Package ‘pbdBASE’

February 5, 2018

Type Package

Title Programming with Big Data -- Base Wrappers for Distributed Matrices

Version 0.4-5.1

Description An interface to and extensions for the 'PBLAS' and 'ScalAPACK' numerical libraries. This enables R to utilize distributed linear algebra for codes written in the 'SPMD' fashion. This interface is deliberately low-level and mimics the style of the native libraries it wraps. For a much higher level way of managing distributed matrices, see the 'pbdDMAT' package.

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Depends R (>= 3.0.0), methods

Imports pbdMPI (>= 0.3-1), pbdSLAP(>= 0.2-1), utils

SystemRequirements OpenMPI (>= 1.5.4) on Solaris, Linux, Mac, and FreeBSD. MS-MPI (Microsoft HPC Pack 2012) or MPICH2 (>= 1.4.1p1) on Windows.

LazyLoad yes

LazyData yes

ByteCompile yes

NeedsCompilation yes

URL http://r-pbd.org/

BugReports http://group.r-pbd.org/

MailingList Please send questions and comments regarding pbdR to RBigData@gmail.com

Maintainer ORPHANED

RoxygenNote 5.0.1

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X-CRAN-Original-Maintainer  Drew Schmidt <schmidt@math.utk.edu>
X-CRAN-Comment  Orphaned and corrected on 2018-02-05 as C++ programming error reported by clang was not corrected despite reminders.

R topics documented:

- pbdBASE-package
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Description

A package contains the basic methods for dealing with distributed data types, as well as the data types themselves.

Details

Package: pbdBASE
Type: Package
License: MPL
LazyLoad: yes
This package requires an MPI library (OpenMPI, MPICH2, or LAM/MPI).

**Author(s)**

Drew Schmidt <schmidt AT math.utk.edu>, Wei-Chen Chen, George Ostrouchov, and Pragneshkumar Patel.

**References**

Programming with Big Data in R Website: http://r-pbd.org/

---

**baseNcrossprod**

**Description**

Crossproduct.

**Usage**

base.crossprod(uplo, trans, x, descx, descc)

---

**baseNcrossprod**

This package requires an MPI library (OpenMPI, MPICH2, or LAM/MPI).

**Author(s)**

Drew Schmidt <schmidt AT math.utk.edu>, Wei-Chen Chen, George Ostrouchov, and Pragneshkumar Patel.

**References**

Programming with Big Data in R Website: http://r-pbd.org/

---

**baseNcrossprod**

**Description**

Crossproduct.

**Usage**

base.crossprod(uplo, trans, x, descx, descc)
base.dallreduce

Arguments

- uplo: Triangle whose values to use.
- trans: tcrossprod or crossprod.
- x: Matrix to crossprod.
- descx: ScaLAPACK descriptor array.
- descx: ScaLAPACK descriptor array of output.

Details

For advanced users only.

---

dallreduce

Description

Allreduce

Usage

base.dallreduce(x, descx, op = "sum", scope = "All")

Arguments

- x: Matrix.
- descx: ScaLAPACK descriptor array.
- op: Operation.
- scope: Rows, columns, or both.

Details

For advanced users only.
**base.descinit**  
**descinit**

**Description**

Creates ScaLAPACK descriptor array.

**Usage**

base.descinit(dim, bldim, ldim, ICTXT = 0)

**Arguments**

- **dim**: Global dim.
- **bldim**: Blocking dim.
- **ldim**: Local dim.
- **ICTXT**: BLACS context.

**Details**

For advanced users only.

---

**base.dgamm2d**  
**BLACS Min**

**Description**

Min value across a process grid.

**Usage**

- base.dgamm2d(ICTXT, SCOPE, m, n, x, lda, RDEST, CDEST)
- base.igamm2d(ICTXT, SCOPE, m, n, x, lda, RDEST, CDEST)
- base.dgamm2d(ICTXT, SCOPE, m, n, x, lda, RDEST, CDEST)

**Arguments**

- **ICTXT**: BLACS ICTXT.
- **SCOPE**: Rows, cols, or both.
- **m, n**: Problem size.
- **x**: Local values.
- **lda**: Leading dimension.
- **RDEST**: Row destination.
- **CDEST**: Col destination.
**base.dgesd2d**

**Details**
For advanced users only.

<table>
<thead>
<tr>
<th>base.dgesd2d</th>
<th><strong>BLACS Point to Point</strong></th>
</tr>
</thead>
</table>

**Description**
Sent value across a process grid.

**Usage**

```
base.dgesd2d(ictxt, scope, m, n, x, lda, rdest, cdest)
base.dgerv2d(ictxt, scope, m, n, x, lda, rdest, cdest)
```

**Arguments**
- `ictxt` BLACS ICTXT.
- `scope` Rows, cols, or both.
- `m, n` Problem size.
- `x` Local values.
- `lda` Leading dimension.
- `rdest` Row destination.
- `cdest` Col destination.

