

debugging/valgrind/example_rank_league

Valgrind

Example: OpenMPI with valgrind support

- FAQ: Debugging applications in parallel: What kind of errors can Memchecker find?)
- Set up valgrind and build environment

```
module purge
export VALGRIND=true
module add \
    compiler/gnu \
    mpi/openmpi \
    devel/valgrind
```

```
# or to update environment
export VALGRIND=true
module update
```

- To check if valgrind tool memchecker is available in OpenMPI, simply run this command:

```
ompi_info | grep memchecker
```

- Build rank_league benchmark with debug symbols and low optimization settings

```
mpicc -O1 -g rank_league.c -o rank_league
```

- Examine rank_league benchmark with valgrind memchecker. Use one output file per rank

```
mpirun -np 4 bash -c \
    'valgrind \
      --log-file=valgrind.out.${OMPI_COMM_WORLD_RANK} \
      --suppressions="${MPI_ROOT}/share/openmpi/openmpi-valgrind.supp" \
      --suppressions="${MPI_ROOT}/share/pmix/pmix-valgrind.supp" \
      --suppressions="/usr/share/hwloc/hwloc-valgrind.supp" \
```

```
rank_league
```

-> many false positives -> massive increase in runtime

- valgrind -v command line options show used suppressions files

```
...
--3322524-- Reading suppressions file: /software/all/mpi/openmpi/4.1_gnu_11_valgrind/sh
--3322524-- Reading suppressions file: /software/all/mpi/openmpi/4.1_gnu_11_valgrind/sh
--3322524-- Reading suppressions file: /usr/share/hwloc/hwloc-valgrind.supp
--3322524-- Reading suppressions file: /software/all/devel/valgrind/3.20.0_gnu_11_openm
...
```

Example: Valgrind with MPI support

- Set up valgrind environment

```
module purge
export VALGRIND=true
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    compiler/gnu \
    mpi/openmpi \
    devel/valgrind
```

```
# or to update environment
```

```
export VALGRIND=true
module update
```

- Build rank_league benchmark with debug symbols and low optimization settings

```
mpicc -O1 -g rank_league.c -o rank_league
```

- Examine rank_league benchmark with valgrind MPI wrapper

```
mpirun -np 4 bash -c \
    'LD_PRELOAD="${VALGRIND_LIB_DIR}/valgrind/libmpiwrap-amd64-linux.so" \
    MPIWRAP_DEBUG="warn" \
    valgrind \
    --log-file=valgrind.out.${OMPI_COMM_WORLD_RANK} \
    ./rank_league 2>valgrind.stderr.${OMPI_COMM_WORLD_RANK}'
```

valgrind.stderr.0:

```
valgrind MPI wrappers 785165: Active for pid 785165
valgrind MPI wrappers 785165: Try MPIWRAP_DEBUG=help for possible options
valgrind MPI wrappers 785165: warning: no wrapper for PMPI_Get_processor_name
valgrind MPI wrappers 785165: warning: no wrapper for PMPI_Barrier
```

-> fewer false positives -> still massive increase in runtime

- Valgrind MPI wrapper options

```
LD_PRELOAD="${VALGRIND_LIB_DIR}/valgrind/libmpiwrap-amd64-linux.so" \
MPIWRAP_DEBUG="help" \
valgrind \
    ./rank_league
```

Valid options for the MPIWRAP_DEBUG environment variable are:

quiet	be silent except for errors
verbose	show wrapper entries/exits
strict	abort the program if a function with no wrapper is used
warn	give a warning if a function with no wrapper is used
help	display this message, then exit
initkludge	debugging hack; do not use
...	