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Open Cloud Testbed

Exploring Next-Generation Cloud Platforms

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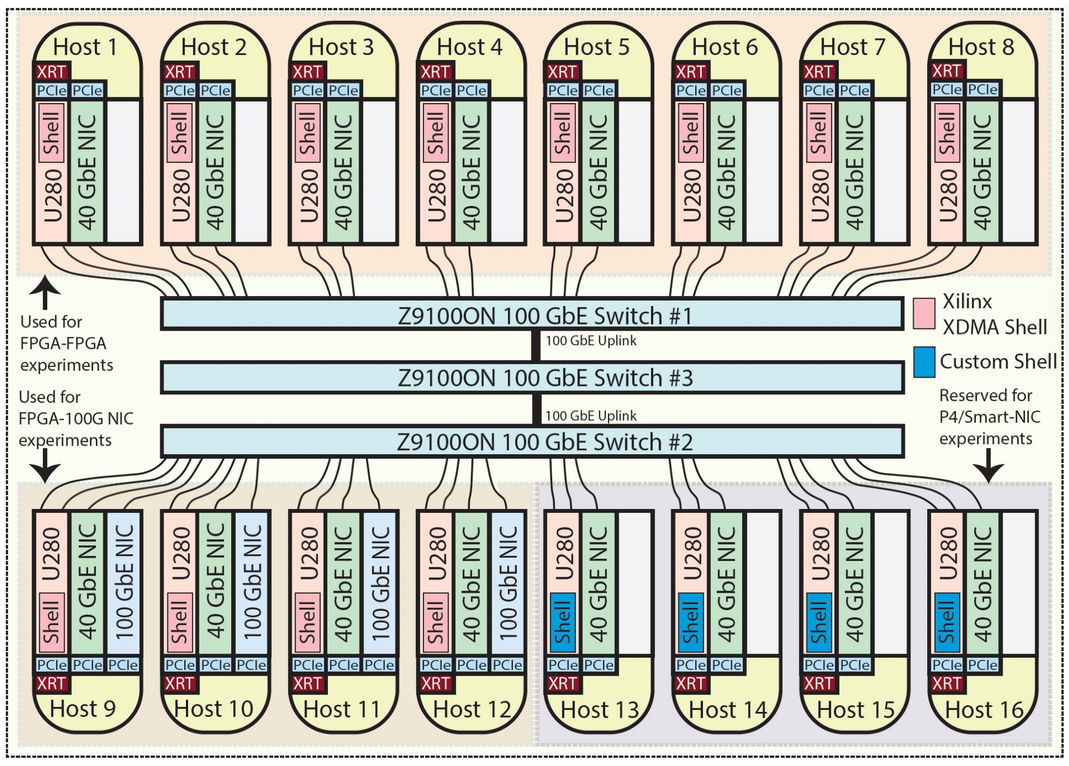
Abstract

The NSF-funded Open Cloud Testbed (OCT) project is building and supporting a testbed for research and experimentation into new cloud platforms – the underlying software which provides cloud services to applications. Testbeds such as OCT are critical for enabling research into new cloud technologies – research that requires experiments which potentially change the operation of the cloud itself.

This poster gives an overview on the community infrastructure we have created as part of the OCT projects. This includes actual hardware which builds the backbone of the project, FPGAs and an accompanying build environment, as well as community engagement.