**Details**
For advanced users only.

<table>
<thead>
<tr>
<th>base.dhilbmk</th>
<th><strong>dhilbmk</strong></th>
</tr>
</thead>
</table>

**Description**
Create Hilbert matrix.

**Usage**

```
base.dhilbmk(n)
```

**Arguments**
- `n` Size.
base.igamx2d

Details
For advanced users only.

| base.dim0 | maxdim |

Description
Compute dimensions on process MYROW=MYCOL=0

Usage
base.dim0(dim, ICTXT = 0)

Arguments
- dim: Global dim.
- ICTXT: BLACS context.

Details
For advanced users only.

| base.igamx2d | BLACS Max |

Description
Max value across a process grid.

Usage
base.igamx2d(ICTXT, SCOPE, m, n, x, lda, RDEST, CDEST)

Arguments
- ICTXT: BLACS ICTXT.
- SCOPE: Rows, cols, or both.
- m, n: Problem size.
- x: Local values.
- lda: Leading dimension.
- RDEST: Row destination.
- CDEST: Col destination.

Details
For advanced users only.
### base.igsum2d

#### Description

Sum across a process grid.

#### Usage

```
base.igsum2d ICTXT, SCOPE, m, n, x, lda, RDEST, CDEST
```

```
base.dgsum2d ICTXT, SCOPE, m, n, x, lda, RDEST, CDEST
```

#### Arguments

- **ICTXT**: BLACS ICTXT.
- **SCOPE**: Rows, cols, or both.
- **m, n**: Problem size.
- **x**: Local values.
- **lda**: Leading dimension.
- **RDEST**: Row destination.
- **CDEST**: Col destination.

#### Details

For advanced users only.

### base.indxg2p

#### Description

Computes the process coordinate which contains the entry of a distributed matrix specified by a global index INDXGLOB. Simplified reimplementation of the ScaLAPACK aux INDXG2P function.

#### Usage

```
base.indxg2p INDXGLOB, NB, NPROCS
```

#### Arguments

- **INDXGLOB**: Global index.
- **NB**: Block size.
- **NPROCS**: Total number of processors over which matrix is distributed.
Details

For advanced users only.

base.matexp

Description

Serial matrix exponentiation.

Usage

base.matexp(A, p = 6, t = 1)

Arguments

A       Matrix to exponentiate.
p       Pade’ expansion size.
t       Scaling factor.

Details

For advanced users only.

base.maxdim

Description

Compute maximum dimension across all nodes

Usage

base.maxdim(dim)

Arguments

dim                Global dim.

Details

For advanced users only.
**base.minctxt**  
*Get BLACS Context Grid Information*

**Description**
Finds the smallest integers for creating a new BLACS context.

**Usage**

```
base.minctxt(after = 0)
```

**Arguments**

- `after` ignores all values below this integer as possibilities

**Details**
For advanced users only.

Returns the smallest integer which could become a new BLACS context value.

For example, if contexts 0, 1, and 2 are taken, and `after=0`, then the function returns 3. If 0, 1, 2, and 5 are taken, the function returns 3 if `after=0`, but returns 6 if `after=4`.

The function is useful when a transitory grid is needed, such as for reading in data onto a subset of processors before distributing out to the full grid.

**Value**
Returns the minimum value.

---

**base.mksubmat**  
*(Un)Distribute*

**Description**
(Un)Distribute matrix.

**Usage**

```
base.mksubmat(x, descx)
```

```
base.mkgbmat(x, descx, rsrcre, csrcre)
```

**Arguments**

- `x` Matrix.
- `descx` ScaLAPACK descriptor array.
- `rsrcre, csrcre` Row/column source.
Details
For advanced users only.

