IBM AIX Parallel Environment
Parallel Programming Subroutine Reference

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IBM

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Note

Before using this information and the product is supports, be sure to read the general information under “Notices” on page iv

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Notices

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About This Book

This book lists the subroutines a programmer can use when writing parallel applications along with the associated parameters, syntax, and examples. In addition, this book provides brief introductory information regarding parallel programming tasks.

Who Should Use This Book

This book is intended for experienced programmers who want to write parallel applications using either the C or FORTRAN programming languages. Readers of this book should know C and FORTRAN and should be familiar with AIX* and UNIX** commands, file formats, and special files. In addition, readers should be familiar with distributed-memory machines.

How to Use This Book

Overview of Contents

This book is divided into the following sections:

- Chapter 1, “Subroutines Listed Alphabetically” on page 1 lists the subroutines alphabetically along with their descriptions, type and page number.
- Appendix A, “Subroutine Argument Quick Reference” on page 99 lists the subroutines and their arguments. Use it as a quick reference. For detailed information on the subroutines refer to Chapter 1, “Subroutines Listed Alphabetically” on page 1.
- Appendix B, “Subroutine Argument Definitions” on page 101 briefly lists the arguments and their definitions. For detailed definitions of the argument definitions, refer to Chapter 1, “Subroutines Listed Alphabetically” on page 1.
- Appendix C, “Reduction Operations” on page 103 gives additional information about reduction functions.

- Appendix D, “Parallel Utility Functions” on page 105 contains the syntax man pages of the user-callable functions that take advantage of the Parallel Operating Environment(POE).
- Appendix E, “Tracing Routines” on page 119 contains the syntax man pages for modifying trace generation for the visualization tool.
- Appendix F, “Exit Status of User Application” on page 139 explains how to determine the exit status of the parallel program (pod).

Terms and Document Conventions

FORTRAN is not case sensitive while the reverse is true for C. This means that you can enter the FORTRAN subroutines in either upper or lower case or in mixed case. However, if you use the "MIXED" FORTRAN compiler option, subroutines must be entered in lower case. The C subroutines must be entered in lower case only.

For the purpose of distinguishing between the FORTRAN and C syntax in this document, FORTRAN subroutines are documented in all upper case while the C subroutines appear in all lower case.

Related Publications

The following books contain information about or related to parallel programming:

- *IBM AIX Parallel Environment: General Information*, GH26-7229
- *IBM AIX Parallel Environment: Programming Primer*, SH26-7223
- *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis*, SH26-7231
- *IBM AIX Parallel Environment: Operation and Use*, SH26-7230

Ordering Additional Copies of This Book

To order additional copies of this book, use order number SH26-7228.

Chapter 1. Subroutines Listed Alphabetically

The following table lists the subroutines alphabetically. Refer to the appropriate page number for information related to subroutine purpose, syntax, and so on.

FORTRAN/C Subroutine	Page Number	Type	Description
MP_BCAST mpc_bcast	5	Collective Communication	Distributes a message from one task to all the tasks in the same group.
MP_BRECV mpc_brecv	8	Message Passing	Receives a message and waits until the requested data arrives.
MP_BSEND mpc_bsend	11	Message Passing	Sends a message and waits until the output buffer can be reused.
MP_BSENDRECV mpc_bsendrecv	14	Message Passing	Sends a message and waits until a message of the same type has been received.
MP_BVRECV mpc_bvrecv	18	Message Passing	Receives a non-contiguous message and waits until the message is available.
MP_BVSEND mpc_bvsend	21	Message Passing	Send a non-contiguous message and waits until the message buffer can be reused.
MP_COMBINE mpc_combine	24	Collective Communication	Performs a reduction operation on data distributed across a group and distributes the result in all tasks in the group.
MP_CONCAT mpc_concat	27	Collective Communication	Concatenates a distinct message from each task to create one message.
MP_ENVIRON mpc_environ	30	Task Management	Returns the number of tasks assigned to the partition and the caller's task id.
MP_GATHER mpc_gather	32	Collective Communication	Concatenates a distinct message from each task to create a single message on task **dest**.
MP_GETLABEL mpc_getlabel	35	Task Group	Returns the label assigned to a group.
MP_GETMEMBERS mpc_getmembers	37	Task Group	Gets the membership array of a specified task group.
MP_GETRANK mpc_getrank	39	Task Group	Checks membership and gets the rank of a given task within a task group.
MP_GETSIZE mpc_getsize	42	Task Group	Gets the size of a specified task group.
MP_GETTASKID mpc_gettaskid	44	Task Group	Returns the task id for a **rank** within a group.
MP_GROUP mpc_group	47	Task Group	Allows you to define a task group by explicitly specifying the tasks that will form the group.
MP_INDEX mpc_index	50	Collective Communication	Each task sends a distinct message to all the tasks in the same group.

FORTRAN/C Subroutine	Page Number	Type	Description
MP_PACK mpc_pack	53	Utilities	Packs data from a non-contiguous buffer into a contiguous buffer.
MP_PARTITION mpc_partition	56	Task Group	Creates a task group by partitioning a previously defined task group.
MP_PREFIX mpc_prefix	58	Collective Communication	Applies a parallel prefix operation with respect to a reduction operation on data distributed across a group and places the result in each task in the group.
MP_PROBE mpc_probe	61	Message Passing	Checks for any messages which may have arrived without matching a pending receive.
MP_RECV mpc_recv	64	Message Passing	Posts a receive buffer for a message and returns without waiting for the message arrival.
MP_REDUCE mpc_reduce	67	Collective Communication	Performs a reduction operation on data distributed across a group.
MP_SCATTER mpc_scatter	70	Collective Communication	Distributes distinct messages to each task in the group.
MP_SEND mpc_send	73	Message Passing	Identifies a message to be sent and returns without waiting for the send to complete.
MP_SHIFT mpc_shift	76	Collective Communication	Performs linear or circular data shifts across a group.
MP_STATUS mpc_status	79	Message Passing	Returns the status of a non-blocking send or receive.
MP_STOPALL mpc_stopall	82	Task Management	Forces an abnormal termination.
MP_SYNC mpc_sync	84	Collective Communication	Synchronizes tasks at a barrier.
MP_TASK_QUERY mpc_task_query	86	Task Management	Returns information about system variables and constants.
MP_TASK_SET mpc_task_set	89	Task Management	Sets user-definable parameters for the task.
MP_UNPACK mpc_unpack	93	Utilities	Unpacks data from a contiguous buffer into a non-contiguous buffer.
MP_WAIT mpc_wait	96	Message Passing	Waits until a non-blocking send or receive has completed.

The following pages list the subroutines available for parallel programming. For each subroutine, a purpose, C and FORTRAN synopsis, description, notes, return values, error conditions, and examples are provided. Review the following sample subroutine before proceeding to better understand how the subroutines are structured.

NAME

MP_SAMPLE, mpc_sample – The text presented in this section briefly describes the use of the subroutine.

LIBRARY

- C Library (library_name.a)
- FORTRAN Library (library_name.a)

The mpcc, mpCC and mpxlf scripts automatically include the libraries identified in this manual.

C SYNOPSIS

- Header file mpproto.h supplies both ANSI-C and C++ prototypes for every function described in the message passing subroutine section of this manual.

```
#include <mpproto.h>
int mpc_sample (parameter(s));
```

In the C prototype:

- A declaration of void * indicates that a pointer to any data type is allowable.
- If ANSI-C type checking is not going to be enabled, then any variable declared as size_t can be declared as int.

FORTRAN SYNOPSIS

```
MP_SAMPLE (parameter(s))
```

In the FORTRAN routines, formal parameters are described using a subroutine prototype format, even though FORTRAN does not support prototyping.

PARAMETERS

Variable or parameter definitions appear below:

parameter1 parameter description.

parameter2 parameter description.

DESCRIPTION

This section contains a more detailed description of the subroutine or function.

NOTES

If applicable, this section contains notes about standards, among other things.

RETURN VALUES

Return values appear here. In almost every routine, the C version is invoked as a function returning integer. In the FORTRAN version, the routine is CALLed as a subroutine; that is, it has no return value.

ERRORS

Error conditions appear here.

EXAMPLES

C Example

A C example appears here.

FORTRAN Example

A FORTRAN example appears here.

RELATED INFORMATION

This section contains a list of related functions or routines in this book among other things.

NAME

MP_BCAST, mpc_bcast – Distributes a message throughout a group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_bcast(void *msg, size_t msglen, int source, int gid);
```

FORTRAN SYNOPSIS

```
MP_BCAST(INTEGER MSG(*), INTEGER MSGLEN, INTEGER SOURCE, INTEGER GID)
```

PARAMETERS

msg	for task id=**source**, **msg** is the application buffer that contains the message to send. For all other tasks in the same group, **msg** is the application buffer into which the incoming message is received.
msglen	is a non-negative integer that specifies the size, in bytes, of the message.
source	is an integer that specifies the task that originates the send.
gid	is a group identifier for the group of participating tasks.

DESCRIPTION

This routine sends a message from the task **source** to all other tasks in the group which is uniquely identified by **gid**. The message is sent from **msg** in the task with **task id**=**source** to **msg** in all other tasks, and is of length **msglen** bytes. All tasks which are members of **gid** must call **MP_BCAST** and specify consistent parameters.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM* AIX* Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

msg	is not a valid buffer
msglen	is less than zero
source	is not a valid task id or is not a member of **gid**
gid	is undefined in the calling task

Develop mode error if:

- all tasks in **gid** do not use identical values for **source** and **msglen**

EXAMPLES

A message is sent from the task with the highest task id in the partition to all other tasks using MP_BCAST.

C Example

```
   #include <mpproto.h>

int bcast_example()
{
   int numtask,taskid,source,msg,msglen,rc;

   mpc_environ(&numtask,&taskid);

   /* Let the "last" task be the source (broadcaster).  */
   source = numtask - 1;
   msglen = sizeof(int);
   if(taskid == source)  msg = 5;      /* initialize data to broadcast  */

   rc = mpc_bcast(&msg,msglen,source,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* All tasks now have "msg" set to "5"  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE BCAST_EXAMPLE

      INTEGER NUMTASK,TASKID,SOURCE,MSG,MSGLEN,NBUF(4),ALLGRP

      CALL MP_ENVIRON(NUMTASK,TASKID)

      CALL MP_TASK_QUERY(NBUF,4,3)       !  get "ALLGRP" value
      ALLGRP = NBUF(4)

c     Let the "last" task be the source (broadcaster).
      SOURCE = NUMTASK - 1
      MSGLEN = 4
      IF(TASKID .EQ. SOURCE)  MSG = 5    ! initialize data to broadcast

      CALL MP_BCAST(MSG,MSGLEN,SOURCE,ALLGRP)

c     All tasks now have "MSG" set to "5"

      END
```

NAME

MP_BRECV, mpc_brecv – Receives a message and waits until the requested data arrives.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_brecv(void *inmsg, size_t msglen, int *source, int *type, size_t *nbytes);
```

FORTRAN SYNOPSIS

```
MP_BRECV(INTEGER INMSG(*), INTEGER MSGLEN, INTEGER SOURCE, INTEGER TYPE,
         INTEGER NBYTES)
```

PARAMETERS

inmsg is the application buffer into which the message is to be received.

msglen is an integer that specifies the size, in bytes, of the buffer **inmsg**.

source is an integer that specifies the task from which the message originated. If **source**=**dontcare**, the next message satisfying the **type** parameter is read, and the sending task is returned in **source**.

type is an integer that specifies the type of the message being received. If **type**=**dontcare**, the next message satisfying the **source** parameter is read, and the message type is returned in **type**. If both **source**=**dontcare** and **typedontcare**, the next message is read, and the source task and type of that incoming message are returned in **source** and **type**, respectively.

nbytes is an integer which returns the number of bytes received. If the message truncation mode is enabled and the length of the message is greater than **msglen**, **nbytes** is returned as equal to the **msglen** parameter.

DESCRIPTION

This routine receives a message into the application buffer and waits until the requested data is available in the application buffer in the receiving task.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

inmsg is not a valid buffer

msglen is less than zero

source is not a valid task id or wildcard value

type is not a valid message type or wildcard value

It is an error if the message truncation mode is not enabled and the length of the message to be received is greater than **msglen**. For information on enabling the message truncation mode, see MP_TASK_SET.

EXAMPLES

A message from task 0 is received by task 1 using MP_BRECV. Immediately after the call to MP_BRECV completes, the received data is available in **inmsg**.

C Example

```
   #include <mpproto.h>

int brecv_example()
{
   int source,dest,type,msglen,nbytes,rc;
   int numtask,taskid,inmsg[2],outmsg[2];

   mpc_environ(&numtask,&taskid);

   type = 1;
   source = 0;
   dest = 1;
   msglen = sizeof(outmsg);

   if(taskid == source)  {
      outmsg[0] = 150;
      outmsg[1] = 250;

      rc = mpc_bsend(outmsg,msglen,dest,type);
      if(rc)  return(-1);  /* error */
   } else {
      if(taskid == dest) {
         rc = mpc_brecv(inmsg,msglen,&source,&type,&nbytes);
         if(rc)  return(-1);  /* error */

         /* Task 1 now has "inmsg" = {150,250}  */
      }
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE BRECV_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,NUMTASK,TASKID,INMSG(2),OUTMSG(2)

      CALL MP_ENVIRON(NUMTASK,TASKID)

      TYPE = 1
      SOURCE = 0
      DEST = 1
      MSGLEN = 8

      IF(TASKID .EQ. SOURCE)  THEN
         OUTMSG(1) = 150
         OUTMSG(2) = 250
         CALL MP_BSEND(OUTMSG,MSGLEN,DEST,TYPE)
      ELSE
         IF(TASKID .EQ. DEST)  THEN

            CALL MP_BRECV(INMSG,MSGLEN,SOURCE,TYPE,NBYTES)

c           Task 1 now has "INMSG" = {150,250}
c           "NBYTES" returns the actual number of bytes sent.

         ENDIF
      ENDIF

      END
```

RELATED INFORMATION

Subroutines: MP_BSEND(3), mpc_bsend(3), MP_RECV(3), mpc_recv(3)

NAME

MP_BSEND, mpc_bsend – Sends a message and waits until the output buffer can be reused.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_bsend(const void *outmsg, size_t msglen, int dest, int type);
```

FORTRAN SYNOPSIS

```
MP_BSEND(INTEGER OUTMSG(*), INTEGER MSGLEN, INTEGER DEST, INTEGER TYPE)
```

PARAMETERS

outmsg is the application buffer that contains the message to be sent.

msglen is a non-negative integer that specifies the size, in bytes, of the message to be sent.

dest is an integer that specifies the task to which the message is to be sent.

type is an integer that specifies the type of the message being sent.

DESCRIPTION

This subroutine sends a message and waits until the application buffer **outmsg** is available for reuse. Completion does not imply that the message has been received by the destination task.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg is not a valid buffer

msglen is less than zero

dest is not a valid task id

type is not a valid message type

EXAMPLES

A message is sent from task 0 to task 1 using MP_BSEND. Immediately after the call to MP_BSEND completes, the send buffer **outmsg** is ready to be reused.

C Example

```
   #include <mpproto.h>

int bsend_example()
{
   int source,dest,type,msglen,nbytes,rc;
   int numtask,taskid,inmsg[2],outmsg[2];

   mpc_environ(&numtask,&taskid);

   type = 1;
   source = 0;
   dest = 1;
   msglen = sizeof(outmsg);

   if(taskid == source)  {
      outmsg[0] = 150;
      outmsg[1] = 250;

      rc = mpc_bsend(outmsg,msglen,dest,type);
      if(rc)  return(-1);  /* error */

      /* "outmsg" can now be reused  */
   } else {
      if(taskid == dest) {
         rc = mpc_brecv(inmsg,msglen,&source,&type,&nbytes);
         if(rc)  return(-1);  /* error */

         /* Task 1 now has "inmsg" = {150,250}  */
      }
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE BSEND_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,NUMTASK,TASKID,INMSG(2),OUTMSG(2)

      CALL MP_ENVIRON(NUMTASK,TASKID)

      TYPE = 1
      SOURCE = 0
      DEST = 1
      MSGLEN = 8

      IF(TASKID .EQ. SOURCE)  THEN
         OUTMSG(1) = 150
         OUTMSG(2) = 250

         CALL MP_BSEND(OUTMSG,MSGLEN,DEST,TYPE)

c        "OUTMSG" can now be reused
      ELSE
         IF(TASKID .EQ. DEST)  THEN
            CALL MP_BRECV(INMSG,MSGLEN,SOURCE,TYPE,NBYTES)

c           Task 1 now has "INMSG" = {150,250}
c           "NBYTES" returns the actual number of bytes sent.

         ENDIF
      ENDIF

      END
```

RELATED INFORMATION

Subroutines: MP_BRECV(3), mpc_brecv(3), MP_SEND(3), mpc_send(3)

NAME

MP_BSENDRECV, mpc_bsendrecv – Sends a message and waits until a message of the same type is received.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_bsendrecv(const void *outmsg, size_t outmsglen, int dest, int type,
                  void *inmsg, size_t inmsglen, int *source, size_t *nbytes);
```

FORTRAN SYNOPSIS

```
MP_BSENDRECV(INTEGER OUTMSG(*), INTEGER OUTMSGLEN, INTEGER DEST, INTEGER TYPE,
             INTEGER INMSG(*), INTEGER INMSGLEN, INTEGER SOURCE, INTEGER NBYTES)
```

PARAMETERS

outmsg is the application buffer that contains the message to be sent.

outmsglen is a non-negative integer that specifies the size, in bytes, of the message to be sent.

dest is an integer that specifies the task to which the message is to be sent. If **dest**=**nulltask**, no message is sent.

type is an integer that specifies the type of the message being sent and the type of the message to be received. **type** cannot be set equal to **dontcare**.

inmsg is the application buffer into which the message is received. The receiving application buffer, **inmsg**, and the sending application buffer, **outmsg**, cannot overlap in memory.

inmsglen is a non-negative integer that specifies the size, in bytes, of the buffer **inmsg**.

source is an integer that specifies the task from which the message originated. If **source**=**dontcare**, the next message satisfying the **type** parameter is read, and the sending task is returned in **source**. If **source**=**nulltask**, no message is received.

nbytes is an integer which returns the number of bytes received. If the message truncation mode is enabled and the length of the message is greater than **inmsglen**, **nbytes** is returned as equal to the **inmsglen** parameter. If **source**=**nulltask**, **nbytes** returns 0.

DESCRIPTION

This routine sends a message to **dest** and waits until a message of the same type is received from **source**. If two tasks each name the other as both **source** and **dest**, then there is an exchange of messages of the same type between the two tasks. However, by making **source** and **dest** distinct, you can use MP_BSENDRECV or mpc_bsendrecv to create different topologies such as a ring structure. In this case, each task receives a message from **source** and sends a message to **dest** MP_BSENDRECV waits until the **outmsg** buffer is available for reuse and the **inmsg** buffer contains the completed message. .

Programs must use MP_BSENDRECV to pass messages in conjunction only with other MP_BSENDRECVs. This means that you cannot mix MP_BSENDRECV on one task with ordinary sends and receives on other tasks. Such programs may work on some implementations but they will be implementation-dependent and cannot be guaranteed to be portable or upward-compatible.

Either **source** or **dest** can take **nulltask**, as an argument. Using **nulltask** means that the corresponding part of the send/receive operation will be inoperative. This is useful in ring operations where in shifting data “up,” for example, one may not wish task 0 to receive a message from the last task.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *and* **inmsg** overlap in memory

outmsg *or* **inmsg** is not a valid buffer

outmsglen *or* **inmsglen** is less than zero

dest *or* **source** is not a valid task id or wildcard value

type is not a valid message type

To use MP_BSENDRECV in conjunction with the other message passing commands such as MP_SEND, MP_BSEND, MP_RECV, and MP_BRECV is an error in semantics. Programming this way may not be portable between implementations.

Undetectable and implementation-dependent error to send a message to another task that has **source**=**nulltask** or to attempt to receive a message from a task that has **dest**=**nulltask** .

EXAMPLES

In a partition with an even number of tasks, pairs of tasks exchange messages with a single call using MP_BSENDRECV.

