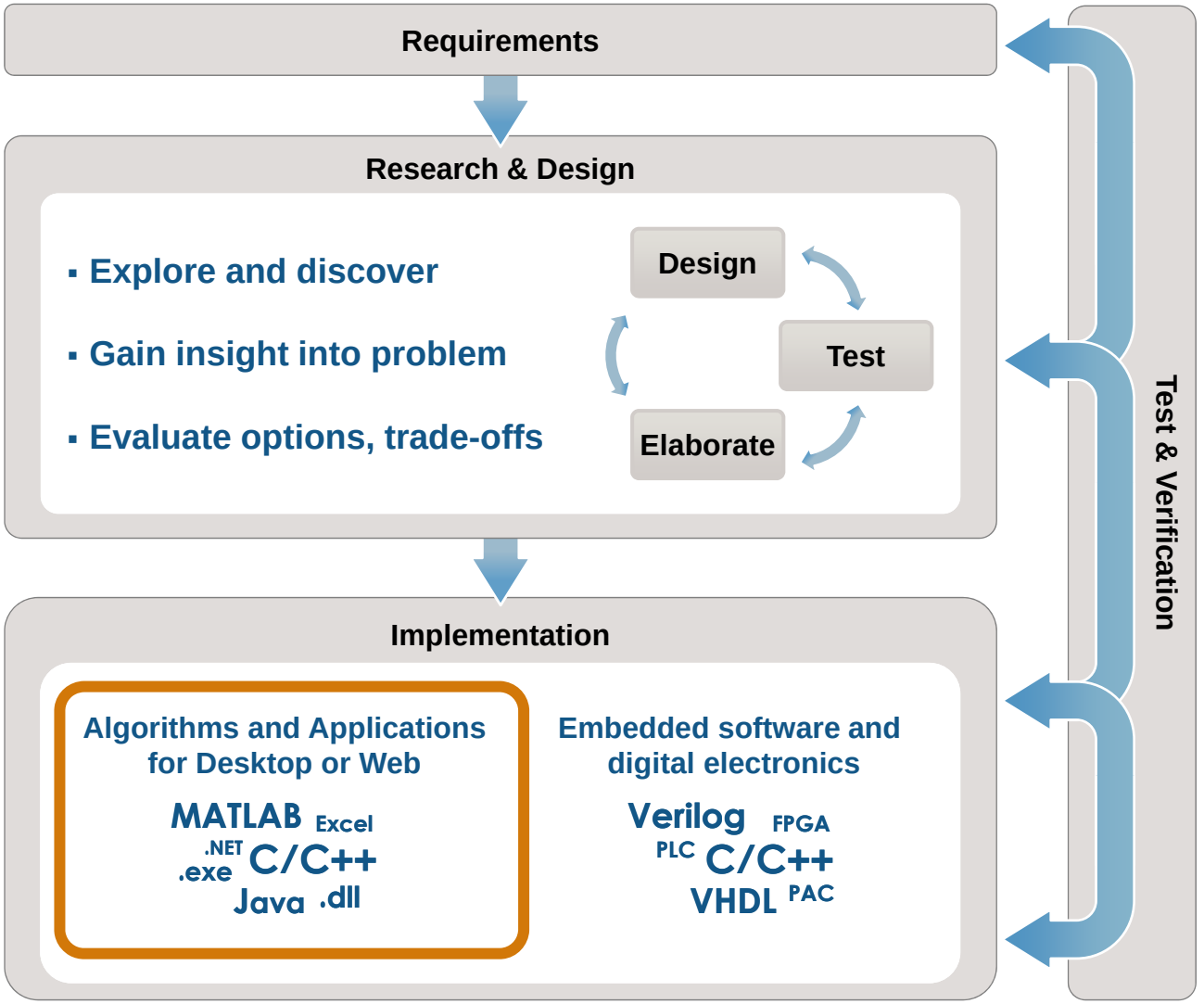
Excel, .NET 및 JAVA 환경에서 사용 가능한 MATLAB Application 개발