---

**base.nbd**

### Next Best Divisor

**Description**
Given integers \( n \) and \( d \), with \( n > d \), this function finds the "next best divisor" of \( n \) which is greater than or equal to \( d \).

**Usage**
```
base.nbd(n, d)
```

**Arguments**
- \( n \): The dividend (number divided into).
- \( d \): The candidate divisor.

**Details**
Suprisingly useful for thinking about processor grid shapes.

**Examples**
```r
## Not run:
library(pbdbase, quiet = TRUE)
base.nbd(100, 10) # 10 divides 100, so 10 is returned
base.nbd(100, 11) # 11 does not, so the "next best" divisor, 20, is returned
```

---

**base.numroc**

### numroc

**Description**
NUMber of Rows Or Columns

**Usage**
```
base.numroc(dim, bldim, ICTXT = 0, fixme = TRUE)
```
Arguments

- dim: Global dim.
- bldim: Blocking dim.
- ICTXT: BLACS context.
- fixme: Should ldims be "rounded" to 0 or not.

Details

For advanced users only.

Determining Local Ownership of a Distributed Matrix

Description

For advanced users only.

Usage

```r
base.ownany(dim, bldim, ICTXT = 0)
```

Arguments

- dim: global dimension
- bldim: blocking dimension
- ICTXT: BLACS context

Details

A simple wrapper of numroc. The return is the answer to the question 'do I own any of the global matrix?'. Passing a distributed matrix is allowed, but often it is convenient to determine that information without even having a distributed matrix on hand. In this case, explicitly passing the appropriate information to the arguments dim=, bldim= (and CTXT= as necessary, since it defaults to 0) while leaving x missing will produce the desired result. See the examples below for more clarity.

The return for each function is local.

Examples

```r
# Not run:
#
# Save code in a file "demo.r" and run with 2 processors by
# > mpiexec -np 2 Rscript demo.r

library(pbdBASE, quiet = TRUE)
init.grid()

iown <- ownany(dim=c(4, 4), bldim=c(2, 2), CTXT=0)
```
pdcchtri

Description
Inverse of cholesky.

Usage
base.pdcchtri(uplo, x, descx, descc)

Arguments
- uplo: Triangle whose values to use.
- x: Matrix to crossprod.
- descx: ScaLAPACK descriptor array.
- descc: ScaLAPACK descriptor array of output.

Details
For advanced users only.

column.var

Description
Computes the variances of a ScaLAPCK-like distributed matrix. Significantly faster than using apply(), even in compared to the performance differences you would find comparing these two approaches using just base R.

Usage
base.pdclvar(x, descx)

Arguments
- x: The matrix.
- descx: ScaLAPACK descriptor array.
base.pdhillbmk

**Description**
Create Hilbert matrix.

**Usage**
base.pdhillbmk(descx)

**Arguments**
descx   ScaLAPACK descriptor matrix.

**Details**
For advanced users only.

base.pdmkcpn1

**Description**
Create Companion Matrix

**Usage**
base.pdmkcpn1(coef, descx)

**Arguments**
coef   Coefficients vector.
descx   ScaLAPACK descriptor array.

**Details**
For advanced users only.
**base.pdmsum**

*R-like Matrix-Vector Sum*

**Description**

For advanced users only.

**Usage**

```r
base.pdmsum(x, descx, y, descy)
```

**Arguments**

- **x**: Matrix.
- **descx, descy**: ScaLAPACK descriptor array.
- **y**: Vector.

---

**base.pdsweep**

**pdsweep**

**Description**

Matrix-Vector Sweep

**Usage**

```r
base.pdsweep(x, descx, vec, margin, fun)
```

**Arguments**

- **x**: Matrix.
- **descx**: ScaLAPACK descriptor array.
- **vec**: Vector
- **margin**: Rows or columns.
- **fun**: Function.

**Details**

For advanced users only.
base.procgrid

Description
"Optimal" process grid when nprow and npcol are empty

Usage
base.procgrid(nprocs)

Arguments
nprocs Number of processors.

Details
For advanced users only.

base.p_matexp_pade_wrap

description
p_matexp_pade_wrap

Description
Pade’ expansion.

Usage
base.p_matexp_pade_wrap(A, desca, p = 6)

Arguments
A Matrix.
desca ScaLAPACK descriptor array.
p Order of the Pade’ approximation.