C Example

```
   #include <mpproto.h>

int bsendrecv_example()
{
   int source,dest,type,msglen,nbytes,rc;
   int numtask,taskid,inmsg,outmsg;

   mpc_environ(&numtask,&taskid);
   if(numtask % 2)  return(-1);
   /* "numtask" must be even in this example  */

   if(taskid % 2)   source = taskid - 1;         /* partner to "left" */
   else             source = taskid + 1;         /* partner to "right" */

   dest   = source;
   outmsg = taskid;
   msglen = sizeof(int);
   type = 1;

   rc = mpc_bsendrecv(&outmsg,msglen,dest,type,&inmsg,msglen,
                      &source, &nbytes);
   if(rc)  return(-1);  /* error */

   /*  Each task now has "inmsg" set to the task id of its partner  */

   return(0);
}
```

FORTRAN Eample

```
      SUBROUTINE BSENDRECV_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,MSGLEN,NBYTES
      INTEGER NUMTASK,TASKID,INMSG,OUTMSG

      CALL MP_ENVIRON(NUMTASK,TASKID)
c     "NUMTASK" must be even in this example
      IF(MOD(NUMTASK,2) .EQ. 1)  STOP 'NUMTASK MUST BE EVEN'

      IF(MOD(TASKID,2) .EQ. 1)  THEN
         SOURCE = TASKID - 1
      ELSE
         SOURCE = TASKID + 1
      ENDIF

      DEST   = SOURCE
      OUTMSG = TASKID
      MSGLEN = 4
      TYPE = 1

      CALL MP_BSENDRECV(OUTMSG,MSGLEN,DEST,TYPE,INMSG,MSGLEN,
     +                  SOURCE,NBYTES)

c     Each task now has "INMSG" set to the task id of its partner
c     "NBYTES" returns the actual number of bytes sent.

      END
```

RELATED INFORMATION

Subroutines: MP_SEND(3), mpc_send(3), MP_RECV(3), mpc_recv(3)

NAME

MP_BVRECV, mpc_bvrecv – Receives a non-contiguous message and waits until message is available

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_bvrecv(void *inmsg, size_t blklen, size_t offset,
               int blknum, int *source, int *type, size_t *nbytes);
```

FORTRAN SYNOPSIS

```
MP_BVRECV(INTEGER INMSG(*), INTEGER BLKLEN, INTEGER OFFSET, INTEGER BLKNUM,
          INTEGER SOURCE, INTEGER TYPE, INTEGER NBYTES)
```

PARAMETERS

inmsg is the starting location of the buffer into which the message is to be received. **inmsg** consists of **blknum** blocks, with each block consisting of **blklen** contiguous bytes. The starting addresses of consecutive blocks are separated by **offset** bytes.

blklen is a non-negative integer that specifies the size, in bytes, of each block contained in buffer **inmsg**.

offset is an integer that specifies the separation, in bytes, between the starting addresses of consecutive blocks. **offset** must be greater than or equal to **blklen**.

blknum is an integer that specifies the number of blocks contained in the buffer **inmsg**.

source is an integer that specifies the task from which the message has originated. If **source**=**dontcare**, the next message satisfying the **type** parameter will be read, and the sending task will be returned in source.

type is an integer that specifies the type of the message being received. If **type**=**dontcare**, the next message satisfying the **source** parameter will be read, and the message type will be returned in **type**. If both **source**=**dontcare** and **type**=**dontcare**, the next message will be read, and the source task and type returned in **source** and **type**, respectively.

nbytes is an integer that specifies the number of bytes received.

DESCRIPTION

This subroutine receives a message into non-contiguous memory and waits until the requested data is available in the application buffer in the receiving task.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

inmsg is not a valid buffer

blklen is less than zero

offset is less than **blklen**

blknum is less than zero

source is not a valid task id or wildcard value

type is not a valid message type or wildcard value

EXAMPLES

A message from task 0 is received by task 1, and the data values are placed at equal intervals in **inmsg** using MP_BRECV. In the comments, data values listed as "x" are not sent, received, or modified.

C Example

```
   #include <mpproto.h>

int bvrecv_example()
{
   int source,dest,type,blklen,offset,blknum,nbytes,rc;
   int numtask,taskid,inmsg[7],outmsg[7];

   mpc_environ(&numtask,&taskid);

   type = 1;
   blklen = sizeof(int);
   offset = 3 * sizeof(int);
   blknum = 3;
   source = 0;
   dest = 1;

   if(taskid == source)  {
      outmsg[0] = 1;
      outmsg[3] = 2;
      outmsg[6] = 3;
      /* "outmsg" is now {1,x,x,2,x,x,3}  */

      rc = mpc_bvsend(outmsg,blklen,offset,blknum,dest,type);
      if(rc)  return(-1);  /* error */
   } else {
      if(taskid == dest) {
```

```
         rc = mpc_bvrecv(inmsg,blklen,offset,blknum,&source,
                         &type,&nbytes);
         if(rc)  return(-1);  /* error */

         /* "inmsg" is now = {1,x,x,2,x,x,3}  */
      }
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE BVRECV_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,BLKLEN,OFFSET,BLKNUM,NBYTES
      INTEGER NUMTASK,TASKID,INMSG(7),OUTMSG(7)

      CALL MP_ENVIRON(NUMTASK,TASKID)

      TYPE = 1
      BLKLEN = 4
      OFFSET = 3 * 4
      BLKNUM = 3
      SOURCE = 0
      DEST = 1

      IF(TASKID .EQ. SOURCE)  THEN
         OUTMSG(1) = 1
         OUTMSG(4) = 2
         OUTMSG(7) = 3
c        "OUTMSG" is now = {1,x,x,2,x,x,3}

         CALL MP_BVSEND(OUTMSG,BLKLEN,OFFSET,BLKNUM,DEST,TYPE)
      ELSE
         IF(TASKID .EQ. DEST)  THEN

            CALL MP_BVRECV(INMSG,BLKLEN,OFFSET,BLKNUM,SOURCE,
     +                     TYPE,NBYTES)

c           "INMSG" is now = {1,x,x,2,x,x,3}

         ENDIF
      ENDIF

      END
```

RELATED INFORMATION

Subroutines: MP_BVSEND(3), mpc_bvsend(3), MP_UNPACK(3), mpc_unpack(3)

NAME

MP_BVSEND, mpc_bvsend – Sends a non-contiguous message and waits until the message buffer can be reused.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_bvsend(const void *outmsg, size_t blklen, size_t offset, int blknum,
               int dest, int type);
```

FORTRAN SYNOPSIS

```
MP_BVSEND(INTEGER OUTMSG(*), INTEGER BLKLEN, INTEGER OFFSET, INTEGER BLKNUM,
          INTEGER DEST, INTEGER TYPE)
```

PARAMETERS

outmsg is the starting location of the buffer that contains the message to be sent. **outmsg** consists of **blknum** blocks, with each block consisting of **blklen** contiguous bytes. The starting addresses of consecutive blocks are separated by **offset** bytes.

blklen is a non-negative integer that specifies the size, in bytes, of each block contained in buffer **outmsg**.

offset is an integer that specifies the separation, in bytes, between the starting addresses of consecutive blocks. **offset** must be greater than or equal to **blklen**.

blknum is an integer that specifies the number of blocks to be sent.

dest is an integer that specifies the task to which the message is to be sent.

type is an integer that specifies the type of the message to be sent.

DESCRIPTION

Takes data out of non-contiguous memory and sends it as a message. Then, the task waits until the application buffer in the sending task is free for reuse.

Completion does not imply that the message has been received by the destination task.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg is not a valid buffer

blklen is less than zero

offset is less than **blklen**

blknum is less than zero

dest is not a valid task id

type is not a valid message type

EXAMPLES

Selected values from **outmsg** on task 0 are sent to task 1 using MP_BVSEND. In the comments, data values listed as "x" are not sent, received, or modified.

C Example

```
   #include <mpproto.h>

int bvsend_example()
{
   int source,dest,type,blklen,offset,blknum,nbytes,rc;
   int numtask,taskid,inmsg[7],outmsg[7];

   mpc_environ(&numtask,&taskid);

   type = 1;
   blklen = sizeof(int);
   offset = 3 * sizeof(int);
   blknum = 3;
   source = 0;
   dest = 1;

   if(taskid == source)  {
      outmsg[0] = 1;
      outmsg[3] = 2;
      outmsg[6] = 3;
      /* "outmsg" is now {1,x,x,2,x,x,3}  */

      rc = mpc_bvsend(outmsg,blklen,offset,blknum,dest,type);
      if(rc)  return(-1);  /* error */
   } else {
      if(taskid == dest) {
         rc = mpc_bvrecv(inmsg,blklen,offset,blknum,&source,
                         &type,&nbytes);
         if (rc)  return(-1);  /* error */

         /* "inmsg" is now {1,x,x,2,x,x,3}  */
      }
```

```
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE BVSEND_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,BLKLEN,OFFSET,BLKNUM,NBYTES
      INTEGER NUMTASK,TASKID,INMSG(7),OUTMSG(7)

      CALL MP_ENVIRON(NUMTASK,TASKID)

      TYPE = 1
      BLKLEN = 4
      OFFSET = 3 * 4
      BLKNUM = 3
      SOURCE = 0
      DEST = 1

      IF(TASKID .EQ. SOURCE)  THEN
         OUTMSG(1) = 1
         OUTMSG(4) = 2
         OUTMSG(7) = 3
c        "OUTMSG" is now = {1,x,x,2,x,x,3}

         CALL MP_BVSEND(OUTMSG,BLKLEN,OFFSET,BLKNUM,DEST,TYPE)

      ELSE
         IF(TASKID .EQ. DEST)  THEN
            CALL MP_BVRECV(INMSG,BLKLEN,OFFSET,BLKNUM,SOURCE,
     +                     TYPE,NBYTES)

c           "INMSG" is now = {1,x,x,2,x,x,3}

         ENDIF
      ENDIF

      END
```

RELATED INFORMATION

Subroutines: MP_BVRECV(3), mpc_bvrecv(3), MP_PACK(3), mpc_pack(3)

NAME

MP_COMBINE, mpc_combine – Performs a reduction operation on data distributed across a group and distributes the result to all tasks in the group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_combine(const void *outmsg, void *inmsg, size_t msglen,
                void (*func)(), int gid);
```

FORTRAN SYNOPSIS

```
MP_COMBINE(INTEGER OUTMSG(*), INTEGER INMSG(*), INTEGER MSGLEN,
           EXTERN FUNC, INTEGER GID)
```

PARAMETERS

outmsg	is the application buffer that contains the local share of the distributed data.
inmsg	is the application buffer in which the result of a reduction operation is stored.
msglen	is a non-negative integer that specifies, in bytes, the size of **outmsg** and **inmsg**.
func	is an external function which implements a reduction operation.
gid	is a group identifier for the group of participating tasks.

DESCRIPTION

This routine performs a reduction operation on data distributed across a group. The result of the operation is stored in the application buffer **inmsg** in all tasks in the group.

The reduction is generally applied to one vector per task and the result is also a vector of the same length. **outmsg** and **inmsg** are of the same size.

You can define the reduction function or it can be one of the predefined functions listed in Appendix C, “Reduction Operations” on page 103.

outmsg and **inmsg** cannot overlap in memory.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, "nnn," can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *or* **inmsg**	is not a valid buffer
msglen	is less than zero
gid	is undefined in the calling task

Develop mode error if

- all tasks in **gid** do not use identical values for **msglen**

EXAMPLES

In a partition of 4 tasks, MP_COMBINE is used to find the sum of the **outmsg** values from all of the tasks, and place it in **inmsg** on each task.

C Example

```
   #include <mpproto.h>
   /* extern void i_vadd() is declared by mpproto.h */
   /* The constant ALLGRP is defined by mpproto.h */
int combine_example()
{
   int numtask,taskid,inmsg,outmsg,msglen,rc;

   mpc_environ(&numtask,&taskid);

   msglen = sizeof(int);
   outmsg = 1;

   rc = mpc_combine(&outmsg,&inmsg,msglen,i_vadd,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* "inmsg" is now equal to the number of tasks in the partition  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE COMBINE_EXAMPLE

      INTEGER NUMTASK,TASKID,INMSG,OUTMSG,MSGLEN,ALLGRP,NBUF(4)
      EXTERNAL I_VADD

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)     ! get "ALLGRP" value
      ALLGRP = NBUF(4)

      MSGLEN = 4
      OUTMSG = 1

      CALL MP_COMBINE(OUTMSG,INMSG,MSGLEN,I_VADD,ALLGRP)

c     "INMSG" is now equal to the number of tasks in the partition

      END
```

RELATED INFORMATION

Subroutines: MP_REDUCE(3), mpc_reduce(3)

See the user-defined reduction functions listed in Appendix C, “Reduction Operations” on page 103.

NAME

MP_CONCAT, mpc_concat – Concatenates a distinct message from each task to create one message.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_concat(const void *outmsg, void *inmsg, size_t blklen, int gid);
```

FORTRAN SYNOPSIS

```
MP_CONCAT(INTEGER OUTMSG(*), INTEGER INMSG(*), INTEGER BLKLEN, INTEGER GID)
```

PARAMETERS

outmsg is the application buffer that contains a distinct outgoing message for each task in the calling group.

inmsg is the application buffer that stores the final concatenation result.

blklen is a non-negative integer that specifies the size, in bytes, of a distinct message from each task in the calling group.

gid is a group identifier for the group of participating tasks.

DESCRIPTION

This routine takes a message that has the size **blklen** from the buffer **outmsg** in each task in the group **gid**. Then, it concatenates them into a message having the size **blklen** times the number of tasks in the calling group, and places the resulting message in the local buffer **inmsg** in each task. Logically, this is the same as MP_GATHER followed by MP_BCAST.

A distinct outgoing message is sent from each task. The incoming identical message for each task is a concatenation according to the order of the group.

outmsg and **inmsg** cannot overlap in memory.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *or* **inmsg**	is not a valid buffer
blklen	is less than zero
gid	is undefined in the calling task

Develop mode error if:

- all tasks in **gid** do not use identical values for **blklen**

EXAMPLES

An ordered list of task ids is placed in **inmsg** on each task by MP_CONCAT. A partition of 4 tasks is assumed.

C Example

```
   #include <mpproto.h>

int concat_example()
{
   int numtask,taskid,blklen,rc;
   int inmsg[4],outmsg;

   mpc_environ(&numtask,&taskid);

   blklen = sizeof(int);
   outmsg = taskid;

   rc = mpc_concat(&outmsg,&inmsg[0],blklen,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* "inmsg" now contains a list of task ids in ascending order,
      i.e. {0,1,2,3} for a partition of 4 tasks  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE CONCAT_EXAMPLE

      INTEGER NUMTASK,TASKID,INMSG(4),OUTMSG,BLKLEN,ALLGRP,NBUF(4)

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)     !  get "ALLGRP" value
      ALLGRP = NBUF(4)

      BLKLEN = 4
      OUTMSG = TASKID

      CALL MP_CONCAT(OUTMSG,INMSG,BLKLEN,ALLGRP)

c     "INMSG" now contains a list of task ids in ascending order,
c     i.e. {0,1,2,3} for a partition of 4 tasks
      END
```

RELATED INFORMATION

Subroutines: MP_INDEX(3), mpc_index(3), MP_GATHER(3), mpc_gather(3)

NAME

MP_ENVIRON, mpc_environ – Returns the number of tasks in the partition and the caller's task id.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_environ(int *numtask, int *taskid);
```

FORTRAN SYNOPSIS

```
MP_ENVIRON(INTEGER NUMTASK, INTEGER TASKID)
```

PARAMETERS

numtask is an integer which returns the number of tasks in the parallel partition.

taskid is an integer which returns the task id. Each task is assigned a unique integer between 0 and **numtask**-1, inclusive, for **taskid**.

DESCRIPTION

This subroutine returns the number of tasks in the partition (which is fixed at run time) and the task id. Each task in the partition obtains a unique task id which ranges from 0 to **numtask**-1, inclusive.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

EXAMPLES

MP_ENVIRON is used to get the number of tasks in the partition, and the task id of the local task.

C Example

```
   #include <mpproto.h>

int environ_example()
{
   int numtask,taskid,rc;

   rc = mpc_environ(&numtask,&taskid);
   if(rc)  return(-1);  /* error */

   /* "numtask" is now equal to the number of tasks in the partition.
      "taskid" is the id of the local task  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE ENVIRON_EXAMPLE

      INTEGER NUMTASK,TASKID

      CALL MP_ENVIRON(NUMTASK,TASKID)

c     "NUMTASK" is now equal to the number of tasks in the partition.
c     "TASKID" is the id of the local task

      END
```

NAME

MP_GATHER, mpc_gather – Concatenates a distinct message from each task to create a single message on task **dest**.

LIBRARY

- .C Library (libccl.a)
- .FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_gather(const void *outmsg, void *inmsg, size_t blklen,
               int dest, int gid);
```

FORTRAN SYNOPSIS

```
MP_GATHER(INTEGER OUTMSG(*), INTEGER INMSG(*), INTEGER BLKLEN,
          INTEGER DEST, INTEGER GID)
```

PARAMETERS

outmsg is the application buffer that contains the outgoing message to be gathered.

inmsg is the application buffer into which the final gathered result is placed for task id equal to **dest**. For the other tasks in the same calling group, **inmsg** is used as scratch space by the system.

inmsg is of size **blklen** multiplied by the number of tasks in the group.

blklen is a non-negative integer that specifies the size, in bytes, of the outgoing message in each of the sending tasks in the group.

dest is an integer that specifies the task to which the final gathered result of the calling group will be written.

gid is a group identifier for the group of participating tasks.

DESCRIPTION

This routine gathers a distinct message of length **blklen** from each task in the calling group, including the destination task **dest**. It then places a concatenated message (according to the order in the group) in the application buffer **inmsg** in the task with id **dest**.

outmsg and **inmsg** cannot overlap in memory.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, "nnn," can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *or* **inmsg**	is not a valid buffer
blklen	is less than zero
dest	is not a valid task id or is not a member of **gid**
gid	is undefined in the calling task

Develop mode error if:

- all taks in **gid** do not use idential values for **dest** and **blklen**.

EXAMPLES

An ordered list of task ids is placed in **inmsg** on task 0 by MP_GATHER. A partition of 4 tasks is assumed.

C Example

```
   #include <mpproto.h>

int gather_example()
{
   int numtask,taskid,dest,blklen,rc;
   int inmsg[4],outmsg;

   mpc_environ(&numtask,&taskid);

   blklen = sizeof(int);
   outmsg = taskid;
   dest = 0;

   rc = mpc_gather(&outmsg,inmsg,blklen,dest,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* "inmsg" in the "dest" task (0) now contains a list of task ids in
      ascending order, i.e. {0,1,2,3} for a partition of 4 tasks  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE GATHER_EXAMPLE

      INTEGER NUMTASK,TASKID,DEST,INMSG(4),OUTMSG,BLKLEN,ALLGRP,NBUF(4)

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)      !  get "ALLGRP" value
      ALLGRP = NBUF(4)

      BLKLEN = 4
      OUTMSG = TASKID
      DEST = 0

      CALL MP_GATHER(OUTMSG,INMSG,BLKLEN,DEST,ALLGRP)

c     "INMSG" in the "DEST" task now contains a list of task ids in
c     ascending order, i.e. {0,1,2,3} for a partition of 4 tasks

      END
```

RELATED INFORMATION

Subroutines: MP_SCATTER(3), mpc_scatter(3)

NAME

MP_GETLABEL, mpc_getlabel – Returns the label assigned to a group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_getlabel(int *label, int gid);
```

FORTRAN SYNOPSIS

```
MP_GETLABEL(INTEGER LABEL, INTEGER GID)
```

PARAMETERS

label is an integer into which the label of the specified task group is placed.

gid is an integer that specifies the identifier of the task group for which the label is returned.

DESCRIPTION

This routine returns the label of the task group **gid** in the argument **label**. The label of the predefined group, **allgrp**, is 0.

It is not necessary for each task in the group to call MP_GETLABEL.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

gid is undefined in the calling task

EXAMPLES

A new task group is created, and MP_GETLABEL is used to retrieve the label given to the group.

C Example

```
   #include <mpproto.h>

int getlabel_example()
{
   int label,numtask,taskid,tasks[4],i,gid,rc;

   mpc_environ(&numtask,&taskid);

   for(i=0;i<numtask;i++)
      tasks[i] = i;

   label = 55;
   rc = mpc_group(numtask,tasks,label,&gid); /* create a new group */
   if(rc)  return(-1);  /* error */
   label = 0;                              /* erase old value */

   rc = mpc_getlabel(&label,gid);
   if(rc)  return(-1);  /* error */

   /* "label" is now set to "55"  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE GETLABEL_EXAMPLE

      INTEGER LABEL,NUMTASK,TASKID,TASKS(4),I,GID

      CALL MP_ENVIRON(NUMTASK,TASKID)

      DO 10 I=1,NUMTASK
   10    TASKS(I) = I - 1

      LABEL = 55
      CALL MP_GROUP(NUMTASK,TASKS,LABEL,GID)   !  create a new group
      LABEL = 0                                !  erase old value

      CALL MP_GETLABEL(LABEL,GID)

c     "LABEL" is now set to "55"

      END
```

RELATED INFORMATION

Subroutines: MP_GROUP(3), mpc_group(3), MP_PARTITION(3), mpc_partition(3)

NAME

MP_GETMEMBERS, mpc_getmembers – Returns the members of a group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_getmembers(int glist[], int gid);
```

FORTRAN SYNOPSIS

```
MP_GETMEMBERS(INTEGER GLIST(*), INTEGER GID)
```

PARAMETERS

glist is an integer array into which the ordered membership list of the task group **gid** is placed. **glist** must be large enough to hold all of the task ids in the group.

gid is an integer that specifies the identifier of the task group for which the membership array is returned.