성호현 과장
MathWorks Korea

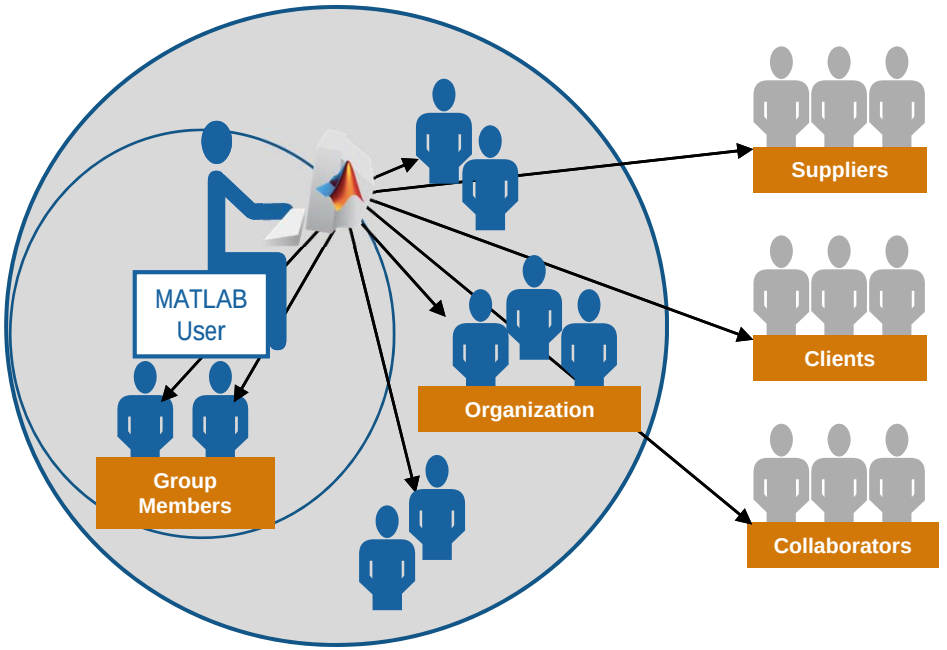
Application Deployment Process



Deploying Algorithms and Applications

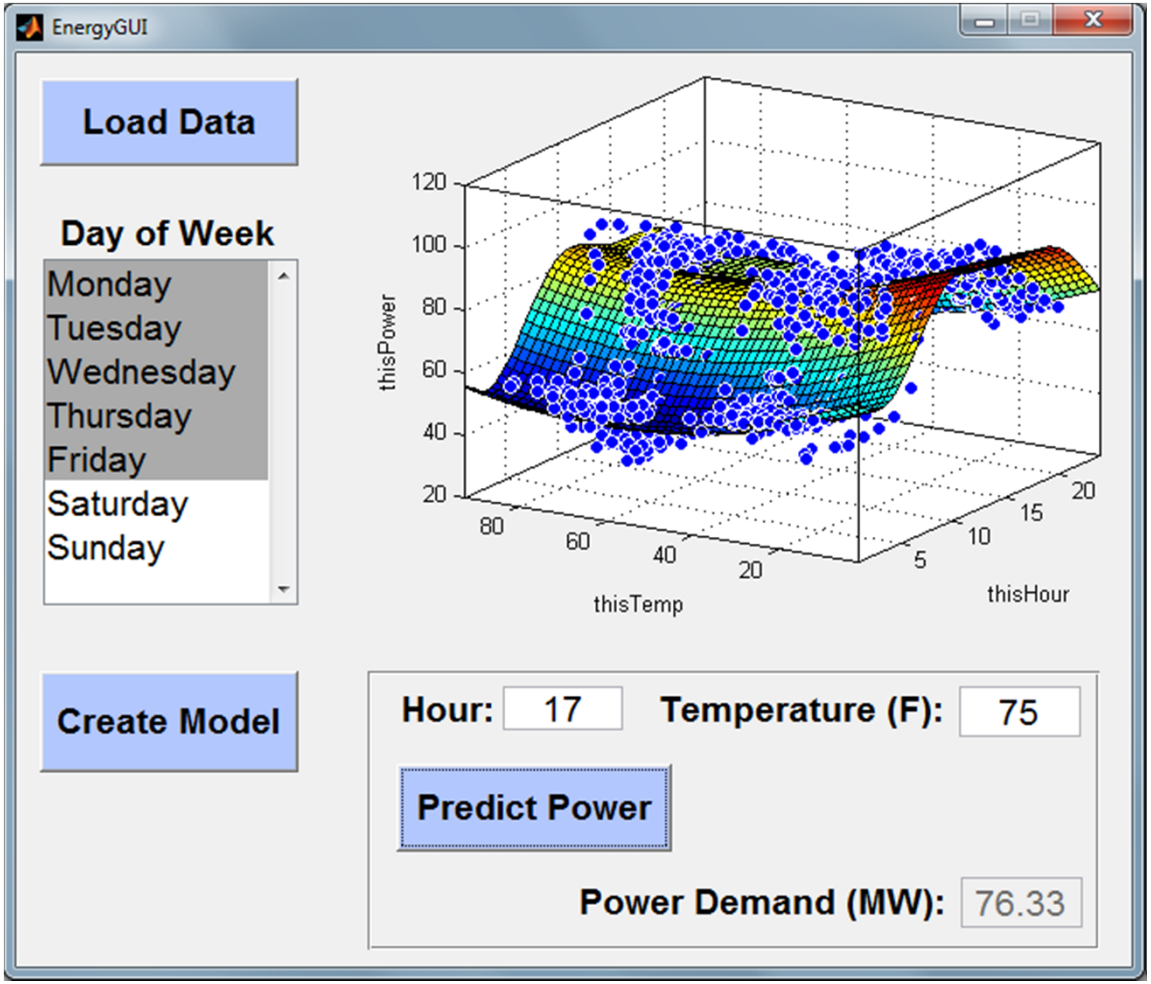
Desktop Applications

- Algorithmic Components
- Web Deployment

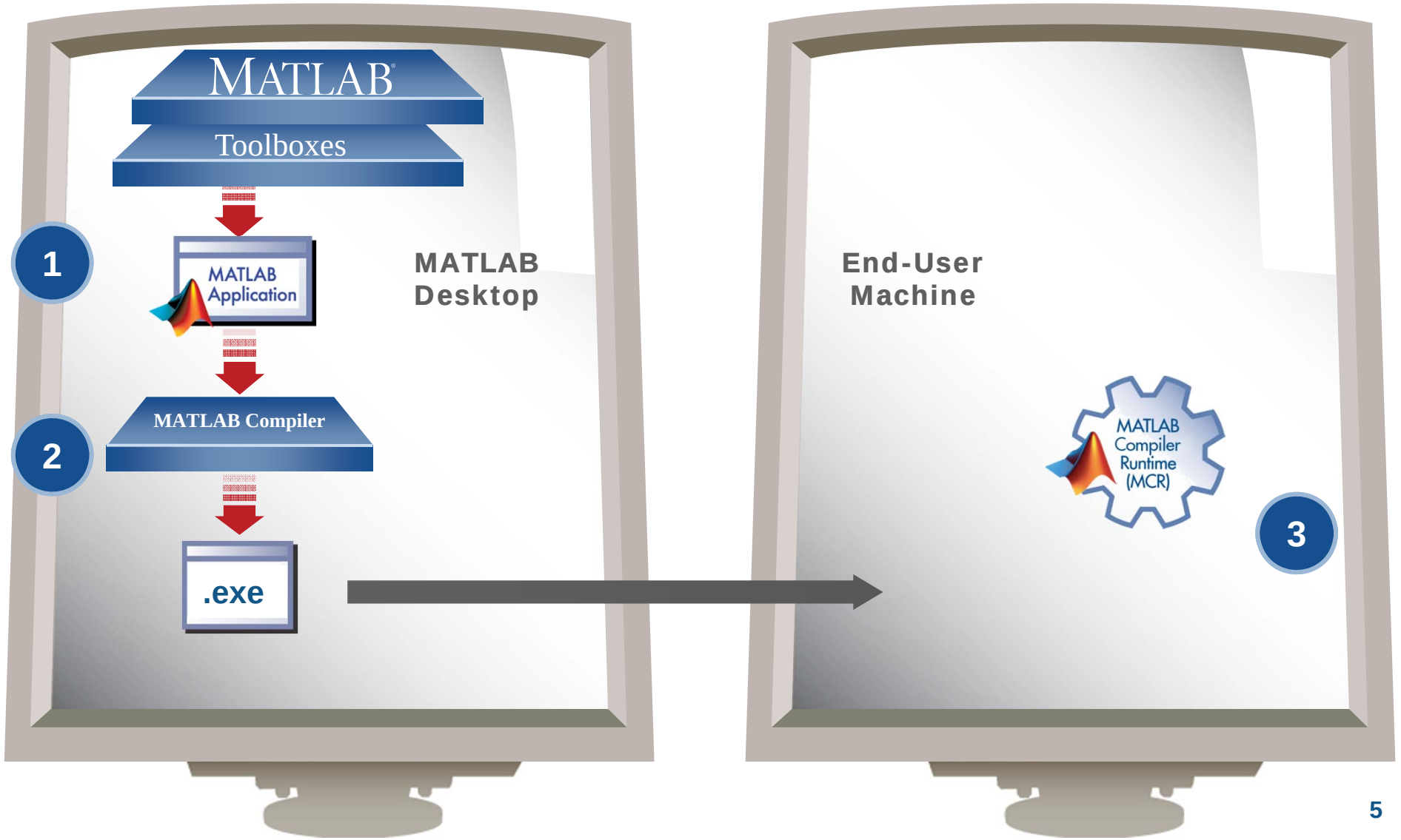


Desktop Applications

Energy Forecasting Stand Alone Application

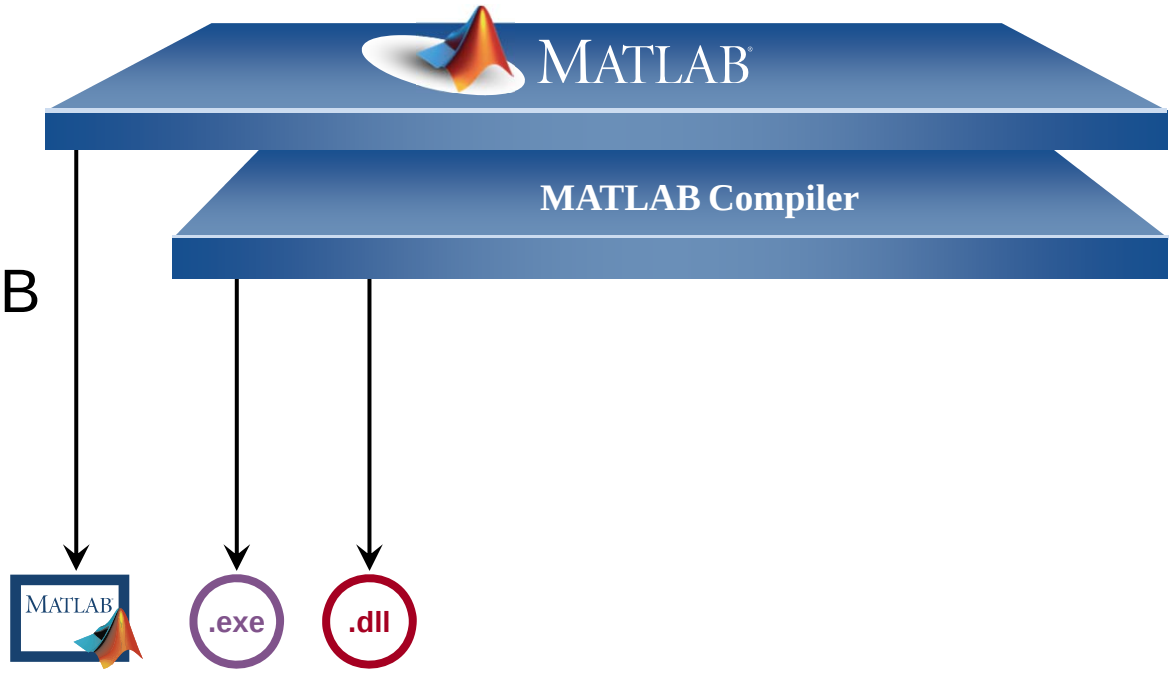


Deploying Applications with MATLAB



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

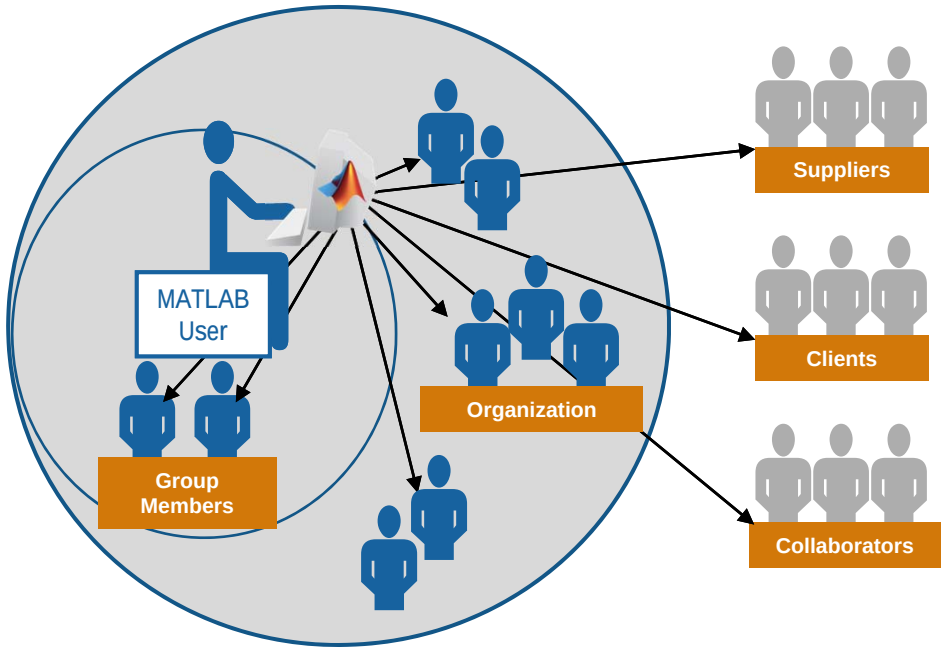
"Using MATLAB and MATLAB Compiler, I can develop an application at least 100 times faster than I could with Visual Basic or C. The time we saved on the very first application that we wrote in MATLAB more than paid for the software."

