

# OpenSHMEM

## Standardization Effort for a Uniform API

### Introduction to SHMEM

- Symmetric Hierarchical MEMORY (SHMEM) library is a Partitioned Global Address Space (PGAS) library .
- A simple library API for C, C++ and Fortran programs that supports the Single Program Multiple Data (SPMD) style of programming .
- The SHMEM API supplies routines for remote data transfer, remote atomic memory operations, with a simple set of ordering, locking, point to point synchronization and **collectives** (broadcast, reduction, group synchronization, collection).
- The processors participating in an application using the SHMEM library are referred to as processing elements (PEs).
- PEs communicate with each other through one-sided updates to **symmetric** data elements.
- Symmetric data can be statically allocated, or dynamically allocated at run-time using a symmetric memory allocator provided by SHMEM.
- The following types of data elements are symmetric in SHMEM
  - Globals (**C/C++**: Non-stack variables, **Fortran**: objects in common blocks or with the **SAVE** attribute)
  - dynamically allocated (**C/C++**: `shmalloc`, **Fortran**: `shpalloc`)

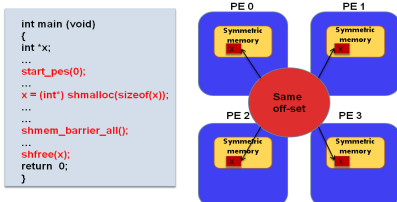


Figure 1. Dynamic allocation of symmetric variable 'x'

- Symmetric data has the same size, type, and relative address on all PEs.
- Explicit synchronization required to guarantee completion of one-sided put operations.

### Towards OpenSHMEM

- Different SHMEM implementations grew out of the SGI and Cray implementations but diverged from the original libraries as they developed.
- The differences between different SHMEM implementations' semantics and APIs are subtle, but result in portability and correctness issues.
- OpenSHMEM is an effort to create a standardized SHMEM library API by making the process open to the community for reviews and contributions.
- SGI's SHMEM API is the baseline for OpenSHMEM Specification 1.0
- The HPC Tools group at the University of Houston in collaboration with Oak Ridge are working on an OpenSHMEM Reference Implementation and Specification development.

### OpenSHMEM Reference Library

- University of Houston's portable SHMEM library in accordance with OpenSHMEM specification 1.0.
- It is designed to use easily available lower level communication libraries like GASNet and ARMCI to interface with the underlying network interconnects.
- Current library implementation is layered over GASNet for efficient one-sided operations.
- Reference library implementation aims to provide multiple algorithms for collectives which are optimized for a range of different execution scenarios.

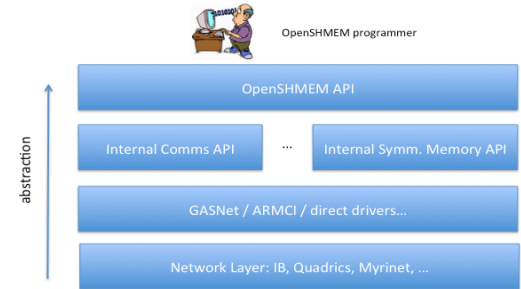


Figure 2. OpenSHMEM Reference Library

- Library design considerations include support for different GASNet segments (fast, large, everything).
- Currently the library implements the complete API as supported by the SGI implementation.

### How to be a part of the OpenSHMEM Community

- OpenSHMEM mailing list for discussions and contributions can be joined by e-mailing [openshmem-join@email.ornl.gov](mailto:openshmem-join@email.ornl.gov)
- OpenSHMEM web site <http://www.openshmem.org/>
- SC11 Birds of a Feather **Wednesday, November 16<sup>th</sup>, 5:30pm – 7:00pm (TCC 203)**
- Come talk with the OpenSHMEMers here