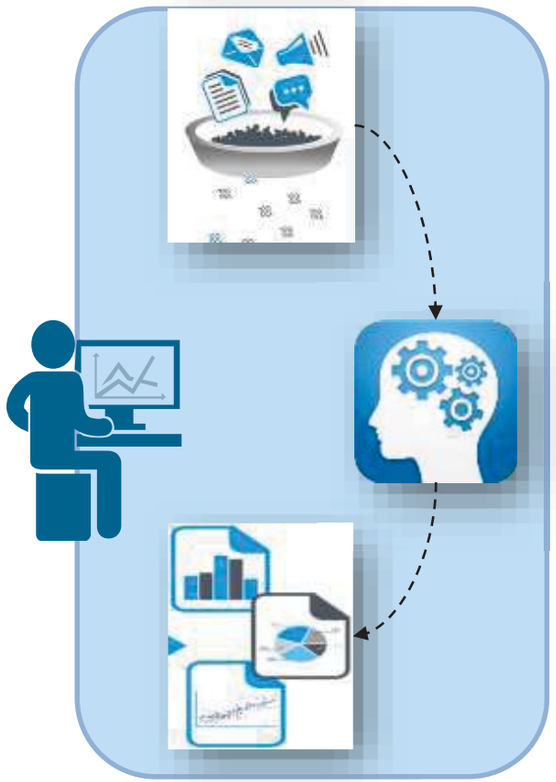
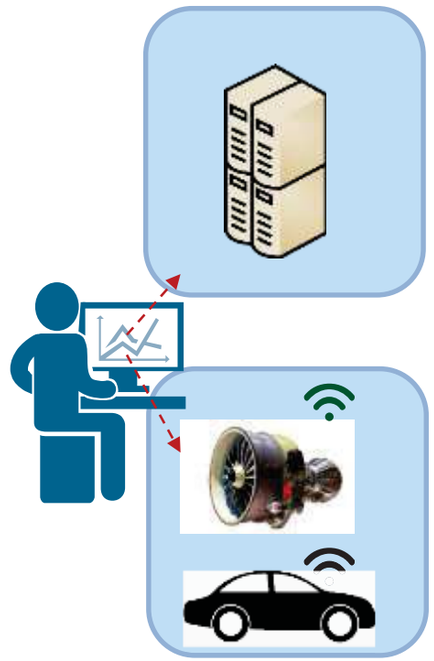

MATLAB EXPO 2017
KOREA
4월 27일, 서울
등록 하기 matlabexpo.co.kr

엔터프라이즈 시스템에서의 빅데이터 애널리틱 애플리케이션 구축을 위한 MATLAB 기능

성호현 차장
Senior Application Engineer
The MathWorks Korea

Data Analytics Workflow





Business Systems

Smart Connected Systems

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

Key Takeaways

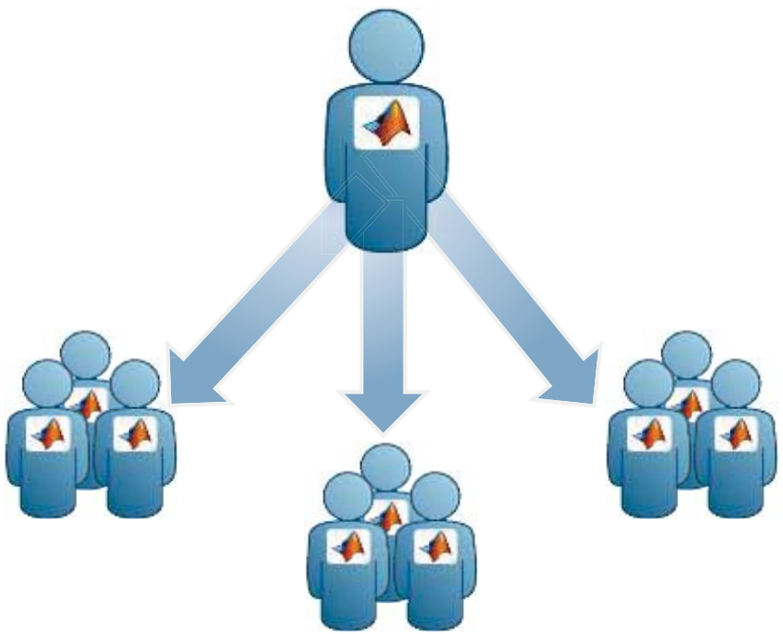
1. Distribute applications to non-MATLAB users royalty-free.
2. Integrate MATLAB functions into existing workflows and development platf orms.
3. Deploy MATLAB Analytics for Big Data on Hadoop enabled Spark Clusters .
4. Deploy MATLAB applications to service simultaneous user requests enterp rise-wide via web or cloud frameworks.

