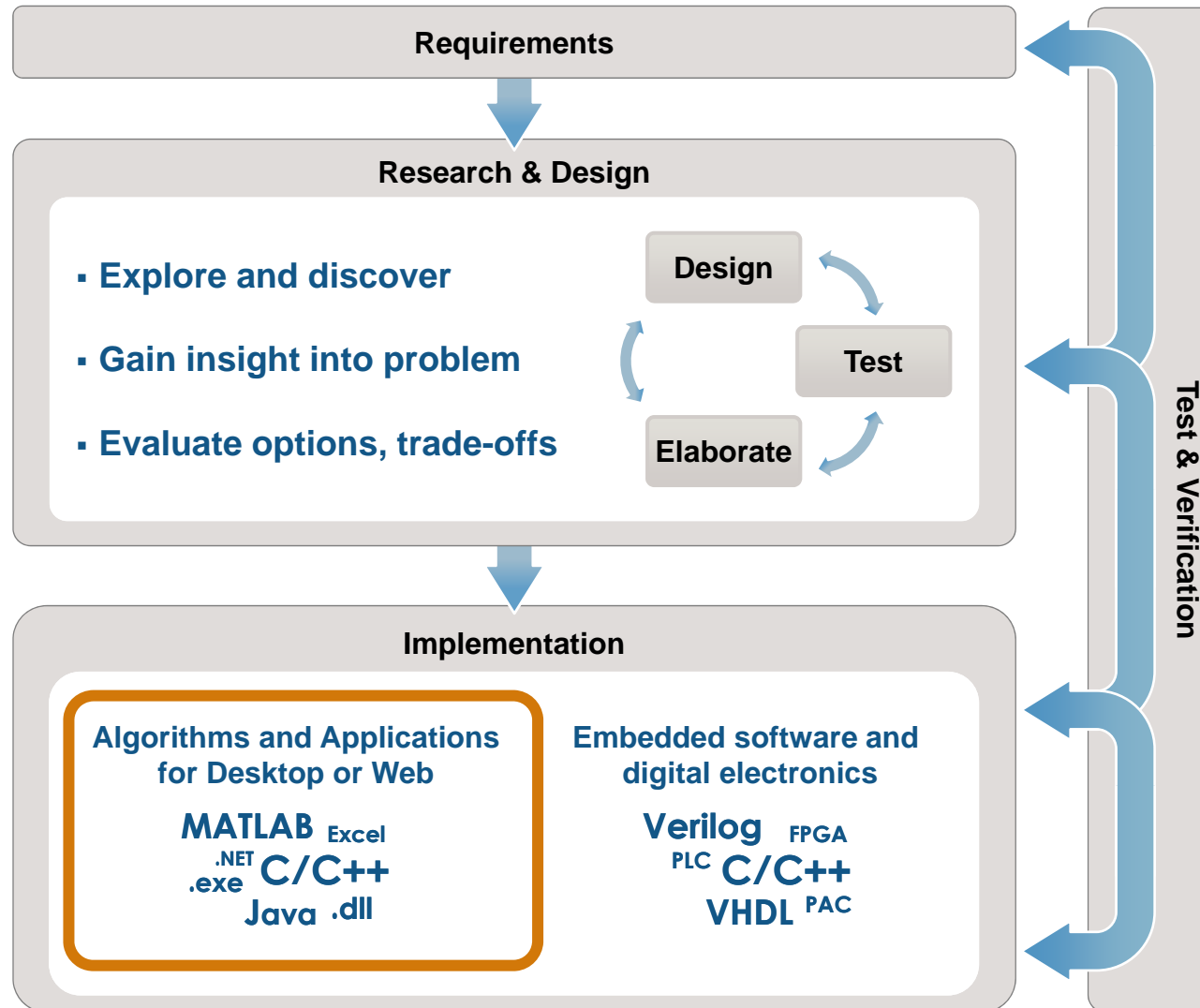


Excel, .NET 및 JAVA 환경에서 사용 가능한 MATLAB Application 개발

성호현 과장

MathWorks Korea

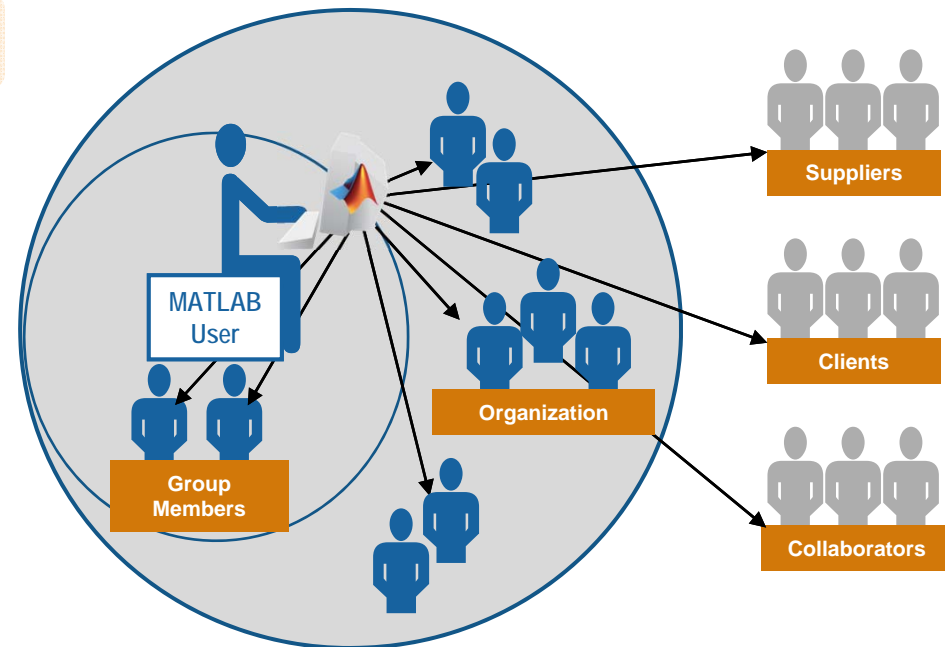
Application Deployment Process



Deploying Algorithms and Applications

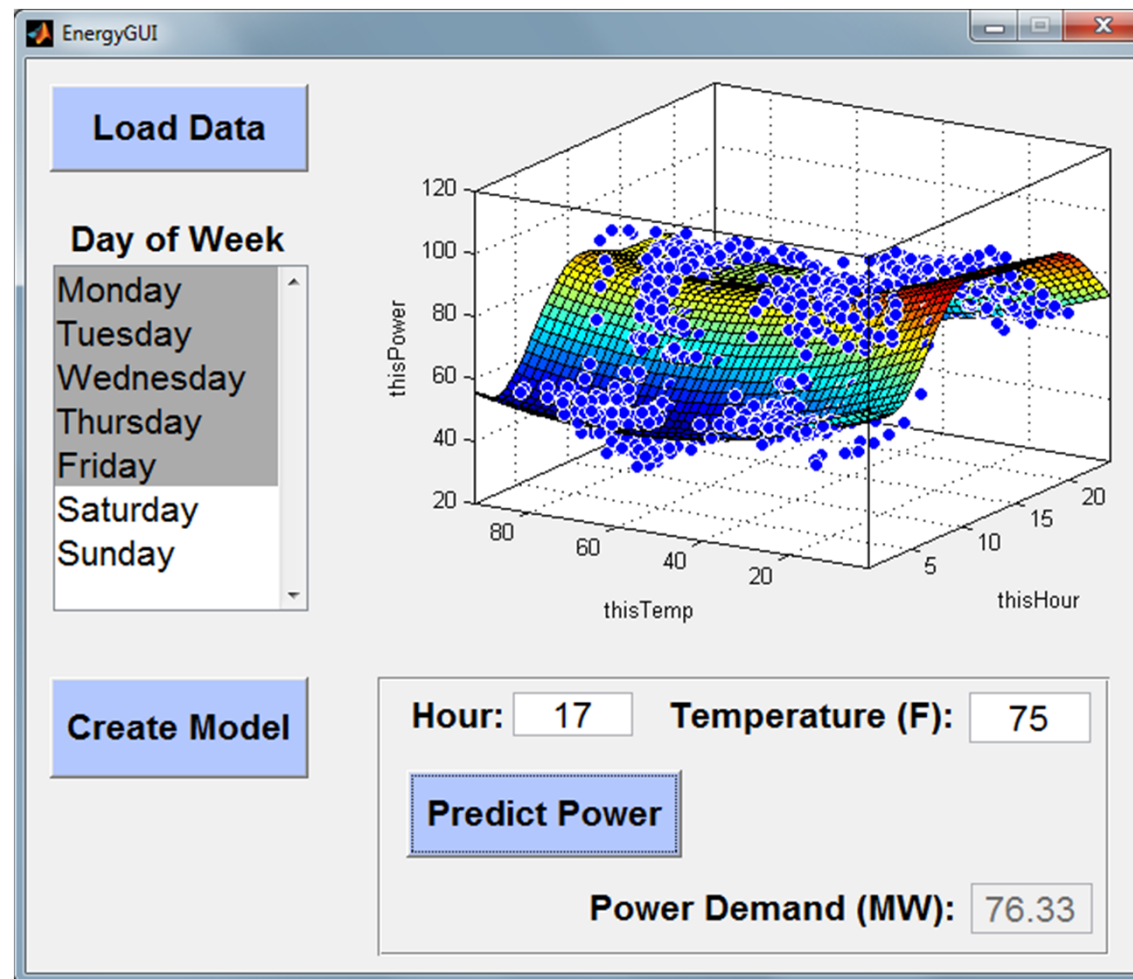
Desktop Applications

- Algorithmic Components
- Web Deployment

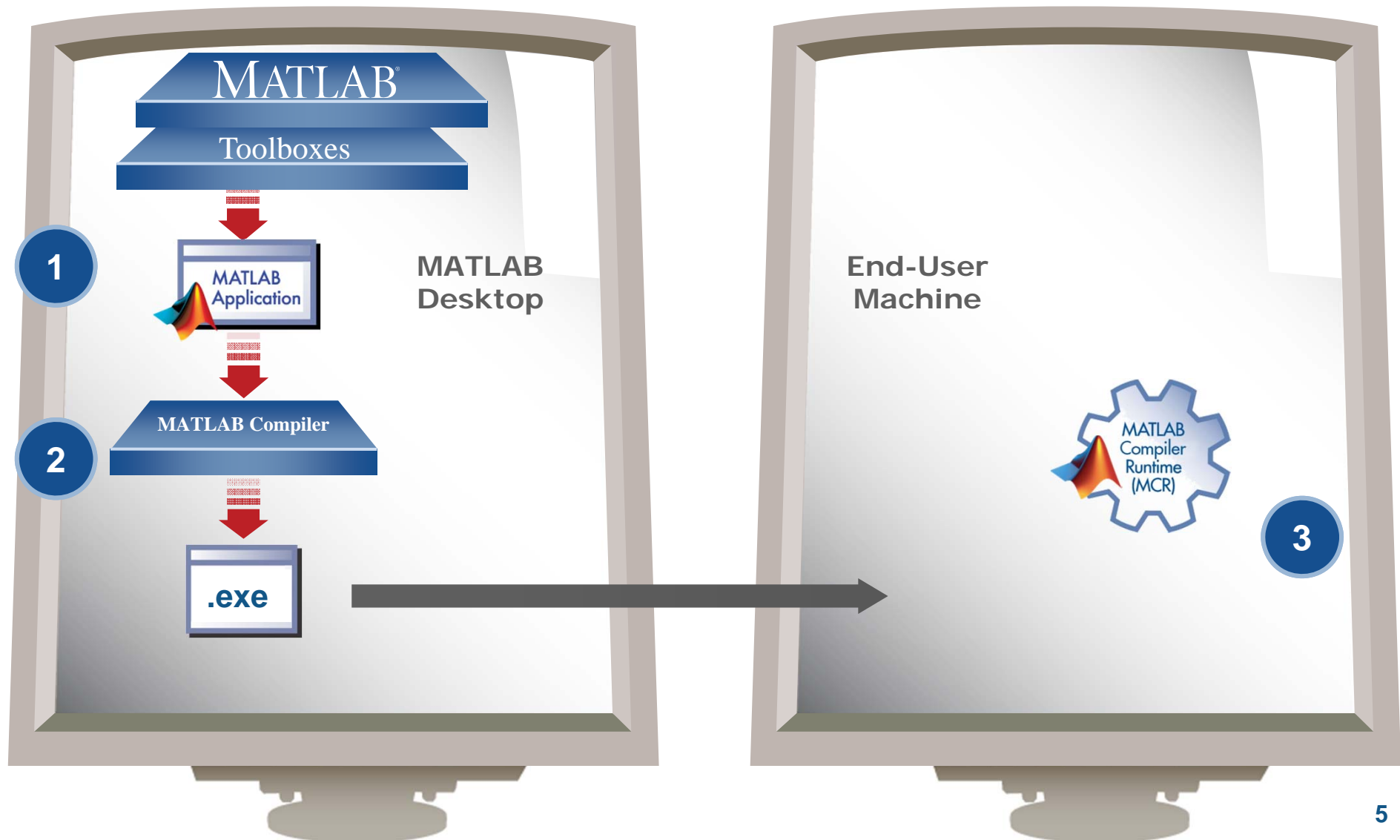


Desktop Applications

Energy Forecasting Stand Alone Application

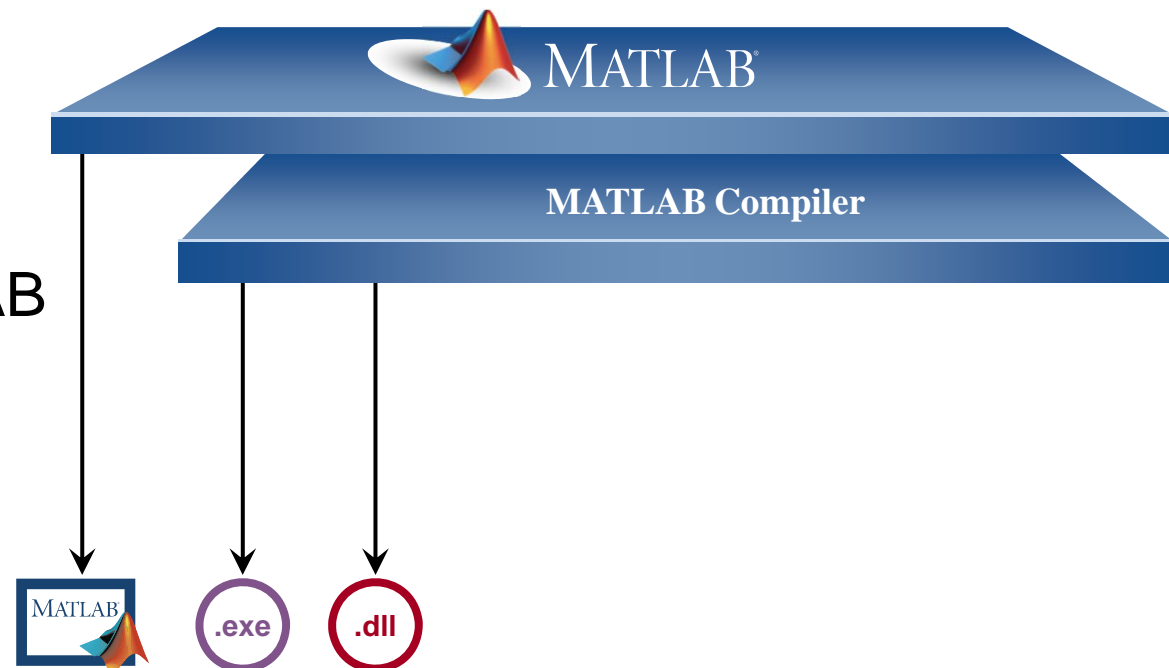


Deploying Applications with MATLAB



Deploying Desktop Applications with MATLAB

- Give MATLAB code to other users
- Share applications with end users who do not need MATLAB
 - Stand-alone executables
 - Shared libraries
- Royalty-Free Distribution



Halliburton Makes Oil Exploration Safer Using MATLAB and Neural Network Toolbox



Challenge

To improve the ability to detect detonation of explosives used to perforate the well bore

Solution

Use MathWorks products to develop an adaptive, predictive neural network filter that cleanses the detonation signal of contaminating noise from onsite machinery

