Design and Implementation of User-level Remote Memory Extension Library

Shinyoung Ahn, Gyuil Cha, Youngho Kim, Eunji Lim
Electronics and Telecommunications Research Institute

Abstract—The increase of memory capacity has not kept up with the continuous increase of large memory applications. Therefore, approaches to utilize remote memory like a local memory has been considered as a cost effective way to run large memory applications in the cluster environment where computing nodes are connected via high speed network. For the users of HPC cluster to run large memory application without administrator’s support, we suggest a user-level remote memory extension method. We designed and implemented a remote memory library model which extends the virtual address space of the large memory application process to remote memory. It includes user-level API and page fault handling mechanism, temporal page pool management and remote page prefetching algorithm. We also developed a performance test program to show if the user-level remote memory extension library works well. From the experimental test, we found that user-level remote memory extension library works well for applications with sequential access pattern.

Keyword—Remote memory, Large memory application, Memory Extension, remote memory library

Shinyoung Ahn was born in South Korea in 1974. He received the B.E., M.E. degree in information engineering from SungKyunKwan University, Seoul, Korea, in 1997, 1999, respectively. He also received the M.E. degree in software engineering from Carnegie Mellon University, Pittsburgh, USA, in 2005. He joined Electronics and Telecommunications Research Institute (ETRI), Daejeon, Korea, in 1999. Since 1999, he has been with the cloud computing department, where he is currently a senior researcher. His main areas of research interest are high performance computing, cloud computing, workflow scheduling, and software architecture. Mr. Ahn is a member of Korea Information Processing Society.

Gyuil Cha was born in South Korea in 1970. He received the B.S., M.S. degree in Computer Science from Korea University, Seoul, Korea, in 1998, 2000, respectively. He joined Electronics and Telecommunications Research Institute (ETRI), Daejeon, Korea, in 2000. Since 2011, he has been with High-Performance Computing Research Section, where he is currently a senior research member of engineering staff. His main areas of research interest are High Performance Computing (HPC), System Architecture, and Kernel software.

Youngho Kim was born in South Korea in 1973. He received the B.E., M.E. degree in Information and Communication Engineering from Chungbuk National University, Korea, in 1999 and 2001 respectively. He joined ETRI (Electronics and Telecommunications Research Institute) in 2001. Since 2001, he has been working as a senior researcher at the Cloud Computing Department. His current research interests include High Performance Computing, Cloud Computing, and Parallel and Distributed Systems. Mr. Kim is a member of Korea Information Processing Society.

Eunji Lim received the B.E., M.E. degree in Computer Science from Pusan National University, Busan, Korea, in 1999, 2001, respectively. Since 2001, she has been with Cloud Computing Department in Electronics and Telecommunications Research Institute (ETRI), Korea, where she is currently a senior researcher. Her main areas of research interest are Distributed System and High Performance Computing.