Screencast:
Tuning the Openib BTL (v1.2 series)

Jeff Squyres

May 2008

openib BTL Parameters

```
ompi_info --param btl openib
```

- Shows all openib BTL MCA parameters
  - …there are a lot!
- Also try:

```
ompi_info --param btl openib \
    --parsable
```

- What do they all mean?

openib BTL Parameter Prefix

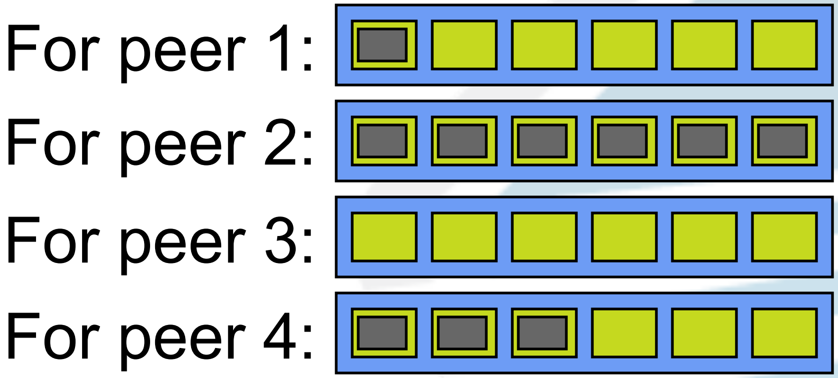
- All parameter names are prefixed
  - Guarantees uniqueness between components
  - “btl_openib_”
- Prefix will not be shown here for brevity
  - “foo” → “btl_openib_foo”

Simple Parameters

- max_btls: integer
  - -1 (use all, default) or >0
  - Max number of IB ports to use (start: port 0)
- mtu: integer (default per hardware)
  - 1=256 bytes, 2=512 bytes, 3=1024 bytes, 4=2048 bytes, 5=4096 bytes
- ib_service_level: integer (default 0)
  - Direct mapping to virtual lane

Receive Queues

Per-peer receive queues



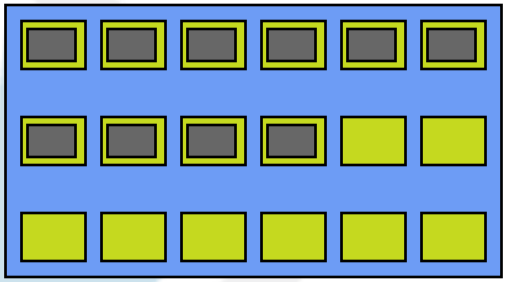
For peer 1:

For peer 2:

For peer 3:

For peer 4:

Shared receive queue

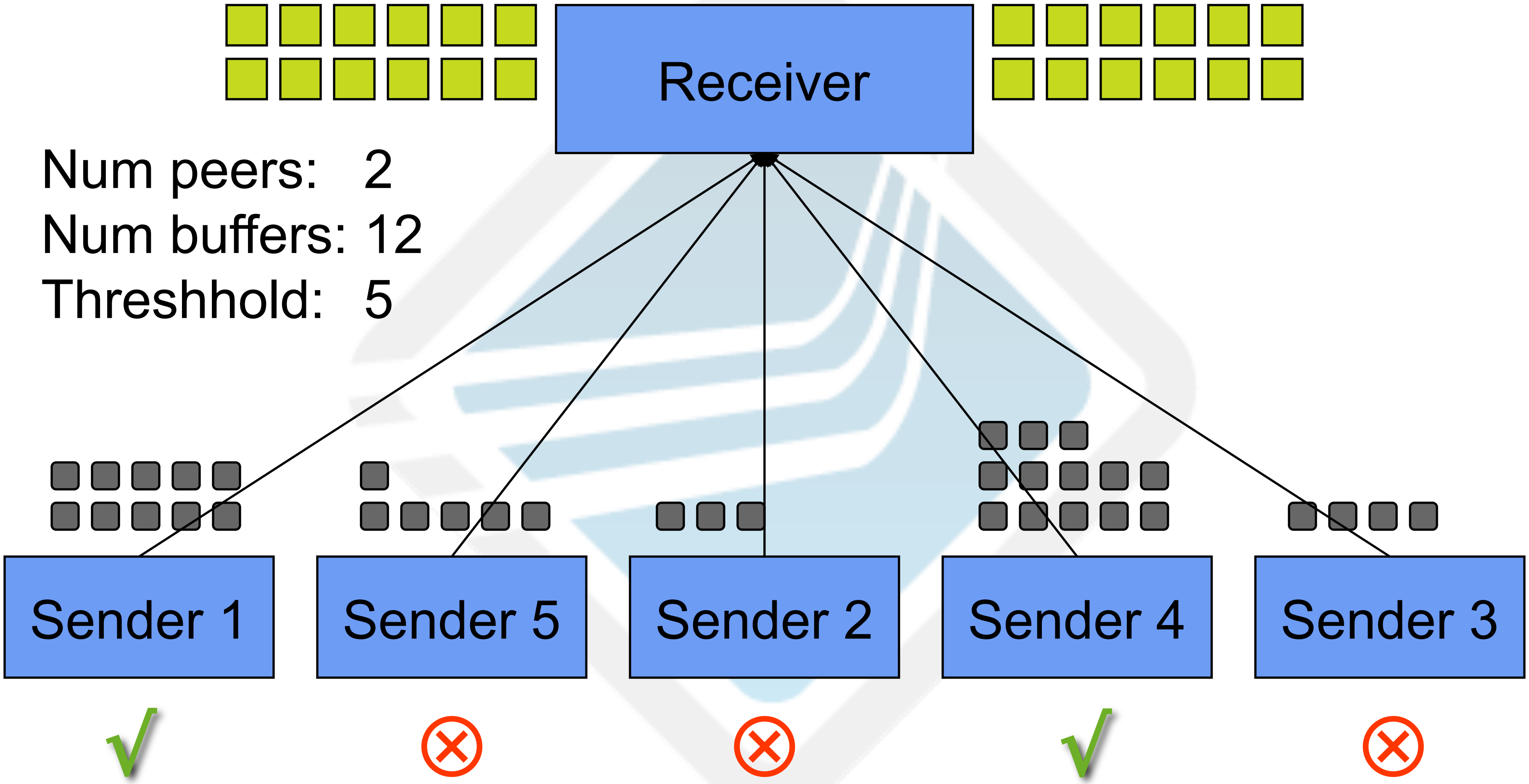


Less than NxM buffers

Receive Parameters (v1.2.x)

- rd_num: integer
  - Number per-peer receive buffers
- use_srq: 0 or 1
  - srq_rd_max: integer
    - Max number of posted receives in the SRQ
    - Set absolute limits
  - srq_rd_max_per_peer: integer
    - Max number of posted receives per peer
    - Uses “stats game” -- log2(num_MPI_procs)
  - srq_sd_max: integer
    - Max number of posted sends to peer SRQ