Roger Schultz
Halliburton Energy Services

Link to user story

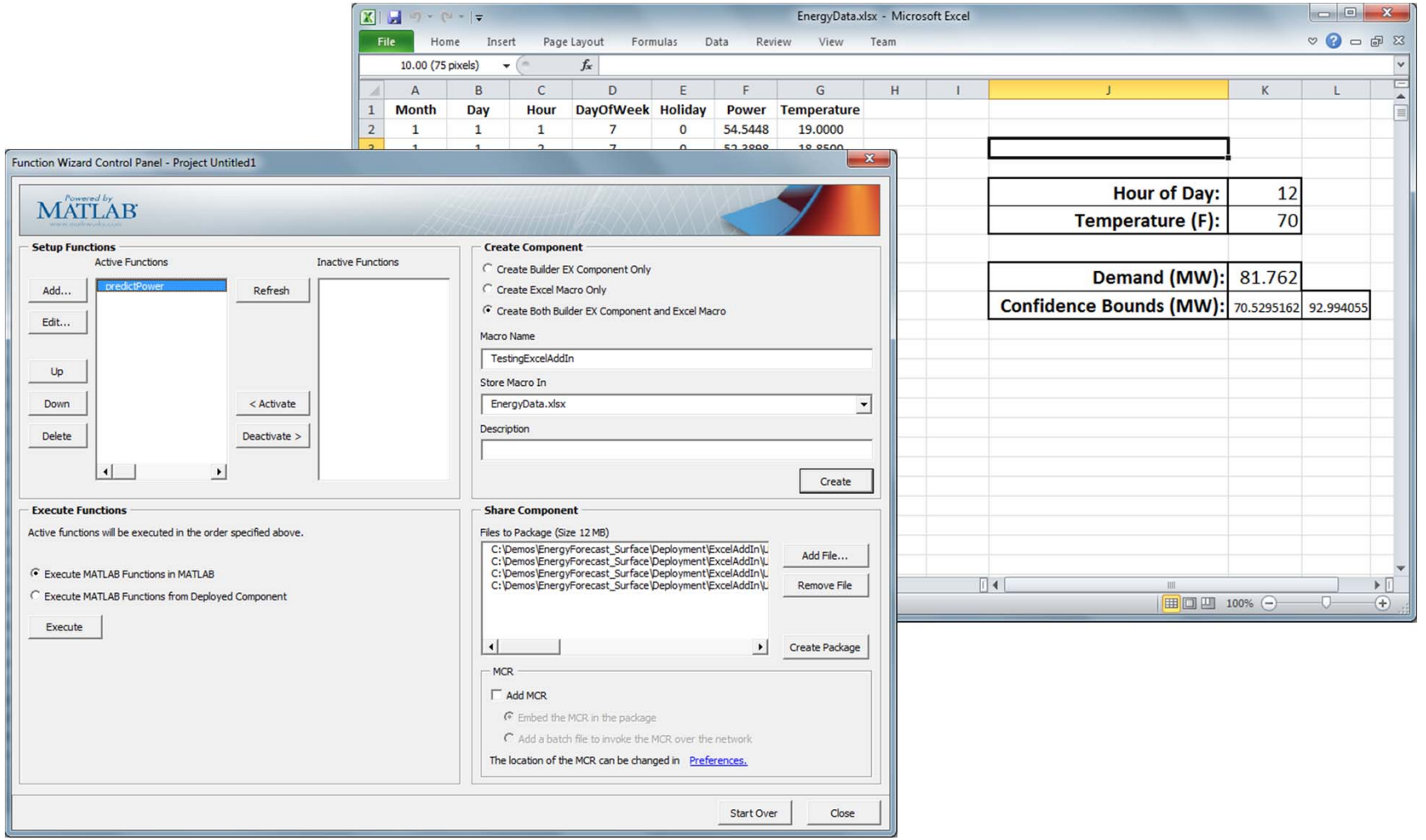
Deploying Algorithms and Applications

- Desktop Applications
- Algorithmic Components
- Web Deployment



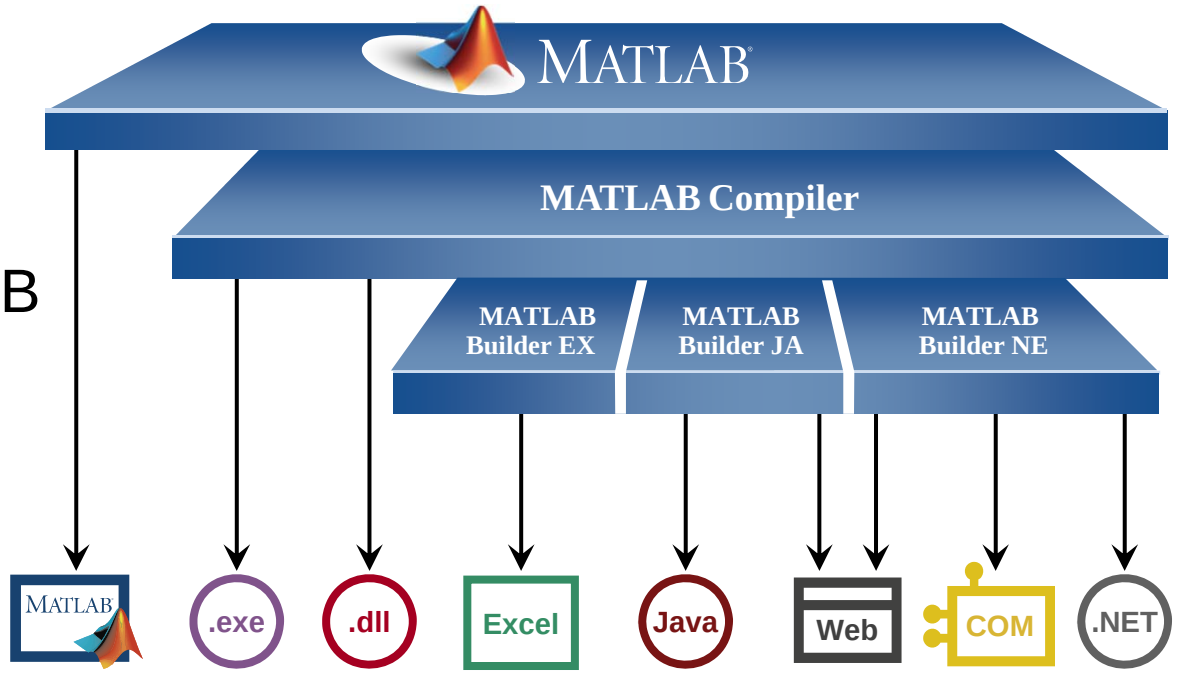
Software Components

Creating an Excel Add-In



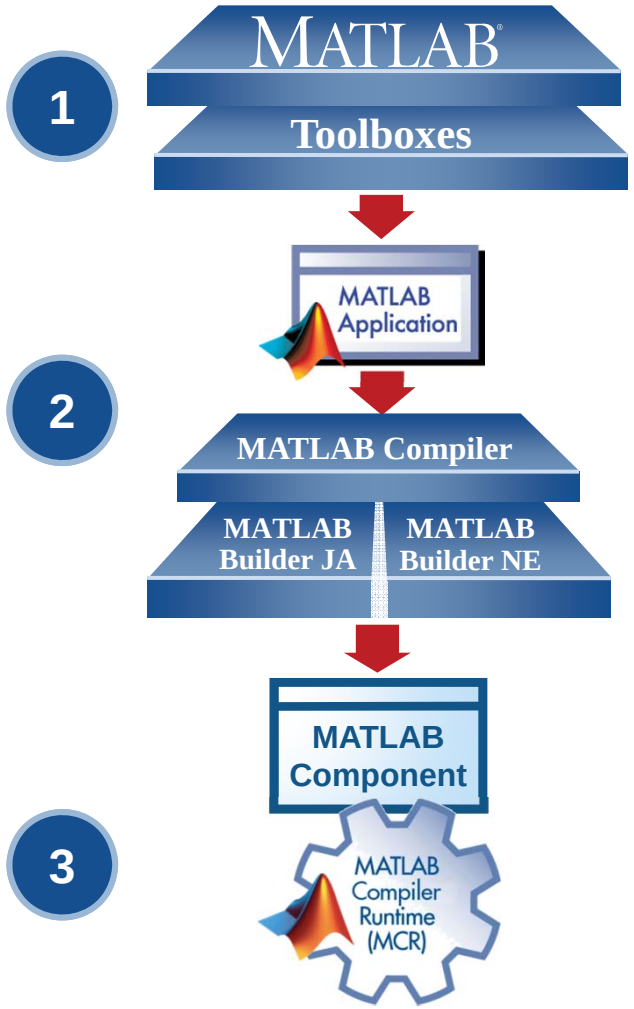
Deploying Applications with MATLAB

- 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



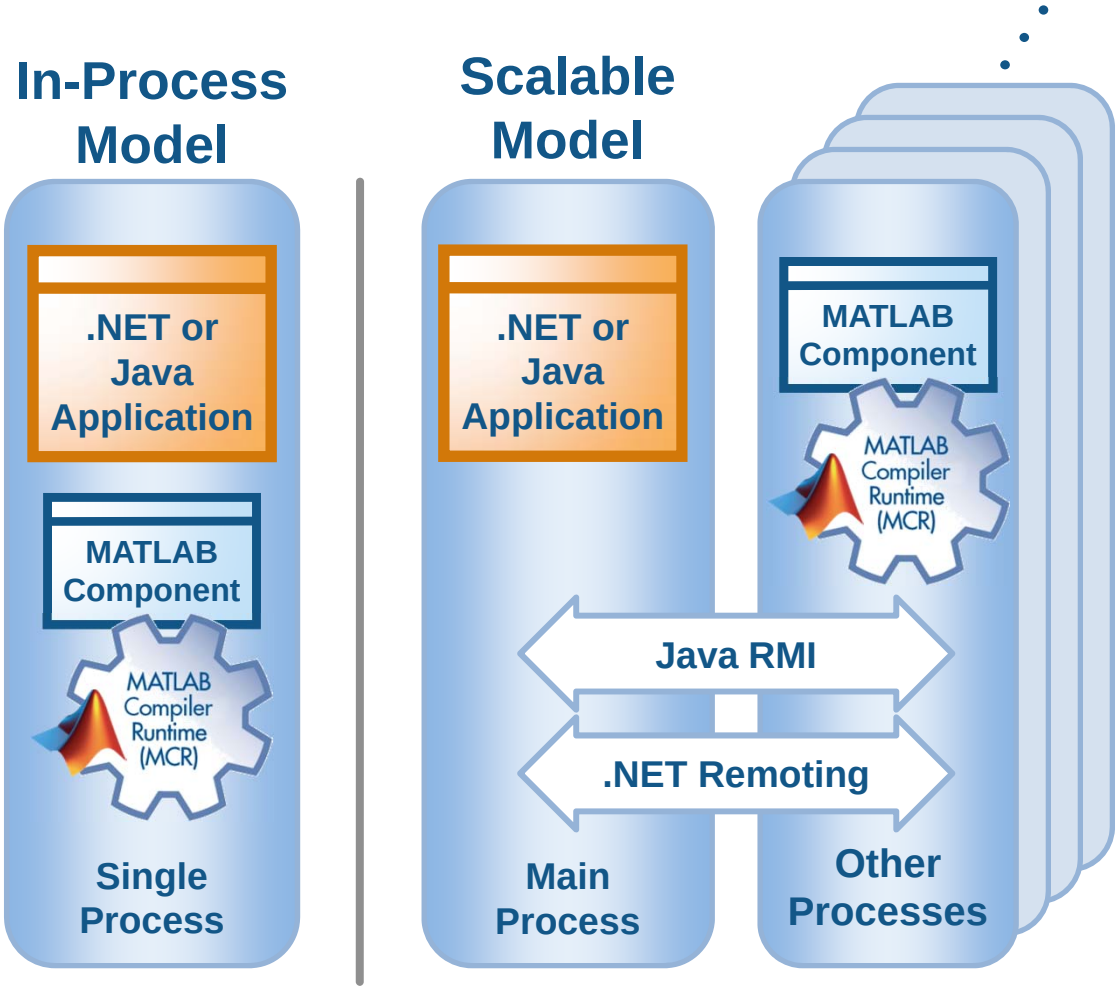
Deploying MATLAB Components

- 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

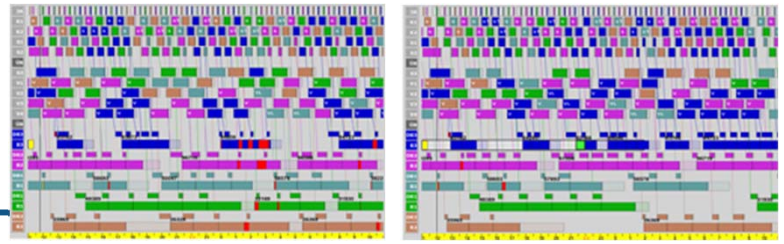


Component Process Architectures

- In process model
  - MCR in application process
- Scalable model
  - MCR in separate processes



HKM Optimizes Just-in-Time Steel Manufacturing Schedule



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.

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

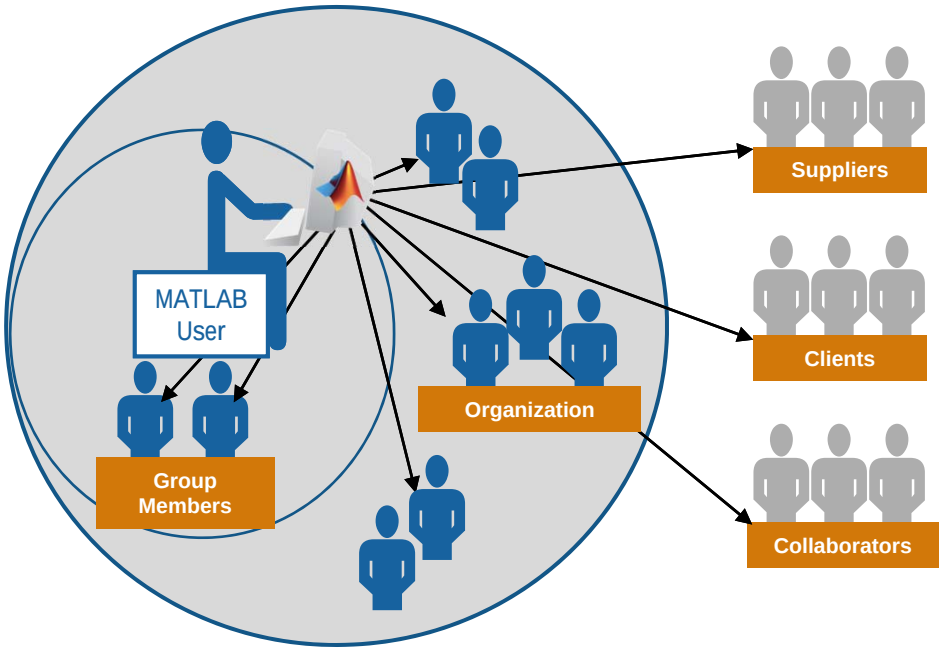
"C++, Java, or third-party optimization solutions would have required us to spend significantly more time in development or to simplify our constraints. Only MATLAB provided the flexibility, scalability, development speed, and level of optimization that we required."