Challenges

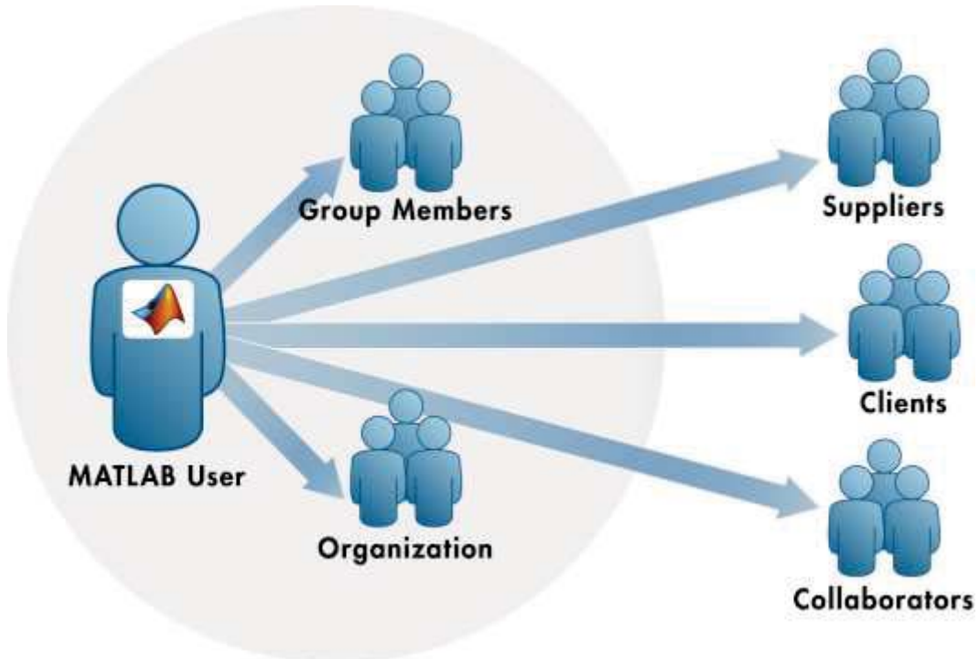
- Multiple internal and external consumers of MATLAB algorithms
- Challenging and time consuming to re-code MATLAB algorithms for integrat ion into IT frameworks
  - Development resources are scarce and time-to-market is short
- Company priority to deploy solutions to enterprise scale web or cloud frame works
  - Scale application to serve large numbers of simultaneous requests

