**Merrimac Applications**

Jung Ho Ahn, Tim Barth, Eric Darve, Mattan Erez, Ankit Garg, Tim Knight

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**StreamFEM**

StreamFEM implements the Discontinuous Galerkin (DG) finite element method for systems of nonlinear conservation laws in divergence form in 2-D or 3-D.

- Loop over tasks:
  - Gather 2 element states
  - Compute flux terms
  - Store fluxes to memory

- Loop over elements:
  - Gather 4 flux terms
  - Compute interelement flux and update element
  - Store updated element state

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**StreamMD**

Molecular Dynamics was chosen as it is compute intensive while requiring relatively low memory bandwidth. GROMACS is the most efficient MD simulation code available today. We implement the force calculation portion of GROMACS on a cycle-accurate Merrimac chip simulator. Our system consists of 900 water molecules.

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**StreamSPAS**

StreamSPAS implements the computation of \( Y = AX \) where

- \( A \) : sparse matrix
- \( X, Y \) : dense vector

StreamSPAS also provides a test suite of sparse matrices corresponding to p-order finite element discretization using continuous Lagrange elements.

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**Imagine**

Performance on Imagine:
- Run time = 11.9ms
- Clock speed: 3.6GHz
- Number of cores: 1.43
- Percent of peak performance: 29.27%
- Cycles / Interaction = 14 cycles
- Bandwidth from MaxQDB [Gf/s] = 0.871.264/31.32 Gf/s

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**Variable rate streaming**

![Variable rate streaming graph](image-url)