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HPC Server 2008 R2 Highlights

Flexible Deployment

- Diskless compute nodes with iSCSI boot

Extremes of Scale

- Proven performance and scalability

Advanced Troubleshooting

- Diagnostics framework and new tests

Business Critical SOA

- Scale out business application to a cluster

Accelerating Excel

- Distributed Excel and UDF offloading

Cluster of Workstations

- Use idle workstations to extend your cluster

Visual Studio 2010 Highlights

F5 HPC Application Debug

- Simple Straight forward configuration leveraging the Job scheduler

New Manycore parallel programming models

- Supporting both managed and native code and easy to use

Manycore parallel building blocks

- Lower the bar for developer to successfully build parallel applications

New Parallel Debugger

- Works at the same abstraction as the new parallel prog models

New Parallel Profiler

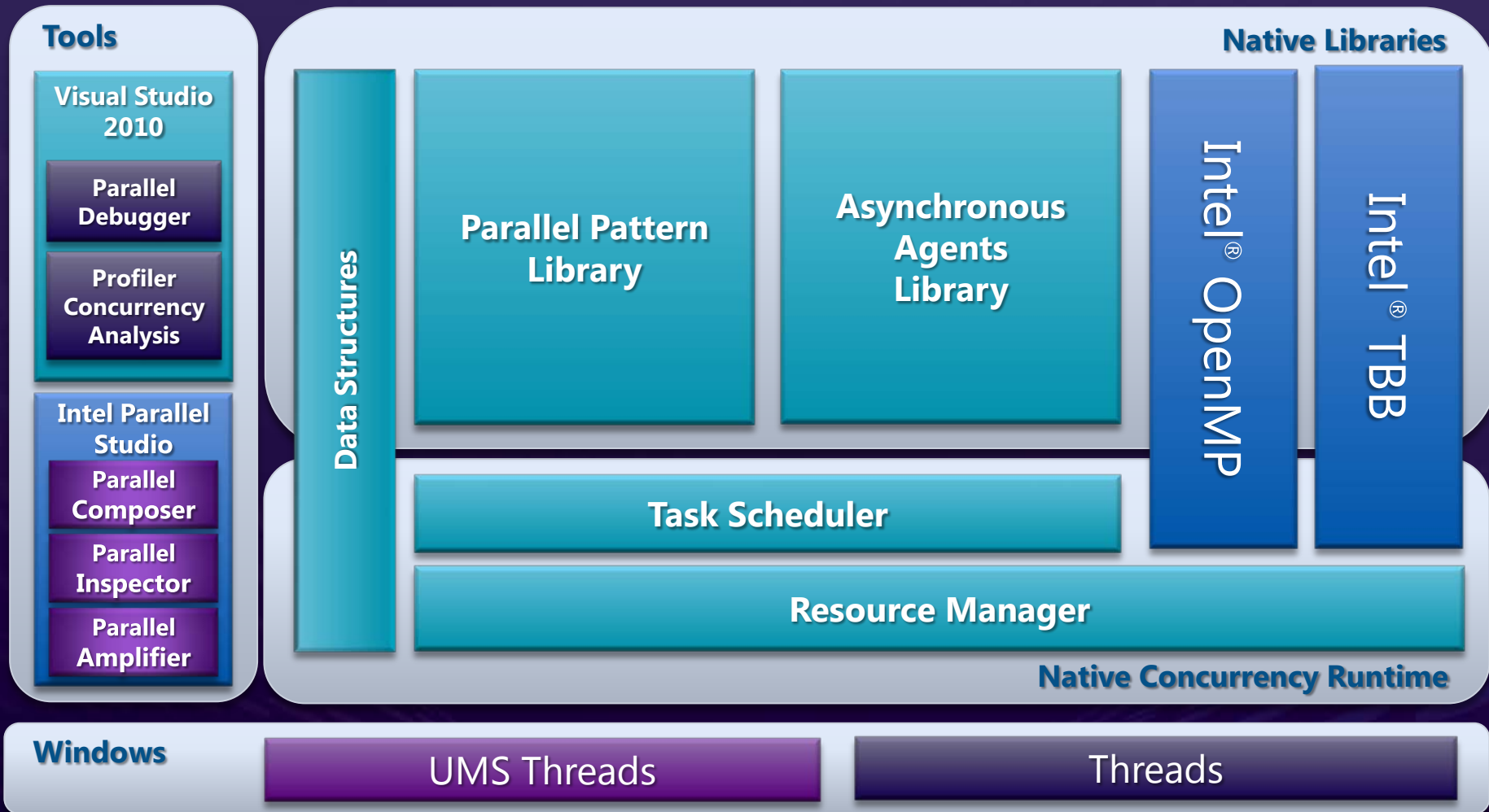
- Advanced visualizations to ease root cause analysis

