Open MPI Community Meeting

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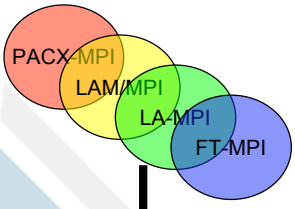
Overview

- Introduction to Open MPI
- Current status
- Future directions
- Audience feedback

Open MPI Is…

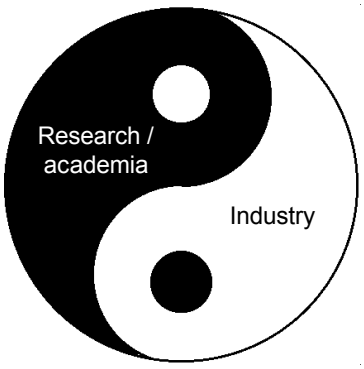
- Open source
  - Started with expertise from 4 MPI implementations
  - Has grown into a full community
- Features of Open MPI:
  - Full MPI-2 implementation
  - Fast, reliable and extensible
  - Production-grade code quality as a base for research
  - BSD license



OPEN MPI

Why Does Open MPI Exist?

- Maximize all MPI expertise
  - Research / academia
  - Industry
  - …elsewhere
- Capitalize on [literally] years of MPI research and implementation experience
- The sum is greater than the parts

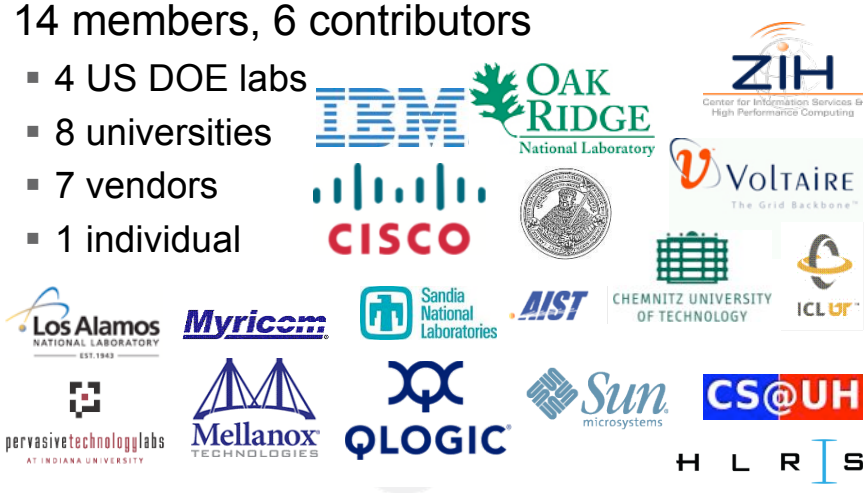


Why Separate From MPICH / MVAPICH?

- Open, inclusive community
- Support for more networks
- Support for many resource managers
- MPICH / MVAPICH have different project goals
  - They both chose to remain separate

Current Membership

- 14 members, 6 contributors
  - 4 US DOE labs
  - 8 universities
  - 7 vendors
  - 1 individual



Sponsers

Current Status

- Stable release version: v1.2.3
- Source code
  - tarballs
  - SRPM
  - Subversion repository
- Binaries available for
  - OpenSuse
  - Mandriva
- Binaries included in
  - RHEL, Fedora, Scientific Linux, …
  - Debian (just saw posting this past weekend)
  - Gentoo
  - OFED
  - Sun ClusterTools 7
  - OS X Leopard (*)

Current Status

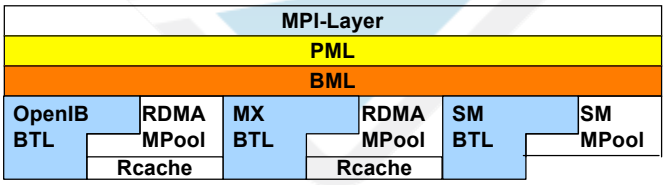
- Networks
  - Shared memory
  - Infiniband:
    - OpenFabrics
    - UDAPL
    - mVAPI (deprecated)
  - InfiniPath
  - Myrinet
    - gm
    - MX
  - Portals
  - TCP
- Resource managers
  - Clustermatic Bproc
  - LoadLeveler
  - PBS / Torque
  - POE
  - rsh/ssh
  - SGE / N1GE
  - SLURM
  - Xgrid
  - LSF (coming soon)

