The Local Area Multicomputer (LAM) Implementation of MPI

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Overview

- What is LAM/MPI?
- Why would I use LAM/MPI?
- How do I use LAM/MPI?
- Where do I get LAM/MPI?
- Future directions

What is LAM/MPI?

- An independent implementation of the MPI standard
- All of MPI-1 (except MPI_CANCEL sent messages)
- Much of MPI-2
- Originally developed at the Ohio Supercomputing Center
  - Now developed / maintained at the University of Notre Dame

MPI-2 Features

- Dynamic processes
- Most of one-sided communication
- Most new MPI-2 datatypes
- Many MPI-2 support functions
- MPI-IO (from the ROMIO package)
- C++ bindings for MPI-1 functions
- Interoperable MPI (IMPI) point-to-point support

Usability Features

- Persistent, daemon-based run-time environment
- Visual debugging through XMPI
- Supports SPMD and MPMD execution models
- Pseudo-tty support (i.e., line-buffered output)
- Can **mpirun** debuggers / scripts
- Can be used with Purify and other memory-checking tools
- *Lots* of documentation

“Cluster Friendly”

- Guaranteed cleanup of user (runaway) processes
- Fast **mpirun** startup, even across large numbers of hosts
- SMP-aware **mpirun** syntax
- Passing of environment to remote ranks
- Works even in non-uniform filesystem environments
- POSIX-like path semantics

Supported Architectures

- Works on just about all POSIX architectures
  - Does not work under Windows
  - ...except under Cygwin
- Supports heterogeneous environments
- 64-bit clean

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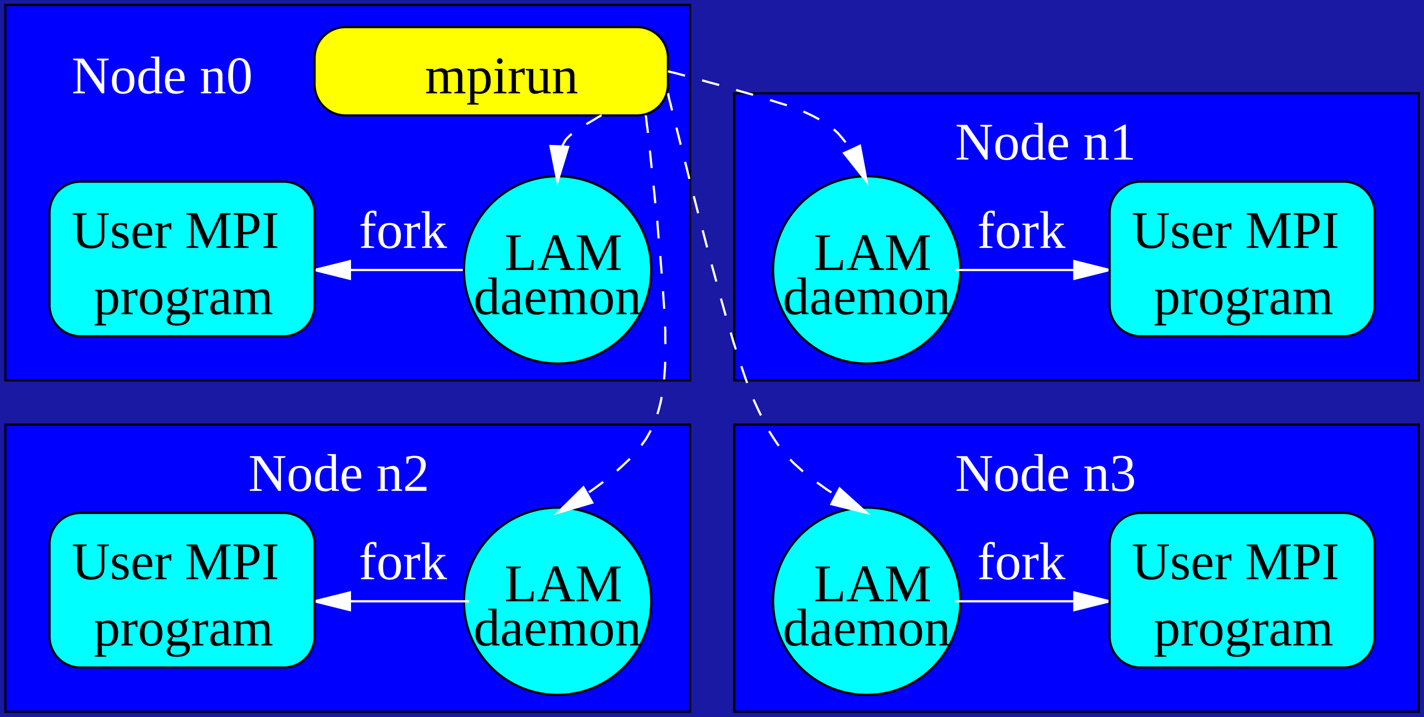
Why would I use LAM/MPI?

