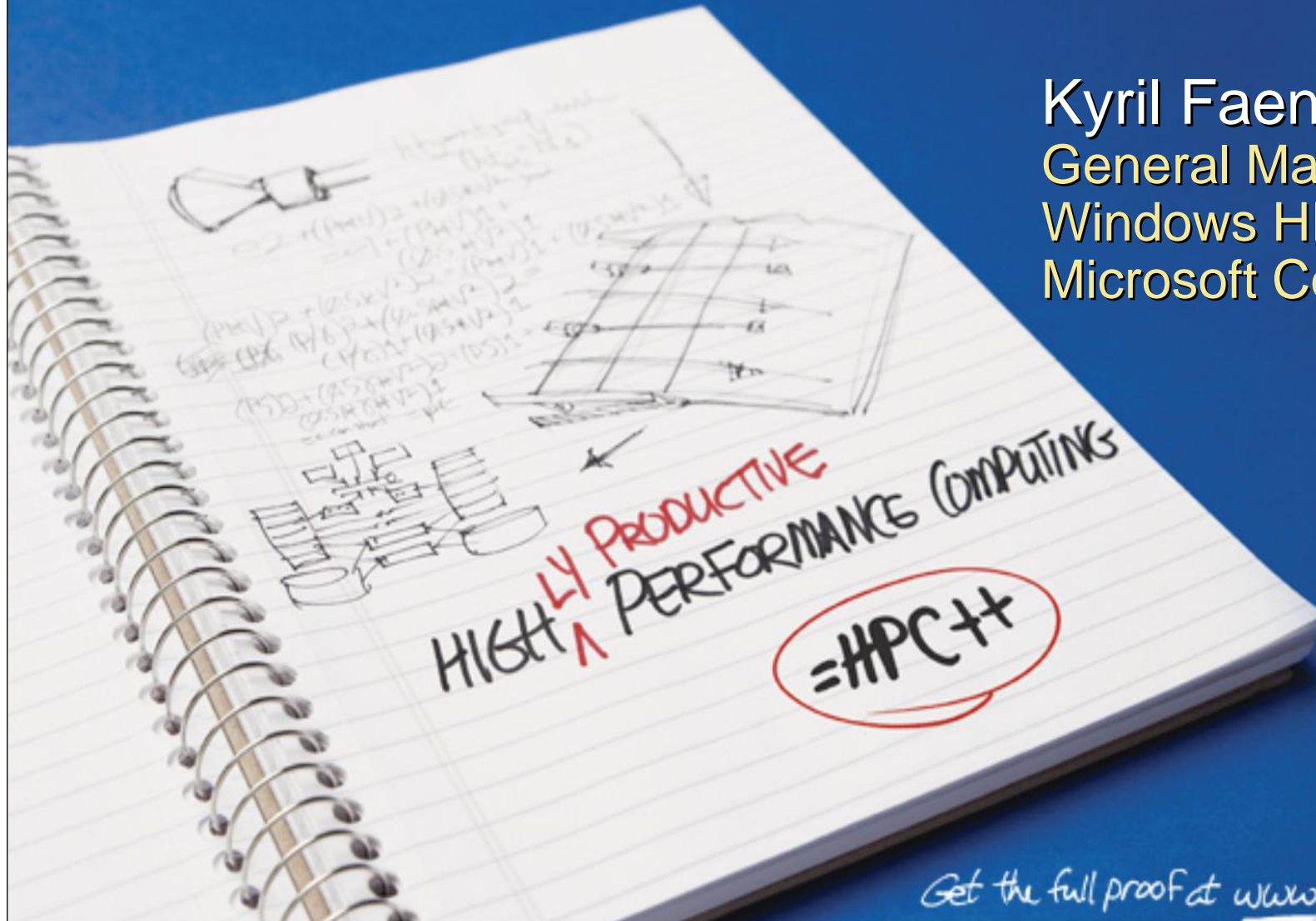


High Productivity Computing

Kyril Faenov
General Manager
Windows HPC
Microsoft Corporation

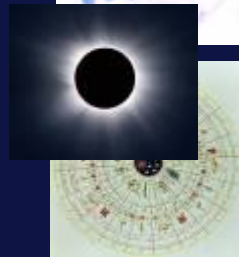
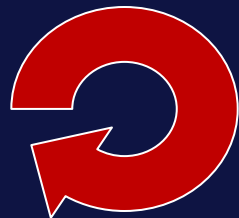


Accelerating Scientific Process

1. Observation



2. Analysis

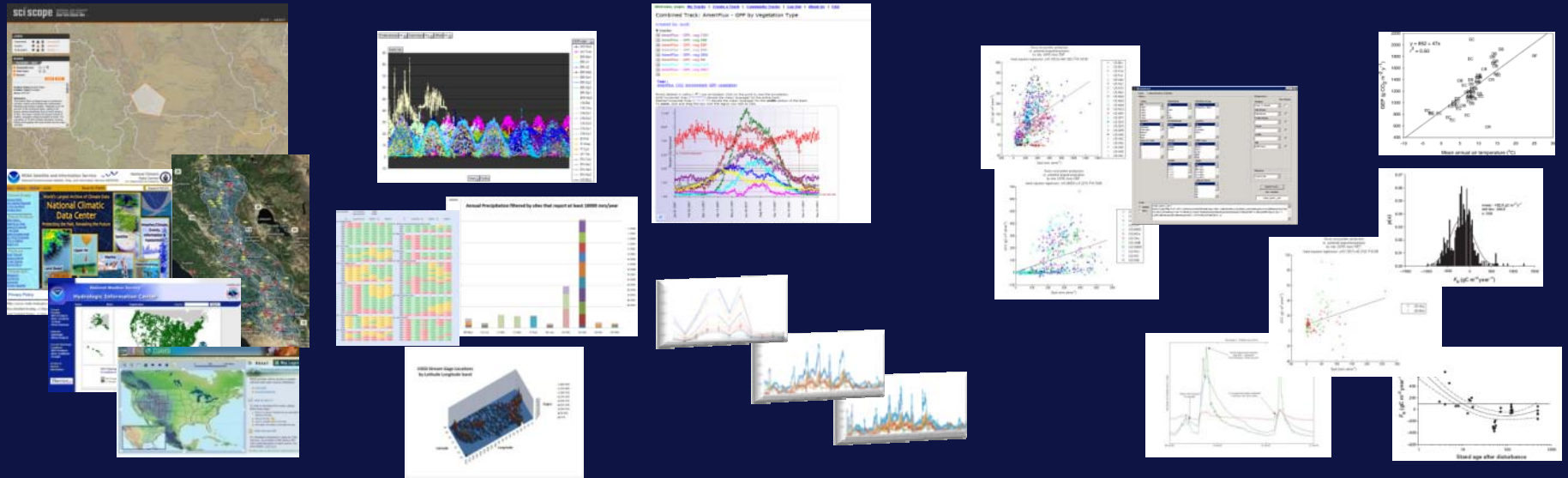


4. Validation

3. Simulation

- **Thousand years ago:**
Experimental Science
 - description of natural phenomena
- **Last few hundred years:**
Theoretical Science
 - Newton's Laws, Maxwell's Equations ...
- **Last few decades:**
Computational Science
 - simulation of complex phenomena
- **Today:**
'e-Science' or Data-centric Science
 - unify theory, experiment, and simulation

The Data Pipeline



Data Gathering

“Raw” data includes sensor output, data downloaded from agency or collaboration web sites, papers (especially for ancillary data)

Discovery and Browsing

“Raw” data browsing for discovery (do I have enough data in the right places?), cleaning (does the data look obviously wrong?), and light weight science via browsing

Science Exploration

“Science variables” and data summaries for early science exploration and hypothesis testing. Similar to discovery and browsing, but with science variables computed via gap filling, units conversions, or simple equation.

Domain specific analyses

“Science variables” combined with models, other specialized code, or statistics for deep science understanding.

Scientific Output

Scientific results via packages such as MatLab or R2. Special rendering package such as ArcGIS.

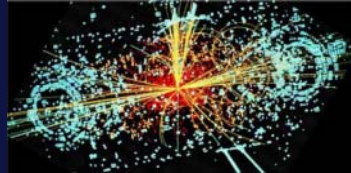
Paper preparation.

Explosion of Data

Experiments



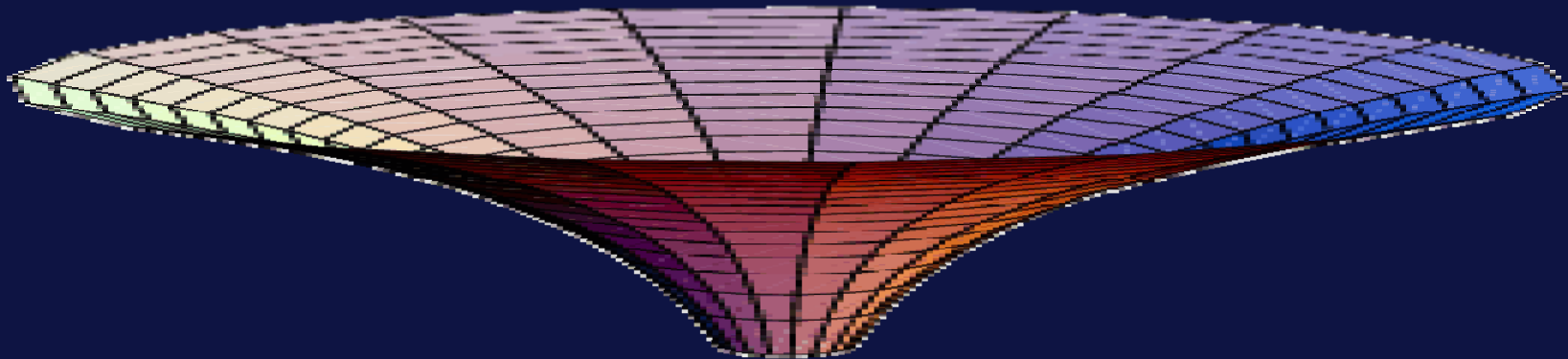
Simulations



Archives



Literature

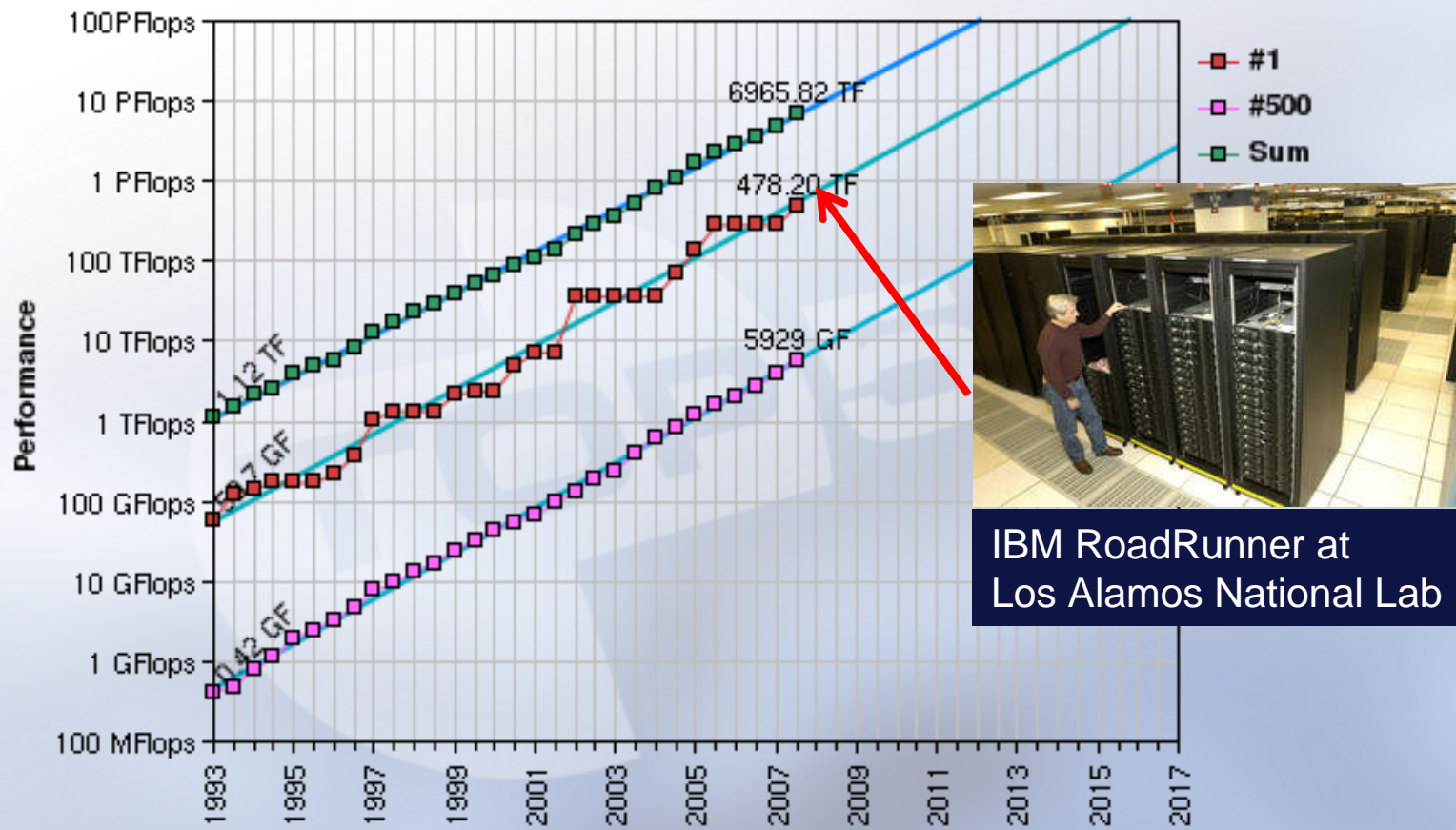


Petabytes
Doubling every
2 years

Supercomputing Reached the Petaflop



Projected Performance Development



08/11/2007

<http://www.top500.org/>

HPC in Every Lab

1991



Cray Y-MP C916

~10 GFlops

\$40,000,000

Government Labs

1998



Sun HPC10000

~10 GFlops

\$1,000,000 (40x drop)

Large Enterprises

2005



X64 Server

~10 GFlops

< \$4,000 (750x drop)

Every Engineer & Scientist

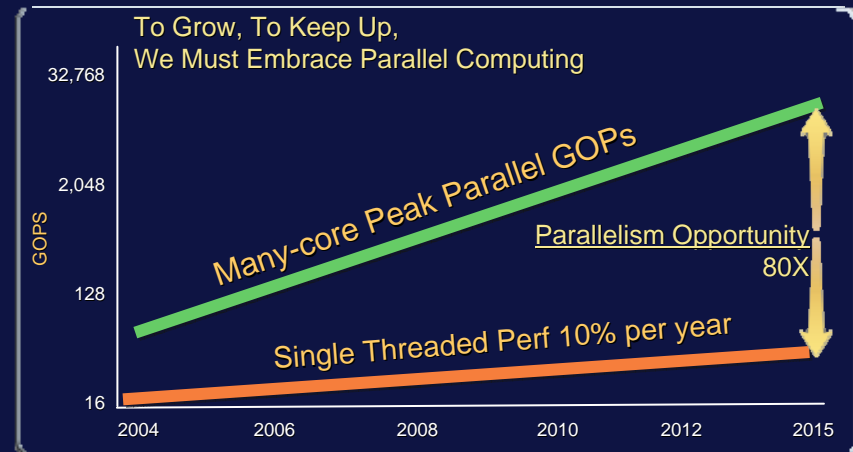
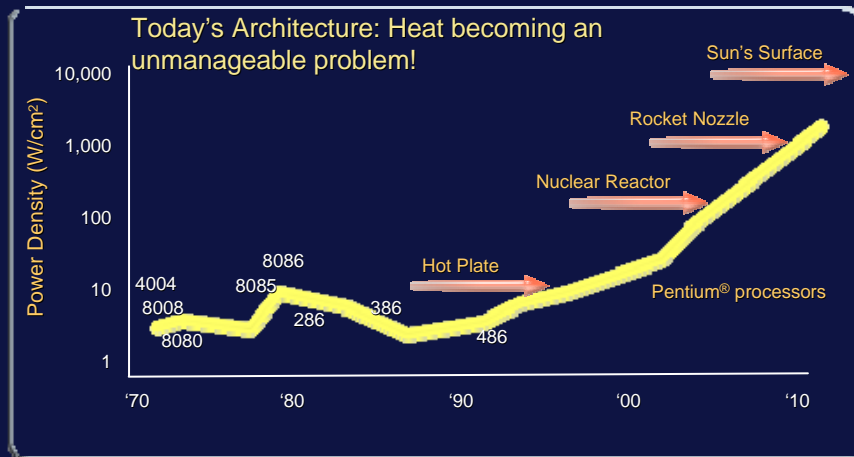
Sample System

Performance

Price

Customers

Hardware Paradigm Shift



Intel Developer Forum, Spring 2004 - Pat Gelsinger

“... we see a very significant shift in what architectures will look like in the future ... fundamentally the way we've begun to look at doing that is to move from instruction level concurrency to ... multiple cores per die. But we're going to continue to go beyond there. And that just won't be in our server lines in the future; this will permeate every architecture that we build. All will have massively multicore implementations.”