DESCRIPTION

This routine returns, in the argument **glist**, the array of task ids forming the task group **gid**. All tasks in the group do not have to call it.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

gid is undefined in the calling task

EXAMPLES

A new task group is created, and MP_GETMEMBERS is used to retrieve the list of tasks in the group.

C Example

```
   #include <mpproto.h>

int getmembers_example()
{
   int label,numtask,taskid,tasks[4],i,gid,rc;

   mpc_environ(&numtask,&taskid);

   for(i=0;i<numtask;i++)
      tasks[i] = i;

   label = 1;
   rc = mpc_group(numtask,tasks,label,&gid); /* create a new group */
   if(rc)  return(-1);  /* error */
   for(i=0;i<numtask;i++)
      tasks[i] = -1;                          /* erase old values */

   rc = mpc_getmembers(&tasks,gid);
   if(rc)  return(-1);  /* error */

   /* "tasks" is now = {0,1,2,3} for a partition of 4 tasks  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE GETMEMBERS_EXAMPLE

      INTEGER LABEL,NUMTASK,TASKID,TASKS(4),I,GID

      CALL MP_ENVIRON(NUMTASK,TASKID)

      DO 10 I=1,NUMTASK
   10    TASKS(I) = I - 1

      LABEL = 1
      CALL MP_GROUP(NUMTASK,TASKS,LABEL,GID)   !  create a new group
      DO 20 I=1,NUMTASK
   20    TASKS(I) = -1                         !  erase old values

      CALL MP_GETMEMBERS(TASKS,GID)

c     "TASKS" is now = {0,1,2,3} for a partition of 4 tasks

      END
```

RELATED INFORMATION

Subroutines: MP_GROUP(3), mpc_group(3), MP_PARTITION(3), mpc_partition(3)

NAME

MP_GETRANK, mpc_getrank – Returns a task's rank within a group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_getrank(int *rank, int taskid, int gid);
```

FORTRAN SYNOPSIS

```
MP_GETRANK(INTEGER RANK, INTEGER TASKID, INTEGER GID)
```

PARAMETERS

rank is an integer into which the rank of the task **taskid** in the task group **gid** is placed. If the **taskid** is not a member of **gid**, **rank** will be set to -1.

taskid is an integer that specifies the task id to check for its membership and rank in the task group **gid**.

gid is an integer that specifies the identifier of the task group for which the task **taskid** is checked for its membership and rank.

DESCRIPTION

If a task belongs to the group identified by **gid**, this routine returns, in **rank**, the rank of **taskid**. Ranks range from 0 through the number of tasks in the group - 1. Typically, **taskid** is the id of the calling task but it can be any other task id as well.

All tasks in the group do not have to call this routine.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

taskid is not a valid task id

gid is undefined in the calling task

EXAMPLES

A task group with descending task id order is created, and MP_GETRANK is used to determine the rank of the local task in the new group.

C Example

```
   #include <mpproto.h>

int getrank_example()
{
   int label,numtask,taskid,tasks[4],i,gid,lasttask,rank,rc;

   mpc_environ(&numtask,&taskid);
   lasttask = numtask - 1;
   for(i=0;i<numtask;i++)              /* create reversed task list */
      tasks[i] = lasttask - i;
      /* "tasks" is now = {3,2,1,0}, assuming a partition of 4 tasks */

   label = 1;
   rc = mpc_group(numtask,tasks,label,&gid); / *create a new group */
   if(rc)  return(-1);  /* error */

   rc = mpc_getrank(&rank,taskid,gid);
   if(rc)  return(-1);  /* error */

   /* "rank" is now set to "lasttask - taskid"  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE GETRANK_EXAMPLE

      INTEGER LABEL,NUMTASK,TASKID,TASKS(4),I,GID,LASTTASK,RANK

      CALL MP_ENVIRON(NUMTASK,TASKID)
      LASTTASK = NUMTASK - 1
      DO 10 I=1,NUMTASK                    ! create reversed task list
   10    TASKS(I) = NUMTASK - I
c     "TASKS" is now = {3,2,1,0}, assuming a partition of 4 tasks

      LABEL = 1
      CALL MP_GROUP(NUMTASK,TASKS,LABEL,GID)   ! create a new group

      CALL MP_GETRANK(RANK,TASKID,GID)

c     "RANK" is now set to "LASTTASK - TASKID"

      END
```

RELATED INFORMATION

Subroutines: MP_GROUP(3), mpc_group(3), MP_PARTITION(3), mpc_partition(3), MP_GETTASKID(3), mpc_gettaskid(3), MP_GETMEMBERS(3), mpc_getmembers(3)

NAME

MP_GETSIZE, mpc_getsize – Returns the number of tasks in a group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_getsize(int *gsize, int gid);
```

FORTRAN SYNOPSIS

```
MP_GETSIZE(INTEGER GSIZE, INTEGER GID)
```

PARAMETERS

gsize is an integer into which the number of tasks (size) in the specified task group is placed.

gid is an integer that specifies the identifier of the task group for which the size is returned.

DESCRIPTION

This routine returns the number of tasks in the task group **gid** in the argument **gsize**. All tasks in the group do not have to call this routine.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

gid is undefined in the calling task

EXAMPLES

A task group is created, and MP_GETSIZE is used to verify the number of tasks in the group. A partition size of 4 is assumed.

C Example

```
   #include <mpproto.h>

int getsize_example()
{
   int label,numtask,taskid,tasks[4],i,gid,gsize,rc;

   mpc_environ(&numtask,&taskid);

   for(i=0;i<numtask;i++)
      tasks[i] = i;

   label = 1;
   rc = mpc_group(numtask,tasks,label,&gid); / *create a new group */
   if(rc)  return(-1);  /* error */

   rc = mpc_getsize(&gsize,gid);
   if(rc)  return(-1);  /* error */

   /* "gsize" is now equal to "numtask"  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE GETSIZE_EXAMPLE

      INTEGER LABEL,NUMTASK,TASKID,TASKS(4),I,GID,GSIZE

      CALL MP_ENVIRON(NUMTASK,TASKID)

      DO 10 I=1,NUMTASK
   10    TASKS(I) = I - 1

      LABEL = 1
      CALL MP_GROUP(NUMTASK,TASKS,LABEL,GID)   !  create a new group

      CALL MP_GETSIZE(GSIZE,GID)

c     "GSIZE" is now equal to "NUMTASK"

      END
```

RELATED INFORMATION

Subroutines: MP_GROUP(3), mpc_group(3), MP_PARTITION(3), mpc_partition(3), MP_GETMEMBERS(3), mpc_getmembers(3)

NAME

MP_GETTASKID, mpc_gettaskid – Returns the task id for a **rank** within a group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_gettaskid(int rank, int *taskid, int gid);
```

FORTRAN SYNOPSIS

```
MP_GETTASKID(INTEGER RANK, INTEGER TASKID, INTEGER GID)
```

PARAMETERS

rank	is an integer that specifies the rank of a task in the group.
taskid	is an integer into which the task id of the task with the given rank is placed.
gid	is an integer that specifies the identifier of the task group to query.

DESCRIPTION

This routine returns the task id of the task which is ranked **rank** in the task group **gid**. It places this information in **taskid**.

Valid ranks range from 0 through the number of tasks in the group - 1.

All tasks in the group do not have to call this routine.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, "nnn," can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

rank	is less than zero or is greater than or equal to the number of tasks in **gid**
gid	is undefined in the calling task

EXAMPLES

A reverse-ordered task group of 4 is created, and MP_GETTASKID is used to determine the task id of a given rank in the resulting group.

C Example

```
   #include <mpproto.h>

int gettaskid_example()
{
   int label,numtask,taskid,tasks[4],i,gid,lasttask,rank,myid,rc;

   mpc_environ(&numtask,&taskid);
   lasttask = numtask - 1;
   for(i=0;i<numtask;i++)              /* create reversed task list */
      tasks[i] = lasttask - i;
      /* "tasks" is now = {3,2,1,0}, assuming a partition of 4 tasks */

   label = 1;

   rc = mpc_group(numtask,tasks,label,&gid); /* create a new group */
   if(rc)  return(-1);  /* error */
   rank = lasttask - taskid;

   rc = mpc_gettaskid(rank,&myid,gid);
   if(rc)  return(-1);  /* error */

   /* "myid" is now equal to "taskid"  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE GETTASKID_EXAMPLE

      INTEGER LABEL,NUMTASK,TASKID,TASKS(4),I,GID,RANK,MYID

      CALL MP_ENVIRON(NUMTASK,TASKID)

      DO 10 I=1,NUMTASK                 ! create reversed task list
   10    TASKS(I) = NUMTASK - I
c     "TASKS" is now = {3,2,1,0}, assuming a partition of 4 tasks

      LABEL = 1
      CALL MP_GROUP(NUMTASK,TASKS,LABEL,GID)   ! create a new group
      RANK = NUMTASK - TASKID - 1              ! compute rank of local task

      CALL MP_GETTASKID(RANK,MYID,GID)

c     "MYID" is now equal to "TASKID"

      END
```

RELATED INFORMATION

Subroutines: MP_GROUP(3), mpc_group(3), MP_PARTITION(3), mpc_partition(3), MP_GETRANK(3), mpc_getrank(3), MP_GETMEMBERS(3), mpc_getmembers(3)

NAME

MP_GROUP, mpc_group – Explicitly defines a task group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_group(int gsize, const int glist[], int label, int *gid);
```

FORTRAN SYNOPSIS

```
MP_GROUP(INTEGER GSIZE, INTEGER GLIST(*), INTEGER LABEL, INTEGER GID)
```

PARAMETERS

gsize	is an integer that specifies the number of tasks in **glist**.
glist	is the array of task ids which form a task group.
label	is a user-defined identifier to associate with the group. The predefined group **allgrp** has label 0.
gid	is an integer variable into which the task group identifier of the newly formed group is placed.

DESCRIPTION

Allows you to define a task group by explicitly specifying the list of tasks that will form the group. You do this by specifying:

- A membership array of task ids
- The size of the group
- A label to associate with the group.

This routine returns **gid**, a new task group identifier, as an argument.

You can use MP_GETSIZE, MP_GETMEMBERS, and MP_GETLABEL to obtain information of gsize, glist and label, respectively.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

gsize is less than or equal to zero, or greater than the number of tasks in the partition

Develop mode error if:

- one or more of the task ids in **glist** is invalid
- a task id appears in **glist** more than once
- the id of the local task does not appear in **glist**
- all tasks in **gid** do not use identical values for **gsize** and **label**
- the task id array **glist** is not identical for all tasks in **gid**.

EXAMPLES

A task group is created consisting of 4 tasks in decreasing task id order.

C Example

```
   #include <mpproto.h>

int group_example()
{
   int label,numtask,taskid,tasks[4],i,gid,rc;

   mpc_environ(&numtask,&taskid);
   for(i=0;i<numtask;i++)              /* create reversed task list */
      tasks[i] = numtask - i - 1;
      /* "tasks" is now = {3,2,1,0}, assuming a partition of 4 tasks */

   label = 1;

   rc = mpc_group(numtask,tasks,label,&gid); /* create a new group */
   if(rc)  return(-1);  /* error */

   /* "gid" now identifies the task group {3,2,1,0}, assuming a partition
      of 4 tasks  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE GROUP_EXAMPLE

      INTEGER LABEL,NUMTASK,TASKID,TASKS(4),I,GID

      CALL MP_ENVIRON(NUMTASK,TASKID)

      LABEL = 1
      DO 10 I = 1,NUMTASK                    ! create reversed task list
   10    TASKS(I) = NUMTASK - I
c     "TASKS" is now = {3,2,1,0}, assuming a partition of 4 tasks

      CALL MP_GROUP(NUMTASK,TASKS,LABEL,GID)     ! create a new group
```

```
c     "GID" now identifies the task group {3,2,1,0} with a label of 1,
c     assuming a partition of 4 tasks.

      END
```

RELATED INFORMATION

Subroutines: MP_PARTITION(3), mpc_partition(3)

NAME

MP_INDEX, mpc_index – Performs an all-to-all personalized communication operation.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_index(const void *outmsg, void *inmsg, size_t blklen, int gid);
```

FORTRAN SYNOPSIS

```
MP_INDEX(INTEGER OUTMSG(*), INTEGER INMSG(*), INTEGER BLKLEN, INTEGER GID)
```

PARAMETERS

outmsg	is the application buffer which contains the distinct outgoing messages.
inmsg	is the application buffer which stores the incoming messages from all the tasks in the group, including itself.
blklen	is a non-negative integer that specifies the size, in bytes, of each distinct outgoing message.
gid	is a group identifier for the group of participating tasks.

DESCRIPTION

This routine performs an all-to-all personalized communication operation. This means that each task sends a distinct message to all the tasks in the same group. Each task in the calling group partitions its local buffers **outmsg** and **inmsg** into *N* blocks each of size **blklen**, where *N* is the number of tasks in the group. The *i*-th task in the group sends the *j*-th block in **outmsg** to the *j*-th task in the same group. The *j*-th task stores the message in the *i*-th block in **inmsg**. Therefore, the *i*-th block of **outmsg** in the *i*-th task will be copied locally to the *i*-th block of **inmsg**.

outmsg and **inmsg** cannot overlap in memory.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *or* **inmsg**	is not a valid buffer
blklen	is less than zero
gid	is undefined in the calling task

Develop mode error if:

- all tasks in **gid** do not use identical values for **blklen**

EXAMPLES

MP_INDEX is used to send a distinct message from each task in a partition of 4 to every other task in the partition. The messages originate from **outmsg** and arrive in **inmsg**.

C Example

```
   #include <mpproto.h>

int index_example()
{
   int numtask,taskid,blklen,i,rc;
   int inmsg[4],outmsg[4];

   mpc_environ(&numtask,&taskid);

   for(i=0;i<numtask;i++)
      outmsg[i] = i;
   /* "outmsg" is now {0,1,2,3}  */
   blklen = sizeof(int);

   rc = mpc_index(outmsg,inmsg,blklen,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* "inmsg" now contains 4 copies of the local task id, assuming
      a partition of 4 tasks  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE INDEX_EXAMPLE

      INTEGER NUMTASK,TASKID,BLKLEN,ALLGRP,I
      INTEGER INMSG(4),OUTMSG(4),NBUF(4)

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)      !  Get "ALLGRP" value
      ALLGRP = NBUF(4)

      BLKLEN = 4
      DO 10 I=1,NUMTASK
   10    OUTMSG(I) = I - 1
c     "OUTMSG" is now {0,1,2,3}

      CALL MP_INDEX(OUTMSG,INMSG,BLKLEN,ALLGRP)

c     "INMSG" now contains 4 copies of the local task id, assuming
c     a partition of 4 tasks

      END
```

RELATED INFORMATION

Subroutines: MP_CONCAT(3), mpc_concat(3)

NAME

MP_PACK, mpc_pack – Packs data from a non-contiguous buffer into a contiguous buffer.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_pack(const void *begbuf, void *endbuf,
             size_t blklen, size_t offset, int blknum);
```

FORTRAN SYNOPSIS

```
MP_PACK(INTEGER BEGBUF(*), INTEGER ENDBUF(*), INTEGER BLKLEN,
        INTEGER OFFSET, INTEGER BLKNUM)
```

PARAMETERS

begbuf is the starting location of the buffer that contains the initial non-contiguous data. **begbuf** consists of **blknum** blocks, with each block consisting of **blklen** contiguous bytes. The starting addresses of consecutive blocks are separated by **offset** bytes.

endbuf is the buffer into which the packed data is to be placed.

blklen is an integer specifying the size, in bytes, of each block contained in buffer **begbuf**.

offset is an integer specifying the separation, in bytes, between the starting addresses of consecutive blocks.

blknum is an integer specifying the number of blocks contained in the buffer **begbuf**.

DESCRIPTION

Packs data from a non-contiguous buffer into a contiguous buffer. For MP_PACK, arguments **blklen**, **offset**, and **blknum** are associated with the source buffer **begbuf**.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

begbuf *or* **endbuf**	is not a valid buffer
blklen	is less than zero
offset	is less than **blklen**
blknum	is less than zero

EXAMPLES

Selected data values in **begbuf** are packed into **endbuf** .

C Example

```
   #include <mpproto.h>

int pack_example()
{
 int blklen,offset,blknum,i,rc;
 int begbuf[16],endbuf[9];

 for(i=0;i<16;i++)
    begbuf[i] = i;  /* "begbuf" = {0,1,2,3,4,5,6,7,8,9,10,
                                                11,12,13,14,15} * 1

 blklen = 3 * sizeof(int);
 offset = 5 * sizeof(int);
 blknum = 3;

 rc = mpc_pack(begbuf,endbuf,blklen,offset,blknum);
 if(rc)  return(-1);  /* error */

 /* "endbuf" = {0,1,2,5,6,7,10,11,12}  */

 return(0);
}
```

FORTRAN Example

```
      SUBROUTINE PACK_EXAMPLE

      INTEGER BLKLEN,OFFSET,BLKNUM,I
      INTEGER BEGBUF(16),ENDBUF(9)

      DO 10 I=1,16
   10    BEGBUF(I) = I-1
c     "BEGBUF" = {0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15}

      BLKLEN = 3 * 4
      OFFSET = 5 * 4
      BLKNUM = 3

      CALL MP_PACK(BEGBUF,ENDBUF,BLKLEN,OFFSET,BLKNUM)

c     "ENDBUF" = {0,1,2,5,6,7,10,11,12}

      END
```

RELATED INFORMATION

Subroutines: MP_UNPACK(3), mpc_unpack(3), MP_BVSEND(3), mpc_bvsend(3)

NAME

MP_PARTITION, mpc_partition – Partitions an existing task group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_partition(int parent_gid, int key, int label, int *gid);
```

FORTRAN SYNOPSIS

```
MP_PARTITION(INTEGER PARENT_GID, INTEGER KEY, INTEGER LABEL, INTEGER GID)
```

PARAMETERS

parent_gid is a previously defined group to partition.

key is an integer value used to specify the initial rank in the new group of the task.

label is an integer value used to partition the parent group. Tasks with the same value of label are formed into new groups.

gid is an integer returning the task group identifier of the newly formed group.

DESCRIPTION

This routine forms multiple new groups by partitioning a previously defined task group **parent_gid**, based on the local value of **label** supplied by each task.

Each task only sees the new group which it is in. The order in each new group is determined by sorting task ids in ascending order of **key**.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

parent_gid is undefined in the calling task

EXAMPLES

A partition of 4 tasks is divided into 2 groups, with the even-numbered tasks in one group and the odd-numbered tasks in the other group.

C Example

```
   #include <mpproto.h>

int partition_example()
{
   int numtask,taskid,gid,label,key,rc;
   int tasks[4];

   mpc_environ(&numtask,&taskid);

   label = taskid % 2;
   key   = -taskid;

   rc = mpc_partition(ALLGRP,key,label,&gid);
   if(rc)  return(-1);  /* error */

   /* "gid" now identifies the task group {2,0} on tasks 0 and 2, and
      the group {3,1} on tasks 1 and 3, assuming a partition of 4 tasks */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE PARTITION_EXAMPLE

      INTEGER NUMTASK,TASKID,ALLGRP,GID,LABEL,KEY
      INTEGER TASKS(4),NBUF(4)

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)    !  Get "ALLGRP" value
      ALLGRP = NBUF(4)

      LABEL = MOD(TASKID,2)
      KEY   = -TASKID

      CALL MP_PARTITION(ALLGRP,KEY,LABEL,GID)

c     "GID" now identifies the task group {2,0} on tasks 0 and 2, and
c     the group {3,1} on tasks 1 and 3, assuming a partition of 4 tasks

      END
```

RELATED INFORMATION

Subroutines: MP_GROUP(3), mpc_group(3)

NAME

MP_PREFIX, mpc_prefix – Applies a parallel prefix operation with respect to a reduction operation on data distributed across a group and places the corresponding result in each task in the group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_prefix(const void *outmsg, void *inmsg, size_t msglen,
               void (*func)(), int gid);
```

FORTRAN SYNOPSIS

```
MP_PREFIX(INTEGER OUTMSG(*), INTEGER INMSG(*), INTEGER MSGLEN,
          EXTERN FUNC, INTEGER GID)
```

PARAMETERS

outmsg	is the application buffer that contains the local share of the distributed data.
inmsg	is the application buffer into which the result of prefix with respect to the current task is stored.
msglen	is a non-negative integer that specifies the size, in bytes, of outmsg and inmsg.
func	is an external function which implements a reduction operation.
gid	is a group identifier for the group of participating tasks.

