value.
***messageText**	a pointer to a character string containing the text for the messageId.

See Also

meiTraceMsgFunction

meiTraceMsgFunction

Declaration

```
long meiTraceMsgFunction(MPIModuleId           moduleId,
                         MEITraceMsgFunction    function);
```

Required Header: stdmei.h

Description

meiTraceMsgFunction sets a module's trace message function.

moduleId	an enumerated module identification value
function	a pointer to a trace message function.

See Also

MEITrace

Definition

```
typedef enum {
    MEITraceNONE = 0,
    MEITraceFIRST = 0x0001,
    MEITraceFUNCTION_ENTRY   = (int) MEITraceFIRST << 0,
    MEITraceFUNCTION_RETURN  = (int) MEITraceFIRST << 1,
    MEITraceMEMORY_ALLOC     = (int) MEITraceFIRST << 2,
    MEITraceMEMORY_FREE      = (int) MEITraceFIRST << 3,
    MEITraceMEMORY_GET       = (int) MEITraceFIRST << 4,
    MEITraceMEMORY_SET       = (int) MEITraceFIRST << 5,
    MEITraceVALIDATE         = (int) MEITraceFIRST << 6,
    MEITraceLOCK_GIVE        = (int) MEITraceFIRST << 7,
    MEITraceLOCK_TAKE        = (int) MEITraceFIRST << 8,
    MEITraceEVENT            = (int) MEITraceFIRST << 9,

    MEITraceALL = (int) ((MEITraceLAST << 1) - 1)
} MEITrace;
```

Description

MEITrace is an enumeration of generic trace bits that can be used to enable/disable library trace statement output for objects throughout the MPI.

MEITraceFUNCTION_ENTRY	Trace the entry into all methods.
MEITraceFUNCTION_RETURN	Trace the return from all methods.
MEITraceMEMORY_ALLOC	Enables trace statements for all host memory allocations.
MEITraceMEMORY_FREE	Enables trace statements for all host memory de-allocations.
MEITraceMEMORY_GET	Enables trace statements for all controller memory reads.
MEITraceMEMORY_SET	Enables trace statements for all controller memory writes.
MEITraceVALIDATE	Enables trace statements for all function parameter validations.
MEITraceLOCK_GIVE	Enables trace statements for all IPC lock releases.
MEITraceLOCK_TAKE	Enables trace statements for all IPC lock takes.
MEITraceEVENT	Enables trace statements for all MPI Events.

See Also

Trace Object | Trace.exe utility

MEITraceFunction

Definition

```
typedef long (*MEITraceFunction) (const char *buffer);
```

Description

Definition for a trace function interface. **MEITraceFunction** can be used to define a custom trace output routine. MEITraceFunction function must take a pointer to a buffer as a parameter and must return a long.

See Also

meiTraceFunction

MEITraceMask

Definition

```
typedef   unsigned long MEITraceMask;
```

Description

MEITraceMask is a bit mask used to enable/disable library trace statement output.

See Also

meiTraceGet | meiTraceSet | MEITraceMaskGLOBAL

MEITraceMaskGLOBAL

Definition

```
extern  MEITraceMask  MEITraceMaskGLOBAL;
```

Description

MEITraceMaskGLOBAL is a non-object specific MPI Trace mask variable used for library wide Trace bits.

See Also

MEITraceMask

Trace Masks

Every MPI object contains an MEITraceMask and every process contains a single global MEITraceMask. An MEITraceMask consists of bits, where each bit corresponds to a single trace category. A trace category is a specific type of debug information that you want to be displayed by the MPI library. A trace category can be either global (applying to all MPI objects) or object-specific (applying only to a specific MPI object).

Trace Category	Is
global	declared by the MEITrace{...} enum in trace.h.
object-specific (for MPI objects)	declared in stdmei.h.
object-specific (for MEI objects)	declared in the object header file (for MEI objects). Note that the trace mask bits for object-specific trace categories overlap.