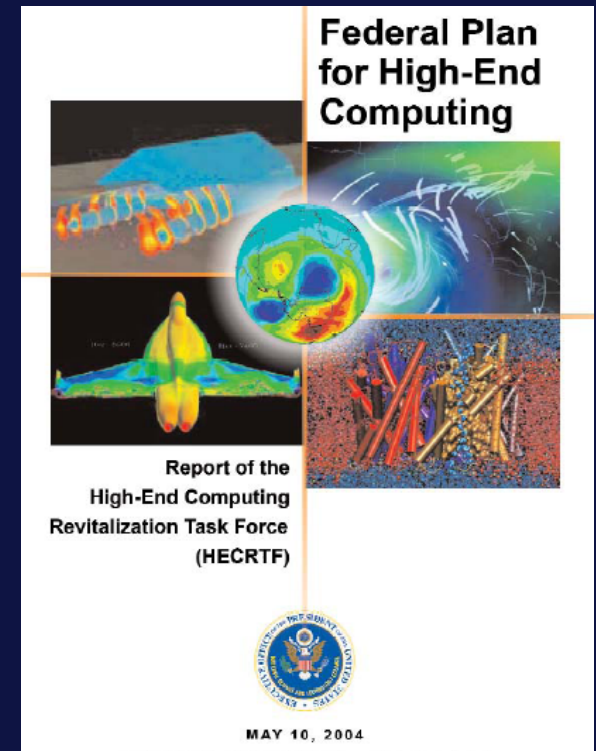
Intel Developer Forum, Spring 2004
Pat Gelsinger
Chief Technology Officer, Senior Vice President
Intel Corporation
February, 19, 2004

Challenge: High Productivity Computing

“Make high-end computing easier and more productive to use.

Emphasis should be placed on time to solution, the major metric of value to high-end computing users...

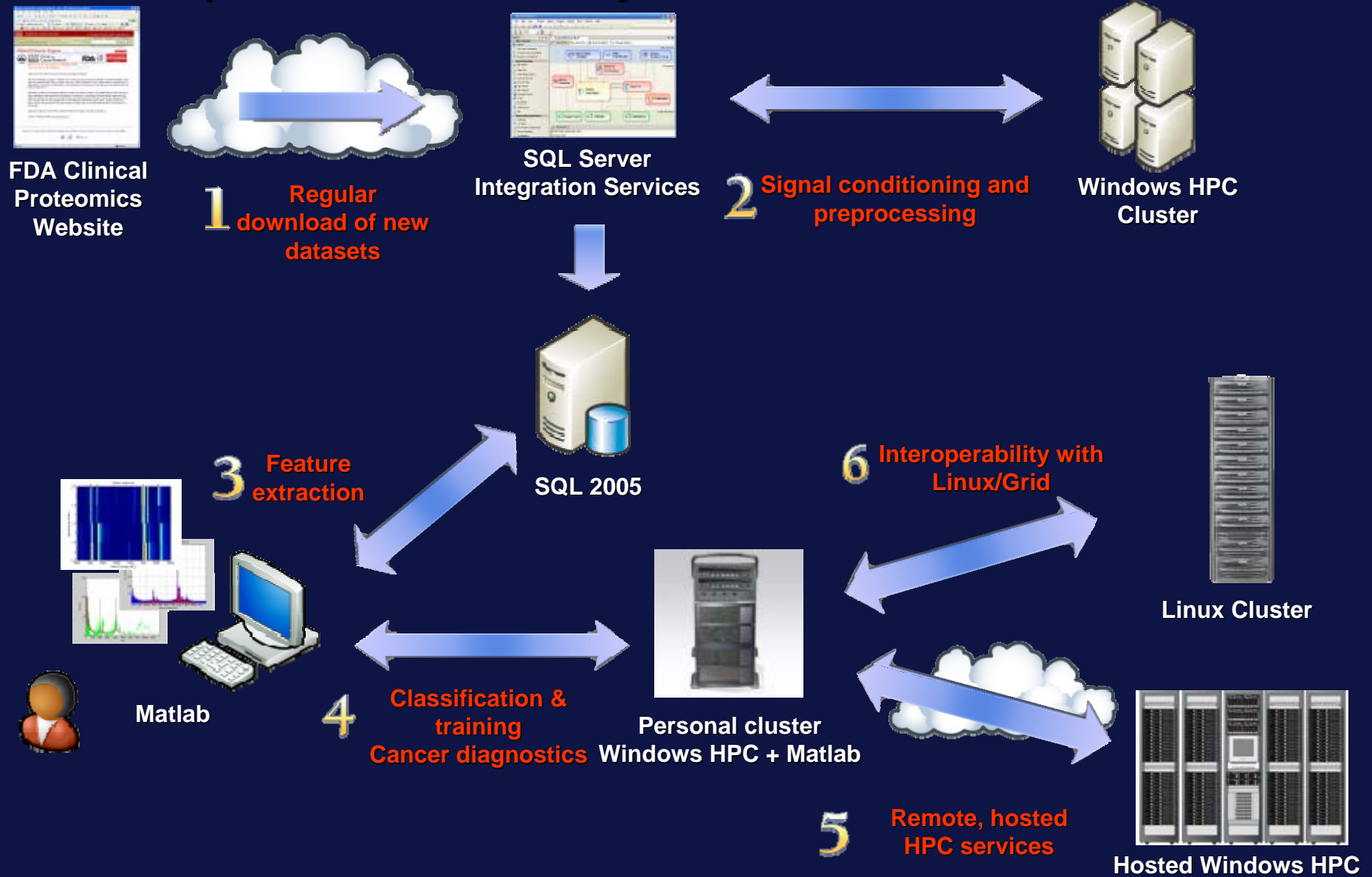
A common software environment for scientific computation encompassing desktop to high-end systems will enhance productivity gains by promoting ease of use and manageability of systems.”



**2004 High-End Computing
Revitalization Task Force**

**Office of Science and
Technology Policy,
Executive Office of the
President**

Example: Productivity in Cancer Research



Microsoft HPC++ Solution

Application Benefits

The most productive distributed application development environment



Cluster Benefits

Complete HPC cluster platform integrated with the rest of the enterprise management infrastructure



System Benefits

Cost-effective, reliable and high performance server operating system



Analysis

SQL Server 2005 Research Intelligence

Microsoft
SQL Server 2005
Integration Services

- Data acquisition from source systems and integration
- Data transformation and synthesis

Microsoft
SQL Server 2005
Analysis Services

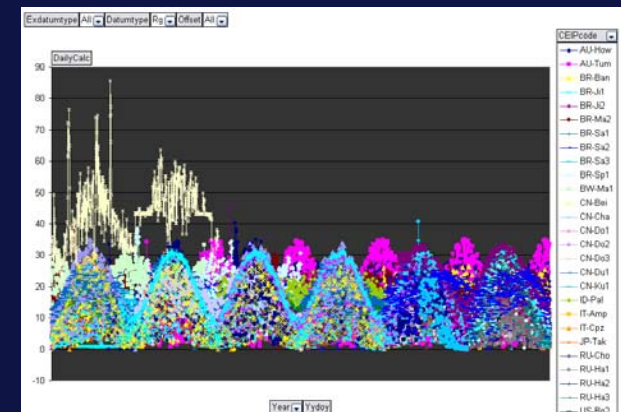
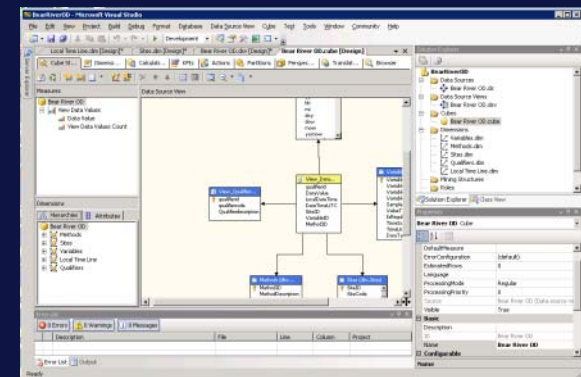
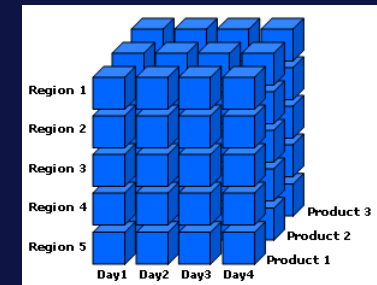
- Data enrichment, with business logic, hierarchical views
- Data discovery via data mining

Microsoft
SQL Server 2005
Reporting Services

- Data presentation and distribution
- Data access for the masses

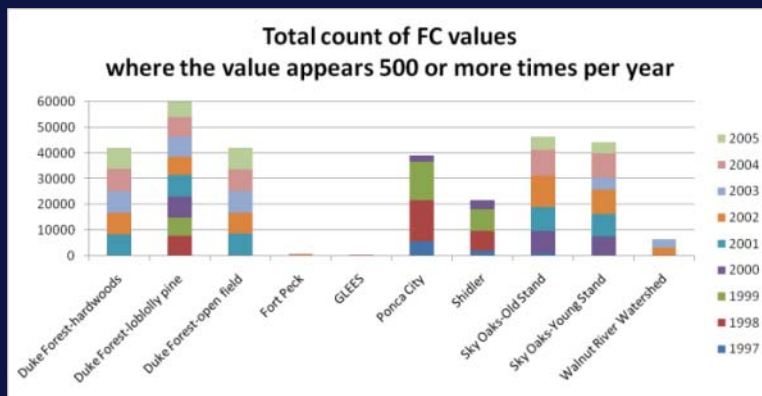
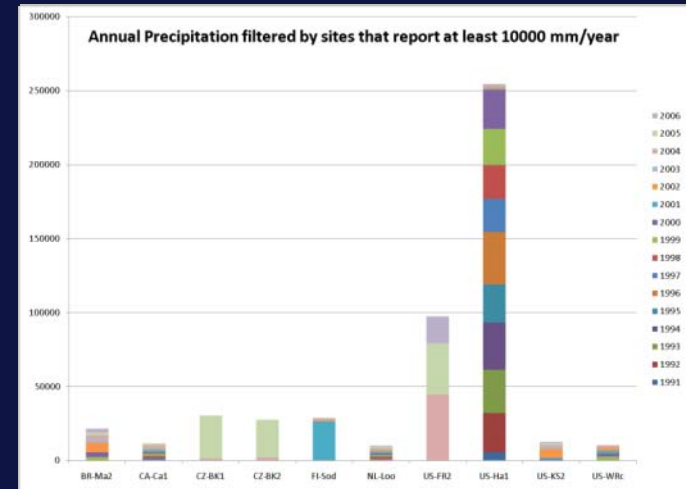
Data Cube Basics

- A data cube is a database specifically for data mining (OLAP)
 - Initially developed for commercial needs like tracking sales of Oreos and milk
 - Simple aggregations (sum, min, or max) can be pre-computed for speed
 - Hierarchies for simple filtering with drilldown capability
 - Additional calculations (median) can be computed dynamically or pre-computed
 - All operate along dimensions such as time, site, or datatype
 - Constructed from a relational database
- Client tool integration is evolving
 - Excel PivotTables allow simple data viewing
 - More powerful analysis and plotting using Matlab and statistics software



Browsing for Data Quality

- Data cleaning never ends
 - Running scripts on specific site years often misses the big picture
 - Spike detection and replacement

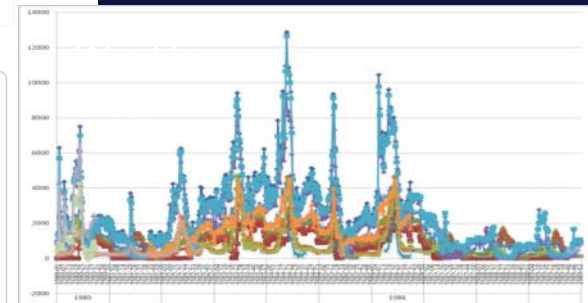
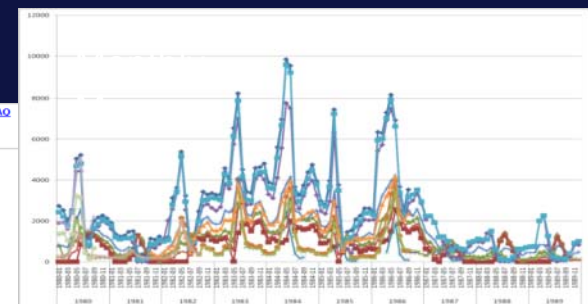
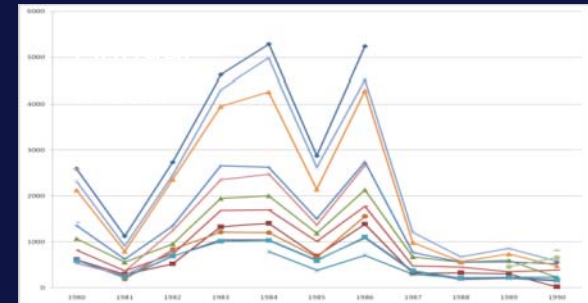
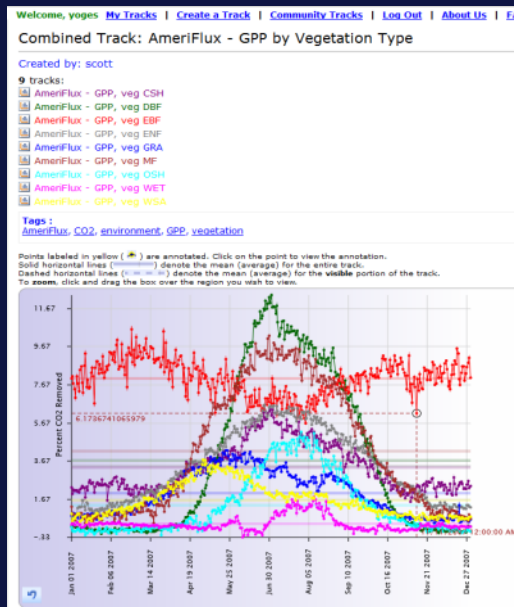
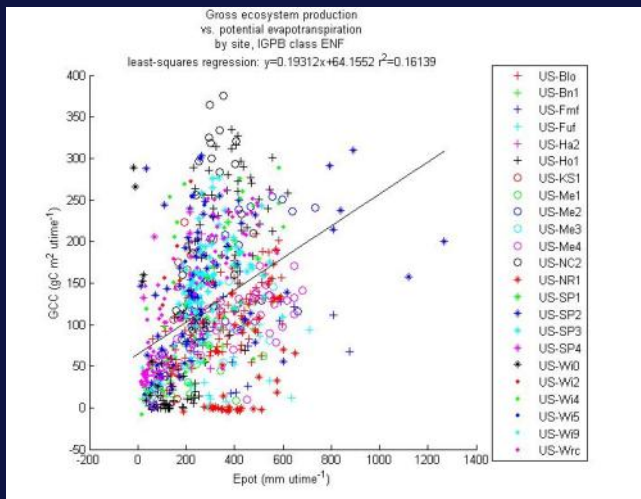


