MATLAB EXPO 2017
Integrate MATLAB Analytics into Enterprise Applications

Ionut Barbu, Application Engineer
Data Analytics Workflow

Access and Explore Data

Preprocess Data

Develop Predictive Models

Integrate Analytics with Systems

Business Data

Sensor Data

Data Reduction/Transformation

Feature Extraction

Model Creation

Model Validation

Enterprise Systems

Embedded Devices

MATLAB: Single Platform
Data Analytics Workflow

Access and Explore Data
- Business Data
- Sensor Data

Preprocess Data
- Data Reduction/Transformation
- Feature Extraction

Develop Predictive Models
- Model Creation
- Model Validation

Integrate Analytics with Systems
- Enterprise Systems
- Embedded Devices

MATLAB: Single Platform
Challenges

- Bridge the gap between multiple disciplines
- Integrate solutions to enterprise scale frameworks
- Deliver fast results with large volumes of data
Different tools for development and productization

Application → Manual translation → Enterprise solution

Domain Expert → Solution Architect
What if you speed up the integration process?

Application → C/C++ shared library, Java, .NET, Python → Enterprise solution

with automatic deployment

Domain Expert

Solution Architect
Sharing and Deploying MATLAB Applications
Write Your Programs Once, Then Share to Different Targets

MATLAB

Compilers

Coders

MATLAB Runtime

With MATLAB Users

With People Who Do Not Have MATLAB
Share with People Who Do Not Have MATLAB

- Share Applications with No Additional Programming
  - Standalone Application
  - Excel Add-in
  - Hadoop, Spark
  - C/C++ shared library
- Integrate MATLAB-based Components With Your Own Software
  - Java
  - .NET
  - Python
  - MATLAB Production Server

- MATLAB Compiler
- MATLAB Compiler SDK

- MATLAB Runtime
  - Royalty-free Sharing
  - IP Protection via Encryption
Integrate MATLAB-based Components With Your Own Software

1. Application Author

MATLAB

Toolboxes

2. MATLAB Compiler SDK

C/C++ .NET Python Java

MATLAB Production Server

3. Software Developer

MATLAB Runtime

4. MATLAB EXPO 2017
Using MATLAB Compiler SDK to create Java Classes
Using MATLAB Compiler SDK to create Java Classes
MATLAB and MATLAB Production Server is the easiest and most productive environment to take your enterprise analytics or Internet of Things solution from idea to production.
Energy Load Forecast

Predictive Data Analytics
Demand Forecasting
Web Service Description
Documentation

Select Zone

Forecast

Plattsburgh International Airport
Station ID: KPBG
Contributes to zones: NYISO D-North(100%), NYISO F-Capitol(5%)
Weather forecast

Comparison
Energy Load Forecast

MATLAB Desktop
- Train in MATLAB
- Predictive Models
- Energy Data
- Weather Data

MATLAB Runtime
- LIBRARY

Web Application Server
- Apache Tomcat
- Web Server/WebService
Energy Load Forecast

MATLAB Desktop
- Train in MATLAB

MATLAB Runtime
- Predictive Models
- LIBRARY

Web Application Server
- Apache Tomcat
- Web Server/Webservice

Energy Data
Weather Data

Multiple users
Energy Load Forecast

MATLAB Desktop
- Train in MATLAB

MATLAB Production Server
- MATLAB Production Server
- LIBRARY

Web Application Server
- Apache Tomcat
- Web Server/Webservice

Request Broker

Predictive Models
- Energy Data
- Weather Data

LIBRARY

Web Application Server

Amazon Web Services
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)
Manage Your Server Instances Using a Dashboard Interface
Manage Your Server Instances Using a Dashboard Interface
Building Automation IoT Analytics on Azure

Building/HVAC automation control system
- Variety of sensors and controls
- Networked communication
- Data reduction

MATLAB Production Server

Request Broker

Azure EventHub

Azure Blob

Azure SQL

Global heavy duty electrical equipment manufacturer

Business Systems

Users

Algorithm Developers

MATLAB EXPO 2017
Technology Stack
Front-end Scalability

Application server for MATLAB

- Manage large numbers of requests to run deployed MATLAB programs

Back-end Scalability

Cluster framework for MATLAB

- Speed up computationally intensive programs on computer clusters, clouds, and grids
Parallel Computing Paradigm

Clusters
Speed-up using Multiple Cores on the Cloud
High Resolution Image Processing
Big Data Workflow

Process out-of-memory data on your Desktop to explore, analyze, gain insights and to develop analytics

Use Parallel Computing Toolbox for increased performance

Run on Compute Clusters or Spark + Hadoop (HDFS), for large scale analysis

MATLAB Distributed Computing Server, Spark+Hadoop
Scale your Applications Beyond the Desktop

<table>
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<td>Description</td>
<td>Explicit desktop scaling</td>
<td>Single-user, basic scaling to cloud</td>
<td>Scale to EC2 with some customization</td>
<td>Scale to custom cloud</td>
<td>Scale to clusters</td>
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<td>Amazon EC2</td>
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<td>United States and Canada</td>
<td>United States, Canada and other select countries in Europe</td>
<td>Worldwide</td>
<td>Worldwide</td>
</tr>
</tbody>
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Customer Example: Financial Customer Advisory Service

Global financial institution with European HQ

- Saved €2 million annually for an external system
- Quicker implementation of adjustments in source code by the quantitative analysts
- Knowledge + MATLAB = Build your own systems

Customer Example: Financial Customer Advisory Service

Algorithm Developers

MATLAB Compiler SDK

MATLAB

MATLAB Production Server

Request Broker

Request Broker

Request Broker
How to get started?

- Data Analytics
- Application Development
- Code Generation

Public

On-Site
## MATLAB®

### Data Analytics
- Data Processing and visualization
- Statistics
- Machine Learning
- Optimization Techniques
- Parallel Computing

### Application-Specific
- Control System Design
- Signal Processing
- Communication Systems
- LTE Systems

### Computational Finance
- Risk Management
- Time-Series Modelling

### Signal Processing
- Using MATLAB
- Using Simulink

### Image and Video Processing
- Image Processing
- Computer Vision

### Code Generation
- MATLAB Coder
- Interfacing with C-code

### Code Integration
- Integrating C and MATLAB

### Code Generation
- Rapid Prototyping and HIL-Simulation
- Embedded Systems
- FPGA Design
- Generating HDL Code
- Xilinx Zynq SoCs
- AUTOSAR

### Stateflow®
- Event-Based Modeling

### Simscape™
- General Simscape™
- Simscape Multibody™
- Simscape Drivelime™
- Simscape Fluids™
- Simscape Power Systems™

### Polyspace®
- Polyspace Code Prover™

### Model-Based Design
- Implementing MBD Workflow
- Model Management and Architecture
- Verification and Validation

### MATLaB®

**Application Development**
- Programming Techniques
- Building Interactive Applications
- Object-Oriented Programming

**MATLAB Coder**

**Interfacing with C-code**

**Signal Processing Using MATLAB**

**Using Simulink**

**Image Processing**

**Computer Vision**

**https://nl.mathworks.com/services/training.html**