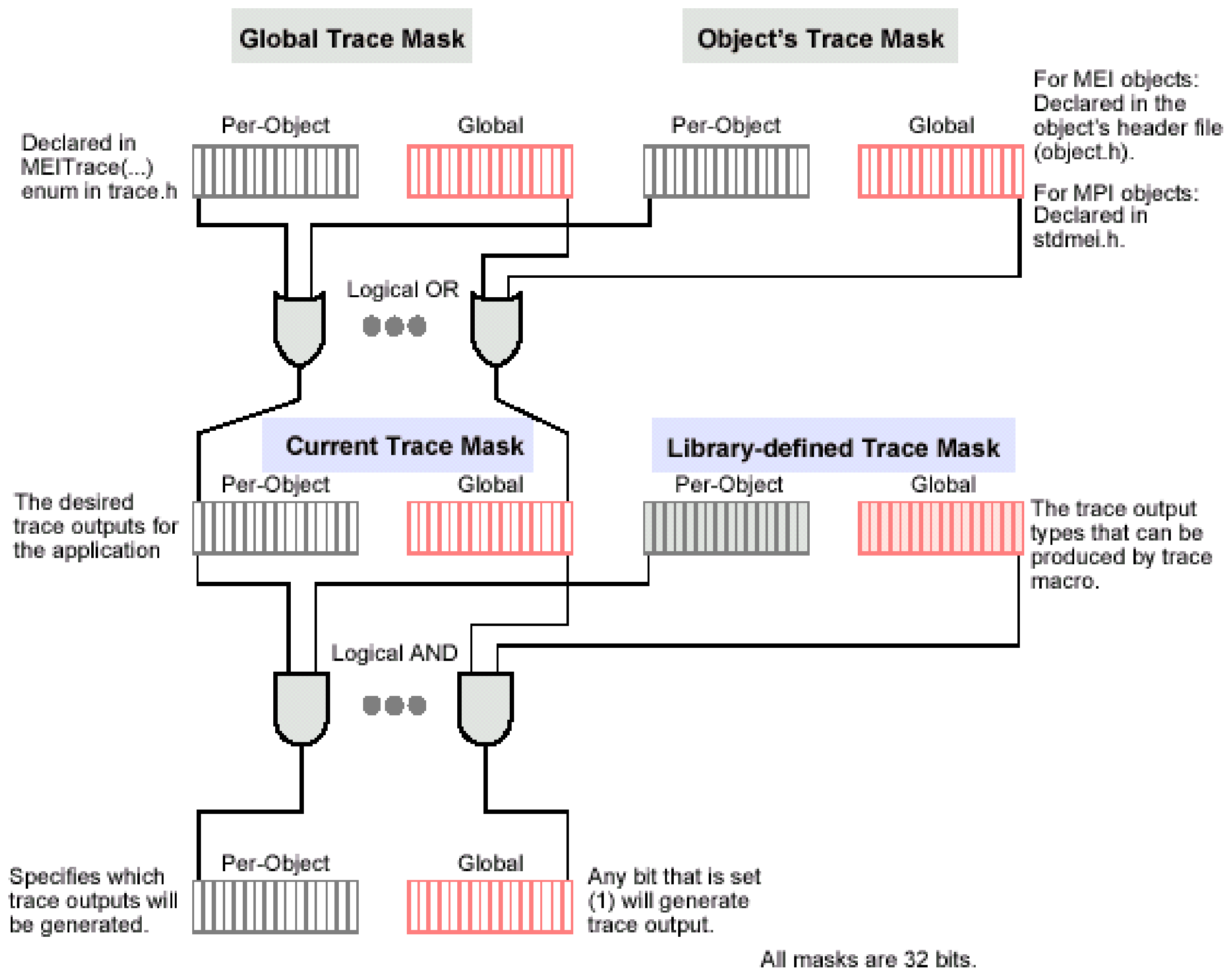
An object will produce trace output for a trace category when the logical **OR** of the **global trace mask** and the **object's trace mask** has the bit set that corresponds to the trace category.

If the global trace mask has all of its bits set, then all objects will display trace output for all trace categories.

If an object's trace mask has **all** of its bits set, then that object will display trace output for all trace categories, but a different object of the same type might produce less or no trace output depending on the setting of its trace mask. The setting of the global and object trace masks is under the control of your application.

