

Numerical Libraries Project

Microsoft Incubation Group

Charles Fu
Microsoft Corporation

CSCADS Workshop
July 8, 2008

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Microsoft Incubation Group

Bill Gates

Steve Ballmer

Craig Mundie

John Manferdelli

Application & Libraries

OS, Resource Management

Security, Partitioning, Virtualization

Incubation Group

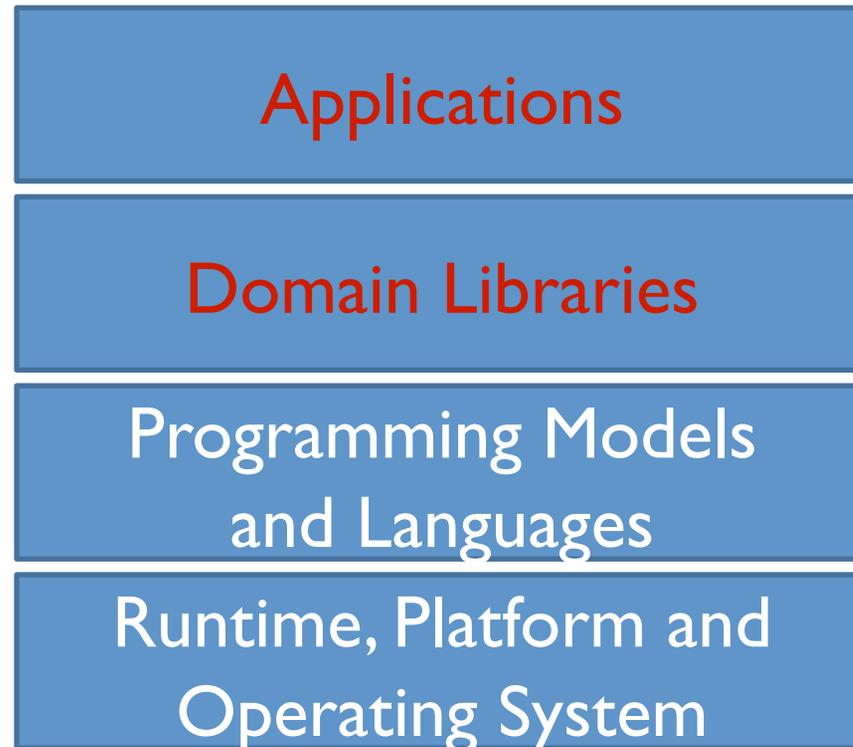
Microsoft
Research

Research Organization

Many-Core Collaboration

- Microsoft effort to realize the performance of many-core architectures in their products
- Widespread internal and external projects to produce complete parallel programming software solution to customers

Many-Core Software Solution



Numerical Libraries Project

- Project in Incubation Group starting Jan, 2008
- Investigate numerical libraries for single node many-core architectures
 - Develop an initial parallel numerical library specifically for Microsoft platforms
 - Demonstrate use of library in parallel applications
 - Contribute to adoption of Microsoft platforms on future many-core and HPC architectures

Tasks

- Investigate small set of functionality
- Implement routines for Microsoft platform
- Consider design of interfaces
- Analyze performance

Functional Areas

- Investigate “core” math functions
- Initially target dense and sparse linear algebra
- Will be looking at other areas
 - Graph algorithms
 - Random number generators
 - FFTs
- Applications drive priority of routines to implement

Implementation

- Implement libraries for Microsoft platforms
- Write versions for native and managed code
 - Native: C++
 - Managed: C#
- Evaluate parallel programming models

Interfaces

- Investigate the design of managed code interfaces
 - “Expert” interfaces allow users to access all algorithmic and performance parameters
 - “Productivity” interfaces allow users to ignore low level details

Performance

- Analyze performance of library routines
 - Scaling performance of algorithms
 - Performance of native vs. managed code
 - Performance of programming models
- Demonstrate performance of libraries in applications

Challenges

- Scalable performance on range of many-core architectures
 - Varying number of cores, memory bandwidth, layout, etc.
 - Successive generations of hardware
 - Small and large input sizes
- Target Microsoft software environments
 - Existing libraries and parallel applications written in native code
 - Libraries for Microsoft's managed code environments may have security requirements which impact performance
 - Potentially mixing programming models within one application

Collaborations

- Within Microsoft
 - Evaluate early releases of programming models and runtime
 - Gather application requirements and plan demonstrations
- Research groups in academia
 - Share new many-core parallel algorithm ideas
 - UTK, Berkeley, and looking for others

Thank you!

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