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The EDRA project: Bringing Efficient Reconfigurable Architectures to the Amazon Cloud for Bioinformatics Applications

FPL 2020: Research Projects Event

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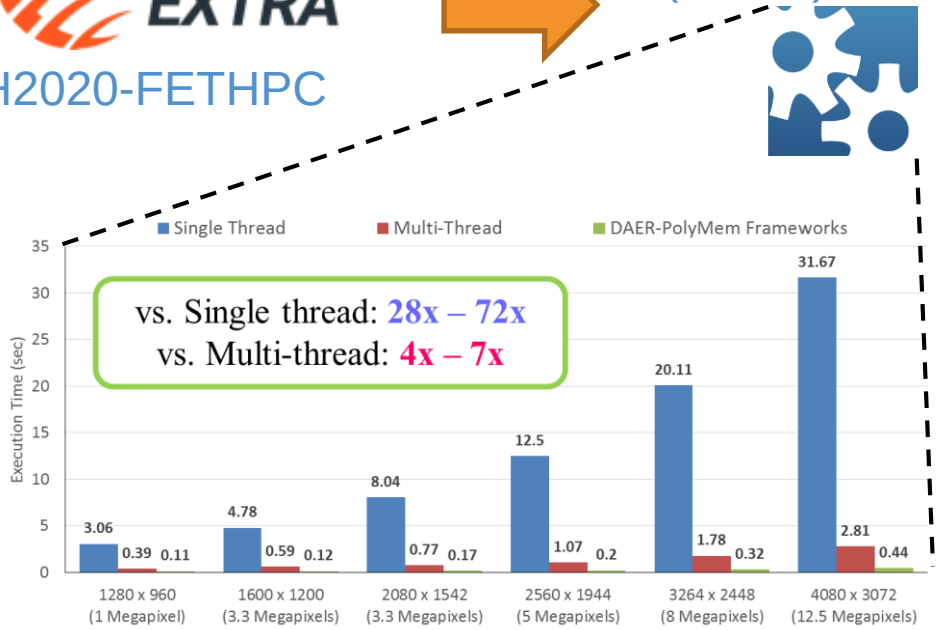
The EDRA concept

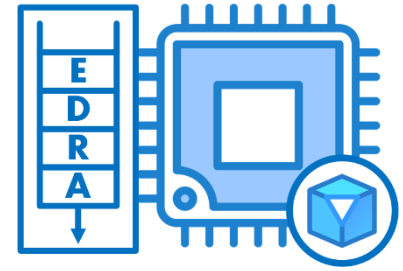
Exploiting e**X**ascale **T**echnology with **R**econfigurable **A**rchitectures

EXTRA

H2020-FETHPC

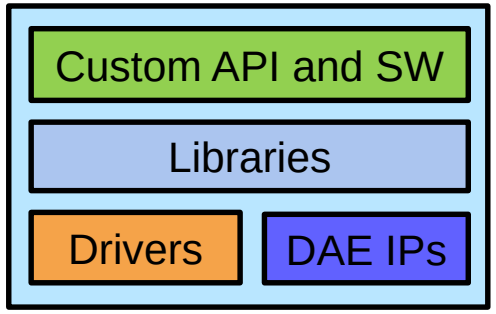
Decoupled Access-Execution Reconfigurable (DAER) framework