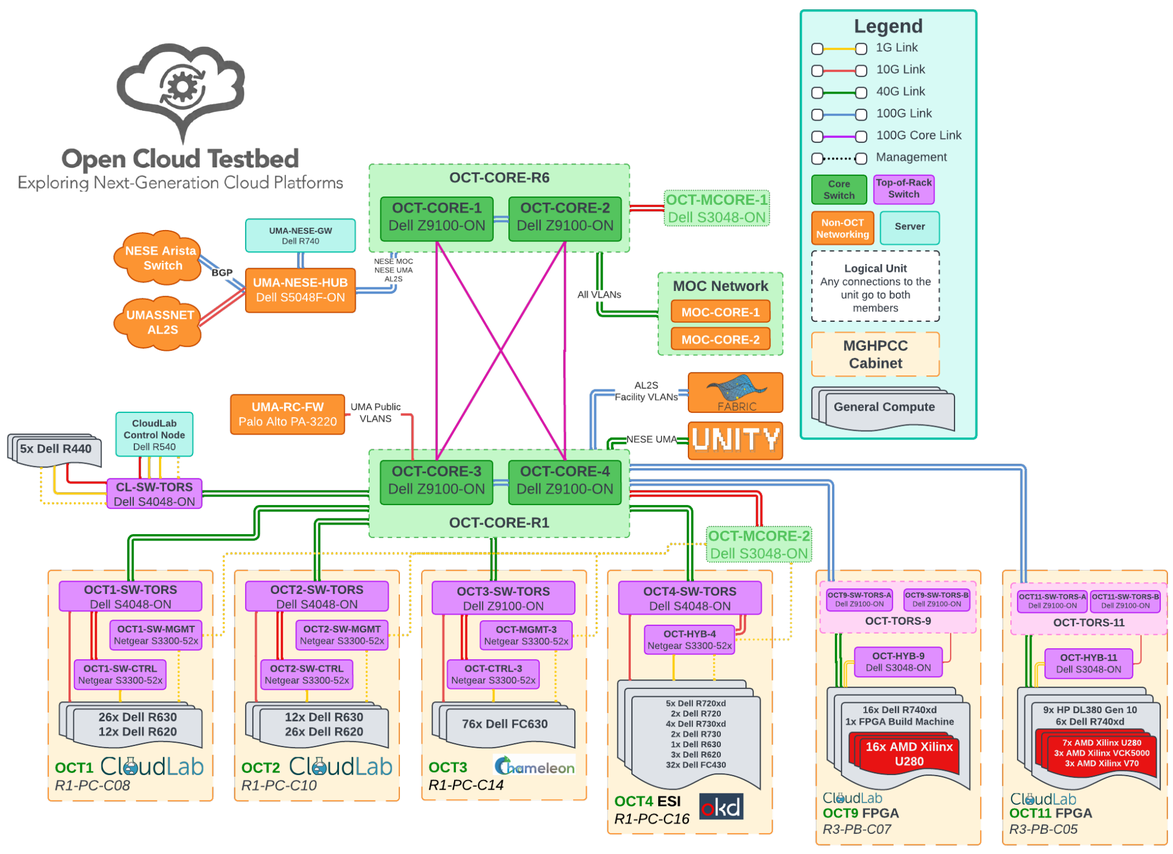
FPGAs in OCT



- 16 (+7) AMD Xilinx U280
- 3 AMD Xilinx VCK5000
- 3 AMD Xilinx V70

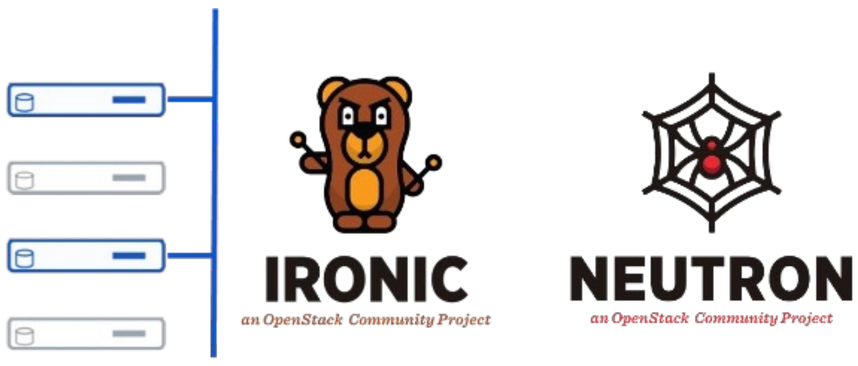
} AI Engines

OCT Overview



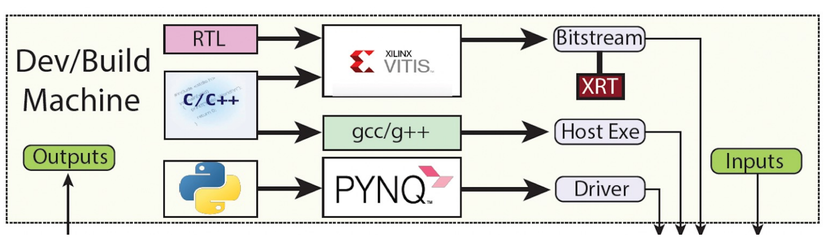
- 283 nodes
- 4968 cores
- 66 TB storage
- 16 FPGAs (32 by the end of Fall 2023)

