Application Development and Deployment
With MATLAB

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Typical Industry Challenges

- How do I build robust applications?
- How do I collaborate in a team?
- What is the most efficient way to share my algorithms?
- How do I get sufficient computing performance?
From Data to Decisions and Design

Observation → Organization → Understanding → Decisions & Design

Physical Sensors → Data → Information → Knowledge → Action

Key:
1 1.1 0.1
4 1.4 NaN NaN
7 1.7 0.7 0.8
9 1.9 NaN NaN

MPG Acceleration Displacement Weight Horsepower
50 100 150 200 2000 4000 200 400 10 20 20 40

Observation
Organization
Understanding
Decisions & Design
Decisions & Design

- Build Robust Applications
- Collaborate in a Team
- Generate Custom reports
- Deploy and Scale your Applications
Building Robust Applications

- Which programming technique?
  - Scripting
  - Procedural
  - Object-oriented

- Easily create user interfaces
  - Graphical environment
  - Automatic MATLAB code generation

- Build Unit Tests
  - Built-in unit test framework
Developing in a Collaborative Environment

- **Version Control Integration**
  - GIT, SVN

- **Simulink Projects**
  - Organize, compare and maintain your models
Automatic Report Generation
Create APPs and Toolboxes to Easily Share Your Projects

- Package your code and distribute to MATLAB users
Deploy and Scale up your application

Integration
into Existing Systems & Product Deployment

MATLAB Excel
.NET .exe C/C++
Java .dll

Excel

MATLAB
CONFERENCE 2015
Share Programs Outside of MATLAB

- Royalty-free
- Encryption to protect intellectual property
Application Deployment from MATLAB

- Platform independent
- Royalty Free
- Scalable
- Flexible

Code Generation

MATLAB Coder
HDL Coder

C/C++ HDL

Application Packaging

MATLAB Compiler
MATLAB Compiler SDK

.exe .NET Java Excel
Benefits of Deploying MATLAB Code

Easily adopt algorithm improvements throughout lifecycle

- Domain experts maintain ownership of ideas, algorithms, and applications
- Flexibility to integrate with different programming languages
- Implement a common algorithm on different platforms

Avoid time consuming and error prone re-coding
The Range of Application Platforms

Standalone Applications

Web and Enterprise Applications

Scale of Distribution
Application Complexity
Enterprise Integration
Which Product will Fit Your Needs?

**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
Sharing Applications with MATLAB Compiler

- Standalone desktop applications
- Add-ins for Excel
- Run MATLAB code against Hadoop

Create professional software with customizable installers, icons, and splash screens … … without integration programming
A 3-step Workflow

1. **Application Author**
   - MATLAB
   - MATLAB Toolboxes

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

3. **End User**
   - MATLAB Runtime
Integrating Applications with MATLAB Compiler SDK

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

A flexible toolkit for software developers to create professional robust components… … **without recoding!**
Integrating MATLAB-based Components

Application Author

MATLAB
Toolboxes

MATLAB Compiler SDK

Software Developer

Application author and software developer *might* be same person

1. MATLAB
2. MATLAB Compiler SDK
3. MATLAB Production Server
4. MATLAB Runtime
R2015a: Functionality Transition

R2014b and earlier

- MATLAB Builder NE
  - .NET assembly
- MATLAB Builder JA
  - .jar files
- MATLAB Builder EX
  - Excel add-ins for MATLAB Production Server
  - Excel add-ins for desktop
- MATLAB Compiler
  - Deployable archive for MATLAB Production Server
  - C/C++ shared libraries
  - Hadoop
  - Standalone applications

R2015a and later

- MATLAB Compiler SDK
  - .NET assembly
  - .jar files
  - Tools for MATLAB Production Server
    - Excel add-ins for servers
    - Deployable archives
    - Client libraries (new in 15a)
    - Debugging tools (new in 15a)
  - C/C++ shared libraries
  - Excel add-ins for desktop
  - Hadoop
  - Standalone applications
Scale up with MATLAB Production Server

**Directly deploy MATLAB programs into production**
- Centrally manage multiple production MATLAB applications
- Automatically deploy updates without server restarts
- **Reduce risks**

**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

**Database Integration**
- Take the algorithm to the data
- Request MATLAB analytics directly from database servers
Production Deployment Workflow

Development
- MATLAB Developer
- Algorithm
- MATLAB Compiler SDK
- CTF
- Web Application
- Client Library
- Function Call

Enterprise Application Developer

Production
- MATLAB Production Server
- Web Application
- Client Library
- MATLAB Production Server
Application Deployment from MATLAB

- 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
Scaling up Computational Intensity

MATLAB only

- Prototype MATLAB code
- Run a single MATLAB process

MATLAB + PCT

- Refine MATLAB code to leverage Parallel Computing
- Leverage your hardware
- Scale Parallel Algorithm to high computational resource

MATLAB Distributed Computing Server

- Profile (Local)
- Profile (Cluster)

Desktop Computer

Local

Simulink, Blocksets, and Other Toolboxes

MATLAB

Computer Cluster

Cluster

Scheduler

Profile (Cluster)
Deployed Applications with Hadoop
Using MATLAB Compiler
Explore and Analyze Data on Hadoop

Using MATLAB Distributed Computing Server

MATLAB MapReduce Code

MATLAB Distributed Computing Server

Datastore

HDFS

Node Data

Map Reduce

Node Data

Map Reduce

Node Data

Map Reduce

hadoop
Practical use case: Load Demand Forecasting

Database Access
Neural Network
Parallel Computing on HPC
Sharing on the web
Success Stories
UniCredit Bank Austria Develops and Rapidly Deploys a Consistent, Enterprise-Wide Market Data Engine

Challenge
Improve risk management operations throughout a multinational financial institution

Solution
Use MATLAB, MATLAB Compiler, and MATLAB Compiler SDK 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
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
Take-aways

- MATLAB is a very efficient algorithm development environment
  - Built-in libraries
  - Utilities for sharing and collaborating

- MATLAB is highly scalable
  - Parallel computing capabilities
  - Integration with clusters for distributed computing

- MATLAB bridges the business integration gap
  - Centralize your application and access it from anywhere
Thank You for Attending!