Results

- Authentic simulation on the desktop
- An accurate, production-standard algorithm
- Dramatic time savings

“Using MATLAB and MATLAB Compiler, I can develop an application at least 100 times faster than I could with Visual Basic or C. The time we saved on the very first application that we wrote in MATLAB more than paid for the software.”

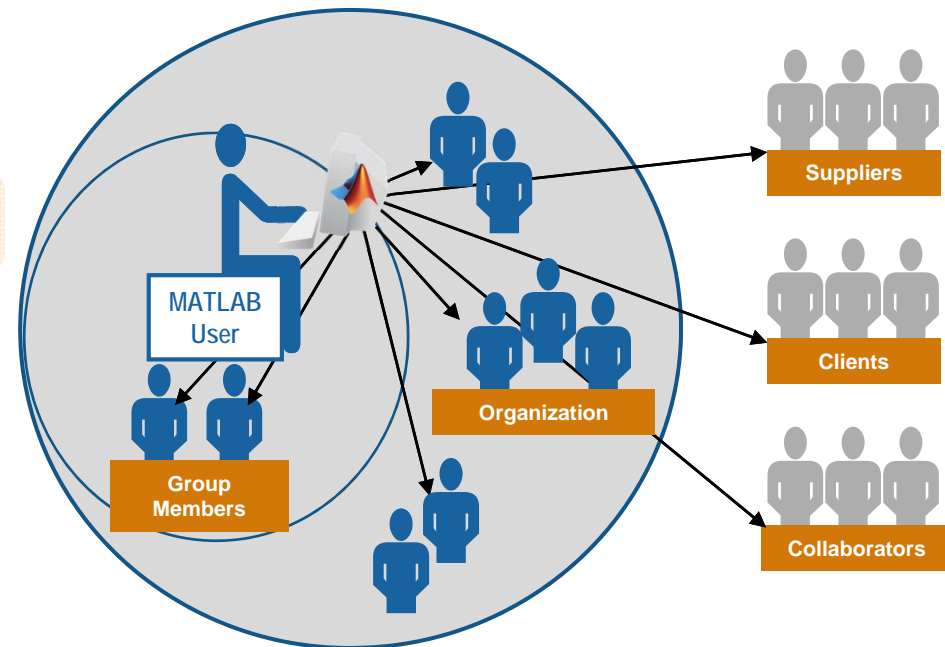
**Roger Schultz
Halliburton Energy Services**

Deploying Algorithms and Applications

- Desktop Applications

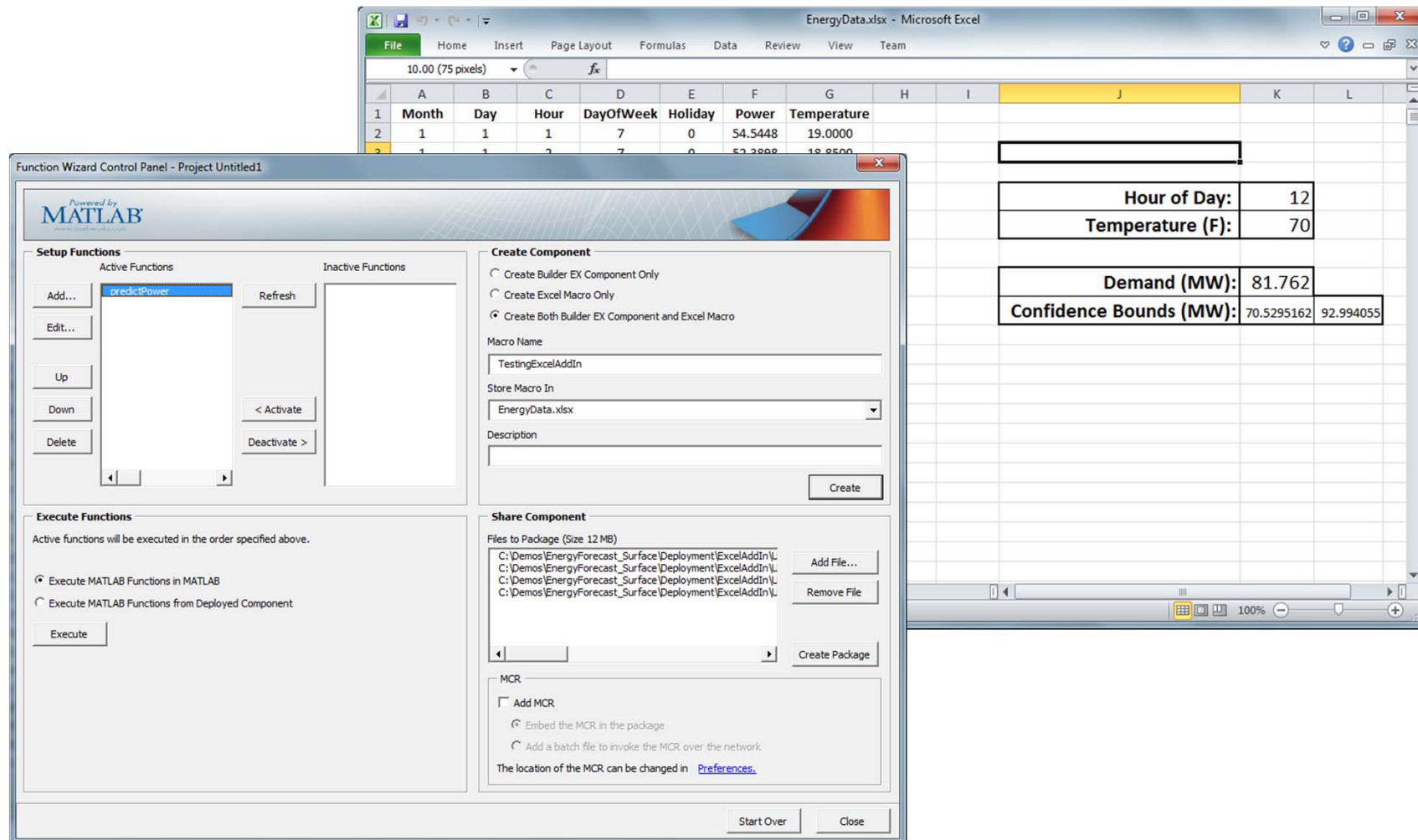
 Algorithmic Components

- Web Deployment



Software Components

Creating an Excel Add-In



The screenshot shows a Microsoft Excel window titled "EnergyData.xlsx" with a spreadsheet containing the following data:

	A	B	C	D	E	F	G	H	I	J	K	L
1	Month	Day	Hour	DayOfWeek	Holiday	Power	Temperature					
2	1	1	1	7	0	54.5448	19.0000					
3	1	1	2	7	0	53.2888	18.8500					

The Function Wizard Control Panel is open, showing the following configuration:

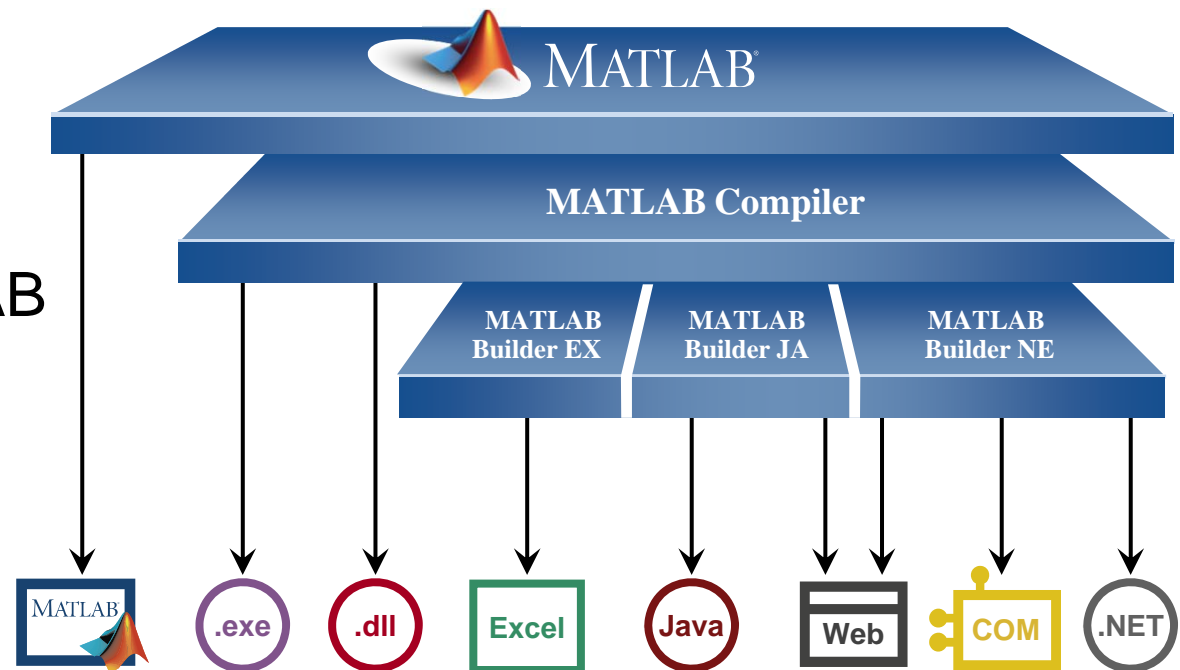
- Setup Functions:** "predictPower" is selected in the Active Functions list.
- Create Component:**
 - Radio button selected: "Create Both Builder EX Component and Excel Macro"
 - Macro Name: "TestingExcelAddIn"
 - Store Macro In: "EnergyData.xlsx"
- Share Component:**
 - Files to Package (Size 12 MB):
 - C:\Demos\EnergyForecast_Surface\Deployment\ExcelAddIn\U
 - C:\Demos\EnergyForecast_Surface\Deployment\ExcelAddIn\U
 - C:\Demos\EnergyForecast_Surface\Deployment\ExcelAddIn\U
 - C:\Demos\EnergyForecast_Surface\Deployment\ExcelAddIn\U
 - MCR:
 - Add MCR
 - Embed the MCR in the package
 - Add a batch file to invoke the MCR over the network

The spreadsheet also displays the following output values:

Hour of Day:	12
Temperature (F):	70
Demand (MW):	81.762
Confidence Bounds (MW):	70.5295162 92.994055

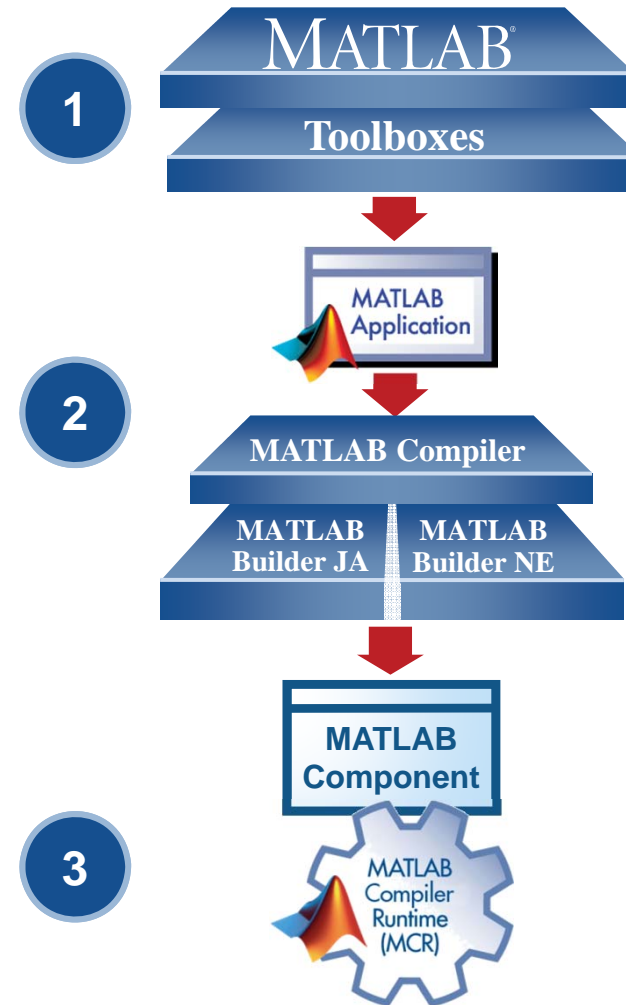
Deploying Applications with MATLAB

- Give MATLAB code to other users
- Share applications with end users who do not need MATLAB
 - Stand-alone executables
 - Shared libraries
 - Components
- Royalty-Free Distribution



Deploying MATLAB Components

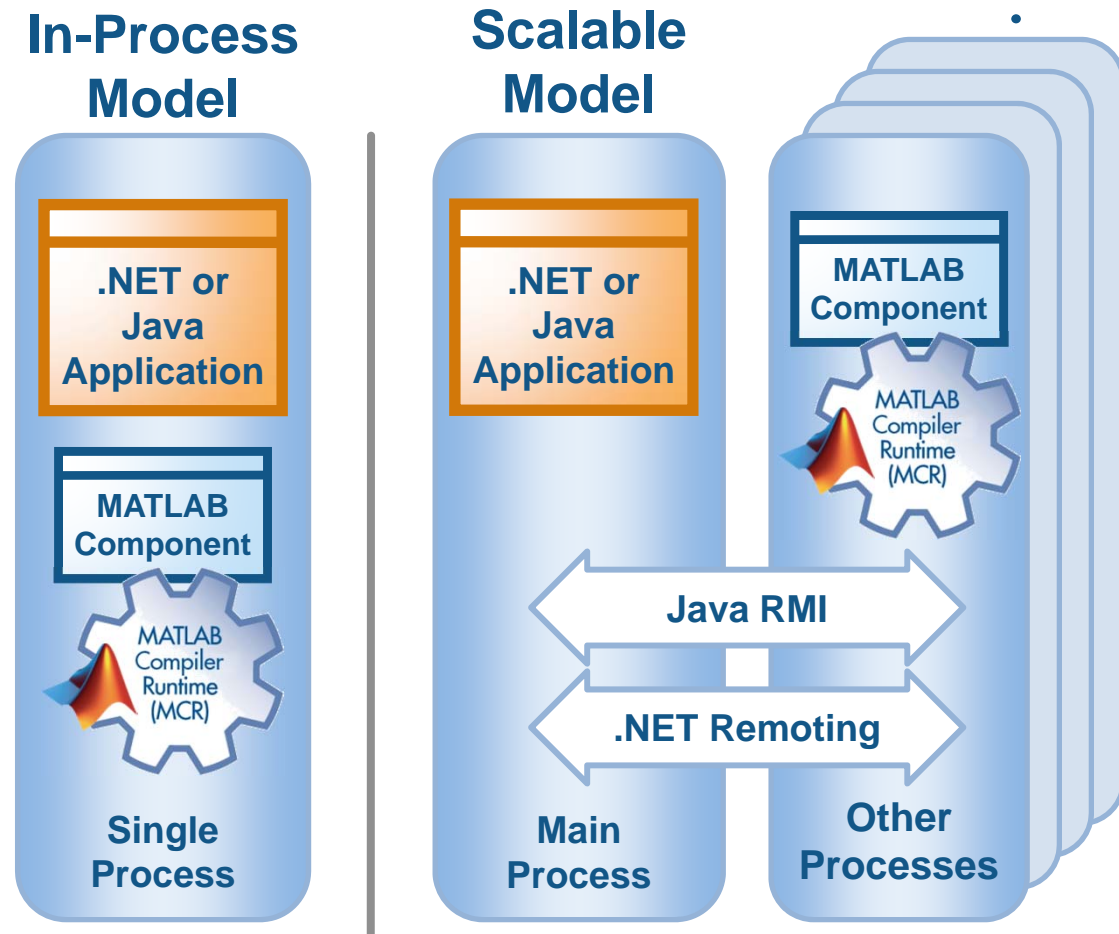
- Create MATLAB application
- Build component
 - MATLAB Compiler
 - MATLAB Builder JA for Java
 - MATLAB Builder NE for .NET
- Deploy against MATLAB Compiler Runtime (MCR)
 - One per process
 - Loaded in-process
 - Single threaded
 - Thread safe



Component Process Architectures

- In process model
 - MCR in application process

- Scalable model
 - MCR in separate processes



HKM Optimizes Just-in-Time Steel Manufacturing Schedule

Challenge

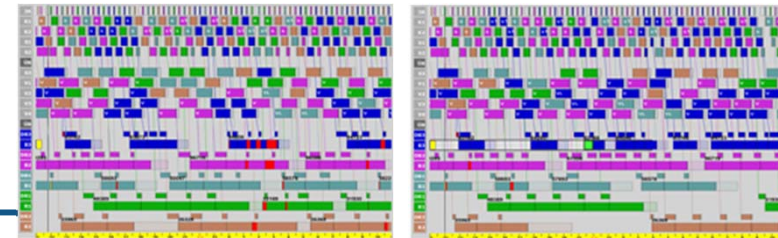
Optimize a steel production process to enable consistent, just-in-time delivery

Solution

Use MATLAB, global optimization, and parallel computing to maximize throughput of more than 5 million tonnes of steel annually

Results

- Algorithm development accelerated by a factor of 10
- Optimization time cut from 1 hour to 5 minutes
- Customer satisfaction increased



Manually reviewed plant schedule (left) and plant schedule automatically optimized with MATLAB genetic algorithms (right). The optimized schedule minimizes schedule conflicts (in red), meets delivery dates, and achieves the target utilization rate.

“C++, Java, or third-party optimization solutions would have required us to spend significantly more time in development or to simplify our constraints. Only MATLAB provided the flexibility, scalability, development speed, and level of optimization that we required.”

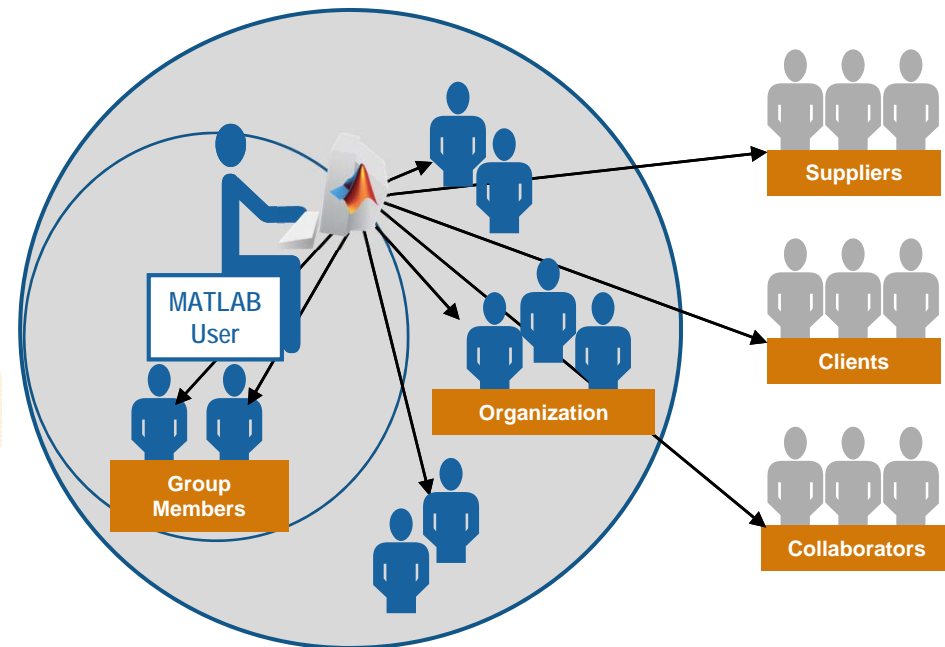
Alexey Nagaytsev
Hüttenwerke Krupp Mannesmann

[Link to user story](#)

