From Apps to Web Services: Deploying Your MATLAB Algorithms and Applications

Marta Wilczkowiak
Why deploy your MATLAB algorithms?

- Raise awareness of your work
- Reduce duplication of efforts
- Serve your customers better
- Reduce errors caused by reimplementation
- Accelerate development cycle by avoiding recoding
Deployment considerations

- Where would the algorithm live and how it will interface with the world?
- Will the end user need and have access to MATLAB?
- Will the product be standalone or a part of larger system?
- Will many users need to access this functionality at the same time?
- What is the performance requirement?
- What product features are required?
Deployment options

- MATLAB Apps

- MATLAB Compiler
  - Standalone applications
  - Software modules

- MATLAB Production Server

- MATLAB Coder
Deployment options

- MATLAB Apps
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  - Standalone applications
  - Software modules
- MATLAB Production Server
- MATLAB Coder
MATLAB Apps

MATLAB Apps: Custom interactive applications running in MATLAB

- Easy to package, install and find
- Support full MATLAB language
- Require MATLAB to run
Deployment options

- MATLAB Apps
- MATLAB Compiler
  - Standalone applications
  - Software modules
- MATLAB Production Server
- MATLAB Coder
MATLAB Compiler and Builders

MATLAB Compiler™

MATLAB Builder™ EX
MATLAB Builder™ JA
MATLAB Builder™ NE

exe
dll/.lib
Excel Add-in
Java
WWW
COM
.NET

Generic CTF

MATLAB Compiler Runtime (MCR)
Application Virtual Machine Concept

Various language implementations

MATLAB Source Code → MATLAB Compiler → MATLAB Encrypted Code → MATLAB Compiler Runtime (MCR) → Execute


Java Source Code → JAVAC → Java Byte Code → Java Runtime Environment (JRE) → Execute
MATLAB Compiler
Product Summary

- Automatically packages your MATLAB programs as standalone applications and software components
- Supports full MATLAB language and most toolboxes
- Allows royalty-free deployment
MATLAB Compiler and Builders
What’s new?

Improvements for all phases of application deployment

- **Compiling apps** … greatly improved usability provided by a toolstrip user interface

- **Distributing apps** … customization options create a more professional software experience

- **Installing apps** … faster and more reliable download and installation of MATLAB Compiler Runtime (MCR)
Compiling Apps
App and User Interface Changes

- Two new apps for deployment – **Application** and **Library**
  - Both apps utilize tool strip style user interface

- Automatic download of runtime (MCR)
  - Ensures end user has correct version for their platform
Distribution and Installation
Improved End Customer Experience

- Customizable Installer
- Splash Screen
- Application in Start Menu
Deployment options

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MATLAB Production Server

- Directly deploy MATLAB programs into production
  - Centrally manage multiple MATLAB programs & MCR versions
  - Automatically deploy updates without server restarts

- Scalable & reliable
  - Service large numbers of concurrent requests
  - Add capacity or redundancy with additional servers

- Use with web, database & application servers
  - Lightweight client library isolates MATLAB processing
  - Access MATLAB programs using native data types
MATLAB Compiler vs MATLAB Production Server

MATLAB Source Code → MATLAB Component → MATLAB Compiler Runtime (MCR)

Package

MATLAB Source Code → MATLAB Component

Execute

Business Application

.NET Client Library

Java

Request Broker & Program Manager

Execute
What is MATLAB Production Server?

Enterprise class framework for running packaged MATLAB programs

- Lightweight client library *(for .NET & Java)*
  - Request MATLAB programs (functions)

- Server software
  - Manages packaged MATLAB programs & worker pool

- Runtime libraries
  - MATLAB Compiler™ Runtime (MCR)
Example: EXPO Conversations

Analysis Server

Java Application

Agent1
Agent2

Amazon Machine Instance

Web Server

results

.gif
.json
.csv
Example: EXPO Conversations

MATLAB

Trigger -> Agent 1

Agent 2

Java

Trigger

Executor

MPS

MPS Worker

Agent 1

MPS Worker

Agent 2
Deployment options

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MATLAB Coder

MATLAB code

```
function [mean, stdev] = stats(vals)

% #codegen

% calculates a statistical mean and a standard

mean = sum(vals)/length(vals);

stdev = sqrt(sum(((vals-mean(vals)).^2))/length(vals));

coder.extrinsic('plot');

plot(vals, '-');
```

C code

```
public static void Main()
{
    List<Circle> circleList = new List<Circle>();
circleList.Add(new Circle(3, 0, 5));
circleList.Add(new Circle(1, 4, 10));

    List<Rectangle> rectangleList = new List<Rectangle>();
rectangleList.Add(new Rectangle(0, 0, 10, 20));
rectangleList.Add(new Rectangle(0, 20, 10, 20));
rectangleList.Add(new Rectangle(0, 20, 20, 10));

    List<RightTriangle> triangleList = new List<RightTriangle>();
triangleList.Add(new RightTriangle(0, 40, 1, 2));
triangleList.Add(new RightTriangle(200, 400, 11, 21));
triangleList.Add(new RightTriangle(78, 42, 17, 21));
}
```
## Deployment options and considerations

### Summary

<table>
<thead>
<tr>
<th>feature support</th>
<th>MATLAB Apps</th>
<th>MATLAB Compiler</th>
<th>Builders</th>
<th>MATLAB Production Server</th>
<th>MATLAB Coder</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using live MATLAB</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Packaging</td>
<td>MATLAB App</td>
<td>exe, dll</td>
<td>java class, .NET assembly, Excel add-in</td>
<td>generic ctf calls over http</td>
<td>c/c++, dll, lib, exe</td>
</tr>
<tr>
<td>Simultaneous access</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Latency</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>Very Low</td>
</tr>
<tr>
<td>MATLAB feature support</td>
<td>Rich</td>
<td>Rich</td>
<td>Rich</td>
<td>Rich</td>
<td>Subset of MATLAB and few toolboxes</td>
</tr>
</tbody>
</table>
Use cases

- Clustering tool
- Medical image segmentation software
- Pension calculator
- Component of an industrial image-based quality inspection software
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