DESCRIPTION

This subroutine applies a parallel prefix operation with respect to a reduction operation on data distributed across a group and places the corresponding result in each task in the group.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *or* **inmsg**	is not a valid buffer
msglen	is less than zero
gid	is undefined in the calling task

Develop mode error if:

- all tasks in **gid** do not use identical values for **msglen**

EXAMPLES

In a partition of 4 tasks, MP_PREFIX is used to generate a task-wise cumulative sum of **outmsg** values in each task in the partition. That is, each task's **inmsg** is set equal to the sum of the **outmsg** values from all tasks numerically less than or equal to itself.

C Example

```
   #include <mpproto.h>
   /* extern void i_vadd() is declared by mpproto.h */

int prefix_example()
{
   int numtask,taskid,msglen,rc;
   int inmsg,outmsg;

   mpc_environ(&numtask,&taskid);

   outmsg = taskid;
   msglen = sizeof(int);

   rc = mpc_prefix(&outmsg,&inmsg,msglen,i_vadd,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* "inmsg" for tasks {0,1,2,3} is now {0,1,3,6}, respectively,
      assuming a partition of 4 tasks  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE PREFIX_EXAMPLE

      INTEGER NUMTASK,TASKID,MSGLEN,ALLGRP
      INTEGER INMSG,OUTMSG,NBUF(4)
      EXTERNAL I_VADD

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)    !  get "ALLGRP" value
      ALLGRP = NBUF(4)

      OUTMSG = TASKID
      MSGLEN = 4

      CALL MP_PREFIX(OUTMSG,INMSG,MSGLEN,I_VADD,ALLGRP)

c     "INMSG" for tasks {0,1,2,3} is now {0,1,3,6}, respectively,
c     assuming a partition of 4 tasks

      END
```

RELATED INFORMATION

Subroutines: MP_REDUCE(3), mpc_reduce(3), MP_COMBINE(3), mpc_combine(3)

See the user-defined reduction functions listed in Appendix C, “Reduction Operations” on page 103.

NAME

MP_PROBE, mpc_probe – Checks for messages which may have arrived without matching a pending receive.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_probe(int *source, int *type, int *mstat);
```

FORTRAN SYNOPSIS

```
MP_PROBE(INTEGER SOURCE, INTEGER TYPE, INTEGER MSTAT)
```

PARAMETERS

source an integer specifying the task from which the probed message has originated. If **source**=**dontcare** (a system-specific flag), a message satisfying the **type** parameter will be selected, and the sending task will be returned in **source**.

type an integer specifying the type of the message being probed. If **type**=**dontcare** (a system-specific flag), a message satisfying the **source** parameter will be selected, and the message type will be returned in **type**. If both **source**=**dontcare** and **type**= **dontcare**, the first available message will be selected, and the source task and type returned in **source** and **type**, respectively. Resetting **source** and **type** to **dontcare** and calling **MP_PROBE** again without posting any new message receives will return information on the same incoming message, not a different one.

mstat an integer which returns the message status or number of bytes for a message, satisfying the **source** and **type** parameters. If no matching message is found, **mstat** is returned as **-1**.

DESCRIPTION

This subroutine probes to see if any messages have arrived for which corresponding receives have not been previously posted.

MP_PROBE checks to see if a message that satisfies the **source** and **type** parameters and for which a corresponding receive has not been posted has arrived at the task. This message, for which a receive has not yet been posted, could have been sent using any of the send calls. **MP_PROBE** does not receive the message, it only determines that a message did arrive.

NOTES

In C, a positive value returned for **mstat** does represent a message size but it is unsafe to use a size_t parameter. This is because **mstat** must be tested for <0 and a size_t parameter is unsigned.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, "nnn," can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

source is not a valid task id or wildcard value

type is not a valid message type or wildcard value

EXAMPLES

A message is sent from task 0 to task 1. Task 1 probes for any incoming message and receives the message into a temporary buffer.

C Example

```
   #include <mpproto.h>

int probe_example()
{

   int source,dest,type,msglen,mstat,rc;
   int numtask,taskid,*inmsg,outmsg[100];

   rc = mpc_environ(&numtask,&taskid);

   if(taskid == 0)  {
      /* send message to task "1" */
      dest = 1;
      type = 1;
      outmsg[0] = 700;
      msglen = sizeof(outmsg);
      rc = mpc_bsend(&outmsg,msglen,dest,type);
      if(rc)  return(-1);
   } else {
      if(taskid == 1) {
         source = DONTCARE;
         type   = DONTCARE;
         for(;;)  {
            rc = mpc_probe(&source,&type,&mstat);
            if(rc)  return(-1);
            if(mstat >= 0)  break;

         /* Other processing can be done while awaiting message arrival */

         }
         /* "mstat" is now equal to the size of the probed message,
```

```
            "source" is 0, and "type" is 1 */

         inmsg = (int *) malloc(mstat);
         msglen = mstat;
         rc = mpc_brecv(inmsg,msglen,&source,&type,&mstat);
         if(rc)  return(-1);

         /* "inmsg" now holds the probed message (inmsg[0] = 700) */

         free(inmsg);
      }
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE PROBE_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,MSGLEN,MSTAT,DONTCARE
      INTEGER NBUF(4),NUMTASK,TASKID,INMSG(500),OUTMSG(100)

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)         ! get DONTCARE value
      DONTCARE = NBUF(1)

      IF(TASKID .EQ. 0)  THEN
         ! Send message to task "1"

         DEST = 1
         TYPE = 1
         OUTMSG(1) = 700
         MSGLEN = 400
         CALL MP_BSEND(OUTMSG,MSGLEN,DEST,TYPE)
      ELSE
         IF(TASKID .EQ. 1)  THEN
            SOURCE = DONTCARE
            TYPE   = DONTCARE
            MSTAT = -1
            DO 10 WHILE (MSTAT .LT. 0)
               CALL MP_PROBE(source,type,mstat)

               ! Other processing can be done while awaiting message arrival

10          CONTINUE

         !  "MSTAT" is now equal to the size of the probed message,
         !  "SOURCE" is 0, and "TYPE" is 1

            MSGLEN = MSTAT
            CALL MP_BRECV(INMSG,MSGLEN,SOURCE,TYPE,MSTAT)

         !  "inmsg" now holds the probed message (inmsg(1) = 700)

         ENDIF
      ENDIF
      END
```

NAME

MP_RECV, mpc_recv – Posts a receive buffer for a message and returns without waiting for the message arrival.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_recv(void *inmsg, size_t msglen, int *source, int *type, int *msgid);
```

FORTRAN SYNOPSIS

```
MP_RECV(INTEGER INMSG(*), INTEGER MSGLEN, INTEGER SOURCE, INTEGER TYPE,
        INTEGER MSGID)
```

PARAMETERS

inmsg is the application buffer into which the message is received.

msglen is an integer that specifies the size, in bytes, of the buffer **inmsg**.

source is an integer that specifies the task from which the message originated. If **source**=**dontcare**, the next message satisfying the **type** parameter is read. MP_RECV does not return **dontcare** overwritten by taskid for the same reason it does not return a completed **inmsg**. MP_RECV retains the location of the **source** datum and asynchronously overwrites **dontcare** when the message arrives.

type is an integer that specifies the type of the message being received. If **type**=**dontcare**, the next message satisfying the **source** parameter is read and the message type is asynchronously reported in **type**. If both **source**=**dontcare** and **type**=**dontcare**, the next message is read, and the source task and type are asynchronously reported in **source** and **type**, respectively.

msgid is an integer returned as a message identifier that can be used to test the status of the message.

DESCRIPTION

Identifies an area in memory to serve as a buffer for the message to be received and continues processing without waiting for the message to arrive.

Use calls to MP_STATUS or MP_WAIT to determine when the MP_RECV operation completes and the requested message is available in the buffer **inmsg**.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

inmsg is not a valid buffer

msglen is less than zero

source is not a valid task id or wildcard value

type is not a valid message type or wildcard value

If the message truncation mode is not enabled and the length of the message to be received is greater than **msglen**. For information on enabling the message truncation mode, see MP_TASK_SET.

EXAMPLES

A message is sent from task 0 using MP_SEND to task 1, where it is received using MP_RECV. Task 1 then calls MP_WAIT before using the data in **inmsg** .

C Example

```
   #include <mpproto.h>

int recv_example()
{
   int source,dest,type,msglen,msgid,nbytes,rc;
   int numtask,taskid,inmsg[2],outmsg[2];

   mpc_environ(&numtask,&taskid);

   type = 1;
   source = 0;
   dest = 1;
   msglen = sizeof(outmsg);

   if(taskid == source)  {
      outmsg[0] = 150;
      outmsg[1] = 250;
      rc = mpc_bsend(outmsg,msglen,dest,type);
      if(rc)  return(-1);  /* error */
   } else {
      if(taskid == dest) {
         rc = mpc_recv(inmsg,msglen,&source,&type,&msgid);
         if(rc)  return(-1);  /* error */

         /*  Data in "inmsg" is not available until "mpc_wait" is executed,
             but other work can continue until it is needed  */

         rc = mpc_wait(&msgid,&nbytes);
         if(rc)  return(-1);  /* error */
```

```
         /*  Task 1 now has "inmsg" = {150,250}  */
      }
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE RECV_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,MSGLEN,MSGID,NBYTES
      INTEGER NUMTASK,TASKID,INMSG(2),OUTMSG(2)

      CALL MP_ENVIRON(NUMTASK,TASKID)

      TYPE = 1
      SOURCE = 0
      DEST = 1
      MSGLEN = 8

      IF(TASKID .EQ. SOURCE)  THEN
         OUTMSG(1) = 150
         OUTMSG(2) = 250
         CALL MP_BSEND(OUTMSG,MSGLEN,DEST,TYPE)
      ELSE
         IF(TASKID .EQ. DEST)  THEN

            CALL MP_RECV(INMSG,MSGLEN,SOURCE,TYPE,MSGID)

c           Data in "INMSG" is not available until "MP_WAIT" is executed,
c           but other work can continue until it is needed

            CALL MP_WAIT(MSGID,NBYTES)

c           Task 1 now has "INMSG" = {150,250}
c           "NBYTES" returns the actual number of bytes sent.

         ENDIF
      ENDIF
      END
```

RELATED INFORMATION

Subroutines: MP_SEND(3), mpc_send(3), MP_WAIT(3), mpc_wait(3), MP_STATUS(3), mpc_status(3), MP_PROBE(3), mpc_probe(3), MP_BRECV(3), mpc_brecv(3)

NAME

MP_REDUCE, mpc_reduce – Performs a reduction operation on data distributed across a group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_reduce(const void *outmsg, void *inmsg, size_t msglen, int dest,
               void (*func)(), int gid);
```

FORTRAN SYNOPSIS

```
MP_REDUCE(INTEGER OUTMSG(*), INTEGER INMSG(*), INTEGER MSGLEN, INTEGER DEST,
          EXTERN FUNC, INTEGER GID)
```

PARAMETERS

outmsg is the application buffer that contains the local share of the distributed data.

inmsg is the application buffer into which the result of the reduction operation is stored, for task id equal to **dest**. For the other tasks in the group, **inmsg** is used as scratch buffer space by the system.

msglen is a non-negative integer that specifies the size, in bytes, of **outmsg** and **inmsg**.

dest is an integer that specifies the task to which the result of a reduction operation across a group is written.

func is an external function which implements a reduction operation.

gid is a group identifier for the group of participating tasks.

DESCRIPTION

Applies a reduction operation on data distributed across a group and places the result in a designated **inmsg** of a specified task in the group. The local data set to be reduced is called **outmsg** and is of length **msglen** bytes.

The reduction is applied to one vector per task and the result is also a vector of the same length.

You can define the reduction function or you can use one of the predefined ones listed in Appendix C, “Reduction Operations” on page 103.

Only the task **dest** in the group receives the final result of a reduction operation, which will be stored in the application buffer **inmsg**. **outmsg** and **inmsg** cannot overlap in memory.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, "nnn," can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *or* **inmsg**	is not a valid buffer
msglen	is less than zero
dest	is not a valid task id or is not a member of **gid**
gid	is undefined in the calling task

Develop mode error if:

- all tasks in **gid** do not use identical values for **dest** and **msglen**

EXAMPLES

In a partition of 4 tasks, MP_REDUCE is used to find the sum of the **outmsg** values from all of the tasks, and places it in **inmsg** on task 0.

C Example

```
   #include <mpproto.h>
   /*  extern void i_vadd() is declared by mpproto.h  */
   /*  The constant ALLGRP is defined by mpproto.h   */

int reduce_example()
{
   int numtask,taskid,dest,msglen,rc;
   int inmsg,outmsg;

   mpc_environ(&numtask,&taskid);

   dest = 0;
   outmsg = taskid;
   /* "outmsg" for tasks {0,1,2,3} is now {0,1,2,3}, respectively */
   msglen = sizeof(int);

   rc = mpc_reduce(&outmsg,&inmsg,msglen,dest,i_vadd,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* "inmsg" for task 0 is now 6, assuming a partition of 4 tasks.
   For tasks 1, 2, and 3, the value of "inmsg" is undefined.  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE REDUCE_EXAMPLE

      INTEGER NUMTASK,TASKID,DEST,MSGLEN,ALLGRP
      INTEGER INMSG,OUTMSG,NBUF(4)
      EXTERNAL I_VADD

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)    !  get "ALLGRP" value
      ALLGRP = NBUF(4)

      DEST = 0
      OUTMSG = TASKID
c     "OUTMSG" for tasks {0,1,2,3} is now {0,1,2,3}, respectively
      MSGLEN = 4

      CALL MP_REDUCE(OUTMSG,INMSG,MSGLEN,DEST,I_VADD,ALLGRP)

c     "INMSG" for task 0 is now 6, assuming a partition of 4 tasks.
c     For tasks 1, 2, and 3, the value of "inmsg" is undefined.

      END
```

RELATED INFORMATION

Subroutines: MP_COMBINE(3), mpc_combine(3), MP_PREFIX(3), mpc_prefix(3)

See the user-defined reduction functions listed in Appendix C, “Reduction Operations” on page 103.

NAME

MP_SCATTER, mpc_scatter – Distributes distinct messages to each task in the group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_scatter(void *outmsg, void *inmsg, size_t blklen,
                int source, int gid);
```

FORTRAN SYNOPSIS

```
MP_SCATTER(INTEGER OUTMSG(*), INTEGER INMSG(*), INTEGER BLKLEN,
           INTEGER SOURCE, INTEGER GID)
```

PARAMETERS

outmsg is the application buffer that contains the messages to scatter for task id equal to **source**. For this task, **outmsg** is not changed but for the other tasks, **outmsg** is used as a scratch space by the system.

inmsg is the application buffer into which the incoming message is received.

blklen is a non-negative integer that specifies the size, in bytes, of **inmsg**.

source is an integer that specifies the task that contains the distinct messages to scatter.

gid is a group identifier for the group of participating tasks.

DESCRIPTION

This routine distributes distinct messages to each task in the same group **gid**. Conceptually, **outmsg** in the task with task id **source** is partitioned into *N* blocks, each of length **blklen** bytes, where *N* is the number of tasks in the group. Each block is a distinct message. As a result of this call, the *i*-th block is sent to the *i*-th task in the group and stored in **inmsg**.

outmsg and **inmsg** cannot overlap in memory.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, "nnn," can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *or* **inmsg**	is not a valid buffer
blklen	is less than zero
source	is not a valid task id or is not a member of **gid**
gid	is undefined in the calling task

Develop mode error if:

- all tasks in **gid** do not use identical values for **source** and **blklen**

EXAMPLES

In a partition of 4 tasks, MP_SCATTER is used to distribute distinct messages from task 2 to all of the tasks in the partition. The data is sent from **outmsg** and is received in **inmsg** .

C Example

```
   #include <mpproto.h>

int scatter_example()
{
   int numtask,taskid,source,blklen,i,rc;
   int inmsg,outmsg[4];

   mpc_environ(&numtask,&taskid);

   blklen = sizeof(int);
   source = 2;
   if(taskid == source)
      for(i=0;i<numtask;i++)
         outmsg[i] = i;
   /* "outmsg" on task 2 is now {0,1,2,3} */

   rc = mpc_scatter(outmsg,&inmsg,blklen,source,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* "inmsg" on tasks {0,1,2,3} is now {0,1,2,3}, respectively,
   assuming a partition of 4 tasks  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE SCATTER_EXAMPLE

      INTEGER NUMTASK,TASKID,SOURCE,BLKLEN,ALLGRP,I
      INTEGER INMSG,OUTMSG(4),NBUF(4)

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)       !  get "ALLGRP" value
      ALLGRP = NBUF(4)

      BLKLEN = 4
      SOURCE = 2
      IF(TASKID .EQ. SOURCE)  THEN
         DO 10 I=1,NUMTASK
   10       OUTMSG(I) = I - 1
      ENDIF
c     "OUTMSG" on task 2 is now {0,1,2,3}

      CALL MP_SCATTER(OUTMSG,INMSG,BLKLEN,SOURCE,ALLGRP)

c     "INMSG" on tasks {0,1,2,3} is now {0,1,2,3}, respectively,
c     assuming a partition of 4 tasks

      END
```

RELATED INFORMATION

Subroutines: MP_GATHER(3), mpc_gather(3)

NAME

MP_SEND, mpc_send – Identifies a message to be sent and returns without waiting for the send to complete.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_send(const void *outmsg, size_t msglen, int dest, int type,
             int *msgid);
```

FORTRAN SYNOPSIS

```
MP_SEND(INTEGER OUTMSG(*), INTEGER MSGLEN, INTEGER DEST, INTEGER TYPE,
        INTEGER MSGID)
```

PARAMETERS

outmsg is the application buffer that contains the message to send.

msglen is a non-negative integer that specifies the size, in bytes, of the message to be sent.

dest is an integer that specifies the task to which the message is to be sent.

type is an integer that specifies the type of the message to be sent.

msgid is an integer returned as a message identifier that can be used to test the status of the message.

DESCRIPTION

This subroutine identifies a message to be sent and returns without waiting for the send operation to complete. Do not modify the application buffer, **outmsg**, until subsequent calls to MP_STATUS or MP_WAIT indicate completion of MP_SEND.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg is not a valid buffer

msglen is less than zero

dest is not a valid task id

type is not a valid message type

EXAMPLES

A message is sent from task 0 to task 1 using MP_SEND. Task 0 then calls MP_WAIT before modifying the data in the send buffer.

C Example

```
   #include <mpproto.h>

int send_example()
{
   int source,dest,type,msglen,msgid,nbytes,rc;
   int numtask,taskid,inmsg[2],outmsg[2];

   mpc_environ(&numtask,&taskid);

   type = 1;
   source = 0;
   dest = 1;
   msglen = sizeof(outmsg);

   if(taskid == source)  {
      outmsg[0] = 150;
      outmsg[1] = 250;
      rc = mpc_send(outmsg,msglen,dest,type,&msgid);
      if(rc)  return(-1);  /* error */

      /* Data in "outmsg" must not be modified until "mpc_wait"
      is called; meanwhile, other work can continue.  */

      rc = mpc_wait(&msgid,&nbytes);
      if(rc)  return(-1);  /* error */
      /* "outmsg" is now available for reuse */
   } else {
      if(taskid == dest) {
         rc = mpc_brecv(inmsg,msglen,&source,&type,&nbytes);
         if(rc)  return(-1);  /* error */

         /*  Task 1 now has "inmsg" = {150,250}  */
      }
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE SEND_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,MSGLEN,MSGID,NBYTES
      INTEGER NUMTASK,TASKID,INMSG(2),OUTMSG(2)

      CALL MP_ENVIRON(NUMTASK,TASKID)

      TYPE = 1
      SOURCE = 0
      DEST = 1
      MSGLEN = 8

      IF(TASKID .EQ. SOURCE)  THEN
         OUTMSG(1) = 150
         OUTMSG(2) = 250

         CALL MP_SEND(OUTMSG,MSGLEN,DEST,TYPE,MSGID)

c        Data in "OUTMSG" must not be modified until "MP_WAIT" is
c        called; meanwhile, other work can continue.

