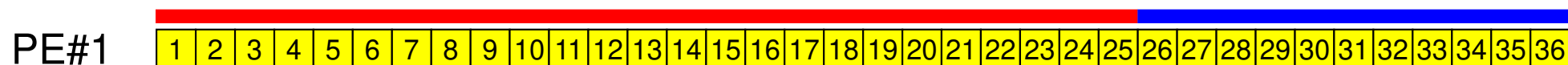
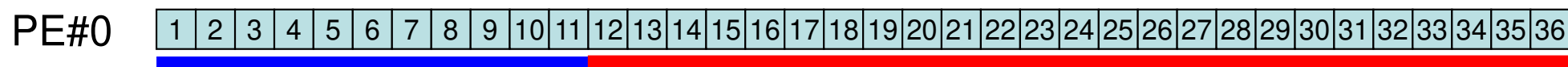


## Ex.2: Send-Recv an Array (1/4)

- Exchange VEC (real, 8-byte) between PE#0 & PE#1
- PE#0 to PE#1
  - PE#0: send VEC(1)-VEC(11) (length=11)
  - PE#1: recv. as VEC(26)-VEC(36) (length=11)
- PE#1 to PE#0
  - PE#1: send VEC(1)-VEC(25) (length=25)
  - PE#0: recv. as VEC(12)-VEC(36) (length=25)



# Practice: t1

- Initial status of VEC(:):
  - PE#0 VEC(1-36) = 101,102,103,~,135,136
  - PE#1 VEC(1-36) = 201,202,203,~,235,236
- Sample codes are in the following directory.  
`/work/gt00/z30088/pFEM/answer/t1`
- Copy them to <\$O-S2>  
`/work/gt18/t18XXX/pFEM/mpi/S2`

# Notice: Send/Recv Arrays

```
#PE0  
send:  
  VEC (start_send) ~  
  VEC (start_send+length_send-1)
```

```
#PE1  
send:  
  VEC (start_send) ~  
  VEC (start_send+length_send-1)
```

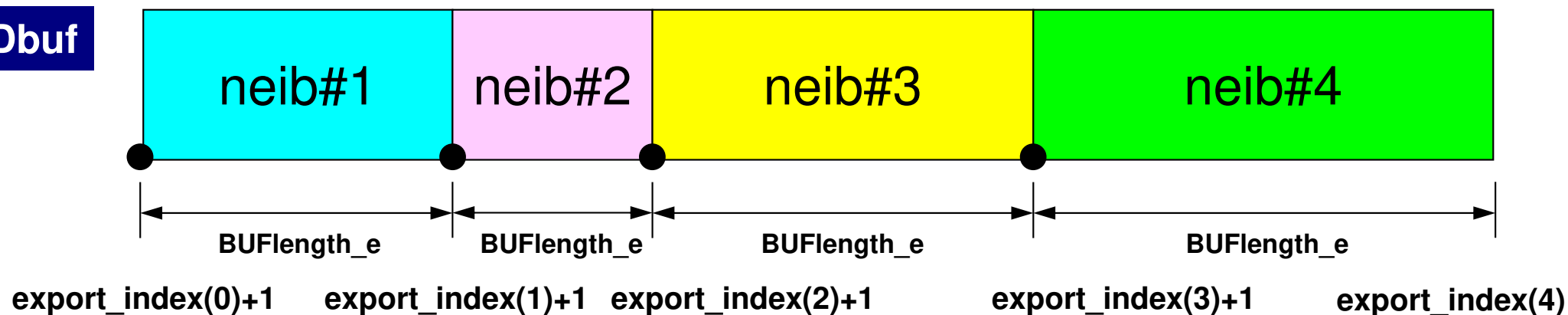
```
#PE0  
recv:  
  VEC (start_recv) ~  
  VEC (start_recv+length_recv-1)
```

```
#PE1  
recv:  
  VEC (start_recv) ~  
  VEC (start_recv+length_recv-1)
```

- “length\_send” of sending process must be equal to “length\_recv” of receiving process.
  - PE#0 to PE#1, PE#1 to PE#0
- “sendbuf” and “recvbuf”: different address

# SEND: MPI\_Isend/Irecv/Waitall

**SENDbuf**



```
do neib= 1, NEIBPETOT
```

```
  iS_e= export_index(neib-1) + 1
```

```
  iE_e= export_index(neib )
```

```
  BUFlength_e= iE_e + 1 - iS_e
```

```
  call MPI_ISEND
```

```
&      (SENDbuf(iS_e), BUFlength_e, MPI_INTEGER,
```

```
&      NEIBPE(neib), 0, MPI_COMM_WORLD,
```

```
&      request_send(neib), ierr)
```

```
enddo
```

```
call MPI_WAITALL (NEIBPETOT, request_send, stat_recv, ierr)
```

# RECV: MPI\_Isend/Irecv/Waitall

```
do neib= 1, NEIBPETOT
```

```
  iS_i= import_index(neib-1) + 1
```

```
  iE_i= import_index(neib )
```

```
  BUFlength_i= iE_i + 1 - iS_i
```

```
  call MPI_Irecv
```

```
&    (RECVbuf(iS_i), BUFlength_i, MPI_INTEGER,
```

