Fortran Interface

Initialization

```
BLACS_PINFO   ( MYPNUM, NPROCS )
BLACS_SETUP   ( MYPNUM, NPROCS )
BLACS_GET     ( ICONTXT, WHAT, VAL )
BLACS_SET     ( ICONTXT, WHAT, VAL )
BLACS_GRIDINIT( ICONTXT, ORDER,           NPROW, NPCOL )
BLACS_GRIDMAP ( ICONTXT, USERMAP, LDUMAP, NPROW, NPCOL )
```

Destruction

```
BLACS_FREEBUFF( ICONTXT, WAIT )
BLACS_GRIDEXIT( ICONTXT )
BLACS_ABORT   ( ICONTXT, ERRORNUM )
BLACS_EXIT    ( DONEFLAG )
```

Sending

```
□GESD2D( ICONTXT,                        M, N, A, LDA, RDEST, CDEST )

□GEBS2D( ICONTXT, SCOPE, TOP,            M, N, A, LDA               )

□TRSD2D( ICONTXT,            UPLO, DIAG, M, N, A, LDA, RDEST, CDEST )

□TRBS2D( ICONTXT, SCOPE, TOP, UPLO, DIAG, M, N, A, LDA              )
```

Receiving

```
□GERV2D( ICONTXT,                        M, N, A, LDA, RSRC, CSRC )

□GEBR2D( ICONTXT, SCOPE, TOP,            M, N, A, LDA, RSRC, CSRC )

□TRRV2D( ICONTXT,            UPLO, DIAG, M, N, A, LDA, RSRC, CSRC )

□TRBR2D( ICONTXT, SCOPE, TOP, UPLO, DIAG, M, N, A, LDA, RSRC, CSRC )
```

Combine Operations

```
□GAMX2D( ICONTXT, SCOPE, TOP, M, N, A, LDA, RA, CA, RCFLAG, RDEST, CDEST )

□GAMN2D( ICONTXT, SCOPE, TOP, M, N, A, LDA, RA, CA, RCFLAG, RDEST, CDEST )

□GSUM2D( ICONTXT, SCOPE, TOP, M, N, A, LDA,                 RDEST, CDEST )
```

All routines preceded by a □ *have the following prefixes:* `S, D, C, Z, I.`

Informational and Miscellaneous

```
BLACS_GRIDINFO( ICONTXT, NPROW, NPCOL, MYPROW, MYPCOL )
BLACS_PNUM    ( ICONTXT,               PROW,   PCOL )
BLACS_PCOORD  ( ICONTXT, PNUM,         PROW,   PCOL )
BLACS_BARRIER ( ICONTXT, SCOPE )
```

Non-standard

```
SETPVMTIDS ( NTASKS, TIDS )
DCPUTIME00 ( )
DWALLTIME00( )
KSENDID    ( ICONTXT,        RDEST, CDEST )
KRECVID    ( ICONTXT,        RSRC,  CSRC  )
KBSID      ( ICONTXT, SCOPE               )
KBRID      ( ICONTXT, SCOPE, RSRC,  CSRC  )
```

Declarations

```
CHARACTER          DIAG, SCOPE, TOP, UPLO
INTEGER            BLACS_PNUM, CDEST, ICONTXT, CSRC, DONEFLAG
INTEGER            ERRORNUM, LDA, RCFLAG, M, MAXID, MINID, N
INTEGER            NBRANCHES, NPCOL, NPROW
INTEGER            PCOL, PNUM, PROW, RDEST, RSRC, WAIT
INTEGER            CA( * ), RA( * )
DOUBLE PRECISION   DCPUTIME00, DWALLTIME00
REAL/DOUBLE        A( LDA, * )
COMPLEX/COMPLEX*16 A( LDA, * )
 or
INTEGER            A( LDA, * )
```

Options

```
UPLO  = 'Upper triangular', 'Lower triangular';
DIAG  = 'Non-unit triangular', 'Unit triangular';
SCOPE = 'All', 'row', 'column';
TOP   = (SEE DESCRIPTION BELOW).
```