New functional .NET language (F#)

- Parallelism implicit in many operations

MPI Debug Demo

Concurrency for C++



Key:

Intel® Parallel Studio

Visual Studio 2010

Windows 7

Demo of parallel_any_of

Carmichael Numbers

n is a carmichael number if n is square-free and for all prime divisors p of :

$$p - 1 \mid n - 1$$

e.g. :

$561 = 3 \cdot 11 \cdot 17$ is square – free

$2 \mid 560, 10 \mid 560, 16 \mid 560$

Distribution gets rare as N increases:

$$C(N) < N \exp \frac{-k \log X \log \log \log N}{\log \log N}$$

Demo of parallel_any_of

Why Agents

Not all patterns map to tasks

- pipelines, state machines, producer / consumer
- Attributes of agents
 - Encapsulation and isolation of data
 - Asynchronous communication between components
 - Manages state transitions, control flow or data flow
- Benefits of agents
 - Safer by default
 - State is coordinated not shared
 - Teachable & Learnable

Demo Dining Philosophers

Visual Studio 2010

Tools, Programming Models, Runtimes

Tools

Parallel Debugger
Tool
Windows
Visual
Studio
IDE
Profilers
Concurrency
Analysis

Programming Models

Parallel LINQ

Task Parallel
Library

.NET Framework 4

ThreadPool

Task Scheduler

Resource Manager

Data Structures

Parallel
Pattern
Library

Agents
Library

Visual C++ 10

Concurrency Runtime

Task Scheduler

Resource Manager

Data Structures

Operating System

Thread Windows

UMS Threads

$$A = \begin{bmatrix} A_{1,1} & A_{1,2} \\ A_{2,1} & A_{2,2} \end{bmatrix}, B = \begin{bmatrix} B_{1,1} & B_{1,2} \\ B_{2,1} & B_{2,2} \end{bmatrix}, C = \begin{bmatrix} C_{1,1} & C_{1,2} \\ C_{2,1} & C_{2,2} \end{bmatrix}$$

Demo

"Strassen's Algorithm"

$$\begin{aligned} M_1 &:= (A_{1,1} + A_{2,2})(B_{1,1} + B_{2,2}) \\ M_2 &:= (A_{2,1} + A_{2,2})B_{1,1} \\ M_3 &:= A_{1,1}(B_{1,2} - B_{2,2}) \\ M_4 &:= A_{2,2}(B_{2,1} - B_{1,1}) \\ M_5 &:= (A_{1,1} + A_{1,2})B_{2,2} \\ M_6 &:= (A_{2,1} - A_{1,1})(B_{1,1} + B_{1,2}) \\ M_7 &:= (A_{1,2} - A_{2,2})(B_{2,1} + B_{2,2}) \end{aligned}$$

$$\begin{aligned} C_{1,1} &= M_1 + M_4 - M_5 + M_7 \\ C_{1,2} &= M_3 + M_5 \\ C_{2,1} &= M_2 + M_4 \\ C_{2,2} &= M_1 - M_2 + M_3 + M_6 \end{aligned}$$

$$A = \begin{bmatrix} A_{1,1} & A_{1,2} \\ A_{2,1} & A_{2,2} \end{bmatrix}, B = \begin{bmatrix} B_{1,1} & B_{1,2} \\ B_{2,1} & B_{2,2} \end{bmatrix}, C = \begin{bmatrix} C_{1,1} & C_{1,2} \\ C_{2,1} & C_{2,2} \end{bmatrix}$$

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Demo

Parallel Profiling of
"Strassen's Algorithm"

Demo Parallel Debugger

Additional Resources

- The “Manycore Shift” is happening
 - Parallelism in your code is inevitable
 - Visual Studio 2010, with .NET 4, Parallel Patterns Library and Agents Library will help
- Parallel Computing Dev Center
 - <http://msdn.com/concurrency>
- Download Visual Studio 2010 RC (“go-live” license)
 - <http://go.microsoft.com/?linkid=9692084>
- Samples for Native & Managed
 - Managed: <http://code.msdn.com/parextsamples>
 - Native: <http://code.msdn.com/concrtexttras>
- Team Blogs
 - Managed: <http://blogs.msdn.com/pfxteam>
 - Native: <http://blogs.msdn.com/nativeconcurrency>
 - Tools: <http://blogs.msdn.com/visualizeparallel>
<http://www.danielmoth.com/Blog/>
- Forums
 - <http://social.msdn.microsoft.com/Forums/en-US/category/parallelcomputing>

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