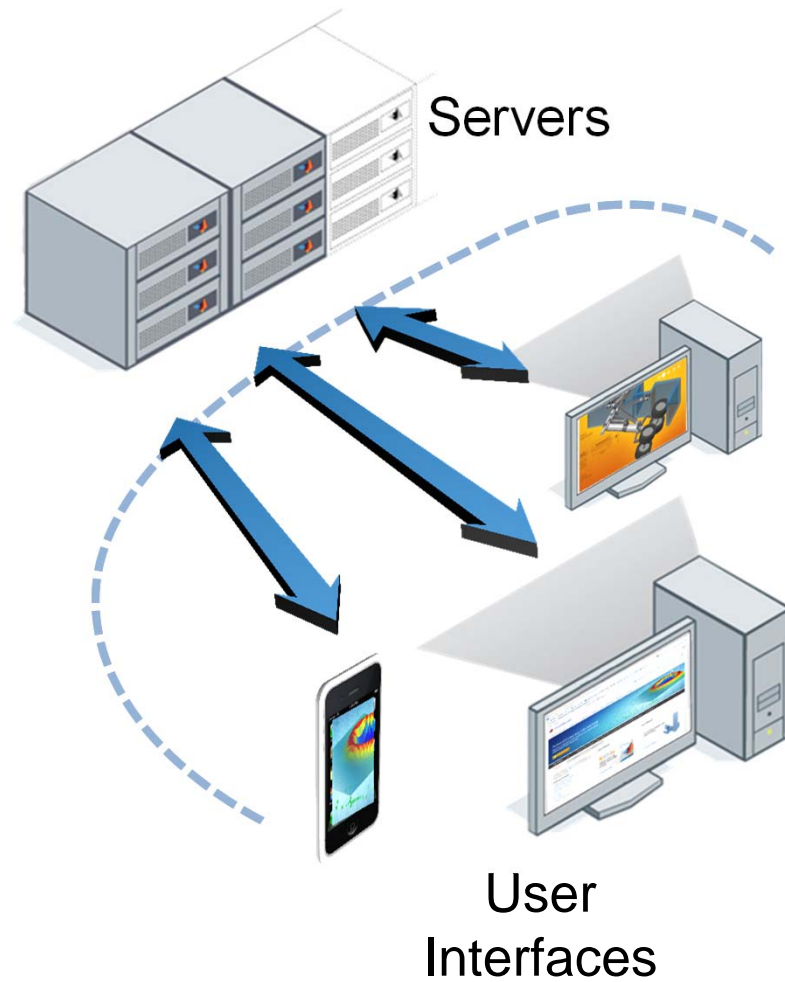
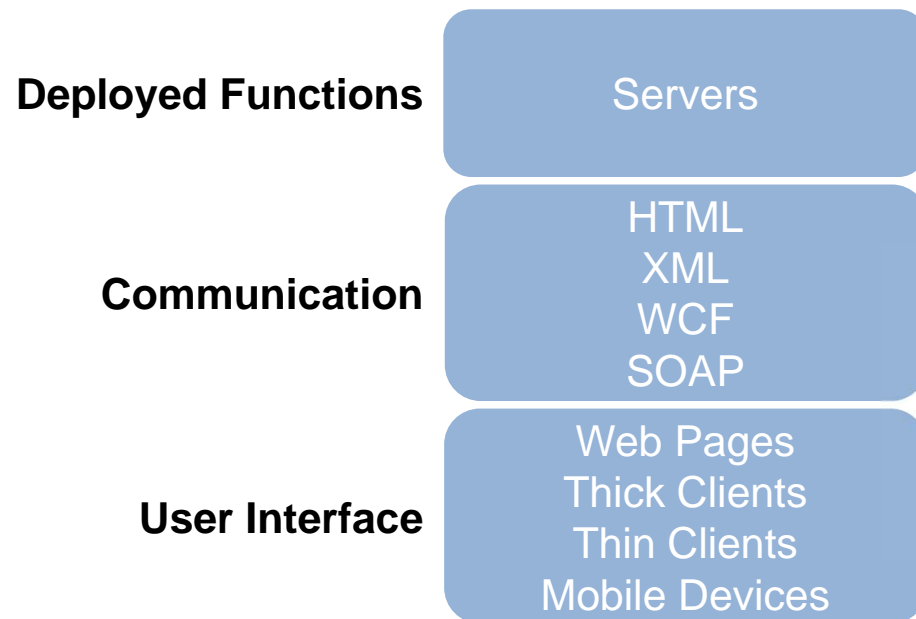
Deploying Algorithms and Applications

- Desktop Applications
- Algorithmic Components

 Web Deployment



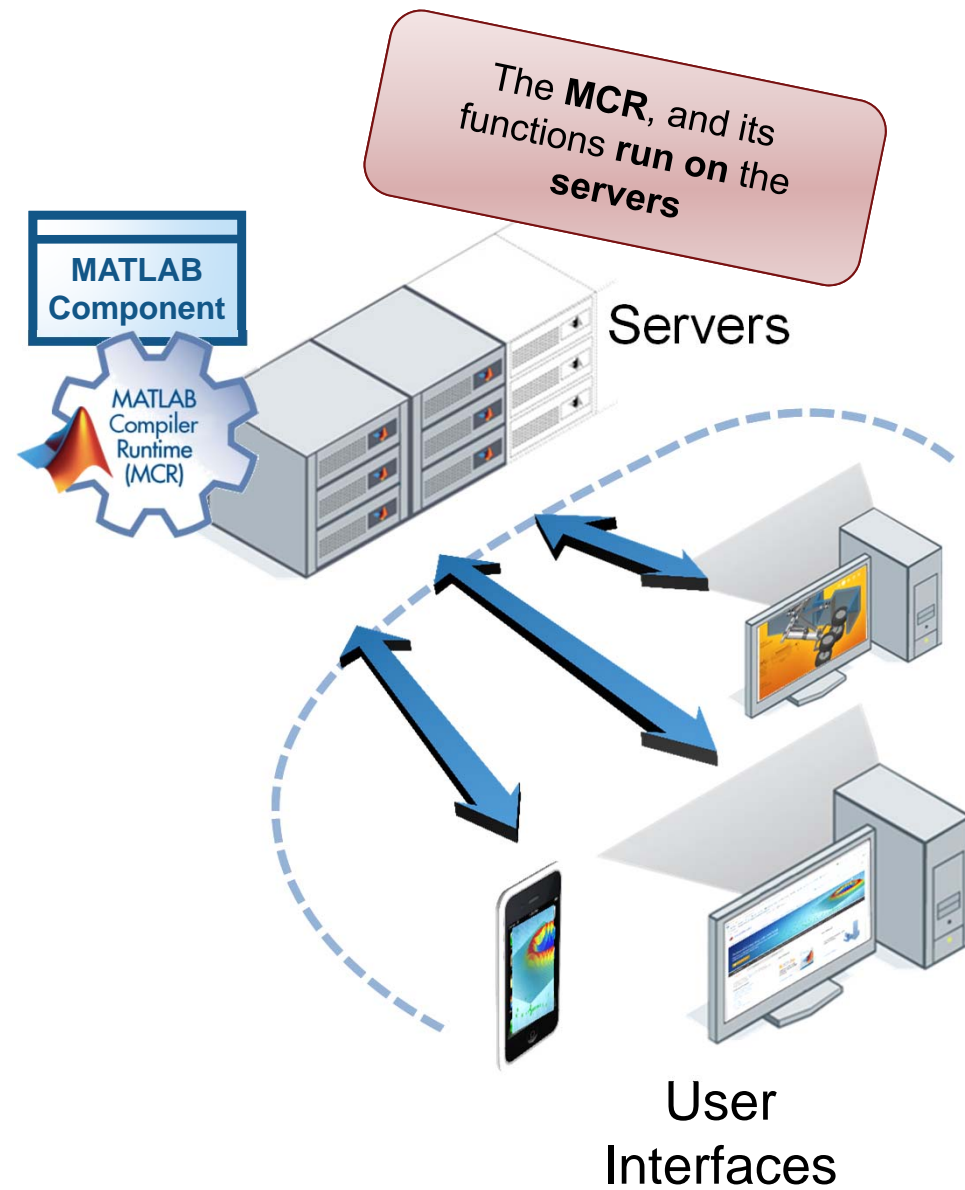
Web Applications



Web Applications Quiz

Where is MCR(s) Running?

- a. Server
- b. User interface
- c. Both
- d. Somewhere else
- e. No where



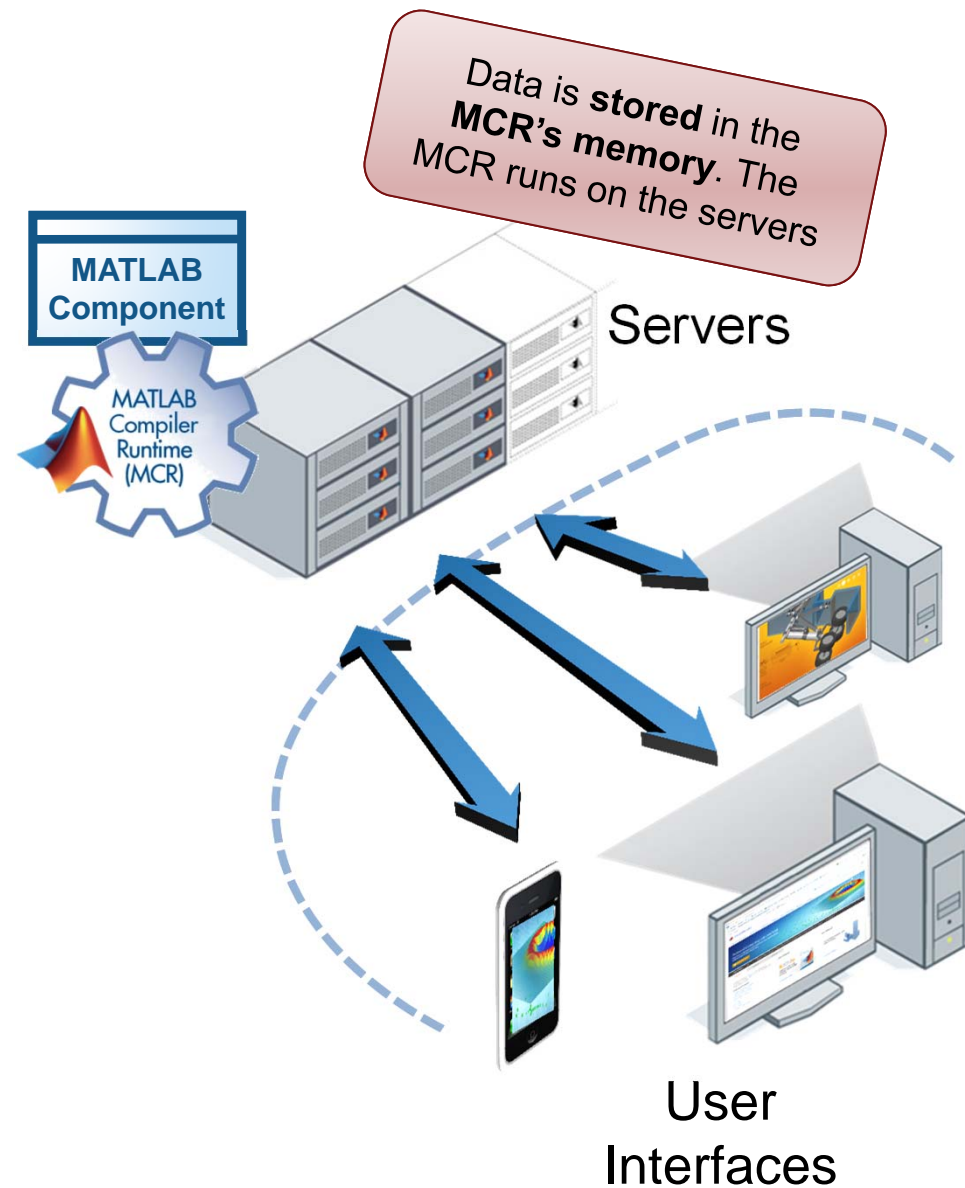
Web Applications Quiz

If the MCR executes:

```
>> a = rand(10)
```

Where is the data stored?

