Message Passing Computing

Lecture 2

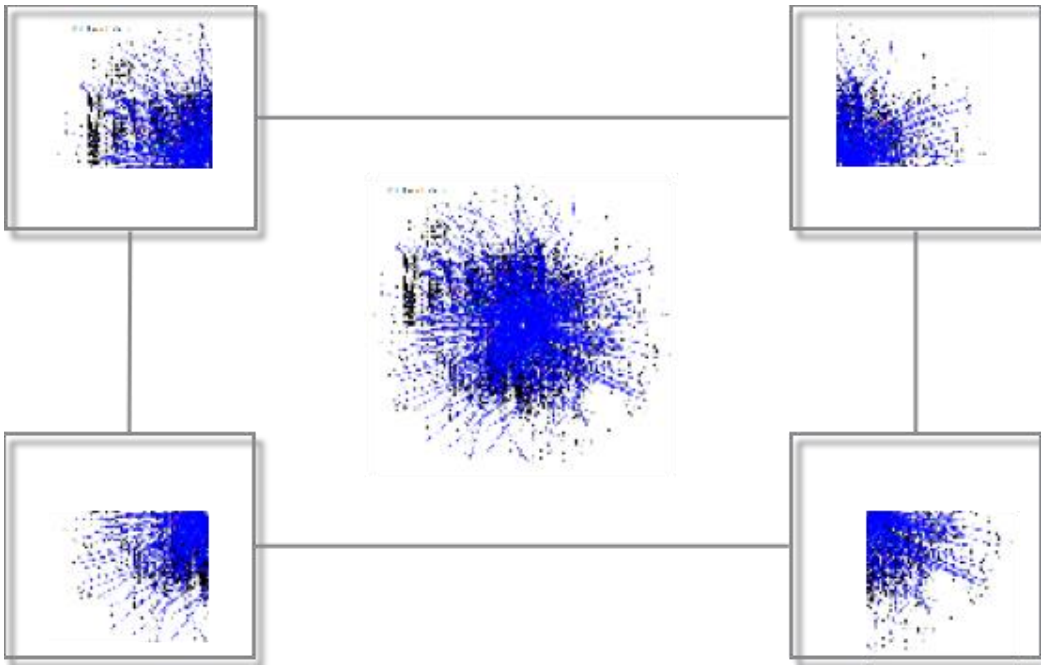
Message Passing

Helvi Hartmann

FIAS

Cluster Computing

parallel computing on systems with distributed memory



ZMQ, PVM, MPI, HPX, OpenMP

Any questions?

What Methods of Message Passing do you know?

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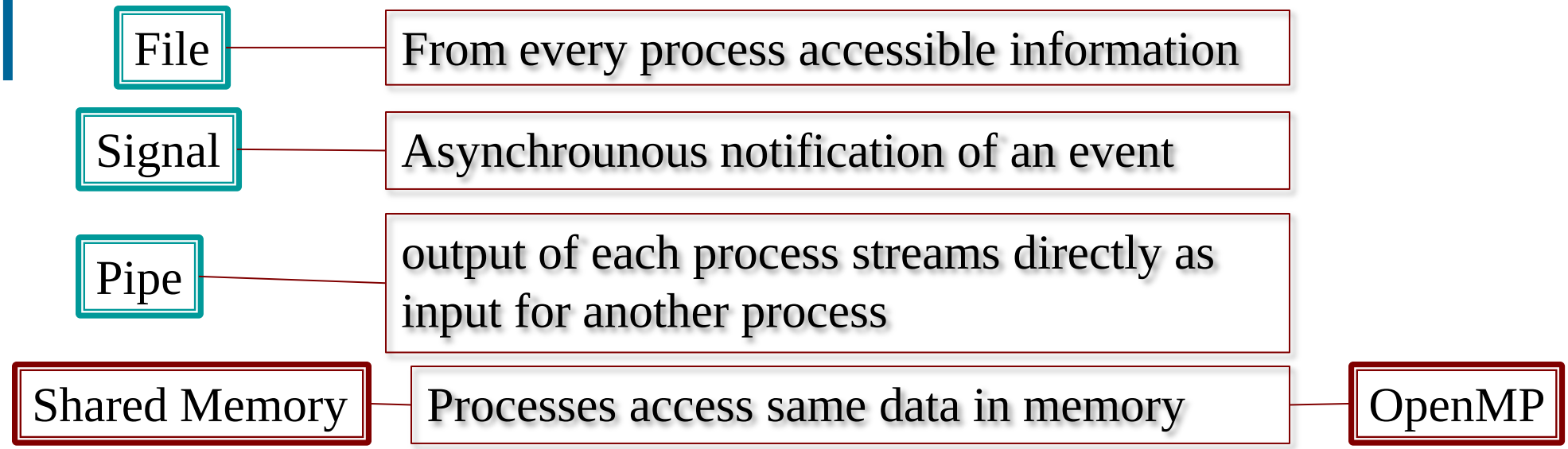
Inter Process Communication

File	From every process accessible information
Signal	Asynchrounous notification of an event
Pipe	output of each process streams directly as input for another process

Inter Process Communication



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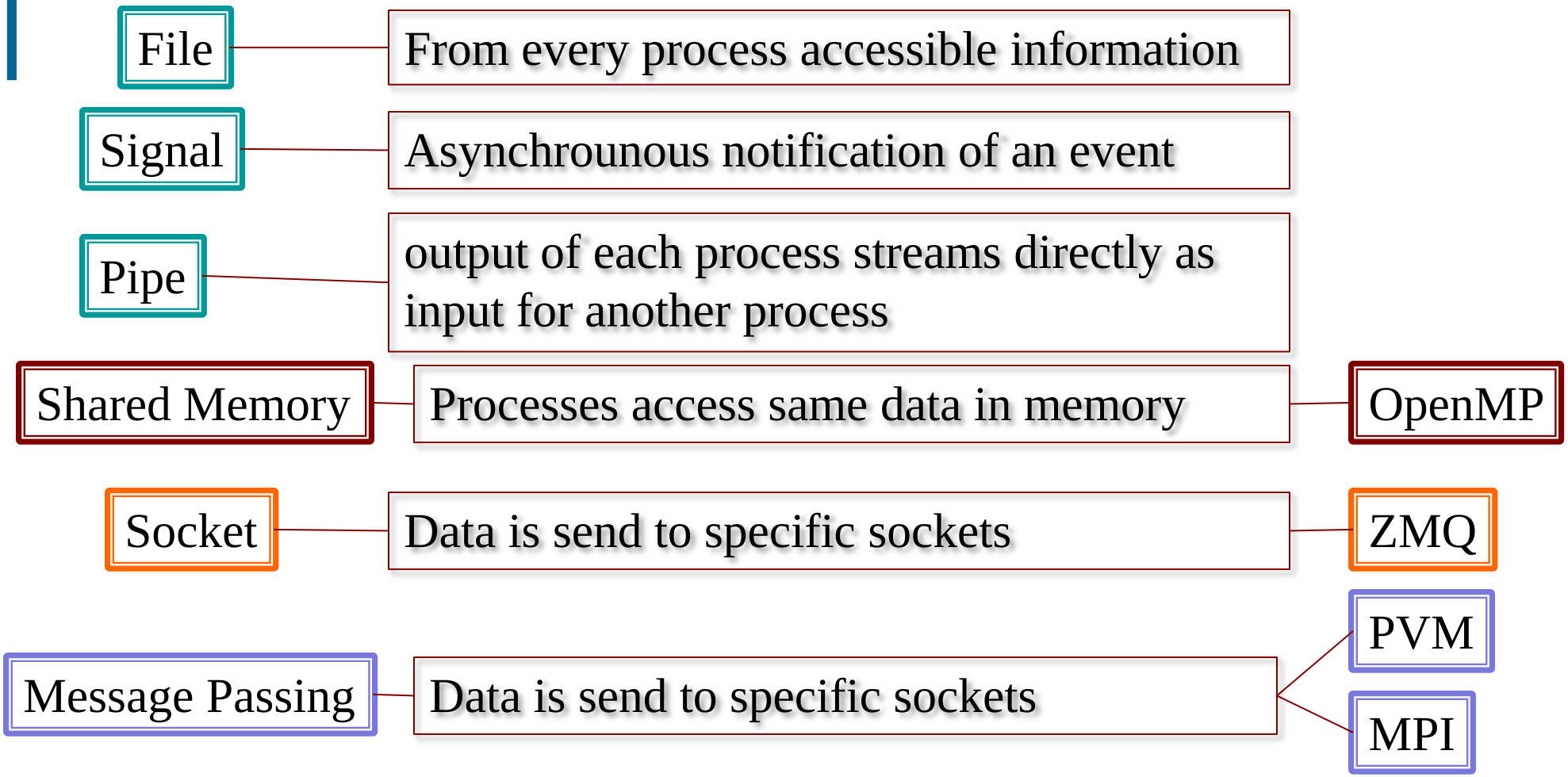