         CALL MP_WAIT(MSGID,NBYTES)
c        "OUTMSG" is now available for reuse
      ELSE
         IF(TASKID .EQ. DEST)  THEN
            CALL MP_BRECV(INMSG,MSGLEN,SOURCE,TYPE,NBYTES)

c           Task 1 now has "INMSG" = {150,250}

         ENDIF
      ENDIF
      END
```

RELATED INFORMATION

Subroutines: MP_RECV(3), mpc_recv(3), MP_BSEND(3), mpc_bsend(3), MP_WAIT(3), mpc_wait(3), MP_STATUS(3), mpc_status(3)

NAME

MP_SHIFT, mpc_shift – Performs linear or circular data shifts across a group.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_shift(const void *outmsg, void *inmsg, size_t msglen, int step,
              int flag, int gid);
```

FORTRAN SYNOPSIS

```
MP_SHIFT(INTEGER OUTMSG(*), INTEGER INMSG(*), INTEGER MSGLEN, INTEGER STEP,
         INTEGER FLAG, INTEGER GID)
```

PARAMETERS

outmsg	is the application buffer that contains the outgoing message.
inmsg	is the application buffer into which the incoming message is received.
msglen	is a non-negative integer that specifies the size, in bytes, of **outmsg** and **inmsg**.
step	is a positive or negative integer that specifies the number of steps of the up/down shift. Up and down refer to increasing or decreasing rank in the group.
flag	is an integer that specifies the type of shift. A value 0 indicates a rotation (circular shift) and all other integer values indicate a non-circular shift.
gid	is a group identifier for the group of participating tasks.

DESCRIPTION

This routine shifts or rotates any specified number of steps along the group in the “up” or “down” directions. The possible values of **flag** are:

- 0 indicates a rotation or circular shift
- All other values indicate a non-circular shift.

Circular shift means that the sequence of tasks “wrap-around”. In other words, that following the highest ranked task is task 0 again. Therefore, for circular shift and a step of -1, the outgoing message from task 0 will go to the highest ranked task. For non-circular shift and a step of -1, the outgoing message from task 0 will not go to any other task. When **step** exceeds 0, **outmsg** at each task in the group shifts or rotates up (along the increasing rank direction) **step** steps into **inmsg**. (In the case of non-circular shift, the **inmsg** of some lower-ranked tasks is not over-

written.) When **step** is less than 0, **outmsg** at each task in the group shifts or rotates down **-step** steps into **inmsg**. (In the case of non-circular shift, the **inmsg** of some higher-ranked tasks will not be over-written.) When **step**=*0*, **outmsg** is copied into **inmsg** locally in all tasks in the group.

It is assumed that **step** is in the range of *-n* through *n* where "n" is the number of tasks in **gid**. When **flag** is 0, both **step**=*n* and **step**=*-n* indicate local copying. When **flag** is nonzero, both **step**=*n* and **step**=*-n* do nothing, as the **outmsg** in all tasks in the group have been shifted out of the group range.

For a non-circular shift (when **flag** does not equal 0), the data in **inmsg** in a task which does not need to receive will remain unchanged (as when it was passed from users to MP_SHIFT).

outmsg and **inmsg** cannot overlap in memory.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, "nnn," can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

outmsg *or* **inmsg**	is not a valid buffer
msglen	is less than zero
step	is less than -n or greater than n, where n is the of tasks in **gid**
gid	is undefined in the calling task

Develop mode error if:

- all tasks in **gid** do not use identical values for **step**, **flag**, and **msglen**

EXAMPLES

Each task in a partition of four sends a message to the next-highest task using a wrap-around or "ring" topology.

C Example

```
   #include <mpproto.h>

int shift_example()
{
   int numtask,taskid,msglen,step,flag,rc;
   int inmsg,outmsg;


   mpc_environ(&numtask,&taskid);

   msglen = sizeof(int);
   step = 1;
   flag = 0;             /* specify circular shift */
   outmsg = taskid;
   /* "outmsg" on tasks {0,1,2,3} is now {0,1,2,3}, respectively  */

   rc = mpc_shift(&outmsg,&inmsg,msglen,step,flag,ALLGRP);
   if(rc)  return(-1);  /* error */

   /* "inmsg" on tasks {0,1,2,3} is now {3,0,1,2}, respectively,
   assuming a partition of 4 tasks  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE SHIFT_EXAMPLE

      INTEGER NUMTASK,TASKID,BLKLEN,ALLGRP,STEP,FLAG, MSGLEN
      INTEGER INMSG,OUTMSG,NBUF(4)

      CALL MP_ENVIRON(NUMTASK,TASKID)
      CALL MP_TASK_QUERY(NBUF,4,3)       !  get "ALLGRP" value
      ALLGRP = NBUF(4)

      MSGLEN = 4
      STEP = 1
c     specify circular shift
      FLAG = 0
      OUTMSG = TASKID
c     "OUTMSG" on tasks {0,1,2,3} is now {0,1,2,3}, respectively

      CALL MP_SHIFT(OUTMSG,INMSG,MSGLEN,STEP,FLAG,ALLGRP)

c     "INMSG" on tasks {0,1,2,3} is now {3,0,1,2}, respectively,
c     assuming a partition of 4 tasks

      END
```

NAME

MP_STATUS, mpc_status – Returns status of a non-blocking send or receive.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_status(int msgid);
```

FORTRAN SYNOPSIS

```
MP_STATUS(INTEGER MSGID)
```

PARAMETERS

msgid is a message identifier returned by a previous call to a non-blocking send or receive subroutine.

DESCRIPTION

This routine provides a non-blocking check of the status of a specified non-blocking send or receive operation. A non-blocking send or receive operation does not wait for the message to be sent or received but continues processing.

MP_STATUS is a function and not a subroutine. This means that it returns the value of a single variable.

When this routine returns a non-negative number, this means that the non-blocking send or receive operation specified by the message identifier has completed. You can apply this routine to any active non-blocking send or receive operation. The message identifier **msgid** cannot be set to the wildcards **allmsg** or **dontcare**.

If you apply MP_STATUS to an inactive **msgid**, no error will result. However, the return value will indicate that the message id is not currently active.

NOTES

In FORTRAN, MP_STATUS is the only routine which is a function rather than a subroutine.

In C, a positive return value from mpc_status does represent a message size but it is unsafe to assign mpc_status to a size_t variable. This is because the return value must be tested for <0.

RETURN VALUES

MP_STATUS returns a value of -1 prior to completion of the non-blocking send or receive subroutine specified by **msgid**. Upon completion, it returns the number of bytes (after truncation, if the truncation mode is enabled) either sent or received by the operation associated with **msgid**. A return value of 0 means a completed send or receive of a 0-byte message.

MP_STATUS returns a value of -2 if **msgid** is currently inactive.

ERRORS

msgid is less than zero

EXAMPLES

A message is sent from task 0 to task 1. Task 1 receives the message using a non-blocking receive operation, and then enters a loop which uses MP_STATUS to determine when the message has arrived.

C Example

```
   #include <mpproto.h>

int status_example()
{
   int source,dest,type,msglen,msgid,mstat,rc;
   int numtask,taskid,inmsg,outmsg;

   mpc_environ(&numtask,&taskid);

   type = 1;
   source = 0;
   dest = 1;
   msglen = sizeof(int);

   if(taskid == source)  {
      outmsg = 5;
      rc = mpc_bsend(&outmsg,msglen,dest,type);
      if(rc)  return(-1);  /* error */
   } else {
      if(taskid == dest) {
         rc = mpc_recv(&inmsg,msglen,&source,&type,&msgid);
         if(rc)  return(-1);  /* error */

         for( ; ; )  {
            mstat = mpc_status(msgid);
            if(mstat < 0)  {
               if(mstat == -1)  {
                  /*  The message has not been received; until it is,
                      other work can continue.  */
               } else {
                  break;
                  /*  Invalid or inactive "msgid"  */
               }
            } else {
               break;
```

```
               /*  The message has been received in "inmsg" */
            }
         }
      }
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE STATUS_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,MSGLEN,MSGID,MSTAT
      INTEGER NUMTASK,TASKID,INMSG,OUTMSG

      CALL MP_ENVIRON(NUMTASK,TASKID)

      TYPE = 1
      SOURCE = 0
      DEST = 1
      MSGLEN = 4

      IF(TASKID .EQ. SOURCE)  THEN
         OUTMSG = 5
         CALL MP_BSEND(OUTMSG,MSGLEN,DEST,TYPE)
      ELSE
         IF(TASKID .EQ. DEST) THEN
            CALL MP_RECV(INMSG,MSGLEN,SOURCE,TYPE,MSGID)

            MSTAT = -1
            DO 10 WHILE (MSTAT .EQ. -1)
c              Until the message is received, other work can continue

               MSTAT = MP_STATUS(MSGID)
   10       END DO
            IF(MSTAT .GE. 0) THEN
c              The message has been received in "INMSG"
            ENDIF
         ENDIF
      ENDIF
      END
```

RELATED INFORMATION

Subroutines: MP_SEND(3), mpc_send(3), MP_RECV(3), mpc_recv(3)

NAME

MP_STOPALL, mpc_stopall – Forces an abnormal termination.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_stopall(int errcode);
```

FORTRAN SYNOPSIS

```
MP_STOPALL(INTEGER ERRCODE)
```

PARAMETERS

errcode is an integer, specified by the application, that is returned to standard error.

DESCRIPTION

When called from any task in the partition, this subroutine terminates all tasks, cancels the parallel job, and returns an abnormal termination condition along with **errcode**. Use this only for abnormal termination since other tasks are stopped regardless of whether or not they have finished. This is, however, a “protected” stop in the sense that buffers are flushed, files are closed, and so on, before each task is terminated.

A standard FORTRAN STOP anywhere or an END statement in the main program only terminates the individual calling task, not the whole job. Normal job termination occurs when every job processes a STOP or END statement.

errcode is a user-supplied integer that can be used in the same way as by programming ‘STOP *digit_string*’. It is intended as a descriptor which can help to identify which call of MP_STOPALL was invoked by the program. See Appendix F, “Exit Status of User Application” on page 139 for more information on the values of the exit status for MP_STOPALL.

If this routine is called in multiple tasks, each executed MP_STOPALL will be reported. However, when multiple tasks are each on the way toward an MP_STOPALL, some tasks may be stopped from outside before getting a chance to call MP_STOPALL.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

EXAMPLES

MP_STOPALL is used to halt a parallel job after an error is detected.

C Example

```
   #include <mpproto.h>

int stopall_example(int code)
{
   /*  If any task detects an error, it can stop all of
       the tasks in the partition with "mpc_stopall".  */

   if(code < 0)
      mpc_stopall(code);
}
```

FORTRAN Example

In the example, MP_STOPALL is used to stop the job if any task encounters an error reading an input file.

```
      SUBROUTINE STOPALL_EXAMPLE(CODE)

      INTEGER CODE

c     If any task detects an error, it can stop all of
c     the tasks in the partition with "MP_STOPALL".

      IF(CODE .LT. 0) THEN
         CALL MP_STOPALL(CODE)
      ENDIF

      END
```

NAME

MP_SYNC, mpc_sync – Synchronizes tasks at a barrier.

LIBRARY

- C Library (libccl.a)
- FORTRAN Library (libccl.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_sync(int gid);
```

FORTRAN SYNOPSIS

```
MP_SYNC(INTEGER GID)
```

PARAMETERS

gid is a group identifier for the group of participating tasks.

DESCRIPTION

Implements barrier synchronization among a group of tasks. This means that all tasks within a group must reach a corresponding MP_SYNC before proceeding.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

gid is undefined in the calling task

EXAMPLES

The tasks in a partition are synchronized by calling MP_SYNC.

C Example

```
   #include <mpproto.h>

int sync_example()
{
   int rc;


   /* The tasks in the partition may be executing at different
   points in the application code  */

   rc = mpc_sync(ALLGRP);
   if(rc)  return(-1);  /* error */

   /* The tasks in the partition have now been synchronized  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE SYNC_EXAMPLE

      INTEGER ALLGRP,NBUF(4)

      CALL MP_TASK_QUERY(NBUF,4,3)    !  get "ALLGRP" value
      ALLGRP = NBUF(4)

c     The tasks in the partition may be executing at different
c     points in the application code

      CALL MP_SYNC(ALLGRP)

c     The tasks in the partition have now been synchronized

      END
```

NAME

MP_TASK_QUERY, mpc_task_query – Returns information about system variables and constants.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_task_query(int nbuf[], int nelem, int qtype);
```

FORTRAN SYNOPSIS

```
MP_TASK_QUERY(INTEGER NBUF(*), INTEGER NELEM, INTEGER QTYPE)
```

PARAMETERS

nbuf is the integer array into which the returned information is received.

nelem is a non-negative integer that specifies the number of array elements to be filled in **nbuf**.

qtype is an integer that specifies the type of query. See Table 1 for further information.

DESCRIPTION

This routine returns information about system variables and constants. The information returned depends on **qtype**, which is set by the application. The **nelem** argument, also set by the application, gives the length (in number of elements) of the **nbuf** integer array where the returned information is received. The information returned is truncated if the **nelem** specified is less than the information usually returned for the given **qtype**.

The information returned for the given **qtype**s is described in the following table.

Table 1 (Page 1 of 2). Description of Qtypes.

qtype	Information Returned
qtype=1	Returns a flag which specifies whether messages are truncated when the length of the buffer identified for an incoming message is smaller than the incoming message. For FORTRAN, with **nelem** = 1, MP_TASK_QUERY returns the following: • **nbuf**(1)= 0 = messages are not truncated and overflows are treated as errors (default), or • **nbuf**(1)= 1 = messages are truncated. For C, mp_task_query returns the following: • **nbuf**[0]=0, messages are not truncated and overflows are treated as errors (default), or • **nbuf**[0]=1, messages are truncated.

Table 1 (Page 2 of 2). Description of Qtypes.

qtype	Information Returned
qtype=2	Returns information on message types. For FORTRAN with **nelem** = 2, MP_TASK_QUERY returns the following: • **nbuf**(1) = Lower bound for user message types • **nbuf**(2) = Upper bound for user message types For C, mp_task_query returns the following: • **nbuf**[0] = Lower bound for user message types • **nbuf**[1] = Upper bound for user message types
qtype=3	Returns information on wildcard values and on predefined group identifiers. It returns the **dontcare** value which can be used as **type** or **source** in many of the message passing subroutines to indicate that any type and/or source can satisfy the request. It returns the **allmsg** value which can be used as **msgid** in MP_WAIT to wait until all posted sends and receives are satisfied. It also returns the **nulltask** value which can be used to make part of a MP_BSENDRECV call inoperative. Additionally, it returns the **allgrp** value which can be used as a group identifier in any of the collective communication routines. For FORTRAN with **nelem** = 4, MP_TASK_QUERY returns the following: • **nbuf**(1) = **dontcare** value • **nbuf**(2) = **allmsg** value • **nbuf**(3) = **nulltask** value • **nbuf**(4) = **allgrp** value For C, mp_task_query returns the following: • **nbuf**[0] = **dontcare** value • **nbuf**[1] = **allmsg** value • **nbuf**[2] = **nulltask** value • **nbuf**[3] = **allgrp** value

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

nelem is less than 0

qtype is not 1, 2 or 3

EXAMPLES

MP_TASK_QUERY is used to obtain the values for the system wildcards **dontcare**, **allmsg**, **nulltask**, and **allgrp**.

C Example

```
   #include <mpproto.h>

int task_query_example()
{
   int nbuf[4],nelem,qtype,dontcare,allmsg,nulltask,allgrp,rc;

   qtype = 3;
   nelem = 4;

   rc = mpc_task_query(nbuf,nelem,qtype);    /*  Get wildcard values  */
   if(rc)  return(-1);  /* error */

   dontcare = nbuf[0];
   allmsg   = nbuf[1];
   nulltask = nbuf[2];
   allgrp   = nbuf[3];

   /* The wildcard values are now available for use  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE TASK_QUERY_EXAMPLE

      INTEGER NBUF(4),NELEM,QTYPE,DONTCARE,ALLMSG,NULLTASK,ALLGRP

      QTYPE = 3
      NELEM = 4

      CALL MP_TASK_QUERY(NBUF,NELEM,QTYPE)    !  get wildcard values

      DONTCARE = NBUF(1)
      ALLMSG   = NBUF(2)
      NULLTASK = NBUF(3)
      ALLGRP   = NBUF(4)

c     The wildcard values are now available for use

      END
```

NAME

MP_TASK_SET, mpc_task_set – Sets system parameters.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_task_set(const int nbuf[], int stype);
```

FORTRAN SYNOPSIS

```
MP_TASK_SET(INTEGER NBUF(*), INTEGER STYPE)
```

PARAMETERS

nbuf is the integer array that contains the parameters to be set in the calling task. Currently only the first value in the array is used.

stype is an integer that specifies which parameters are being set. See Table 2 on page 90 for further information.

DESCRIPTION

This routine lets you set system-dependent parameters for the task. **stype** specifies which parameters to set and **nbuf** contains the values to set. You may not need to use this routine because the default values for environment settings should satisfy most of your programming requirements.

The application should call this routine at the beginning of the job, before any communication routines are invoked. However, the system does not restrict when and how often this routine can be called. When called, it usually applies only to commands not yet started. However, if non-blocking communications are in progress the results will be unpredictable if you invoke this command. To be sure of predictable, repeatable behavior, this routine should be called very infrequently and only when it applies to non-active communications.

Whether the values set in **nbuf** need to be the same in every task or whether every task needs to invoke the routine simultaneously depends on what you are setting.

The following table lists the parameters you can set.

Table 2. Description of Stype.

stype	Description
1	Specifies whether messages will be truncated when the length of the application buffer posted for an incoming message is smaller than the incoming message. For FORTRAN, MP_TASK_SET interprets **nbuf** as follows: • **nbuf**(1)=0, messages will not be truncated (default). • **nbuf**(1)=1, messages will be truncated. For C, mpc_task_set interprets **nbuf** as follows: • **nbuf**[0]=0, messages will not be truncated (default). • **nbuf**[0]=1, messages will be truncated. All tasks do not have to call this or supply the same value.
2	Sets develop and run modes. In ***run*** mode, minimal checking is done without necessarily affecting performance. In ***develop*** mode, more detailed checking is done although all detectable user errors may not be detected. For FORTRAN, MP_TASK_SET interprets **nbuf** as follows: • **nbuf**(1) = 0 - Set ***run*** mode (default). • **nbuf**(1) = 1 - Set ***develop*** mode. For C, mpc_task_set interprets **nbuf** as follows: • **nbuf**[0] = 0 - Set ***run*** mode (default) • **nbuf**[0] = 1 - Set ***develop*** mode. If any task sets this mode, then all tasks must set it to the same value.
3	Specifies whether blocking sends will be buffered. If buffer space is available, messages will be copied into system buffers and control will return to the user. Otherwise, sends will block. For FORTRAN, MP_TASK_SET interprets **nbuf** as follows: • **nbuf**(1) = nbytes -If possible, ***nbytes*** of system buffers will be allocated. • **nbuf**(2) = nmsgs -Up to ***nmsgs*** blocking sends can be buffered at the same time. For C, mpc_task_set intreprets **nbuf** as follows: • **nbuf**[0] = nbytes -If possible, ***nbytes*** of system buffers will be allocated. • **nbuf**[1] = nmsgs -Up to ***nmsgs*** blocking sends can be buffered at the same time. These parameters can only be set once per task. All tasks do not have to call this or supply the same values.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

stype is 1 and the mode is not 0 or 1

stype is 2 and the mode is not 0 or 1

stype is 3 and buffering is already turned on

stype is 3 and the buffer size requested is less than zero

stype is 3 and the number of sends to buffer is less than zero

stype is not 1, 2, or 3

Undetectable error for **stype**= 2 if all the tasks do not call MP_TASK_SET (and with the same value for the mode) if any call it.

EXAMPLES

The examples cause truncation mode to be set.

C Example

```
   #include <mpproto.h>

int task_set_example()
{
   int nbuf,stype,rc;

   stype = 1;
   nbuf  = 1;

   rc = mpc_task_set(&nbuf,stype);
   if(rc)  return(-1);  /* error */

   /* Truncation mode is now in effect */

   mpc_task_query(&nbuf,1,1);

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE TASK_SET_EXAMPLE

      INTEGER NBUF,STYPE

      STYPE = 1
      NBUF  = 1

      CALL MP_TASK_SET(NBUF,STYPE)

c     Truncation mode is now in effect

      CALL MP_TASK_QUERY(NBUF,1,1)

      END
```

RELATED INFORMATION

Subroutines: MP_TASK_QUERY(3), mpc_task_query(3)

NAME

MP_UNPACK, mpc_unpack – Unpacks data from a contiguous buffer into a non-contiguous buffer.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_unpack(const void *begbuf, void *endbuf, size_t blklen, size_t offset,
               int blknum);
```

FORTRAN SYNOPSIS

```
MP_UNPACK(INTEGER BEGBUF(*), INTEGER ENDBUF(*), INTEGER BLKLEN,
          INTEGER OFFSET, INTEGER BLKNUM)
```

PARAMETERS

begbuf is the buffer that contains the data to be unpacked.

endbuf is the starting location of the buffer into which the unpacked data is to be placed. **endbuf** consists of **blknum** blocks, with each block consisting of **blklen** contiguous bytes. The starting addresses of consecutive blocks are separated by **offset** bytes.

blklen is an integer specifying the size, in bytes, of each block contained in buffer **endbuf**.

offset is an integer specifying the separation, in bytes, between the starting addresses of consecutive blocks.

blknum is an integer specifying the number of blocks contained in the buffer **endbuf**.

