



# **HPC Parallel Programming Directions**

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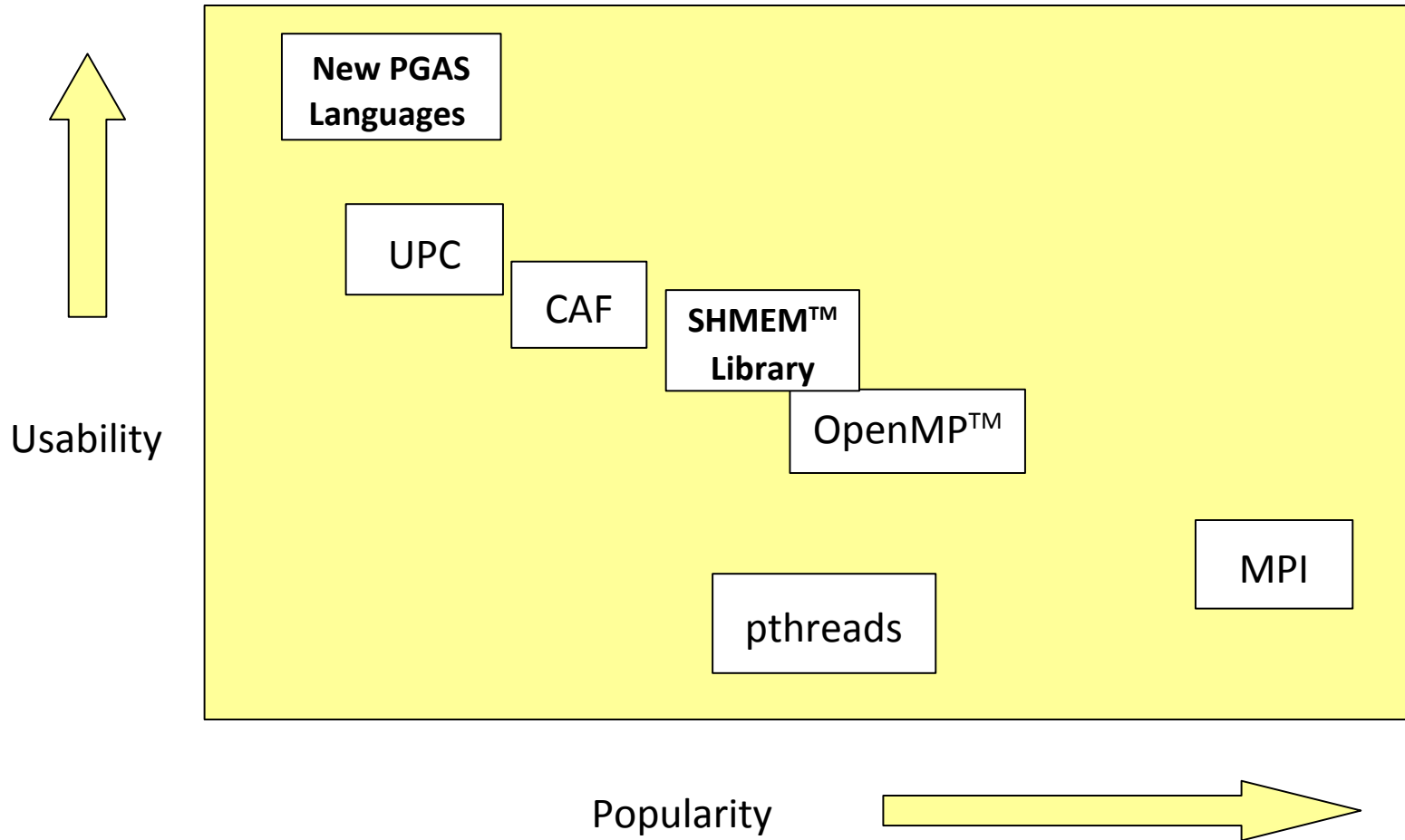
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MPI and Parallel Programming

SGI

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# Can Parallel Programming be Easy?



# Adaptability

- Smart optimized collective operations in MPI, SHMEM, and UPC
  - adapt to interconnect
  - adapt to node socket and NUMA memory layouts
- UPC near/far optimization and tuning
  - user env variables can tune the near/far threshold to choose shared memory vs. DMA engine

# Supporting Heterogeneous Systems

- Avoid heterogeneous processors in the same parallel application
  - load balance between parallel threads is important
- One Strategy: Use OpenMP with MPI
  - Slower processors are teamed together using OpenMP
  - SGI's MPI has **omplace** tool to flexibly and correctly pin OpenMP threads within MPI job

# New Tools for Parallel Programming

## ■ SGI UPC

- strategic investment in a PGAS language
- now under development, planned availability in 2010

## ■ 3<sup>rd</sup> party CAF and UPC

- SGI provides SHMEM to support GASNet SHMEM conduit

## ■ Profiling tools

- SGI perfcatcher – simple MPI and SHMEM profiler
- Intel<sup>®</sup> Trace Analyzer and Collector – supports Intel MPI and SGI MPT MPI

# Supporting Binary Interfaces

- SGI programming models are compiler-agnostic
  - MPI, SHMEM, UPC
- MPI ABIs
  - MPT MPI will provide shim layers to interface with binaries compiled with other MPIs
- SGI MPI, SHMEM and UPC are inter-operable
  - Allow MPI-based libraries to work with SHMEM and UPC programs, and vice-versa

# SGI's Parallel Programming Picture

- MPI is highest priority because it is the most popular parallel programming model
- Involved in strategic forays into PGAS – SHMEM, UPC, 3<sup>rd</sup> party CAF
- Future hardware development aimed at:
  - efficient massively parallel systems
  - efficient new parallel programming models
- SGI ProPack™ Software
  - <http://www.sgi.com/products/software/linux/propack.html>

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