Data Availability	Low Threshold	High Threshold	FC	CO2/CO2	UET	PAA/RG	TA	RH/QD	FC	CO2/CO2	UET	PAA/RG	TA	RH/QD
CA - Bidgett Forest	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CA - Merlotus intermediate aged ponderosa pine	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CA - Merlotus intermediate aged ponderosa pine - Black Hills	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CA - Total Ranch	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CA - Nivert Ridge Forest	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CA - Walker Branch Watershed	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
CO - Bonville	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
IL - Bonville	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
NC - Duke Forest Hardwoods	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
OK - Shidler	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
TX - Wind River Crane Site	0.0000	0.2241	0.4349	0.4937	0.2443	0.4120	0.4120	0.4120	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

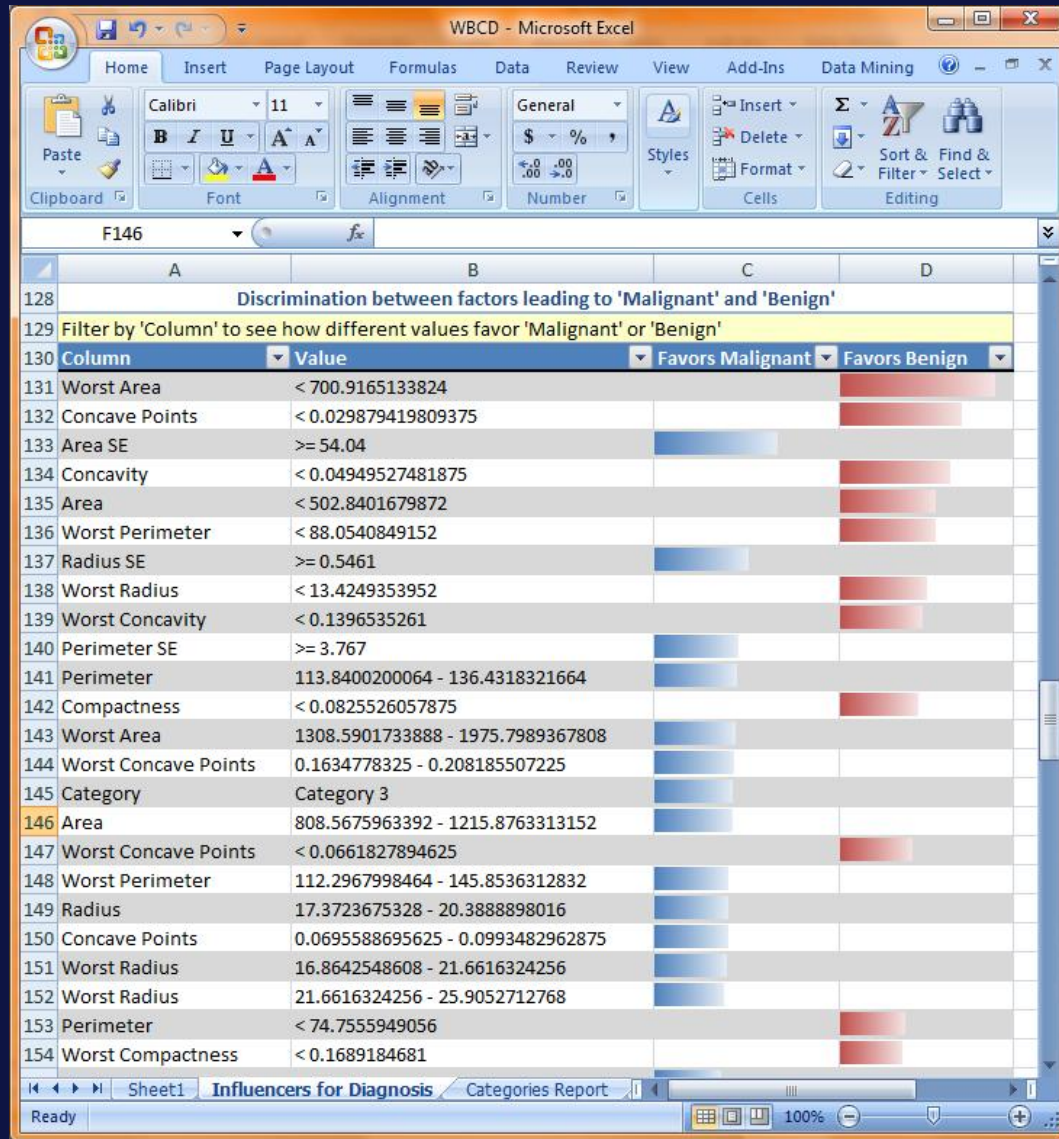
Courtesy Catherine VanIngen, MSR

Browsing for Data Analysis

- Plotting is the way of visualizing data
 - Most are discarded so scripting matters



Datamining with SQL and Excel



WBCD - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Add-Ins Data Mining

Clipboard Font Alignment Number Cells Editing

F146

Discrimination between factors leading to 'Malignant' and 'Benign'

Filter by 'Column' to see how different values favor 'Malignant' or 'Benign'

Column	Value	Favors Malignant	Favors Benign
Worst Area	< 700.9165133824		
Concave Points	< 0.029879419809375		
Area SE	>= 54.04		
Concavity	< 0.04949527481875		
Area	< 502.8401679872		
Worst Perimeter	< 88.0540849152		
Radius SE	>= 0.5461		
Worst Radius	< 13.4249353952		
Worst Concavity	< 0.1396535261		
Perimeter SE	>= 3.767		
Perimeter	113.8400200064 - 136.4318321664		
Compactness	< 0.0825526057875		
Worst Area	1308.5901733888 - 1975.7989367808		
Worst Concave Points	0.1634778325 - 0.208185507225		
Category	Category 3		
Area	808.5675963392 - 1215.8763313152		
Worst Concave Points	< 0.0661827894625		
Worst Perimeter	112.2967998464 - 145.8536312832		
Radius	17.3723675328 - 20.3888898016		
Concave Points	0.0695588695625 - 0.0993482962875		
Worst Radius	16.8642548608 - 21.6616324256		
Worst Radius	21.6616324256 - 25.9052712768		
Perimeter	< 74.7555949056		
Worst Compactness	< 0.1689184681		

Sheet1 Influencers for Diagnosis Categories Report

Ready 100%

Integrated algorithms

- Text Mining
- Neural Nets
- Naïve Bayes
- Time Series
- Sequent Clustering
- Decision Trees
- Association Rules

Language Integrated Query

```
using ...  
  
public partial class DataDemos_1_HelloWorld : System.Web.UI.  
{  
    protected void Page_Load(object sender, EventArgs e)  
    {  
        AdventureWorks db = new AdventureWorks ();  
  
        var query = from person in db.SalesPeople  
                    where person.HireDate > new DateTime(2002, 1, 1)  
                    select person;  
  
        DataList1.DataSource = query;  
        DataList1.DataBind();  
    }  
}
```

Query is created against relevant entity data model

Query in terms of the model and programming language (VB and C#)

Results are .NET objects, strongly typed, support data binding

EntityLINQDemos - Microsoft Visual Studio
File Edit View Refactor Website Build Debug Tools Window Community Help
Mixed Platforms salesperson
1_DataQueryDemo...HelloWorld.aspx
DataDemos_1_HelloWorld
Page_Load(object sender, EventArgs e)
Solution Explorer - Solution 'EntityLINQDemos'
EntityLINQDemos (3 projects)
WorksModel
ies
ces
ces
AdventureWorks.edm
nfig
WorksStore
ies
ces
App.Config
awstore.edm
C:\websites\EntityLINQDemos\
1_DataQueryDemos
1_HelloWorld.aspx
1_HelloWorld.aspx.cs
2_ForEachLoop.aspx
2_ForEachLoop.aspx.cs
3_DataListLoop.aspx
Loop.aspx.cs
aspx
ons.aspx.cs
nos

Item(s) Saved
Ln 20 Col 30 Ch 30 INS
EntityLINQDemos - ... Demoing 101 [Com... ADO.NET Entity Fram... Inbox - Microsoft O... Linq to ADO.NET En... Microsoft PowerPoi... 10:43 PM

Simulation

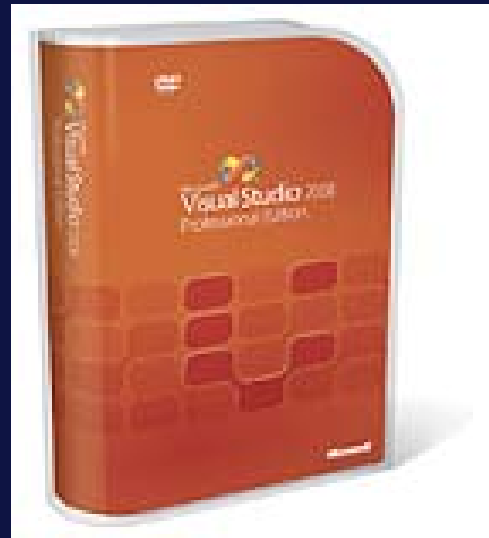
High Productivity Modeling with Visual Studio

Languages/Runtimes

- C++, C#, VB
- F#, Python, Ruby, Jscript
- Fortran (Intel, PGI)
- OpenMP, MPI

Team Development

- Team portal: version control, scheduled build, bug tracking
- Test and stress generation
- Code analysis, Code coverage
- Performance analysis



.Net Framework

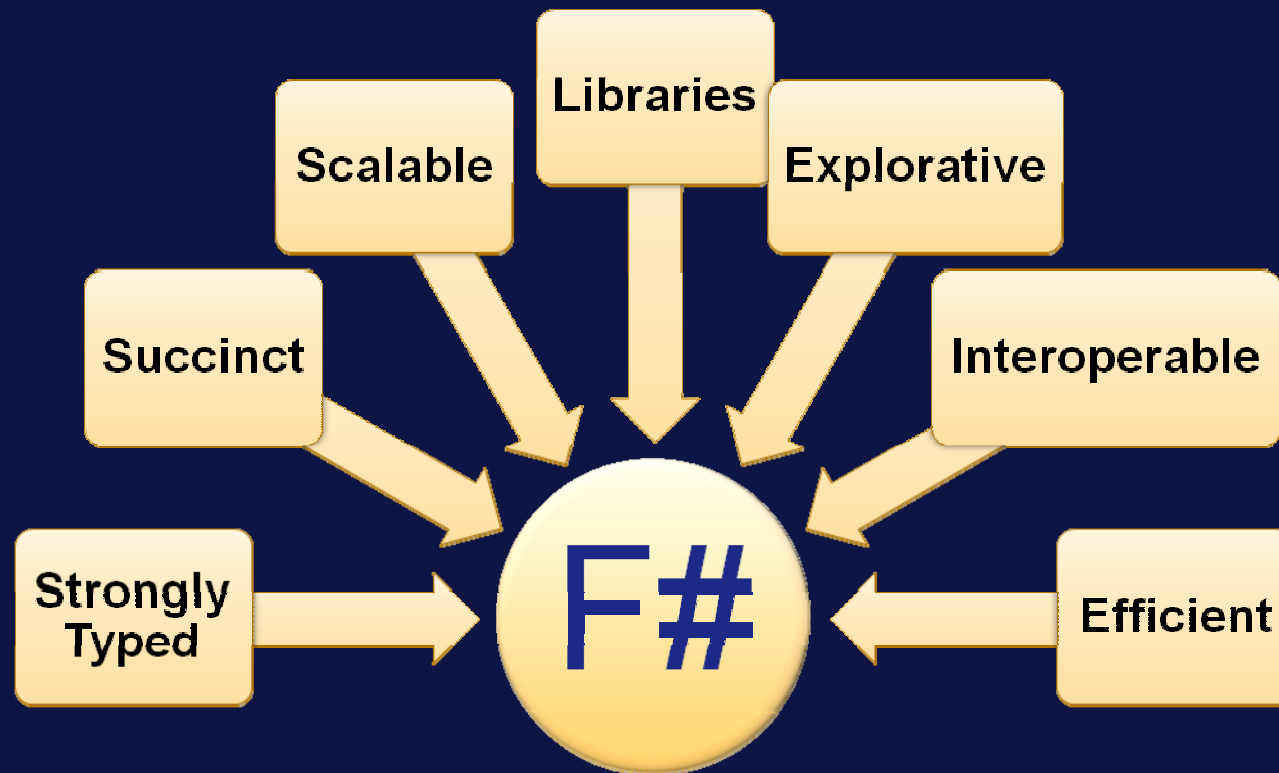
- LINQ: language integrated query
- Dynamic Language Runtime
- Fx/JIT/GC improvements
- Native support for Web Services

IDE

- Rapid application development
- Parallel debugging
- Multiprocessor builds
- Work flow design

F# is...

...a **functional, object-oriented, imperative and explorative** programming language for .NET



Interactive F# Shell

```
C:\fsharpv2>bin\fsi
```

```
MSR F# Interactive, (c) Microsoft Corporation, All Rights Reserved  
F# Version 1.9.2.9, compiling for .NET Framework Version v2.0.50727
```

```
NOTE:
```

```
NOTE: See 'fsi --help' for flags
```

```
NOTE:
```

```
NOTE: Commands: #r <string>; reference (dynamically load) the given DLL.
```

```
NOTE: #I <string>; add the given search path for referenced DLLs.
```

```
NOTE: #use <string>; accept input from the given file.
```

```
NOTE: #load <string> ...<string>;
```

```
NOTE: load the given file(s) as a compilation unit.
```

```
NOTE: #time;; toggle timing on/off.
```

```
NOTE: #types;; toggle display of types on/off.
```

```
NOTE: #quit;; exit.
```

```
NOTE:
```

```
NOTE: Visit the F# website at http://research.microsoft.com/fsharp.
```

```
NOTE: Bug reports to fsbugs@microsoft.com. Enjoy!
```

```
> let rec f x = (if x < 2 then x else f (x-1) + f (x-2));;
```

```
val f : int -> int
```

```
> f 6;;
```

```
val it = 8
```

```
val it : int
```