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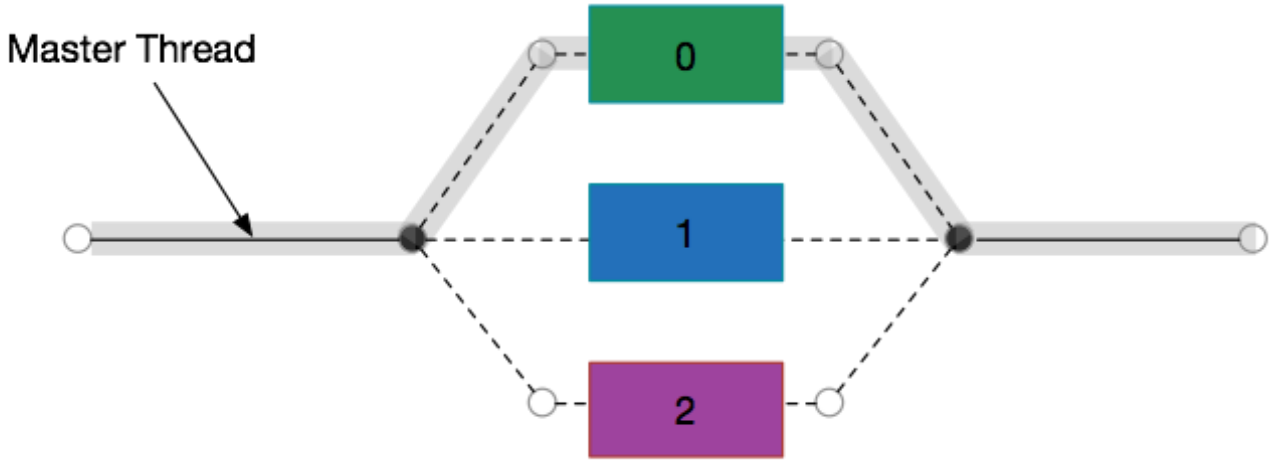
OpenMP



Example OpenMP C++

```
void simple(int n, float *a, float *b)
{
int i;
#pragma omp parallel for
    for (i=1; i<n; i++) /* i is private by default */
}
```

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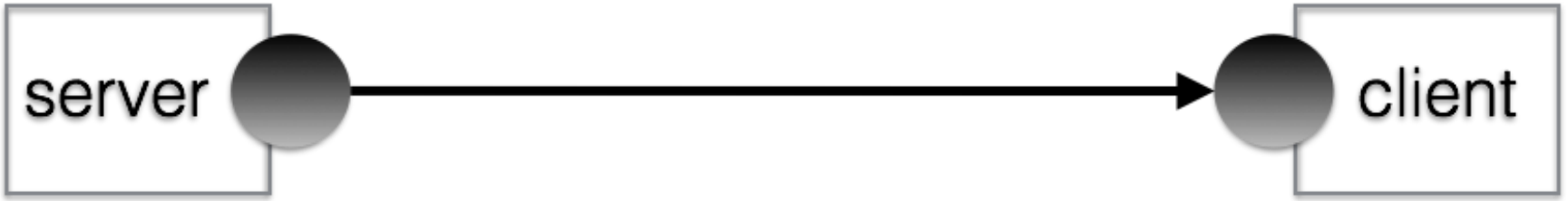
Socket Programming

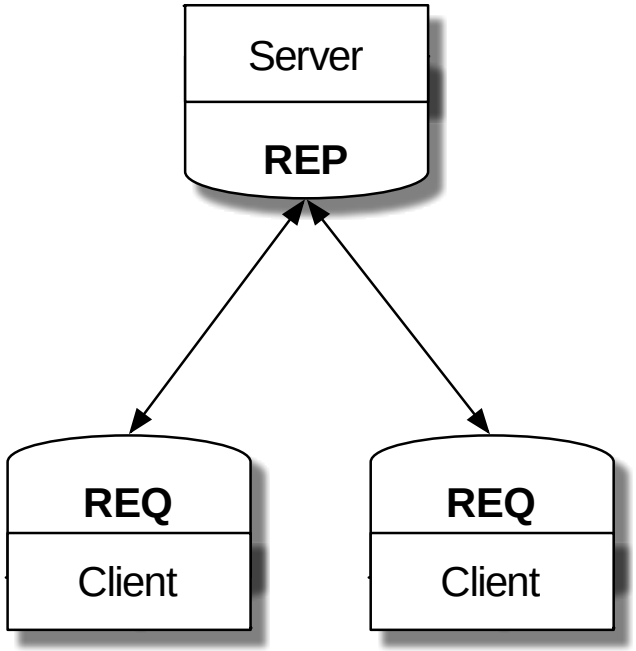


ZMQ

- automatically reconnects to peers
- queues messages at sender and receiver
- routes messages
- handles sockets errors
- does all I/O in background threads
- lock free techniques for communication

