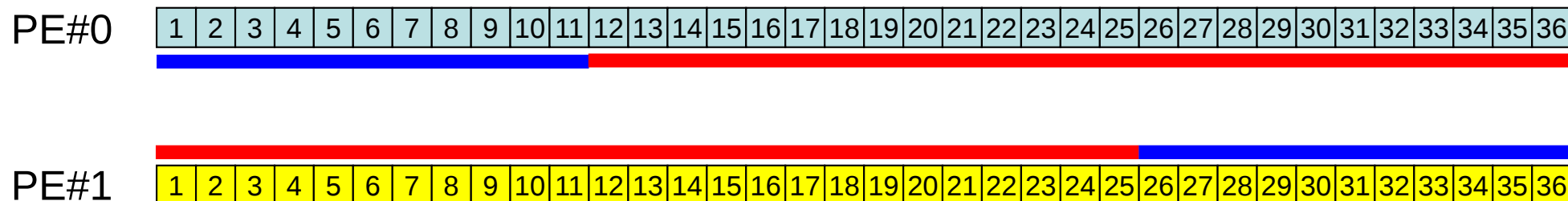


# Ex.2: Send-Recv an Array (1/4)

- 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/gt62/t62XXX/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**

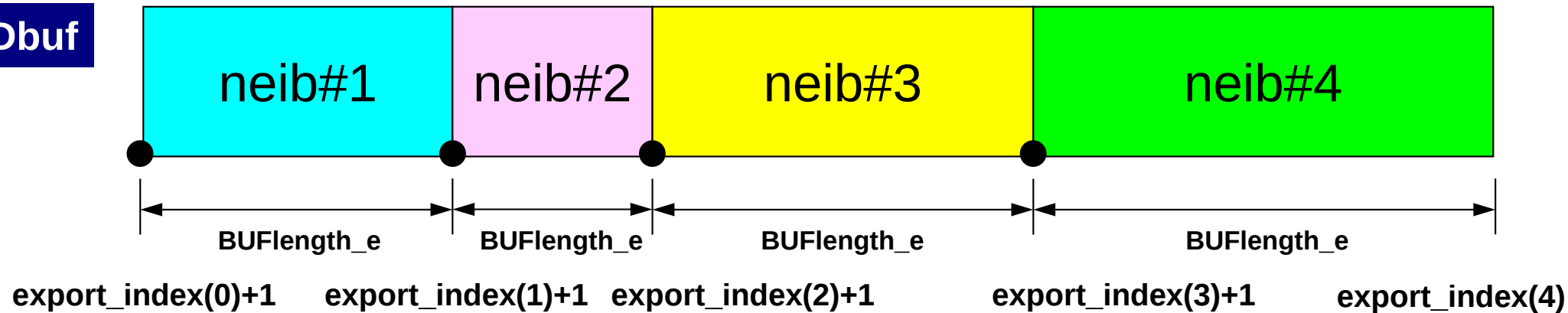
recv:

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,
```

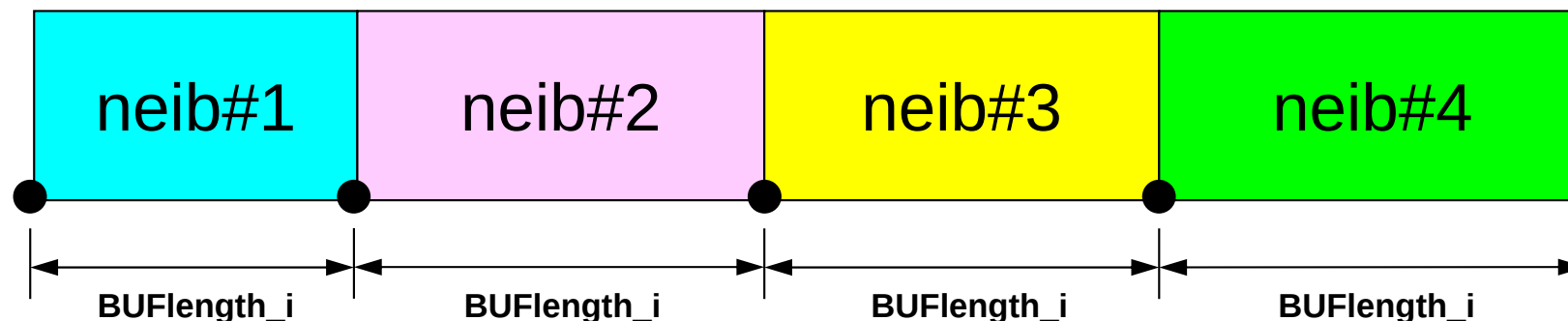
```
&
```

```
&      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)

Fortran

## Isend/Irecv/Waitall

```
$> cd /work/gt62/t62XXX/pFEM/mpi/S2
$> mpiifort -O3 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. |