Example: Taming Asynchronous I/O

```
using System;
using System.IO;
using System.Threading;

public class BulkImageProcAsync
{
    public const String ImageBaseName = "image";
    public const int numImages = 200;
    public const int numPixels = 512;

    // ProcessImage has a simple O(N)
    // of times you repeat that loop
    // bound or more IO-bound.
    public static int processImageRepeats = 10;

    // Threads must decrement NumImagesToFinish
    // their access to it through a
    public static int NumImagesToFinish;
    public static Object[] NumImages;
    // WaitObject is signalled when
    public static Object[] WaitObjects;
    public class ImageStateObject
    {
        public byte[] pixels;
        public int imageNum;
        public FileStream fs;
    }
}
```

```
public static void ReadInImageCallback(IAsyncResult asyncResult)
{
    ImageStateObject state = (ImageStateObject)asyncResult.AsyncState;
    Stream stream = state.fs;
    int bytesRead = stream.EndRead(asyncResult);
    if (bytesRead != numPixels)
        throw new Exception(String.Format(
            "In ReadInImageCallback, got the wrong number of
            bytes from the image: {0}.", bytesRead));
    ProcessImage(state.pixels, state.imageNum);
    stream.Close();

    // Now write out the image.
    // Using asynchronous I/O here appears not to be the best idea.
    // It ends up swamping the threadpool, because the threads
    // are blocked on I/O requests that were in the threadpool.
    FileStream fs = new FileStream(ImageBaseName + state.imageNum +
        ".done", FileMode.Create, FileAccess.Write, FileShare.None,
        4096, false);
    fs.Write(state.pixels, 0, numPixels);
    fs.Close();

    // This application model uses too much memory.
    // Releasing memory as soon as possible is a good idea,
    // especially global state.
    state.pixels = null;
    fs = null;
    // Record that an image is finished now.
    lock (NumImagesMutex)
    {
        NumImagesToFinish--;
        if (NumImagesToFinish == 0)
        {
            Monitor.Enter(WaitObject);
            Monitor.Pulse(WaitObject);
            Monitor.Exit(WaitObject);
        }
    }
}
```

```
public static void ProcessImagesInBulk()
{
    Console.WriteLine("Processing images... ");
    long t0 = Environment.TickCount;
    NumImagesToFinish = numImages;
    AsyncCallback readImageCallback = new AsyncCallback(ReadInImageCallback);
    for (int i = 0; i < numImages; i++)
    {
        ImageStateObject state = new ImageStateObject();
        state.pixels = new byte[numPixels];
        state.imageNum = i;
        // Very large items are read only once, so you can make the
        // buffer on the FileStream very small to save memory.
        FileStream fs = new FileStream(ImageBaseName + i + ".tmp",
            FileMode.Open, FileAccess.Read, FileShare.Read, 1, true);
        state.fs = fs;
        fs.BeginRead(state.pixels, 0, numPixels, readImageCallback,
            state);
    }

    // Determine whether all images are done being processed.
    // If not, block until all are finished.
    bool mustBlock = false;
    lock (NumImagesMutex)
    {
        if (NumImagesToFinish > 0)
            mustBlock = true;
    }
    if (mustBlock)
    {
        Console.WriteLine("All work done. Blocking until they complete. numLeft: {0}",
            NumImagesToFinish);
        Monitor.Enter(WaitObject);
        Monitor.Wait(WaitObject);
        Monitor.Exit(WaitObject);
    }
    long t1 = Environment.TickCount;
    Console.WriteLine("Total time processing images: {0}ms",
        (t1 - t0));
}
```

**Processing
200 images in
parallel**

Example: Taming Asynchronous I/O

Equivalent F#
code
(same perf)

Open the file,
synchronou
sly

Read from the
file,
asynchronously

```
let ProcessImageAsync(i) =  
    async {  
        let inStream = File.OpenRead(sprintf "source%d.jpg" i)  
        let! pixels = inStream.ReadAsync(numPixels)  
        let pixels' = TransformImage(pixels, i)  
        let outStream = File.OpenWrite(sprintf "result%d.jpg" i)  
        do! outStream.WriteAsync(pixels')  
        do Console.WriteLine "done!" }  
    }
```

This object
coordinates

Write the result,
asynchronously

```
let ProcessImagesAsync() =  
    Async.Run (Async.Parallel  
        [ for i in 1 .. numImages -> ProcessImageAsync(i) ])
```

“!”
= “asynchronous”

Generate the
tasks and queue
them in parallel

Parallel Extensions to .NET

- Declarative data parallelism (PLINQ)

```
var q = from n in names.AsParallel()  
        where n.Name == queryInfo.Name &&  
              n.State == queryInfo.State &&  
              n.Year >= yearStart &&  
              n.Year <= yearEnd  
        orderby n.Year ascending  
        select n;
```

- Imperative data and task parallelism (TPL)

```
Parallel.For(0, n, i => {  
    result[i] = compute(i);  
});
```

- Data structures and coordination constructs

Example: Tree Walk

Sequential

```
static void ProcessNode<T>(Tree<T>
tree, Action<T> action) {
    if (tree == null) return;

    ProcessNode(tree.Left, action);
    ProcessNode(tree.Right, action);
    action(tree.Data);
}
```

Thread Pool

```
static void ProcessNode<T>(Tree<T> tree, Action<T> action) {
    if (tree == null) return;

    Stack<Tree<T>> nodes = new Stack<Tree<T>>();
    Queue<T> data = new Queue<T>();

    nodes.Push(tree);
    while (nodes.Count > 0) {
        Tree<T> node = nodes.Pop();
        data.Enqueue(node.Data);
        if (node.Left != null) nodes.Push(node.Left);
        if (node.Right != null) nodes.Push(node.Right);
    }

    using (ManualResetEvent mre = new ManualResetEvent(false)) {
        int waitCount = Environment.ProcessorCount;

        WaitCallback wc = delegate {
            bool gotItem;
            do {
                T item = default(T);
                lock (data) {
                    if (data.Count > 0) {
                        item = data.Dequeue();
                        gotItem = true;
                    }
                    else gotItem = false;
                }
                if (gotItem) action(item);
            } while (gotItem);

            if (Interlocked.Decrement(ref waitCount) == 0) mre.Set();
        };

        for (int i = 0; i < Environment.ProcessorCount - 1; i++) {
            ThreadPool.QueueUserWorkItem(wc);
        }

        wc(null);
        mre.WaitOne();
    }
}
```

Example: Tree Walk

Parallel Extensions (with Task)

```
static void ProcessNode<T>(Tree<T> tree, Action<T> action) {  
    if (tree == null) return;  
  
    Task t = Task.Create(delegate { ProcessNode(tree.Left, action); });  
    ProcessNode(tree.Right, action);  
    action(tree.Data);  
    t.Wait();  
}
```

Parallel Extensions (with Parallel)

```
static void ProcessNode<T>(Tree<T> tree, Action<T> action) {  
    if (tree == null) return;  
  
    Parallel.Do(  
        () => ProcessNode(tree.Left, action),  
        () => ProcessNode(tree.Right, action),  
        () => action(tree.Data) );  
}
```

Parallel Extensions (with PLINQ)

```
static void ProcessNode<T>(Tree<T> tree, Action<T> action) {  
    tree.AsParallel().ForAll(action);  
}
```

MPI.NET

- Supports all .NET languages (C#, C++, F#, ..., even Visual Basic!)
- Natural expression of MPI in C#

```
if (world.Rank == 0)
    world.Send("Hello, World!", 1, 0);
else
    string msg = world.Receive<string>(0, 0);
```

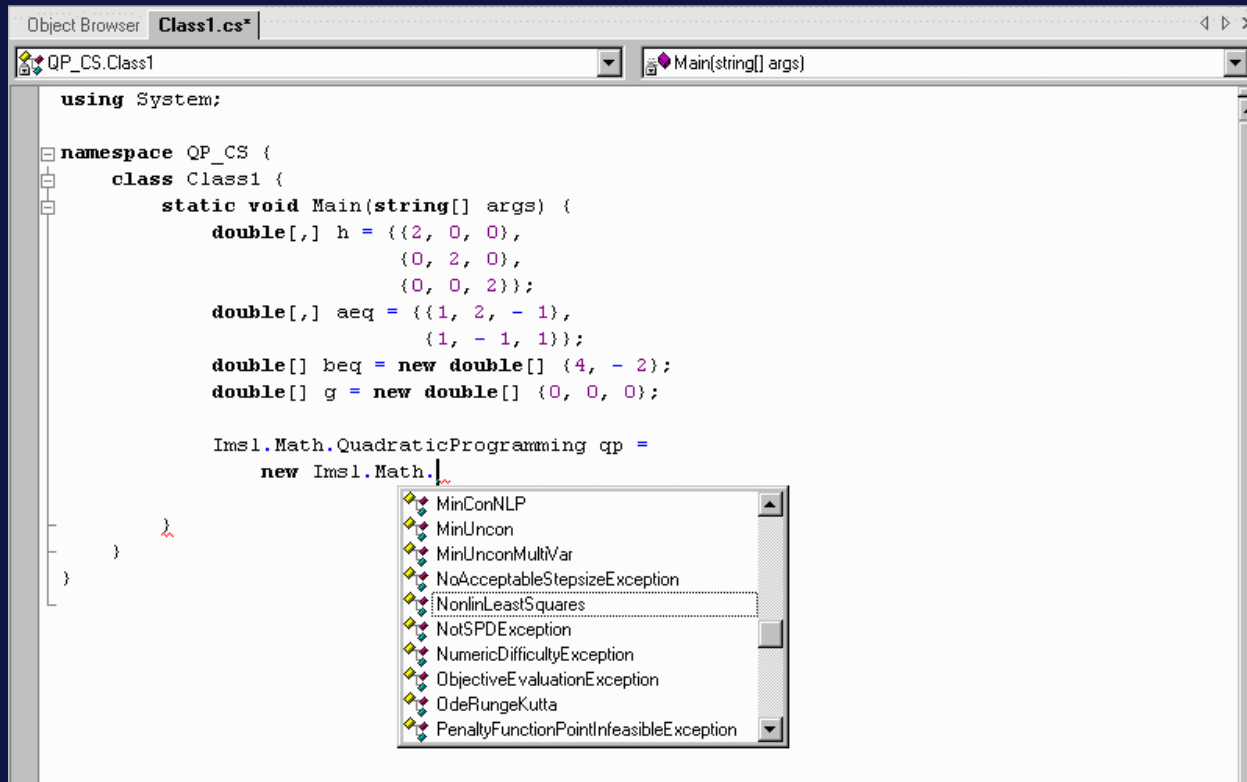
```
string[] hostnames =
comm.Gather(MPI.Environment.ProcessorName, 0);

double pi = 4.0*comm.Reduce(dartsInCircle,(x, y) =>
return x + y, 0) / totalDartsThrown;
```

- Negligible overhead (relative to C) over TCP

Visual Numerics .NET IMSL Library

- Linear Algebra
- Eigensystems
- Interpolation and Approximation
- Quadrature
- Differential Equations
- Transforms
- Nonlinear Equations
- Optimization
- Basic Statistics
- Nonparametric Tests
- Goodness of Fit
- Regression
- Variances, Covariances and Correlations
- Multivariate Analysis
- Analysis of Variance
- Time Series and Forecasting
- Distribution Functions
- Random Number Generation

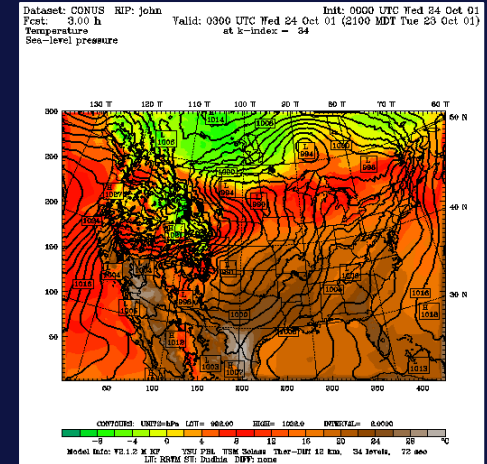


```
Object Browser Class1.cs*
QP_CS.Class1
Main(string[] args)
using System;
namespace QP_CS {
    class Class1 {
        static void Main(string[] args) {
            double[,] h = {{2, 0, 0},
                          {0, 2, 0},
                          {0, 0, 2}};
            double[,] aeq = {{1, 2, -1},
                             {1, -1, 1}};
            double[] beq = new double[] {4, -2};
            double[] g = new double[] {0, 0, 0};

            Imsl.Math.QuadraticProgramming qp =
                new Imsl.Math.
                MinConNLP
                MinUncon
                MinUnconMultiVar
                NoAcceptableStepsizeException
                NonlinLeastSquares
                NotSPDException
                NumericDifficultyException
                ObjectiveEvaluationException
                OdeRungeKutta
                PenaltyFunctionPointInfeasibleException
        }
    }
}
```

Porting With Subsystem for Unix Applications

- Subsystem for Unix applications
 - Subsystem for POSIX applications
 - Complete SVR-5 and BSD UNIX environment with 300 commands, utilizes, shell scripts, compilation tools
 - Visual Studio extensions for debugging POSIX applications
 - Support for 32 and 64-bit applications
- Recent port of WRF V2.1.2
 - ~1/3 million lines, Fortran 90 and some C using MPI, OpenMP
 - Traditionally developed for Unix HPC systems
 - Two dynamical cores, full range of physics options
 - Rapid community growth - more than 3,000 registered users
- Porting experience
 - Of 360K lines, fewer than 750 changed to compile and link under Services for Unix
 - Largest number of changes involved the WRF build mechanism (Makefiles, scripts)
 - Level of effort and nature of tasks was not unlike porting to any new version of UNIX
 - Performance on par with the Linux systems



Using Excel to Drive Linpack

Linpack Tukwila - V0.xlsx - Microsoft Excel

Table Tools

Home Insert Page Layout Formulas Data Review View Developer Add-Ins Design

B175 24000

1

2 **Ping Pong - capture lowest latency and highest bandwidth values**

3 **Interconnect Latency Bandwidth**

4 **GigE**

5 **IB/WSD** 12,1 954401830

6 **Linpack - Gflops per core = (instructions cycles)*frequency**

7 **Frequency (Ghz)** 1,86

8 **flop/cycle** 4 core/node 8

9 **Max GF / core** 7,44 **Max GF/node** 59,52

10 **Intel Optimized Linpack results**

11 **Max GF / node** 43,89 **Efficiency** 73,74%

12 **Nodeperf - capture one node**

13 **Gflops/Core** 6,6 **Efficiency** 88,71%

14

15 **hpl parameters**

16 **Estimation data**

17 **Actual Results**

18 **Instructions:**

19 Set Max/proc GF value to the theoretical max per processor based on its clock rate and architecture

20 Set NB, Bcast, P, Q and Nodes values for a row. PxQ should be equal to the total number of processors.

21 Set N to define the problem size and watch Mem MB (mem usage per-node) change

22 Set Exp Eff value and watch Exp Time in seconds be calculated

23 **Rules of thumb:**

24 NB should fit in the cache line

25 N should generate memory usage per node of 100+ MB and less than (total memory - 700MB)

26 P should be roughly quarter of Q value

27 Expected efficiency is 60%+ for GigE, 70%+ for IPoB and close to 80% for IB with WSD - for large values of N

16 **N** **NB** **BCAST** **P** **Q** **Nodes** **Mem M** **Target Efficiency** **Expected Runtin** **Cluster Per** **Gflops** **Runtin** **Efficien** **MPI_HPL_PARAMS**

175 24000 96 1 2 8 2 2197 50% 144 59,52 54,18 170 45,5% -env MPICH_SOCKET_SBUFFER_SIZE 0

176 24000 96 1 2 8 2 2197 50% 144 59,52 47,09 196 39,6% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env M

177 24000 96 0 2 8 2 2197 50% 144 59,52 53,75 171 45,2% -env MPICH_SOCKET_SBUFFER_SIZE 0

178 24000 96 1 2 8 2 2197 50% 144 59,52 47,00 196 39,5% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env M

179 24000 96 1 2 8 2 2197 50% 144 59,52 54,14 170 45,5% -env MPICH_SOCKET_SBUFFER_SIZE 0

180 24000 96 1 2 8 2 2197 50% 144 59,52 49,76 185 41,8% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env O

181 24000 96 1 2 8 2 2197 50% 144 59,52 49,94 185 42,0% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env O

182 24000 96 1 2 8 2 2197 50% 144 59,52 57,83 159 48,6% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env O

183 24000 96 1 2 8 2 2197 50% 144 59,52 64,91 142 54,5% -env MPICH_SOCKET_SBUFFER_SIZE 0

188 24000 96 1 2 8 2 2197 50% 144 59,52 54,17 170 45,5% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env M