MATLAB Programs Can be Shared With Anyone

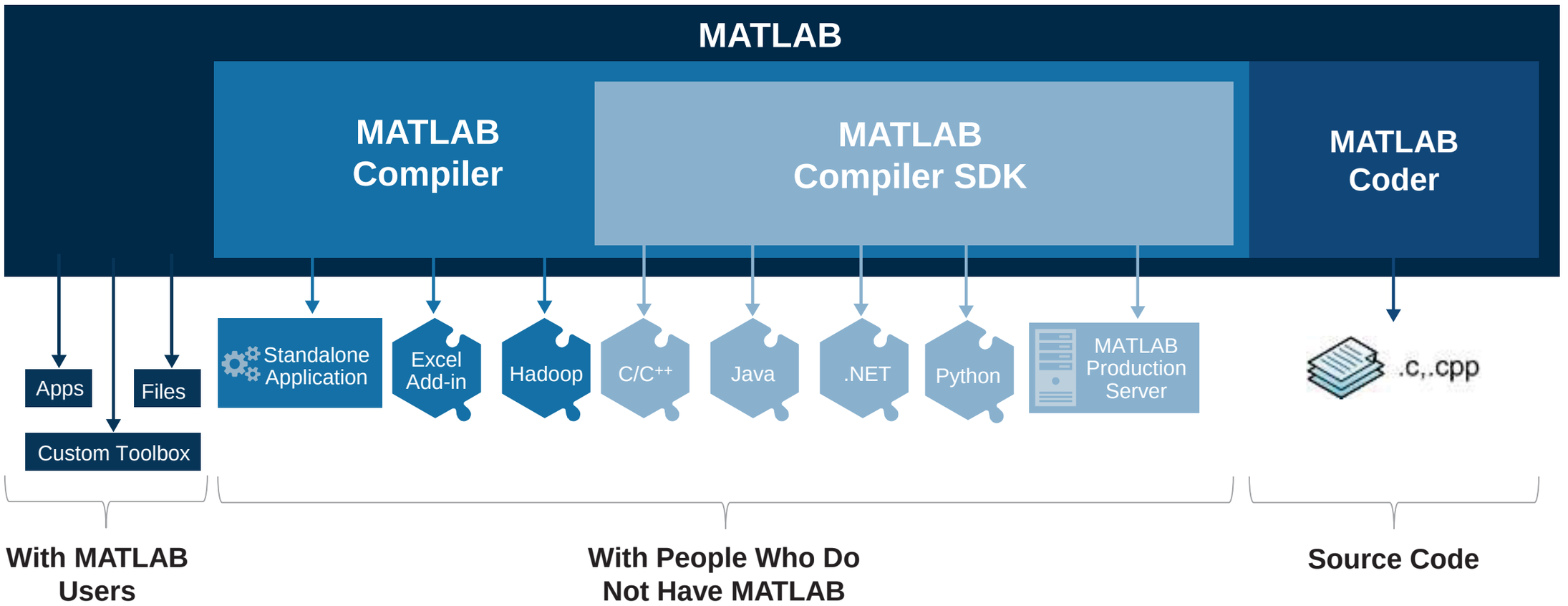
Share With Other MATLAB Users



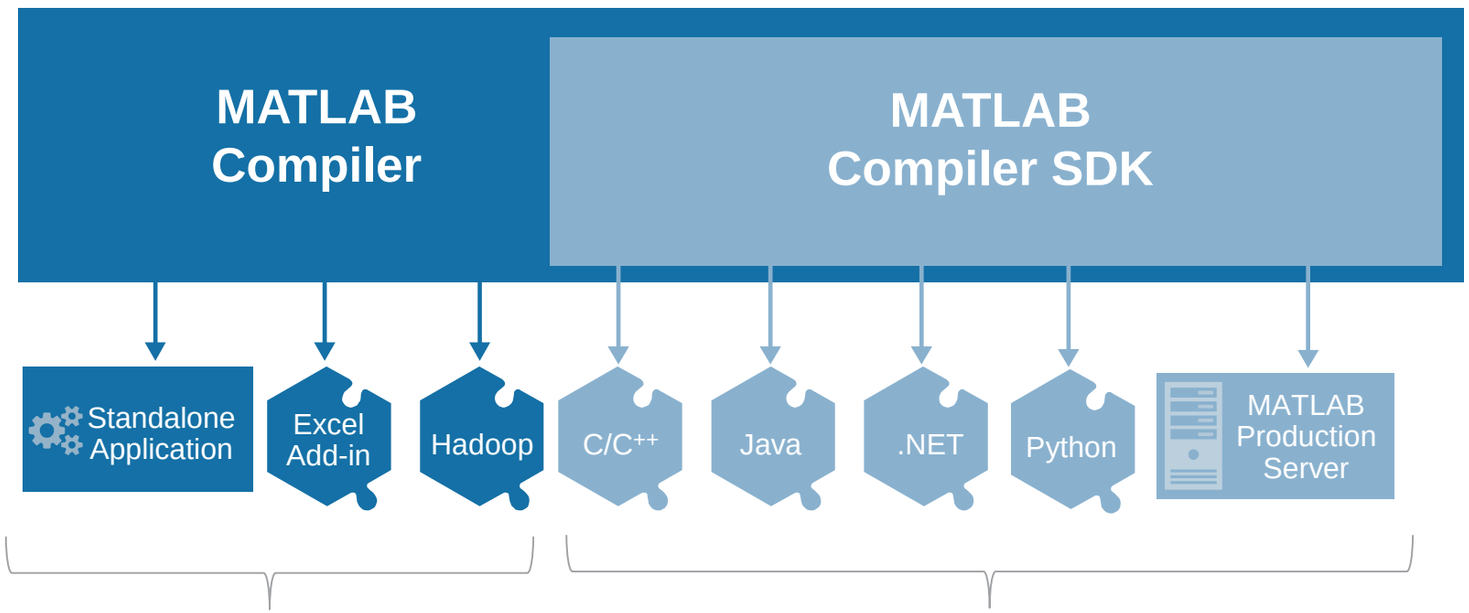
Share With People Who do Not Have MATLAB