Alexey Nagaytsev
Hüttenwerke Krupp Mannesmann

Link to user story

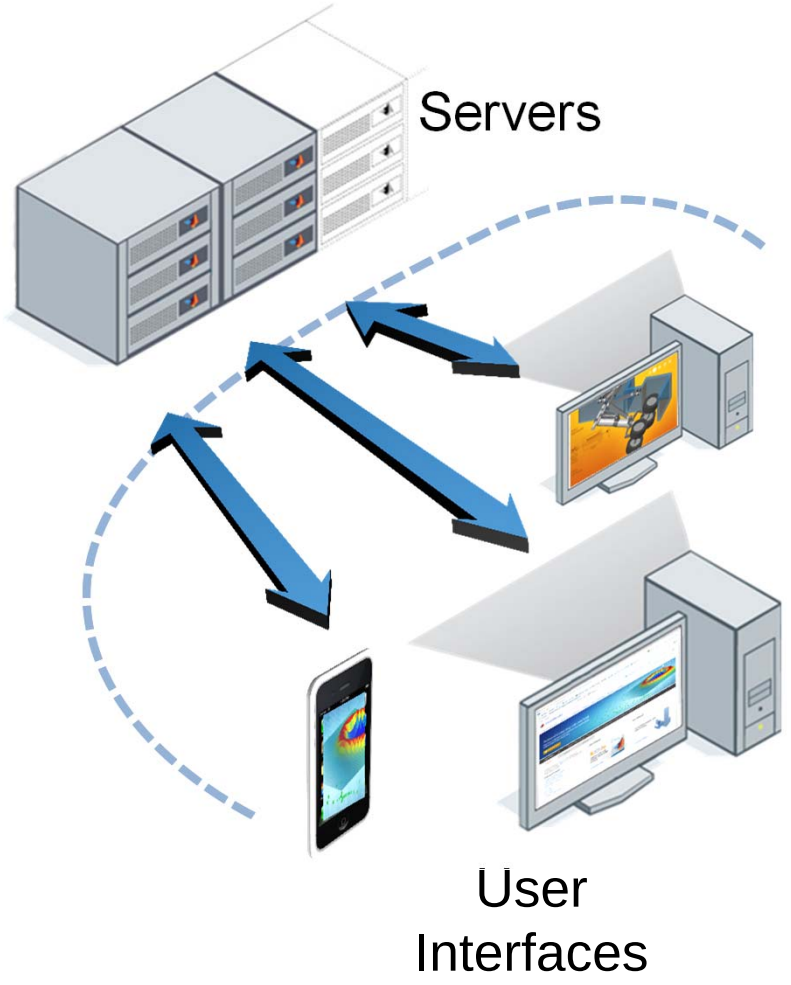
Deploying Algorithms and Applications

- Desktop Applications
- Algorithmic Components
- Web Deployment



Web Applications

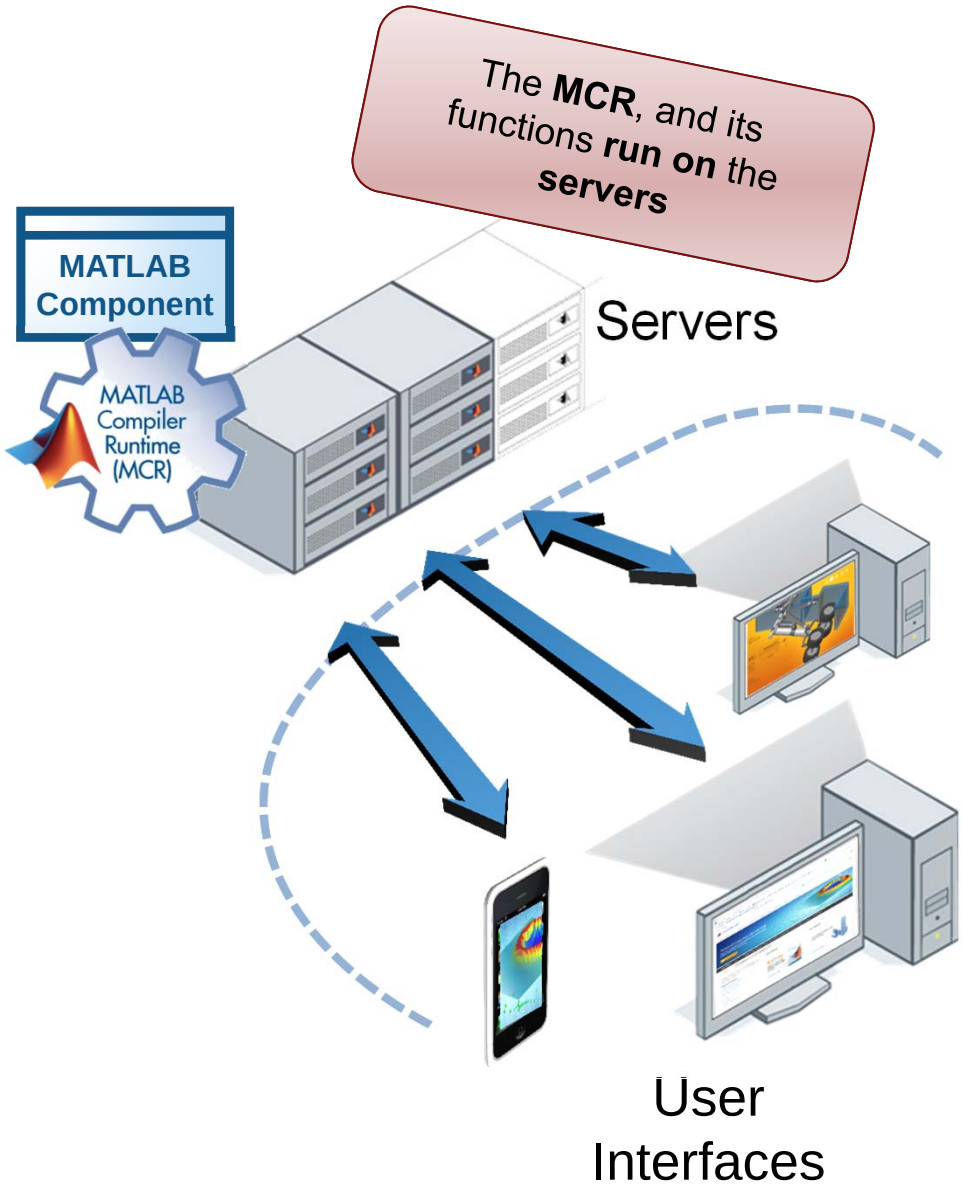
Deployed Functions	Servers
Communication	HTML XML WCF SOAP
User Interface	Web Pages Thick Clients Thin Clients Mobile Devices



Web Applications
Quiz

Where is MCR(s) Running?