Details
For advanced users only.
**base.p_matpow_by_squaring_wrap**

**Description**
Matrix power by squaring.

**Usage**
```r
base.p_matpow_by_squaring_wrap(A, desca, b = 1)
```

**Arguments**
- **A**  
  Matrix.
- **desca**  
  ScaLAPACK descriptor array.
- **b**  
  Power.

**Details**
For advanced users only.

---

**base.rcolcpy**

**R Column Copy**

**Description**
For advanced users only.

**Usage**
```r
base.rcolcpy(x, descx, y, descy, xcol, ycol)
```

**Arguments**
- **x, y**  
  Matrix.
- **descx, descy**  
  ScaLAPACK descriptor array.
- **xcol, ycol**  
  Columns.


---

**base.rcolcpy2**

**R Column Copy-2**

---

**Description**

For advanced users only.

**Usage**

```
base.rcolcpy2(xL, descxL, yL, descyL, xcolL, ycolL)
```

**Arguments**

- `xL`, `yL` : Matrix.
- `descxL`, `descyL` : ScaLAPACK descriptor array.
- `xcolL`, `ycolL` : Columns.

---

**base.redist**

**base.redist**

---

**Description**

Redistribute a matrix from rank 0 to all ranks in block cyclic fashion.

**Usage**

```
base.redist(descL, A)
```

**Arguments**

- `descL` : ScaLAPACK descriptor array.
- `A` : Matrix.
Level 2 R-like BLAS

Description
For advanced users only.

Usage
base.r2blas(x, descx, vec, FUN)

Arguments
- x: Matrix.
- descx: ScaLAPACK descriptor array.
- vec: Global vector.
- FUN: Function.

R-like Matrix-Vector Insertion

Description
For advanced users only.

Usage
base.r2insert(x, descx, vec, i, j)

Arguments
- x: Matrix.
- descx: ScaLAPACK descriptor array.
- vec: Global vector.
- i, j: Indices.
**base.rpdgecon**  
**rpdgcon**

**Description**
Inverse condition number of a general matrix.

**Usage**
base.rpdgecon(norm, m, n, a, desca)

**Arguments**
- **norm**  
  Type of norm.
- **m, n**  
  Problem size.
- **a**  
  Matrix.
- **desca**  
  ScaLAPACK descriptor array.

**Details**
For advanced users only.

**base.rpdgels**  
**rpdgels**

**Description**
Linear model fitter via rank-revealing QR (with pivoting).

**Usage**
base.rpdgels(tol, m, n, nrhs, a, desca, b, descb)

**Arguments**
- **tol**  
  Numerical tolerance for the QR.
- **m, n**  
  Problem size.
- **nrhs**  
  Number of right hand sides.
- **a**  
  Left hand side.
- **desca**  
  ScaLAPACK descriptor array.
- **b**  
  Right hand side.
- **descb**  
  ScaLAPACK descriptor array.

**Details**
For advanced users only.
**Description**

Matrix-Matrix Multiply.

**Usage**

```plaintext
base.nrpdgemm(transxL, transyL, xL, descxL, yL, descyL, descc)
```

**Arguments**

- `transxL, transy` 'T' or 'N' for transpose or not.
- `x, y` Matrix.
- `descx, descy, descc` ScaLAPACK descriptor array.

**Details**

For advanced users only.

---

**Description**

General 2d block cyclic redistribution function.

**Usage**

```plaintext
base.rpdgemr2d(x, descx, descy)
```

**Arguments**

- `x` Matrix.
- `descx, descy` ScaLAPACK descriptor array.

**Details**

For advanced users only.
Description
QR.

Usage
base.rpdgeqpf(tol, m, n, x, descx)

Arguments
tol Numerical tolerance for the QR.
 m, n Problem size.
x Matrix.
descx ScaLAPACK descriptor array.

Details
For advanced users only.

Description
Solving a (square) system of equations.

Usage
base.rpdgesv(n, nrhs, a, desca, b, descb)

Arguments
 n Problem size.
 nrhs Number of right hand sides.
a, b Matrix.
desca, descb ScaLAPACK descriptor array.

Details
For advanced users only.
**base.rpdgesvd**

**Description**

SVD.

**Usage**

```python
base.rpdgesvd(jobuL, jobvt, mL, nL, aL, descaL, descuL, descvtL, ..., inplace = false)
```

**Arguments**

- `jobuL, jobvt` Control for u/vt return.
- `mL, nL` Problem size.
- `aL` Matrix.
- `descaL, descuL, descvtL` ScaLAPACK descriptor array.
- `...` Ignored
- `inplace` Should the computation be done in-place or not. For REALLY advanced users only.

