AMD Scientific Libraries

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AGENDA

Current state of AMD Libraries

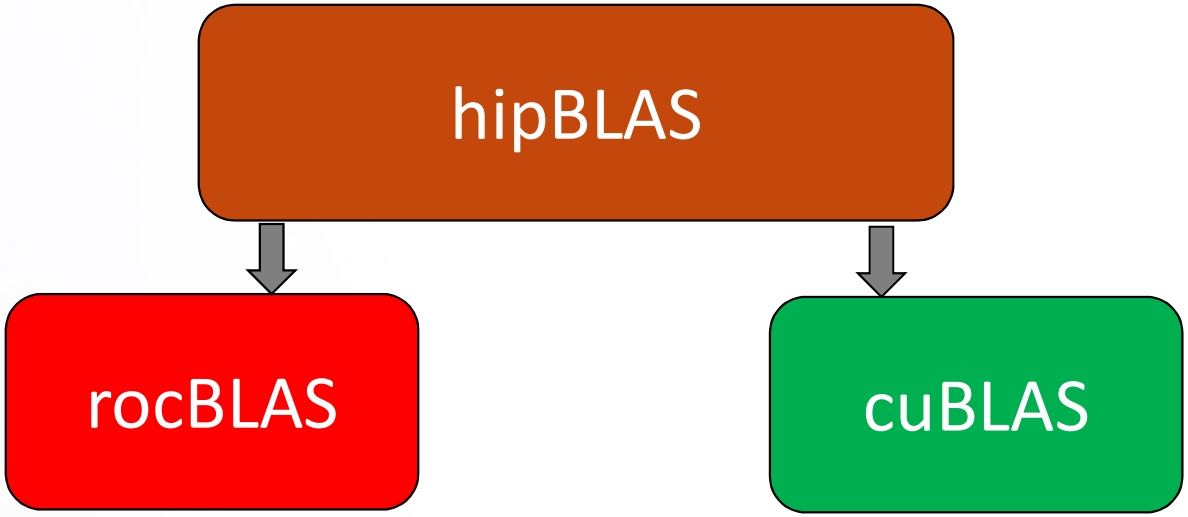
Mapping of CUDA to HIP

Future of AMD Libraries

What is missing, what do you need to succeed?

AMD GPU Library Organizational Pattern

- AMD ROCm has two classifications of libraries
  - roc* -> AMD GPU library, usually written in HIP
  - hip* -> Thin interface between AMD roc* and Nvidia cu* library
    - “Marshalling libraries”, “Shim libraries”
  - Targeting both CUDA and AMD devices: use the hip* libraries
  - Targeting only AMD devices, consider the roc* libraries



AMD Math Library Equivalents: “Decoder Ring” (1/2)

CUBLAS	**ROCBLAS**	Basic Linear Algebra Subroutines
CUFFT	**ROCFFT**	Fast Fourier Transforms
THRUST	**ROCTHRUST**	C++ Parallel Algorithms
CUB	**ROCPRIM**	Optimized Parallel Primitives
EIGEN	**EIGEN**	C++ Template Library for Linear Algebra

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AMD Math Library Equivalents: “Decoder Ring” (2/2)

CUSPARSE	**ROCSPARSE**	Sparse BLAS, SpMV, etc.
CUSOLVER	**ROCALUTION**	Solvers and preconditioners for GMG & AMG
CURAND	**ROCRAND**	Random number generators

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AMD Machine Learning Library Support

Machine Learning Frameworks:

- Tensorflow: https://github.com/ROCmSoftwarePlatform/tensorflow-upstream
- Pytorch: https://github.com/ROCmSoftwarePlatform/pytorch
- Caffe

Machine Learning Libraries:

- MIOpen (similar to cuDNN): https://github.com/ROCmSoftwarePlatform/MIOpen
- Tensile (_GEMM Autotuner): https://github.com/ROCmSoftwarePlatform/Tensile
- RCCL (ROCm analogue of NCCL): https://github.com/ROCmSoftwarePlatform/rccl
- Horovod (Distributed ML): https://github.com/ROCmSoftwarePlatform/horovod

Benchmarks:

- DeepBench: https://github.com/ROCmSoftwarePlatform/DeepBench
- MLPerf: https://mlperf.org

Missing

- Batched linear algebra:
  - dgetrf_batched, dgeqrf_batched, Xtrmm_batched, etc.
- Complex types:
  - zgetrf, zgetrs, etc.
- Portability Abstractions:
  - Kokkos, RAJA, etc.

Library availability is the first step
Expect tuned libraries


Requests?
What do you need?

Wrap up

Questions?

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Key AMD Libraries

- BLAS
  - rocBLAS (https://github.com/ROCmSoftwarePlatform/rocBLAS)
  - hipBLAS (https://github.com/ROCmSoftwarePlatform/hipBLAS)
- FFTs
  - rocFFT (https://github.com/ROCmSoftwarePlatform/rocFFT)
- Random number generation
  - rocRAND (https://github.com/ROCmSoftwarePlatform/rocRAND)
  - hipRAND (https://github.com/ROCmSoftwarePlatform/hipRAND)
- Sparse linear algebra
  - rocSPARSE (https://github.com/ROCmSoftwarePlatform/rocSPARSE)
  - hipSPARSE (https://github.com/ROCmSoftwarePlatform/hipSPARSE)
- Iterative solvers
  - rocALUTION (https://github.com/ROCmSoftwarePlatform/rocALUTION)
- Parallel primitives
  - rocPRIM (https://github.com/ROCmSoftwarePlatform/rocPRIM)
  - hipCUB (https://github.com/ROCmSoftwarePlatform/hipCUB)

AMD Open Source Benchmarks

ROCHPCG	High performance CG
ROCALUTION	Solvers and preconditioners for GMG & AMG
ROCRAND	Random number generators

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