- a. Server
- b. User interface
- c. Both
- d. Somewhere else
- e. No where



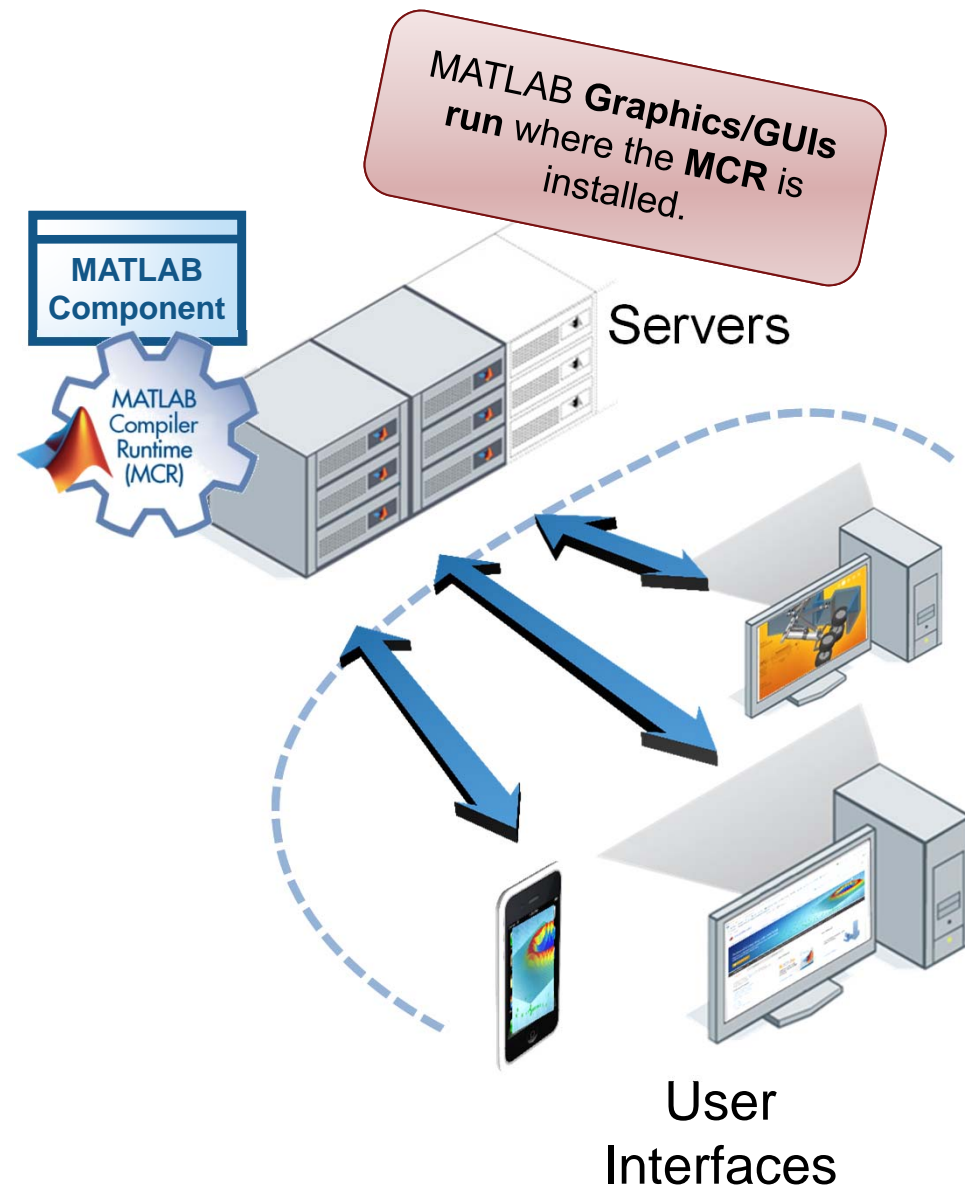
Web Applications Quiz

If the MCR executes:

```
>> plot(a)
```

Where would the plot appear?

- a. Server
- b. User interface
- c. Both
- d. Somewhere else
- e. No where



Web Applications Quiz

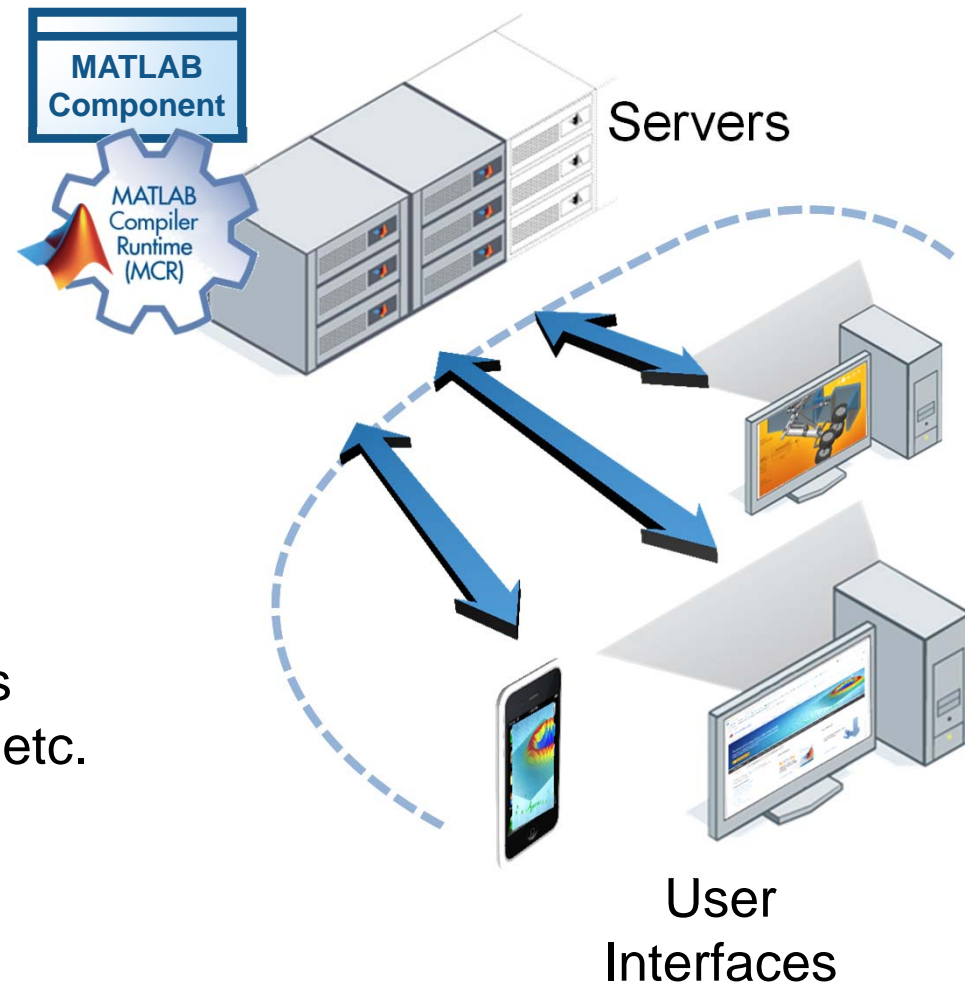
How do we get graphics or data to the user interface?

Graphics:

- WebFigures
- Streaming Images

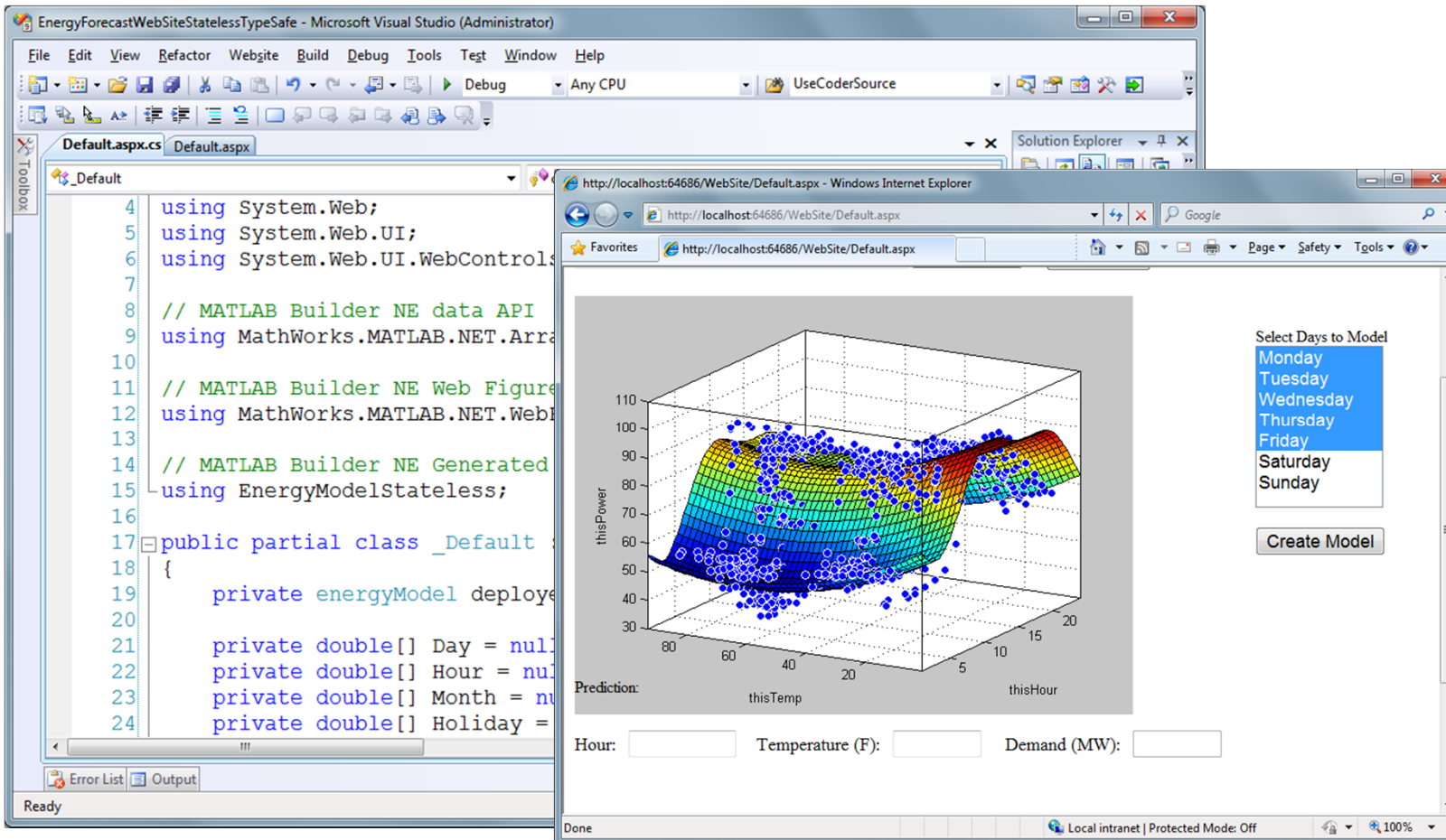
Data:

- Standard web interfaces
- e.g. XML, WCF, SOAP, etc.



