A Portable Implementation of Point-to-Point Partitioned Communication

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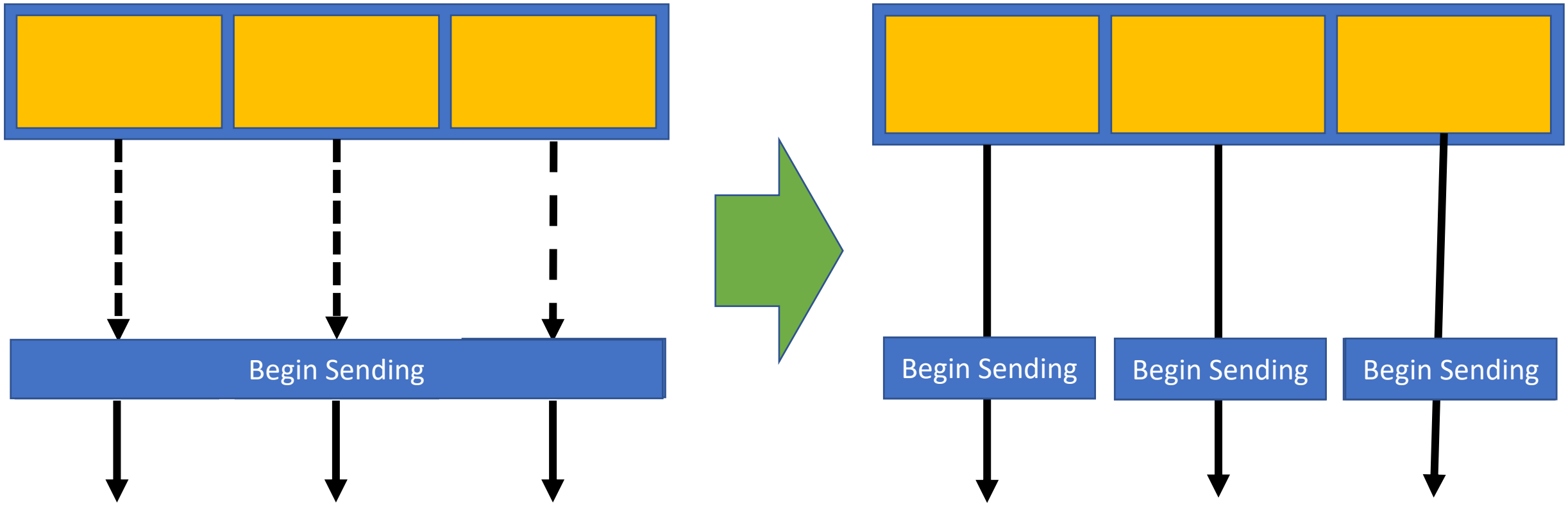
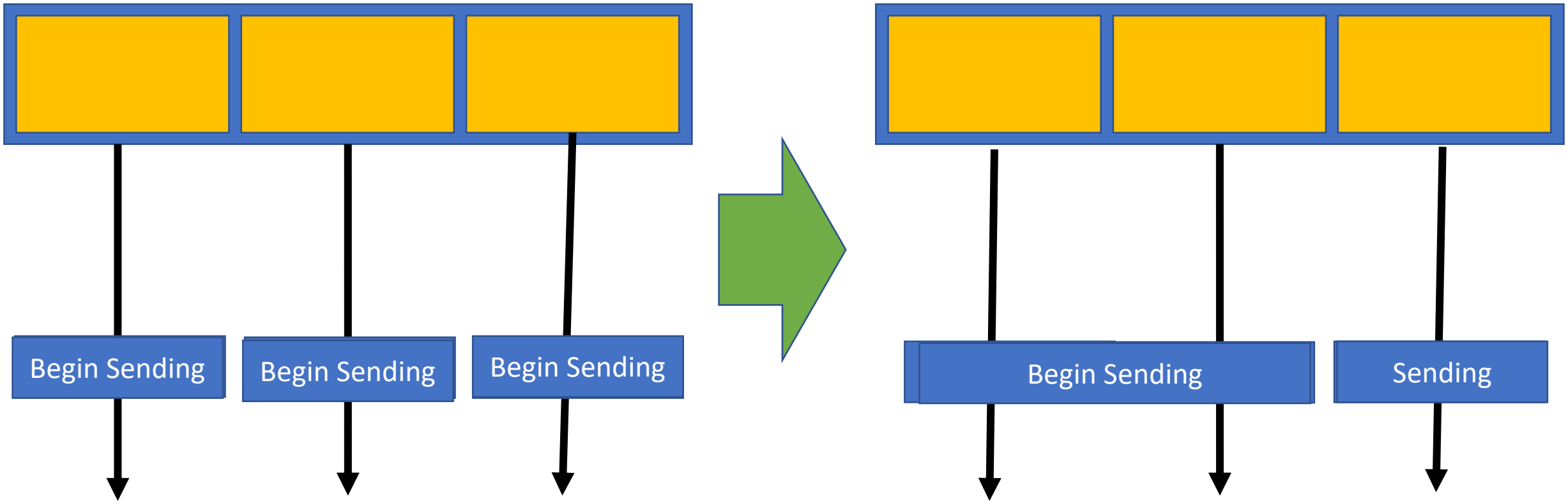
Partitioned Communication Model