ZMQ – Socket Types

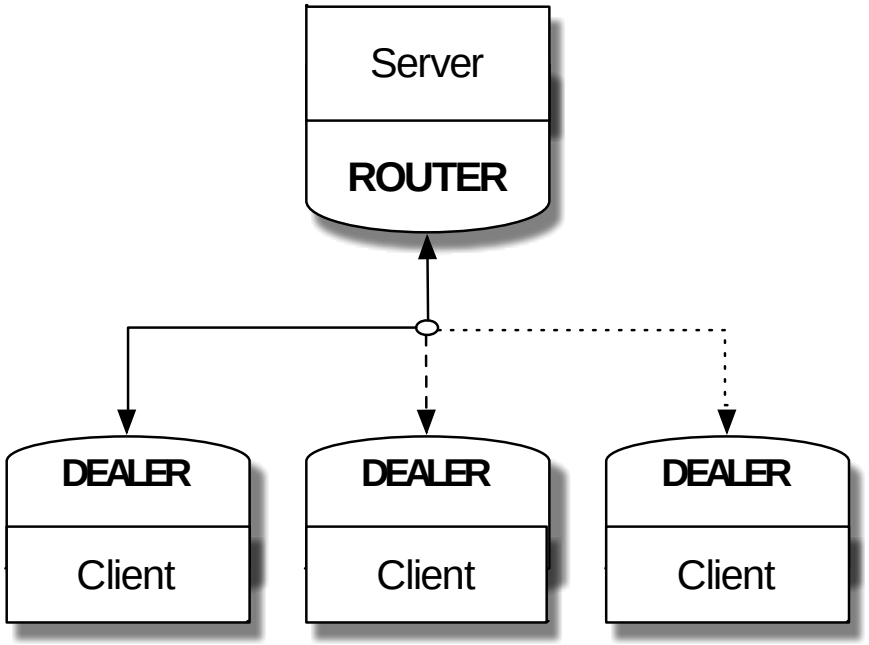
Request/Reply
blocking



ZMQ – Socket Types

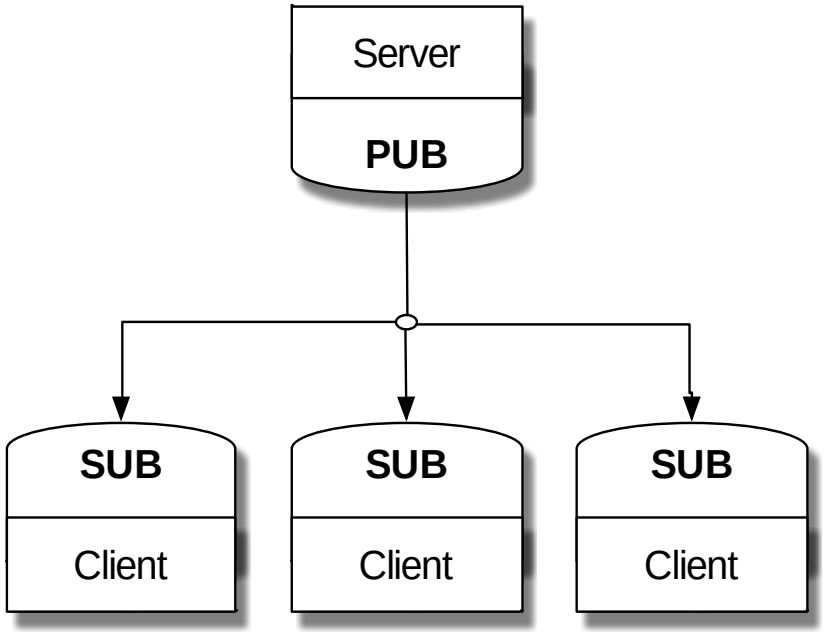
Push/Pull

nonblocking



ZMQ – Socket Types

Publish/Subscribe



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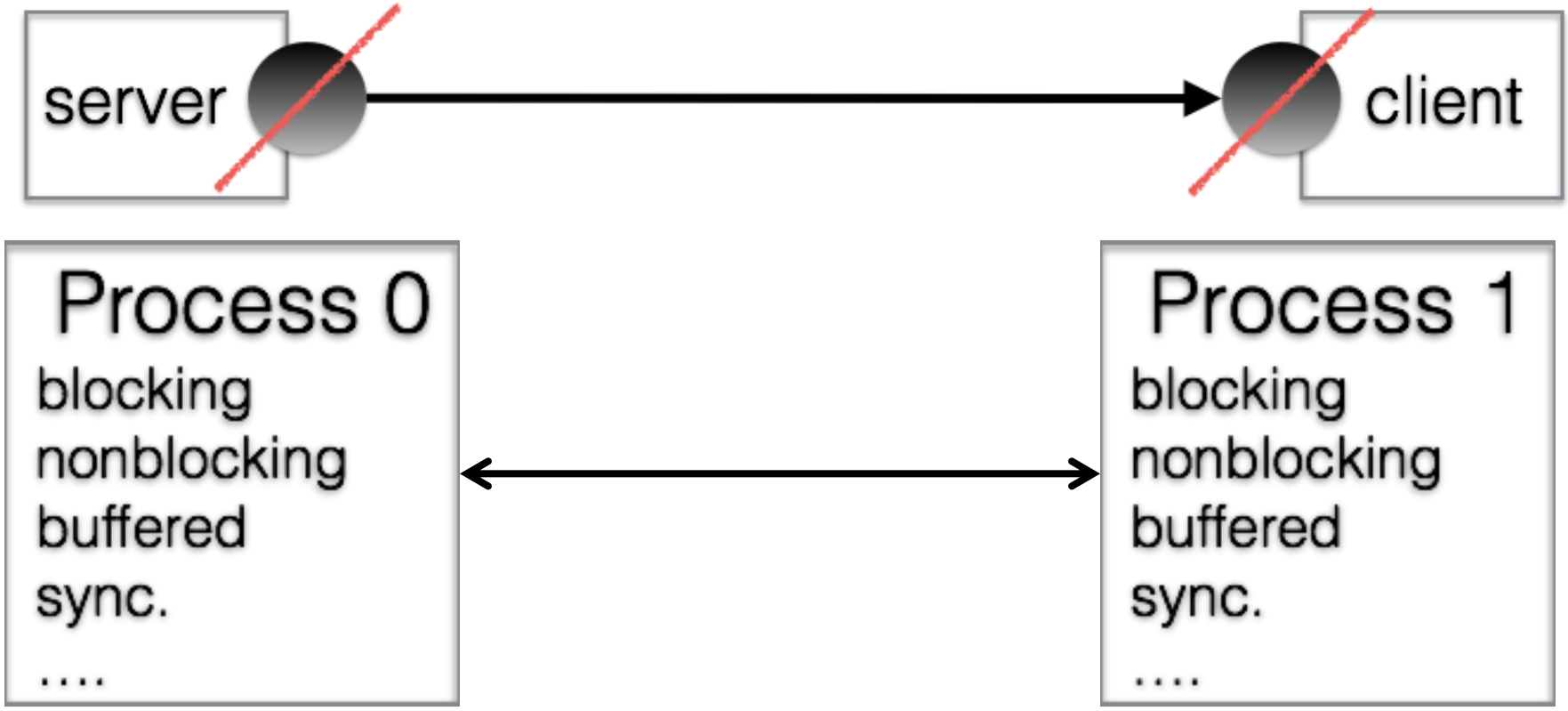
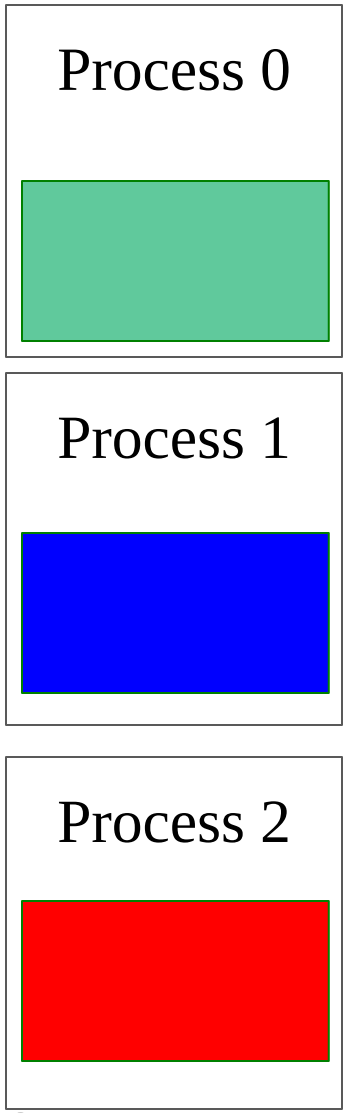
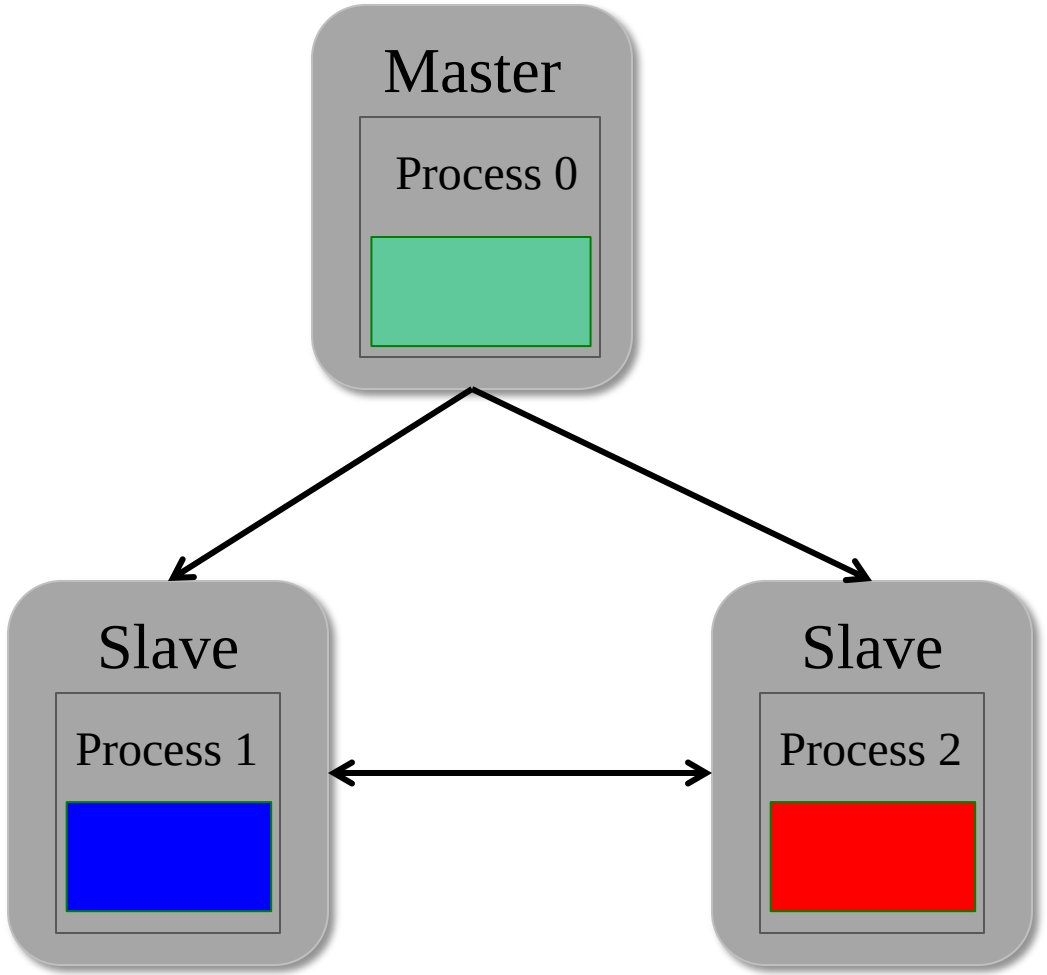
Message Passing

