Target applications performance estimation through the codesign of Fugaku computer

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Abstract—The target applications representing the nine social and scientific priority issues were chosen for codesigning Fugaku computer, a.k.a. post-K. Each of the nine target applications represents the typical work load in the originating priority issue. They cover different numerical schemes, the different space and time discretization types, the different grid structure, the different data elements. Consequently, they show quite different computing characteristics and exhibit the bottle necks in the system's different components. Addressing and relaxing the performance bottle necks of the target applications is expected to help improving the computational performance of the applications, not only in the priority issues but also in the wide range of high performance computing demand on Fugaku. The list of target applications and their objectives, the numerical algorithm, the computing characteristics and the estimated performance will be shown in the poster.

The target applications undergo many performance analyses by using various tools. The tools can be categorized, for example, as below:

- software simulator executed on non-Fugaku platform.
- performance estimation tool based on precise PA data from FX100.
- hardware emulator
- Fugaku prototype test vehicle

There are multiple simulators and estimation tools for supporting different user/usage. The output example from these tools will be shown in the poster.

For each design and update of the application, detail analysis is conducted in order to identify the latest computing bottle neck, and the corresponding feasibility study of system design is requested to the system development and the manufacturing vendor, expecting the improved system design parameters. The updated system design in turn provides the target applications the opportunity of further optimization from different perspectives. Thus, after all, the codesign of the target applications and Fugaku computer is effectively the repeated procedure of mutual optimization in terms of performance, power and economy. The design of Fugaku allows the user to choose the processor operating frequency and the mode of economy. Although the default Fugaku operation should provide the efficient environment for most of the applications, the users will be able to explicitly set up the best combination for their applications, as the target application developers do. The estimated performance under the restricted power consumption will be shown in the poster.

The codesign in the early stage can contribute to the design of systems architecture such as the processor and memory specification and configuration, and the codesign in the later stage can contribute to the design of system software such as compilers and libraries. Ideally, the codesign of Fugaku and the applications can be completed at the same time. Some codesign achievements reflected to the system will be shown in the poster.

Target applications reference [1].

Index Terms—Fugaku computer, Target application, Priority issue, Performance estimation, Codesign

REFERENCES

[1] FS2020. target applications performance site. https://postk-web.r-ccs.riken.jp/perf.html.