**Details**

For advanced users only.

---

**base.rpdgetrf**

**Description**

LU factorization.

**Usage**

```python
base.rpdgetrf(aL, descaL)
```

**Arguments**

- `aL` Matrix.
- `descaL` ScaLAPACK descriptor array.

**Details**

For advanced users only.
**Description**

Matrix inversion.

**Usage**

```
base.rpdgetri(n, a, desca)
```

**Arguments**

- **n**: Problem size.
- **a**: Matrix.
- **desca**: ScaLAPACK descriptor array.

**Details**

For advanced users only.

---

**Description**

Matrix norms.

**Usage**

```
base.rpdlange(norm, m, n, a, desca)
```

**Arguments**

- **norm**: Type of norm.
- **m, n**: Problem size
- **a**: Matrix.
- **desca**: ScaLAPACK descriptor array.

**Details**

For advanced users only.
**base.rpdlaprnt**

---

**Description**
Matrix printer.

**Usage**
base.rpdlaprnt(m, n, a, desca)

**Arguments**
- **m, n**: Number rows/cols.
- **a**: Matrix.
- **desca**: ScaLAPACK descriptor array.

**Details**
For advanced users only.

---

**base.rpdorgqr**

---

**Description**
Recover Q.

**Usage**
base.rpdorgqr(m, n, k, qr, descqr, tau)

**Arguments**
- **m, n**: Problem size.
- **k**: Number of elementary reflectors.
- **qr**: QR decomposition.
- **descqr**: ScaLAPACK descriptor array.
- **tau**: Elementary reflectors.

**Details**
For advanced users only.
**Description**

\[ \text{op}(Q)^* y. \]

**Usage**

\[
\text{base.rpdormqr} (\text{side}, \text{trans}, m, n, k, \text{qr}, \text{descqr}, \text{tau}, c, \text{descc})
\]

**Arguments**

- **side**
  'L' or 'R', for left or right application of Q matrix.
- **trans**
  Q or \( Q^T \).
- **m, n**
  Problem size.
- **k**
  Number of elementary reflectors.
- **qr**
  QR decomposition.
- **descqr**
  ScaLAPACK descriptor array.
- **tau**
  Elementary reflectors.
- **c**
  Vector.
- **descc**
  ScaLAPACK descriptor array.

**Details**

For advanced users only.

---

**Description**

Cholesky factorization.

**Usage**

\[
\text{base.rpdpotrf} (\text{uplo}, n, a, \text{desca})
\]

**Arguments**

- **uplo**
  Triangle where the information is stored (in the symmetric matrix).
- **n**
  Problem size.
- **a**
  Matrix.
- **desca**
  ScaLAPACK descriptor array.
Details
For advanced users only.

---

**base.rpdsyevr**  **rpdsyevr**

Description
Symmetric eigenvalue decomposition.

Usage
```
base.rpdsyevr(jobz, uplo, n, a, desca, descz)
```

Arguments
- **jobz**: Control for if vectors/values/both are returned.
- **uplo**: Triangle where the information is stored (in the symmetric matrix).
- **n**: Problem size.
- **a**: Matrix.
- **desca, descz**: ScaLAPACK descriptor array.

Details
For advanced users only.

---

**base.rpdsyevx**  **rpdsyevx**

Description
Generalized eigenvalue problem.

Usage
```
base.rpdsyevx(jobz, range, n, a, desca, vl, vu, il, iu, abstol = 1e-08, orfac = 0.001)
```
Arguments

jobz Control for if vectors/values/both are returned.
range Parameter to determine the search criteria for eigenvalues.
n Problem size.
a Matrix.
desca ScaLAPACK descriptor array.
vL, vu Endpoints of the interval subset of the real line in which to search for eigenvalues, if specified by range.
il, iu Eigenvalues with indices iL, ..., iu will be found, if specified by range.
abstol Absolute error tolerance for the eigenvalues.
orfac Eigenvectors with eigenvalues below orfac*norm(a) of each other are reorthogonalized.

Details

For advanced users only.

base.rpdtran rpdtran

Description

Transpose.

Usage

base.rpdtran(a, desca, descc)

Arguments

a Matrix.
desca, descc ScaLAPACK descriptor array.

