Sharing MATLAB® Based Applications

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Data Analytics and Technical Computing Workflow

- **Data Exploration**
  - Gain Insights
  - Filter Data
  - Build Intuition
  - Hypothesize

- **Analytics Development**
  - Create prototype
  - Machine Learning
  - Optimization
  - App Development

- **Analytics Integration**
  - Version Control
  - Testing Code
  - Validation
  - Deploy & Share

- **Desktop**

- **Web Application**

- **SERVER**

- **HDFS**

- **MATLAB Production Server(s)**

- **Web Server(s)**
Ways to share your work using MATLAB

1. Collaborative Development

2. Testing your code

3. Sharing MATLAB programs with MATLAB Users
   - MATLAB Apps
   - Toolbox Packaging

4. Share MATLAB programs with people who do not have MATLAB
   - Create Standalone Executable
   - Integrate MATLAB programs with other applications
   - Deploy MATLAB application on large scale
"Scientists typically develop their own software ... recent studies have found that scientists typically spend 30% or more of their time developing software.

90% or more of them are primarily self-taught ... lack exposure to basic software development practices such as writing maintainable code, using version control and issue trackers, code reviews, unit testing, and task automation."

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Collaborative Development

- Collaborative development is growing
  - Achieve results faster and more efficiently by sharing code and ideas
  - **Key to success is the capability to manage your code**

- Modern source control environments let you:
  - Track, compare and revert changes in your code
  - Modify your working copy of the code and commit changes when ready to share with others
  - Highlight and resolve differences when multiple people edit the same file
Source Control Integration

- Manage your code from within the MATLAB Desktop
- Leverage modern source control capabilities
  - GIT and Subversion integration in Current Folder browser
- Use Comparison Tool to view and merge changes between revisions
Collaborating using GitHub
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Why formally test your code?

- **Testing improves quality**
  - Check that your code works the way you think it should
  - Can easily see what broke and where bugs are located

- **Testing saves development time**
  - Improve or rewrite your code without fear of breaking it
  - Most of the effort we spend on code, we actually spend fixing it
Effectively Test Your Code in MATLAB

- MATLAB Unit Test Framework
  - Script-based interface
  - Function-based interface
  - Object-oriented interface

- Report generation and publishing
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App Packaging

- Apps are self-contained tools, typically with a UI

- Package your app as single installation file
  - Easy distribution and installation into the app 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
Summary – Managing & Sharing MATLAB Code

Testing
- Unit Testing
- Report generation and publishing

MATLAB Authors
- MATLAB files
- Data
- Documentation

MATLAB End Users
- MATLAB files
- Data
- Documentation

GitHub
- Peer
- Collaborate
- Code Quality / Performance
  - Analysis
  - Complexity
  - Debugging
  - Profiling

Source control
- (Git, Subversion)
- Check-in / check-out
- Revision control
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A Primer on Sharing MATLAB Programs

MATLAB

MATLAB Compiler

MATLAB Compiler SDK

MATLAB Runtime

MATLAB Coder products

Integrate algorithms with custom software

Prototype algorithms on PC's

Accelerate algorithm execution

Implement algorithms on embedded processors
Deployment using MATLAB Compiler

**MATLAB Compiler** for sharing MATLAB programs without integration programming

**MATLAB Compiler SDK** provides implementation and platform flexibility for software developers

**MATLAB Production Server** provides the most efficient development path for secure and scalable web and enterprise applications
Demo: Example Used for Deployment

- **Goal**
  - Estimate daily mean global solar radiation given low cost and easily obtained measurements; thus, estimate the power that can be generated from photovoltaic cells

\[ R_s = a (1 + bH)(1 - e^{-c \Delta T^n}) \]
Demo 2: Modeling Global Solar Radiation
Using MATLAB Compiler

Compiled applications can be shared as:

- Standalone desktop applications
- Add-ins for integration with Microsoft Excel® spreadsheets
- Components that run MATLAB code against Hadoop

Create professional software with customizable installers, icons, and splash screens … without integration programming
Sharing Standalone Applications

1. Application Author
   - MATLAB
   - Toolboxes

2. MATLAB Compiler
   - Standalone Application
   - Excel Add-in
   - Hadoop

3. End User
   - MATLAB Runtime
Using MATLAB Compiler SDK

Flexible toolkit for software developers

- Integrate with applications written in C/C++, .NET, Java
- Develop applications for MATLAB Production Server

Develop a custom application server or deploy with MATLAB Production Server
Integrating MATLAB-based Components

1. MATLAB Toolboxes
2. MATLAB Compiler SDK
3. Application Author and software developer *might* be the same person
4. MATLAB Runtime

- Application Author
- MATLAB
- MATLAB Toolboxes
- MATLAB Compiler SDK
- C/C++
- Java
- .NET
- MATLAB Production Server

- Software Developer

Application author and software developer *might* be the same person.
Deployed Applications with Hadoop

MATLAB runtime

Node
Data
Map
Reduce
Node
Data
Map
Reduce
Node
Data
Map
Reduce

Datastore

HDFS

MATLAB runtime

MATLAB
MapReduce Code
Scale up with MATLAB Production Server

Most efficient path for creating enterprise applications

Deploy MATLAB programs into production
- Manage multiple MATLAB programs and versions
- Update programs without server restarts
- Reliably service large numbers of concurrent requests

Integrate with web, database, and application servers
Summary - MATLAB Application Deployment

- Share MATLAB programs with people who do not have MATLAB
  - Royalty-free distribution
  - Encryption to protect your IP

- Create both standalone applications and components for integration

- Deploy to desktop, web, and enterprise applications
Additional Resources

- **Documentation**
  - Source Control Integration
  - Techniques for Improving Performance
  - Unit Testing Framework
  - Toolbox Distribution and Documentation Tools

- **Webinars**
  - Programming with MATLAB
  - Speeding up MATLAB Applications

- **MATLAB Central**
  - Open exchange for the MATLAB and Simulink user community
Thank you