- It’s free!
- Under continual development
  - We’re not just the developers, we’re users too
  - New research directions lead to better performance
- Bunches of MPI-2 already implemented
- Ability to **mpirun** scripts and arbitrary debuggers
  - We use this feature extensively to develop LAM itself

Cluster Friendliness

- Integrated process management
- Integrated fast **mpirun** startup

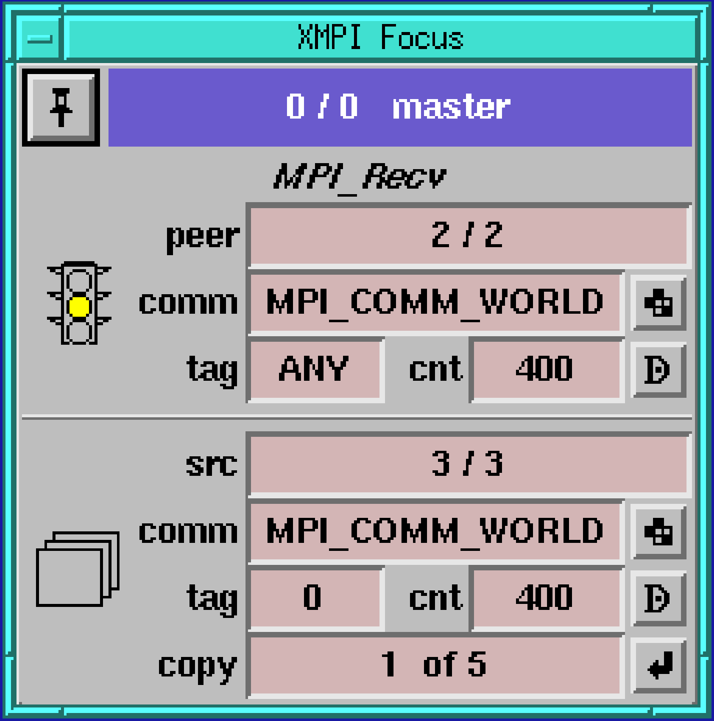


Even More Reasons

- High performance
  - Transparent dual mode shared memory / TCP message passing
  - Optimized common-case send/receive
  - Optimized persistent mode send/receive
- POSIX behavior for serial-like execution semantics

XMPI

- Visualization of messgae passing

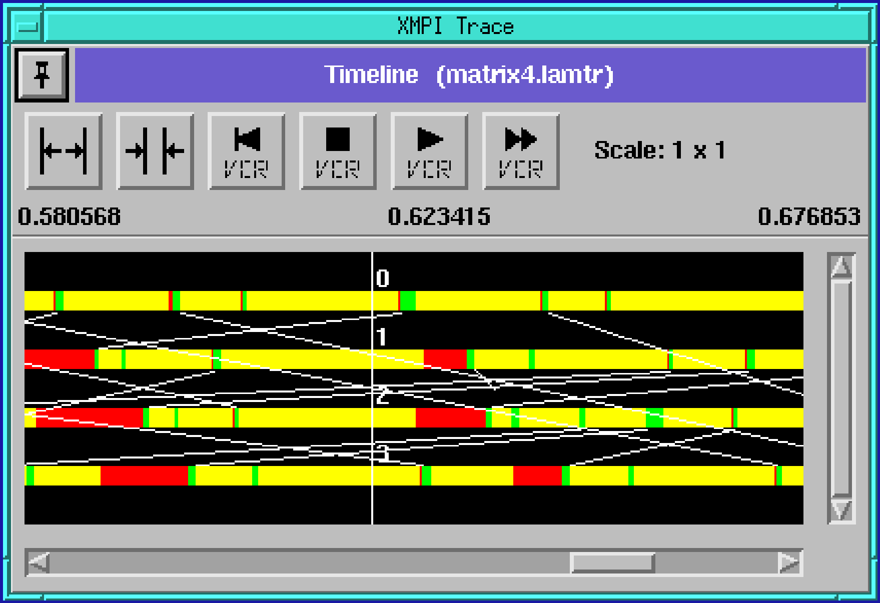


XMPI Focus

0 / 0 master

MPI_Recv

peer	2 / 2		
comm	MPI_COMM_WORLD		
tag	ANY	cnt	400
src	3 / 3		
comm	MPI_COMM_WORLD		
tag	0	cnt	400
copy	1 of 5		



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How do I use LAM/MPI?

- Three main steps:

  1. Start the LAM/MPI run-time environment

     lamboot -v hostfile

  2. Run user program(s)

     mpirun -np 4 program1

     mpirun -np 8 program2

     . . .

  3. Shutdown the LAM/MPI run-time environment

     lamhalt

Compiling

- “Wrapper” compilers take care of all necessary flags
- Used just like “real” compilers

C:	**mpicc foo.c**
C++:	**mpiCC bar.cc**
Fortran:	**mpif77 baz.f**

- Can change the underlying compiler

```
setenv LAMHF77 f90
mpif77 baz.f
```

Process Management

- **lamclean**: Clean up "runaway" processes
  - Most helpful when debugging parallel code
  - Especially if ˆC, for some reason, doesn't kill everything
- **mpitask**: Check progress of MPI ranks

```
TASK          FUNC   SRC   TAG    COMM    CNT    DTYPE
0/0 a.out     Recv   1/1   1234   WORLD   1024   INT
1   a.out     <run>
```

- **mpimsg**: See pending messages on the network

```
SRC   DEST   TAG    COMM    CNT    DTYPE
1/1   0/0    4321   WORLD   1024   INT
```

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Where do I get LAM/MPI?

- The main LAM web site is:

  http://www.mpi.nd.edu/lam/

- Also contained in the leading Linux and BSD distributions
  - RedHat
  - S.u.S.E.
  - Debian
  - BlackLab
  - LinuxPPC
  - OpenBSD

Additional Information / Documentation

- The LAM FAQ contains much information about LAM, MPI, and typical cluster-based setups

http://www.mpi.nd.edu/lam/faq/

- The LAM mailing list archives

http://www.mpi.nd.edu/MailArchives/lam/

- To join the LAM mailing list, send mail to "**majordomo@mpi.nd.edu**" with "**subscribe lam**" in the body

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Future Directions

- Myrinet and VIA “drivers”
- Tighter integration with PBS
- Improved shared memory performance
- Full IMPI functionality
- TotalView debugger support
- Thread safety / thread concurrency
- C++ bindings for MPI-2 functions
- Fortran 90 module