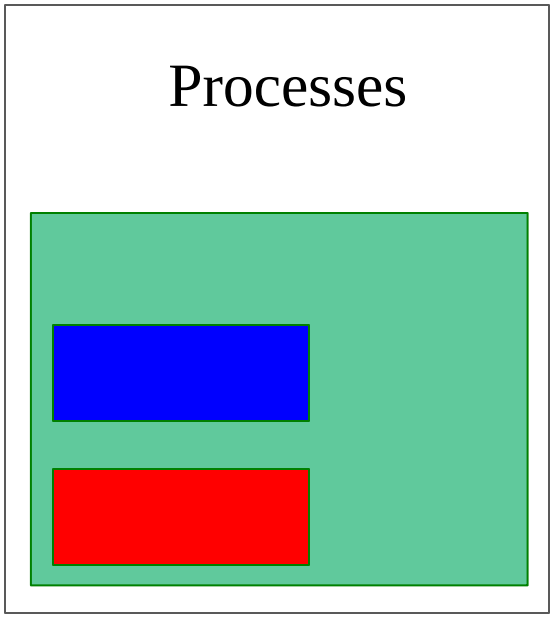


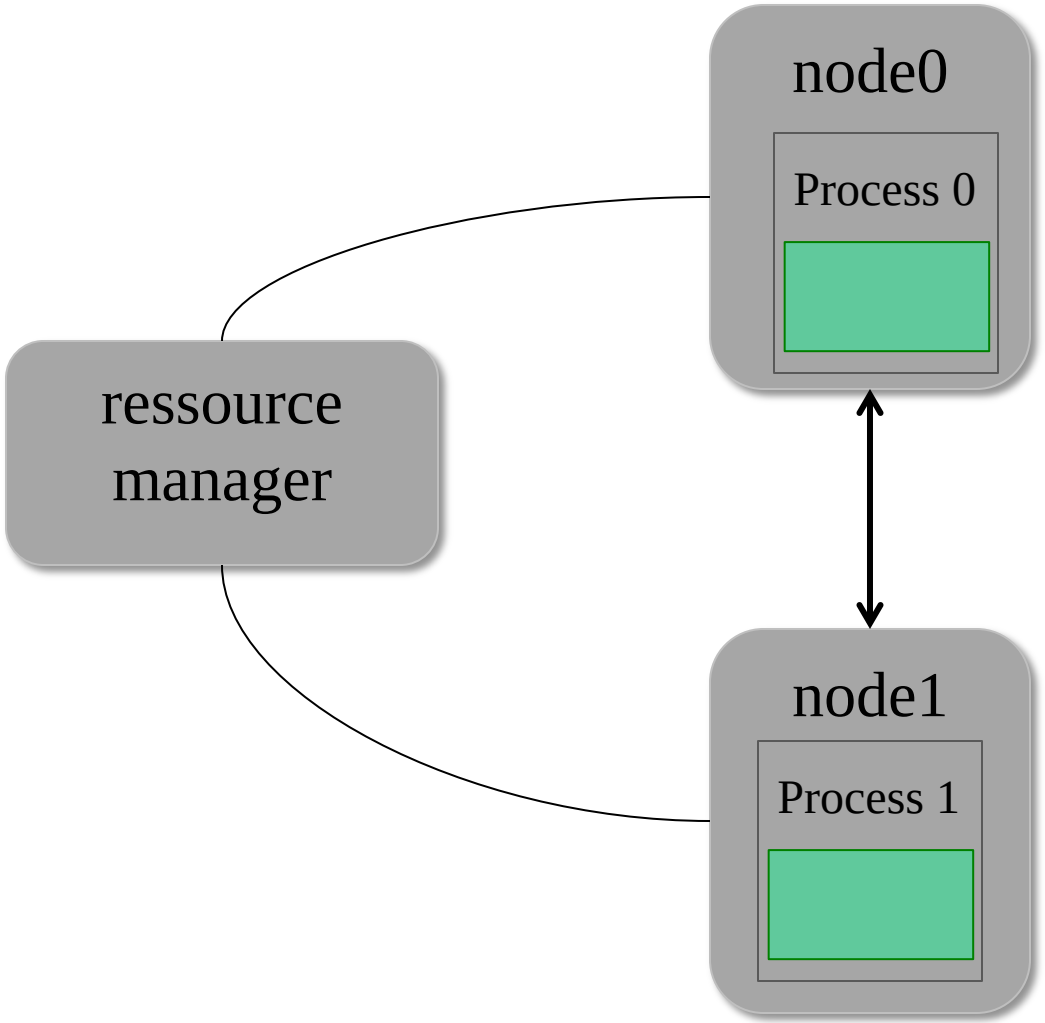
PVM


Process 0
Process 1
Process 2


Master
Process 0
Slave
Process 1
Slave
Process 2

MPI

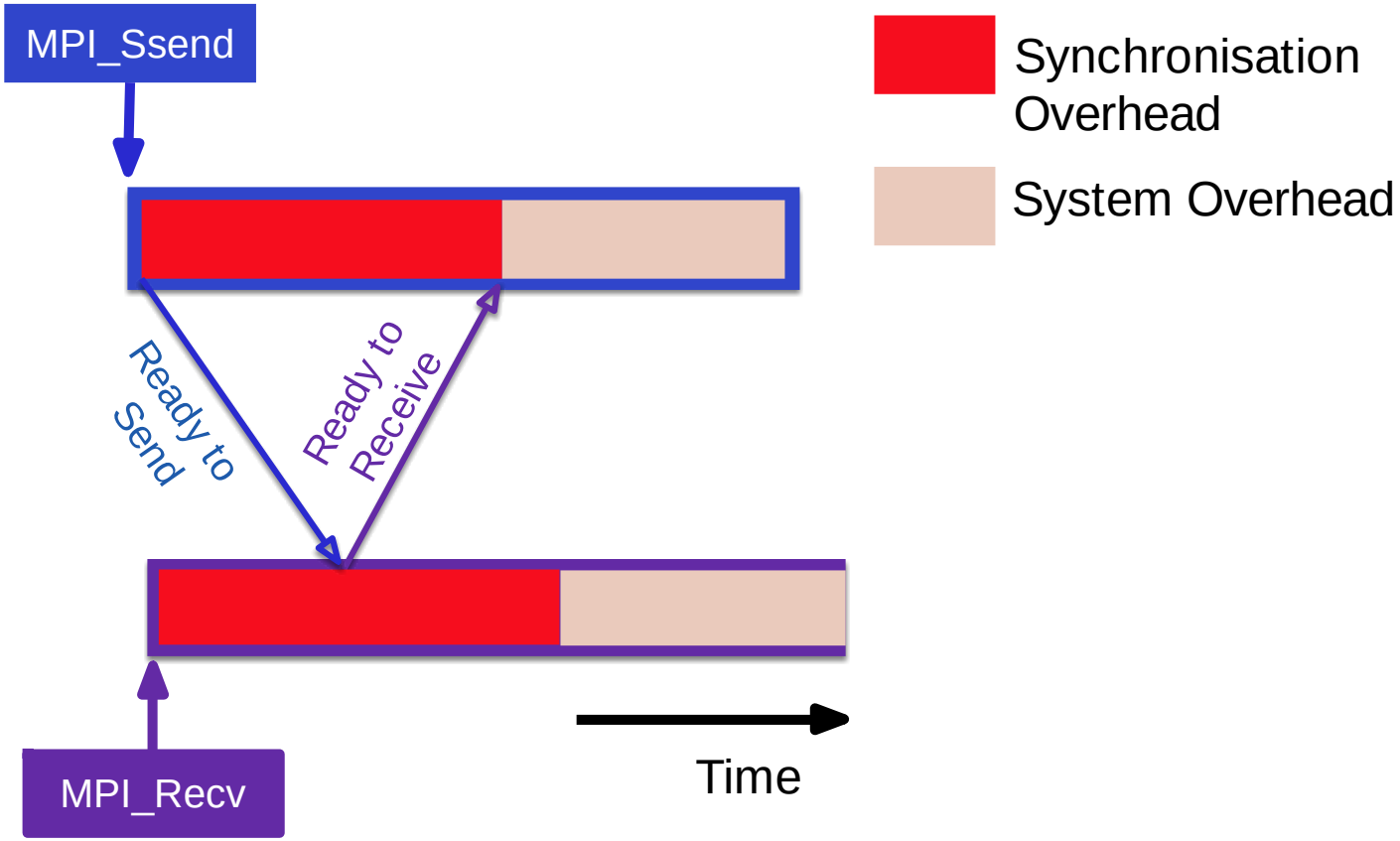

Processes


node0
Process 0
ressource
manager
node1
Process 1

MPI - Blocking

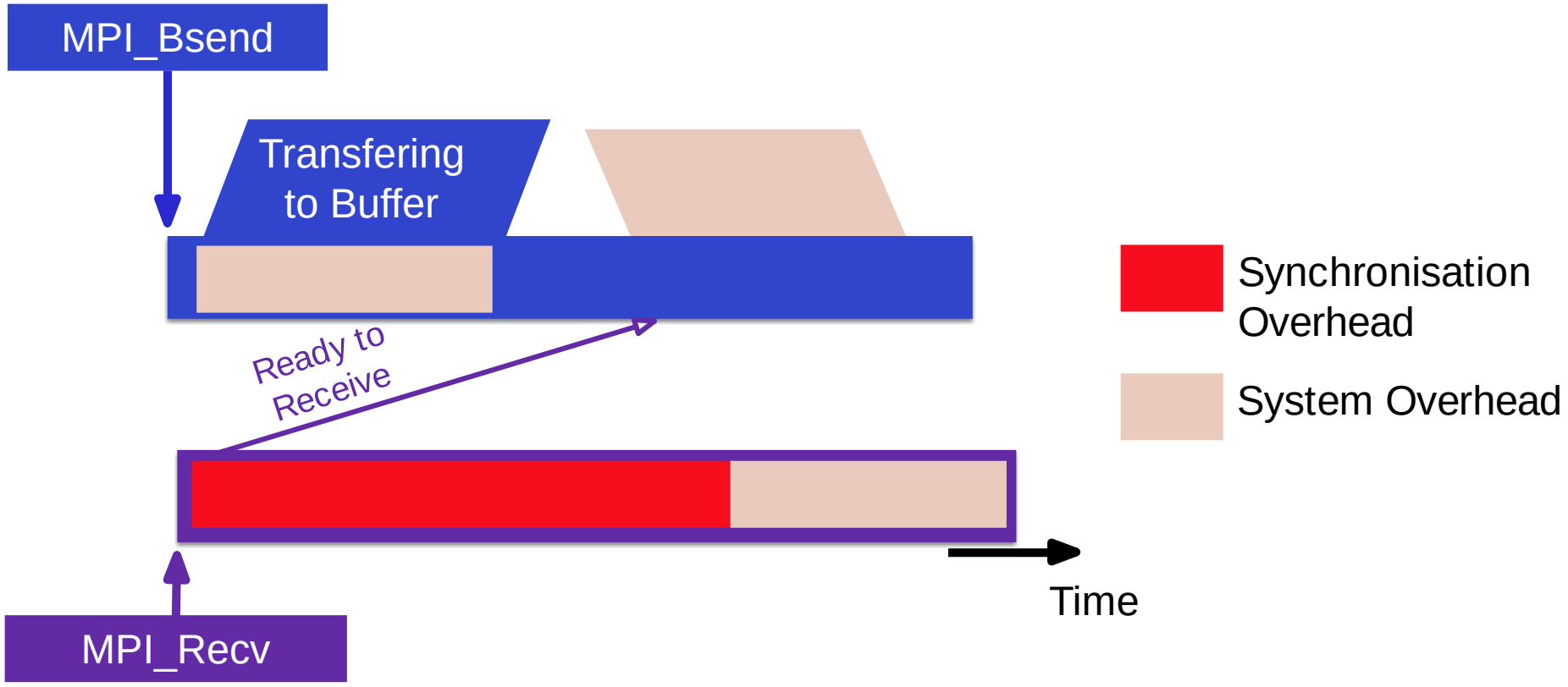
MPI - Blocking

Synchronous Send (MPI_Ssend)