Web Deployment

MATLAB Builder NE



The image displays two windows from a computer screen. The top window is Microsoft Visual Studio (Administrator) showing the code for a web application. The code is in C# and includes the following lines:

```

4 using System.Web;
5 using System.Web.UI;
6 using System.Web.UI.WebControls;
7
8 // MATLAB Builder NE data API
9 using MathWorks.MATLAB.NET.ArrayServices;
10
11 // MATLAB Builder NE Web Figure
12 using MathWorks.MATLAB.NET.WebServices;
13
14 // MATLAB Builder NE Generated
15 using EnergyModelStateless;
16
17 public partial class _Default : System.Web.UI.Page
18 {
19     private energyModel deploy;
20
21     private double[] Day = null;
22     private double[] Hour = null;
23     private double[] Month = null;
24     private double[] Holiday = null;

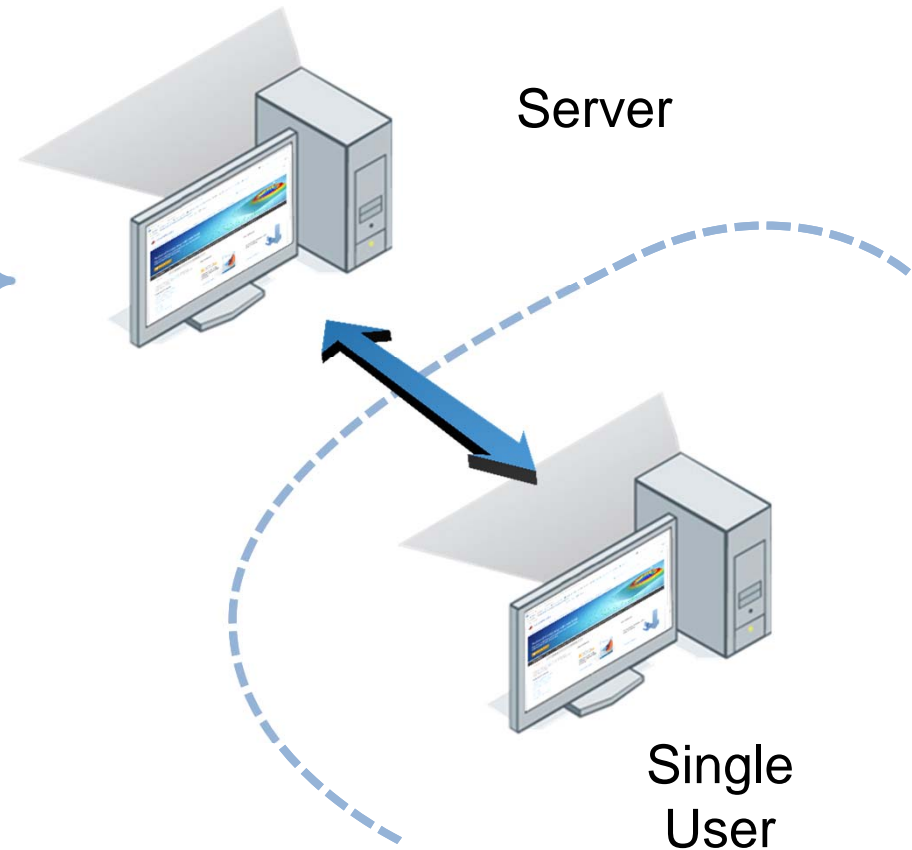
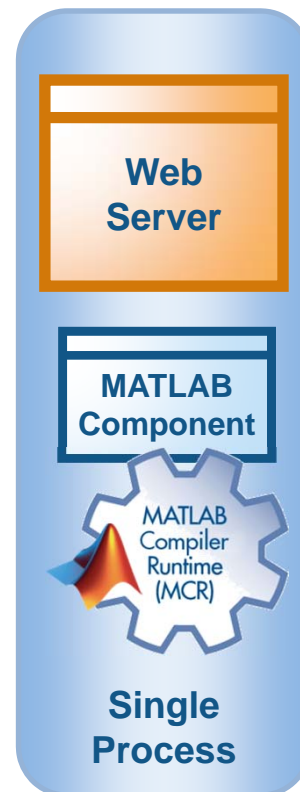
```

The bottom window is Windows Internet Explorer showing the web application running at <http://localhost:64686/WebSite/Default.aspx>. The application displays a 3D plot of power demand over time. The vertical axis is labeled 'thisPower' and ranges from 30 to 110. The horizontal axes are 'thisTemp' (ranging from 20 to 80) and 'thisHour' (ranging from 5 to 20). The plot shows a surface with blue dots representing data points. To the right of the plot is a 'Select Days to Model' dropdown menu with options: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, and Sunday. Below the menu is a 'Create Model' button. At the bottom of the page, there are input fields for 'Hour:', 'Temperature (F):', and 'Demand (MW):'.

Web Deployment Example

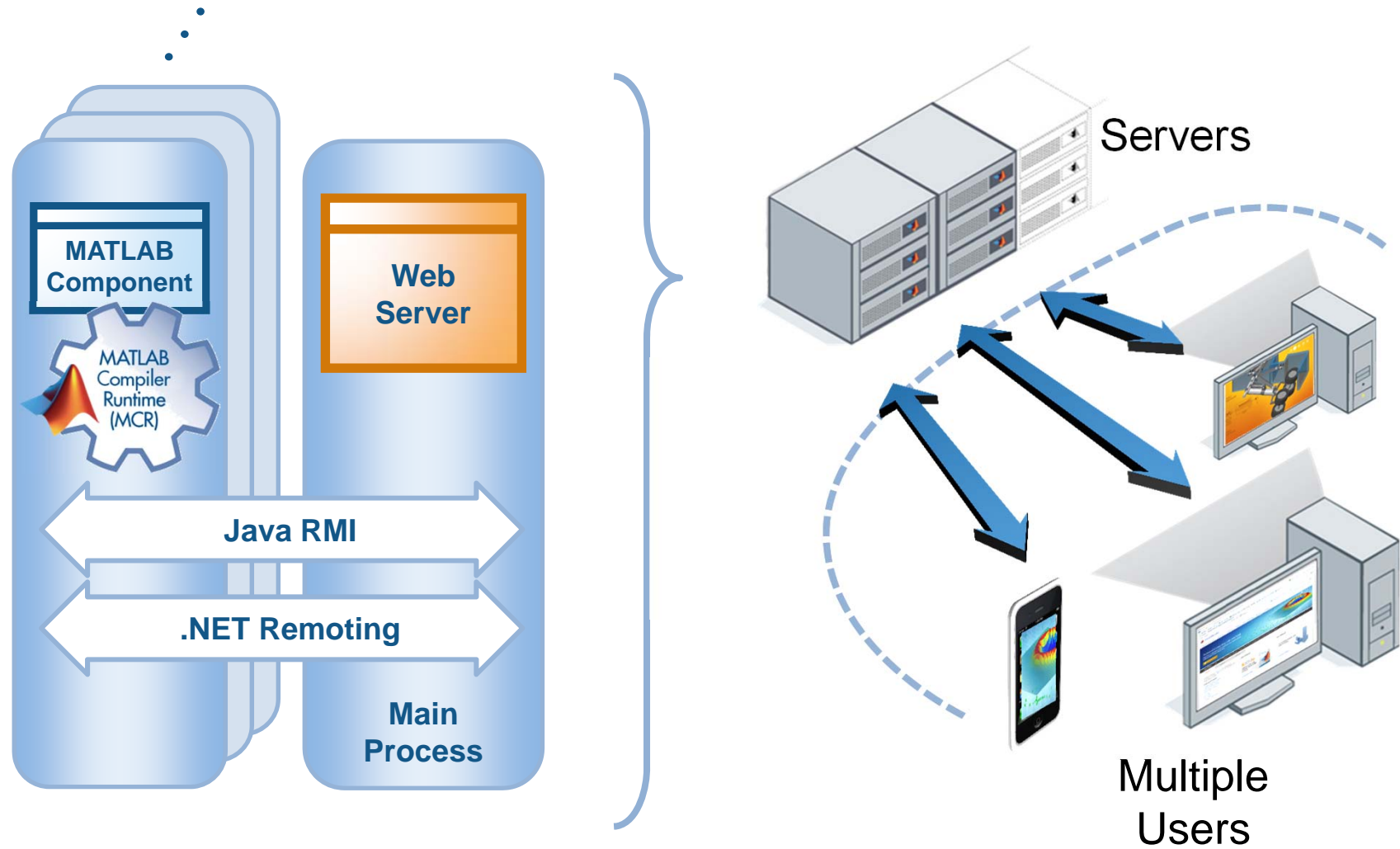
Single User

In-Process Model



Web Deployment Example

Scalable Number of Users



Web Architectures

	Web Servers and Web Pages	Web Services
Interface	Web Browser	Web Browser or Thick Client
Graphics	Web Figures or Streaming Image	Streaming Image
Communication	HTML	WCF, XML, SOAP, etc.
MATLAB Builder NE	Active Server Pages (ASP or ASP.NET)	.NET Web Service
MATLAB Builder JA	Java Server Pages (JSP), Java Servlets	Java Web Service

UniCredit Bank Austria Develops and Rapidly Deploys a Consistent, Enterprise-Wide Market Data Engine

Challenge

Improve risk management operations throughout a multinational financial institution

Solution

Use MATLAB, MATLAB Compiler, and MATLAB Builder JA to build and rapidly deploy a consistent enterprise-wide data warehouse into J2EE Web Architecture

Results

- Development time reduced by 50%
- Risk management improved across the bank
- Operational, audit, and maintenance costs reduced

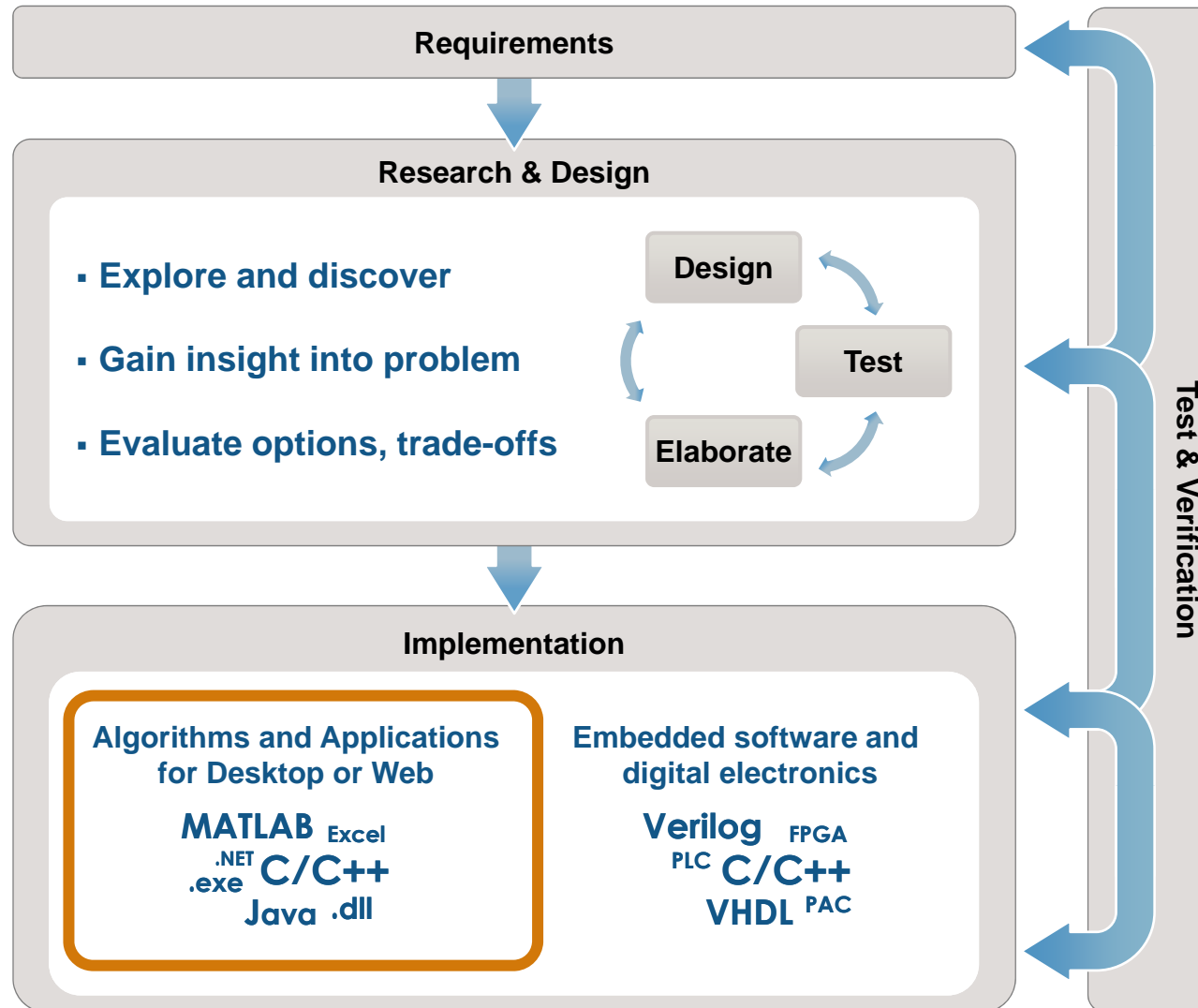


Zero-coupon yield curve plot in UniCredit Bank Austria's UMD environment.

“ With MATLAB, we can focus on business logic instead of implementation details. We can deploy an algorithm in a Java environment the same day, without any additional coding. This approach enabled us to cut our development time in half, if not more weeks, instead of months.”