Features

- Plugins: “MCA”
  - Plugins auto-select based on environment
  - Selectable by user/admin
- ISVs may
  - Distribute binary plugins
  - Redistribute Open MPI
- Run-time tunable values
  - MPI layer parameters
  - Per plugin parameters
- Change behavior of code at run-time
  - Does *not* require recompiling / re-linking
- Simple example
  - Choose which network to use for MPI communications

Point to Point Architecture

- Now MPI_SEND is fantastically complex!
  - Fragment the message
  - Select which device(s) to use
  - Send each fragment on an available device
  - Be careful with resource usage…etc.



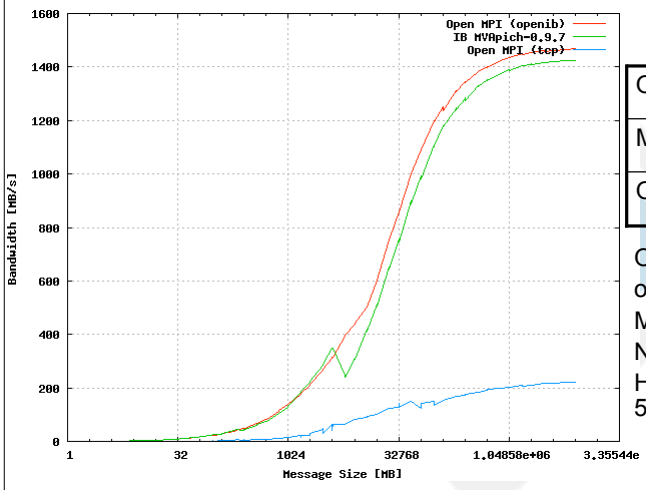
Configuration

- "Normal" GNU installation

```
shell$ configure && make all install
```

- Can easily adapt for your site:
  - Select which plugins to be compiled
  - Build static libraries (including plugins)
  - Deselect optional features (C++/F90 bindings)
  - Enable tracing based on PERUSE
  - …etc.

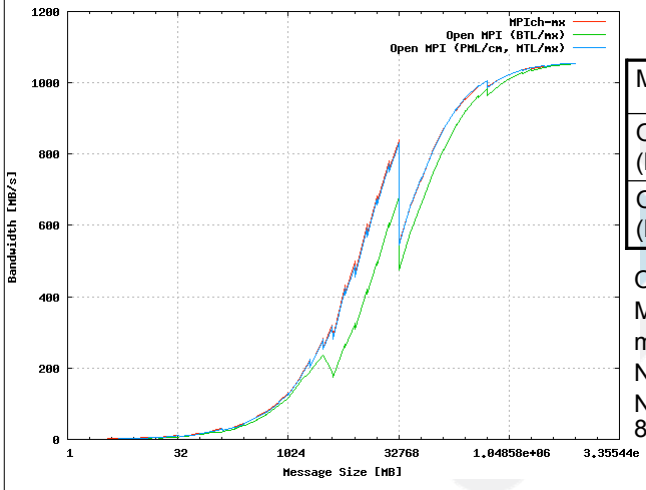
Open MPI IB DDR Performance



	µs	MB/s
Open MPI IB	3,23	1467
MVApich 0.9.7	3,15	1425
Open MPI (tcp)	62.6	221

Open MPI-trunk~r14000 (BTL)
ofed-1.1-stack
MVApich-0.9.7
NetPipe-3.6.2
HCA: MT25204 !mem, 4x, 5Gbps = 20 Gbps, 8x PCIe