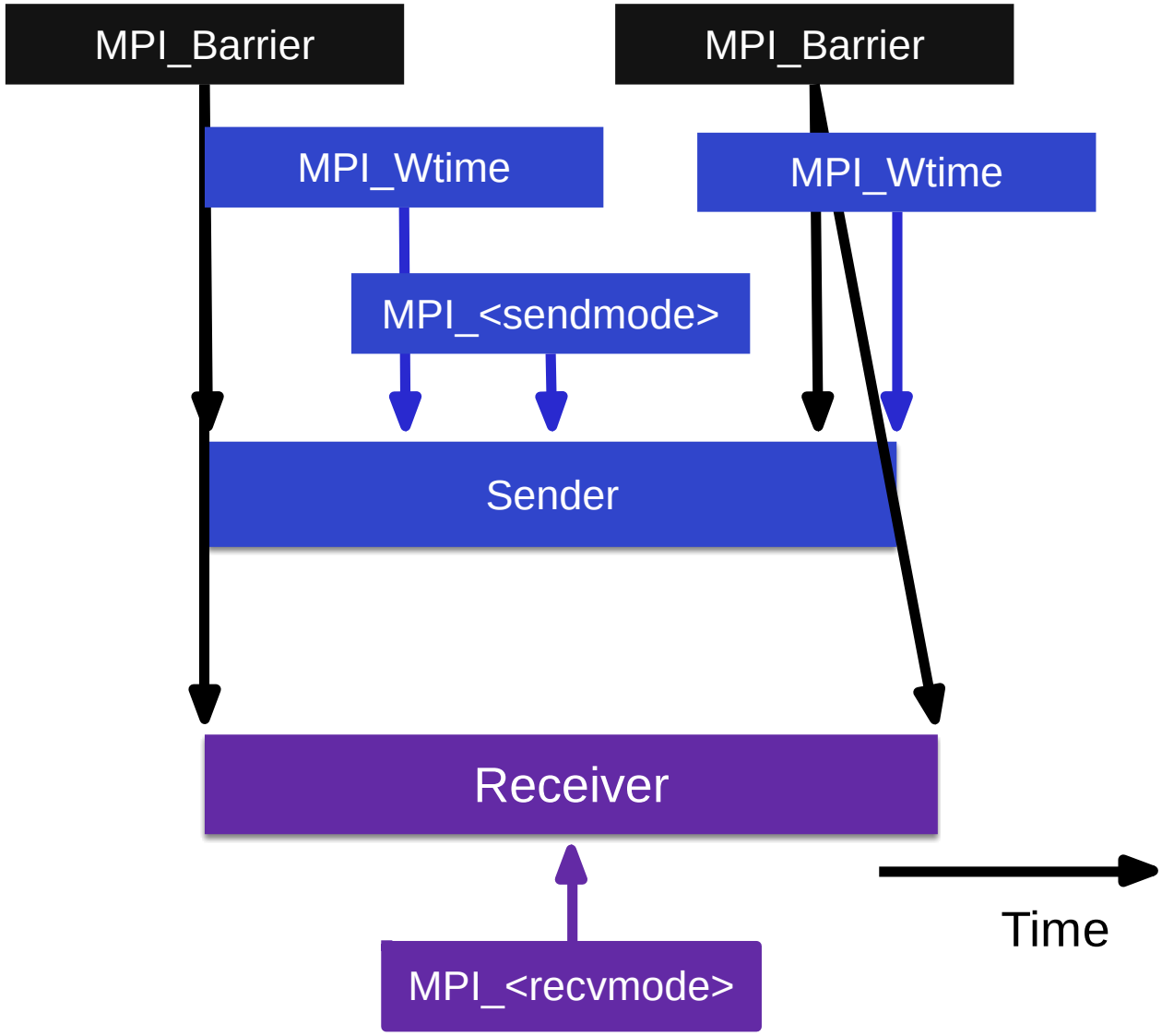


MPI - Blocking

Buffered Send (MPI_Bsend)



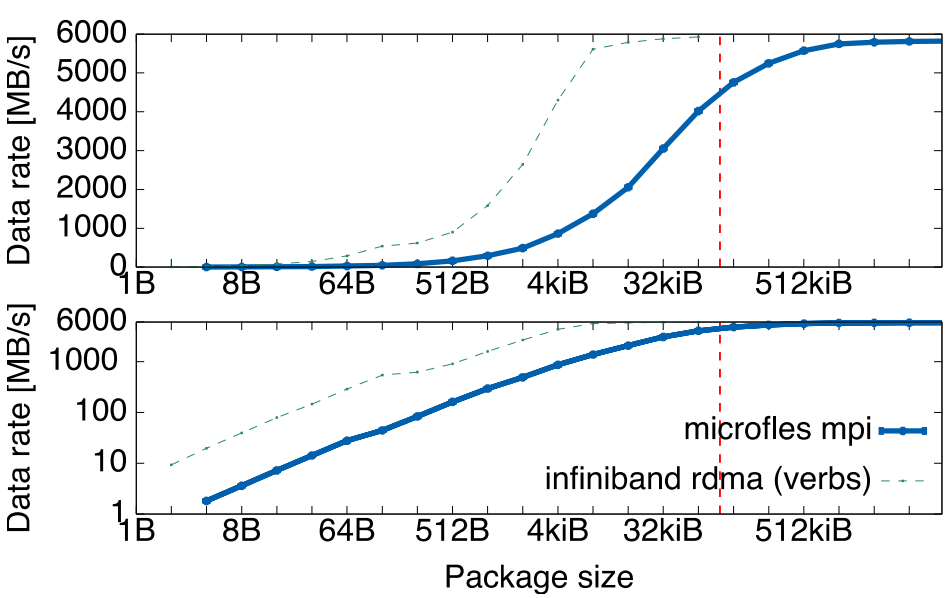
MPI - Blocking

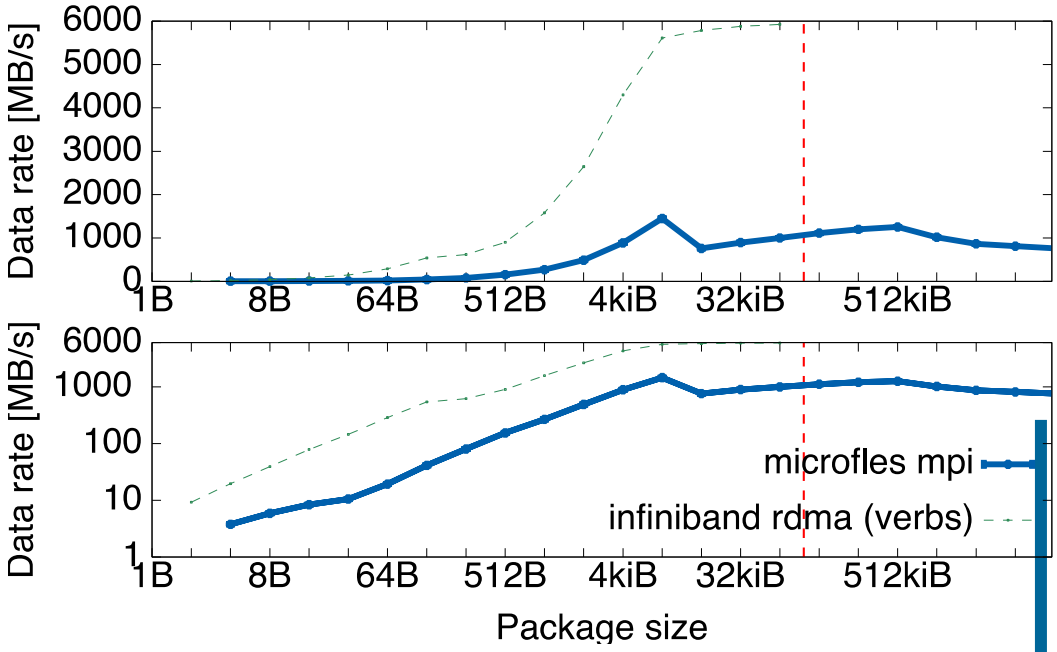


MPI - Blocking

Synchronous Send
(MPI_Ssend)

Buffered Send
(MPI_Bsend)



