

RC3E: Design and Test Automation in the Cloud

Patrick Lehmann, Oliver Knodel, Martin Zabel and Rainer G. Spallek
 Department of Computer Science
 Technische Universität Dresden
 Dresden, Germany
 {firstname.lastname}@tu-dresden.de

Abstract— Cloud computing is getting more and more interesting for companies, caused by its flexibility to provide apparently endless resources and nouveau services, while reducing the total cost of ownership for the user. Fields of applications reach from web technologies over storage solutions to complex business processes.

The domain of chip and system design is well known for offloading resource intensive and long running synthesis or simulation task onto centralized servers. As hardware designs grow in an exponential way and verification requirements were strengthened, cloud services are investigated to compensate these needs.

Anyway, in the end real hardware tests cannot be avoided. Our RC3E eco system brings close to the hardware prototype development and automated hardware testing into the cloud, continuing the principle of "test often and test early". The architecture offers virtualized and shared FPGA resources for prototyping, with automated remote debugging capabilities.

I. MOTIVATION

Our hardware demonstration presents the Reconfigurable Common Cloud Computing Environment – RC3E – a cloud capable FPGA resource management system for design and test automation in a cloud environment. The motivations for our RC3E system are:

- Hardware pooling to reduce acquisition costs and increase hardware utilization
- Remote access to a high variety of FPGA-based systems
- Ready-to-use programming and test environment for on-demand self service
- Automated hardware integration testing
- Team oriented hardware design and test
- Centralized license management

An use case is the team oriented design and test of a streaming-optimized IP-Core for the attachment of hard disks and solid state drives with Serial ATA interface.

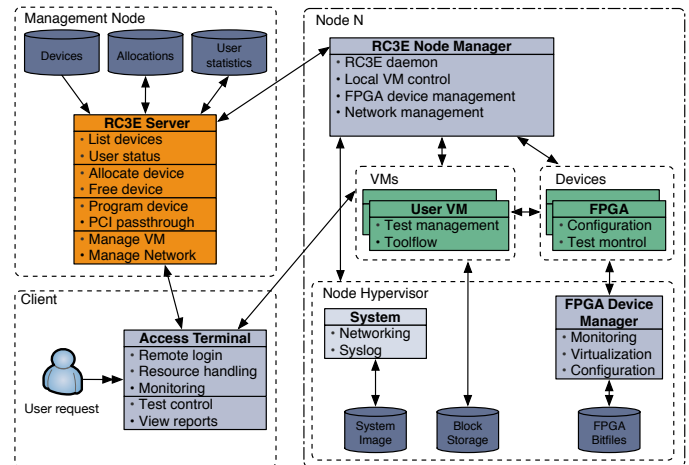


Figure 1: Architecture of the RC3E resource management with FPGAs and virtual machines (VMs).

II. PROVIDED SERVICES

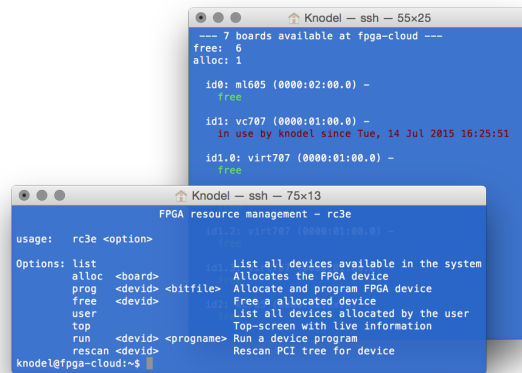
Fig. 1 illustrates the RC3E client-server architecture with a remote access terminal, management and compute node. The system therefore provides the following services:

- Flexible resource allocation of FPGA boards and VMs
- Remote access via SSH, Remote Desktop
- Remote debugging via e.g. Xilinx ChipScope
- Ethernet network access to the FPGA board
- Host/Device communication via PCIe, Ethernet, UART

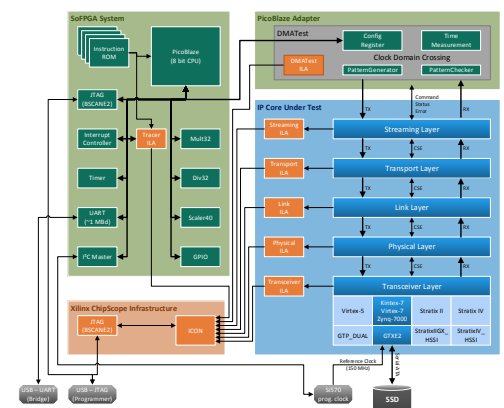
Fig. 2 shows a) our two node test system with four FPGAs in total, b) the resource management in a remote terminal session and c) the hardware design of one of our use cases, comprising the IP core under test and the test controller.



a) Demonstration system.



b) Allocation of devices using remote access.



c) Hardware design of our use case.

Figure 2: Three main steps in the RC3E workflow and the interaction with the system.