Open MPI Myri-10G Performance



	µs	MB/s
MPIch-mx	2,62	1055
Open MPI (BTL mx)	3,34	1053
Open MPI (MTL mx)	2,83	1055

Open MPI-trunk~r14000 (BTL)
MPIch-MX-1.2.7..1
mx-1.2.0i
NetPipe-3.6.2
NIC: Myri-10GE, 2MB mem, 8xPCIe

Success Stories

- Achieved #6 slot on Sandia Thunderbird
  - 53 tflops
  - November 2006 Top500 list
- Vendor support
  - Sun ClusterTools 7
  - OpenFabrics vendors / OFED
- Integrated in many Linux distros

COMMUNITY

Roadmap

- v1.2 series
  - Current stable version: v1.2.3
  - v1.2.4 is possible (minor bug fixes)
- v1.3 series
  - “Expected” towards end of 2007
  - Difficult to exactly predict timelines with multi-organization open source projects

Possible Upcoming Features

- v1.3 *may possibly* contain:
  - Checkpoint / restart functionality
  - Better mapping of IB HCA ports to processes
  - Add the Portable Linux Processor Affinity (PLPA) support to portably pin processes to specific cores
  - End-to-end data reliability
  - Memory debugging features
  - Symbol visibility, compiler attributes, Fortran fixes
- Something down the road:
  - Windows CCS support
  - More forms of fault tolerance

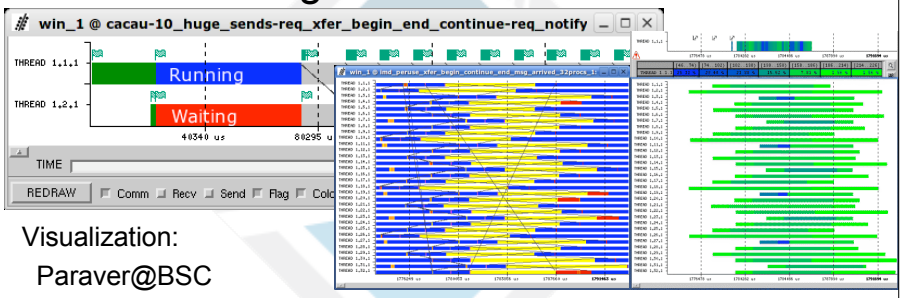
Valgrind Memory Debugging

- Work by HLRS
- Check of Open MPI memory failures:
  - Parameters passed to MPI
  - Definedness of MPI-internal structures
- Check of application's MPI-conformance:
  - MPI-buffers passed to MPI_IRECV, …

```
MPI_Irecv (buffer, … &req);
buffer[n] = 1;
MPI_Wait (&req, &status);
```

PERUSE

- Work by HLRS, U. Tennessee
- Give tools insight to MPI-internal state



Visualization:
Paraver@BSC

- # of fragments/second - congestion (top)
- # of physical concurrent transfers (bottom)

Checkpoint / Restart

- Work by Indiana University
- Added much infrastructure to Open MPI
  - Next generation beyond LAM/MPI
  - Generic process and parallel job FT support
  - Foundation for many other forms of fault tolerance
- First: LAM/MPI-like coordinated checkpoint
  - Uses BLCR or “self” plugins

OpenFabrics Features

- Work by OpenFabrics vendors, Livermore
- Better mapping of cores to HCAs (NUMA)
- Better multi-NIC fragment scheduling
- Support for asynchronous events
- Small message aggregation
- RDMA connection manager (iWARP)
- Threaded progress
- Unreliable datagram support (?)

What do You Want From MPI?

(audience -- you talk now)

How Important Is…

- Thread safety
  - Multiple threads making simultaneous MPI calls
- Parallel I/O
  - Working with parallel file systems
- Dynamic processes
  - Spawn, connect / accept
- One-sided operations
  - Put, get, accumulate
- Multi-core operations
  - Fine-grained process affinity
  - Internal host topology awareness

Come Join Us!

http://www.open-mpi.org/