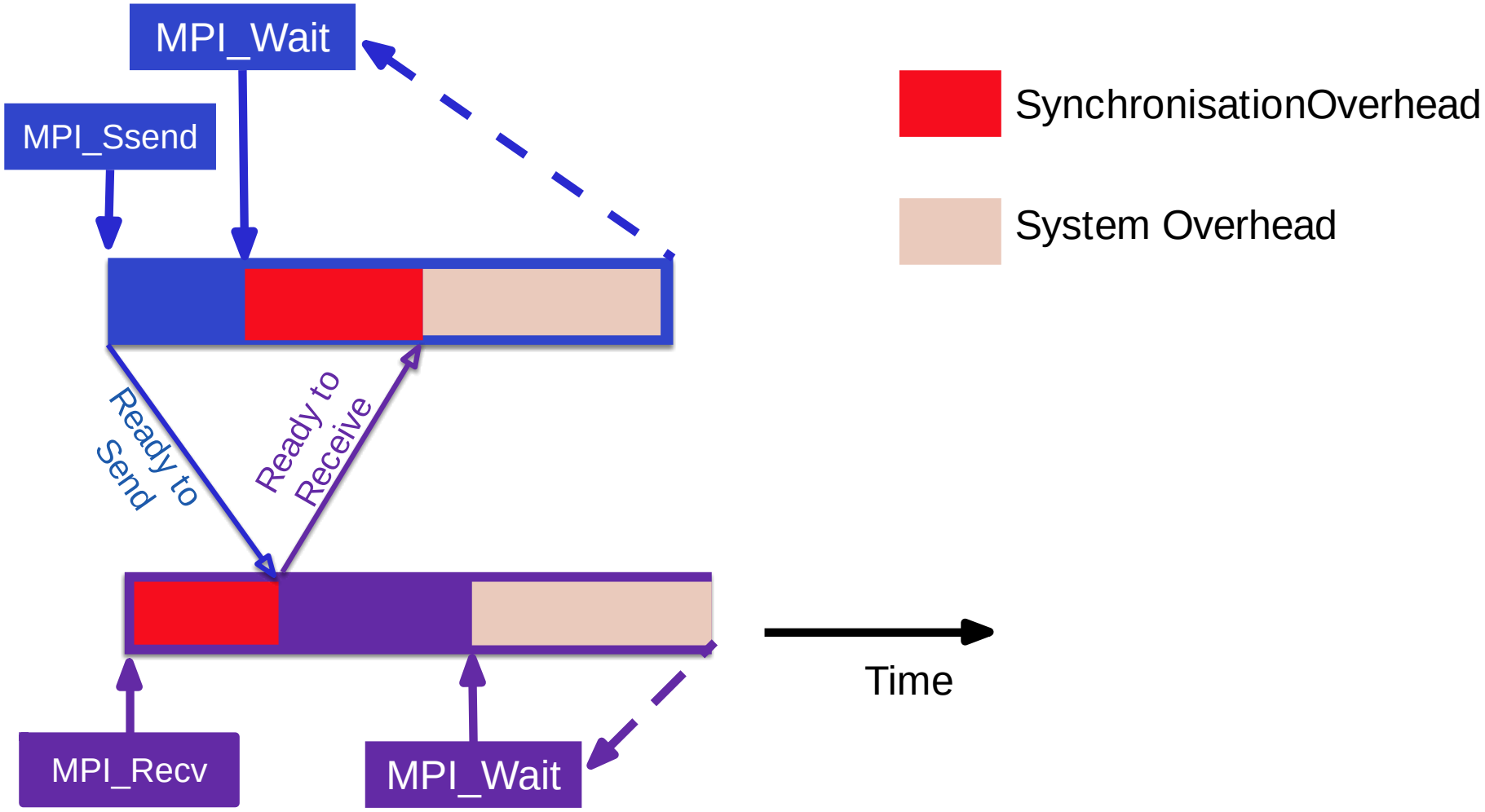


MPI - Blocking

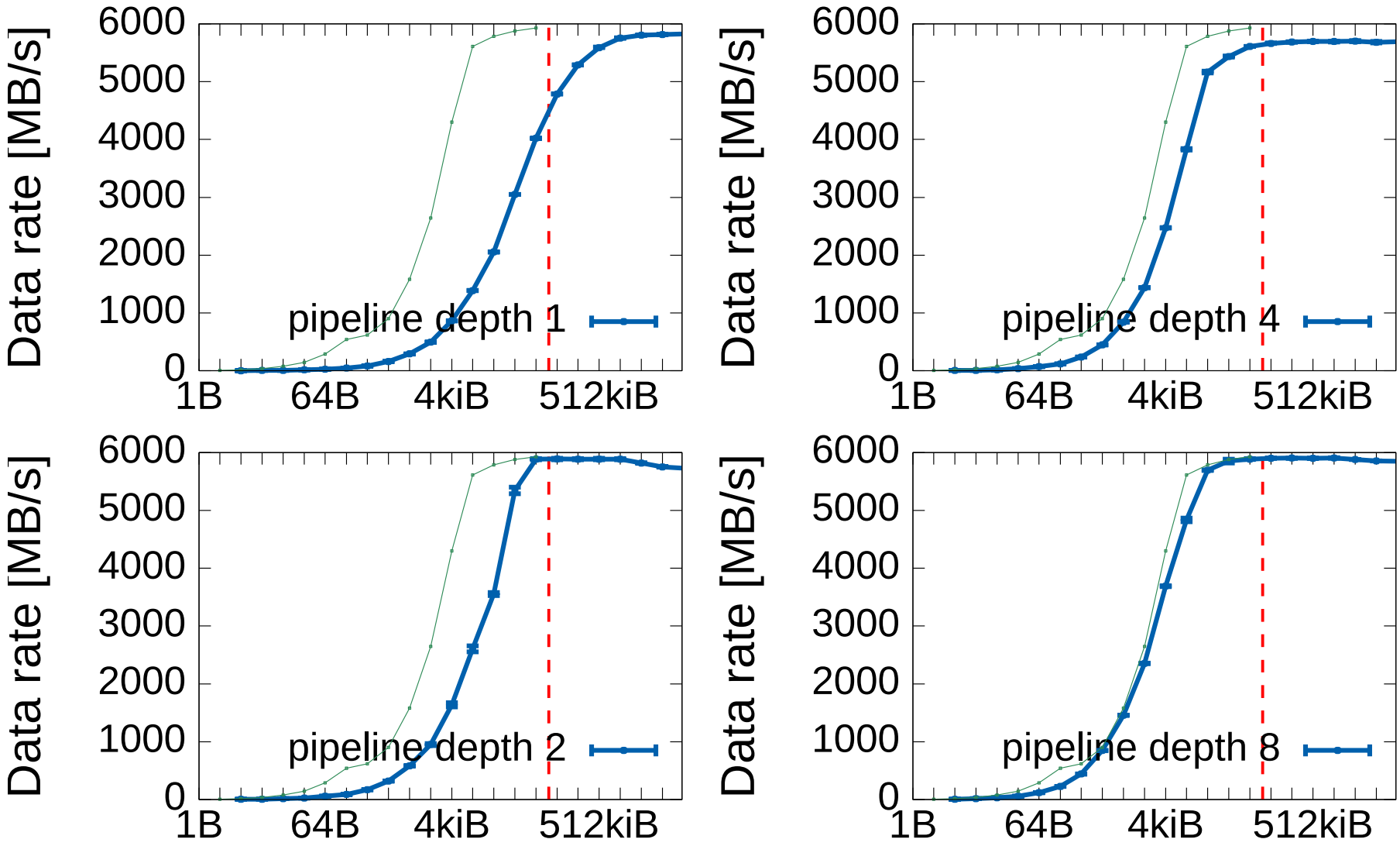
function returns immediately

MPI - Nonblocking

Synchronous

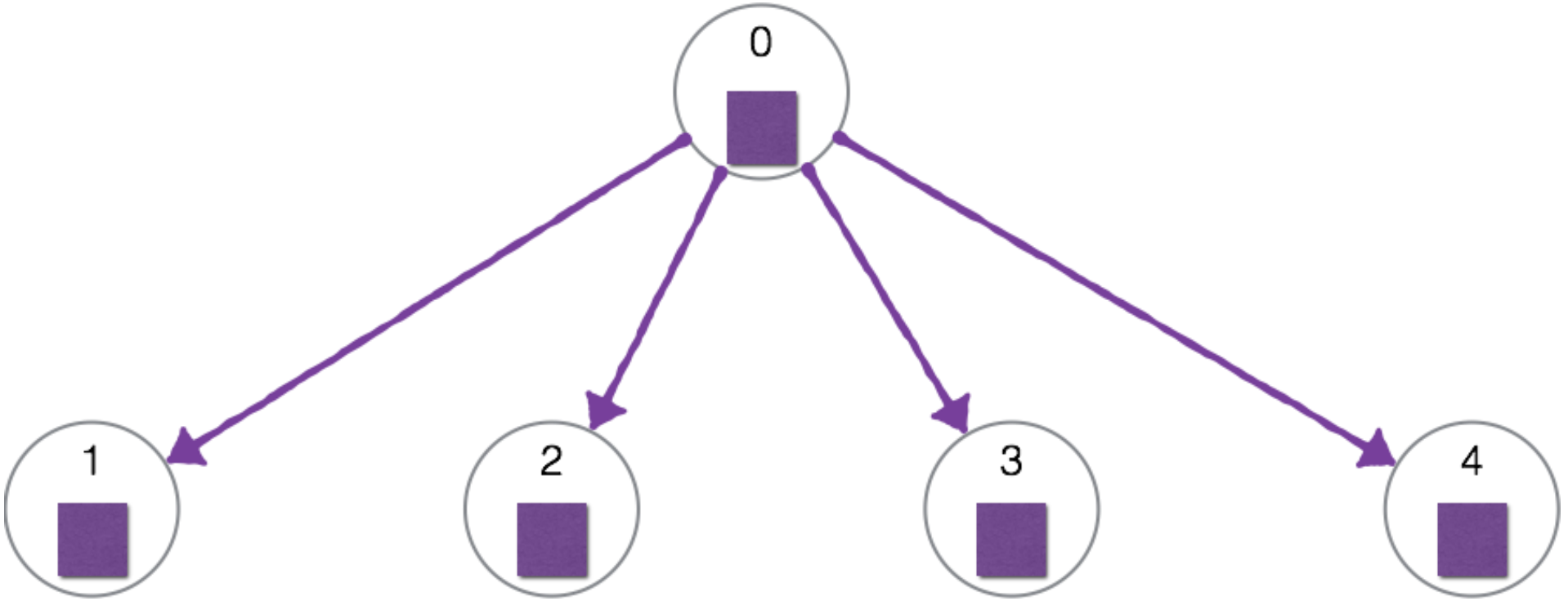


MPI - Nonblocking