Write Your Programs Once
Then Share To Different Targets

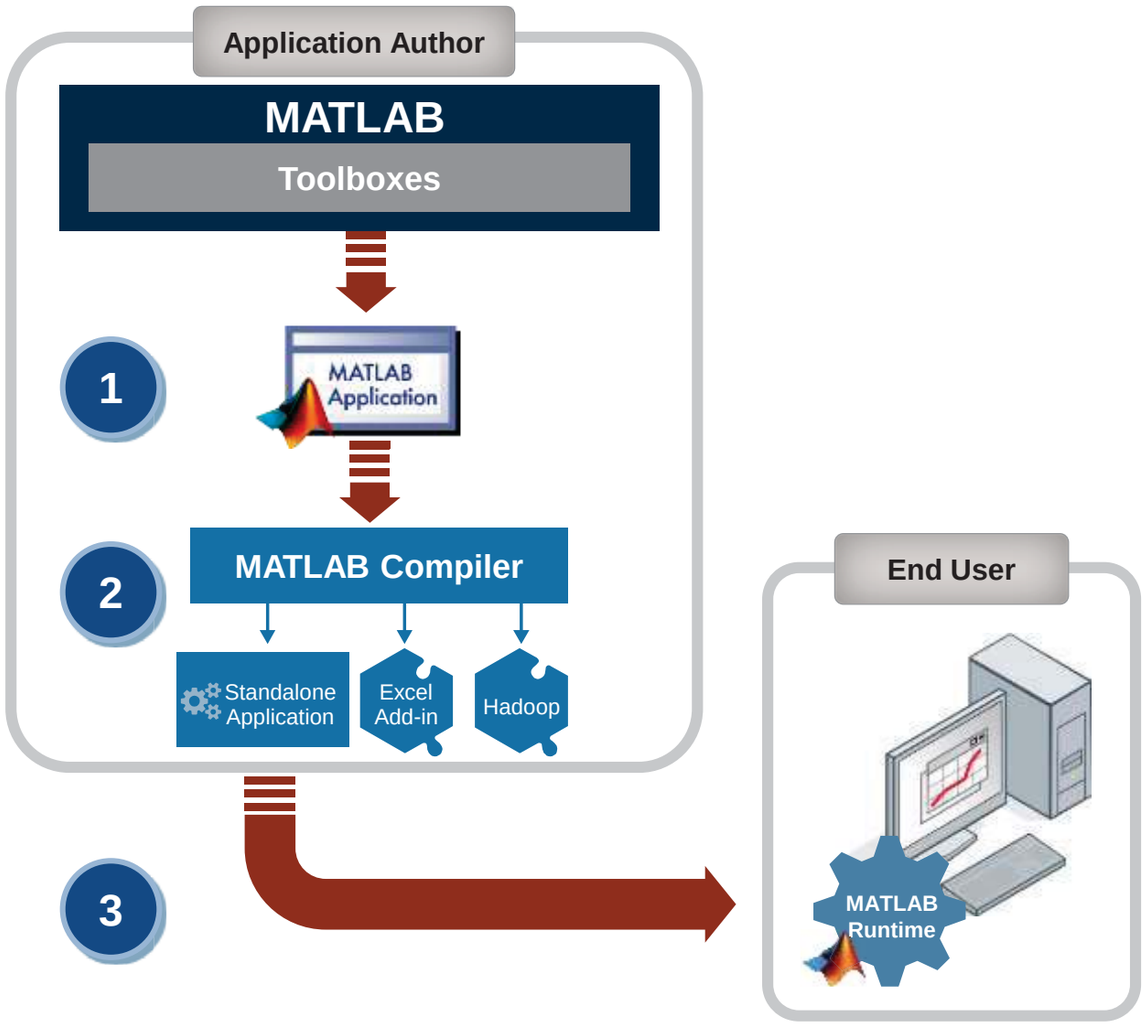