Short Eager RDMA Params



Receiver

Num peers: 2
Num buffers: 12
Threshhold: 5

Sender 1 ✓

Sender 5 ⊗

Sender 2 ⊗

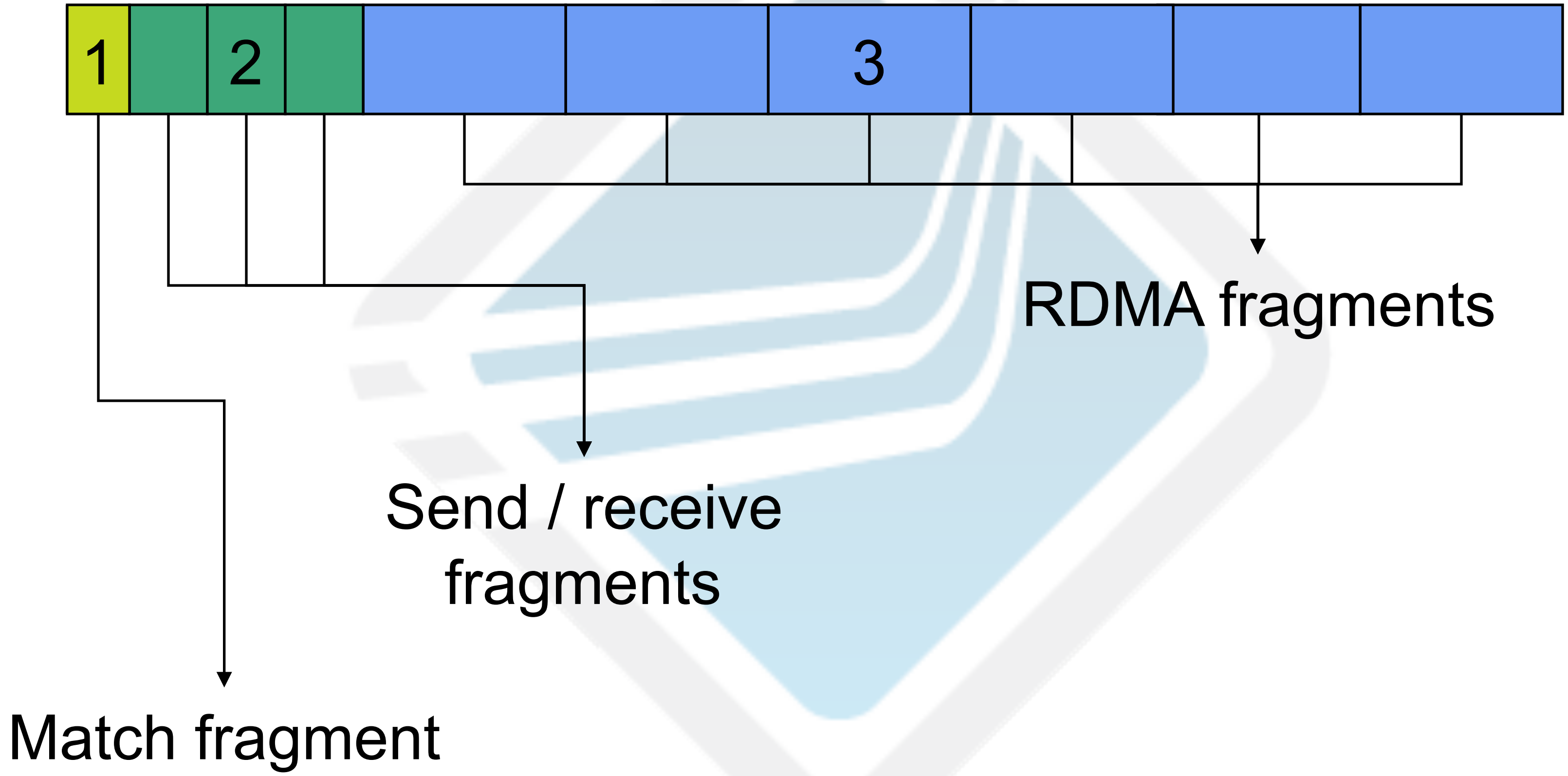
Sender 4 ✓

Sender 3 ⊗

Short Eager RDMA Params

- use_eager_rdma: 0 or 1
- eager_rdma_threshhold: integer
  - Number of receives before setup eager RDMA
- max_eager_rdma: integer
  - Max number of peers to use eager RDMA
- eager_rdma_num: integer
  - Number of posted receive buffers per peer

