Defense Science Board

Task Force on Supercomputer Applications

Meeting Minutes

Date/Place

9:30 a.m. - 5:30 p.m. 20 June 1983
9:00 a.m. - 3:00 p.m. 21 June 1983
DARPA Headquarters, Rosslyn, Va.

Attendees

Task Force Members:
Dr. Joshua Lederberg, Chairman
CDR Ronald B. Ohlander, Executive Secretary
Dr. Frederick P. Brooks
Lt. Gen. Philip D. Shutler, USMC (ret)
Adm. Bobby Inman, USN (Ret)
Mr. Robert R. Everett

DSB Members:
Dr. George H. Heilmeier

DSB Staff:
LCDR Ralph Chatham

Invited Guest Participants:
Mr. Marvin Denicoff, ONR
Dr. Joseph Markowitz, CIA

Business

The third meeting of the DSB Task Force on Supercomputer Applications was opened by the Chairman, Dr. Joshua Lederberg. The primary objectives of this meeting were to further refine task force requirements, identify candidate supercomputer applications, and gain additional familiarity with military defense systems requirements and artificial intelligence (AI) technology. Prof. Lederberg once again emphasized that the charter of the task force was to assess supercomputer applications, not to specify or evaluate supercomputer architectures. He also outlined a sample table of information that should serve to provide guidance for the needs of the final report:

Application	Sensor (Inputs)	Computat. Bandwidth Required	Density Power Memory	Output	Military Significance	What Else Needs To Be Done - esp. long lead items
Automated Vision a. Photointerp. b. Missile Guidance (F&F) c. Pilot Assistant						

The task force then received additional inputs in the series of briefings on military applications and AI technology. Copies of briefing charts are appended to these minutes.

The first briefing was presented by representatives of PMS-409, the project management group charged with development and maintenance of the MK 117 Fire Control System. Interesting factors in the design and development of the system were that it was the first all-digital submarine fire control system and that the project managers were required to use Navy standard computers. Additional points of interest were the software development problems encountered, the significant length of time it takes to develop major weapon systems, and the long life time of such systems. The next generation fire control system is planned to be distributed in nature and will integrate additional sensors and subsystems. In the view of PMS-409, succeeding generations of fire control systems will require symbolic computation, image processing, performance prediction, and will incorporate knowledge-based expertise.

The second presentation concerned technology for autonomous vehicle navigation. The nature of the task is for a fully automated vehicle to navigate from point to point autonomously while avoiding obstacles and performing a surveillance mission. The vehicle has prestored map and landmark data and knows about cultural detail. The vehicle vision system has to process sensory data and reconcile this information against the prestored navigational data to plan its movements. The vehicle must also recognize obstacles and maneuver around them. A number of sensors such as laser, flir, imaging, and acoustic sensing equipment are expected to be incorporated in the vehicle. The task involves sensor understanding, sensor integration, and reasoning. It is computationally complex in nature. Existing state-of-the-art computational resources are expected to give it a movement rate of about 1 mile per hour.

Dr. George Heilmeier next presented some thoughts on supercomputers. Some of the benefits and limitations of parallel architectures were examined. The most significant problem in implementing such architectures is the difficulty in decomposing programming applications to fit the architecture. One of the strengths of parallel architectures is the relative ease with which they can be implemented utilizing VLSI. Some characteristics of VLSI were also discussed. In addition, potential applications in signal processing and symbolic applications were addressed.

The final briefing on military systems covered the Ocean Surveillance Information System (OSIS). The OSIS baseline system is the one currently implemented. It provides a minimal dissemination capability for intelligence information. An upgrade is planned for the system that will provide more information and allow for some integration of information. Longer term requirements include substantial data fusion requirements and intelligent assistance for analysis.

The Terms of Reference were discussed in terms of how far in the future the task force should be looking for an implementation of supercomputer applications. In other words, if the task force considered only systems that would be fielded in the next decade, applications would be restricted to that technology that was demonstrable today but limited by having sufficient processing power available. On the other hand, a consideration of technology that would be capable of concept demonstration in the next decade would substantially broaden the task force's horizons to areas that were promising and which might be pushed to a breakthrough if sufficient funding were provided. It was resolved, in conjunction with Dr. Kahn from DARPA, that the task force would not limit itself to nearer term issues that were resolvable with simply more computational power, but would also consider longer-term revolutionary conceptual approaches that were capable of demonstration in the 1990's.

The last part of the meeting involved a discussion of potential supercomputer applications. It was agreed that autonomous vehicles and simulation were two application areas that required supercomputing capability and also offered benefit to the military. The field of intelligence was also thought to be appropriate and it was resolved to get a briefing on requirements in that area in September or October. It was proposed and accepted that the task force should receive presentations on underwater autonomous vehicles, terminal homing, pilot assistance, battlefield assessment, and robotics. It will also seek state-of-the-art information and experience with "Lisp Machine" and similar architectures.

The principal source of augmented computational power foreseen from DARPA-supported efforts, i.e., what is super about the target computer, is the degree of parallelism to be exploited. There are few realizations of high parallelism related to symbolic processing. Part of the task's force job is to assess the capabilities of this kind of supercomputer and match them to military applications.

Certified: _____
Joshua Lederberg,
Chairman