The Case for an Integrated Platform for Parallel Software

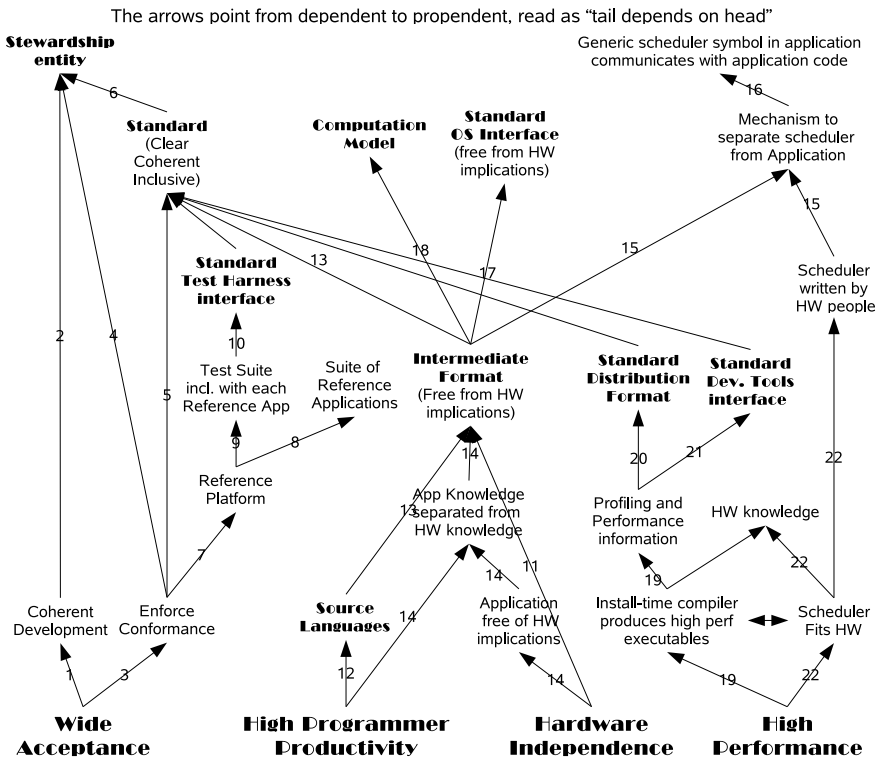
by Sean Halle, UC Santa Cruz, seanhalle@yahoo,com

Parallel Programming is entering the mainstream due to the exponentially increasing number of cores on each successive generation of processor chip. The industry needs a solution to creating parallel software that allows similar levels of productivity to current programming practices, and allows a program to be written once then run on future generations of processors as well as on past generations of processors. The solution needs to be a widely accepted standard, so that software developers can write to one standard format, and their programs will run on any current hardware. Hardware manufacturers need to be able to write one adaptor for their new, parallel, machine then run existing out-of-the-box programs.

To summarize, industry needs a solution for parallel software that simultaneously meets these four goals: 1) widely accepted, uniformly implemented standard 2) high programmer productivity 3) write once, run anywhere 4) high performance anywhere.

These goals, together with the inherent nature of parallel software, lead to a web of inter-dependencies. A means for creating parallel software that achieves all four goals will have to respect all of the dependencies. We propose a graph of many of these dependencies (as seen in the figure), then describe why each dependency-link is in the graph and what the presence of the link implies.

We draw the conclusions, from the pattern of dependencies, that an entire software platform should be defined as a coherent comprehensive standard. The standard should specify the interfaces between every component of the platfrom, from development tools, through a packaging tool, a computation model, and an intermediate format, all the way to an install-time compiler, an OS interface and a run-time system. Further, we suggest that a non-profit stewardship entity should be created that guides development, writes the standard, tests against a reference platform, and legally enforces conformance to the standard.



The dependency graph roots are at the bottom, where the goals are stated in bold. From each goal emanates a number of arrows, each indicating something that goal depends directly upon.

The stewardship entity would use branding and a certification mark to enforce conformance. Only products that had passed the certification process could use the mark. The entity should be, because of the need for wide acceptance, a non-profit, but charge for the certification process in order to support its various activities.

The proposal is not entirely theoretical as concrete proposals have been made for the design os such a platform, and the design of each component.