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



Web Applications

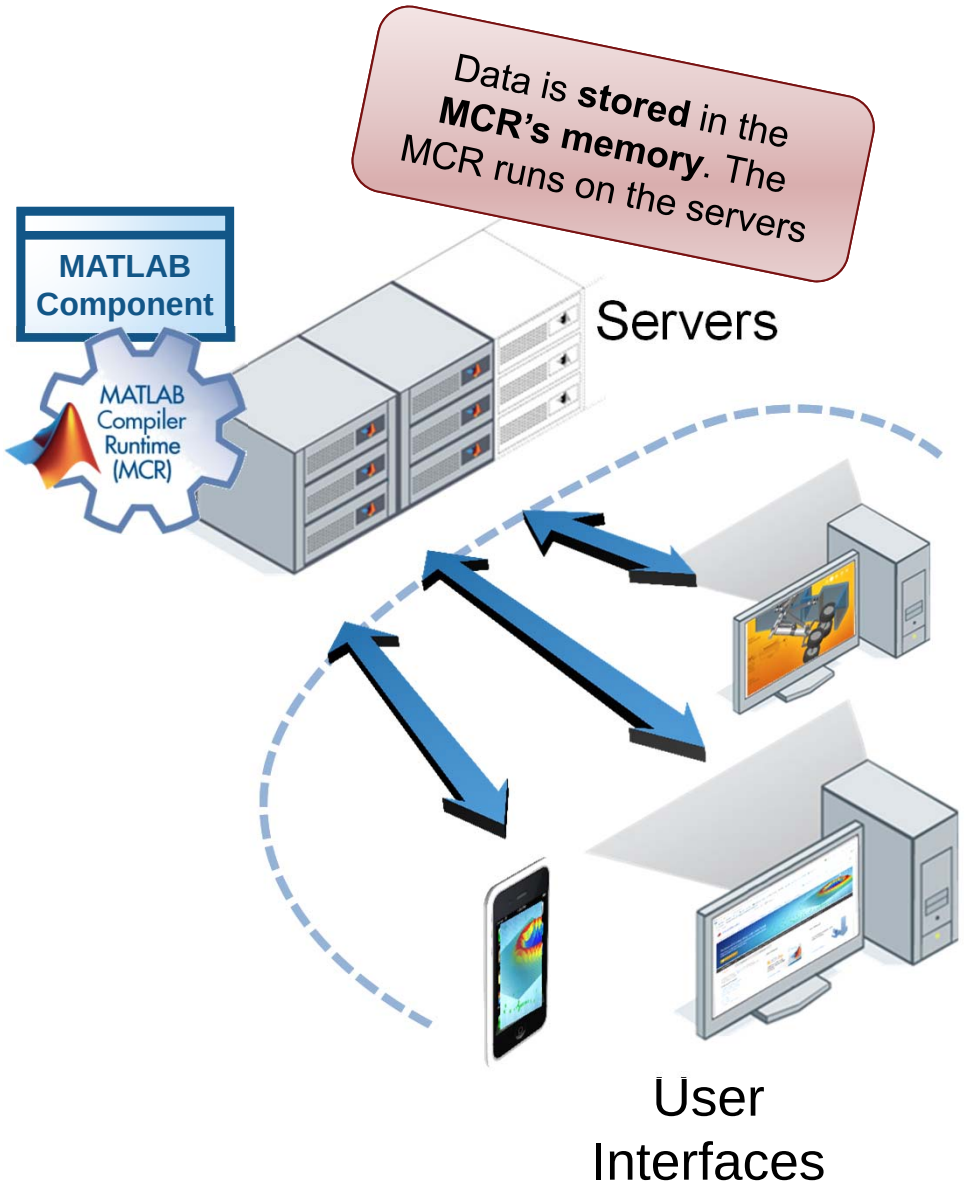
Quiz

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

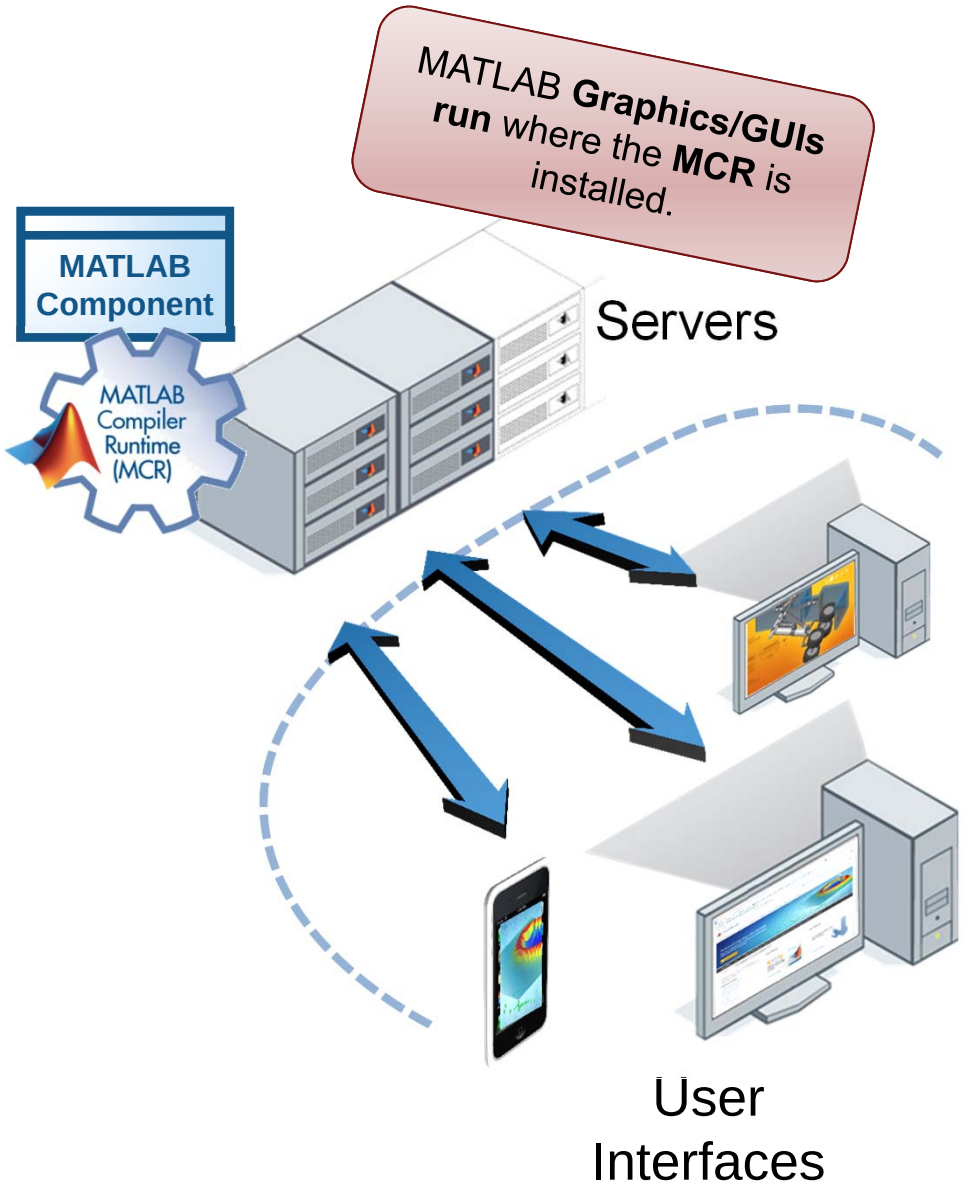
Quiz

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

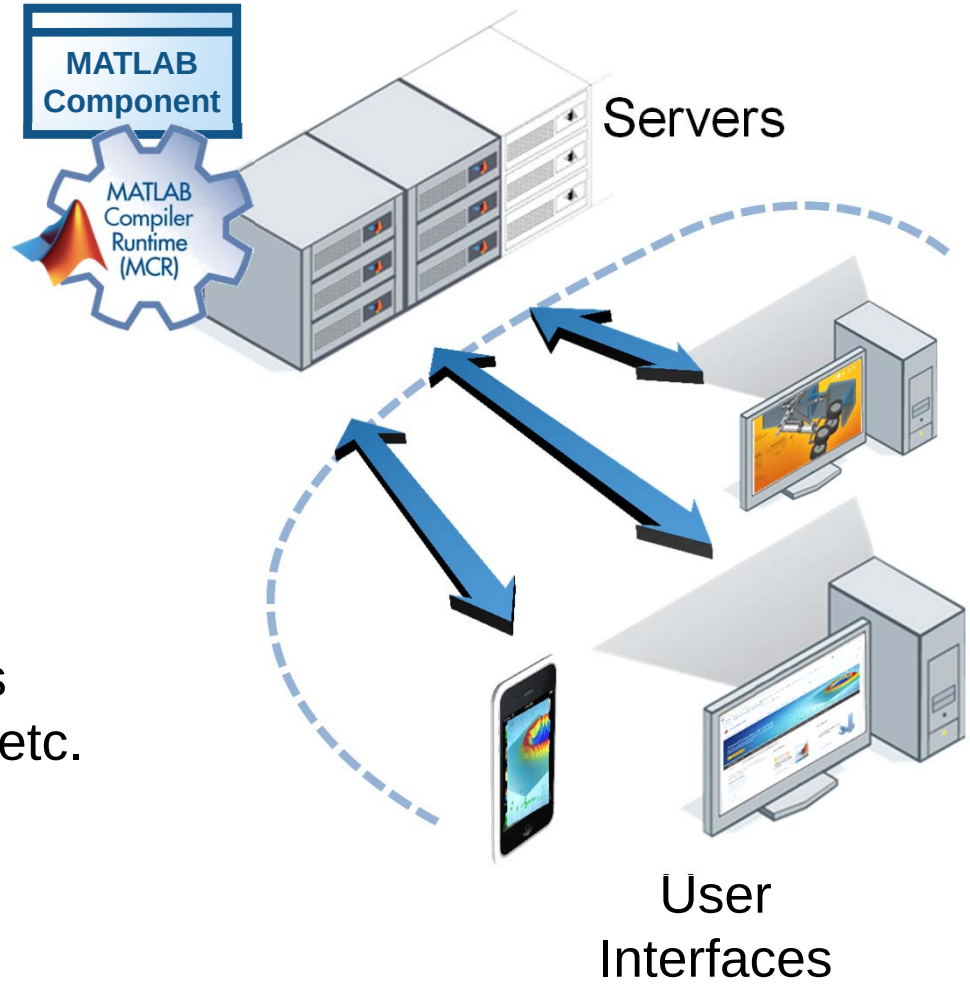
How do we get graphics or data to the user interface?

Graphics:

- WebFigures
- Streaming Images

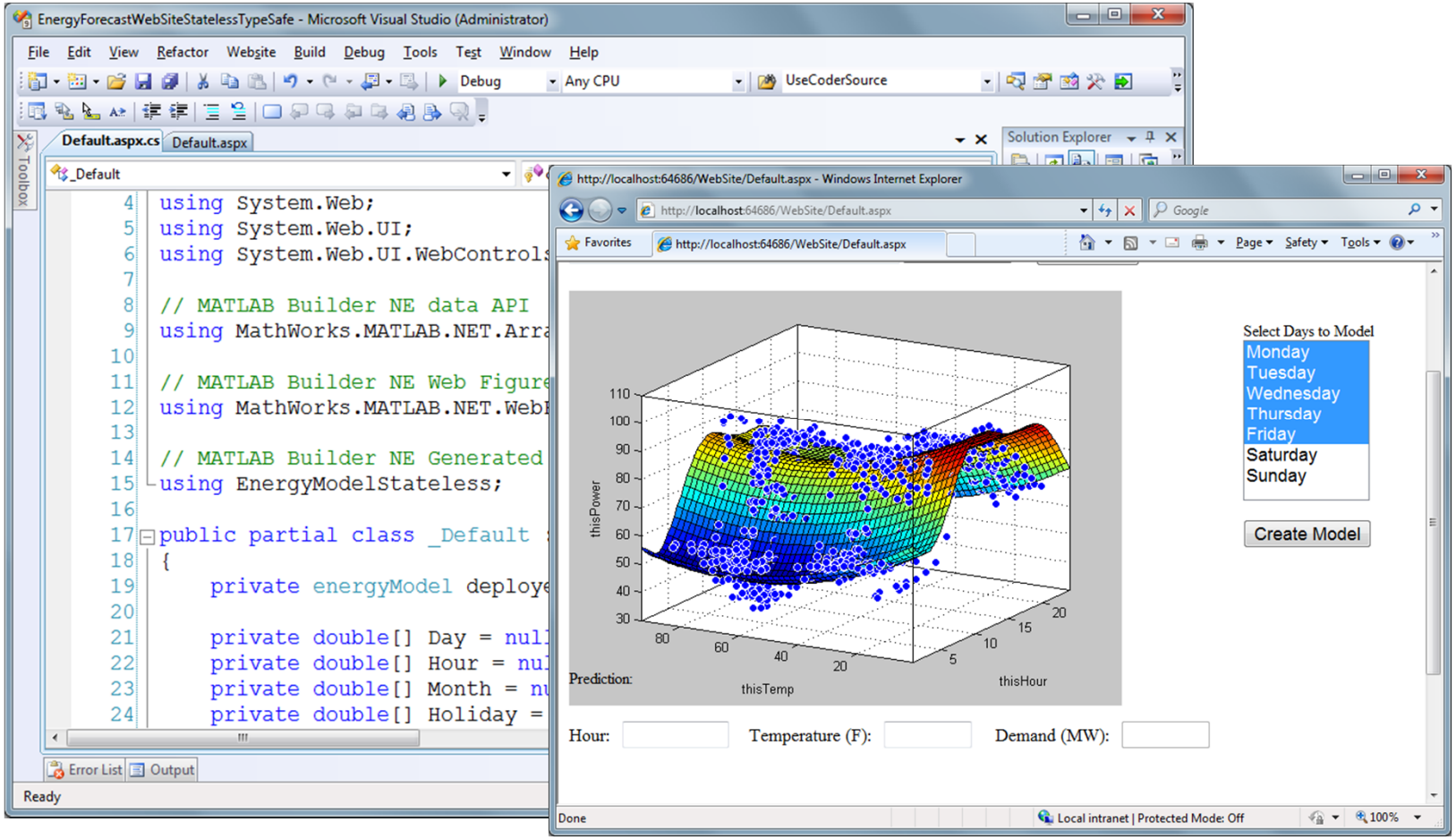
Data:

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



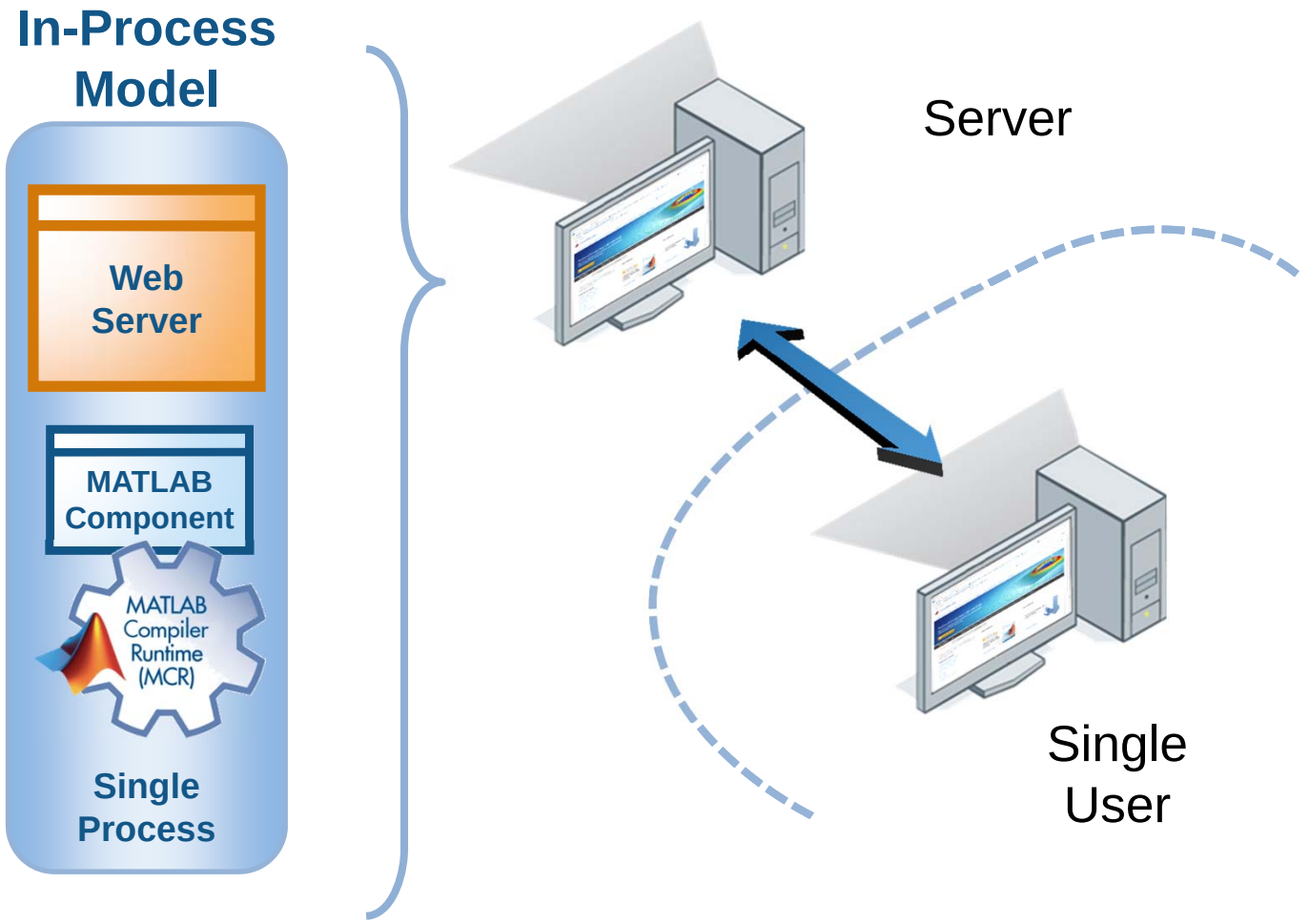
Web Deployment

MATLAB Builder NE



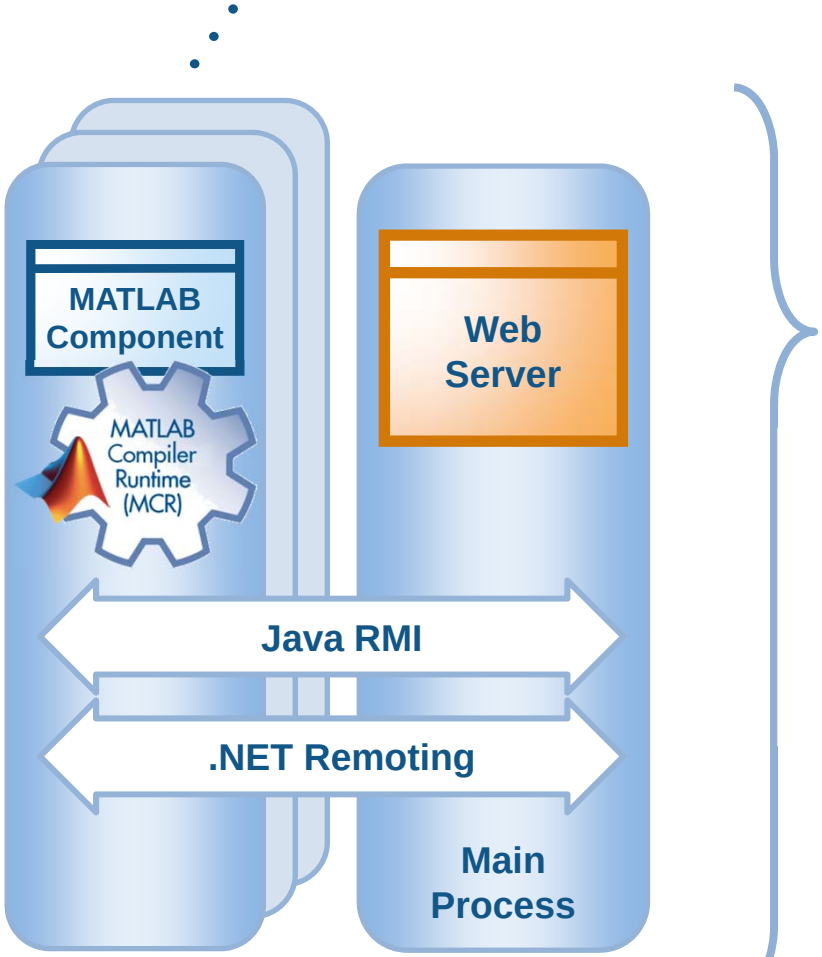
Web Deployment Example

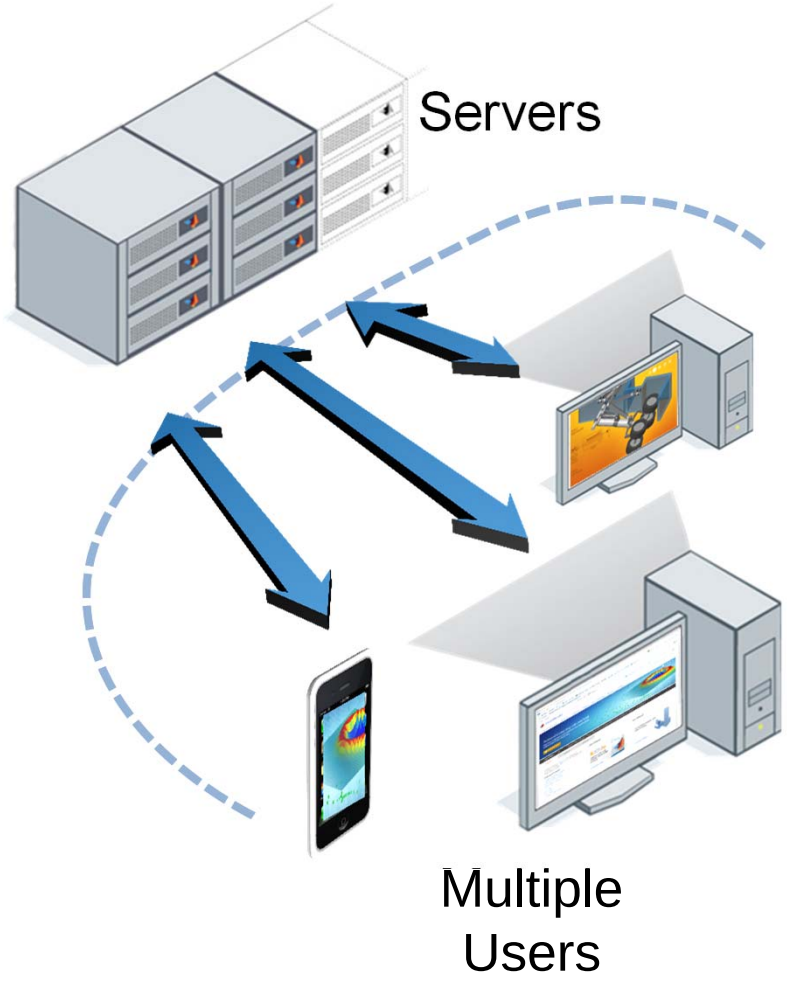
Single User



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

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

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

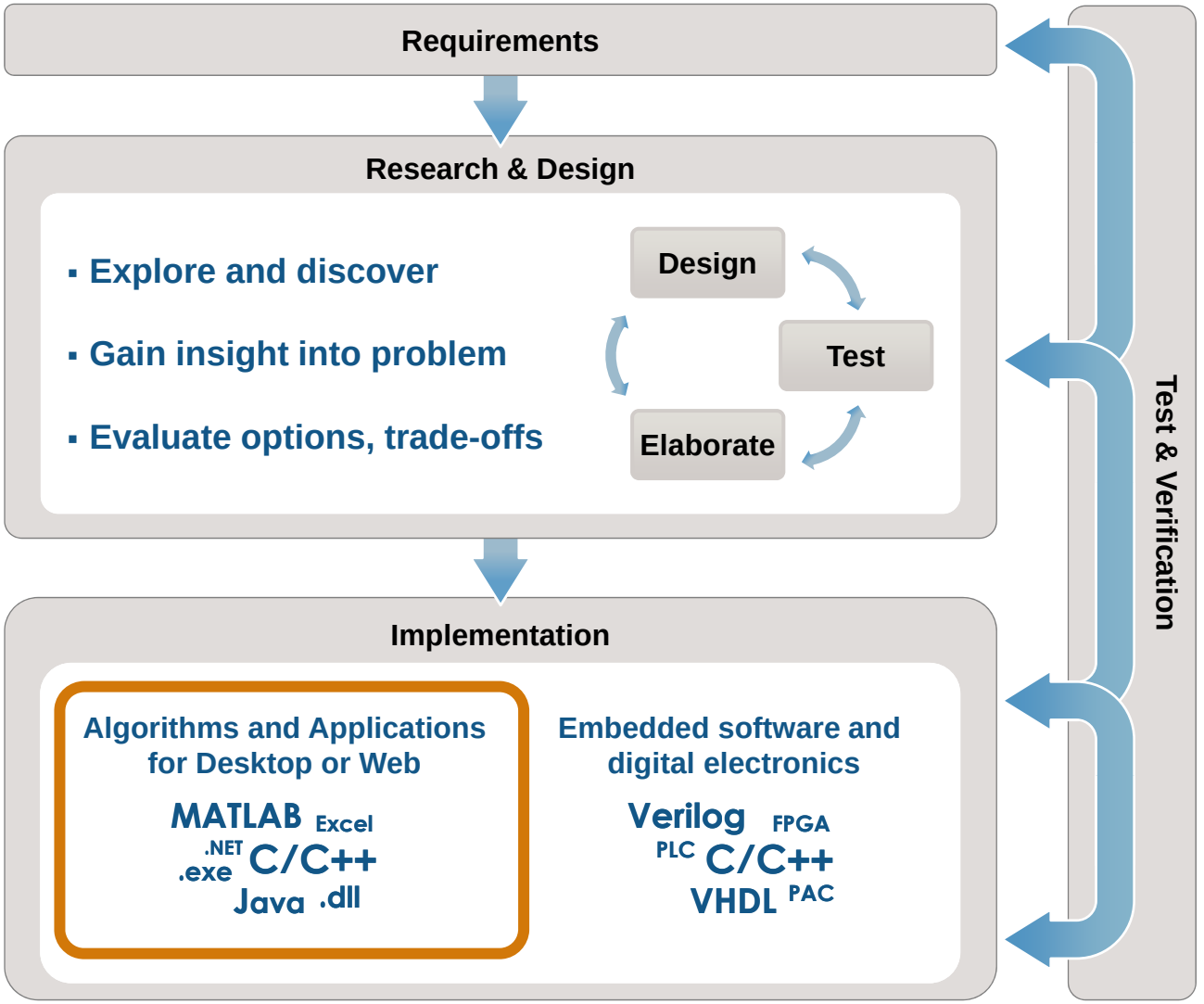
- Development time reduced by 50%
- Risk management improved across the bank
- Operational, audit, and maintenance costs reduced