Details

For advanced users only.
**Description**
Inverse condition number of a triangular matrix.

**Usage**
base.rpdtrcon(norm, uplo, diag, n, a, desca)

**Arguments**
- **norm**: Type of norm.
- **uplo**: Triangle where information is stored.
- **diag**: Specifies if the matrix is unit triangular or not.
- **n**: Problem size
- **a**: Matrix.
- **desca**: ScaLAPACK descriptor array.

**Details**
For advanced users only.

---

**Description**
For advanced users only.

**Usage**
base.rrowcpy(x, descx, y, descy, xrow, yrow)

**Arguments**
- **x, y**: Matrix.
- **descx, descy**: ScaLAPACK descriptor array.
- **xrow, yrow**: Rows.
**Description**

For advanced users only.

**Usage**

```r
base.rrowcpy2(x, descx, y, descy, xrow, yrow)
```

**Arguments**

- `x, y` Matrix.
- `descx, descy` ScaLAPACK descriptor array.
- `xrow, yrow` Rows.

---

**Description**

Zero Triangle

**Usage**

```r
base.tri2zero(x, descx, uplo = "L", diag = "N")
```

**Arguments**

- `x` Matrix.
- `descx` ScaLAPACK descriptor array.
- `uplo` Triangle.
- `diag` Zero diagonal as well.

**Details**

For advanced users only.
**base.valid_context**  
*BLACS Context Validation*

**Description**
Checks if a supplied ICTXT is valid.

**Usage**

base.valid_context(ICTXT, ..., override = FALSE)

**Arguments**

- **ICTXT**: BLACS context number.
- **...**: Not used.
- **override**: If override=FALSE, the context number will produce an error if it is any of the reserved contexts (0, 1, or 2).

**blacsexit**  
*BLACS Exit*

**Description**
Shuts down all BLACS communicators.

**Usage**

base.blacsexit(CONT = TRUE)

blacsexit(CONT = TRUE)

**Arguments**

- **CONT**: logical; determines whether or not to shut down all MPI communicators

**Details**
If the user wishes to shut down BLACS communicators but still have access to MPI, then call this function with CONT=TRUE. Calling blacsexit(CONT=FALSE) will shut down all MPI communicators, equivalent to calling

> blacsexit(CONT=TRUE) > finalize(mpi.finalize=TRUE)

This function is automatically invoked if BLACS communicators are running and finalize() is called.
Value

Has an invisible return of 0 when successful.

Examples

```r
## Not run:
# Save code in a file "demo.r" and run with 2 processors by
# > mpiexec -np 2 Rscript demo.r

library(pbdBASE, quiet = TRUE)
init.grid()
blacsexit()
finalize()

## End(Not run)
```

---

### coords

**Local to Global/Global to Local Indexing**

#### Description

Get the local index given global information.

#### Usage

```r
indxg2l(INDXGLOB, NB, IPROC, ISRCPROC, NPROCS)

indx12g(INDXLOC, NB, IPROC, ISRCPROC, NPROCS)
```

#### Arguments

- **INDXGLOB**: Global index.
- **NB**: Block size.
- **IPROC**: Coordinate of the process whose local info is to be determined.
- **ISRCPROC**: The coordinate of the process that possesses the first row/column of the distributed matrix. That’s always 0 pbdMAT.
- **NPROCS**: Total number of processors over which matrix is distributed.
- **INDXLOC**: Local index.

#### Details

For advanced users only.
Global to Local/Local to Global Pair Indexing

Description
Get the local index-pair given global information.

Usage
- \texttt{g2lpair}(gi, gj, bldim, ICTXT)
- \texttt{l2gpair}(i, j, bldim, ICTXT)

Arguments
- \texttt{gi, gj} \hspace{1em} Global indices.
- \texttt{bldim} \hspace{1em} Blocking dimension
- \texttt{ICTXT} \hspace{1em} BLACS context.
- \texttt{i, j} \hspace{1em} Local indices.

Details
For advanced users only.

diag

Description
Grab diagonal or create distributed diagonal matrix.

Usage
- \texttt{base.ddiagtk}(x, descx, proc.dest = "all")
- \texttt{base.ddiagmk}(diag, descx)

Arguments
- \texttt{x} \hspace{1em} Matrix.
- \texttt{descx} \hspace{1em} ScaLAPACK descriptor array.
- \texttt{proc.dest} \hspace{1em} Who owns the result.
- \texttt{diag} \hspace{1em} Diagonal.