Broadcast Topologies

```
TOP  = ' ' : System dependent default topology;
     = 'I' : increasing ring;
     = 'D' : decreasing ring;
     = 'H' : hypercube (minimum spanning tree);
     = 'S' : split-ring;
     = 'F' : fully connected;
     = 'M' : nodes divided into I increasing
             rings, where I is set with call
             to BLACS_SET;
     = 'T' : tree broadcast with NBRANCHES = I,
             where I is set with call to
             BLACS_SET;
     = '1' : tree broadcast with NBRANCHES = 1;
     = '2' : tree broadcast with NBRANCHES = 2;
        :
     = '9' : tree broadcast with NBRANCHES = 9.
```

Global Topologies

```
TOP  = ' ' : System dependent default topology;
     = '1' : tree gather with NBRANCHES = 1;
     = '2' : tree gather with NBRANCHES = 2;
        :
     = '9' : tree gather with NBRANCHES = 9;
     = 'T' : tree gather with NBRANCHES = I,
             where I is set with call to
             BLACS_SET;
     = 'F' : Fully connected;
     = 'H' : if RDEST = -1, a specialized
             "leave on all" hypercube topology
             called bidirectional exchange is used.
             Otherwise, TOP = '1' is substituted.
```

Notation

Underlined parameters are output arguments. If a routine is underlined it is a function that returns a value. The prefix **P** usually stands for process. Other standard notations are:

```
GE - GENERAL        TR - TRAPEZOIDAL
SD - SEND           BS - BROADCAST/SEND
RV - RECEIVE        BR - BROADCAST/RECEIVE
GAMX - General element-wise Absolute value MAXIMUM
GAMN - General element-wise Absolute value MINIMUM
GSUM - General element-wise SUMMATION
```

Key Ideas:

A BLACS context is created via a call to either `BLACS_GRIDINIT` or `BLACS_GRIDMAP`. No routine requiring a context may be used until one of these routines has been called. Multiple calls to `BLACS_GRIDINIT` or `BLACS_GRIDMAP` result in the creation of new contexts. To preserve resources, the user should free unused contexts by calling `BLACS_GRIDEXIT`. When all BLACS operations are done, a call to `BLACS_EXIT` frees any remaining contexts, and shuts down all BLACS operations.
Please note that `BLACS_GRIDINIT` and `BLACS_GRIDMAP` accept system contexts as input. A default system context encompassing all available processes may be obtained by a call to `BLACS_GET`.
`BLACS_SET` can only be used to change the message ID range before the creation of the first context. Subsequent calls will be ignored.

Topology Hints

Topologies allow the user to optimize communication patterns for a particular operation. If the user does not have a communication pipe to maintain, the default `TOP = ' '` is recommended. For more details examine the mosiac page or the papers referenced below.

References

R. Clint Whaley, LAPACK, Working Note 73, *Basic Linear Algebra Communication Subprograms: Analysis and Implementation Across Multiple Parallel Architectures*, Computer Science Dept. Technical Report CS-94-234, University of Tennessee, Knoxville, May, 1994. To receive a postscript copy, send email to netlib@ornl.gov and in the mail message type: `send lawn73.ps from lapack/lawns`.

To get the user's guide to the BLACS, send email to netlib@ornl.gov and in the mail message type: `send blacs_ug.ps from blacs`.

Reference, examples, troubleshooting, downloading options and installation instructions are available on mosaic. The URL is `http://www.cs.utk.edu/~rwhaley/Blacs.html`

Send comments and questions to `blacs@cs.utk.edu`.

Basic Linear Algebra Communication Subprograms

Quick Reference Guide, Fortran77 Interface

Release 1.0

February 14, 1995

University of Tennessee

Obtaining the BLACS

mosaic: `http://www.cs.utk.edu/~rwhaley/Blacs.html`

ftp: `netlib2.cs.utk.edu`, directory `blacs/`

email: `netlib@ornl.gov` with the message `send index from blacs`