DESCRIPTION

Unpacks data from a contiguous buffer into a non-contiguous buffer. For programming convenience, all arguments are presented in the same order as **mpc_pack**. For MP_UNPACK, arguments **blklen**, **offset**, and **blknum** are associated with the result buffer **endbuf**.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

begbuf is not a valid buffer

endbuf is not a valid buffer

blklen is less than zero

offset is less than **blklen**

blknum is less than zero

EXAMPLES

Data in **begbuf** is unpacked into **endbuf**. Data values listed as "x" are not modified.

C Example

```
   #include <mpproto.h>

int unpack_example()
{
   int blklen,offset,blknum,i,rc;
   int begbuf[9],endbuf[15];

   for(i=0;i<9;i++)
      begbuf[i] = i;
   /* "begbuf" = {0,1,2,3,4,5,6,7,8} */

   blklen = 3 * sizeof(int);
   offset = 5 * sizeof(int);
   blknum = 3;
   rc = mpc_unpack(begbuf,endbuf,blklen,offset,blknum);
   if(rc)  return(-1);  /* error */

   /* "endbuf" = {0,1,2,x,x,3,4,5,x,x,6,7,8,x,x}  */

   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE UNPACK_EXAMPLE

      INTEGER BLKLEN,OFFSET,BLKNUM,I
      INTEGER BEGBUF(9),ENDBUF(15)

      DO 10 I=1,9
   10    BEGBUF(I) = I-1
c     "BEGBUF" = {0,1,2,3,4,5,6,7,8}

      BLKLEN = 3 * 4
      OFFSET = 5 * 4
      BLKNUM = 3

      CALL MP_UNPACK(BEGBUF,ENDBUF,BLKLEN,OFFSET,BLKNUM)

c     "ENDBUF" = {0,1,2,x,x,3,4,5,x,x,6,7,8,x,x}

      END
```

RELATED INFORMATION

Subroutines: MP_PACK(3), mpc_pack(3), MP_BVRECV(3), mpc_BVRECV(3)

NAME

MP_WAIT, mpc_wait – Waits until a non-blocking send or receive has completed.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mpproto.h>
int mpc_wait(int *msgid, size_t *nbytes);
```

FORTRAN SYNOPSIS

```
MP_WAIT(INTEGER MSGID, INTEGER NBYTES)
```

PARAMETERS

msgid	is a message identifier returned by a previous call to a non-blocking send or receive function or system-specific flags **allmsg** or **dontcare**.
nbytes	is the number of bytes sent or received.

DESCRIPTION

Waits (blocks) until a specified non-blocking send or receive operation has completed. A non-blocking operation is one that does not wait until the operation completes but instead, continues processing. This routine can be applied to any active non-blocking send or receive operation.

If **msgid**=**dontcare**, the system waits until the next send or receive operation completes. If **msgid**=**allmsg**, the system waits until all pending send and receive operations complete.

For **msgid**=**dontcare** and **msgid**=**allmsg**, **msgid** returns the identifier of the last message that was sent or received and **nbytes** returns the number of bytes sent or received .

To find out the value of **allmsg**, use MP_TASK_QUERY.

RETURN VALUES

In C, return code = 0 means the operation was successful. Return code = -1 means that an error occurred and the global variable **mperrno** contains the error number. This number, “nnn,” can be used to find a description of the error condition by looking for **0032-nnn** in the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

ERRORS

msgid. is less than zero and is not a valid wildcard value

EXAMPLES

A message is sent from task 0 to task 1 using non-blocking operations. MP_WAIT is then called by task 0 before the data in the send buffer is modified, and by task 1 before the data in the receive buffer is used.

C Example

```
   #include <mpproto.h>

int wait_example()
{
   int source,dest,type,msglen,msgid,nbytes,rc;
   int numtask,taskid,inmsg,outmsg;

   mpc_environ(&numtask,&taskid);

   type = 1;
   source = 0;
   dest = 1;
   msglen = sizeof(int);

   if(taskid == source)  {
      outmsg = 700;
      rc = mpc_send(&outmsg,msglen,dest,type,&msgid);
      if(rc)  return(-1);  /* error */

      /* Data in "outmsg" must not be modified until "mpc_wait"
      is executed; meanwhile, other work can continue.  */

      rc = mpc_wait(&msgid,&nbytes);
      if(rc)  return(-1);  /* error */

      /*  "outmsg" is now available for reuse.
          "nbytes" returns the actual number of bytes sent. */
   } else {
      if(taskid == dest) {
         rc = mpc_recv(&inmsg,msglen,&source,&type,&msgid);
         if(rc)  return(-1);  /* error */

         /* Incoming data is not available in "inmsg" until "mpc_wait"
         is executed; meanwhile, other work can continue.  */

         rc = mpc_wait(&msgid,&nbytes);
         if(rc)  return(-1);  /* error */

         /*  "inmsg" is now equal to 700.
             "nbytes returns the number of bytes received */
      }
   }
   return(0);
}
```

FORTRAN Example

```
      SUBROUTINE WAIT_EXAMPLE

      INTEGER SOURCE,DEST,TYPE,MSGLEN,MSGID,NBYTES
      INTEGER NUMTASK,TASKID,INMSG,OUTMSG

      CALL MP_ENVIRON(NUMTASK,TASKID)

      TYPE = 1
      SOURCE = 0
      DEST = 1
      MSGLEN = 4

      IF(TASKID .EQ. SOURCE)  THEN
         OUTMSG = 700
         CALL MP_SEND(OUTMSG,MSGLEN,DEST,TYPE,MSGID)

c        Data in "OUTMSG" must not be modified until "MP_WAIT"
c        is executed; meanwhile, other work can continue.

         CALL MP_WAIT(MSGID,NBYTES)

c        "OUTMSG" is now available for reuse.
c        "NBYTES" returns the actual number of bytes sent.

      ELSE
         IF(TASKID .EQ. DEST)  THEN
            CALL MP_RECV(INMSG,MSGLEN,SOURCE,TYPE,MSGID)

c           Incoming data is not available in "INMSG" until "MP_WAIT"
c           is executed; meanwhile, other work can continue.

            CALL MP_WAIT(MSGID,NBYTES)

c           "INMSG" is now equal to 700.
c           "NBYTES returns number of bytes received.

         ENDIF
      ENDIF

      END
```

RELATED INFORMATION

Subroutines: MP_SEND(3), mpc_send(3), MP_RECV(3), mpc_recv(3), MP_STATUS(3), mpc_status(3)

Appendix A. Subroutine Argument Quick Reference

Use this appendix to quickly find out in what order you need to enter the arguments of a subroutine. For detailed information about a subroutine, refer to Chapter 1, "Subroutines Listed Alphabetically" on page 1. Refer to the following table for information:

FORTRAN/C Subroutine	Argument order
MP_BCAST mpc_bcast	msg, msglen, source, gid
MP_BRECV mpc_brecv	inmsg, msglen, source, type, nbytes
MP_BSEND mpc_bsend	outmsg, msglen, dest, type
MP_BSENDRECV mpc_bsendrecv	outmsg, outmsglen, dest, type, inmsg, inmsglen, source, nbytes
MP_BVRECV mpc_bvrecv	inmsg, blklen, offset, blknum, source, type, nbytes
MP_BVSEND mpc_bvsend	outmsg, blklen, offset, blknum, dest, type
MP_COMBINE mpc_combine	outmsg, inmsg, msglen, func, gid
MP_CONCAT mpc_concat	outmsg, inmsg, blklen, gid
MP_ENVIRON mpc_environ	numtask, taskid
MP_GATHER mpc_gather	outmsg, inmsg, blklen, dest, gid
MP_GETLABEL mpc_getlabel	label, gid
MP_GETMEMBERS mpc_getmembers	glist, gid
MP_GETRANK mpc_getrank	rank, taskid, gid
MP_GETSIZE mpc_getsize	gsize, gid
MP_GETTASKID mpc_gettaskid	rank, taskid, gid
MP_GROUP mpc_group	gsize, glist, label, gid

FORTRAN/C Subroutine	Argument order
MP_INDEX mpc_index	outmsg, inmsg, blklen, gid
MP_PACK mpc_pack	begbuf, endbuf, blklen, offset, blknum
MP_PARTITION mpc_partition	parent_gid, key, label, gid
MP_PREFIX mpc_prefix	outmsg, inmsg, msglen, func, gid
MP_PROBE mpc_probe	source, type, mstat
MP_RECV mpc_recv	inmsg, msglen, source, type, msgid
MP_REDUCE mpc_reduce	outmsg, inmsg, msglen, dest, func, gid
MP_SCATTER mpc_scatter	outmsg, inmsg, blklen, source, gid
MP_SEND mpc_send	outmsg, msglen, dest, type, msgid
MP_SHIFT mpc_shift	outmsg, inmsg, msglen, step, flag, gid
MP_STATUS mpc_status	msgid
MP_STOPALL mpc_stopall	errcode
MP_SYNC mpc_sync	gid
MP_TASK_QUERY mpc_task_query	nbuf, nelem, qtype
MP_TASK_SET mpc_task_set	nbuf, stype
MP_UNPACK mpc_unpack	begbuf, endbuf, blklen, offset, blknum
MP_WAIT mpc_wait	msgid, nbytes

Appendix B. Subroutine Argument Definitions

The following table lists all of the arguments (parameters) that the subroutines listed in Chapter 1 use along with their definitions. The definitions listed here are general definitions. For more detailed explanations of these arguments and their relation to the subroutines, refer to Chapter 1.

Argument	Description
begbuf	The starting location of the buffer that contains the initial non-contiguous data. **begbuf** consists of **blknum** blocks with each block consisting of **blklen** contiguous bytes.
blklen	A non-negative integer that specifies the size, in bytes, of each block contained in buffer **inmsg**.
blknum	An integer that specifies the number of blocks to be sent.
dest	An integer that specifies the task to which the message is to be sent.
endbuf	The buffer into which the packed data is to be placed.
errcode	An integer that is returned to standard error.
flag	An integer that specifies the type of shift. A value of 0 indicates a circular shift and all other integer values indicate a non-circular shift.
func	An external function which implements a reduction operation.
gid	A group identifier for the group of participating tasks.
glist	An integer array into which the ordered membership list of the task group is placed. **glist** must be large enough to hold the number of tasks in the group.
gsize	An integer into which the number of tasks in the specified task group is placed.
inmsg	The application buffer into which the message is to be received.
inmsglen	A non-negative integer that specifies the size, in bytes, of the buffer **inmsg**.
key	An integer value used to specify the initial rank of the local task in the new group.
label	An integer into which the label of the specified task group is placed
msg	For **task id = source**, **msg** is the application buffer that contains the message to send. For all other tasks in the same group, **msg** is the application buffer into which the incoming message is received.
msgid	An integer returned as a message identifier that can be used to test the status of the message.
msglen	A non-negative integer that specifies the size, in bytes, of the message to send.
mstat	An integer which returns status of the targeted message. When it is non-negative, it is the number of bytes.
nbuf	The integer array into which the returned information is received.
nbytes	An integer which returns the number of bytes received.
nelem	A non-negative integer that specifies the number of array elements to be filled in **nbuf**.
numtask	An integer which returns the number of tasks in the parallel partition.
offset	An integer that specifies the separation, in bytes, between the starting addresses of consecutive blocks.
outmsg	The application buffer that contains the message to be sent.
outmsglen	A non-negative integer that specifies the size, in bytes, of the message to be sent.
parent_gid	A previously defined group to partition.

Argument	Description
qtype	An integer that specifies the type of query.
rank	An integer into which the rank of the task in the task group is placed. The rank of a task is its position in relation to the other tasks in the group.
source	An integer that specifies the task that originates the send.
step	An integer that specifies the number of steps of the up or down shift. Up and down refer to increasing or decreasing rank in the group.
stype	An integer that specifies which parameters are being set.
taskid	An integer which specifies a task id. Each task is assigned a unique integer between 0 and **numtask** - 1, inclusive.
type	An integer that specifies the type of the message being received.

Appendix C. Reduction Operations

Reduction Operation	Description
i_vadd	Integer vector addition
s_vadd	Single-precision floating-point vector addition
d_vadd	Double-precision floating-point vector addition
i_vmul	Integer vector multiplication
s_vmul	Single-precision floating-point vector multiplication
d_vmul	Double-precision floating-point vector multiplication
i_vmax	Integer vector maximum
s_vmax	Single-precision floating-point vector maximum
d_vmax	Double-precision floating-point vector maximum
i_vmin	Integer vector minimum
s_vmin	Single-precision floating-point vector minimum
d_vmin	Double-precision floating-point vector minimum
b_vand	Bitwise vector AND
b_vor	Bitwise vector OR
b_vxor	Bitwise vector XOR
l_vand	Logical (Boolean) vector AND
l_vor	Logical (Boolean) vector OR

Examples of user-defined reduction functions for integer vector addition.

C Example

```
/* Integer Vector Addition */
void i_vadd (in1, in2, out, len)
int in1[], in2[], out[]
int *len   /* Note that "len" is a pointer */
{
   int i,n;
   n = *len/sizeof(int); /* compute number of elements */
   for (i=0; i<n; i++)
      out[i] = in1[i] + in2[i] /* Do reduction */
}
```

FORTRAN Example

```
      SUBROUTINE I_VADD(IN1,IN2,OUT,LEN)

      INTEGER IN1(*),IN2(*),OUT(*),LEN,I,N

      N = LEN/4
      DO 10 I=1,N
10      OUT(I) = IN1(I) + IN2(I)
      END
```

User-supplied reduction operations have four arguments:

- The first argument, **in1**, is an array or scalar variable. The length, in bytes, is specified by the fourth argument, **len**.

  This argument is an input array to be reduced.

- The second argument, **in2**, is an array or scalar variable. The length, in bytes, is specified by the fourth argument, **len**.

  This argument is an input array to be reduced.

- The third argument, **out**, is an array or scalar variable. The length, in bytes, is specified by the fourth argument, **len**.

  This argument is the output array for the reduced result. It is assumed that the output array is disjoint from the two input arrays.

- The fourth argument is **len**, a pointer to an integer containing the number of bytes to be reduced.

Users may code their own reduction operations, with the restriction that the operations must be both commutative and associative. Also note that the value of **len** will be passed as a pointer. No communication calls are allowed in user-defined reduction operations.

Appendix D. Parallel Utility Functions

This chapter contains the man pages for the Parallel Utility Functions. These user-callable functions exploit features of the Parallel Operating Environment (POE). Included are functions for:

- updating the Program Marker Array lights
- controlling distribution of STDIN and STDOUT
- synchronizing parallel tasks without using the MPL.

There is a C and FORTRAN version for each of the functions.

The Parallel Utility Functions are:

MP_FLUSH and mpc_flush flushes output buffers to STDOUT. This is a synchronizing call across all parallel tasks.

MP_MARKER and mpc_marker requests that the numeric and text data passed in the call be forwarded to the Program Marker Array for display.

MP_NLIGHTS and mpc_nlights returns the number of Program Marker Array lights defined for this session.

MP_STDOUT_MODE and mpc_stdout_mode requests that STDOUT be set to single, ordered, or unordered mode. In single mode, only one task output is displayed. In unordered mode, output is displayed in the order received at the home node. In ordered mode, each parallel task writes output data to its own buffer; when a flush request is made all the task buffers are flushed, in order of the task id, to home node's STDOUT.

MP_STDOUTMODE_QUERY and mpc_outmode_query returns the mode to which STDOUT is currently set.

For more information on the Program Marker Array, or on controlling STDIN and STDOUT using POE, refer to *IBM AIX Parallel Environment: Operation and Use*.

NAME

MP_FLUSH, mpc_flush – Flushes task output buffers to STDOUT.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <pm_util.h>
int mpc_flush(int option);
```

FORTRAN SYNOPSIS

```
MP_FLUSH(INTEGER OPTION)
```

PARAMETERS

option is an AIX file descriptor. The only valid value is:

1 to flush STDOUT buffers.

DESCRIPTION

This Parallel Utility Function flushes output buffers from all the parallel tasks to STDOUT at the home node. This is a synchronizing call across all parallel tasks.

If the current STDOUT mode is ordered, then when all tasks have issued this call or when any of the output buffers are full:

1. all STDOUT buffers are flushed and put out to the user screen (or redirected) in task order.
2. an acknowledgement is sent to all tasks and control is returned to the user.

If current STDOUT mode is unordered and all tasks have issued this call, all output buffers are flushed and put out to the user screen (or redirected).

If the current STDOUT mode is single and all tasks have issued this call, the output buffer for the current single task is flushed and put out to the user screen (or redirected).

NOTES

- This is a synchronizing call regardless of the current STDOUT mode.
- All STDOUT buffers will be flushed at the end of the parallel job.
- If mpc_flush is not used, standard output streams not terminated with a newline character are buffered, even if a subsequent read to standard input is made. This may cause prompt message to appear only after input has been read.

RETURN VALUES

In C and C++ calls, the following applies:

0 indicates successful completion

-1 indicates that an error occurred. A message describing the error will be issued.