Details
For advanced users only.
**finalizer**

**Finalizer**

**Description**

A replacement for pbdMPI::finalize() that automatically shuts BLACS communicators down.

**Usage**

```r
base.finalize(mpi.finalize = .pbd_env$SPMD.CT$mpi.finalize)
```

```r
finalize(mpi.finalize = .pbd_env$SPMD.CT$mpi.finalize)
```

**Arguments**

- `mpi.finalize` If MPI should be shut down.

---

**g2lcoord**

**g2lcoord**

**Description**

Global to local coordinates with explicit ownership given.

**Usage**

```r
g2lcoord(dim, bldim, gi, gj, gridinfo)
```

**Arguments**

- `dim` Global dimension.
- `bldim` Blocking dimension.
- `gi, gj` Global row and column indices, respectively.
- `gridinfo` The return of base.blacs(ICTXT(x)). See the Details section for more information.

**Value**

For the process that owns the desired local data at global indices `(gi, gj)`, the return is the local index. Otherwise, `NA` is returned.
**g2l_coord**

**Description**
Global to local coords.

**Usage**
base.g2l_coord(ind, dim, bldim, ICTXT = 0)
g2l_coord(ind, dim, bldim, ICTXT = 0)

**Arguments**
ind  Matrix indices.
dim  Global dim.
bldim Blocking dimension.
ICTXT BLACS context.

**Details**
For advanced users only.

**gridexit**

**Description**
Frees a BLACS context.

**Usage**
base.gridexit(ICTXT, override = FALSE)
ggridexit(ICTXT, override = FALSE)

**Arguments**
ICTXT  BLACS context number.
override logical; if TRUE, ignores normal check preventing the closing of ICTXT values of 0, 1, and 2. This could cause things to go crazy and I do not recommend it.
gridinfo  

Details
For advanced users only.
The function frees the requested BLACS context. It is a trivial wrapper for the BLACS routine BLACS_GRIDEXIT. Also removes the object .__blacs_gridinfo__ICTXT.
Contexts 0, 1, and 2 can not be freed in this way unless the argument override=FALSE. This will probably break something and I do not recommend it.

Value
Silently returns 0 when successful. Silently returns 1 when requested ICTXT does not exist.

gridinfo Get BLACS Context Grid Information

Description
Grabs the existing BLACS context grid information.

Usage
base.blacs(ICTXT = 0)
blacs(ICTXT = 0)

Arguments
ICTXT BLACS context number.

Details
BLACS contexts have important internal use, and advanced users familiar with ScaLAPACK might find some advantage in directly manipulating these process grids. Most users should not need to directly manage BLACS contexts, in this function or elsewhere.
The function effectively serves as a shorthand for
eval(parse(text=paste("._blacs_gridinfo_", ICTXT, sep="")))

Value
Returns a list with 5 elements: NPROW and NPCOL, the number of process rows and columns respectively; ICTXT, the associated BLACS context number; MYROW and MYCOL, the current process’ row and column position in the process grid.
Examples

## Not run:

```
# Not run:  
# Save code in a file "demo.r" and run with 2 processors by  
# > mpiexec -np 2 Rscript demo.r

library(pbdBASE, quiet = TRUE)  
init.grid()

mygrid <- blacs(0)  
pbdMPI::comm.print(mygrid)

finalize()

## End(Not run)
```

---

**gridinit**

**blacs_gridinit**

### Description

BLACS grid initialization.

### Usage

```
base.blacs_gridinit(ICTXT, NPROW, NPCOL, ..., quiet = FALSE)

blacs_gridinit(ICTXT, NPROW, NPCOL, ..., quiet = FALSE)
```

### Arguments

- **ICTXT**: BLACS context.
- **NPROW, NPCOL**: Number of process rows/cols.
- **...**: Additional arguments.
- **quiet**: Verbose initialization or not.

### Details

For advanced users only.
**InitGrid**

**Initialize Process Grid**

**Description**

Manages the creation of BLACS context grids.

**Usage**

```plaintext
init.grid(NPROW, NPCOL, ICTXT, quiet = FALSE)
```

**Arguments**

- **NPROW**
  - number of process rows. Can be missing; see details.
- **NPCOL**
  - number of process columns. Can be missing; see details.
- **ICTXT**
  - BLACS context number.
- **quiet**
  - logical; controls whether or not information about grid size should be printed.