" 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

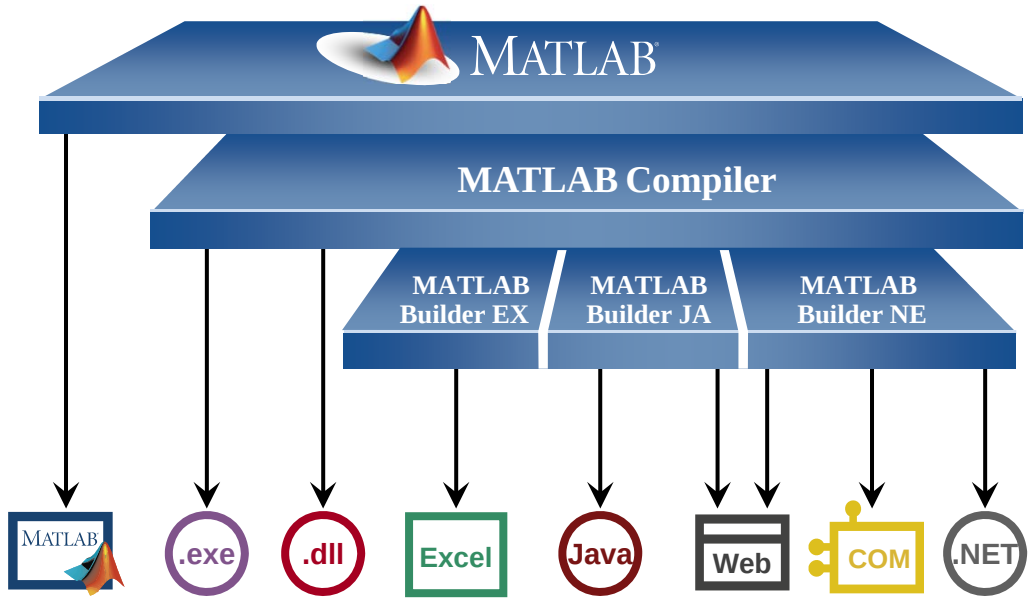
Link to user story

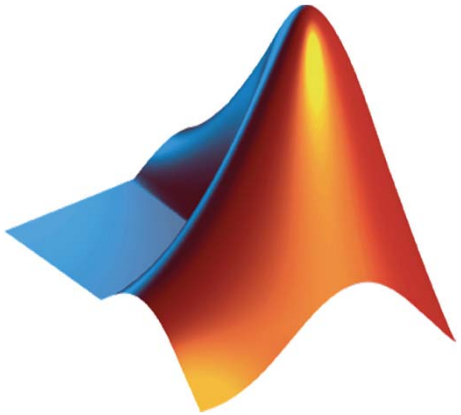
Application Deployment Process



Deploying Algorithms and Applications

- Desktop Applications
  - MATLAB Compiler
- Software Components
  - MATLAB Builders
  - MATLAB Compiler
- Web Deployment
  - MATLAB Builder NE
  - MATLAB Builder JA





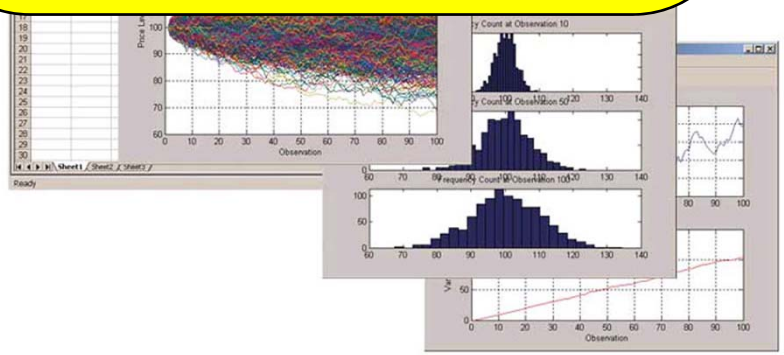
MATLAB Builder EX *for Microsoft® Excel®*

- 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**

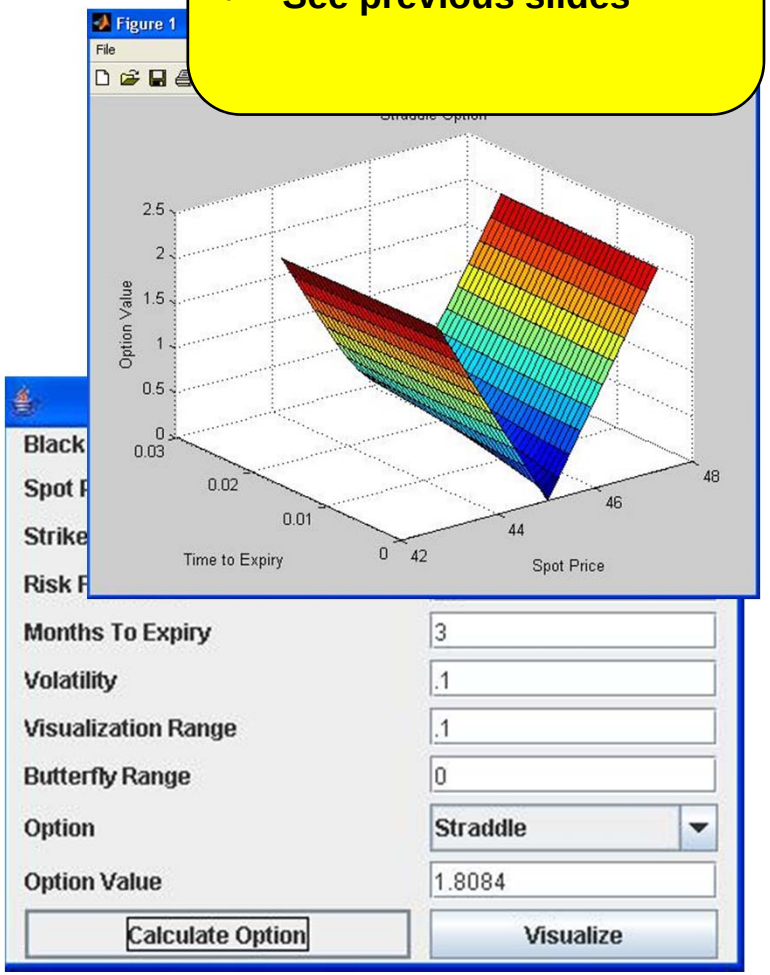


MATLAB Builder JA
for Java language

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

Update?

