BEYOND SPEEDS AND FEEDS - WHAT NEW CAPABILITIES ARE NEEDED FOR EXASCALE INTERCONNECTS?

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Hanlon's Razor (blame stupidity, not malice).
Hardware

• Endpoint resource partitioning (primarily for multithreading).
• Standard atomics, including 64b float math. Whatever MPI3+ needs.
• Pre-posted receives should make asynchronous progress.
• Support fabric isolation and/or QoS.
• Performance monitoring tools everywhere.
• Power-related features.
• Efficient reliability. Handle node faults effectively. Prevent Byzantine failures.
Software

• MPI-4 is the only necessary exascale programming model runtime system.

• Unrestricted multithreading support should be maximally efficient.

• Lockless. MPI endpoints? Per-communicator queues?

• Send-Recv is a necessary evil. Emphasize scalable/efficient constructs like neighborhood collectives and RMA.

• Nonblocking must mean asynchronous.

• Fault-tolerance. Checkpoint-restart inadequate for many workloads.

• Efficient interaction with the processor without heavy polling (for power).
Software

• Composability
  • MPI, PGAS, IO/Analysis, Profile/Debug as separate clients of network API.
  • Bootstrap MPI on top of cloud frameworks (MPI sessions?).