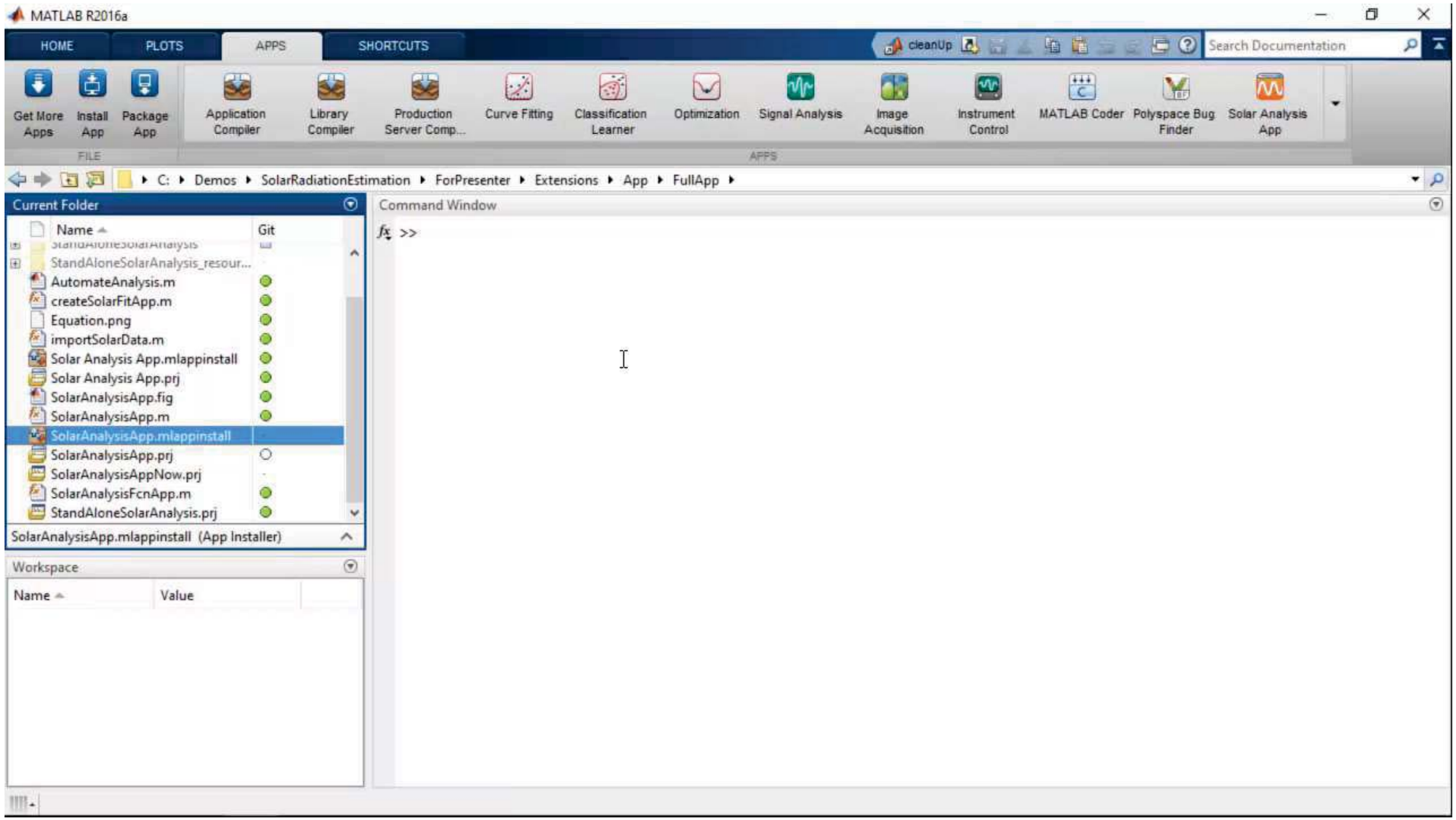
Share with People Who Do Not Have MATLAB