Partition Aggregation



Partitioned Communication API

Approved MPI 4.0 Functions	C Language Binding
MPI_Psend_init	void *buf, int partitions, MPI_Count count, MPI_Datatype datatype, int dest, int tag, MPI_Comm comm, MPI_Info info, MPI_Request *request
MPI_Precv_init	void *buf, int partitions, MPI_Count count, MPI_Datatype datatype, int source, int tag, MPI_Comm comm, MPI_Info info, MPI_Request *request
MPI_Pready	int partition, MPI_Request *request
MPI_Pready_range	int partition_low, int partition_high, MPI_Request *request
MPI_Pready_list	int length, int array_of_partitions[], MPI_Request *request
MPI_Parrived	MPI_Request *request, int partition, int *flag
Proposed MPI 4.1 Functions	
MPI_Pbuf_prepare	MPI_Request request
MPI_Pbuf_prepareall	int count, MPI_Request requests[]

Initialize Operation

Signal Partition Read

Check for Partition Arrival

Robust Synchronization

In practice

- Break buffer into partitions.
- Threads signal when ready to transmit.
- Library decides transmission method
- Data is arrives as piecewise at receiver

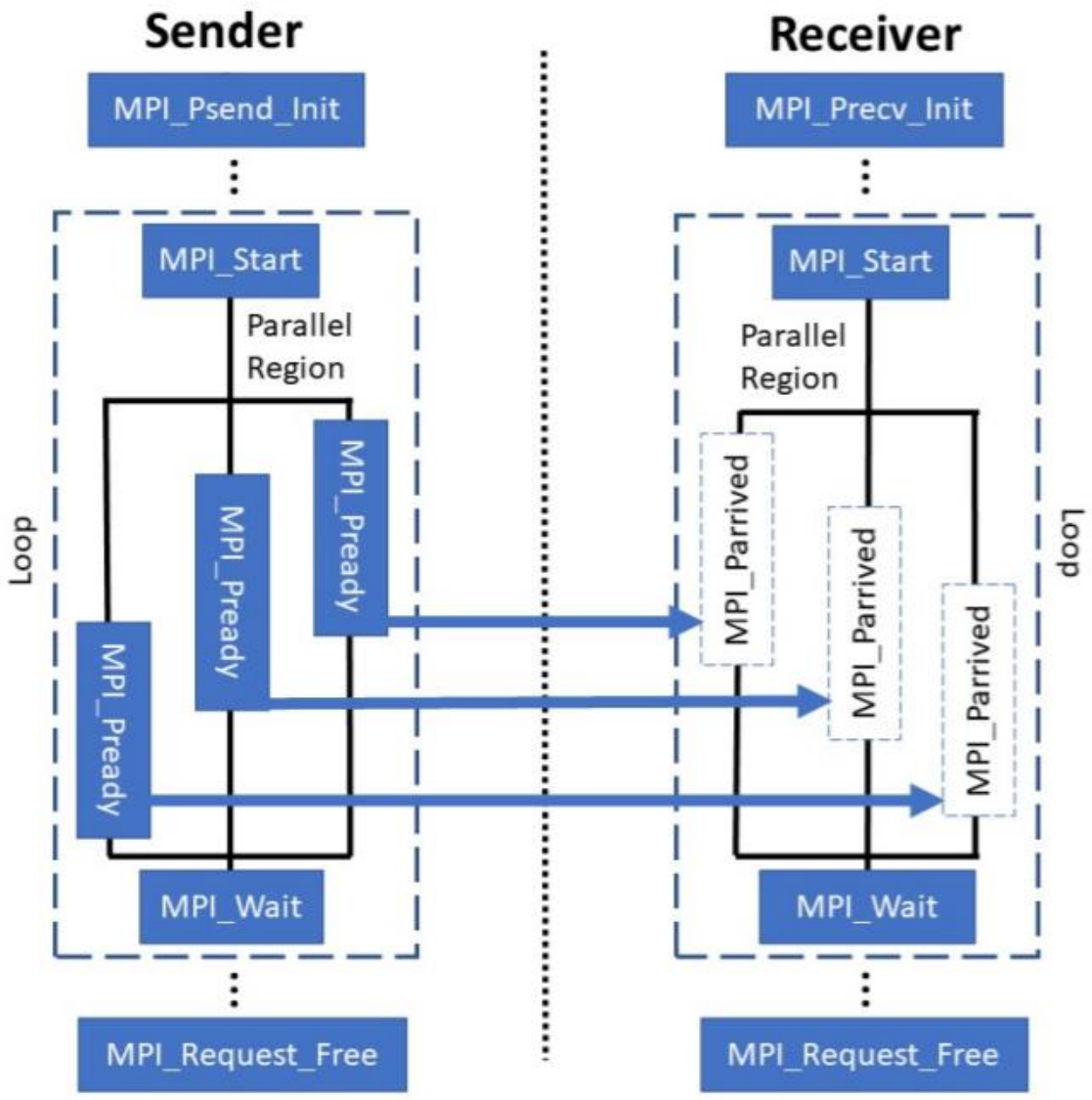


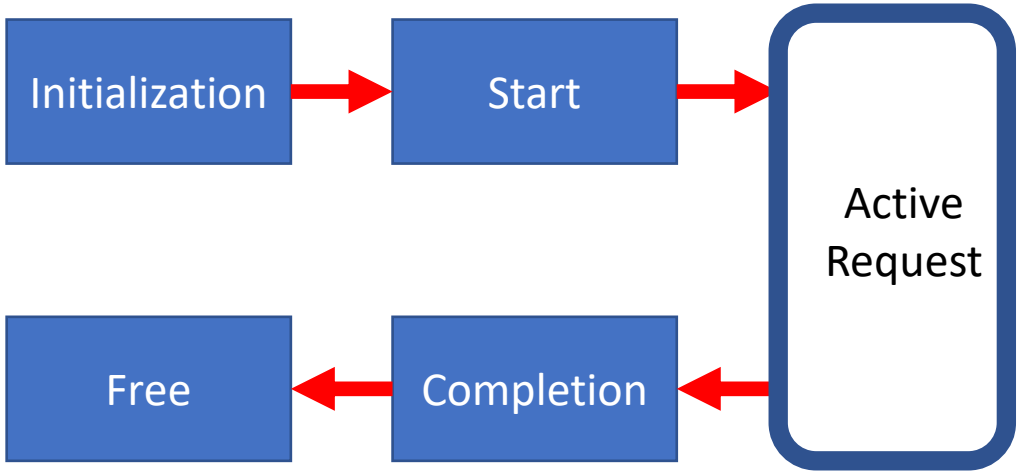
Figure 3.1: Functional, user-level view of partitioned communication according to