Elastic Secure Infrastructure



OCT FPGA HW/SW

Build



Outputs

Xilinx Vitis
Vitis
Vivado
Vitis HLS
Vitis P4

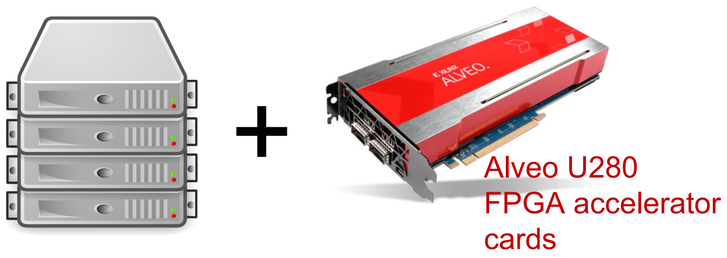
Tools

Xilinx Runtime (XRT)
Deployment target platform
The communication layer required to interact with the card
Development target platform
Used to build custom applications for U280 FPGAs
FINN Framework
Explore ML on FPGAs

Bitstream, host executable, inputs

Deployment

CloudLab



Alveo U280 FPGA accelerator cards

AMD XILINX

CloudLab

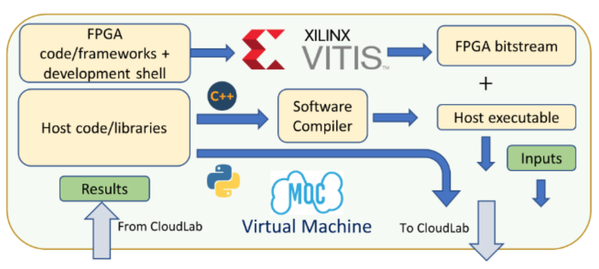
NSF

Community Engagement

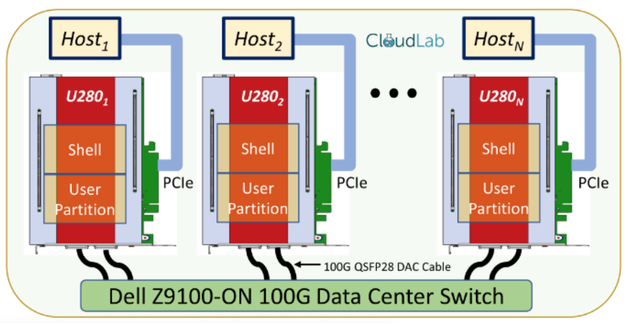
Getting Started

The Open Cloud Testbed (OCT) workflow consists of two parts.

1. Development: OCT development tools are hosted in Massachusetts Open Cloud (MOC). Users can sign up for an MOC account and build FPGA bitstreams/host executables using the tools.



2. Deployment: After creating the bitstreams/host executables, users will use CloudLab for targeting. There are eight Alveo U280s in CloudLab Massachusetts cluster which are PCIe connected to eight host machines. The U280s are connected to a 100 GbE data center switch using 100G QSFP28 passive DAC cables.



- Tutorials
- Webinars
- Workshops
- Advisory board meetings
- ~30 researchers from 12 different US institutions for FPGAs

References:

[1] Miriam Leeser, Suranga Handagala, and Michael Zink. FPGAs in the Cloud. Computing in Science Engineering, 23(6):72–76, 2021.

[2] Michael Zink, David Irwin, Emmanuel Cecchet, Hakan Saplakoglu, Orran Krieger, Martin Herbordt, Michael Daitzman, Peter Desnoyers, Miriam Leeser, , and Suranga Handagala. The Open Cloud Testbed (OCT): A Platform for Research into New Cloud Technologies. In CloudNet, December 2021.

[3] Suranga Handagala, Michael Zink, Miriam Leeser. Network Attached FPGAs in the Open Cloud Testbed (OCT). In CNERT 2022 (IEEE INFOCOM Workshop). Runner up for best paper!

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