15 Panel Discussion 1: Questions and Answers

Member of the audience: Dr. Tomita discussed the future of supercomputer hardware in his talk. Given this, I wonder if you have any conceptions as to how software or languages should be developed around hardware. In other words, do you think anything needs to be done for the development of languages specific for hardware?

Tomita (Kyushu University): I think Dr. Oyanagi gave us a fairly detailed explanation concerning languages [summarized in Chap. 12]. From the standpoint of hardware, I think that in the future it will be absolutely necessary to develop parallel languages and for these to be adopted by users. Earlier, I said that the very long instruction word (VLIW) is a good method for the elements comprising multi-processors, but at the object-code level this has virtually no compatibility with current general-purpose machines.

There is a very large gap between maintaining compatibility and making another big leap. Only when this gap is overcome will a high-speed processing environment become possible. This situation is often compared to that of old railway lines and the Shinkansen [bullet train]. I hope that users will soon make this leap and throw off the bonds of the past. If they do this, I think that we are now at the stage where we can provide them with excellent hardware. If we attempt to maintain current standards of compatibility with supercomputers, we are approaching the limits of performance. As a result, such moves are being made to a certain extent by the manufacturers as well.

Shimazaki (Chairman; Kyushu University): I think that Dr. Tomita just made several important points. When we look at the history of computers in information engineering, we find a trend towards avoiding the presentation of computer hardware in its natural form, or when memory space is limited, of making it as natural-appearing and as easy to use as possible in order to keep the programmer from recognizing this. With the advent of supercomputing, however, one of the demands is to use these machines to their theoretical limits. As a result, user-friendly design has, although we would not necessarily like it to be this way, been frequently discarded. This trend is also coming to a dead end, however, and in the future I think we will have to search out new directions.
As pointed out by Dr. Kalos [Chap. 14], the field of supercomputing deals with the most advanced technological problems, and there is a need for those in various fields to stop being passive accepters and become active participators in the search for new directions. Concerning this point, how is it from the standpoint of the users? Does the user to use computers in as passive a form as possible? Do you have any opinion regarding this?

Kalos (Cornell University): Architects must pay attention to the hardware support for operating systems, tools, languages, and all other issues that affect the productivity of users of their computers. It is not enough to produce a very fast numerical processor. This is especially true for highly parallel systems, particularly those aimed at a range of applications. That is another example of how supercomputing now and in future must be done in an “interdisciplinary” sense. Architecture is too important to be left to the architects.

Member of the audience: This may broaden the topic of discussion a little, but I would like to ask Dr. Tomita in particular about the following: 1-terabyte computers would easily be capable of producing 1-terabyte of data, or even a thousand times that amount. No problem arises when this data is to be thrown away after use, but sometimes it must be stored. From the standpoint of hardware, what could be done to deal with cases like this? Input/output-related matters have been left at a primitive stage of development. When computers this fact actually appear on the scene, corresponding data accumulation will also become necessary. Related hardware and language support are being ignored. In relation to this, what kind of concept is present behind the file processor being proposed by Dr. Tomita and others?

Tomita: To be honest, there is none. At present, I do not think we have a new storage medium capable of replacing disks.

Member of the audience: From the standpoint of languages as well, it would be difficult to consider languages without some such plan for hardware. It would be nice if you could incorporate this point in your concept.

Tomita: The area of input/output is a very “cluttered” one; everyone would rather ignore it. But we will try.

Member of the audience: In our case, about one-third of all computer costs are accounted for by disk usage fees. The use of three-dimensional computation would bring about a great increase in the amount of data being handled, and I am in perfect agreement with the previous questioner.

Kalos: At Cornell, we are right now faced with serious issues involving very large data sets. COCORP (the Consortium for Continental Reflection Profiling) seismic exploration of the earth crust accumulates a great deal of data; the Global Basins Research Network will be centered around a very large database of knowledge