Portable Layered Library

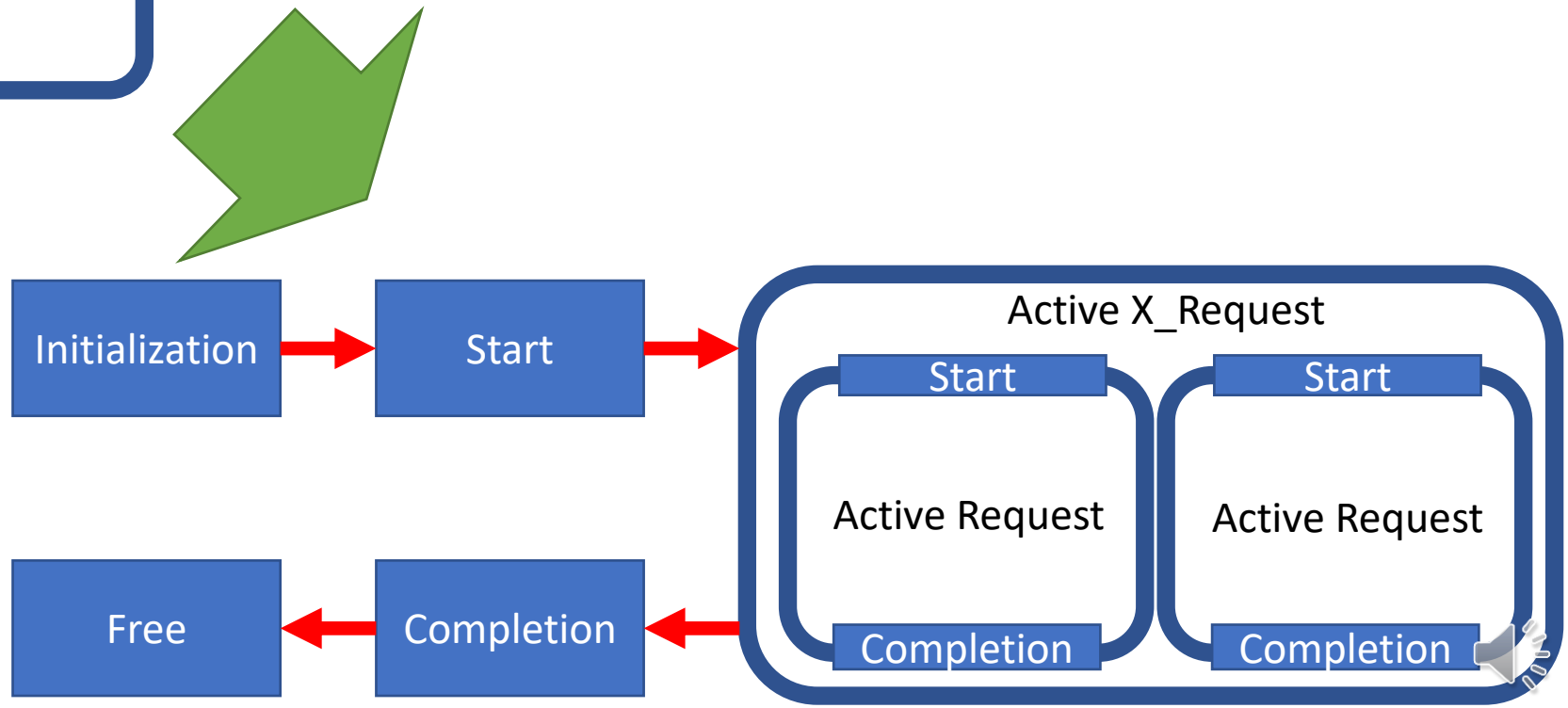
- Features
  - Runs on top of MPI 3.0 complaint implementations
  - MPIX versions of Partitioned Communication API
  - Uses new Request Object for tracking internal messages
  - Basic Static Aggregation Functionality

- Purpose
  - Early testing and Prototyping

Tracking Partition Tracking via MPIX_Request



- Multiple Requests nested inside a MPIX_Request object.
- Each internal request starts as soon as possible



Synchronization

- Non-local operation required by a local function
- Need to separate progress from function return.
- Solution: off-load to a progress engine.
  - Internal Implementations can use a internal progress engi
  - MPIPCL spawns a thread to act as a Progress Engine.