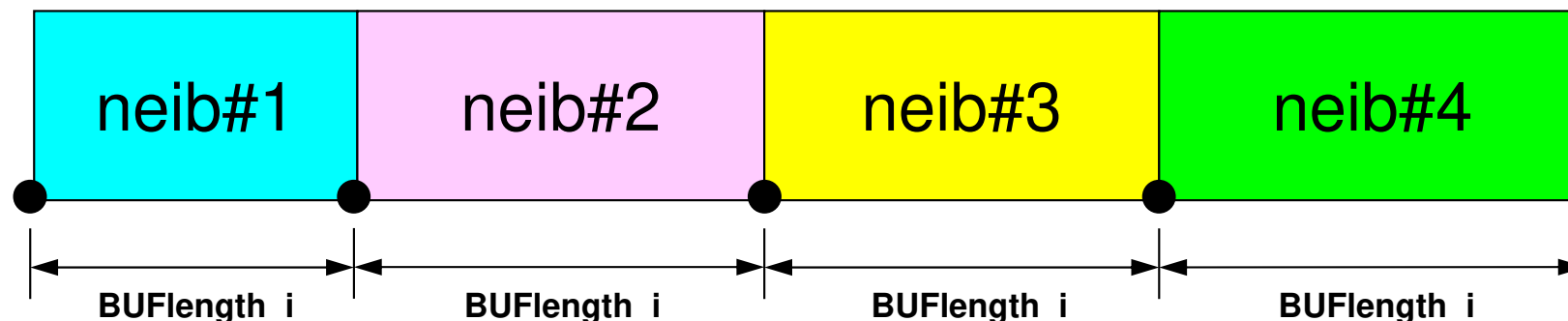
```
&    NEIBPE(neib), 0, MPI_COMM_WORLD,
```

```
&    request_recv(neib), ierr)
```

```
enddo
```

```
call MPI_WAITALL (NEIBPETOT, request_recv, stat_recv, ierr)
```

**RECVbuf**



import\_index(0)+1    import\_index(1)+1    import\_index(2)+1    import\_index(3)+1    import\_index(4)

# Example: Fortran (1/3)

## Isend/Irecv/Waitall

```
$> cd /work/gt18/t18XXX/pFEM/mpi/S2
$> module load fj
$> mpifrtpx -Kfast ex2a.f
$> pjsub go2.sh
```

```
implicit REAL*8 (A-H,O-Z)
include 'mpif.h'

integer(kind=4) :: my_rank, PETOT, NEIB
real (kind=8) :: VEC(36)

integer(kind=4), dimension(MPI_STATUS_SIZE,1) :: stat_send
integer(kind=4), dimension(MPI_STATUS_SIZE,1) :: stat_recv
integer(kind=4), dimension(1) :: request_send
integer(kind=4), dimension(1) :: request_recv

integer(kind=4) :: start_send, length_send
integer(kind=4) :: start_recv, length_recv

call MPI_INIT (ierr)
call MPI_COMM_SIZE (MPI_COMM_WORLD, PETOT, ierr )
call MPI_COMM_RANK (MPI_COMM_WORLD, my_rank, ierr )
```

# Example: Fortran (2/3)

Fortran

## Isend/Irecv/Waitall

```
if (my_rank.eq.0) then
  NEIB= 1
  start_send= 1
  length_send= 11
  start_recv= length_send + 1
  length_recv= 25
  do i= 1, 36
    VEC(i)= 100 + i
  enddo
endif

if (my_rank.eq.1) then
  NEIB= 0
  start_send= 1
  length_send= 25
  start_recv= length_send + 1
  length_recv= 11
  do i= 1, 36
    VEC(i)= 200 + i
  enddo
endif

do i= 1, 36
  write (*,'(i1,a,i2,f10.0)') my_rank, ' #BEFORE# ', i,VEC(i)
enddo
```

# Example: Fortran (3/3)

Fortran

## Isend/Irecv/Waitall

```
call MPI_ISEND (VEC(start_send), length_send,           &
&              MPI_DOUBLE_PRECISION, NEIB, 0, MPI_COMM_WORLD, &
&              request_send(1), ierr)
call MPI_IRECV (VEC(start_recv), length_recv,           &
&              MPI_DOUBLE_PRECISION, NEIB, 0, MPI_COMM_WORLD, &
&              request_recv(1), ierr)

call MPI_WAITALL (1, request_recv, stat_recv, ierr)
call MPI_WAITALL (1, request_send, stat_send, ierr)

do i= 1, 36
  write (*,'(i1,a,i2,f10.0)') my_rank, ' #AFTER # ', i,VEC(i)
enddo

call MPI_FINALIZE (ierr)

end
```

- Portability !
- “Data (structure) is everything”... don't you agree with that ?



