Sharing and Deploying MATLAB Programs

Sundar Umamaheshwaran
Amit Doshi
Application Engineer-Technical Computing
Summary: Data Analytics Workflow

Data Acquisition
- Engineering, Scientific, and Field
- Business and Transactional

Data Analytics
- Data Pre-processing
- Feature Extraction
- Building algorithms, math models
- Making business decisions

Analytics Integration
- Integrate algorithms with IT
- Analytics run on Embedded targets

MATLAB: Single Platform
Data Analytics Workflow: Analytics Integration

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MATLAB Analytics Integrated with Enterprise Level Application

Predictive Data Analytics
This website tightly integrates MATLAB analytics with web technologies for demonstrating predictive data analytics models in production with live data.

Get started »

Demand Forecasting
Forecast electricity demand for US power grids with live data from ISOs and weather stations using Neural Network models. Forecasts can be compared to past data as well as normal weather. Prediction bands at different confidence intervals also quantify uncertainty in forecast.

Start »

Web Service Information
Documentation on end points and query parameters for demand forecast web services

Read more

App Documentation
Documentation of the entire web application and its components

Coming soon

http://ec2-54-165-201-58.compute-1.amazonaws.com:8080/DemandForecastWeb/index.jsp
MATLAB Programs Can be Shared With Anyone

Share With Other MATLAB Users

Share With People Who do Not Have MATLAB

MATLAB User

Group Members

Suppliers

Clients

Organization

Collaborators
Before We Share Apps- Ways to Build Apps in MATLAB

- Use GUIDE
- Use MATLAB Functions to Create Apps Programmatically
- Use App Designer – 2016 a
Why App Designer

- GUIDE is our current offering for building apps with user interfaces

- Existing customers have expressed concerns
  - **Design environment** looks dated
  - **Component set** is limited
  - **Programming app behavior** is challenging
    - Difficult to share data between parts of the app
    - Generated code is hard to understand
    - No editor integration
App Designer

- Enhanced design environment
- Expanded UI component set
- Code integration
  - Tight synchronization of design and code views with embedded editing
  - New object-based code format

Built on Web Technology
App Designer is Not a Replacement for GUIDE (today)

- Limited graphics support
  - Only 2D line and scatter plots are supported
  - Does not support zoom, pan, rotate
  - Does not support custom interaction through mouse and keyboard callbacks

- Some existing UI components are not supported
  - e.g., components for creating menus, toolbars, or tables

- Optimized for small to medium apps (<100 components)
Available Resources for App Designer

- Dedicated **landing page**
  - Overview video
  - Summary of key features
  - Comparison with GUIDE
  - Summary of graphics support
  - Examples

![App Designer Examples](image)

![App Designer Features](image)
Write Your Programs Once
Then Share To Different Targets

MATLAB

MATLAB Compiler

MATLAB Compiler SDK

Apps
Files
Custom Toolbox

With MATLAB Users
With People Who Do Not Have MATLAB

Standalone Application
Excel Add-in
Hadoop
C/C++
Java
.NET
Python
MATLAB Production Server
Share with MATLAB Users

- Package an App
- Package Entire Toolboxes
- Directly share MATLAB files
App Packaging

- Apps are self-contained tools, typically with a User Interface

- Package your app as single installation file
  - Easy distribution and installation into the apps gallery
  - Automatically includes all necessary files
  - Documents required products
Custom Toolbox Packaging

- Package your toolbox as a single installer file
  - Contains all of the code, data, apps, documentation, and examples
  - Checks for dependent files and automatically includes them
  - Documents required products

- Included folders and files automatically appear on path when installed

- View details and uninstall toolboxes with Manage Custom Toolboxes dialog box
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- Clients
- Collaborators

Organization
Integrate analytics with your enterprise systems

MATLAB Compiler and MATLAB Coder

MATLAB Coder

for k=1:max
x = fft(dat)
y = 20*log1
\nMATLAB Compiler and SDK

for k=1:max
x = fft(dat)
y = 20*log1
### MATLAB Compiler SDK or MATLAB Coder for C code?

<table>
<thead>
<tr>
<th>Output</th>
<th>Shared libraries</th>
<th>Portable and readable C source code</th>
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<tr>
<td>MATLAB language support</td>
<td>Full</td>
<td>Subset</td>
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<tr>
<td>Library Dependency</td>
<td>MATLAB Runtime</td>
<td>None</td>
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<td>Supported toolboxes</td>
<td>Most toolboxes</td>
<td>Some toolboxes</td>
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<td>Extensions</td>
<td>MATLAB Production Server</td>
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Share with People Who Do Not Have MATLAB

- MATLAB Compiler
- MATLAB Compiler SDK

- Standalone Application
- Excel Add-in
- Hadoop
- C/C++
- Java
- .NET
- Python
- MATLAB Production Server

Share Applications Built Completely in MATLAB
Integrate MATLAB Programs With Your Own Software

- Royalty-free Sharing
- IP Protection via Encryption
Share Applications Built Completely in MATLAB

1. Application Author

2. MATLAB Compiler

3. End User

- MATLAB
- Standalone Application
- Excel Add-in
- Hadoop

- MATLAB Compiler
- MATLAB Runtime
Integrate MATLAB Programs With Your Excel

Application author and software developer *might* be same person
Integrate MATLAB Programs With Your Own Software

Application author and software developer might be same person
Scale Up with MATLAB Production Server

Most efficient path for creating enterprise applications

Deploy MATLAB programs into production
  – Manage multiple MATLAB programs and versions
  – Hot Deployment: Update programs without server restarts
  – Reliably service concurrent requests

Integrate with web, database, and application servers
**MATLAB Production Server**

Enterprise Class Framework For Running Packaged MATLAB Programs

- **Server software**
  - Manages packaged MATLAB programs and worker pool

- **MATLAB Runtime libraries**
  - Single server can use runtimes from different releases

- **RESTful JSON interface and lightweight client library (C/C++, .NET, Python, and Java)**
MATLAB Production Server Demos
MATLAB Analytics Running using MPS

- Solar Radiation Estimation WebApp

\[ R_s = a(1+bH)(1-e^{-cAt^3}) \]
Layers of Data Analytics

Data Layer

- Databases
- Data Warehouses

Analytics Layer

- Open Source
  - Python
  - R
- Enterprise
  - Revolution Analytics
  - Microsoft

Presentation Layer

- Data Visualization
  - Spotfire
  - Tableau
  - Qlik
  - Microsoft Excel
MATLAB Analytics with TIBCO Spotfire

- MATLAB analytics for use with Spotfire desktop, web, and mobile visualizations and dashboards
  - *Individual MATLAB sessions for small scale MATLAB analytics support*
  - *MATLAB Production Server for large scale, robust analytics support*
Reference Diagram
Share with People Who Do not Have MATLAB

- Program once, then choose your target:
  - Desktop, Web, Enterprise applications
  - C++, Java, Python, .NET

- Royalty-free distribution

- Encryption to protect your IP
Online Resources

- Documentation – [Create and Share Toolboxes](#)
- Website – [Desktop and Web Deployment](#)
- Free White Paper – [Building a Website with MATLAB Analytics](#)
- Website – [Using MATLAB With Other Programming Languages](#)
Additional Resources

- Documentation
  - Source Control Integration
  - Techniques for Improving Performance
  - Unit Testing Framework

- Webinars
  - Programming with MATLAB
  - Speeding up MATLAB Applications

- MATLAB Central
  - Open exchange for the MATLAB and Simulink user community