An Introduction to GASNet-EX for Chapel Users (Talk Proposal)

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Have you ever typed "`export CHPL_COMM=gasnet`"? If you've used Chapel with multi-locale support on a system without "Cray" in the model name, then you've probably used GASNet [1]. Did you ever wonder what GASNet is? What GASNet should mean to you? This talk aims to answer those questions and more.

Chapel has system-specific implementations of multi-locale communication for Cray-branded systems including the Cray XC and HPE Cray EX lines. On other systems, Chapel communication uses the GASNet communication library embedded in `third-party/gasnet`. In this talk, that third-party will introduce itself to you in the first person.

GASNet-EX [2] is a language-independent, networking middleware library that provides network-independent, high-performance communication primitives including Remote Memory Access (RMA) and Active Messages (AM). We will describe the purpose, motivation and a brief history of GASNet-1 [3] and GASNet-EX. Somewhere short of putting you to sleep with history, we'll switch to describing the relationship between Chapel and GASNet-EX (as seen from our side), including some of the more interesting work the two project teams have collaborated on in the past two years. Having covered the past and present, we'll include the obligatory description of future work.

While this is not a tutorial, we will provide an overview of the main features of the GASNet-EX API. We'll explain how GASNet-EX interfaces serve the needs of not only Chapel, but of numerous other Partitioned Global Address Space (PGAS) programming models such as UPC++ [4] and Legion [5] (see Fig.1). We will present performance results (see Fig.2) which demonstrate that GASNet-EX is a good alternative to MPI for implementing such models.

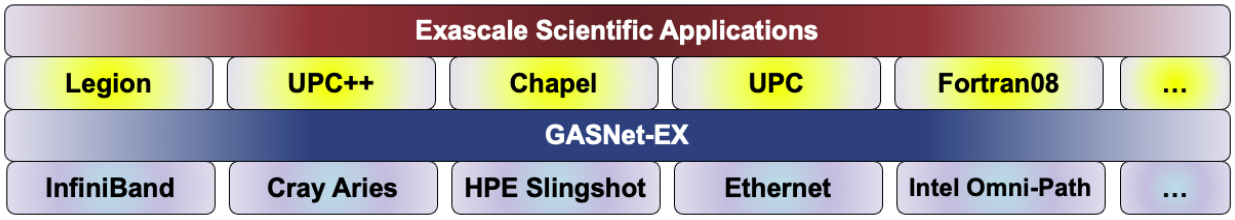

Figure 1. GASNet-EX System Stack

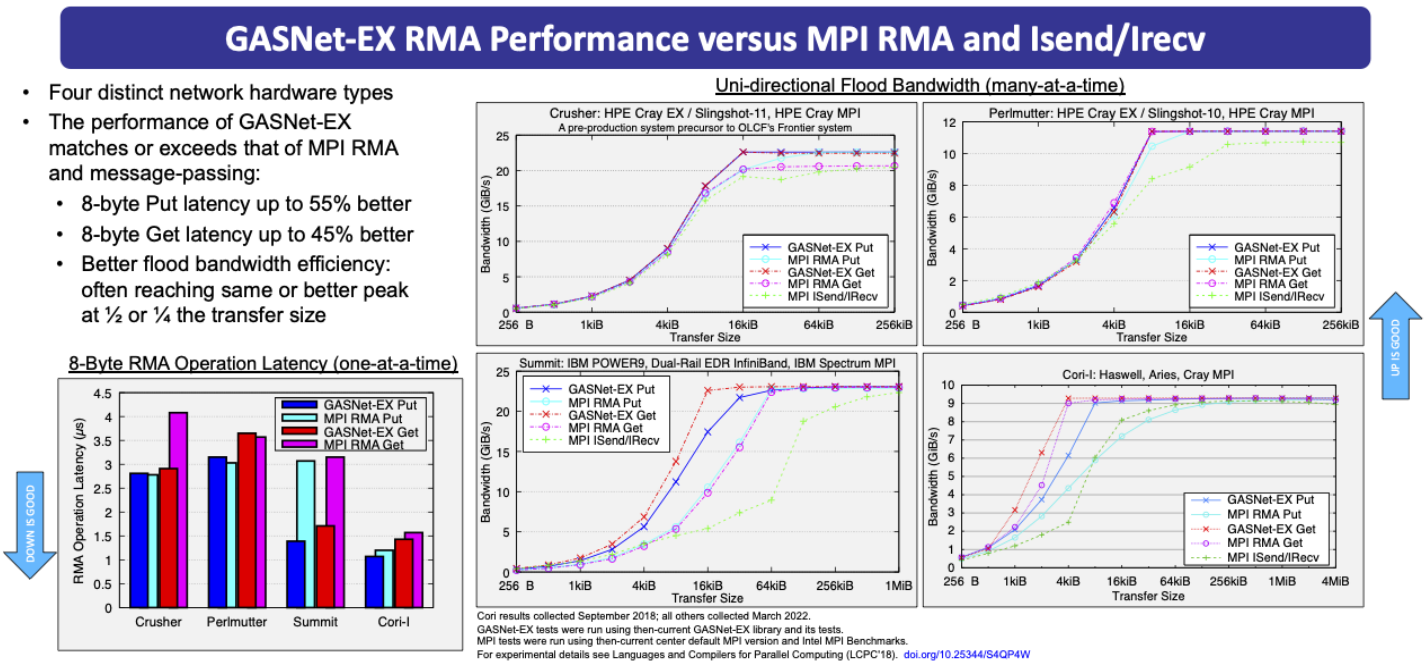

Figure 2. Examples of performance data to be presented

References:

1. GASNet web site https://gasnet.lbl.gov
2. Bonachea D, Hargrove P. GASNet-EX: A High-Performance, Portable Communication Library for Exascale, Proceedings of Languages and Compilers for Parallel Computing (LCPC'18). Lawrence Berkeley National Laboratory Technical Report (LBNL-2001174). Oct 2018. https://doi.org/10.25344/S4QP4W
3. D. Bonachea GASNet Specification, v1.1, U.C. Berkeley Tech Report (UCB/CSD-02-1207), 2002. https://doi.org/10.25344/S4MW28
4. John Bachan, Scott B. Baden, Steven Hofmeyr, Mathias Jacquelin, Amir Kamil, Dan Bonachea, Paul H. Hargrove, Hadia Ahmed. "UPC++: A High-Performance Communication Framework for Asynchronous Computation", In 33rd IEEE International Parallel & Distributed Processing Symposium (IPDPS'19), May 20-24, 2019, Rio de Janeiro, Brazil. IEEE. 11 pages. https://doi.org/10.25344/S4V88H
5. Bauer, M., Treichler, S., Slaughter, E., Aiken, A. “Legion: expressing locality and independence with logical regions”. In: Proceedings of the International Conference on High Performance Computing, Networking, Storage and Analysis. SC ’12 (2012). https://doi.org/10.1109/SC.2012.71