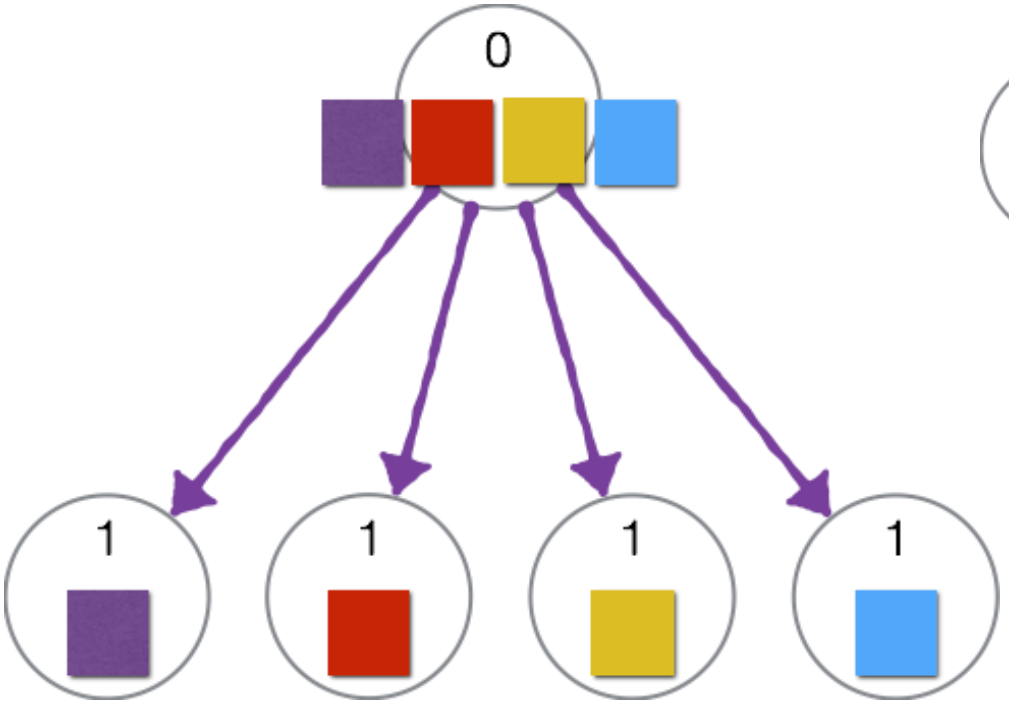
MPI – Collectives

Broadcast

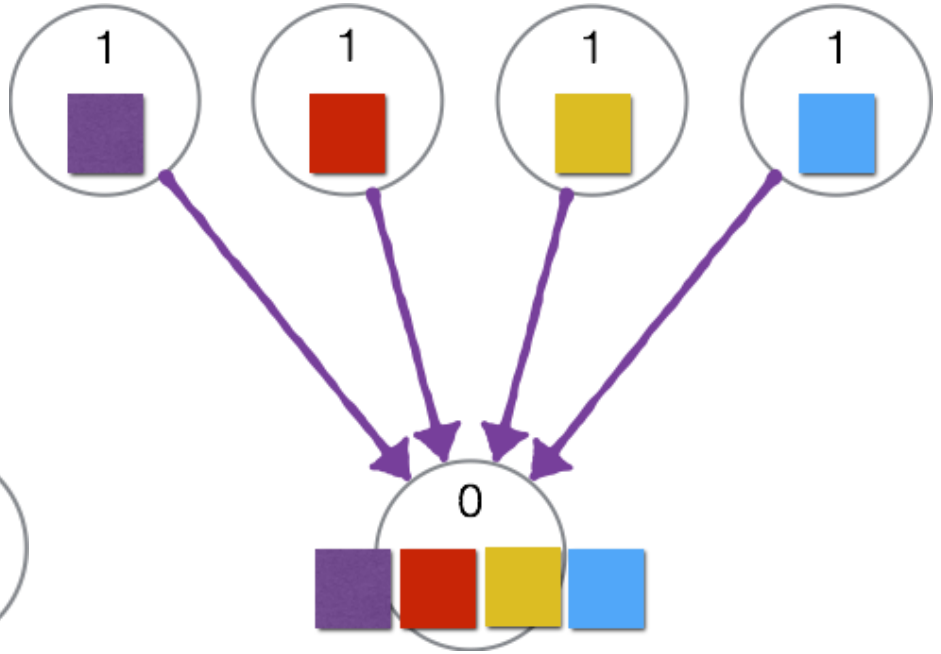


MPI – Collectives

Scatter



Gather



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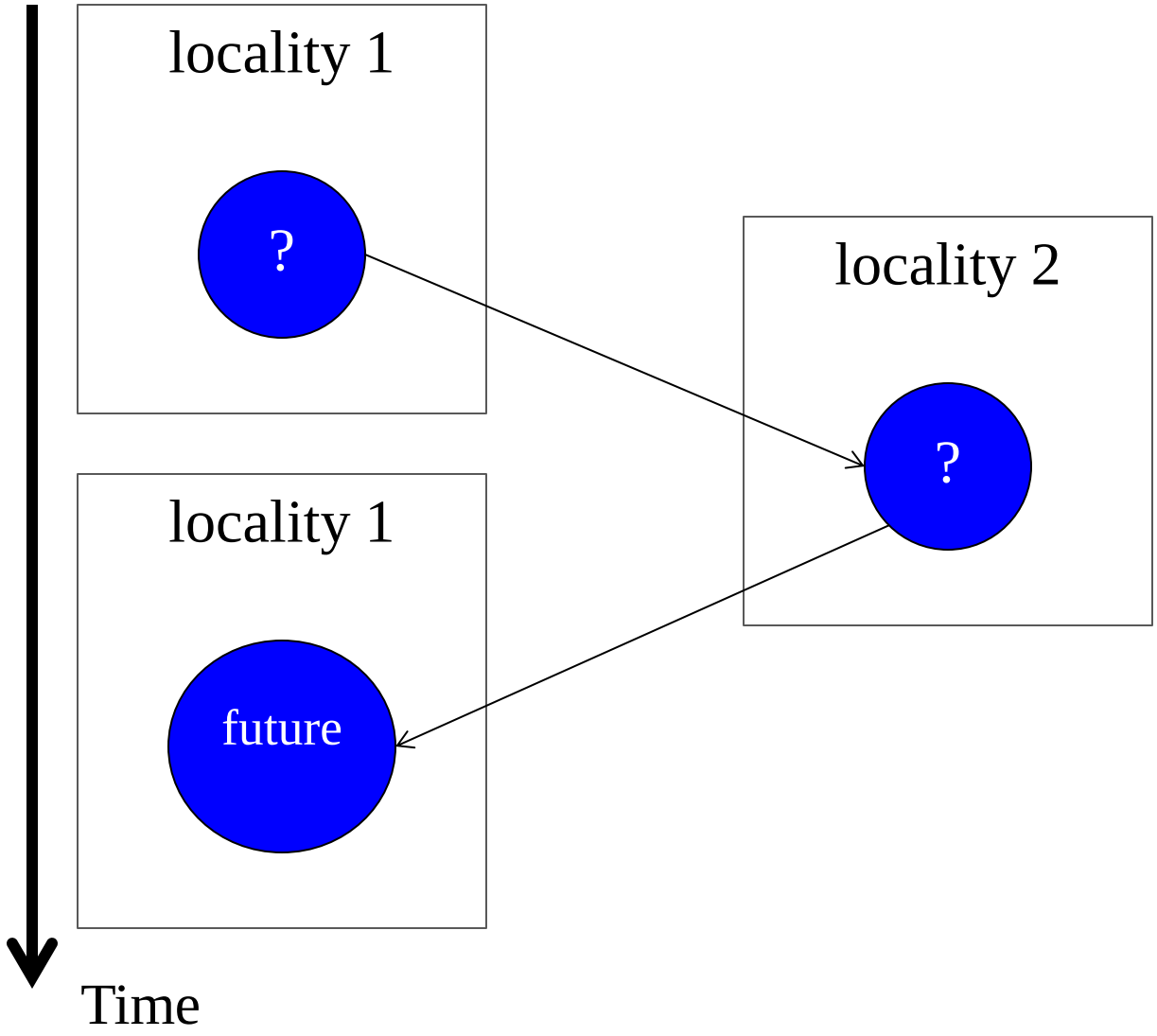
Futures