EDRA machine image

aws



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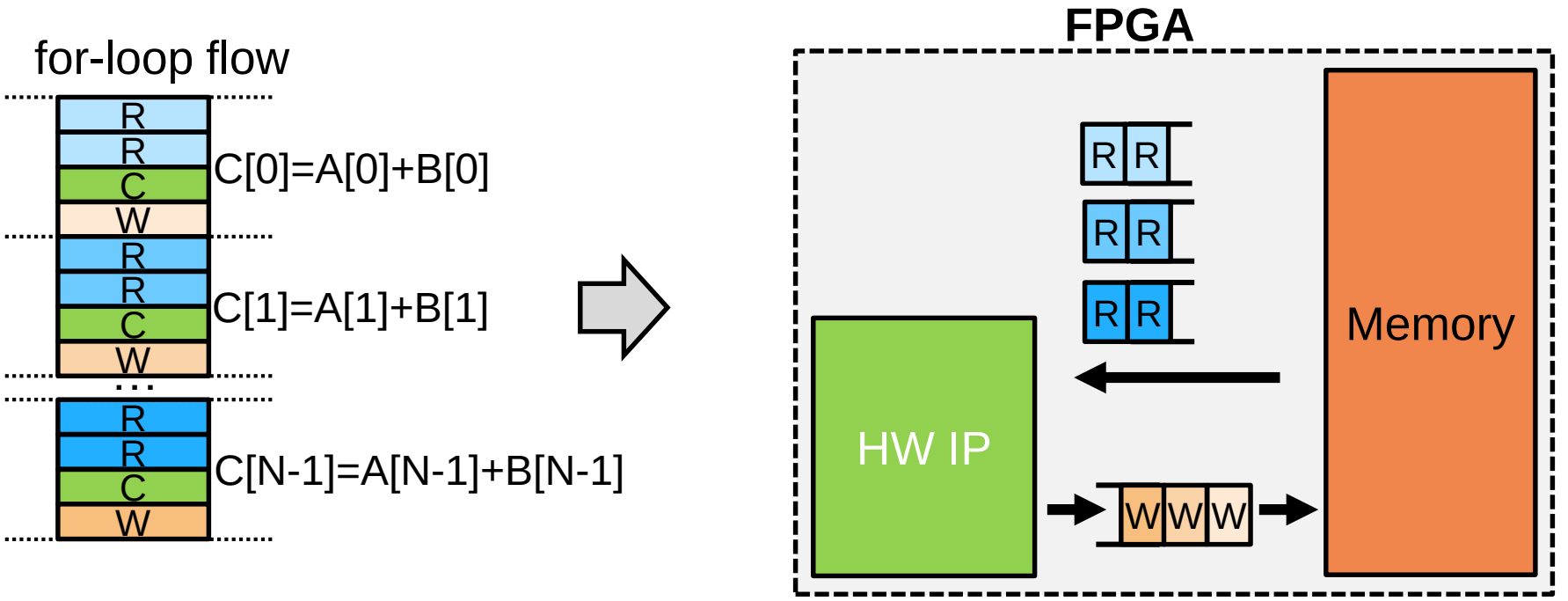
The EDRA concept

- EXTRA FET-HPC* **Decoupled Access – Execute Reconfigurable** (DAER) framework



* https://www.extrahpc.eu/

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The EDRA concept

- EDRA: ***E***XTRA ***D***AE ***R***econfigurable ***A***rchitecture
- Objectives
  1. Automate software workflow for DAER-compatible accelerators
  2. Integrate the EDRA framework with the AWS FGPA infrastructure
  3. Publish an EDRA Amazon Machine Image (AMI)

Invest on the DAER architecture as an FPGA cloud service

- First MVP
  - Publish on the AWS marketplace a VM for accelerating phylogenetics analysis

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Demo application

- **RAxML** (Randomized Axelerated Maximum Likelihood) is a widely employed phylogenetic inference software
- Dominant kernel
  - *Phylogenetic Likelihood Function (PLF)* ➔ from **50% to 80%**
  - Hardware kernel implemented on AWS F1 instances
  - The kernel architecture is based on the Decoupled Access Execute design paradigm
  - Xilinx SDAccel framework + HLS to describe the accelerator and OpenCL/Xilinx XRT integration with RAxML

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Demo application

- Communication with host CPU
  - Two 512-bit interfaces to stream input data to the execution pipeline
  - One 512-bit interface streams the results back to memory
  - One 64-bit memory interface reads kernel configuration parameters
  - Double buffering
- Hardware specifications
  - Initiation interval at 2 cc
  - Design frequency at 222MHz
- Performance
  - Up to 6x compared to the original software-optimized RAxML version

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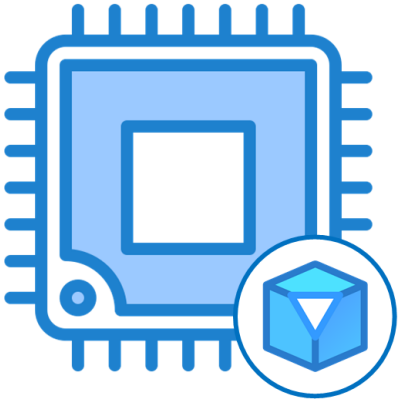

Thank you

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