189 40000 96 1 2 8 2 6104 60% 556 71,424 71,38 598 60,0% -env MPICH_SOCKET_SBUFFER_SIZE 0

194 24000 96 1 2 8 2 2197 60% 120 71,424 66,21 139 55,6% -env MPICH_SOCKET_SBUFFER_SIZE 0

195 40000 96 1 2 8 2 6104 60% 556 71,424 72,96 585 61,3% -env MPICH_SOCKET_SBUFFER_SIZE 0

198 32000 96 1 2 8 2 3906 60% 285 71,424 69,66 314 58,5% -env MPICH_SOCKET_SBUFFER_SIZE 0

199 32000 96 1 2 8 2 3906 60% 285 71,424 68,70 318 57,7% -env MPICH_SOCKET_SBUFFER_SIZE 0

200 32000 96 1 2 8 2 3906 60% 285 71,424 64,60 338 54,3% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env O

201 32000 96 1 2 8 2 3906 60% 285 71,424 64,66 338 54,3% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env O

202 32000 96 1 2 8 2 3906 60% 285 71,424 69,01 317 58,0% -env MPICH_SOCKET_SBUFFER_SIZE 0

203 32000 96 1 2 8 2 3906 60% 285 71,424 70,00 312 58,8% -env MPICH_SOCKET_SBUFFER_SIZE 0

205 32000 96 1 2 8 2 3906 60% 285 71,424 62,96 347 52,9% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env O

208 32000 96 1 2 8 2 3906 60% 285 71,424 62,96 347 52,9% -env MPICH_SOCKET_SBUFFER_SIZE 0 -env O

227 32000 96 2 2 8 2 3906 60% 285 71,424 67,72 323 56,9% -env MPICH_SOCKET_SBUFFER_SIZE 0

228 32000 96 2 2 8 2 3906 60% 285 71,424 66,89 327 56,2% -env MPICH_SOCKET_SBUFFER_SIZE 0

229 32000 96 3 2 8 2 3906 60% 285 71,424 67,72 323 56,9% -env MPICH_SOCKET_SBUFFER_SIZE 0

230 32000 96 3 2 8 2 3906 60% 285 71,424 68,65 318 57,7% -env MPICH_SOCKET_SBUFFER_SIZE 0

231 32000 96 4 2 8 2 3906 60% 285 71,424 68,01 321 57,1% -env MPICH_SOCKET_SBUFFER_SIZE 0

232 32000 96 4 2 8 2 3906 60% 285 71,424 66,56 328 55,9% -env MPICH_SOCKET_SBUFFER_SIZE 0

Ready Filter Mode

90%

Linpack Parameters

HPL Input tabPage2

Select the range of HPL input then click on the button below

Save HPL inputs

Select cells for which you want to submit a job

Submit Job

Query Status

Select the cells for which you want to read the linpack result

Read Results

Windows HPC Server 2008

- Rapid large scale deployment and built-in diagnostics suite
- Integrated monitoring, management and reporting
- Familiar UI and rich scripting interface

Systems Management

- Integrated security via Active Directory
- Support for batch, interactive and service-oriented applications
- High availability scheduling
- Interoperability via OGF's HPC Profile

Job Scheduling

- Access to SQL, Windows and Unix file servers
- Key parallel file server vendor support (GPFS, Lustre, Panasas)
- In-memory caching options

Storage

- MS-MPI stack based on MPICH2 reference implementation
- Performance improvements for RDMA networking and multi-core shared memory
- MS-MPI integrated with Windows Event Tracing

MPI



Ease of deployment

The screenshot displays the 'Cluster KYRILFL - HPC Cluster Manager' application window. The interface is divided into a left-hand navigation pane and a main content area. The navigation pane includes a 'To-do List' section with sub-items: Network, Node Templates, Images, Job Templates, and Users. Below this are buttons for Configuration, Node Management, Job Management, Diagnostics, and Charts and Reports. The main content area is titled 'To-do List' and contains several sections:

- To-do List**: A list of four completed configuration steps, each marked with a green checkmark:
 - Configure your network**: Choose one of five network topologies for your cluster.
 - Provide installation credentials**: Specify the user name and password to use for system configuration and when adding compute nodes.
 - Configure the naming of new nodes**: Specify the naming convention to use when generating names automatically for new compute nodes.
 - Create a node template**: Create a template that defines the steps to follow when configuring a compute node.
- Add an operating system image**: Create a new image or load an existing image to use with your node templates when deploying compute nodes.
- Add or remove users**: Add or remove users or administrators for your cluster.
- Add compute nodes**: Add compute nodes to the cluster by choosing one of three supported options.
- Manage drivers**: Add device drivers to the operating system images.
- Join the Customer Experience Improvement Program**: Help Microsoft identify which HPC features to improve.

On the right side of the main content area, there are three sections with icons and links:

- Node Management (Help)**:
 - [Change the role of the head node](#): Assign additional functionality for the head node.
 - [View operations](#): See a list of current and past node operations.
 - [Open the remote desktop tool](#): Access your compute nodes from a single terminal window.
- Job Management (Help)**:
 - [Create a job template](#): Job templates help simplify and constrain the job submission process.
 - [Configure job scheduler policies and settings](#): Customize policies, error handling and filters for your cluster.
- Diagnostics (Help)**:
 - [Validate your cluster](#): Run tests to validate cluster functionality or troubleshoot failures.

At the bottom right, there is a **Learn more** section with a question mark icon and two links:

- [Overview of Windows HPC Server](#)
- [Online Resources for Windows HPC Server](#)

Ease of Deployment

The screenshot displays the 'Cluster KYRILFL - HPC Cluster Manager' application window. The interface is divided into several sections:

- Configuration Panel (Left):** A sidebar with a 'To-do List' containing 'Network', 'Node Templates', 'Images', 'Job Templates', and 'Users'. Below this is a vertical menu with icons for 'Configuration', 'Node Management', 'Job Management', 'Diagnostics', and 'Charts and Reports'.
- Network Section (Center):**
 - Topology 2:** Described as 'All nodes on enterprise and private networks.' It features a diagram with a yellow circle (Head Node) and three blue triangles (Compute Nodes). Solid blue lines represent the Enterprise Network, and dashed green lines represent the Private Network.
 - Legend:** A yellow circle for 'Head Node', a blue triangle for 'Compute Node', a solid blue line for 'Enterprise Network', and a dashed green line for 'Private Network'.
 - Description:** 'As with topology 1, communication between nodes, including deployment, management, and application traffic, is all carried on the private network, but in this configuration the enterprise network is attached to all cluster nodes.'
 - Network adapters:** A table listing two network adapters:

Icon	Name	Device name	IP address	Subnet mask	Domain	Link speed	Status	MAC address	NetworkDirect	Bound to network:
	Local_Area_Connection	Intel(R) PRO/1000 PL Network Connection			redmond.corp.microsoft.com	1 Gbps	Offline	00-16-D3-37-77-F6	False	
	Enterprise	Intel(R) PRO/Wireless 3945ABG Network Connection	128.141.225.34	255.255.0.0	cem.ch	24 Mbps	Online	00-19-D2-44-65-87		
- Actions Panel (Right):** A sidebar with a 'Network Actions' section containing 'Configure Network ...' and 'Save Report ...', and a 'Help Resources' section with links to 'Configuration', 'Network Configuration', 'Node Templates', 'Job Templates', and 'Managing Cluster Users'.

Single Management Console

Cluster LOCALHOST

File View Actions Options Go Help

Back Forward Navigation Pane Actions Column Chooser

Node Management

- Nodes (5)
 - Group
 - HeadNodes
 - ComputeNodes
 - WcfBrokerNodes
 - Rack1
 - Rack2
 - Status
 - Node Template
 - WunderApp Node Template
 - Default ComputeNode Template without image
 - Default ComputeNode Template
 - Default ComputeNode Template
 - HeadNodeTemplate
 - Operations
 - Archived
 - Committed
 - Executing
 - Failed
- Configurations
- Node Management
- Job Management
- Diagnostics
- Charts and Reports

ComputeNodes (5)

List Heat Map Search nodes by name

Netbios Name	State	Node Template	Location
CPALMER-HN1	Online	HeadNodeTemplate	Chassis 1, Rack 1
MYCLUSTER5003	Online	Default ComputeNode Templa...	Chassis 2, Rack 1
MYCLUSTER5004	Online	Default ComputeNode Templa...	Chassis 1, Rack 2
MYCLUSTER5005	Online	Default ComputeNode Templa...	Chassis 2, Rack 2
MYCLUSTER5006	Offline		Chassis 3, Rack 2

Node MYCLUSTER5003 Executing operations: 0

Last Updated	State	Name
2/7/2008 4:20:19 PM	Committed	02/07/2008 16:20:19
2/7/2008 4:19:50 PM	Committed	Adding nodes to group Rack1
2/7/2008 4:19:24 PM	Committed	Removing nodes from group Rack2
2/7/2008 4:18:53 PM	Committed	Removing nodes from group Rack1
2/7/2008 4:12:47 PM	Committed	02/07/2008 16:12:47
2/7/2008 4:09:17 PM	Committed	Updating the configuration of HPCDEV\MYCLUSTER5003
2/7/2008 3:24:39 PM	Committed	02/07/2008 15:24:39
2/7/2008 3:24:08 PM	Committed	Updating the configuration of HPCDEV\MYCLUSTER5003
2/7/2008 3:14:57 PM	Committed	02/07/2008 15:14:56
2/7/2008 11:17:16 AM	Committed	Bringing nodes online
2/6/2008 10:17:10 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 10:12:07 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 10:07:04 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 10:02:01 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 9:56:58 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 9:51:55 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 9:46:52 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 9:41:49 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 9:36:46 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 9:31:42 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...
2/6/2008 9:26:39 PM	Committed	Discovering the configuration of node 'HPCDEV\MYCLUST...

Actions

Node

- Take Online
- Take Offline
- Force Offline
- Reboot
- Run Command
- Add Node
- Re-image
- Patch
- Change Role...
- Delete
- Reject
- Approve
- Assign Node Template
- Edit
- Export Node XML
- Run Diagnostics
- View Performance Charts
- Open Event Viewer

Tutorial Help

Pivot To

- Jobs for the node
- Diagnostics for the node
- Operations for the node

Data updated: 2/7/2008 4:20:23 PM.

Integrated Monitoring

The screenshot displays the 'Cluster LOCALHOST' monitoring application. The main window is titled 'State/Offline (212)' and shows a heat map of CPU usage for 212 nodes. The 'Metric' is set to 'Cpu Usage'. The heat map consists of a grid of colored squares representing different nodes. A red box highlights a specific node in the top right corner of the grid. The interface includes a navigation pane on the left with options like 'Overview', 'All Nodes', 'Custom Tags', and 'State'. The 'State' section is expanded to show 'Offline'. On the right, there is an 'Actions' pane with various operations such as 'Add', 'Edit', 'Delete', 'Remote Desktop', 'Open Event Viewer', 'Take Online', 'Take Offline', 'Start Up', 'Reboot', 'Shut Down', 'Reject node', 'Assign Template', and 'Re-image'. The bottom status bar indicates 'Data updated: 8/21/2007 8:23:34 AM.'

Comprehensive Diagnostics Suite

The screenshot displays the 'Cluster LOCALHOST' interface. The left sidebar shows a navigation tree with categories like 'Diagnostics', 'Tests', 'Scheduler', 'Services', 'Connectivity', 'System Configuration', 'Performance', 'Test Results', 'Running', 'Success', 'Warning', 'Failure', 'FailedToRun', and 'Complete'. The main area is titled 'Test Results (6)' and contains a table of test results.

Name	Result	Test Suite	Target	Last Run
FirewallConfigurationReport	Success	System Configuration	MYCLUSTER5003	2/7/2008 9:40:00 PM
MpiPingPongTest	Running	Performance	2 nodes	2/7/2008 9:28:07 PM
SimpleSchedulerTest	Running	Scheduler	MYCLUSTER5001	2/6/2008 11:26:25 AM
SimpleSchedulerTest	Running	Scheduler	MYCLUSTER5000	2/4/2008 11:18:02 PM
ActiveDirectoryTest	Success	Connectivity	3 nodes	2/4/2008 11:16:10 PM

Below the table, a summary for 'MYCLUSTER5003' shows '20 Succeeded' with a close button (X). A list item indicates 'The firewall is enabled'.

Name	Ports	Application
Windows Communication Foundation Net.TCP Listener Adapter (TCP-In)	808	NetTcpActivator
Core Networking - Destination Unreachable (ICMPv6-In)		System
Core Networking - Destination Unreachable Fragmentation Needed (ICMPv4-In)		System
Core Networking - Dynamic Host Configuration Protocol (DHCP-In)	68	dhcp
Core Networking - Internet Group Management Protocol (IGMP-In)		System
Core Networking - IPv6 (IPv6-In)		System
Core Networking - Multicast Listener Done (ICMPv6-In)		System
Core Networking - Multicast Listener Query (ICMPv6-In)		System

At the bottom left, a status bar indicates 'Data updated: 2/7/2008 9:44:21 PM.' The bottom right corner has a small icon.

Built-in Reporting

Cluster LOCALHOST

File View Options Go Help

Back Forward Navigation Pane Actions

Charts and Reports

Monitoring Charts

Reports

- Job Resource Usage
- Job Throughput**
- Job Turnaround
- Node Availability
- Cluster Utilization

Job Throughput

Duration Day Group By User View Report

Date 2/5/2008 Filter

User Project Service Template % Find Next

Group

Total Number of Users: 3

Job Throughput Groups
(Sorted by # of Total Jobs in descending order)

of Jobs

Legend:

- # Finished Job
- # Failed Job
- # Canceled Job

User

Expand to see data

User	# of Finished Jobs	% of Finished Jobs	# of Failed Jobs	% of Failed Jobs	# of Canceled Jobs	% of Canceled Jobs	# of Total Jobs
HPCDEV\administrator	216	100.00 %	0	0.00 %	0	0.00 %	216
HPCDEV\cpalmer	3	100.00 %	0	0.00 %	0	0.00 %	3
NT AUTHORITY\SYSTEM	2	66.67 %	1	33.33 %	0	0.00 %	3
Total	221	99.55 %	1	0.45 %	0	0.00 %	222