# Results

```

0 #BEFORE# 1      101.
0 #BEFORE# 2      102.
0 #BEFORE# 3      103.
0 #BEFORE# 4      104.
0 #BEFORE# 5      105.
0 #BEFORE# 6      106.
0 #BEFORE# 7      107.
0 #BEFORE# 8      108.
0 #BEFORE# 9      109.
0 #BEFORE# 10     110.
0 #BEFORE# 11     111.
0 #BEFORE# 12     112.
0 #BEFORE# 13     113.
0 #BEFORE# 14     114.
0 #BEFORE# 15     115.
0 #BEFORE# 16     116.
0 #BEFORE# 17     117.
0 #BEFORE# 18     118.
0 #BEFORE# 19     119.
0 #BEFORE# 20     120.
0 #BEFORE# 21     121.
0 #BEFORE# 22     122.
0 #BEFORE# 23     123.
0 #BEFORE# 24     124.
0 #BEFORE# 25     125.
0 #BEFORE# 26     126.
0 #BEFORE# 27     127.
0 #BEFORE# 28     128.
0 #BEFORE# 29     129.
0 #BEFORE# 30     130.
0 #BEFORE# 31     131.
0 #BEFORE# 32     132.
0 #BEFORE# 33     133.
0 #BEFORE# 34     134.
0 #BEFORE# 35     135.
0 #BEFORE# 36     136.

```

```

0 #AFTER # 1      101.
0 #AFTER # 2      102.
0 #AFTER # 3      103.
0 #AFTER # 4      104.
0 #AFTER # 5      105.
0 #AFTER # 6      106.
0 #AFTER # 7      107.
0 #AFTER # 8      108.
0 #AFTER # 9      109.
0 #AFTER # 10     110.
0 #AFTER # 11     111.
0 #AFTER # 12     201.
0 #AFTER # 13     202.
0 #AFTER # 14     203.
0 #AFTER # 15     204.
0 #AFTER # 16     205.
0 #AFTER # 17     206.
0 #AFTER # 18     207.
0 #AFTER # 19     208.
0 #AFTER # 20     209.
0 #AFTER # 21     210.
0 #AFTER # 22     211.
0 #AFTER # 23     212.
0 #AFTER # 24     213.
0 #AFTER # 25     214.
0 #AFTER # 26     215.
0 #AFTER # 27     216.
0 #AFTER # 28     217.
0 #AFTER # 29     218.
0 #AFTER # 30     219.
0 #AFTER # 31     220.
0 #AFTER # 32     221.
0 #AFTER # 33     222.
0 #AFTER # 34     223.
0 #AFTER # 35     224.
0 #AFTER # 36     225.

```

```

1 #BEFORE# 1      201.
1 #BEFORE# 2      202.
1 #BEFORE# 3      203.
1 #BEFORE# 4      204.
1 #BEFORE# 5      205.
1 #BEFORE# 6      206.
1 #BEFORE# 7      207.
1 #BEFORE# 8      208.
1 #BEFORE# 9      209.
1 #BEFORE# 10     210.
1 #BEFORE# 11     211.
1 #BEFORE# 12     212.
1 #BEFORE# 13     213.
1 #BEFORE# 14     214.
1 #BEFORE# 15     215.
1 #BEFORE# 16     216.
1 #BEFORE# 17     217.
1 #BEFORE# 18     218.
1 #BEFORE# 19     219.
1 #BEFORE# 20     220.
1 #BEFORE# 21     221.
1 #BEFORE# 22     222.
1 #BEFORE# 23     223.
1 #BEFORE# 24     224.
1 #BEFORE# 25     225.
1 #BEFORE# 26     226.
1 #BEFORE# 27     227.
1 #BEFORE# 28     228.
1 #BEFORE# 29     229.
1 #BEFORE# 30     230.
1 #BEFORE# 31     231.
1 #BEFORE# 32     232.
1 #BEFORE# 33     233.
1 #BEFORE# 34     234.
1 #BEFORE# 35     235.
1 #BEFORE# 36     236.

```

```

1 #AFTER # 1      201.
1 #AFTER # 2      202.
1 #AFTER # 3      203.
1 #AFTER # 4      204.
1 #AFTER # 5      205.
1 #AFTER # 6      206.
1 #AFTER # 7      207.
1 #AFTER # 8      208.
1 #AFTER # 9      209.
1 #AFTER # 10     210.
1 #AFTER # 11     211.
1 #AFTER # 12     212.
1 #AFTER # 13     213.
1 #AFTER # 14     214.
1 #AFTER # 15     215.
1 #AFTER # 16     216.
1 #AFTER # 17     217.
1 #AFTER # 18     218.
1 #AFTER # 19     219.
1 #AFTER # 20     220.
1 #AFTER # 21     221.
1 #AFTER # 22     222.
1 #AFTER # 23     223.
1 #AFTER # 24     224.
1 #AFTER # 25     225.
1 #AFTER # 26     101.
1 #AFTER # 27     102.
1 #AFTER # 28     103.
1 #AFTER # 29     104.
1 #AFTER # 30     105.
1 #AFTER # 31     106.
1 #AFTER # 32     107.
1 #AFTER # 33     108.
1 #AFTER # 34     109.
1 #AFTER # 35     110.
1 #AFTER # 36     111.

```