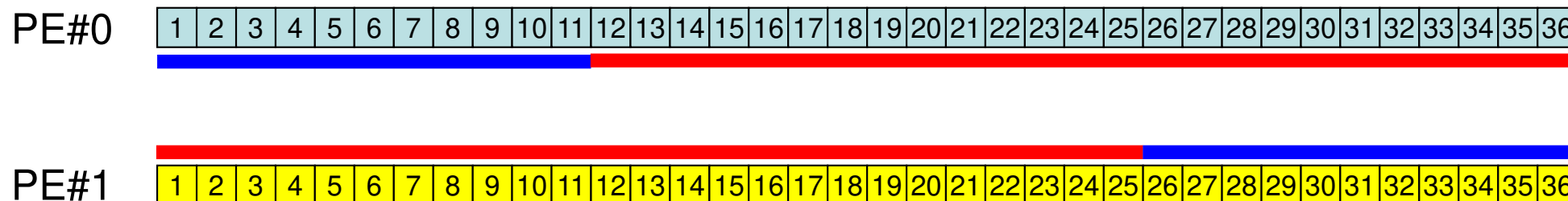


Ex.2: Send-Recv an Array (1/4)

- Exchange VEC (real, 8-byte) between PE#0 & PE#1
- PE#0 to PE#1
 - PE#0: send VEC[0]-VEC[10] (length=11)
 - PE#1: recv. as VEC[25]-VEC[35] (length=11)
- PE#1 to PE#0
 - PE#1: send VEC[0]-VEC[24] (length=25)
 - PE#0: recv. as VEC[11]-VEC[35] (length=25)



Practice: t1

- Initial status of VEC(:):
 - PE#0 VEC[0-35]= 101,102,103,~,135,136
 - PE#1 VEC[0-35]= 201,202,203,~,235,236
- Sample codes are in the following directory.
`/work/gt00/z30088/pFEM/answer/t1`
- Copy them to <\$O-S2>
`/work/gt87/t87XXX/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:

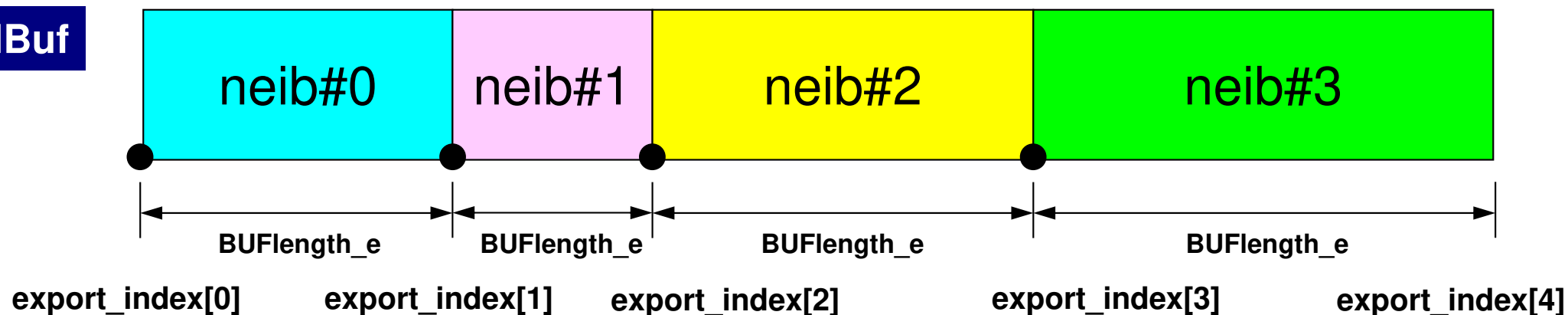
VEC(start_recv) ~
VEC(start_recv+length_recv-1)

