

LS-Dyna on the Cray XD1

Authors:

Dominik Obrist, Himanshu Misrah, Ting-Ting Zhu
Cray Inc., 411 First Ave S, Suite 600, Seattle, WA 98104, USA

Correspondence:

Dominik Obrist
Cray Inc.
411 First Ave S, Suite 600
Seattle, WA 98104, USA

www.cray.com

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Abstract:

As the numerical procedures in Computer Aided Engineering (CAE) are validated and accepted as the mainstream design process, the users have increased the size of their problems and complexity of the physics. At the same time, constraints on the length of the product design cycle have become even more stringent due to increased competition and economic pressure to introduce products in the market, faster. Therefore, there is an urgent need to solve larger and more complex problems in an ever-shorter time. One of the cost-effective ways of achieving this is to utilize state-of-the-art clusters with extremely fast interconnects that can harness the full potential of the software codes. With the recent advances in the distributed memory implementation of software codes, the robustness and parallel scalability of CAE codes such as LS-Dyna have improved dramatically to a point where multiple processors can be realistically deployed in production environments.

Cray has recently announced the availability of the Cray XD1: an AMD Opteron based cluster system with a high-speed proprietary interconnect (RapidArray). The Cray XD1 system makes good use of commodity components (processor, memory, disks, etc.) that allow for an attractive pricing. Nevertheless the Cray XD1 is designed and manufactured as a single system with all the advantages to quality and usability.

The RapidArray interconnect – one of the main innovations of the Cray XD1 – offers superior latency ($<2\mu\text{s}$) and bandwidth ($>1.2\text{GB/s}$) as compared with other standard interconnects due to its Direct Connect Processor architecture which connects the processor directly to the network through its Hypertransport interface.

The key advantage of the Cray XD1's RapidArray interconnect is the ability of most third party software codes to scale almost linearly to a much higher number of processors as compared with the other interconnects, for actual real-life industrial class problems.

Furthermore, the Cray XD1 has the ActiveManager toolkit that makes it extremely easy to use, monitor and administer: the system administrator is able to define virtual system partitions, has single system command and control, and can make use of a journaled operating system. Portability of CAE codes is trivial since the system uses AMD's Opteron microprocessor and is based on a Linux operating system.

Most CAE codes are already being ported and tuned on the Cray XD1. Cray and LSTC have begun work on porting and validating LS-Dyna. Preliminary results of this effort will be reported at this conference.