Benefits & Complications of Static Aggregation

What do we mean by static aggregation?

A single constant mapping between the partition contents and the internally generated messages

Pros:

- Easier Mapping and Tracking
- Single synchronization required.

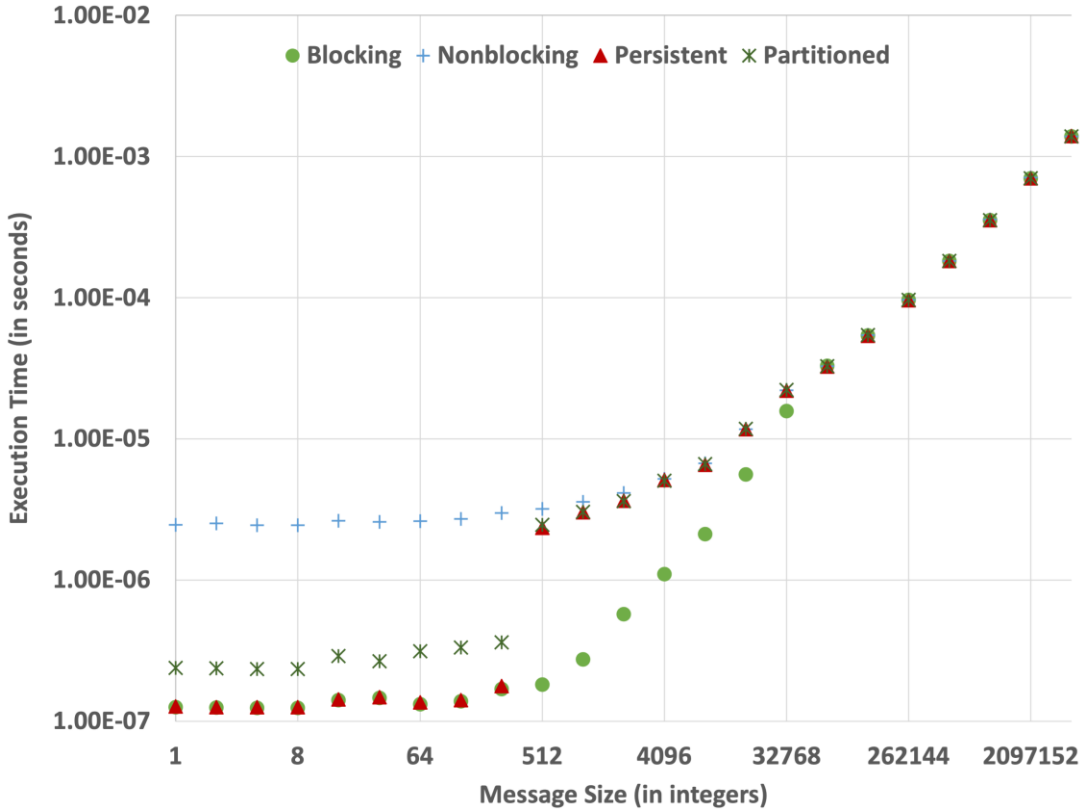
- Cons
  - Synchronization needed at initiation
  - Message aggregation cannot be modified based on dynamic conditions.