EXAMPLES

C Example

The following program uses poe with the **-labelio yes** option and three tasks:

```
    #include <mp_util.h>

main()
{
 mpc_stdout_mode(STDIO_ORDERED);
 printf("These lines will appear in task order\n");
 /*
  * Call mpc_flush here to make sure that one task
  * doesn't change the mode before all tasks have
  * sent the previous printf string to the home node.
  */
 mpc_flush(1);
 mpc_stdout_mode(STDIO_UNORDERED);
 printf("These lines will appear in the order received by the home node\n");
 /*
  * Since synchronization is not used here, one task could actually
  * execute the next statement before one of the other tasks has
  * executed the previous statement, causing one of the unordered
  * lines not to print.
  */
 mpc_stdout_mode(1);
 printf("Only 1 copy of this line will appear from task 1\n");
}
```

Running the above C program produces the following output (task order of lines 4-6 may differ):

```
   0 : These lines will appear in task order.
   1 : These lines will appear in task order.
   2 : These lines will appear in task order.
   1 : These lines will appear in the order
   received by the home node.
   2 : These lines will appear in the order
   received by the home node.
   0 : These lines will appear in the order
   received by the home node.
   1 : Only task 1 will print this line.
```

FORTRAN Example

```
 CALL MP_STDOUT_MODE(-2)
 WRITE(6, *) 'These lines will appear in task order'
 CALL MP_FLUSH(1)
 CALL MP_STDOUT_MODE(-3)
 WRITE(6, *) 'These lines will appear in the order received by the
xhome node'
 CALL MP_STDOUT_MODE(1)
 WRITE(6, *) 'Only 1 copy of this line will appear from task 1'
 END
```

RELATED INFORMATION

Functions: mpc_stdout_mode(3), MP_STDOUT_MODE(3), mpc_stdoutmode_query(3), MP_STDOUTMODE_QUERY(3)

NAME

MP_MARKER, mpc_marker – Passes numeric and text data to the Program Marker Array for display.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mp_marker.h>
void mpc_marker(int light, int color, char *string);
```

FORTRAN SYNOPSIS

```
MP_MARKER(INTEGER LIGHT, INTEGER COLOR,
          CHARACTER STRING)
```

PARAMETERS

light is the light number to be colored. The lights in each task row are numbered, left to right, from 0 to one less than the number of lights. The row on which the light is colored is that of the calling task.

If the value of light is out of range, the parameter is ignored. No light is colored by the subroutine. Setting the light to a negative number allows you to update the string only.

color is the color you want to make the light. Supported values range from 0 to 102. The range 0 to 99 is, roughly, a spectrum starting with black and going through brown, green, blue, purple, red, orange, yellow, and ending with white. 100, 101, and 102 are three shades of gray growing increasingly dark. These are approximations, as the actual colors used are requested from the default X-Windows color map. If the X-Server is not capable of providing the colors in the RGB intensities requested, it colors the light with a close approximation.

If the value of color is out of range, the parameter is ignored. The subroutine does not give the light a new color.

string is the output string to be passed to the PM Array. In C programs the string must be null-terminated. This is not necessary in FORTRAN programs. The string can be any length, although only the first 80 characters can display. A null string can be passed.

DESCRIPTION

This Parallel Utility Function requests that the numeric and text data passed in the call be forwarded to the Program Marker Array for display. This call waits for a specific acknowledgement from the Partition Manager if the number of lights (specified by the **MP_PMLIGHTS** environment variable) is positive. The program returns only after the message has been acknowledged by the Partition Manager. Hence this call will slow down the user's application and approximately synchronize it with the Program Marker Array.

If **MP_PMLIGHTS** is set to *0*, no message is sent.

NOTES

- Creates a Visualization Tool(VT) trace record (marker event).
- Sends message only if PMLIGHTS is greater than 0. Each call waits for an acknowledgement from the home node.
- The Program Marker Array X-Windows display routing is distributed as a sample program.

EXAMPLES

C Example

```
The C statement:
   #include <mp_marker.h>
mpc_marker(2, 0, "Starting task 2");

gives the third light of the calling task the color black and
after the lights on that task's row, prints the string "Starting
task 2".
```

FORTRAN Example

```
The Fortran statements:

 MP_MARKER(2, 0, 'Starting task 2')

 gives the third light of the calling task the color black and
 after the lights on that task's row, prints the string "Starting
 task 2".
```

RELATED INFORMATION

Functions: mpc_nlights(3), MP_NLIGHTS(3)

Commands: pmarray(1)

NAME

MP_NLIGHTS, mpc_nlights – Gets the number of Program Marker Array lights defined for this session.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <mp_marker.h>
int mpc_nlights();
```

FORTRAN SYNOPSIS

```
MP_NLIGHTS(INTEGER NLIGHT)
```

PARAMETERS

In FORTRAN, the number of Program Marker Array lights defined for this session is returned in the variable **NLIGHT.**

DESCRIPTION

This Parallel Utility Function returns the number of Program Marker Array lights defined for this session.

NOTES

The number of Program Marker Array lights may be set using the environment variable **MP_PMLIGHTS** or the command line option **-pmlights**.

RETURN VALUES

In C, the current number of the Program Marker Array lights is the return value.

EXAMPLES

C Example

The following program uses poe with the **-pmlights 3** option and 1 task:

```
   #include <mp_marker.h>

main()
{
 printf("Number of Program Marker Array lights for this session is %d\n",
 mpc_nlights());
}
```

Running the above C program produces the following output:

```
Number of Program Marker Array lights for this session is 3.
```

FORTRAN Example

The following program using poe with the **-pmlights 3** option and 1 task:

```
      INTEGER LIGHTS

      CALL MP_NLIGHTS(LIGHTS)
      WRITE(6, *) 'Number of Program Marker Array lights for this
     xsession is ', LIGHTS
      END
```

Running the above produces the following output:

```
Number of Program Marker Array lights for this session is 3.
```

RELATED INFORMATION

Functions: mpc_marker(3), MP_MARKER(3)

Commands: pmarray(1)

NAME

MP_STDOUT_MODE, mpc_stdout_mode – Requests that STDOUT be set to single, ordered, or unordered mode.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <pm_util.h>
int mpc_stdout_mode(int mode);
```

FORTRAN SYNOPSIS

```
MP_STDOUT_MODE(INTEGER MODE)
```

PARAMETERS

mode is the mode to which STDOUT is to be set. The valid values are:

taskid specifies single mode for STDOUT, where taskid is the task identifier of the new single task. This value must be between 0 and n-1, where n is the total of tasks in the current partition. The taskid requested does not have to be the issuing task.

-2 specifies ordered mode for STDOUT. The macro STDIO_ORDERED is supplied for use in C programs.

-3 specifies unordered mode for STDOUT. The macro STDIO_UNORDERED is supplied for use in C programs.

DESCRIPTION

This Parallel Utility Function requests that STDOUT be set to single, ordered, or unordered mode. In single mode, only one task output is displayed. In unordered mode, output is displayed in the order received at the home node. In ordered mode, each parallel task writes output data to its own buffer. When a flush request is made all the task buffers are flushed, in order of task id, to STDOUT home node.

NOTES

- All current STDOUT buffers will be flushed before the new STDOUT mode is established.
- The initial mode for STDOUT is set by using the environment variable **MP_STDOUTMODE**, or by using the poe command line option **-stdoutmode**, with the latter overriding the former. The default STDOUT mode is unordered.
- This function is implemented with a half second sleep interval to ensure that the mode change request is processed before subsequent writes to STDOUT.

RETURN VALUES

In C and C++ calls, the following applies:

0 indicates successful completion.

-1 indicates that an error occurred. A message describing the error will be issued.

EXAMPLES

C Example

The following program uses poe with the **-labelio yes** option and three tasks:

```
    #include <mp_util.h>

main()
{
 mpc_stdout_mode(STDIO_ORDERED);
 printf("These lines will appear in task order\n");
 /*
  * Call mpc_flush here to make sure that one task
  * doesn't change the mode before all tasks have
  * sent the previous printf string to the home node.
  */
 mpc_flush(1);
 mpc_stdout_mode(STDIO_UNORDERED);
 printf("These lines will appear in the order received by the home node\n");
 /*
  * Since synchronization is not used here, one task could actually
  * execute the next statement before one of the other tasks has
  * executed the previous statement, causing one of the unordered
  * lines not to print.
  */
 mpc_stdout_mode(1);
 printf("Only 1 copy of this line will appear from task 1\n");
}
```

Running the above C program produces the following output (task order of lines 4-6 may differ):

0 : These lines will appear in task order.
1 : These lines will appear in task order.
2 : These lines will appear in task order.
1 : These lines will appear in the order received by the home node.
2 : These lines will appear in the order received by the home node.
0 : These lines will appear in the order received by the home node.
1 : Only task **1** will print this line.

FORTRAN Example

```
      CALL MP_STDOUT_MODE(-2)
      WRITE(6, *) 'These lines will appear in task order'
      CALL MP_FLUSH(1)
      CALL MP_STDOUT_MODE(-3)
      WRITE(6, *) 'These lines will appear in the order received by the
     xhome node'
      CALL MP_STDOUT_MODE(1)
      WRITE(6, *) 'Only 1 copy of this line will appear from task 1'
      END
```

Running the above program produces the following output (task order of lines 4-6 may differ):

0 : These lines will appear in task order.
1 : These lines will appear in task order.
2 : These lines will appear in task order.
1 : These lines will appear in the order received by the home node.
2 : These lines will appear in the order received by the home node.
0 : These lines will appear in the order received by the home node.
1 : Only task **1** will print this line.

RELATED INFORMATION

Functions: mpc_flush(3), MP_FLUSH(3), mpc_stdoutmode_query(3), MP_STDOUTMODE_QUERY(3), mpc_synch(3), MP_SYNCH(3), mpcc(1), mpCC(1), mpxlf(1),

NAME

MP_STDOUTMODE_QUERY, mpc_stdoutmode_query – Query current STDOUT mode setting.

LIBRARY

- C Library (libeui1c.a)
- FORTRAN Library (libeui1f.a)

C SYNOPSIS

```
#include <pm_util.h>
int mpc_stdoutmode_query(int *mode);
```

FORTRAN SYNOPSIS

```
MP_STDOUTMODE_QUERY(INTEGER MODE)
```

PARAMETERS

mode is the address of an integer in which the current STDOUT mode setting will be returned. Possible return values are:

taskid indicates that the current STDOUT mode is single, i.e. output for only task taskid is displayed.

-2 indicates that the current STDOUT mode is ordered. The macro STDIO_ORDERED is supplied for use in C programs.

-3 indicates that the current STDOUT mode is unordered. The macro STDIO_UNORDERED is supplied for use in C programs.

DESCRIPTION

This Parallel Utility Function returns the mode to which STDOUT is currently set.

NOTES

- Between the time one task issues a mode query request and receives a response, it is possible that another task can change the STDOUT mode setting to another value unless proper synchronization is used.

RETURN VALUES

In C and C++ calls, the following applies:

0 indicates successful completion

-1 indicates that an error occurred. A message describing the error will be issued.

EXAMPLES

C Example

The following program uses poe with one task:

```
#include <pm_util.h>

main()
{
 int mode;

 mpc_stdoutmode_query(&mode);
 printf("Initial (default) STDOUT mode is %d\n", mode);
 mpc_stdout_mode(STDIO_ORDERED);
 mpc_stdoutmode_query(&mode);
 printf("New STDOUT mode is %d\n", mode);
}
```

Running the above program produces the following output:

```
Initial (default) STDOUT mode is -3
New STDOUT mode is -2
```

Fortran Example

The following program uses poe with one task:

```
      INTEGER MODE

      CALL MP_STDOUTMODE_QUERY(mode)
      WRITE(6, *) 'Initial (default) STDOUT mode is', mode
      CALL MP_STDOUT_MODE(-2)
      CALL MP_STDOUTMODE_QUERY(mode)
      WRITE(6, *) 'New STDOUT mode is', mode
      END
```

Running the above program produces the following output:

```
Initial (default) STDOUT mode is -3
New STDOUT mode is -2
```

RELATED INFORMATION

Functions: mpc_flush(3), MP_FLUSH(3), mp_stdout-mode(3), MP_STDOUT_MODE(3), mpc_synch(3), MP_SYNCH(3), mpcc(1), mpCC(1), mpxlf(1),

MP_STDOUTMODE_QUERY

Appendix E. Tracing Routines

This chapter contains the syntax man pages for the tracing routines used in the Visualization Tool Tracing Subsystem. These user-callable routines allow the programmer to customize the trace collection from within the application being traced. Included are functions for:

- modifying trace collection parameters
- starting and stopping the trace from within the program, dynamically and selectively
- writing trace records back to the home node.

There is a C and FORTRAN version for each of the routines.

The following tracing routines will be provided:

VT_TRC_FLUSH and VT_trc_flush_c flushes the memory buffer and the temporary directory files to the user specified (or the current working) directory.

VT_TRC_SET_PARAMS and VT_trc_set_params_c sets certain tracing parameters at which the daemon should sample kernel statistics.

VT_TRC_START and VT_trc_start_c requests a trace from within the program, dynamically and selectively.

VT_TRC_STOP and VT_trc_stop_c requests that the collecting of trace events be discontinued.

For more information, refer to *IBM AIX Parallel Environment: Operation and Use*, SH26-7230.

NAME

VT_TRC_FLUSH, VT_trc_flush_c – Flushes the memory buffer and the temporary directory files to the trace collection directory.

LIBRARY

- C Library (libvtd.a)
- FORTRAN Library (libvtd.a)

  The above are automatically included by the POE functions.

C SYNOPSIS

```
#include <VT_trc.h>
int VT_trc_flush_c();
```

FORTRAN SYNOPSIS

```
VT_TRC_FLUSH(INTEGER RETURN_CODE)
```

PARAMETERS

In FORTRAN, the following applies:

return_code integer which receives the return value.

- **0** indicates successful completion
- **-1** indicates an error occurred.

DESCRIPTION

This routine may be called from the application to flush the memory buffer and the temporary directory files to the trace collection directory. This is specified by the MP_TRACE directory environment variable or -tracedir parameter and defaults to the directory from which the application was stored.

RETURN VALUES

In C and C++ calls, the following applies:

0 indicates successful completion

-1 indicates that an error occurred. A message describing the error will be issued.

ERRORS

- 0033-3051 VT_trc_capture(), write_tmp_to_usd_file(), No space is left in usd_file

  The node trace file reached the maximum size set by MP_PARMSIZE or -parmsize.

- 0033-3072 write_temp_to_usd_file(), Fork failed to the write data onto the user

  The trace writing routine could not fork. It is probable that either too many processes are active or there is not enough page space.

- 0033-3088 VT_trrtn::write_trc_data(), Tracing continued after reducing the max size for temp file from number to number

  The temp directory was full so the size of the maximum temp trace file was reduced.

- 0033-3092 VT_trint, statfs call failed, Disk space computation failed.

  An error occurred while obtaining information about the temp file directory.

For more information about error conditions, refer to the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

EXAMPLES

C Example

```
    #include <stdlib.h>
    #include <stdio.h>
    #include <VT_trc.h>

void main()
{
  int     i;
#define SIZE 1024
  int    msgin[SIZE], msgout[SIZE];
  int    numtask, taskid;
  int    src, dest, len, send_msgid, recv_msgid, nbytes;
  int    type;

  /* Find out number of tasks/nodes. */
  mpc_environ (&numtask,&taskid );

  /************************************
    Set tracing parameters as follows:
    Memory buffer = 500K
    Temporary File = 1M
    Final Node File = 10M
    Sample every second
    Do not use wrap-around buffer
    ************************************/
  if(0!=VT_trc_set_params_c(500000,1000000,10000000,1000,0))
    {
      printf("Could not reset trace parameters\n");
    }

  /* Disable tracing while the message buffer is initialized */
  if(0!=VT_trc_stop_c())
    {
      printf("Could not stop tracing\n");
    }
  /* Flush the buffer so far to the control node */
  if(0!=VT_trc_flush_c())
    {
      printf("Could not flush trace buffer\n");
    }

  for(i=0;i<SIZE;i++)
    msgout[i] = taskid;
```

```
  /* Re-enable tracing (9 asks for everything but only events */
  /* enabled by command line or environment variable will be  */
  /* re-enabled)                                              */
  if(0!=VT_trc_start_c(9))
    {
      printf("Could not restart tracing\n");
    }


  len  = SIZE*sizeof(int);
  dest = taskid + 1;
  if( dest == numtask ) dest = 0;
  type = 1;
  mpc_send ( msgout, len, dest, type, &send_msgid );

  len  = SIZE*sizeof(int);
  src = taskid -1;
  if( src < 0 ) src = numtask-1;
  type = 1;
  mpc_recv ( msgin, len, &src, &type, &recv_msgid );

  mpc_wait (&send_msgid,&nbytes );
  mpc_wait (&recv_msgid,&nbytes );

}
```

FORTRAN Example

```
      PROGRAM  TRCDEMO
C
      IMPLICIT   NONE
      INTEGER    SIZE, I
      INTEGER    BSZ, TSZ, PSZ
      INTEGER    SAMP, WRAP
      PARAMETER  ( SIZE = 1024 )
      PARAMETER  ( BSZ = 500000, TSZ = 1000000, PSZ = 10000000 )
      PARAMETER  ( SAMP = 1000, WRAP = 0 )
      INTEGER    MSGIN(SIZE), MSGOUT(SIZE)
      INTEGER    NUMTASK, TASKID
      INTEGER    SRC, DEST, LEN, SEND_MSGID, RECV_MSGID, NBYTES
      INTEGER    TYPE
      INTEGER    RC
C
C  FIND OUT NUMBER OF TASKS/NODES.
         CALL MP_ENVIRON ( NUMTASK, TASKID )
C
C    SET TRACING PARAMETERS AS FOLLOWS:
C    MEMORY BUFFER = 500K
C    TEMPORARY FILE = 1M
C    FINAL NODE FILE = 10M
C    SAMPLE EVERY SECOND
C    DO NOT USE WRAP-AROUND BUFFER
C
         CALL VT_TRC_SET_PARAMS ( BSZ, TSZ, PSZ, SAMP, WRAP, RC )
         IF( RC .NE. 0 ) THEN
            WRITE(6,*)'Could not reset trace parameters'
```

```
         ENDIF
C
C DISABLE TRACING WHILE THE MESSAGE BUFFER IS INITIALIZED
         CALL VT_TRC_STOP ( RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not stop tracing'
         ENDIF
C
C FLUSH THE BUFFER SO FAR TO THE CONTROL NODE
         CALL VT_TRC_FLUSH ( RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not flush trace buffer stop tracing'
         ENDIF
C
         DO I = 1, SIZE
            MSGOUT(I) = TASKID
         ENDDO
C
C RE-ENABLE TRACING (9 ASKS FOR EVERYTHING BUT ONLY EVENTS
C ENABLED BY COMMAND LINE OR ENVIRONMENT VARIABLE WILL BE
C RE-ENABLED)
         CALL VT_TRC_START ( 9, RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not restart tracing'
         ENDIF
C
         LEN  = 4 * SIZE
         DEST = TASKID + 1
         IF( DEST .EQ. NUMTASK ) THEN
            DEST = 0
         ENDIF
         TYPE = 1
         CALL MP_SEND ( MSGOUT, LEN, DEST, TYPE, SEND_MSGID )
C
         LEN  = 4 * SIZE
         SRC  = TASKID - 1
         IF( SRC .LT. 0 ) THEN
            SRC = NUMTASK - 1
         ENDIF
         TYPE = 1
         CALL MP_RECV ( MSGIN, LEN, SRC, TYPE, RECV_MSGID )
         CALL MP_WAIT ( RECV_MSGID, NBYTES )
C
         CALL MP_WAIT ( SEND_MSGID, NBYTES )

         STOP
         END
C
```

RELATED INFORMATION

Functions: VT_trc_set_params_c, VT_TRC_SET_PARAMS, VT_trc_start_c, VT_TRC_START, VT_trc_stop_c, VT_TRC_STOP

NAME

VT_TRC_SET_PARAMS, VT_trc_set_params_c – Allows applications to modify certain tracing parameters during execution.

LIBRARY

- C Library (libvtd.a) functions.
- FORTRAN Library (libvtd.a)

  The above are automatically included by the POE.

C SYNOPSIS

```
#include <VT_trc.h>
int VT_trc_set_params_c(size_t buff_size, size_t temp_file_size,
                        size_t usd_file_size, int sampling_freq,
                        int wrap_around_flag);
```

FORTRAN SYNOPSIS