- “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

C

SendBuf



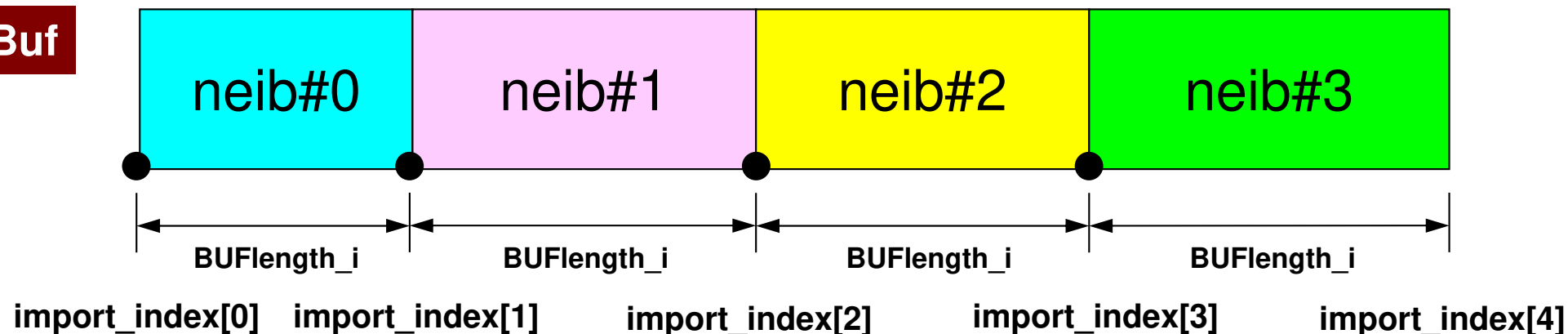
```
for (neib=0; neib<NeibPETot; neib++){  
    tag= 0;  
    iS_e= export_index[neib];  
    iE_e= export_index[neib+1];  
    BUFlength_e= iE_e - iS_e  
  
    ierr= MPI_Isend  
        (&SendBuf[iS_e], BUFlength_e, MPI_DOUBLE,  
         NeibPE[neib], 0,  
         MPI_COMM_WORLD, &ReqSend[neib])  
}  
  
MPI_Waitall(NeibPETot, ReqSend, StatSend);
```

RECV: MPI_Isend/Irecv/Waitall

C

```
for (neib=0; neib<NeibPETot; neib++){  
    tag= 0;  
    iS_i= import_index[neib];  
    iE_i= import_index[neib+1];  
    BUFlength_i= iE_i - iS_i  
  
    ierr= MPI_Irecv  
        (&RecvBuf[iS_i], BUFlength_i, MPI_DOUBLE,  
         NeibPE[neib], 0,  
         MPI_COMM_WORLD, &ReqRecv[neib])  
}  
  
MPI_Waitall(NeibPETot, ReqRecv, StatRecv);
```

import_item (import_index[neib]:import_index[neib+1]-1) are received from neib-th neighbor

RecvBuf

Example: C (1/3)

C

Isend/Irecv/Waitall

```
$> cd /work/gt87/t87XXX/pFEM/mpi/S2
$> module load fj
$> mpifccpx -Nclang -Kfast ex2a.c
$> pjsub go2.sh
```

```
#include <stdio.h>
#include <stdlib.h>
#include "mpi.h"

int main(int argc, char **argv){
    int i, neib;
    int MyRank, PeTot;
    double VEC[36];
    int Start_Send, Length_Send;
    int Start_Recv, Length_Recv;

    MPI_Status *StatSend, *StatRecv;
    MPI_Request *RequestSend, *RequestRecv;

    MPI_Init(&argc, &argv);
    MPI_Comm_size(MPI_COMM_WORLD, &PeTot);
    MPI_Comm_rank(MPI_COMM_WORLD, &MyRank);
```

Example: C (2/3)

C

Isend/Irecv/Waitall

```
Start_Send= 1;

if(MyRank == 0) {
    neib= 1;
    Length_Send= 11;
    Length_Recv= 25;
    for (i=0;i<36;i++){VEC[i]=100.0+i+1;}}

if(MyRank == 1) {
    neib= 0;
    Length_Send= 25;
    Length_Recv= 11;
    for (i=0;i<36;i++){VEC[i]=200.0+i+1;}}

Start_Recv= 1 + Length_Send;

StatSend = malloc(sizeof(MPI_Status) * 1);
StatRecv = malloc(sizeof(MPI_Status) * 1);
RequestSend = malloc(sizeof(MPI_Request) * 1);
RequestRecv = malloc(sizeof(MPI_Request) * 1);

for (i=0;i<36;i++) {
    printf("%s%2d%5d%8.0f¥n", "### before", MyRank, i, VEC[i]);}
```

Example: C (3/3)

C

Isend/Irecv/Waitall

```
MPI_Isend(&VEC[Start_Send-1], Length_Send, MPI_DOUBLE, neib, 0,
          MPI_COMM_WORLD, &RequestSend[0]);

MPI_Irecv(&VEC[Start_Recv-1], Length_Recv, MPI_DOUBLE, neib, 0,
          MPI_COMM_WORLD, &RequestRecv[0]);

MPI_Waitall(1, RequestRecv, StatRecv);

MPI_Waitall(1, RequestSend, StatSend);

for (i=0;i<36;i++) {
    printf("%s%2d%5d%8.0f¥n", "### after ", MyRank, i, VEC[i]);}

MPI_Finalize();
return 0;
}
```

- 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.