The trace mask is derived in 2 steps:

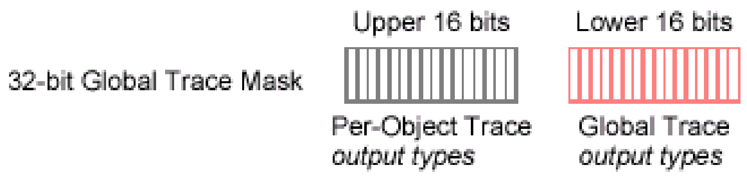
1. The **global trace mask** is logically **OR**ed with the **object trace mask**. This yields the **current trace mask**, representing the desired trace output types as specified by the application.
2. The **current trace mask** (from step1) is logically **AND**ed with a **library-defined trace mask** (that describes the trace output types for which the trace macro should produce output). If the result of the AND is non-zero, trace output will be produced using the ***format*** and the ***args*** [from **meiTrace#(mask, format, arg ...**


Global Trace Mask
Object's Trace Mask
Per-Object
Global
Per-Object
Global
Declared in MEITrace(...) enum in trace.h
For MEI objects: Declared in the object's header file (object.h).
For MPI objects: Declared in stdmei.h.
Logical OR
Current Trace Mask
Library-defined Trace Mask
Per-Object
Global
Per-Object
Global
The desired trace outputs for the application
The trace output types that can be produced by trace macro.
Logical AND
Per-Object
Global
Specifies which trace outputs will be generated.
Any bit that is set (1) will generate trace output.
All masks are 32 bits.

Return to Trace Object's page

Global Trace Outputs

There is a global 32-bit trace mask: the low 16 bits are the global trace output types, while the upper 16 bits are the per-object trace output types. Each object has a similar trace mask. The upper 16 bits of the global trace mask are not defined, but can be used to set the per-object output types for all objects. To enable all trace output types for all objects, set the global trace mask to all 1s (i.e., -1).



The **MEITrace{...}** enum (declared in trace.h) specifies the global types of trace output, i.e., the types of trace output that can be produced by any object or module. **The MEITrace{...}** enum defines constants that you use together as a bit mask. You specify the desired trace output as a combination (logical OR) of **MEITrace{...}** constants.

There are 16 possible types of global trace output, with 12 global trace outputs defined.

Output Type	Displays
MEITraceFUNCTION_ENTRY	Function name & calling parameters upon entry to function
MEITraceFUNCTION_RETURN	Function name, calling parameters & return value upon exit from function
MEITraceMEMORY_ALLOC	The Address & byte count when memory is dynamically allocated
MEITraceMEMORY_FREE	The Address & byte count when dynamically allocated memory is freed
MEITraceMEMORY_GET	Source address, destination address, byte count when reading XMP firmware memory
MEITraceMEMORY_SET	Source address, destination address, byte count when writing XMP firmware memory
MEITraceVALIDATE	Results of object validation
MEITraceLOCK_GIVE	When a resource lock is released
MEITraceLOCK_TAKE	When a resource lock is waited for & obtained
MEITraceEVENT	When an XMP event is received
MEITraceALL	All global trace outputs (lower 16 bits)
MEIModuleTraceALL	All per-object trace outputs (upper 16 bits)

Return to Trace Object's page

Per-Object Trace Outputs

There are 16 possible types of per-object trace output. Each object can declare up to 16 of its own trace output types. MPI modules declare per-object trace output types in stdmei.h. MEI modules declare per-object trace output types in the module header file.

Output Type	Displays
MEIMotionTraceSTATUS	Status of the Motion Supervisor
MEINotifyTrcaeTHREAD	When a thread goes to sleep or wakes up
MEISequenceTraceLOAD	When a batch of new commands are sent to the XMP Program Sequencer
MEIConfigTracePROGRESS	Displays "." as it executes (used by config utility)
MEIRecorderTraceRECORD_GET	When the Recorder gets records from the XMP
MEIRecorderTraceSTATUS	The number of data records available in the XMP

Note: The first 5 output types overlap in the mask.

Return to Trace Object's page