```
VT_TRC_SET_PARAMS(INTEGER BUFF_SIZE, INTEGER TEMP_FILE_SIZE,
                  INTEGER USD_FILE_SIZE, INTEGER SAMPLING_FREQ,
                  INTEGER WRAP_AROUND_FLAG, INTEGER RETURN_CODE)
```

PARAMETERS

buff_size the size of the tier 1 memory buffer

temp_file_size the size of the tier 2 temporary file

usd_file_size the size of the tier 3 working directory file

sampling_freq the frequency with which to sample AIX statistics

wrap_around_flag if non-zero, a wrap around memory buffer will be used.

return_code integer which receives the return value.

- **0** indicates successful completion
- **-1** indicates an error occurred.

DESCRIPTION

This routine allows applications to set certain tracing parameters such as the size of the memory buffer and trace files, and the kernel statistics sampling interval.

NOTES

- Parameter values replace command line values.

RETURN VALUES

In C and C++ calls, the following applies:

0 indicates successful completion

-1 indicates that an error occurred. A message describing the error will be issued.

ERRORS

- 0033-3011 VT_trc_set-params(), reallocation of ... bytes failed

  The application could not obtain the memory required to change parameters.

- 0033-3090 write failed to the dig daemon, ..., error is ...

  The application could not contact the kernel statistics sampling daemon.

For more information about error conditions, refer to the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

EXAMPLES

C Example

```
   #include <stdlib.h>
   #include <stdio.h>
   #include <VT_trc.h>

void main()
{
  int     i;
#define SIZE 1024
  int    msgin[SIZE], msgout[SIZE];
  int    numtask, taskid;
  int    src, dest, len, send_msgid, recv_msgid, nbytes;
  int    type;

  /* Find out number of tasks/nodes. */
  mpc_environ (&numtask,&taskid );

  /************************************
    Set tracing parameters as follows:
    Memory buffer = 500K
    Temporary File = 1M
    Final Node File = 10M
    Sample every second
    Do not use wrap-around buffer
    ************************************/
  if(0!=VT_trc_set_params_c(500000,1000000,10000000,1000,0))
    {
      printf("Could not reset trace parameters\n");
    }

  /* Disable tracing while the message buffer is initialized */
  if(0!=VT_trc_stop_c())
    {
      printf("Could not stop tracing\n");
    }
  /* Flush the buffer so far to the control node */
```

```
  if(0!=VT_trc_flush_c())
    {
      printf("Could not flush trace buffer\n");
    }

  for(i=0;i<SIZE;i++)
    msgout[i] = taskid;

  /* Re-enable tracing (9 asks for everything but only events */
  /* enabled by command line or environment variable will be  */
  /* re-enabled)                                              */
  if(0!=VT_trc_start_c(9))
    {
      printf("Could not restart tracing\n");
    }


  len  = SIZE*sizeof(int);
  dest = taskid + 1;
  if( dest == numtask ) dest = 0;
  type = 1;
  mpc_send ( msgout, len, dest, type, &send_msgid );

  len  = SIZE*sizeof(int);
  src = taskid -1;
  if( src < 0 ) src = numtask-1;
  type = 1;
  mpc_recv ( msgin, len, &src, &type, &recv_msgid );

  mpc_wait (&send_msgid,&nbytes );
  mpc_wait (&recv_msgid,&nbytes );

}
```

FORTRAN Example

```
      PROGRAM  TRCDEMO
C
      IMPLICIT   NONE
      INTEGER    SIZE, I
      INTEGER    BSZ, TSZ, PSZ
      INTEGER    SAMP, WRAP
      PARAMETER  ( SIZE = 1024 )
      PARAMETER  ( BSZ = 500000, TSZ = 1000000, PSZ = 10000000 )
      PARAMETER  ( SAMP = 1000, WRAP = 0 )
      INTEGER    MSGIN(SIZE), MSGOUT(SIZE)
      INTEGER    NUMTASK, TASKID
      INTEGER    SRC, DEST, LEN, SEND_MSGID, RECV_MSGID, NBYTES
      INTEGER    TYPE
      INTEGER    RC
C
C  FIND OUT NUMBER OF TASKS/NODES.
         CALL MP_ENVIRON ( NUMTASK, TASKID )
C
C    SET TRACING PARAMETERS AS FOLLOWS:
C    MEMORY BUFFER = 500K
C    TEMPORARY FILE = 1M
C    FINAL NODE FILE = 10M
```

```
C    SAMPLE EVERY SECOND
C    DO NOT USE WRAP-AROUND BUFFER
C
         CALL VT_TRC_SET_PARAMS ( BSZ, TSZ, PSZ, SAMP, WRAP, RC )
         IF( RC .NE. 0 ) THEN
            WRITE(6,*)'Could not reset trace parameters'
         ENDIF
C
C DISABLE TRACING WHILE THE MESSAGE BUFFER IS INITIALIZED
         CALL VT_TRC_STOP ( RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not stop tracing'
         ENDIF
C
C FLUSH THE BUFFER SO FAR TO THE CONTROL NODE
         CALL VT_TRC_FLUSH ( RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not flush trace buffer stop tracing'
         ENDIF
C
         DO I = 1, SIZE
            MSGOUT(I) = TASKID
         ENDDO
C
C RE-ENABLE TRACING (9 ASKS FOR EVERYTHING BUT ONLY EVENTS
C ENABLED BY COMMAND LINE OR ENVIRONMENT VARIABLE WILL BE
C RE-ENABLED)
         CALL VT_TRC_START ( 9, RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not restart tracing'
         ENDIF
C
         LEN  = 4 * SIZE
         DEST = TASKID + 1
         IF( DEST .EQ. NUMTASK ) THEN
            DEST = 0
         ENDIF
         TYPE = 1
         CALL MP_SEND ( MSGOUT, LEN, DEST, TYPE, SEND_MSGID )
C
         LEN  = 4 * SIZE
         SRC  = TASKID - 1
         IF( SRC .LT. 0 ) THEN
            SRC = NUMTASK - 1
         ENDIF
         TYPE = 1
         CALL MP_RECV ( MSGIN, LEN, SRC, TYPE, RECV_MSGID )
         CALL MP_WAIT ( RECV_MSGID, NBYTES )
C
         CALL MP_WAIT ( SEND_MSGID, NBYTES )

         STOP
         END
C
```

RELATED INFORMATION

Functions: VT_trc_flush_c, VT_TRC_FLUSH, VT_trc_start_c, VT_TRC_START, VT_trc_stop_c, VT_TRC_STOP

NAME

VT_TRC_START, VT_trc_start_c – Allows you to start the program trace from within the program, dynamically and selectively.

LIBRARY

- C Library (libvtd.a)
- FORTRAN Library (libvtd.a)

The above is automatically included by the POE functions.

C SYNOPSIS

```
#include <VT_trc.h>
int VT_trc_start_c(int flag);
```

FORTRAN SYNOPSIS

```
VT_TRC_START(INTEGER FLAG, INTEGER RETURN_CODE)
```

PARAMETERS

flag the trace control flags that define what information is traced.

return_code integer which receives the return value.

- **0** indicates successful completion
- **-1** indicates an error occurred.

DESCRIPTION

This routine may be called by the application program. This gives the program capability to start the trace from within the program, dynamically and selectively. The flag has the same meaning as the trace flag passed by PM upon startup. If the flag indicates VT_AIX_TRACE, this routine also sends a message to the monitoring daemon process.

NOTES

- Tracing is initially on when the application starts.
- If a trace event, such as kernel statistics or communication events, was not selected at the start of the application it cannot be enabled by this routine.
- If tracing is turned off around one event of a send/receive pair, it will not be possible to visualize that send/receive pair correctly or subsequent communications correctly.

RETURN VALUES

In C and C++ calls, the following applies:

0 indicates successful completion

-1 indicates that an error occurred. A message describing the error will be issued.

ERRORS

- 0033-3090 write failed to the dig daemon ...., error is ...

  The application could not contact the kernel statistics sampling daemon.

For more information about error conditions, refer to the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

EXAMPLES

C Example

```
   #include <stdlib.h>
   #include <stdio.h>
   #include <VT_trc.h>

void main()
{
  int     i;
#define SIZE 1024
  int    msgin[SIZE], msgout[SIZE];
  int    numtask, taskid;
  int    src, dest, len, send_msgid, recv_msgid, nbytes;
  int    type;

  /* Find out number of tasks/nodes. */
  mpc_environ (&numtask,&taskid );

  /************************************
    Set tracing parameters as follows:
    Memory buffer = 500K
    Temporary File = 1M
    Final Node File = 10M
    Sample every second
    Do not use wrap-around buffer
    ************************************/
  if(0!=VT_trc_set_params_c(500000,1000000,10000000,1000,0))
    {
      printf("Could not reset trace parameters\n");
    }

  /* Disable tracing while the message buffer is initialized */
  if(0!=VT_trc_stop_c())
    {
      printf("Could not stop tracing\n");
    }
  /* Flush the buffer so far to the control node */
  if(0!=VT_trc_flush_c())
    {
      printf("Could not flush trace buffer\n");
```

```
    }

  for(i=0;i<SIZE;i++)
    msgout[i] = taskid;

  /* Re-enable tracing (9 asks for everything but only events */
  /* enabled by command line or environment variable will be  */
  /* re-enabled)                                              */
  if(0!=VT_trc_start_c(9))
    {
      printf("Could not restart tracing\n");
    }


  len  = SIZE*sizeof(int);
  dest = taskid + 1;
  if( dest == numtask ) dest = 0;
  type = 1;
  mpc_send ( msgout, len, dest, type, &send_msgid );

  len  = SIZE*sizeof(int);
  src = taskid -1;
  if( src < 0 ) src = numtask-1;
  type = 1;
  mpc_recv ( msgin, len, &src, &type, &recv_msgid );

  mpc_wait (&send_msgid,&nbytes );
  mpc_wait (&recv_msgid,&nbytes );

}
```

FORTRAN Example

```
      PROGRAM  TRCDEMO
C
      IMPLICIT   NONE
      INTEGER    SIZE, I
      INTEGER    BSZ, TSZ, PSZ
      INTEGER    SAMP, WRAP
      PARAMETER  ( SIZE = 1024 )
      PARAMETER  ( BSZ = 500000, TSZ = 1000000, PSZ = 10000000 )
      PARAMETER  ( SAMP = 1000, WRAP = 0 )
      INTEGER    MSGIN(SIZE), MSGOUT(SIZE)
      INTEGER    NUMTASK, TASKID
      INTEGER    SRC, DEST, LEN, SEND_MSGID, RECV_MSGID, NBYTES
      INTEGER    TYPE
      INTEGER    RC
C
C  FIND OUT NUMBER OF TASKS/NODES.
         CALL MP_ENVIRON ( NUMTASK, TASKID )
C
C    SET TRACING PARAMETERS AS FOLLOWS:
C    MEMORY BUFFER = 500K
C    TEMPORARY FILE = 1M
C    FINAL NODE FILE = 10M
C    SAMPLE EVERY SECOND
C    DO NOT USE WRAP-AROUND BUFFER
C
```

```
         CALL VT_TRC_SET_PARAMS ( BSZ, TSZ, PSZ, SAMP, WRAP, RC )
         IF( RC .NE. 0 ) THEN
            WRITE(6,*)'Could not reset trace parameters'
         ENDIF
C
C DISABLE TRACING WHILE THE MESSAGE BUFFER IS INITIALIZED
         CALL VT_TRC_STOP ( RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not stop tracing'
         ENDIF
C
C FLUSH THE BUFFER SO FAR TO THE CONTROL NODE
         CALL VT_TRC_FLUSH ( RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not flush trace buffer stop tracing'
         ENDIF
C
         DO I = 1, SIZE
            MSGOUT(I) = TASKID
         ENDDO
C
C RE-ENABLE TRACING (9 ASKS FOR EVERYTHING BUT ONLY EVENTS
C ENABLED BY COMMAND LINE OR ENVIRONMENT VARIABLE WILL BE
C RE-ENABLED)
         CALL VT_TRC_START ( 9, RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not restart tracing'
         ENDIF
C
         LEN  = 4 * SIZE
         DEST = TASKID + 1
         IF( DEST .EQ. NUMTASK ) THEN
            DEST = 0
         ENDIF
         TYPE = 1
         CALL MP_SEND ( MSGOUT, LEN, DEST, TYPE, SEND_MSGID )
C
         LEN  = 4 * SIZE
         SRC  = TASKID - 1
         IF( SRC .LT. 0 ) THEN
            SRC = NUMTASK - 1
         ENDIF
         TYPE = 1
         CALL MP_RECV ( MSGIN, LEN, SRC, TYPE, RECV_MSGID )
         CALL MP_WAIT ( RECV_MSGID, NBYTES )
C
         CALL MP_WAIT ( SEND_MSGID, NBYTES )

         STOP
         END
C
```

RELATED INFORMATION

Functions: VT_trc_flush_c, VT_TRC_FLUSH, VT_trc_set_params_c, VT_TRC_SET_PARAMS, VT_trc_start_c, VT_TRC_START, VT_trc_stop_c, VT_TRC_STOP

NAME

VT_TRC_STOP, VT_trc_stop_c – Stops collecting trace events.

LIBRARY

- C Library (libvtd.a)
- FORTRAN Library (libvtd.a)

The above is automatically included by the POE functions.

C SYNOPSIS

```
#include <VT_trc.h>
int VT_trc_stop_c();
```

FORTRAN SYNOPSIS

```
VT_TRC_STOP(INTEGER RETURN_CODE)
```

PARAMETERS

return_code integer which receives the return value.

0 indicates successful completion

-1 indicates an error occurred.

DESCRIPTION

This routine may be called by the application program to stop tracing.

NOTES

- If tracing is turned off around one event of a send/receive pair, it will not be possible to visualize that send/receive pair correctly or subsequent communications correctly.

RETURN VALUES

In C and C++ calls, the following applies:

0 indicates successful completion

-1 indicates that an error occurred. A message describing the error will be issued.

ERRORS

- 0033-3090 write failed to the dig daemon ...., error is ...

  The application could not contact the kernel statistics sampling daemon.

For more information about error conditions, refer to the *IBM AIX Parallel Environment: Installation, Administration, and Diagnosis* manual.

EXAMPLES

C Example

```
   #include <stdlib.h>
   #include <stdio.h>
   #include <VT_trc.h>

void main()
{
  int     i;
#define SIZE 1024
  int    msgin[SIZE], msgout[SIZE];
  int    numtask, taskid;
  int    src, dest, len, send_msgid, recv_msgid, nbytes;
  int    type;

  /* Find out number of tasks/nodes. */
  mpc_environ (&numtask,&taskid );

  /************************************
    Set tracing parameters as follows:
    Memory buffer = 500K
    Temporary File = 1M
    Final Node File = 10M
    Sample every second
    Do not use wrap-around buffer
    ************************************/
  if(0!=VT_trc_set_params_c(500000,1000000,10000000,1000,0))
    {
      printf("Could not reset trace parameters\n");
    }

  /* Disable tracing while the message buffer is initialized */
  if(0!=VT_trc_stop_c())
    {
      printf("Could not stop tracing\n");
    }
  /* Flush the buffer so far to the control node */
  if(0!=VT_trc_flush_c())
    {
      printf("Could not flush trace buffer\n");
    }

  for(i=0;i<SIZE;i++)
    msgout[i] = taskid;

  /* Re-enable tracing (9 asks for everything but only events */
  /* enabled by command line or environment variable will be  */
  /* re-enabled)                                              */
  if(0!=VT_trc_start_c(9))
    {
      printf("Could not restart tracing\n");
    }


  len  = SIZE*sizeof(int);
  dest = taskid + 1;
  if( dest == numtask ) dest = 0;
```

```
  type = 1;
  mpc_send ( msgout, len, dest, type, &send_msgid );

  len  = SIZE*sizeof(int);
  src = taskid -1;
  if( src < 0 ) src = numtask-1;
  type = 1;
  mpc_recv ( msgin, len, &src, &type, &recv_msgid );

  mpc_wait (&send_msgid,&nbytes );
  mpc_wait (&recv_msgid,&nbytes );

}
```

FORTRAN Example

```
      PROGRAM  TRCDEMO
C
      IMPLICIT   NONE
      INTEGER    SIZE, I
      INTEGER    BSZ, TSZ, PSZ
      INTEGER    SAMP, WRAP
      PARAMETER  ( SIZE = 1024 )
      PARAMETER  ( BSZ = 500000, TSZ = 1000000, PSZ = 10000000 )
      PARAMETER  ( SAMP = 1000, WRAP = 0 )
      INTEGER    MSGIN(SIZE), MSGOUT(SIZE)
      INTEGER    NUMTASK, TASKID
      INTEGER    SRC, DEST, LEN, SEND_MSGID, RECV_MSGID, NBYTES
      INTEGER    TYPE
      INTEGER    RC
C
C  FIND OUT NUMBER OF TASKS/NODES.
         CALL MP_ENVIRON ( NUMTASK, TASKID )
C
C    SET TRACING PARAMETERS AS FOLLOWS:
C    MEMORY BUFFER = 500K
C    TEMPORARY FILE = 1M
C    FINAL NODE FILE = 10M
C    SAMPLE EVERY SECOND
C    DO NOT USE WRAP-AROUND BUFFER
C
         CALL VT_TRC_SET_PARAMS ( BSZ, TSZ, PSZ, SAMP, WRAP, RC )
         IF( RC .NE. 0 ) THEN
            WRITE(6,*)'Could not reset trace parameters'
         ENDIF
C
C DISABLE TRACING WHILE THE MESSAGE BUFFER IS INITIALIZED
         CALL VT_TRC_STOP ( RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not stop tracing'
         ENDIF
C
C FLUSH THE BUFFER SO FAR TO THE CONTROL NODE
         CALL VT_TRC_FLUSH ( RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not flush trace buffer stop tracing'
         ENDIF
C
```

```
         DO I = 1, SIZE
            MSGOUT(I) = TASKID
         ENDDO
C
C RE-ENABLE TRACING (9 ASKS FOR EVERYTHING BUT ONLY EVENTS
C ENABLED BY COMMAND LINE OR ENVIRONMENT VARIABLE WILL BE
C RE-ENABLED)
         CALL VT_TRC_START ( 9, RC )
         IF(RC .NE. 0) THEN
            WRITE(6,*)'Could not restart tracing'
         ENDIF
C
         LEN  = 4 * SIZE
         DEST = TASKID + 1
         IF( DEST .EQ. NUMTASK ) THEN
            DEST = 0
         ENDIF
         TYPE = 1
         CALL MP_SEND ( MSGOUT, LEN, DEST, TYPE, SEND_MSGID )
C
         LEN  = 4 * SIZE
         SRC  = TASKID - 1
         IF( SRC .LT. 0 ) THEN
            SRC = NUMTASK - 1
         ENDIF
         TYPE = 1
         CALL MP_RECV ( MSGIN, LEN, SRC, TYPE, RECV_MSGID )
         CALL MP_WAIT ( RECV_MSGID, NBYTES )
C
         CALL MP_WAIT ( SEND_MSGID, NBYTES )

         STOP
         END
C
```

RELATED INFORMATION

Functions: VT_trc_flush_c, VT_TRC_FLUSH, VT_trc_set_params_c, VT_TRC_SET_PARAMS, VT_trc_start_c, VT_TRC_START,

VT_TRC_STOP

Appendix F. Exit Status of User Application

This chapter explains how to determine the exit status of the parallel program (pod).

Exit status is determined as follows:

- If MP_STOPALL(nn > 0) (or mpc_stopall(nn)) is called, the exit status is nn.
- If all tasks terminate via exit(mm >= 0) or STOP(mm >= 0), the exit status is the largest value of mm returned.
- If any task is terminated via a signal (e.g. segment violation), the exit status is 128+(signal).
- If poe terminates before starting execution of the remote programs, the exit status = 1.

Readers' Comments — We'd Like to Hear from You

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	Very Satis-fied	Satis-fied	Neutral	Dissatisfied	Very Dissatisfied
Overall satisfaction	□	□	□	□	□

How satisfied are you that the information in this book is:

	Very Satis-fied	Satis-fied	Neutral	Dissatisfied	Very Dissatisfied
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Please tell us how we can improve this book:

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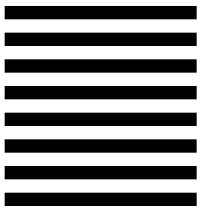

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