Abstract

The demands for flexibility and performance maybe are the two main driving forces of modern computing systems. Both are ever increasing requirements of users, devices, machines, processes, etc. Computer scientists and engineers constantly search for methods and architectures to solve these demands. Recently, reconfigurable systems—adaptable and fairly powerful computing devices—have approached this scene.

Reconfigurable systems appear to be most appropriate for high flexibility and high performance. They process in parallel and can change their behavior by loading different configurations on their fabrics, also during run-time. However, comprehensive exploitation of the paradigms of reconfigurable computing is rarely found in modern systems. In particular, dynamic reconfiguration, i.e., the adaptation of the behavior during run-time, combined with partial reconfiguration capabilities of modern FPGAs remains unused in most modern designs.

If we search for reasons, the answers are twofold. On one hand, we have to generally argue on what benefits partial run-time reconfiguration yields, as we have to overcome challenging technical hurdles. On the other hand, also few high-level methods exist that target the partial reconfiguration capabilities of modern FPGAs and would allow a system designer to exploit partial run-time reconfiguration.

This thesis approaches the situation described along the second train of thoughts—the need for methods. We discuss new methods to exploit run-time reconfiguration, which explore given reconfiguration constraints and often target at specific application areas. In order to evaluate the methods, we integrate them into an abstracting layer view on reconfigurable computing. We also discuss the technical challenges, which have to be overcome to implement the methods. Altogether and maybe most notably, the introduced methods themselves explain where they can be useful, thus also making a case for the use of run-time reconfiguration in everyday systems—making reconfigurable systems mature.