All dates and times and shown in Pacific Standard Time Page 4 of 4

Configurations

Node Management

Job Management

Diagnostics

Charts and Reports

Spring 2008, NCSA, ~#20
9472 cores, 68.5 TF, 77.7%

Spring 2008, Umea, ~#50
5376 cores, 46 TF, 85.5%



30% efficiency
improvement

Fall 2007, Microsoft, #116
2048 cores, 11.8 TF, 77.1%



Spring 2007, Microsoft
2048 cores, 9 TF, #106

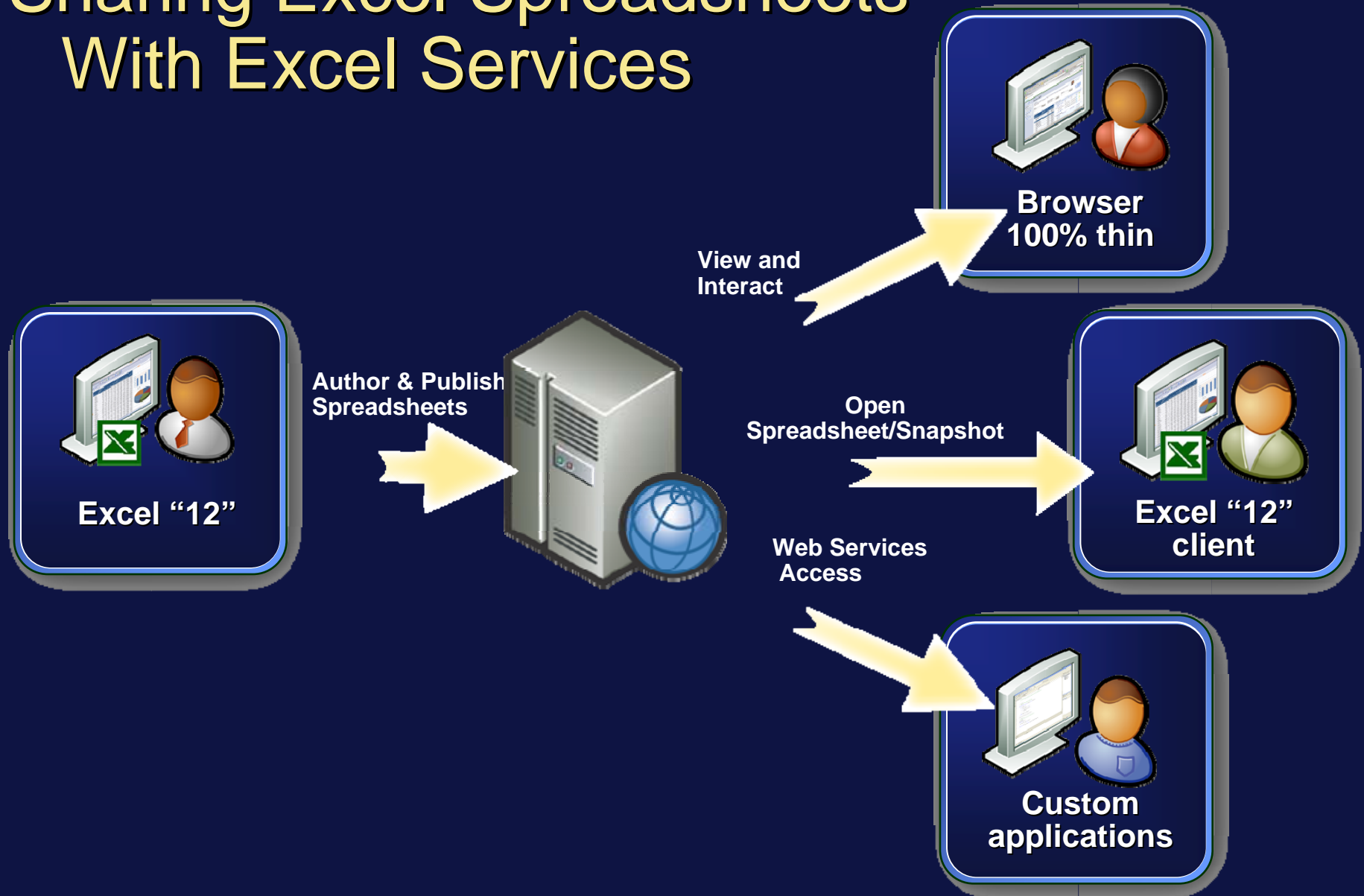


Spring 2006, NCSA, #130
896 cores, 4.1 TF



Collaboration

Sharing Excel Spreadsheets With Excel Services



Server-based Spreadsheets

View and interact with spreadsheets in the browser

The screenshot shows a browser window titled "Excel Web Access" displaying a spreadsheet with columns E through L and rows 10 through 19. The spreadsheet contains financial data for various cities. Below the spreadsheet is a line chart titled "Top 10 Cities Sales over Time" showing sales from CY 2001 to CY 2004 for ten cities: Seattle, Garland, Memphis, Nashua, Houston, Tooele, San Antonio, Loveland, Bellingham, and Lacey. The chart shows a general upward trend in sales for most cities, peaking in CY 2003.

City	2001	2002	2003	2004
Seattle	\$150,000	\$350,000	\$550,000	\$250,000
Garland	\$100,000	\$250,000	\$450,000	\$200,000
Memphis	\$120,000	\$280,000	\$480,000	\$220,000
Nashua	\$110,000	\$270,000	\$470,000	\$210,000
Houston	\$130,000	\$300,000	\$500,000	\$230,000
Tooele	\$140,000	\$320,000	\$520,000	\$240,000
San Antonio	\$160,000	\$340,000	\$540,000	\$260,000
Loveland	\$170,000	\$360,000	\$560,000	\$270,000
Bellingham	\$180,000	\$380,000	\$580,000	\$280,000
Lacey	\$190,000	\$390,000	\$590,000	\$290,000

Excellent visual fidelity including all new conditional formatting

100% HTML and script no client components

Server side charting

Reusable Business Logic

Incorporate Excel models in business applications

Calculate spreadsheet and set and get values

The screenshot shows a web browser window titled "Mortgage Calculator - Microsoft Internet Explorer". The page is divided into three main sections:

- Web Part:** A form with input fields for "Mortgage Amount" (250,000 dollars), "Mortgage Length" (30 years), and "Interest Rate" (6.00 %). A "Calculate" button is present, and the "Total Payment" is displayed as "\$1,498.88 month".
- Source Workbook:** A preview of an Excel spreadsheet titled "Simple Calculator". The data is as follows:

	A	B	C	D
1				
2				
3				
4		Principal:	\$250,000.00	
5		Interest:	6.00	
6		Length:	30	
7		Total:	\$1,498.88	
8				
- Code:** A code editor showing the implementation of the "Calculate" button. The code uses a web service to interact with the Excel spreadsheet.

Reusable web-rendered UI

Cross platform web services interface

```
Code:  
  
/// <summary>  
/// Calculate the workbook by calling the Excel Server Web Service API remotely  
/// </summary>  
/// <remarks>  
/// The Web Service will be called at ExcelServerWebServiceUrl.  
/// </remarks>  
  
private void CalculateUsingWebService()  
{  
    Status[] status;  
    string sessionId = null;  
  
    // initialize the excel server  
    XI MortgageCalcWebPart.Es.ExcelService es = new  
    XI MortgageCalcWebPart.Es.ExcelService();  
    es.Url = this.ExcelServerWebServiceUrl;  
    es.Credentials = System.Net.CredentialCache.DefaultCredentials;  
  
    // open the workbook  
    sessionId = es.OpenWorkbook(this.MortgageCalculatorWorkbookUrl, "en-US",  
    "en-US", out status);  
  
    // set the values from the form  
    es.SetCellA1(sessionId, "SimpleCalculator", "MortgageAmount",
```

Reusable Business Logic

Incorporate Excel models in business applications

Excel Server M0 Demo - Microsoft Internet Explorer

Address: <http://danbatt08/webclient/BSOptions.aspx>

Microsoft® Office System
Excel Server

Inputs

Asset Price

Exercise Price

Risk Free Rate

Volatility (β)

Years to Exp.

Dividend Yield

Outputs

Call Value 20.1998

Call Value (w/Div) 20.0332

Put Value

Put Value (w/Div)

Microsoft®

Call Service Cancel

Done Local intranet

Workflow Design for Sharepoint

The screenshot displays the Microsoft Visual Studio interface for designing a workflow. The main workspace shows a **Sequential Workflow** diagram with the following components:

- OnWorkflowActivated1**: The starting event of the workflow.
- whileActivity1**: A loop structure containing a single activity.
- codeActivity1**: A code activity located inside the while loop.
- codeActivity2**: A code activity that follows the while loop.

The **Solution Explorer** on the right shows the following references:

- Microsoft.SharePoint
- microsoft.sharepoint.portal
- Microsoft.SharePoint.WorkflowActiv...
- System
- System.Data
- System.Design
- System.Drawing
- System.Drawing.Design
- System.Transactions
- System.Web
- System.Web.Services
- System.Workflow.Activities
- System.Workflow.ComponentMode
- System.Workflow.Runtime

The **Properties** window shows the following file properties for **Workflow1.cs**:

Workflow1.cs File Properties	
Advanced	
Build Action	Compile
Copy to Output Direct	Do not copy
Custom Tool	
Custom Tool Namespace	
Misc	
File Name	Workflow1.cs
Full Path	C:\Projects\JupiterMediaW...

The **Toolbox** on the left lists various workflow activities, including **OnWorkflowActivated** and **While**.

Workflow Tracing

Poc.Workflow.Fisher - Workflow Monitor

File View Monitor

Workflow Status From 01/01/200C Until 26/10/200E Activity Name Property Value Workflow Instance ID 00000C

New Workflow... Edit this Workflow... 100%

Workflows - 185 records

Id	Name	Status
306	Poc.Workflow.Fisher	Completed
307	Poc.Workflow.Fisher	Completed
308	Poc.Workflow.Fisher	Completed
309	Poc.Workflow.Fisher	Terminated
310	Poc.Workflow.Fisher	Completed
311	Poc.Workflow.Fisher	Completed
312	Poc.Workflow.Fisher	Completed
313	Poc.Workflow.Fisher	Completed
314	Poc.Workflow.Fisher	Completed
315	Poc.Workflow.Fisher	Completed
316	Poc.Workflow.Fisher	Terminated
317	Poc.Workflow.Fisher	Completed
318	Poc.Workflow.Fisher	Completed
319	Poc.Workflow.Fisher	Completed
320	Poc.Workflow.Fisher	Completed
321	Poc.Workflow.Fisher	Completed
322	Poc.Workflow.Fisher	Completed
323	Poc.Workflow.Fisher	Completed
324	Poc.Workflow.Fisher	Running

Activities

- CreateWorkingDirectory (Closed) - 25/10/2006 - 10:34
- CopyGene (Executing) - 25/10/2006 - 10:34
- CopyGene (Closed) - 25/10/2006 - 10:34
- CopyCase (Executing) - 25/10/2006 - 10:34
- CopyCase (Closed) - 25/10/2006 - 10:34
- CopyPerm (Executing) - 25/10/2006 - 10:34
- CopyPerm (Closed) - 25/10/2006 - 10:34
- CopyIncl (Executing) - 25/10/2006 - 10:34
- CopyIncl (Closed) - 25/10/2006 - 10:34
- CopyMap (Executing) - 25/10/2006 - 10:34
- CopyMap (Closed) - 25/10/2006 - 10:34
- CopyExe (Executing) - 25/10/2006 - 10:34
- CopyExe (Closed) - 25/10/2006 - 10:34
- NotifyCopied (Executing) - 25/10/2006 - 10:34
- NotifyCopied (Closed) - 25/10/2006 - 10:34
- Fisher1 (Executing) - 25/10/2006 - 10:34
- Fisher1 (Executing) - 25/10/2006 - 10:34
- Fisher1 (Executing) - 25/10/2006 - 10:34

```
graph TD; ExecuteClusterJobs --> CCS_Fisher[CCS Fisher 'Fisher1']; CCS_Fisher --> Notify_SPS[Notify the SPS workflow 'NotifyJobFinished']; Notify_SPS --> LoadResultsData[LoadResultsData]; LoadResultsData --> singlepass; LoadResultsData --> interaction2; singlepass --> Run_dtsx_package[Run dtsx database package 'LoadOneWay']; interaction2 --> Run_dtsx_database[Run dtsx database 'LoadTwoWa']; Run_dtsx_package --> Merge; Run_dtsx_database --> Merge; Merge --> End;
```

Connected to: sql/WorkflowTracking Monitoring

Home - Liver - Microsoft Internet Explorer provided by MTC Thames Valley

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites Mail Print W

Address <http://hp01dual4:31696/personal/paul/Liver/default.aspx> Go Links >>

Paul Appleby Welcome Paul Appleby | My Site | My Links |

Liver This Site: Liver Site Actions

Big Project ARC Analysis RHA **Liver**

View All Site Content

Results Viewer

Documents

- Shared Documents
- Association Wiki

Lists

- Tasks
- Association Analysis
- Workflow Tasks

Discussions

- Team Discussion

Sites

People and Groups

Recycle Bin

Paul Appleby > Liver

Welcome to the site. From here you can:

- [upload new data](#);
- find what data has been uploaded;
- preprocess data in preparation for association analyses;
- [run association analysis jobs](#);
- monitor the state of jobs you are running;
- view the results of current and past analyses.

RSS Viewer

Genetics current issue

[Perspectives] [Learning the Common Language of Genetics](#)

[Review] [Sometimes the Result Is Not the Answer: The Truths and the Lies That Come From Using the Complementation Test](#)

[Genome integrity and transmission] [Discovery and Mapping of Wheat Ph1 Suppressors](#)

[Genome integrity and transmission] [A Sequence-Tagged Linkage Map of Brassica rapa](#)

[Genome integrity and transmission] [Different Mating-Type-Regulated Genes Affect the DNA Repair Defects of Saccharomyces RAD51, RAD52 and RAD55 Mutants](#)

Links

- Ensembl
- NIBHI
- Add new link

Tasks

Title Assigned To

[Prepare Gene & Case File](#) !NEW

[Prepare permutation file](#) !NEW

[Upload Data Files](#) !NEW

- Add new item

Page maintainer

- Peter Crowther

<http://hp01dual4:31696/personal/paul/Liver/internals/upload.aspx> Local intranet

Paul Appleby > Liver > Association Analysis
Association Analysis

- View All Site Content
- Results Viewer**
- Documents**
 - Shared Documents
 - Association Wiki
- Lists**
 - Tasks
 - Association Analysis
 - Workflow Tasks
- Discussions**
 - Team Discussion
- Sites**
- People and Groups**
- Recycle Bin**

Use this list to manage you association analysis jobs

New Actions Settings View: **All Items**

Association analysis
A specification of a regression test of measures against cases/controls
Association Analysis
Association Analysis" list. To create a new item, click "New" above.

Paul Appleby > Liver > Association Analysis > New Item

Association Analysis: New Item

OK Cancel

Attach File | Spelling... * indicates a required field

Title *	<input type="text" value="Liver tel"/>
Compressed Measures (.gene) File Name *	<input type="text" value="affy100k.10000.perm"/>
Case/Control (.case) File Name *	<input type="text" value="affy100k.10000.perm"/>
Permutation (.perm) File Name *	<input type="text" value="affy100k.10000.perm"/>
Included Measures (.incl) File Name *	<input type="text" value="affy100k.10000.perm"/>
Genome Map (.map) File Name *	<input type="text" value="affy100k.10000.perm"/>
Operation Name *	<input type="text"/>
P-Value Threshold (example: 1e-6) *	<input type="text"/>

OK Cancel

Paul Appleby > Liver > Association Analysis > Liver test for marker XYZ

Association Analysis: Liver test for marker XYZ

Close

New Item Edit Item Delete Item Manage Permissions **Workflows** Alert Me

Title	Liver test for marker XYZ
Compressed Measures (.gene) File Name	affy100k.gene
Case/Control (.case) File Name	affy100k.case
Permutation (.perm) File Name	affy100k.10000.perm
Included Measures (.incl) File Name	affy100k.incl
Genome Map (.map) File Name	affy100k.map
Operation Name	singlepass
P-Value Threshold (example: 1e-6)	0.0001

Content Type: Association analysis
Created at 25/10/2006 11:07 by Paul Appleby
Last modified at 25/10/2006 11:07 by Paul Appleby

Close

Inbox - Microsoft Outlook

File Edit View Go Tools Actions Help

New Reply Reply to All Forward Send/Receive Search address books

Type a question for help

Mail

Favorite Folders

- Inbox (1)
- Unread Mail
- Sent Items

Mail Folders

All Mail Items

- Mailbox - Peter Crowther
 - Deleted Items (1)
 - Drafts
 - Inbox (1)
 - Junk E-mail
 - Outbox
 - RSS Feeds
 - Sent Items
 - Search Folders
 - SharePoint Lists

Mail

Calendar

Contacts

Tasks

Inbox

Search Inbox

Click here to enable Instant Search

Arranged By: Date Newest on top

Today

Liver 11:14

Workflow Tasks - Liver test for ma...

Create Rule... Edit this task...

Workflow Tasks - Liver test for marker XYZ has been assigned to you

Liver [workflow@mtcpoc.net]

Sent: Wed 25/10/2006 11:11

To: Peter Crowther

Task assigned by Paul Appleby on 10/25/2006.

Workflow for Liver test for marker XYZ

To complete this task:

1. Review [Liver test for marker XYZ](#).
2. Perform the specific activities required for this task.
3. Use the **Edit this task** button to mark the task as completed. (If you cannot update this task, you might not have access to it. Click [here](#) to request access.)

To-Do Bar

October 2006

M	T	W	T	F	S	S
25	26	27	28	29	30	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

No upcoming appointments.

Arranged By: Due Date

Type a new task

There are no items to show in this view.