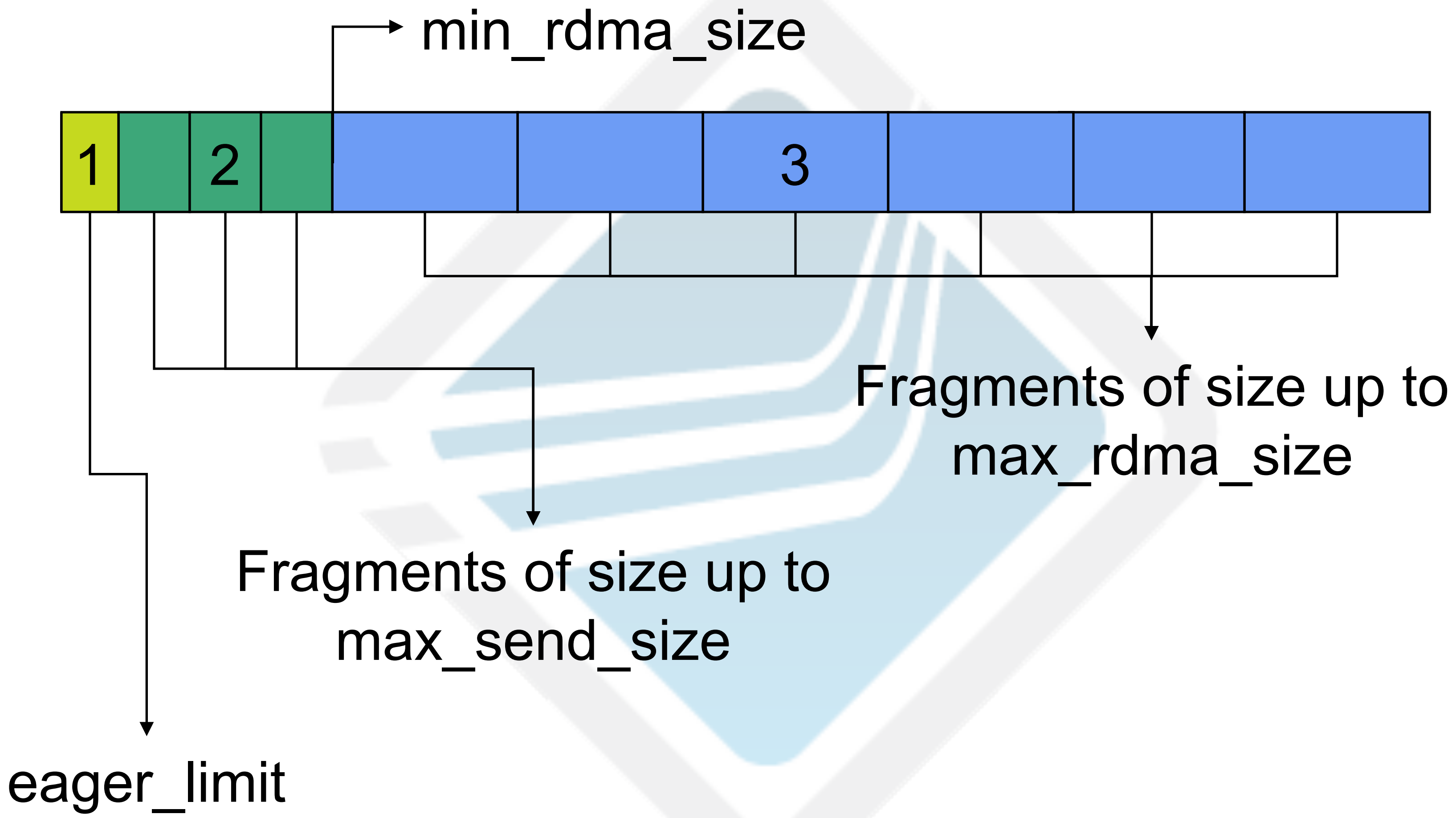
Long Message Protocol



Long Message Parameters

- eager_limit: integer
  - Max size of “eager” (short) messages
- max_send_size: integer
  - Max size of “prime the pipeline” fragments
- min_rdma_size: integer
  - Offset where to start RDMA
- max_rdma_size: integer
  - Max size of long message RDMA fragments

v1.2 Long Message Params



min_rdma_size

Fragments of size up to max_rdma_size

Fragments of size up to max_send_size

eager_limit

Disabling “Eager” Completion

- pml_ob1_use_early_completion
  - “Early completion” latency optimization
  - Enabled (set to 1) by default
- Behavior can be disabled by setting this MCA parameter to 0
  - Can cause problems (hangs) in some applications that do not enter the MPI library frequently

Timeout Parameters

- All are directly given to verbs API
- btl_openib_ib_min_rnr_timer: 0-31
  - Receiver not ready timer (seconds)
- btl_openib_ib_timeout: 0-31
  - InfiniBand transmit timeout, plugged into:

$$4.096\mu s * 2^{\text{btl\_openib\_ib\_timeout}}$$

- btl_openib_ib_retry_count: 0-7
- btl_openib_ib_rnr_retry: 0-7

Freelist Parameters

- “Freelists” maintained of registered memory buffers
  - Indexed by *count* of buffers (not size)
- free_list_max: integer
  - Max number of buffers in freelist (-1 = infinite)
- free_list_num: integer
  - Initial number of buffers
- free_list_inc: integer
  - Number of buffers to add when empty

Memory Pool Parameter

- mpool_rdma_cache_size_limit: integer
  - In “rdma” mpool component; not openib BTL
  - Memory pool
  - Max limit on user-registered memory
- Used in conjunction with openib BTL parameters, can establish a maximum limit of all registered memory

Registered Memory Footprint

- Still quite complicated!
  - Sum of combinations of many MCA parameters
  - FAQ web page gives good description
- Total registered memory can be limited
  - May need to use an Excel spreadsheet…

MPI Layer Parameters

- mpi_leave_pinned: 0 (default) or 1
  - Leave user buffers registered (“pinned”)
  - **Extremely important for benchmarks that re-use buffers!**
- mpi_paffinity_alone: 0 or 1
  - Must be manually set
  - Assume MPI job is “alone” on the node
  - Pin MPI processes→processors starting with 0
- mpi_yield_when_idle: 0 or 1
  - When busy-polling, call yield()

Sidenote: Portable Linux Processor Affinity (PLPA)

- Sub-project of Open MPI
- Small library to do processor affinity
  - Pin process A to processor X
  - API for processor affinity has changed 3 times
  - Depends on glibc, kernel, and distro versions
- PLPA provides stable API
- New version can map (socket, core) tuples to Linux virtual processor ID
  - plpa_taskset(1) command

More Information

- Open MPI FAQ
  - General tuning

    http://www.open-mpi.org/faq/?category=tuning
  - InfiniBand / OpenFabrics tuning

    http://www.open-mpi.org/faq/?category=openfabrics

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