**Peter W. Schweighofer
UniCredit Bank Austria**

Application Deployment Process

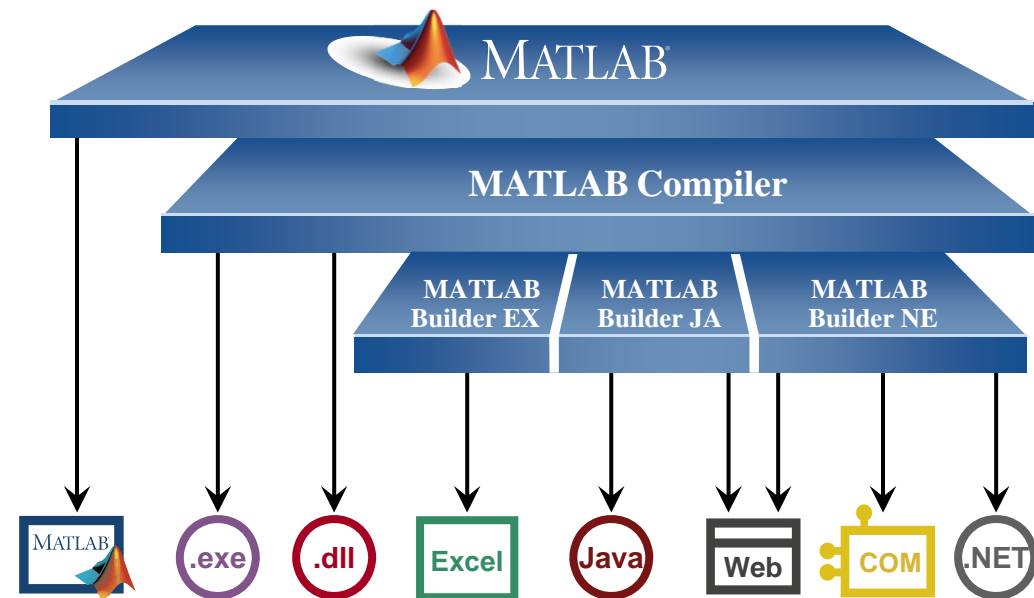


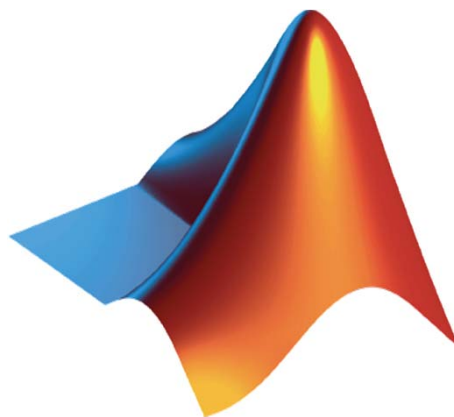
Deploying Algorithms and Applications

- Desktop Applications
 - MATLAB Compiler

- Software Components
 - MATLAB Builders
 - MATLAB Compiler

- Web Deployment
 - MATLAB Builder NE
 - MATLAB Builder JA





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Other product or brand names may be trademarks or registered trademarks of their respective holders.”

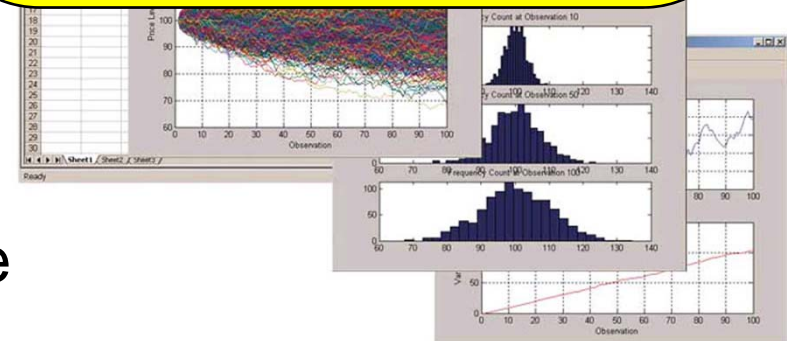
MATLAB Builder EX for Microsoft® Excel®

- Deploy MATLAB code to Microsoft Excel
- Integrate MATLAB applications into Excel workbooks
- Provides a Visual Basic interface
- Royalty-free deployment

- Should these product slides come after the “Builder” demo?
- Should we have product specific slides or a more general builder overview slide
- Idea: have an Excel slide and then another slide for Builder NE and JA

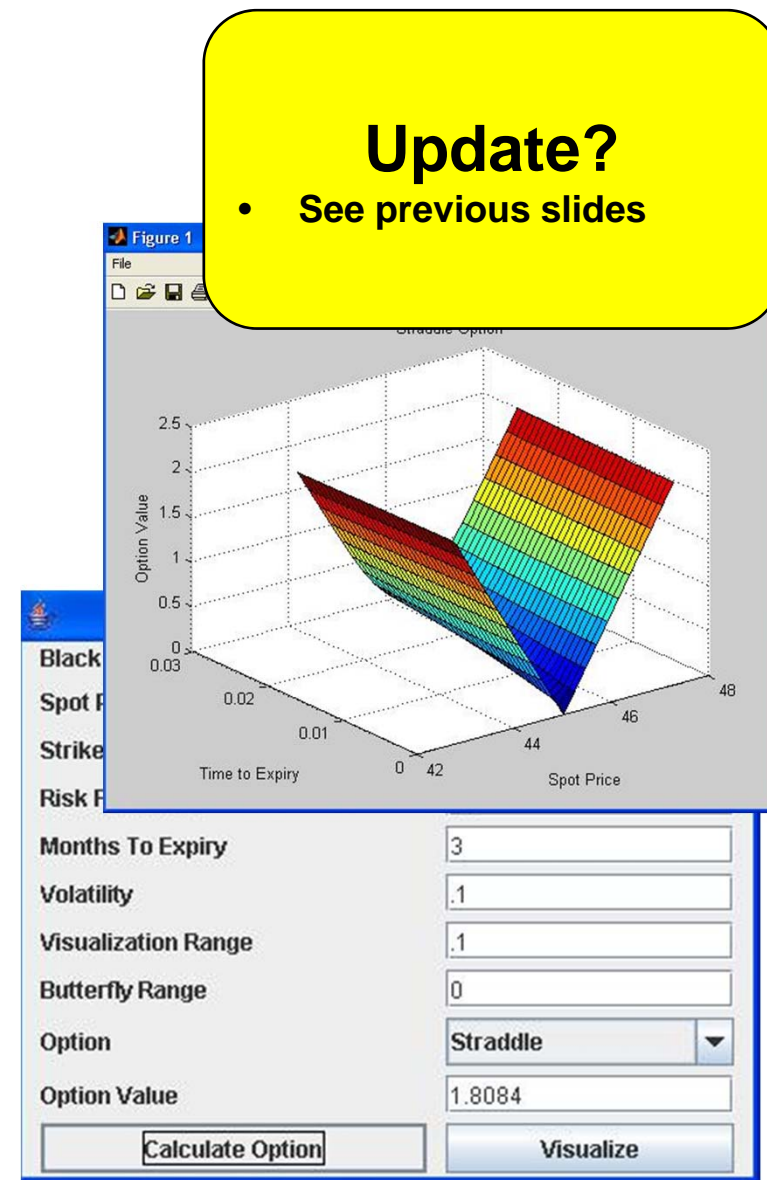
Update

- Function Wizard image
- Spreadsheet image with controls & graphics
- Notes need to be updated



MATLAB Builder JA for Java language

- Deploy MATLAB code as Java classes
- Integrate with desktop or Web applications
- Provides client-side controls for interactive Web graphics
- Royalty-free deployment

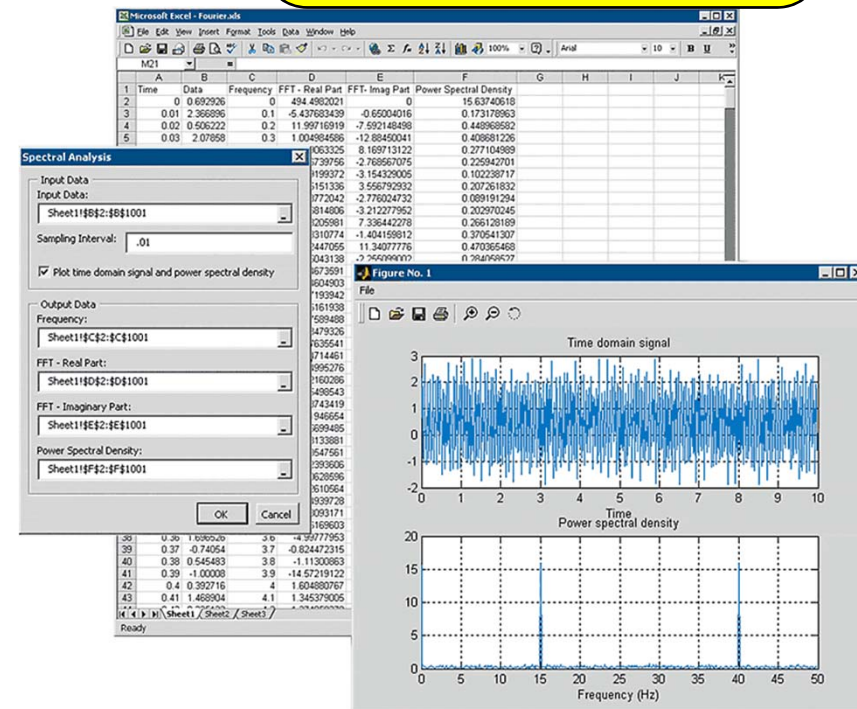


MATLAB Builder NE for Microsoft .NET Framework

Update?

- See previous slides

- Deploy MATLAB code as .NET and COM components
- Integrate with desktop or Web applications
- Provides client-side controls for interactive Web graphics
- Royalty-free deployment



Desktop and Web Deployment

What's New for NE?

See previous slides

- MATLAB Builder NE

8b

- Support for .NET Remoting
(for interfacing with a distributed .NET Framework)
- Ability to manipulate MATLAB figures over the Web

- Enhanced readme.txt file

9a

- Customized to MATLAB Compiler deployment requirements
- Generated with each build

- Redesigned Deployment Tool facilitates navigation

9b

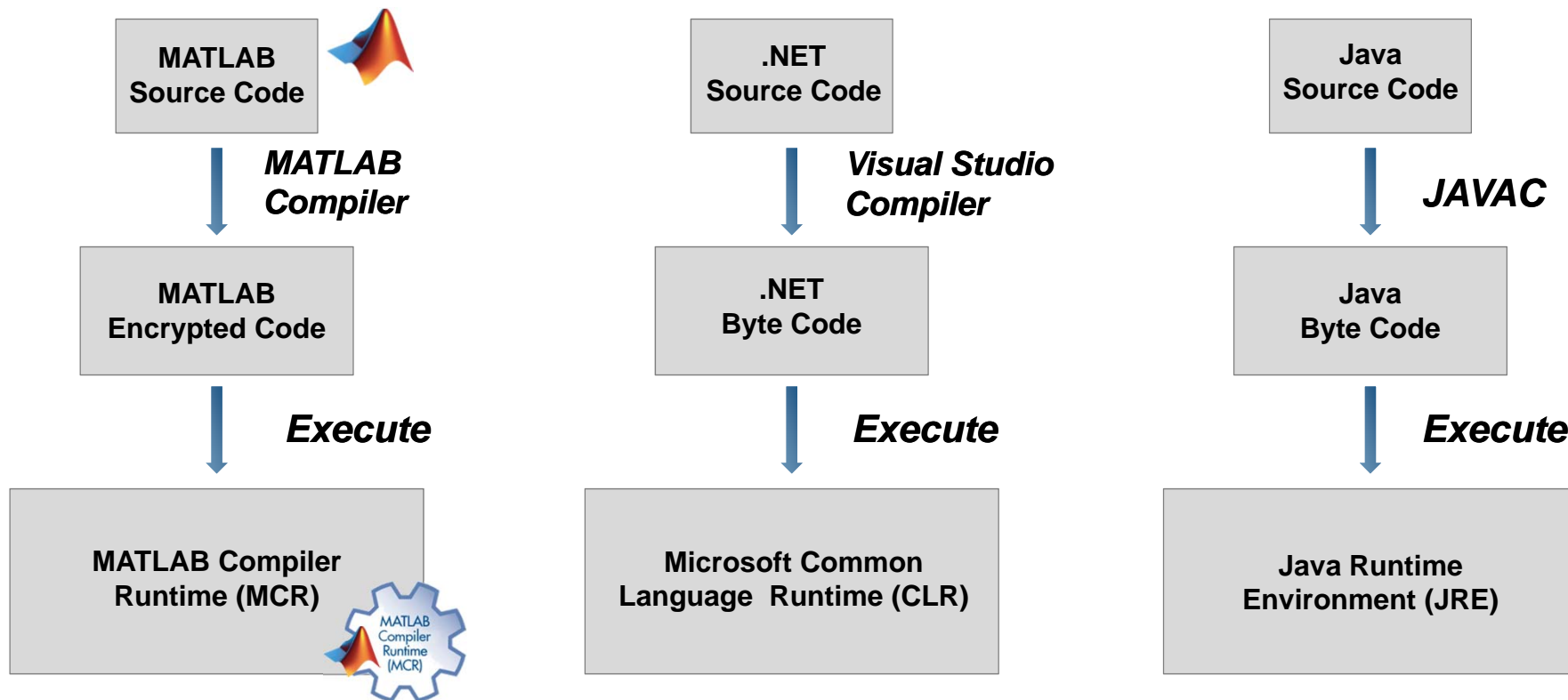
- Cancellable progress dialog
- Fast loading of projects
- Ability to add supporting files as folders

- Command-line version of Deployment Tool, providing programmatic control over building and packaging options


10a

Application Virtual Machine Concept

Various language implementations



Online Information on Compiler Support for Toolboxes



The screenshot shows the MathWorks website interface. At the top, there is a navigation bar with links for Home, Select Country, Contact Us, Store, and a search box. Below this is a secondary navigation bar with links for Products & Services, Industries, Academia, Support, User Community, and Company. The main content area is titled "MATLAB Compiler 4.11" and "MATLAB Compiler 4.11 Support for MATLAB and Toolboxes". It includes a description of supported features, a table of supported and unsupported toolboxes, and a sidebar with navigation links.