1 Item All folders are up to date. Connected to Microsoft Exchange

Inbox - Workflow Tasks - Liver test for marker XYZ has been assigned to you - Message (HTML)

Message

Mail

Favorite F

Inb

Unr

Sen

Mail Folders

All Mail

Mail

Share

Mail

Calendar

Contacts

Tasks

1 Item

File Edit

New

Edit this Task Open

Reply Reply to All Forward Respond

Delete Move to Folder Create Rule Other Actions

Block Sender Not Junk Junk E-mail

Safe Lists

Categorize Follow Up Mark as Unread Options

Find Related Select Find

From: Liver [workflow@mtcpoc.net] Sent: Wed 25/10/2006 11:11

To: Peter Crowther

Cc:

Subject: Workflow Tasks - Liver test for marker XYZ has been assigned to you

Task assigned

Workflow for Liver test for mar

To complete this task:

1. Review [Liver test for n](#)
2. Perform the specific ac
3. Use the **Edit this task**

Liver test for marker XYZ

Approve Cluster Job

Comment Field:

This looks fine,|

Reject Hold Approve

st access.)

Workflow Status - Microsoft Internet Explorer provided by MTC Thames Valley

File Edit View Favorites Tools Help

Address http://hp01dual4:31696/personal/paul/Liver/_layouts/WrkStat.aspx?List=%7b45265758%2d5BD8%2d4C22%2d8473%2d6382F55AD3BE%7d&WorkflowInstanceID=%7b Go Links >>

Liver

Big Project ARC Analysis RHA **Liver**

Paul Appleby > Liver > Association Analysis > Workflow Status

Workflow Status: Association Analysis

Workflow Information

Initiator:	Paul Appleby	Item:	Liver test for marker XYZ
Started:	25/10/2006 11:08	Status:	In Progress
Last run:	25/10/2006 11:15		

If an error occurs or this workflow stops responding, it can be terminated. Terminating the workflow will set its status to Canceled and will delete all data associated with the workflow.

▣ [Terminate this workflow now.](#)

Tasks

The following tasks have been assigned to the participants in this workflow. Click a task to edit it. You can also view these tasks in the list [Workflow Tasks](#).

Assigned To	Title	Due Date	Status
Peter Crowther	Liver test for marker XYZ NEW		In Progress

Workflow History

The following events have occurred in this workflow.

Date Occurred	Event Type	User ID	Description
25/10/2006 11:08	Workflow Initiated	System Account	Workflow Started
25/10/2006 11:08	Task Created	System Account	Workflow Task Created
25/10/2006 11:15	Comment	System Account	
25/10/2006 11:15	Comment	System Account	

workflow@mtcpoc.net

Liver test for marker XYZ

Your job has finished running on the cluster and the results are being processed <end>

Done Local intranet

Workflow Status - Microsoft Internet Explorer provided by MTC Thames Valley

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites

Address http://hp01dual4:31696/personal/paul/Liver/_layouts/WrkStat.aspx?List=%7b45265758%2d5BD8%2d4C22%2d8473%2d6382F55AD3BE%7d&WorkflowInstanceID=%7b Go Links >>

Liver

Big Project ARC Analysis RHA **Liver**

Paul Appleby > Liver > Association Analysis > Workflow Status

Workflow Status: Association Analysis

Workflow Information

Initiator:	Paul Appleby	Item:	Liver test for marker XYZ
Started:	25/10/2006 11:08	Status:	In Progress
Last run:	25/10/2006 11:16		

If an error occurs or this workflow stops responding, it can be terminated. Terminating the workflow will set its status to Canceled and will delete all data associated with the workflow.

[Terminate this workflow now.](#)

Tasks

The following tasks have been assigned to the participants in this workflow. Click a task to edit it. You can also view these tasks in the list [Workflow Tasks](#).

Assigned To	Title	Due Date	Status
Peter Crowther	Liver test for marker XYZ NEW		In Progress

Workflow History

The following events have occurred in this workflow.

Date Occurred	Event Type	User ID	Description
25/10/2006 11:08	Workflow Initiated	System Account	Workflow Started
25/10/2006 11:08	Task Created	System Account	Workflow Task Created
25/10/2006 11:15	Comment	System Account	Workflow Job Approved
25/10/2006 11:15	Comment	System Account	Files Copied & Cluster Job Queued
25/10/2006 11:16	Comment	System Account	Cluster Job completed

Done Local intranet

internals - Results - Microsoft Internet Explorer provided by MTC Thames Valley

File Edit View Favorites Tools Help

Back Forward Stop Home Search Favorites

Address <http://hp01dual4:31696/personal/paul/Liver/internals/Results.aspx> Go Links

Home Report Builder

- Report1
- resultsbyregion
- resultsbyMArker
- Single-pass measures for experiment
- resultsbyPathway
- Two-way measures for experiment

Report Viewer

Experiment: Fisher Workflow run ended 2006-10-25 11:19:55 Minimum Chi-squared: 15 View Report

1 of 6 100% Find | Next Select a format Export

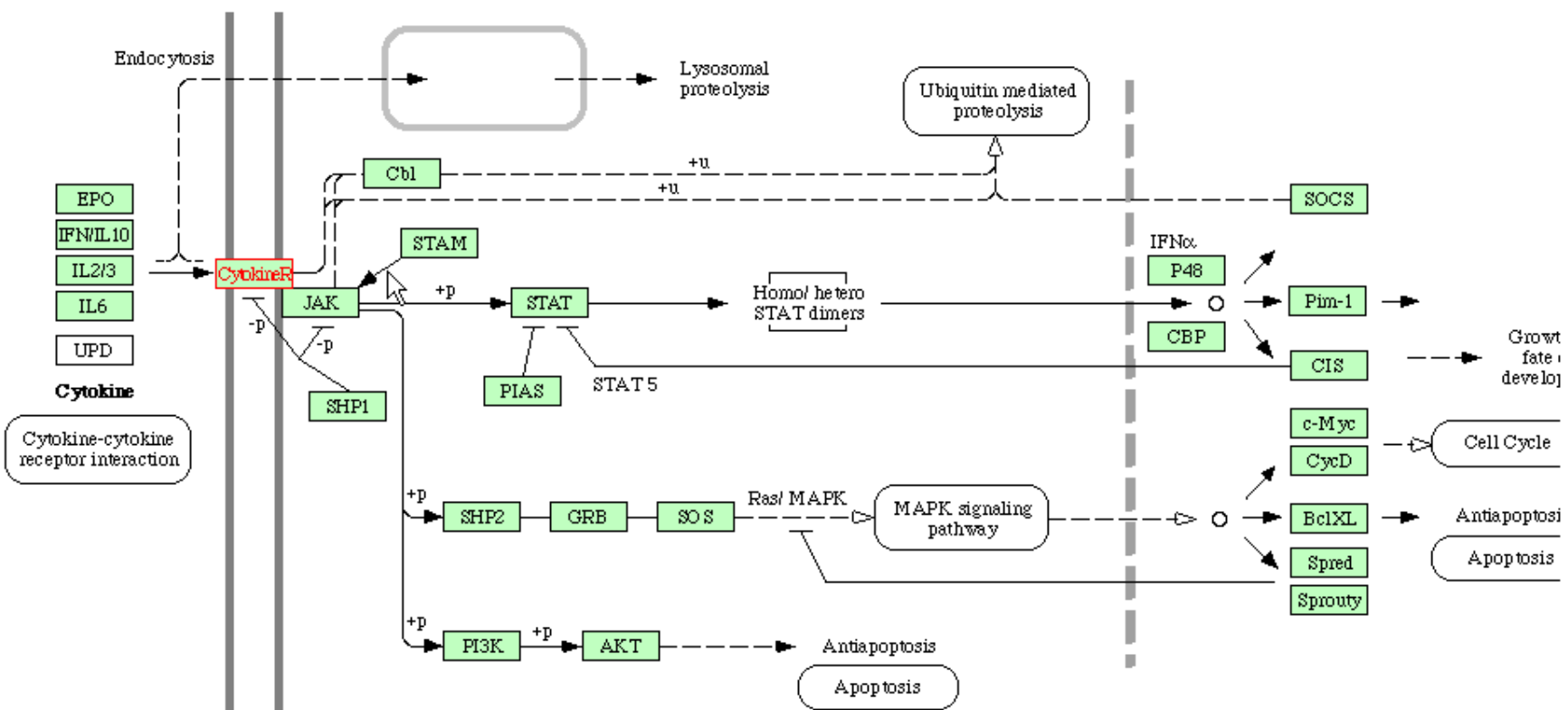
Single-pass measures for experiment

Chromosome	Marker	Chi Square	Empirical p-Value
9	rs1227458	158.844	9.999E-05
20	rs978768	107.888	9.999E-05
7	rs2734062	106.556	9.999E-05
8	rs1025928	103.784	9.999E-05
6	rs4128536	85.2886	9.999E-05
12	rs10506822	78.0319	9.999E-05
8	rs10504421	76.5693	9.999E-05
1	rs629760	70.3255	9.999E-05
3	rs10511117	68.9063	9.999E-05
6	rs2789013	67.9387	9.999E-05
11	rs963960	62.8091	9.999E-05
13	rs10507507	58.5796	9.999E-05
16	rs10500567	56.8849	9.999E-05
15	rs10518943	56.7858	9.999E-05
6	rs6930406	56.0217	9.999E-05
18	rs10515057	52.7862	0.000E-05

Done Local intranet

Homo sapiens (human) Go Current selection Select

JAK-STAT SIGNALING PATHWAY



04630 1/5/06

HPC++ Scenario



Microsoft HPC++ Labs



Microsoft HPC++ CompFin Lab

The Microsoft HPC++ CompFin Lab integrates Microsoft Windows HPC Server, a central market data database and Microsoft productivity products to provide university courses with an online service to publish, execute and manage computational finance models.

Lab Details:

- | | |
|---------------------------------|---|
| Computing Resources: | <ul style="list-style-type: none">256 core/64 node compute cluster5 TB disk spaceLow latency interconnect |
| Rich User Interface: | <ul style="list-style-type: none">SharePoint 2007 portal to publish, browse and monitor modelsExcel 2007 as the user interface for models and resultsModel execution workflow with status email notifications |
| Central Market Database: | <ul style="list-style-type: none">5 year tick data for S&P500Daily & fundamental data for 10,000 stocksMortgage Backed Securities pool data |
| Simplified Modeling: | <ul style="list-style-type: none">.NET platform with Linq for SQL data accessSOA framework for parameter sweep modelsLocal model development and test environment |

Microsoft HPC++ Labs

Microsoft HPC++ Labs is an incubation effort within the Microsoft Windows HPC Server product team whose goals include:

- Demonstrate end-to-end integrated HPC solutions using Microsoft Windows HPC Server 2008 with Microsoft productivity and developer products
- Develop expertise in operating end user focused compute and data intensive HPC services
- Incubate Microsoft product extensions required to support HPC++ scenarios "out of the box" on customer premises

[HPC++ Labs is Hiring!](#)

Next Steps

- [Request Enrollment](#)
- [Watch Demonstration](#)
- [Read Our Blog](#)

- View All Site Content
- Documents**
 - My Models Library
 - Published Models Library
 - Class Wiki
- Lists**
 - Job List
- Discussions**
 - Team Discussion
- Sites**
- People and Groups**
- [Recycle Bin](#)

Home > UW

Course Announcements

Get Started Microsoft Financial Computing! 10/28/2007 5:32 AM
 by hpc_richi@microsofthpc.net
 Microsoft Financial Computing helps you to be more effective in doing your financial calculations!

[Add new announcement](#)

- Course Materials**
- Department of Economics, University of Washington
 - Scott Payseur
 - Eric Zivot
 - Scott Payseur's Realized Variance Library
 - Athena Job Queue
- [Add new link](#)

Course Calendar

New Actions Settings

November, 2007 Expand All Collapse All | Day Week Month

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
28	29	30 2:00 PM Class Lecture	31	1	2	3
4	5	6 2:00 PM Class Lecture	7	8	9	10



My Models Library - Windows Internet Explorer

https://portal.microsofthpc.net/uw/My%20Models%20Library/Forms/My%20Models%20View.aspx

My Models Library

Welcome hpc_richi@microsofthpc.net

Home Document Center News Project Reports Search Sites **UW**

All Sites Advanced Search **Site Actions**

Home > UW > My Models Library

My Models Library

View All Site Content

Documents

- My Models Library
- Published Models Library
- Class Wiki

Lists

- Job List

Discussions

- Team Discussion

Sites

People and Groups

Recycle Bin

New | Upload | Actions | Settings

View: **My Models View**

	Modified	Modified By	Created By
Document Create a new document.	10/29/2007 8:04 PM	Rich Ciapala	hpc_richi@microsofthpc.net
RealizedCovariance Create a new document.	11/2/2007 7:15 PM	Rich Ciapala	hpc_richi@microsofthpc.net
Folder Add a new folder to this document library.			

Done

Trusted sites | Protected Mode: Off | 100%

RealizedCovariance_Tech_14.xlsx [Read-Only] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Developer Compute Cluster

Cut Copy Paste Format Painter Clipboard

Font: Calibri 11, Bold, Italic, Underline, Text Color, Background Color

Alignment: Wrap Text, Merge & Center

Number: General, Currency, Percentage, Increase/Decrease

Styles: Conditional Formatting, Format as Table, Cell Styles

Cells: Insert, Delete, Format

Editing: AutoSum, Fill, Clear, Sort & Find & Filter, Select

D14 XNYS:CA

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1															
2															
3				University of Washington											
4				Realized Covariance & Correlation											
5															
6				Iterations	10	Adjustment	False								
7															
8				Kernel Type	Rectangular										
9															
10				Instruments	XNAS:AAPL	Period	1								
11					XNYS:AMD										
12					XNAS:AMZN	Start Date	1/9/2006								
13					XNYS:ATI										
14					XNYS:CA	End Date	1/13/2006								
15					XNAS:C										
16					XNAS:D										
17					XNAS:E										
18					XNYS:E										
19					XNYS:IE										
20					XNYS:G										

Instrument
 An instrument, in the format of "Exchange:Symbol" that the covariance model will be executed for.
 NOTE: New York Stock Exchange is Exchange XNYS.
 Example: XNYS:F

Submit Job

You cannot submit this workbook because it is currently running.