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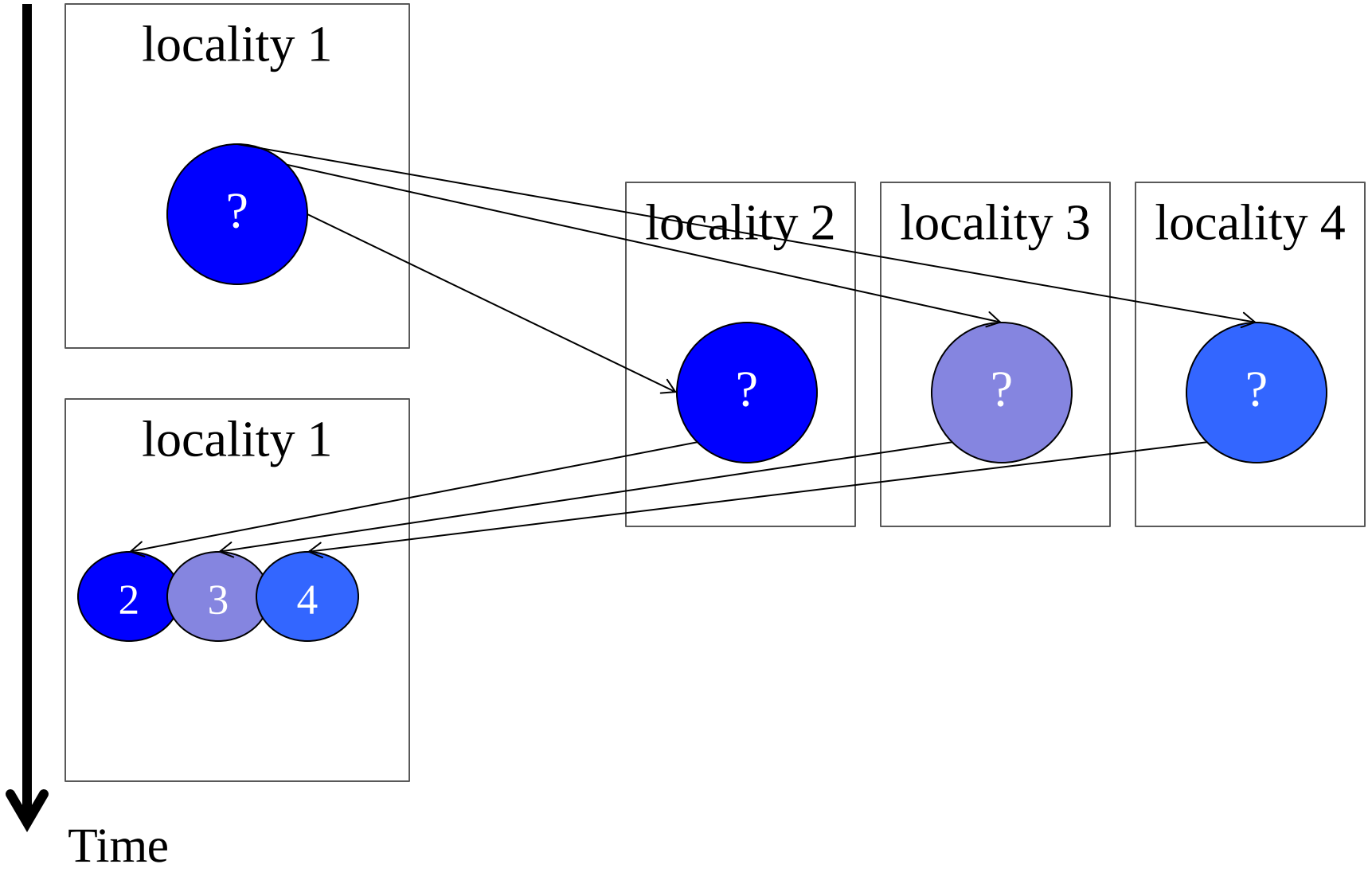
locality 1
?
locality 2
?
locality 3
?
locality 4
?
locality 1
2
3
4
Time

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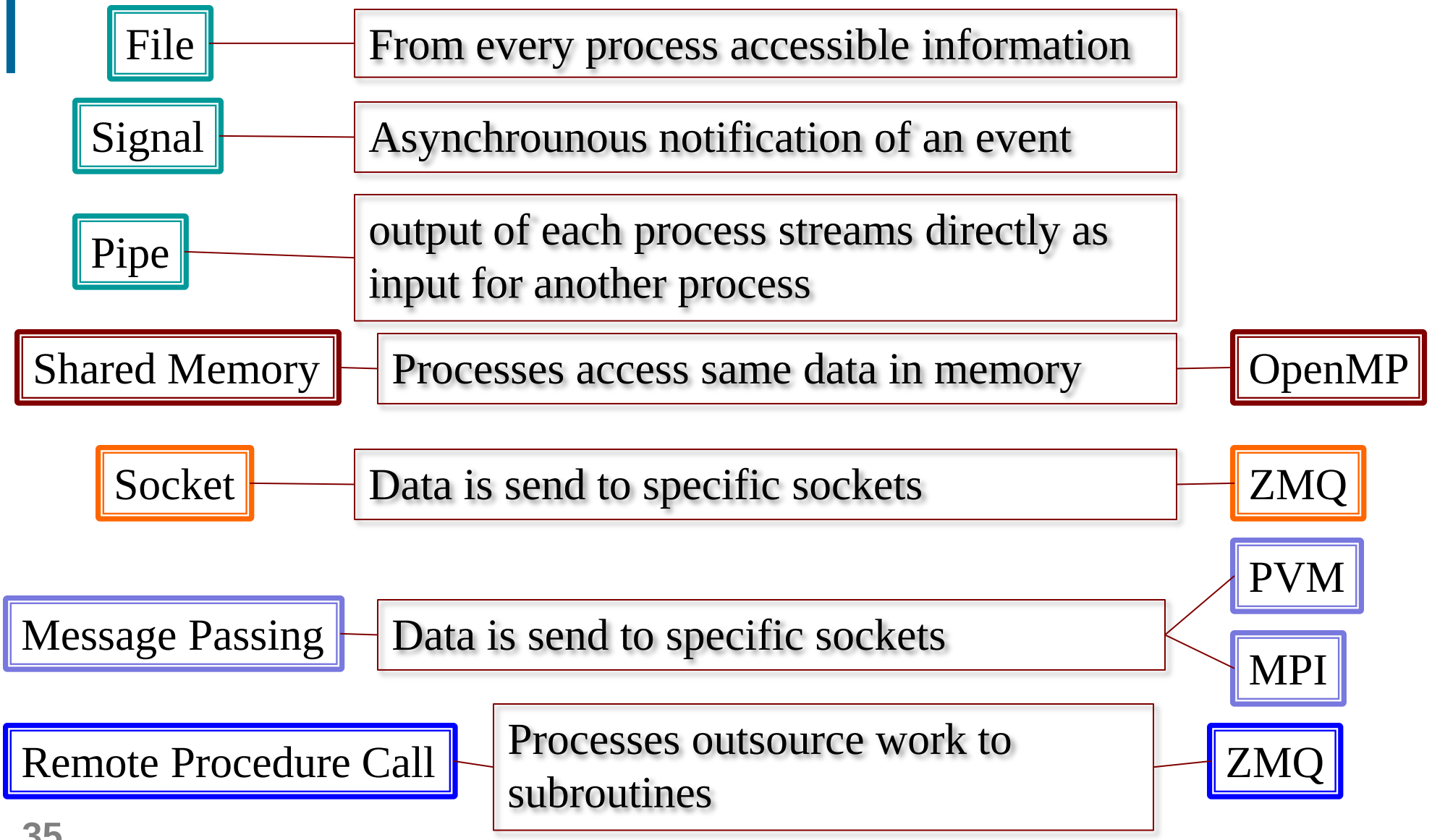
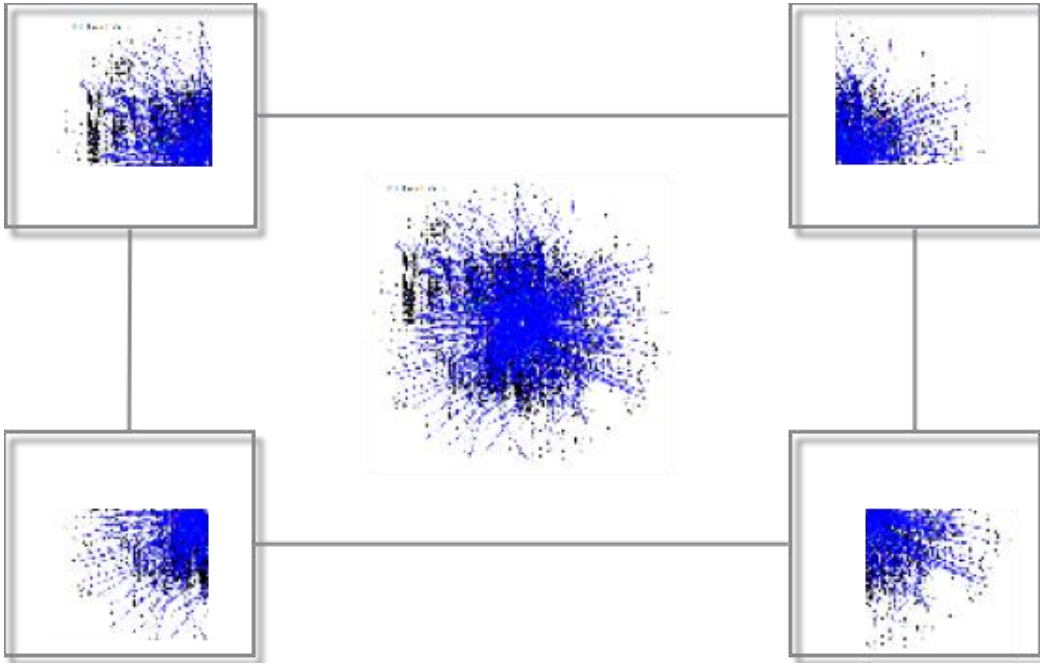
Inter Process Communication





05.11.2014:
http://creatia2013.wordpress.com/2013/03/12/dna-is-like-a-computer-program-but-far-far-more-advanced-than-any-software-weve-ever-created-bill-gates/

http://www.lhc-facts.ch/index.php?page=datenverarbeitung

http://www.computerhistory.org/fellowawards/hall/bios/Gene,Amdahl/

http://www.heise.de/newsticker/meldung/AMD-bringt-neuen-Notebook-Prozessor-Llano-1259681.html

http://en.wikipedia.org/wiki/TBR1

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