Testing

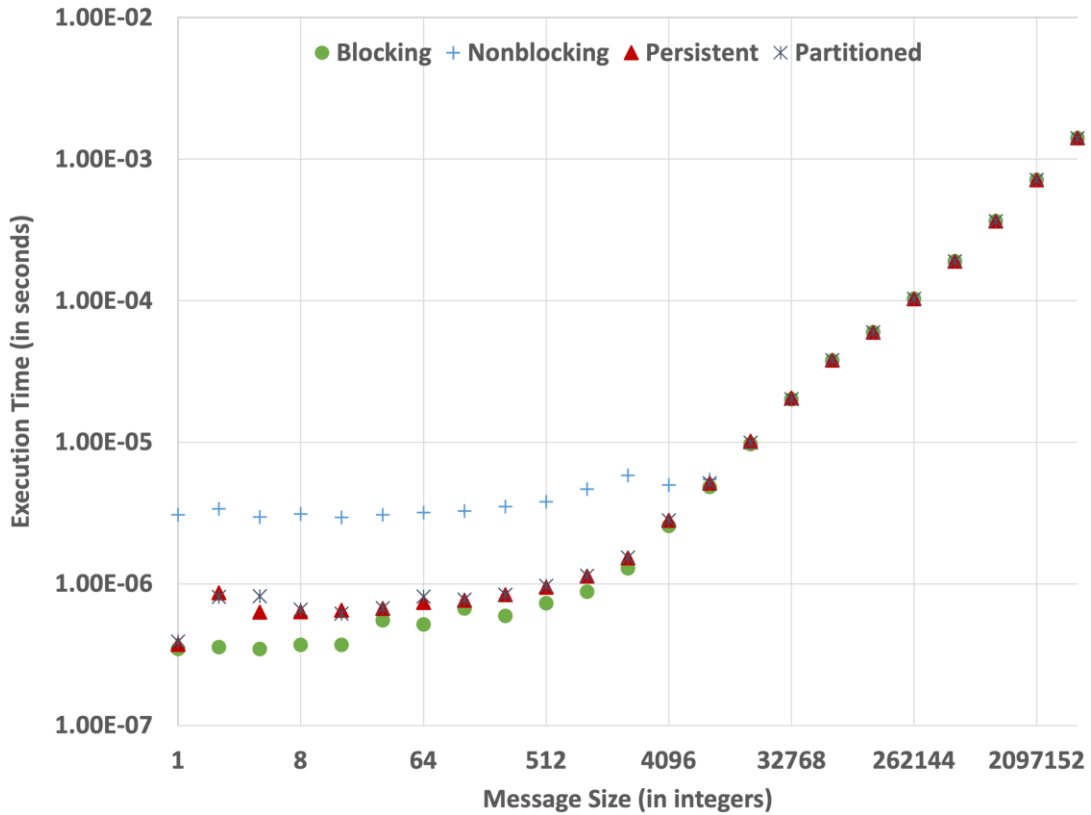
- External MPIPCL Library
  - Intel MPI
  - OpenMPI

- OpenMPI Integrated Version
  - Some modifications required.
  - Used internal progress engine
  - Changed how some of the functions worked.