Sheet Input Ranges

Current Sheet

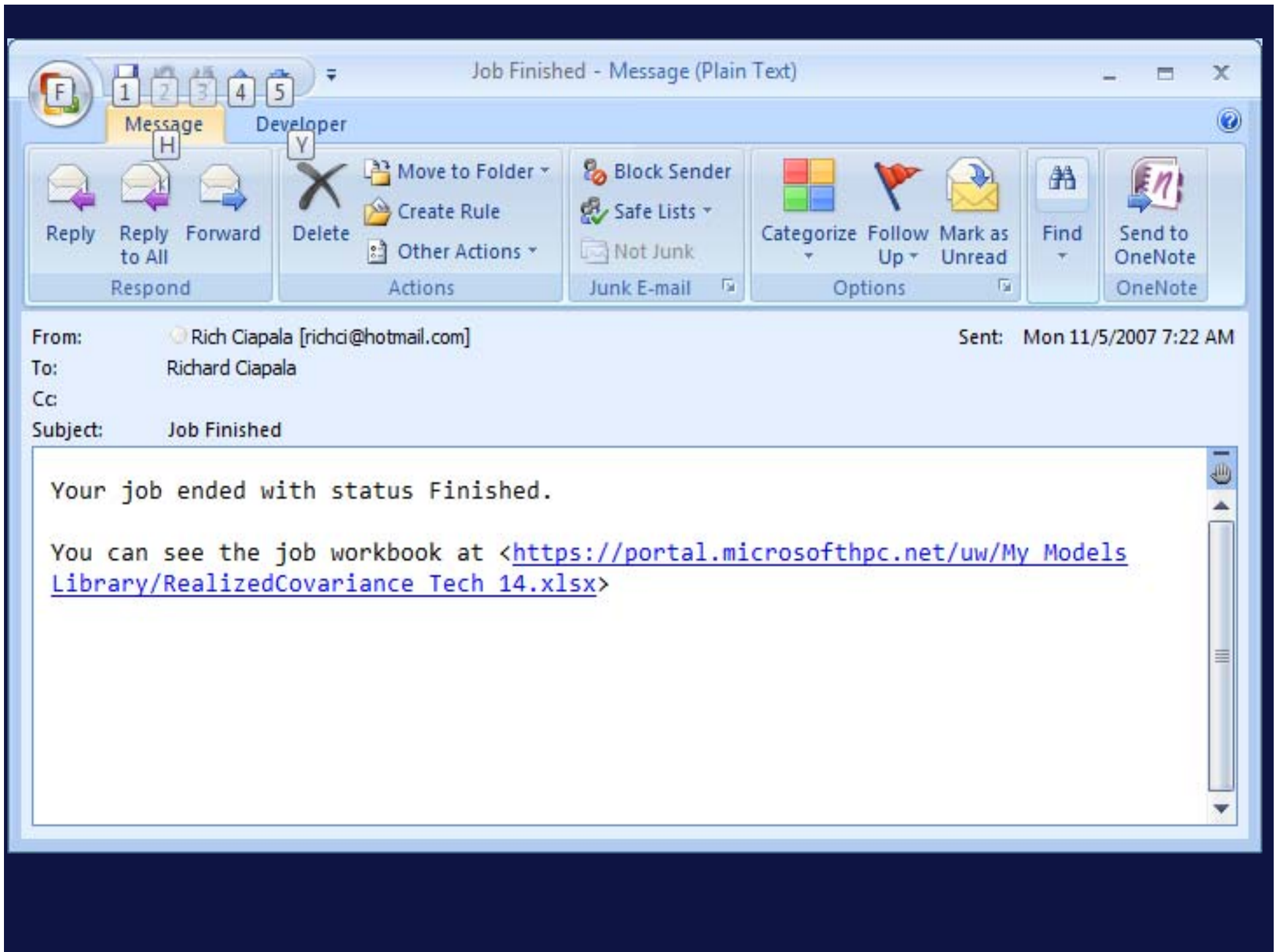
Job Running...

Processor Count: 4

Runtime (minutes): 30 Infinite

Send Status Email

Cancel



From: Rich Ciapala [richci@hotmail.com]
To: Richard Ciapala
Subject: Job Finished

Sent: Mon 11/5/2007 7:22 AM

Your job ended with status Finished.

You can see the job workbook at <[https://portal.microsofthpc.net/uw/My_Models_Library/RealizedCovariance Tech 14.xlsx](https://portal.microsofthpc.net/uw/My_Models_Library/RealizedCovariance_Tech_14.xlsx)>

Home Insert Page Layout Formulas Data Review View Developer Compute Cluster

Cut Copy Paste Format Painter Clipboard

Calibri 11 Font

Wrap Text Alignment

Text Number

Conditional Formatting Styles

Format as Table

Cell Styles

Insert Delete Format Cells

AutoSum Fill Clear Editing

Sort & Find & Filter Select

B4 XNAS:AAPL

Results						Error		Exception	
SymbolA	SymbolB	DateTime	Covariance	Correlation	Message	NodeID	Type	Message	Stack
XNAS:AAPL	XNAS:AAPL	2006-01-09	0.00013473	100.0000%					
XNAS:AAPL	XNAS:AAPL	2006-01-10	0.00148047	100.0000%					
XNAS:AAPL	XNAS:AAPL	2006-01-11	0.00055431	100.0000%					
XNAS:AAPL	XNAS:AAPL	2006-01-12	0.00041653	100.0000%					
XNAS:AAPL	XNYS:AMD	2006-01-09	0.00004261	28.9055%					
XNAS:AAPL	XNYS:AMD	2006-01-10	0.00034918	32.1566%					
XNAS:AAPL	XNYS:AMD	2006-01-11	0.00007747	21.1803%					
XNAS:AAPL	XNYS:AMD	2006-01-12	0.00032495	55.7433%					
XNAS:AAPL	XNAS:AMZN	2006-01-09	0.00013152	60.8821%					
XNAS:AAPL	XNAS:AMZN	2006-01-10	0.00013419	18.5009%					
XNAS:AAPL	XNAS:AMZN	2006-01-11	0.00005776	12.6053%					
XNAS:AAPL	XNAS:AMZN	2006-01-12	0.00010372	23.2622%					
XNAS:AAPL	XNYS:ATI	2006-01-09	0.00005825	40.4805%					
XNAS:AAPL	XNYS:ATI	2006-01-10	0.00018489	25.1277%					
XNAS:AAPL	XNYS:ATI	2006-01-11	0.00002105	6.3636%					
XNAS:AAPL	XNYS:ATI	2006-01-12	0.00008094	34.6323%					
XNYS:AMD	XNAS:AAPL	2006-01-09	0.00004253	28.8523%					
XNYS:AMD	XNAS:AAPL	2006-01-10	0.00036403	33.5237%					
XNYS:AMD	XNAS:AAPL	2006-01-11	0.00002009	5.4933%					
XNYS:AMD	XNAS:AAPL	2006-01-12	0.00027874	47.8163%					
XNYS:AMD	XNYS:AMD	2006-01-09	0.00016129	100.0000%					
XNYS:AMD	XNYS:AMD	2006-01-10	0.00079647	100.0000%					
XNYS:AMD	XNYS:AMD	2006-01-11	0.00024136	100.0000%					
XNYS:AMD	XNYS:AMD	2006-01-12	0.00081583	100.0000%					

Submit Job

Sheet Input Ranges

Current Sheet

Job Complete, See Results

Processor Count: 4

Runtime (minutes): 30 Infinite

Send Status Email

Submit

RealizedCovariance_Tech_14.xlsx - Microsoft Excel

PivotTable Tools

Home Insert Page Layout Formulas Data Review View Developer Compute Cluster Options Design

Clipboard Font Alignment Number Styles Cells Editing

B8 XNYS:AMD

		XNAS:AAPL	XNYS:AMD	XNAS:AMZN	XNYS:ATI	XNYS:CA	XNAS:CSCO	XNAS:DELL	XNAS:EBAY	XNYS:EMC
1										
2	Filter									
3	DateTime		2006-01-09							
4										
5	Average of Correlation									
6		XNAS:AAPL	XNYS:AMD	XNAS:AMZN	XNYS:ATI	XNYS:CA	XNAS:CSCO	XNAS:DELL	XNAS:EBAY	XNYS:EMC
7	XNAS:AAPL	100.00%	28.91%	60.88%	40.48%	-4.39%	30.55%	11.92%	63.40%	35.02%
8	XNYS:AMD	28.85%	100.00%	43.57%	5.38%	-8.21%	45.14%	43.45%	50.43%	88.93%
9	XNAS:AMZN	27.53%	27.70%	100.00%	9.69%	-4.01%	21.50%	29.89%	56.80%	14.88%
10	XNYS:ATI	62.56%	39.74%	31.08%	100.00%	53.40%	27.27%	19.85%	46.78%	53.58%
11	XNYS:CA	-8.73%	22.50%	-1.04%	55.91%	100.00%	12.81%	23.87%	-6.53%	19.11%
12	XNAS:CSCO	19.55%	29.16%	17.78%	10.54%	7.72%	100.00%	30.76%	3.64%	-0.38%
13	XNAS:DELL	15.37%	35.24%	0.30%	12.43%	30.59%	-9.09%	100.00%	-8.10%	6.23%
14	XNAS:EBAY	73.62%	49.45%	51.76%	13.15%	15.23%	23.12%	4.10%	100.00%	53.38%
15	XNYS:EMC	49.89%	81.99%	19.40%	14.33%	-26.38%	29.63%	4.20%	82.83%	100.00%
16	XNYS:IBM	26.59%	-10.44%	41.74%	19.63%	-20.26%	9.92%	26.90%	41.08%	63.63%
17	XNYS:GLW	11.48%	9.38%	42.82%	37.99%	37.54%	17.25%	3.89%	0.73%	-2.16%
18	XNAS:GOOG	30.88%	55.21%	18.57%	45.53%	19.20%	-4.93%	51.57%	38.53%	31.13%
19	XNAS:MSFT	31.98%	4.79%	6.08%	24.00%	-3.50%	-15.98%	59.02%	33.07%	0.00%
20	XNAS:YHOO	48.98%	79.05%	42.86%	40.60%	54.14%	45.56%	56.75%	66.95%	38.58%
21										
22										
23										
24										
25										
26										
27										

Submit Job

Sheet Input Ranges

Current Sheet

Job Complete, See Results

Processor Count 4

Runtime (minutes) 30 Infinite

Send Status Email

Submit

Home Insert Page Layout Formulas Data Review View Developer Compute Cluster

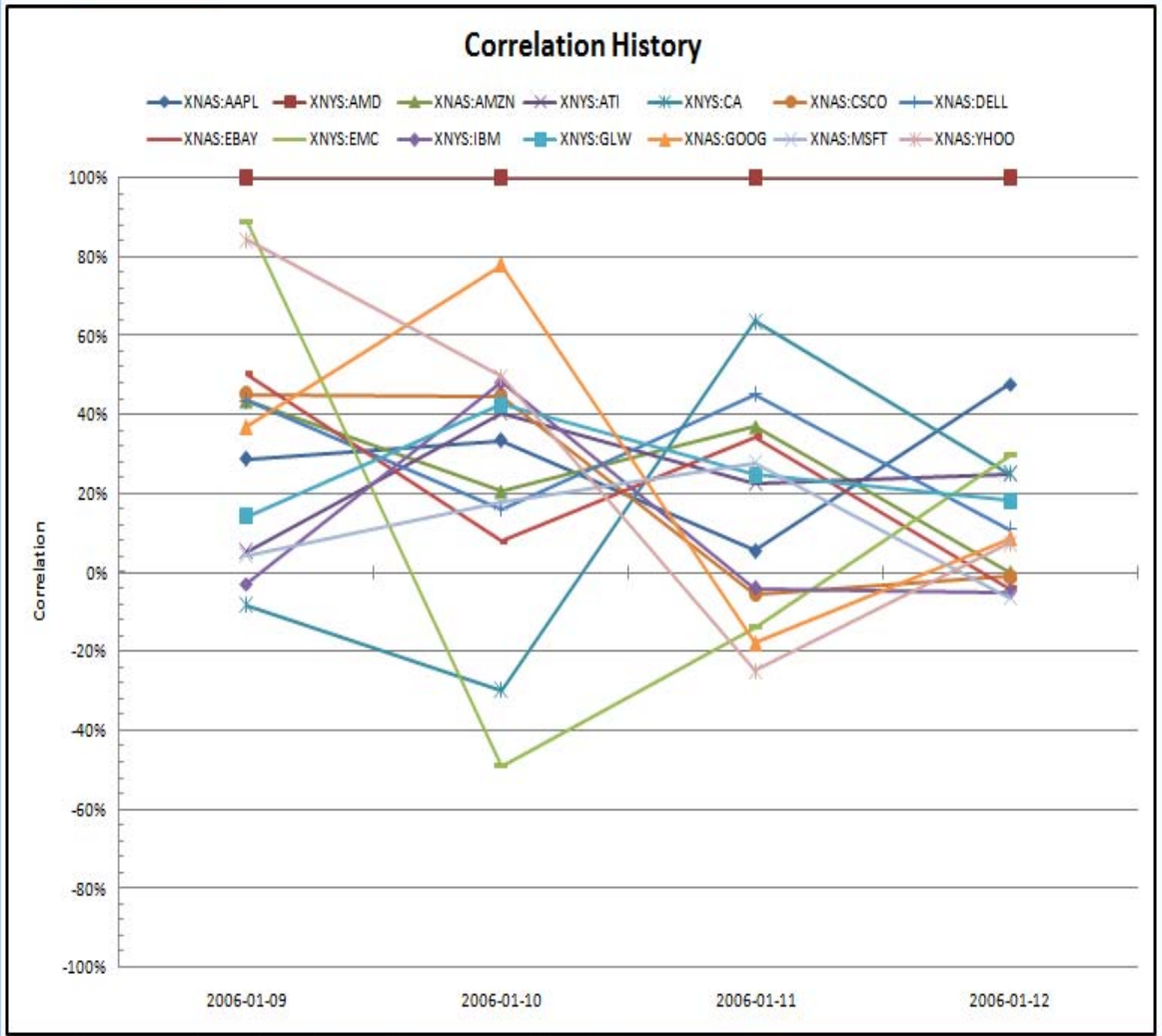
Clipboard Font Alignment Number Styles Cells Editing

Callibri 11 General \$ % .00 .00

Conditional Formatting as Table Cell Styles

Insert Delete Format

AutoSum Fill Clear Sort & Filter Find & Select



Submit Job

Sheet Input Ranges

Current Sheet

Job Complete, See Results

Processor Count: 4

Runtime (minutes): 30 Infinite

Send Status Email

Submit

Home Insert Page Layout Formulas Data Review View Developer Compute Cluster

Cut Copy Paste Format Painter Clipboard

Calibri 11 Font

Wrap Text Alignment

General Number

Conditional Formatting Styles

Format as Table

Cell Styles

Insert Delete Format Cells

AutoSum Fill Clear Sort & Filter Find & Select Editing

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1															
2															
3			University of Was												
4			Realized Covariance & Corr												
5															
6			Iterations	10			Adjustm								
7															
8			Kernel Type	Rectangular											
9															
10			Instruments	XNAS:AAPL			Period								
11				XNYS:AMD											
12				XNAS:AMZN			Start Da								
13				XNYS:ATI											
14				XNYS:CA			End Date	1/13/2006							
15				XNAS:CSCO											
16				XNAS:DELL											
17				XNAS:EBAY											
18				XNYS:EMC											
19				XNYS:IBM											
20				XNYS:GLW											

Versions saved for RealizedCovariance_Tech_14.xlsx

Versions saved to: <https://portal.microsofthpc.net/uw/My Models Library/>

No.	Modified	Modified By	Size	Comments
14.0	11/5/2007 7:22 AM	MICROSOFTHPC\hpc_richi	132 KB	Model execution complet...
13.0	11/2/2007 7:15 PM	MICROSOFTHPC\hpc_richi	132 KB	Model execution complet...
12.0	11/2/2007 1:33 PM	membershipadprovider:h...	102.8 KB	
11.0	11/2/2007 1:33 PM	MICROSOFTHPC\hpc_richi	132 KB	Model execution complet...
10.0	11/1/2007 5:42 PM	MICROSOFTHPC\hpc_richi	132 KB	Model execution complet...
9.0	11/1/2007 5:32 PM			
8.0	11/1/2007 5:17 PM			
7.0	11/1/2007 5:06 PM			
6.0	10/31/2007 5:55 PM			
5.0	10/31/2007 5:46 PM			

Check In Comments

Date and time: 11/5/2007 7:22 AM

Modified by: MICROSOFTHPC\hpc_richi

Comments on version:

Model execution complete: status - Finished

Close

Submit Job

Sheet Input Ranges

Current Sheet

Job Complete, See Results

Processor Count: 4

Runtime (minutes): 30 Infinite

Send Status Email

Submit

Microsoft HPC++ Solution

Application Benefits

The most productive distributed application development environment



Cluster Benefits

Complete HPC cluster platform integrated with the rest of the enterprise management infrastructure



System Benefits

Cost-effective, reliable and high performance server operating system



Resources

- www.microsoft.com/hpc
- www.microsoft.com/science
- www.microsoft.com/servers
- www.microsoft.com/sql
- www.microsoft.com/excel
- research.microsoft.com/fsharp
- www.osl.iu.edu/research/mpi.net
- www.microsoft.com/msdn
- www.microsoft.com/technet

Thank you!