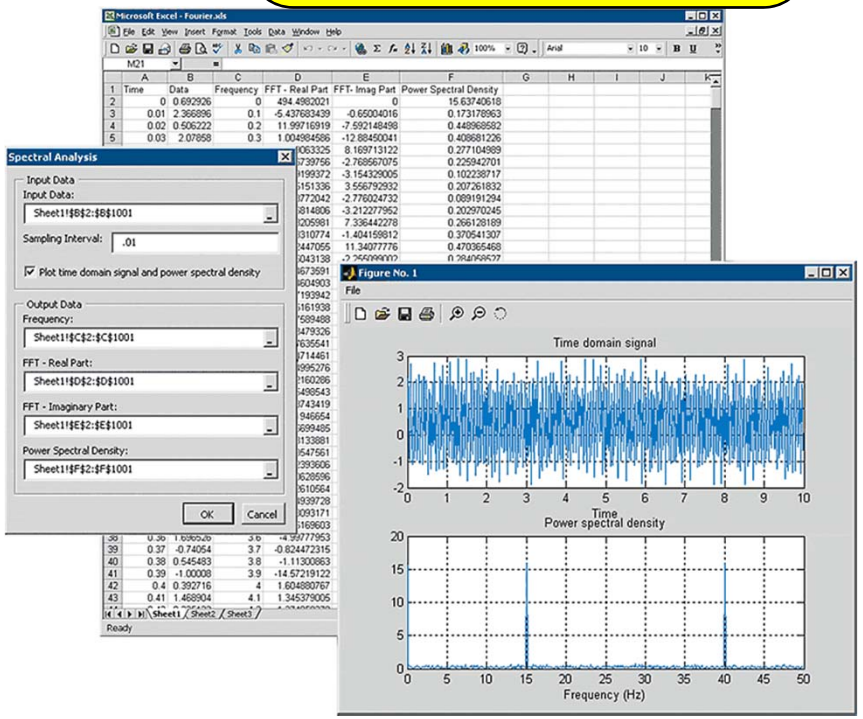
- **See previous slides**



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



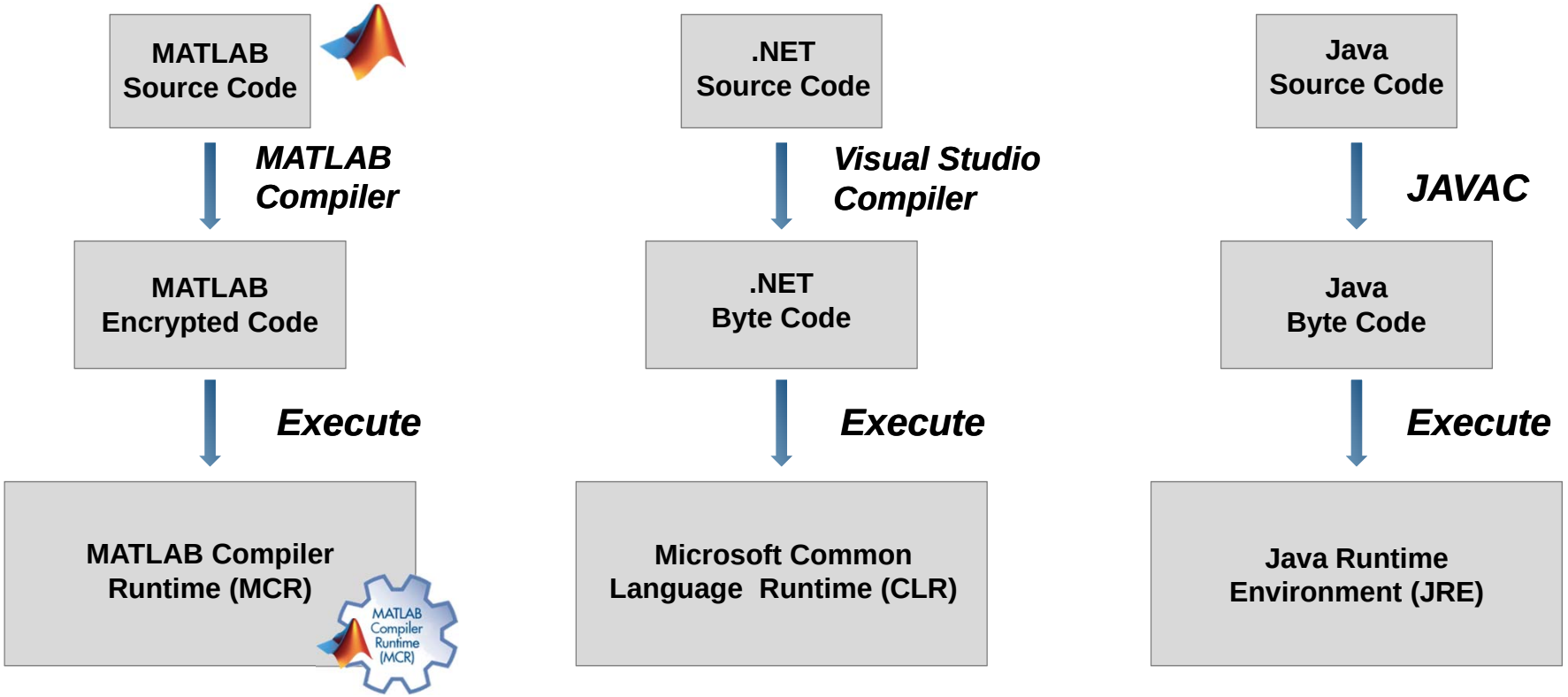
Desktop and Web Deployment

What's New for NE?
See previous slides

- MATLAB Builder NE
  - Support for .NET Remoting (for interfacing with a distributed .NET Framework) — 8b
  - Ability to manipulate MATLAB figures over the Web
- Enhanced readme.txt file
  - Customized to MATLAB Compiler deployment requirements — 9a
  - Generated with each build
- Redesigned Deployment Tool facilitates navigation
  - Cancellable progress dialog — 9b
  - 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

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

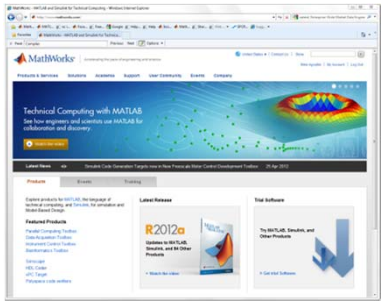
- MATLAB Compiler Runtime (MCR)
  - Enables the execution of generated applications
  - Deployed and installed only once on end-user desktop
- Standalone executables, libraries, or components
  - Generated each time MATLAB Compiler runs
  - Contains all supporting files

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

Understanding the Web

Use

Deploy



Web Browser

Here be Dragons (INTERWEB)

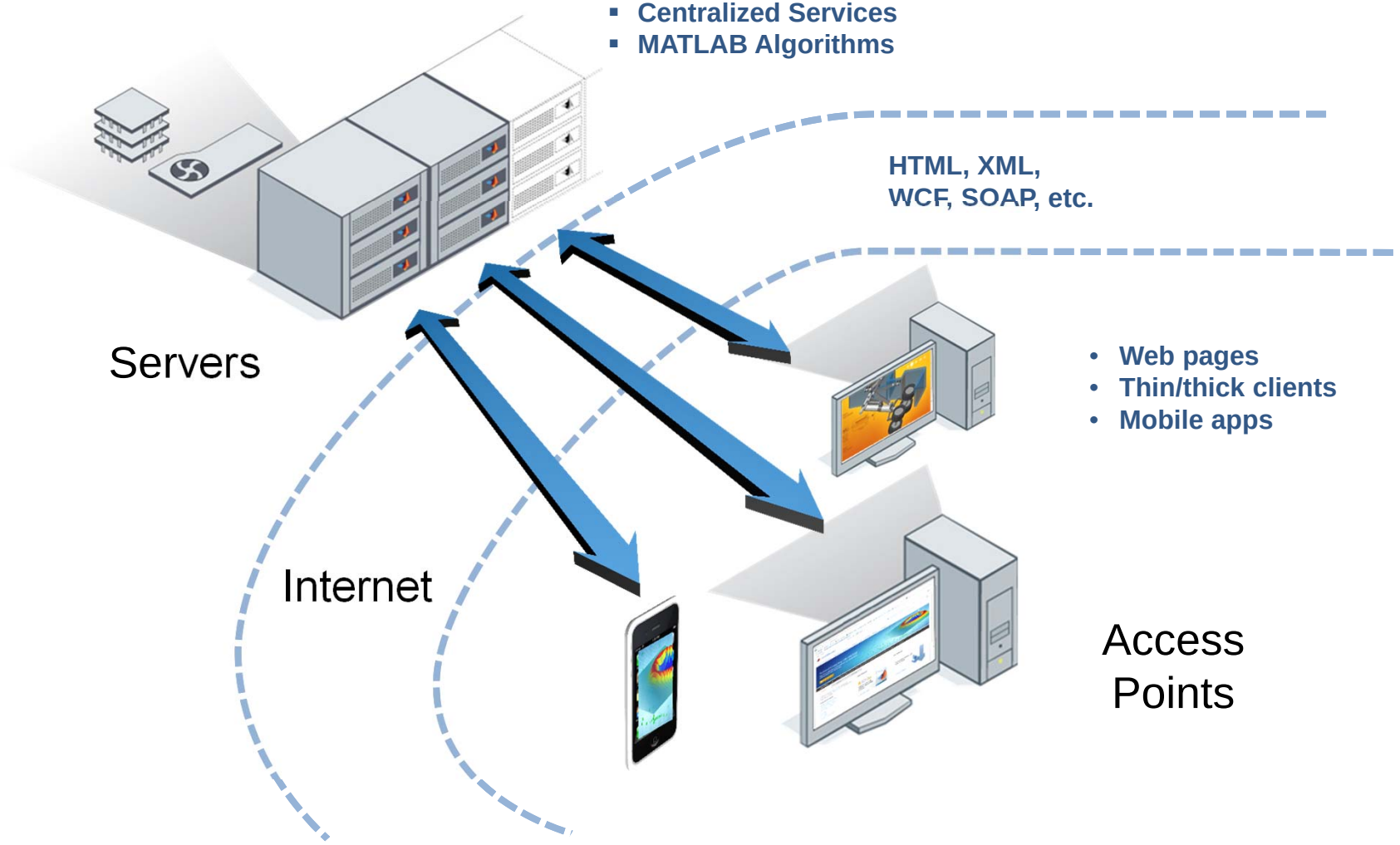
Web Client Application

Web Service

Web Server

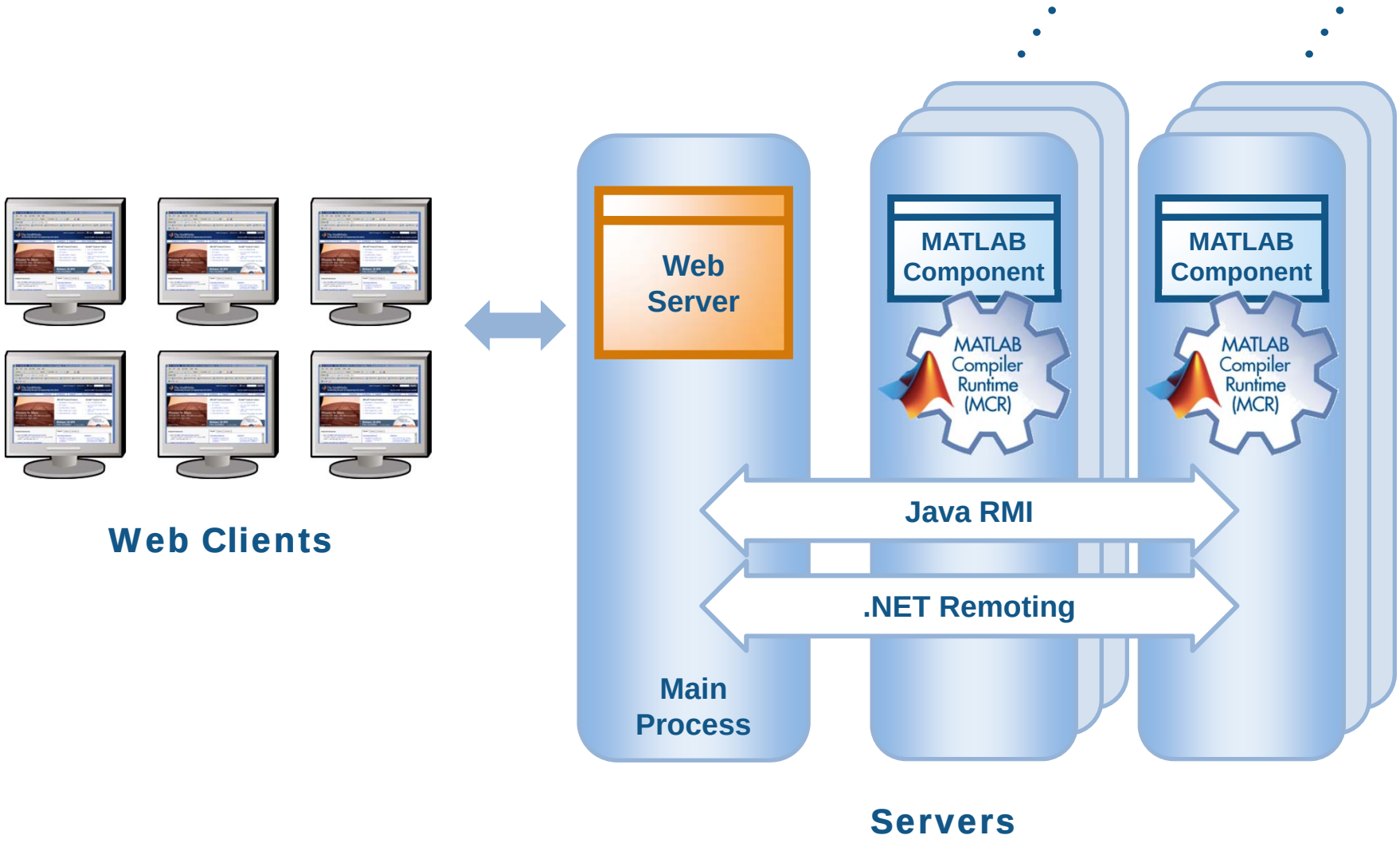
Web Applications

- Computational Resources
- Centralized Services
- MATLAB Algorithms



- Web pages
- Thin/thick clients
- Mobile apps

Web Deployment
How to Scale

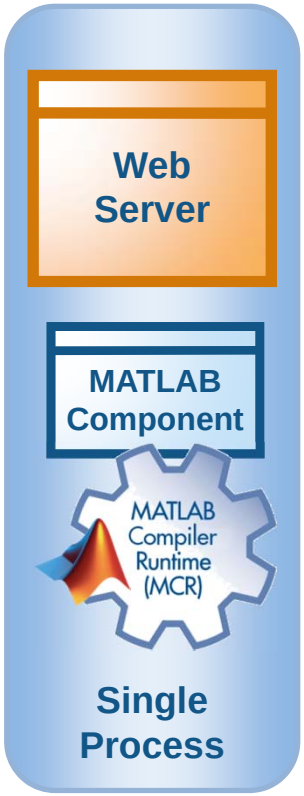


Web Deployment

What we did

Web Client

In-Process Model



Component Process Architectures