MATLAB Compiler 4.11
MATLAB Compiler 4.11 Support for MATLAB and Toolboxes

MATLAB Compiler 4.11 supports the full MATLAB language:

- All MATLAB 7 language features, including objects
- Most MATLAB toolboxes
- User-developed GUIs

The following table shows the MATLAB toolboxes that you can use with MATLAB Compiler 4.11 and describes which functionality can and cannot be compiled. For MATLAB Compiler, this means that an application or component you deploy cannot use functionality from these products. In general, MathWorks provided GUIs and code generation functionality will not compile.

Product	Can be compiled	Cannot be compiled
Aerospace Toolbox 2.4	Everything except for animation functionality	Animation functionality: interface to FlightGear flight simulator and MATLAB Handle Graphics animation objects
Bioinformatics Toolbox 3.4	All command line functionality	<ul style="list-style-type: none"> All GUIs provided with toolbox affyread, proteinplot, phytreetool
Communications Toolbox 4.4	All command line functionality	All GUIs provided with toolbox
Control System Toolbox 8.4	<ul style="list-style-type: none"> LTI objects Analysis and synthesis commands Response plots 	<ul style="list-style-type: none"> LTI Viewer SISO Design GUI

www.mathworks.com/products/compiler/compiler_support.html

Link from MATLAB Compiler main page

Component Runtime Lifecycle Management

- **Startup Time**
 - First instantiation starts MCR (equivalent to starting MATLAB)
 - Additional instances start much faster

- **Ways to Mitigate**
 - Instantiate first component with application startup
 - Create a Web Service / Web Application that is already running

Required Files for Deployment

- MATLAB Compiler Runtime (MCR)
 - Enables the execution of generated applications
 - Deployed and installed only once on end-user desktop

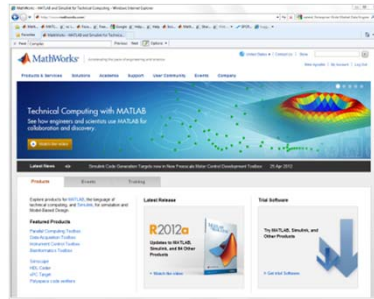
- Standalone executables, libraries, or components
 - Generated each time MATLAB Compiler runs
 - Contains all supporting files

Note: MATLAB does not need to be available on the target user's desktop.

Understanding the Web

Use

Deploy



Web Browser



Web Client Application



Here be
Dragons
(INTERWEB)

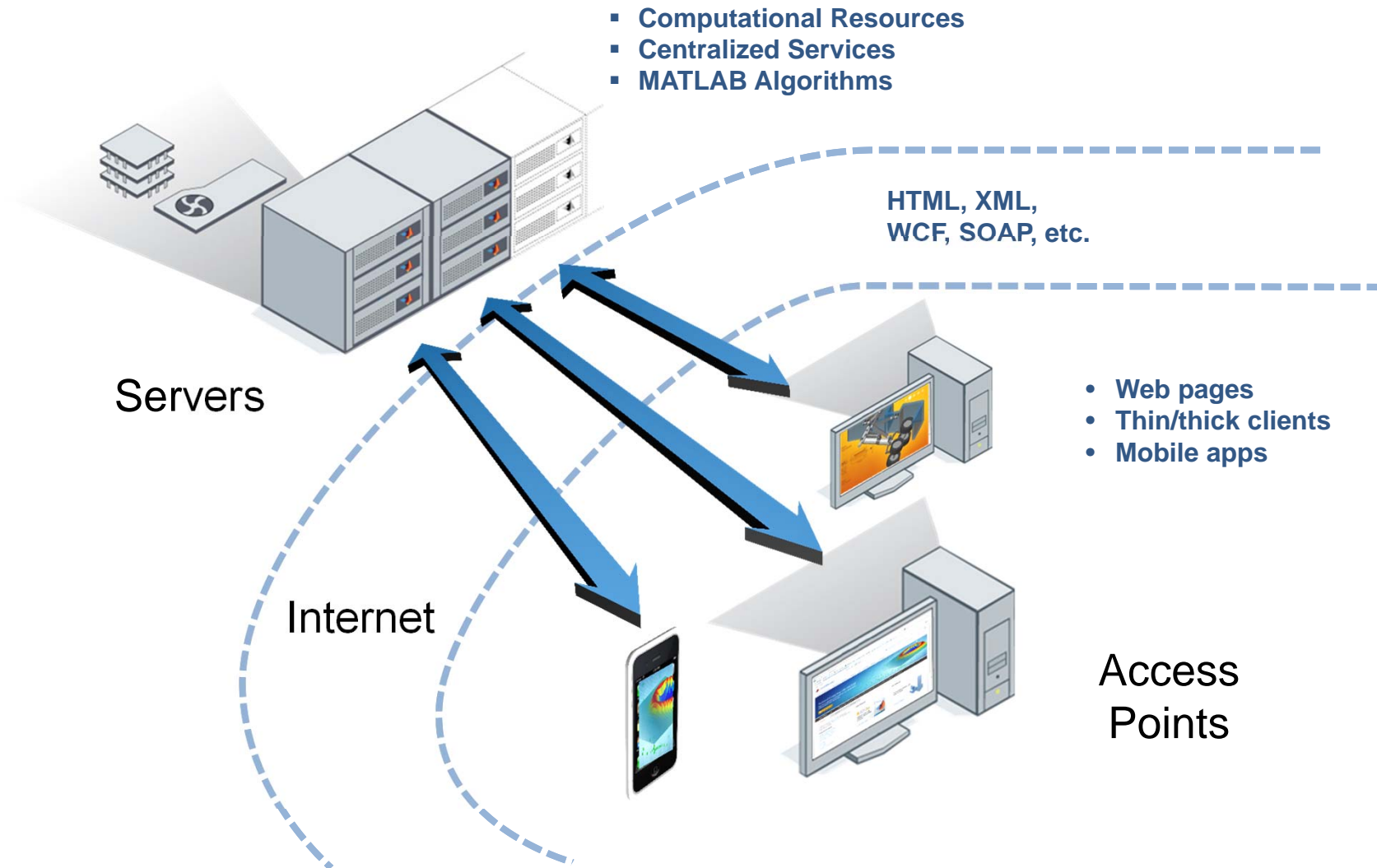


Web Service



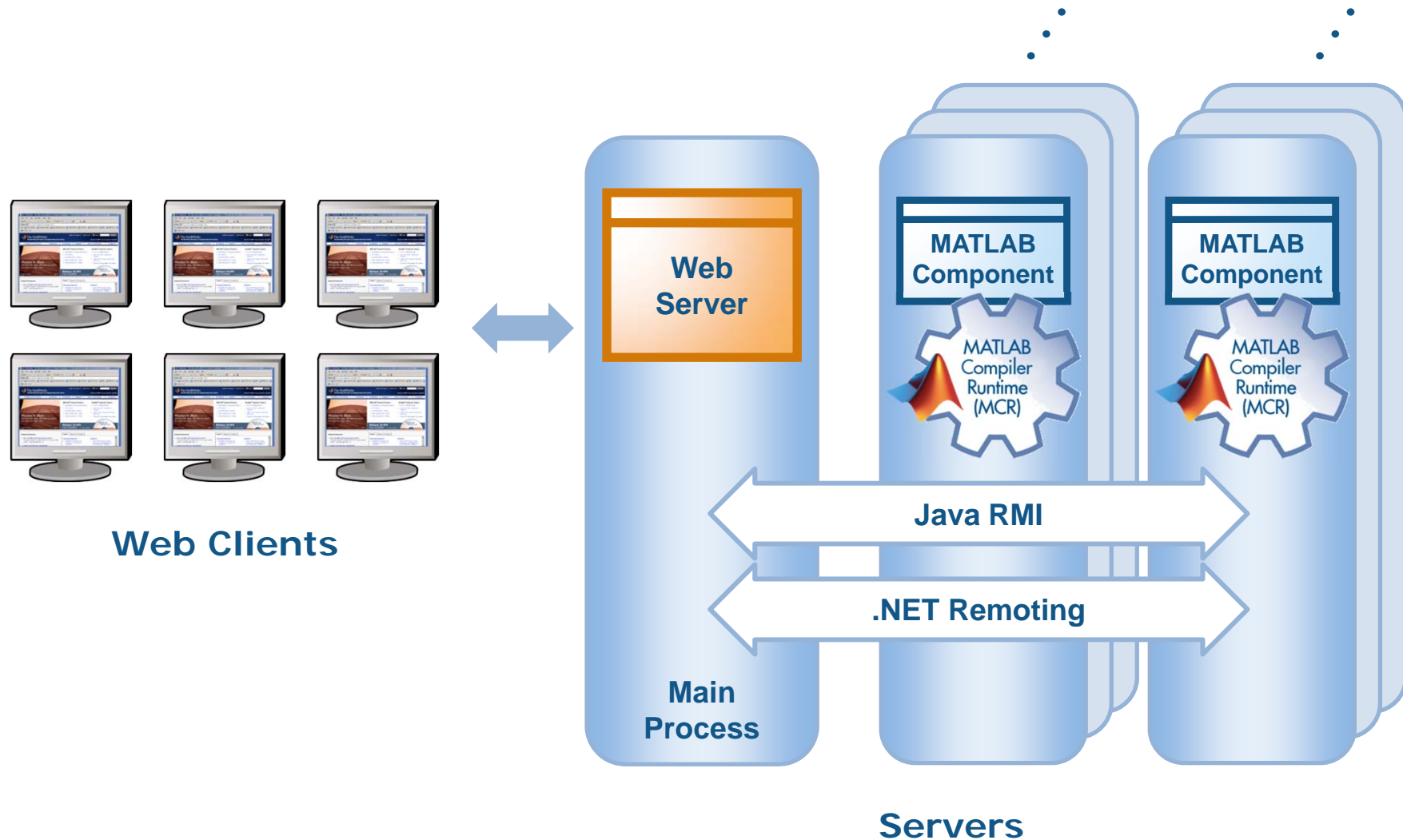
Web Server

Web Applications



Web Deployment

How to Scale



Web Deployment

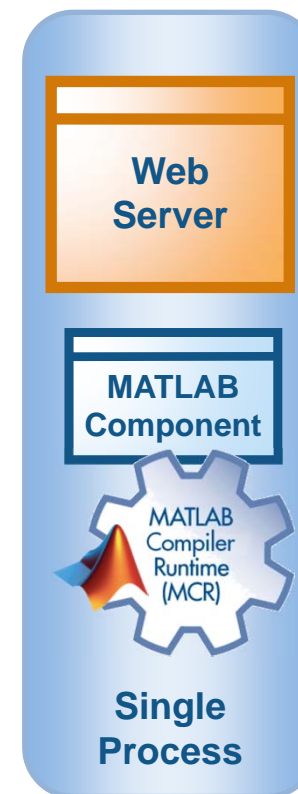
What we did



Web Client



In-Process Model



Component Process Architectures

