Channel Interface

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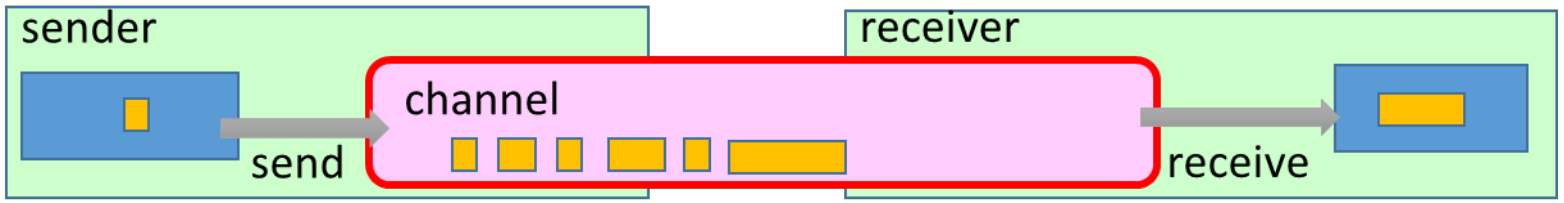
Overview of the proposal in Kobe (Sep, 2014)

- Single-directional, in-order and on-demand channel
- Data type
  - `MPI_Ch` : a handle of a channel
- Routines for channel allocation / deallocation
  - `MPI_Channel_create(sender, receiver, &ch, comm)`
  - `MPI_Channel_free(ch)`
  - `MPI_Channel_ifree(ch, &req)`
- Routines for message passings on a channel
  - `MPI_Channel_send(ch, addr, count, type, comm)`
  - `MPI_Channel_isend(ch, addr, count, type, comm, &req)`
  - `MPI_Channel_recv(ch, addr, count, type, comm)`
  - `MPI_Channel_irecv(ch, addr, count, type, comm, &req)`



Background and motivation of the proposal

- Background:
  Memory requirement for communication.
  - For buffers and/or control structures
    (e.g. remote addresses, flags and counters)
  - Requirement depends on the pattern of producers and consumers.
    - High speed communication tends to require larger memory.
- Motivation:
  Enable memory-efficient implementation of the library.
  - lower latency, higher bandwidth
  - just enough memory consumption
- Approach:
  Explicit specification of the duration and the pattern of the communication.

Comments so far

- Need use-cases to show its advantage.
- There were similar approaches.
- Can't be memory efficient.
  - MPI_COMM_WORLD requires O(N) memory consumption.
  - Even proposed channels require O(N) memory to keep information for establishing connections.
- 'On demand' techniques already exists.
  - Lazy creation of connection.
  - Heuristic de-allocation.
- Effect from 'in order' is not promising.
  - 'no-wildcards' on INFO (Ticket 381) will solve the problem.
  - Data transfers on networks can be 'unordered'.

Comments so far (cont.)

- Should consider other patterns.
  - P2P is too primitive
    - Dedicated buffers for every P2P are not scalable.
    - Require dumping information for creating channels.
  - 'Topology' may be more efficient way to express the change of the communication pattern.
    - Collectives, Graphs, etc.
- Should consider MPI_Freeze / MPI_Thaw also.
- 'Count' should be MPI_Count.
- How to decide the internal buffer size?
- Functions for querying the address of the buffer?
  - Helps to use zero-copy data transfer.

Chances of advantages of the current proposal

- Still, memory consumption can be small enough.
  - Choose appropriate options to minimize the memory consumption at MPI_Init.
  - Information for connection is usually less than 100byte / procs.
    ... less than 100MB for 1M procs.
  - In case the number of connections per process is few enough.
- Different from persistent communication.
  - Address and size of the message are not fixed.
- More precise de-allocation of buffers than heuristics.
- Hints can be provided per channel, rather than per communicator.
  - e.g. size of the internal buffer, etc.

but ...

Problems in the current proposal.

- No practical use-cases
  - Persistent communication seems to be sufficient in most of the cases.
    - ex)
      Adaptive Mesh Refinement, Stencil, ...
      - Messages with different addresses and sizes may be packed into one buffer.

- May conflict with other similar approaches.
  - Op_notify / Sync_notify
  - Stream(?)

Other ways

- Topology: Multiple producers and consumers
  - Persistent collectives
    (proposed 7 years ago in Collectives WG).
    - https://svn.mpi-forum.org/trac/mpi-forum-web/wiki/PersColl
    - ex)

```
MPI_Request *persreq;
 ...
 do_init();
 MPI_Bcast_init(buf, count, datatype, root, comm, persreq);
 while (!finished) {
    fill_buffer(buf, count);
    MPI_Start(persreq);
    finished = do_computation();
    MPI_Wait(persreq, status);
 }
 MPI_Request_free(persreq);
```

  - Persistent neighbors
    - Graph comms with fixed address and size of the buffer to be used.

Conclusions

- Proposal of Channel Interface.
- At least, there are some differences over other ones.
- Practical use case is the critical issue.
  - We continue to look for it.
- Persistent collectives and neighbors are other options.