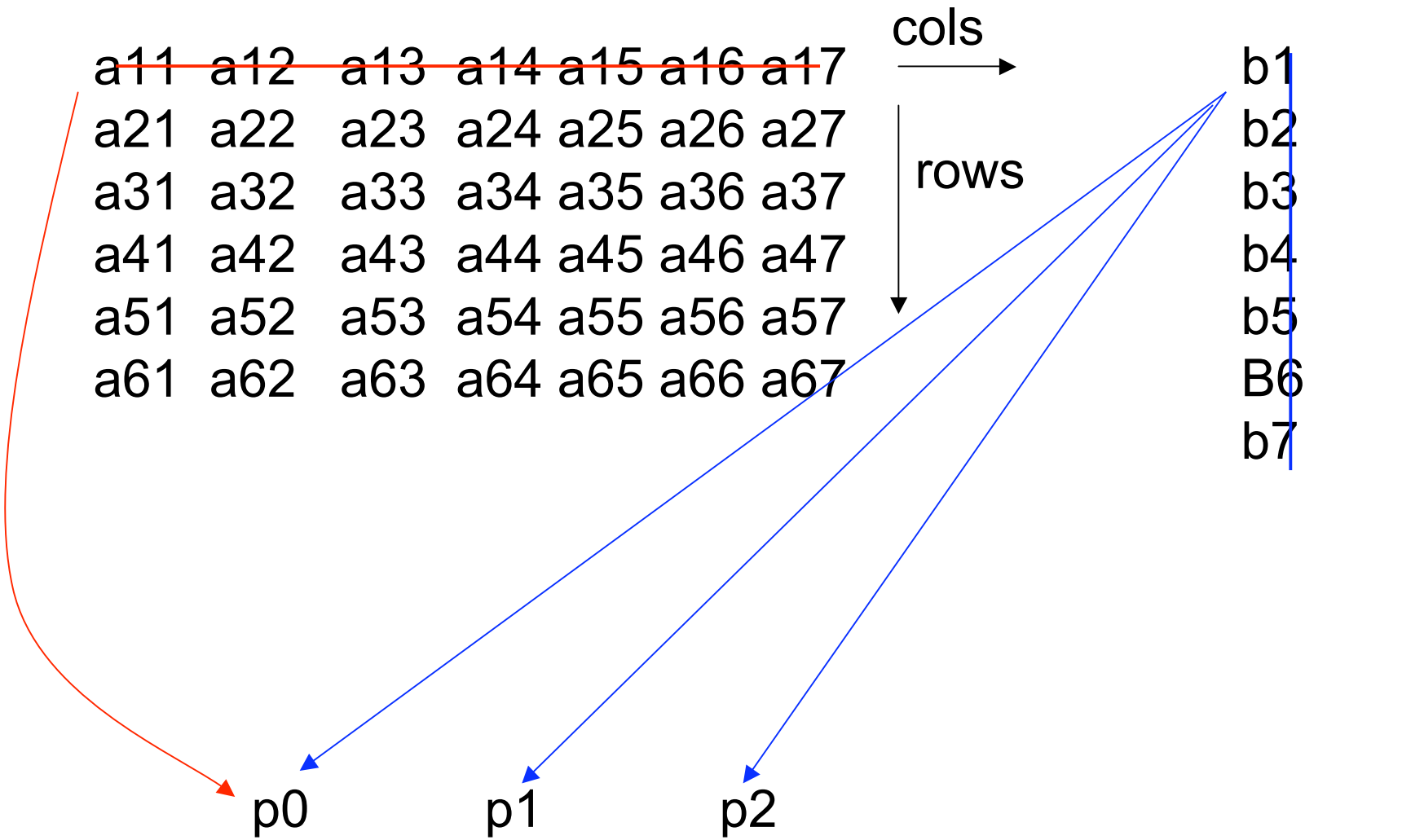
Matrix-Vector Multiplication: Master-Slave

```
 program main
include 'mpif.h'
integer MAX_ROWS, MAX_COLS, rows, cols
parameter (MAX_ROWS = 1000, MAX_COLS = 1000)
double precision a(MAX_ROWS,MAX_COLS), b(MAX_COLS), c(MAX_ROWS)
double precision buffer(MAX_COLS), ans

integer myid, master, numprocs, ierr, status(MPI_STATUS_SIZE)
integer i, j, numsent, sender
integer anstype, row

call MPI_INIT( ierr )
call MPI_COMM_RANK( MPI_COMM_WORLD, myid, ierr )
call MPI_COMM_SIZE( MPI_COMM_WORLD, numprocs, ierr )
master = 0

rows   = 100
cols   = 100
```



Bn x Anm =Cm

Note: B's row is A's col

```
 if ( myid .eq. master ) then
c    master initializes and then dispatches
c    initialize a and b  (arbitrary)
      do 20 j = 1,cols
        b(j) = 1
        do 10 i = 1,rows
          a(i,j) = i
 10     continue
 20   continue
      numsent = 0
c     send b to each slave process
      call MPI_BCAST(b, cols, MPI_DOUBLE_PRECISION, master,
     &               MPI_COMM_WORLD, ierr)
c     send a column to each slave process; tag with col id
      do 40 i = 1,min(numprocs-1,rows)
        do 30 j = 1,cols
c 1D array for address
          buffer(j) = a(i,j)
 30     continue
        call MPI_SEND(buffer, cols, MPI_DOUBLE_PRECISION, i,
     &                i, MPI_COMM_WORLD, ierr)
        numsent = numsent+1
 40   continue
```

```
do 70 i = 1,rows
      call MPI_RECV(ans, 1, MPI_DOUBLE_PRECISION,
   &                MPI_ANY_SOURCE, MPI_ANY_TAG,
   &                MPI_COMM_WORLD, status, ierr)
      sender     = status(MPI_SOURCE)
      anstype    = status(MPI_TAG)       ! col is tag value
      c(anstype) = ans
      if (numsent .lt. cols) then        ! send another col
        do 50 j = 1,rows
          buffer(j) = a(j, numsent+1)
50        continue
        call MPI_SEND(buffer, cols, MPI_DOUBLE_PRECISION,
   &                  sender, numsent+1, MPI_COMM_WORLD, ierr)
        numsent = numsent+1
      else      ! Tell sender that there is no more work
        call MPI_SEND(1, 0, MPI_DOUBLE_PRECISION,
   &                  sender, 0, MPI_COMM_WORLD, ierr)  !tag=0
      endif
70    continue
```

```
 else
c       slaves receive b, then compute dot products until
c       done message received. Why we need the following?
        call MPI_BCAST(b, cols, MPI_DOUBLE_PRECISION, master,
     &                 MPI_COMM_WORLD, ierr)
c       skip if more processes than work
        if (myid.gt. cols)
     &      goto 200
 90     call MPI_RECV(buffer, cols, MPI_DOUBLE_PRECISION, master,
     &                MPI_ANY_TAG, MPI_COMM_WORLD, status, ierr)
        if (status(MPI_TAG) .eq. 0) then
          go to 200
        else
          row = status(MPI_TAG)
          ans = 0.0
          do 100 i = 1,cols
            ans = ans+buffer(i)*b(i)
 100        continue
          call MPI_SEND(ans, 1, MPI_DOUBLE_PRECISION, master,
     &                  row, MPI_COMM_WORLD, ierr)
          go to 90
        endif
 200    continue
      endif
```

```
call MPI_FINALIZE(ierr)
      stop
      end
```