**Details**

`blacs_gridinit()` is for experienced users only. It is a shallow wrapper of the BLACS routine `BLACS_GRIDINIT`, with the addition of creating the .`_blacs_gridinfo_`ICTXT objects, as described below.

The remainder of this section applies only to `init.grid()`.

If `ICTXT` is missing, three variables will be created in the .`pdbBASEEnv` environment:

- `.blacs_gridinfo_0`
- `.blacs_gridinfo_1`
- `.blacs_gridinfo_2`

These variables store the BLACS process grid information for the BLACS context corresponding to the trailing digit of the variable. Most users should invoke `init.grid()` in this fashion, namely with `ICTXT` missing, and only do so once.

Contexts 0, 1, and 2 are reserved. Additional custom contexts are possible to create, but they must be integers >= 3.

Context 0 is the “full” process grid of NPROW by NPCOL processes; contexts 1 is the process grid consisting of 1 process row and NPROW*NPCOL processes columns; context 2 is the process grid consisting of NPROW*NPCOL processes rows and 1 process column. These contexts can be redundant depending on the number of processes available.

BLACS contexts have important internal use, and advanced users familiar with ScaLAPACK might find some advantage in directly manipulating these process grids. Most users should not need to directly manage BLACS contexts, in this function or elsewhere.

If the NPROW and NPCOL values are missing, then a best process grid will be chosen for the user based on the total available number of processes. Here “best” means as close to a square grid as possible.
The variables .__blacs_gridinfo_ICTXT are just storage mechanisms to avoid needing to directly invoke the BLACS routine BLACS_GRIDINFO.
Additionally, another variable is created in the .pdbBASEEnv environment, namely .__blacs_initialized. Its existence is to alert finalize() to shut down BLACS communicators, if necessary, to prevent memory leaks.

Value
Silently returns 0 when successful. Additionally, several variables are created in the .pdbBASEEnv environment. See Details section.

Examples
```r
## Not run:
# Save code in a file "demo.r" and run with 2 processors by
# > mpiexec -np 2 Rscript demo.r

library(pdbBASE, quiet = TRUE)
init.grid()
finalize()

## End(Not run)
```

### l2g_coord

**Description**
Local to global coords.

**Usage**

`base.l2g_coord(ind, dim, bldim, ICTXT = 0)`

`l2g_coord(ind, dim, bldim, ICTXT = 0)`

**Arguments**

- `ind` Matrix indices.
- `dim` Global dim.
- `bldim` Blocking dimension.
- `ICTXT` BLACS context.

**Details**
For advanced users only.
Description

A better version of NUMROC (NUMber Rows Or Columns). Returns the local dimension given global matrix + distribution parameters.

Usage

```c
numroc2(N, NB, IPROC, NPROCS)
```

Arguments

- **N**: Global number of rows/cols.
- **NB**: Block size.
- **IPROC**: Coordinate of the process whose local info is to be determined.
- **NPROCS**: Total number of processors over which matrix is distributed.

Details

For advanced users only.

Interchange Between Process Number and BLACS Coordinates

Description

Grabs the existing BLACS context grid information.

Usage

```c
base.pnum(ICTXT, PROW, PCOL)
base.pcoord(ICTXT, PNUM)
```

Arguments

- **ICTXT**: BLACS context number.
- **PROW, PCOL**: BLACS grid location row/column
- **PNUM**: process rank
**Details**

For advanced users only. These functions are simple recreations of the BLACS routines `BLACS_PNUM` and `BLACS_PCOORD`. The former gets the process number associated with the BLACS process grid location `c(MYPROW, MYPOL)`, while the latter does the reverse.

**Value**

`pnum` returns an integer; `pcoord` returns a list containing elements `PROW` and `PCOL`.

**Examples**

```r
## Not run:
# Save code in a file "demo.r" and run with 2 processors by
# > mpiexec -np 2 Rscript demo.r

library(pbdBASE, quiet = TRUE)
init.grid()

blacs_ <- blacs(ICTXT = 0)

# get the ICTXT = 0 BLACS coordinates for process 0
myCoords <- pcoord(ICTXT = 0, PNUM = 0)

comm.print(myCoords)

finalize()

## End(Not run)
```
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