

# 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 mosaic 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`