Performance Vs. Existing Communications

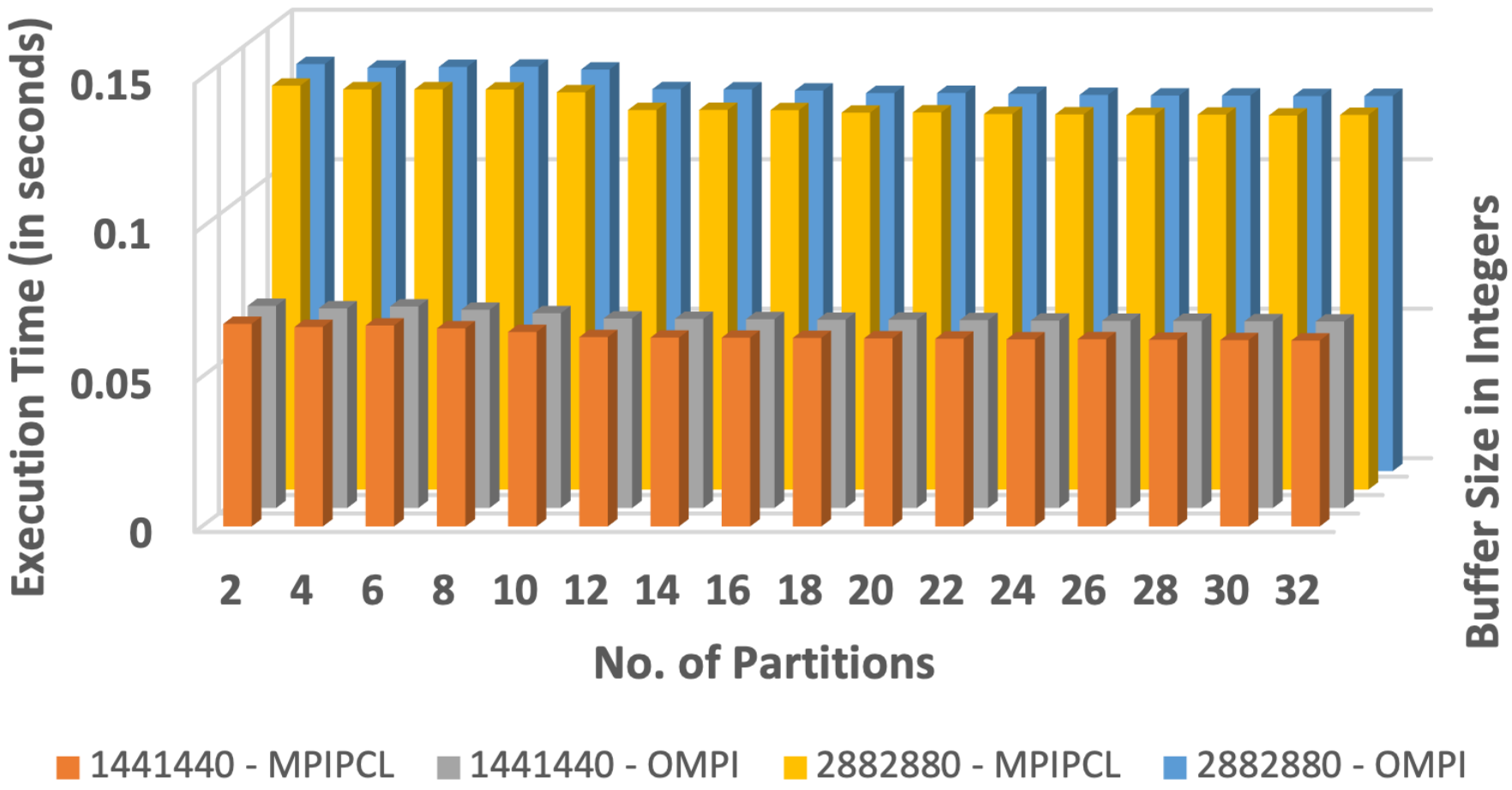


OpenMPI

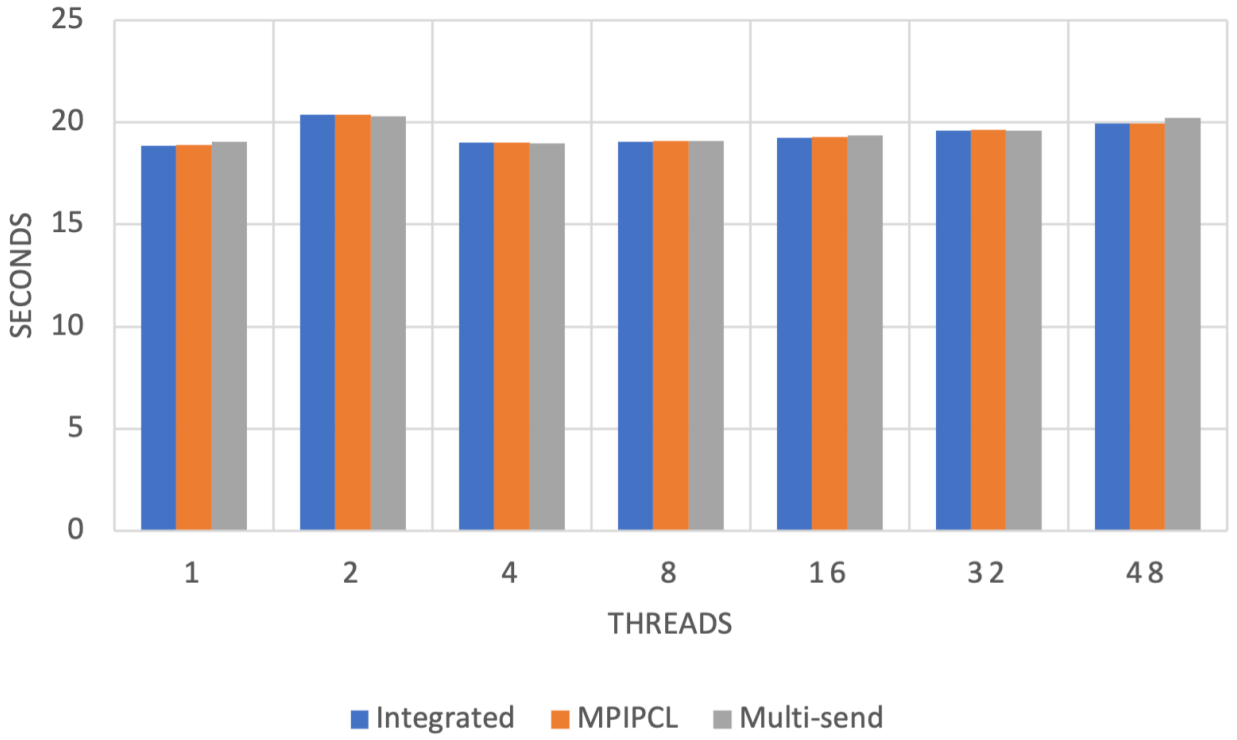


Intel MPI

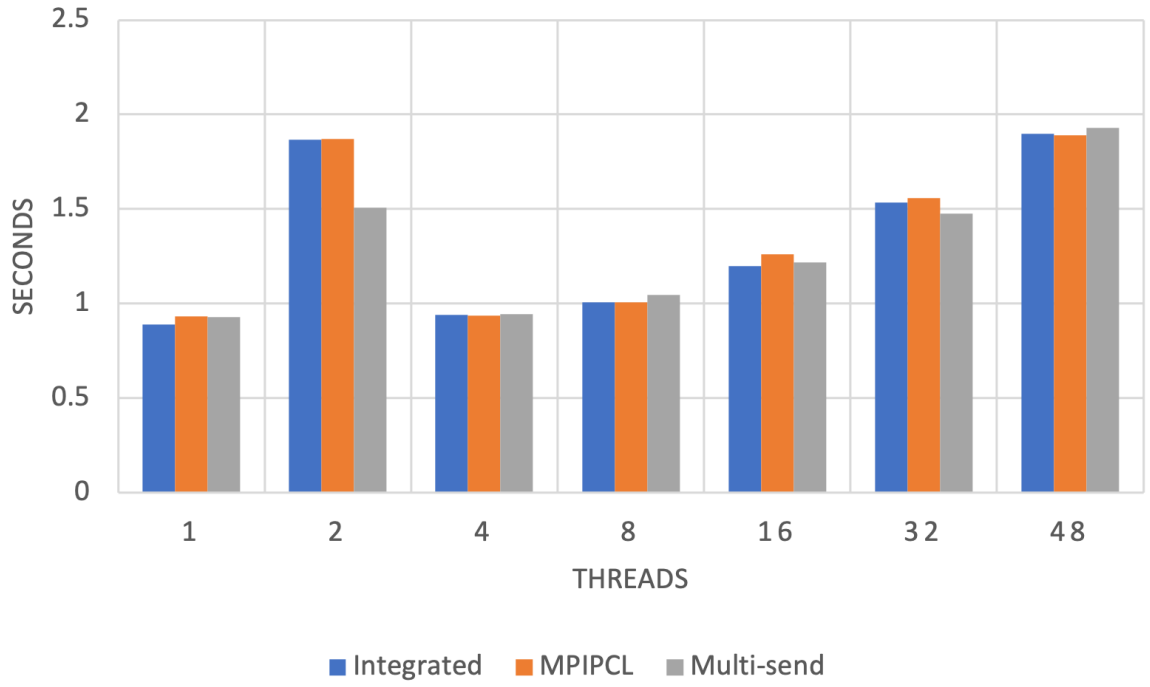
Layered vs. Internal



Performance Results - MiniFE



Solve Time



Communication Time

Conclusion

- The library successfully allows access to the partitioned communication API.

- Performance is not negatively effected even with lack of optimizations.