- Royalty-free Sharing
- IP Protection via Encryption

Share Applications Built Completely in MATLAB

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Production Server Comp...
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Classification Learner
Optimization
Signal Analysis
Image Acquisition
Instrument Control
MATLAB Coder
Polyspace Bug Finder
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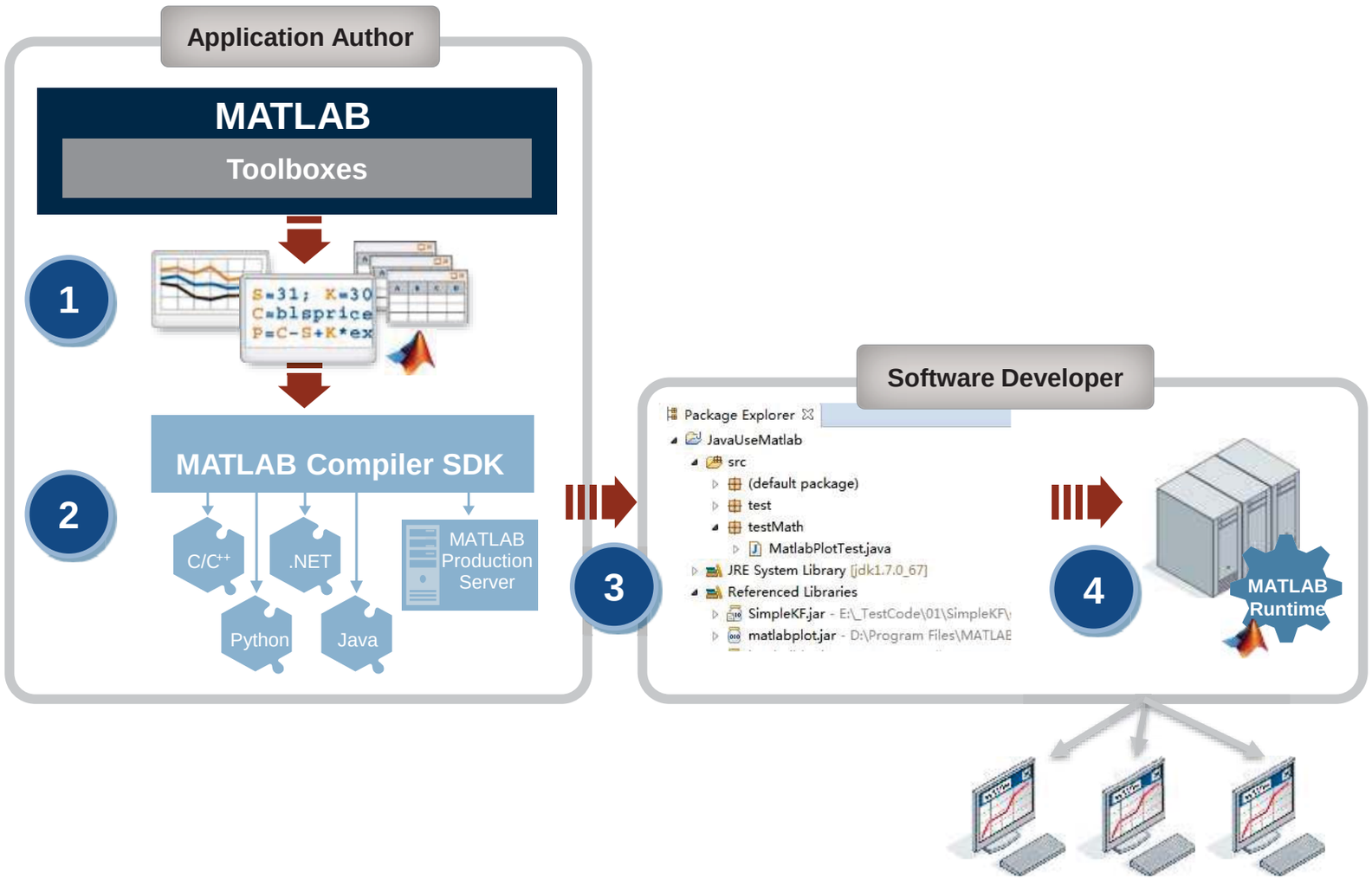
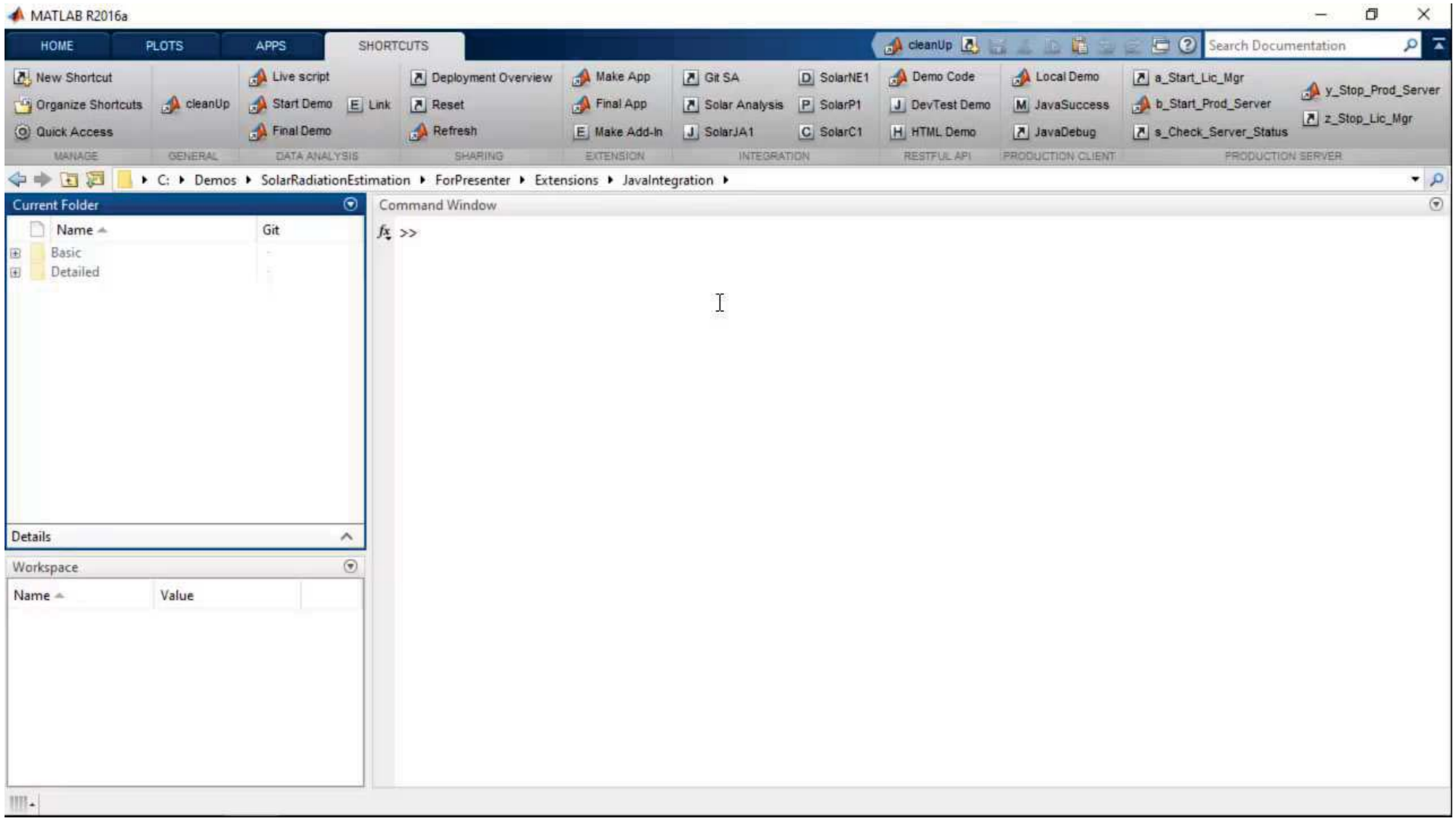
Integrate MATLAB-based Components With Your Own Software

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Deployment Overview
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Make App
Final App
E Make Add-In
Git SA
Solar Analysis
J SolarJA1
D SolarNE1
P SolarP1
C SolarC1
Demo Code
J DevTest Demo
H HTML Demo
Local Demo
M JavaSuccess
JavaDebug
a_Start_Lic_Mgr
b_Start_Prod_Server
s_Check_Server_Status
y_Stop_Prod_Server
z_Stop_Lic_Mgr
MANAGE
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RESTFUL API
PRODUCTION CLIENT
PRODUCTION SERVER
C: ▸ Demos ▸ SolarRadiationEstimation ▸ ForPresenter ▸ Extensions ▸ JavaIntegration ▸
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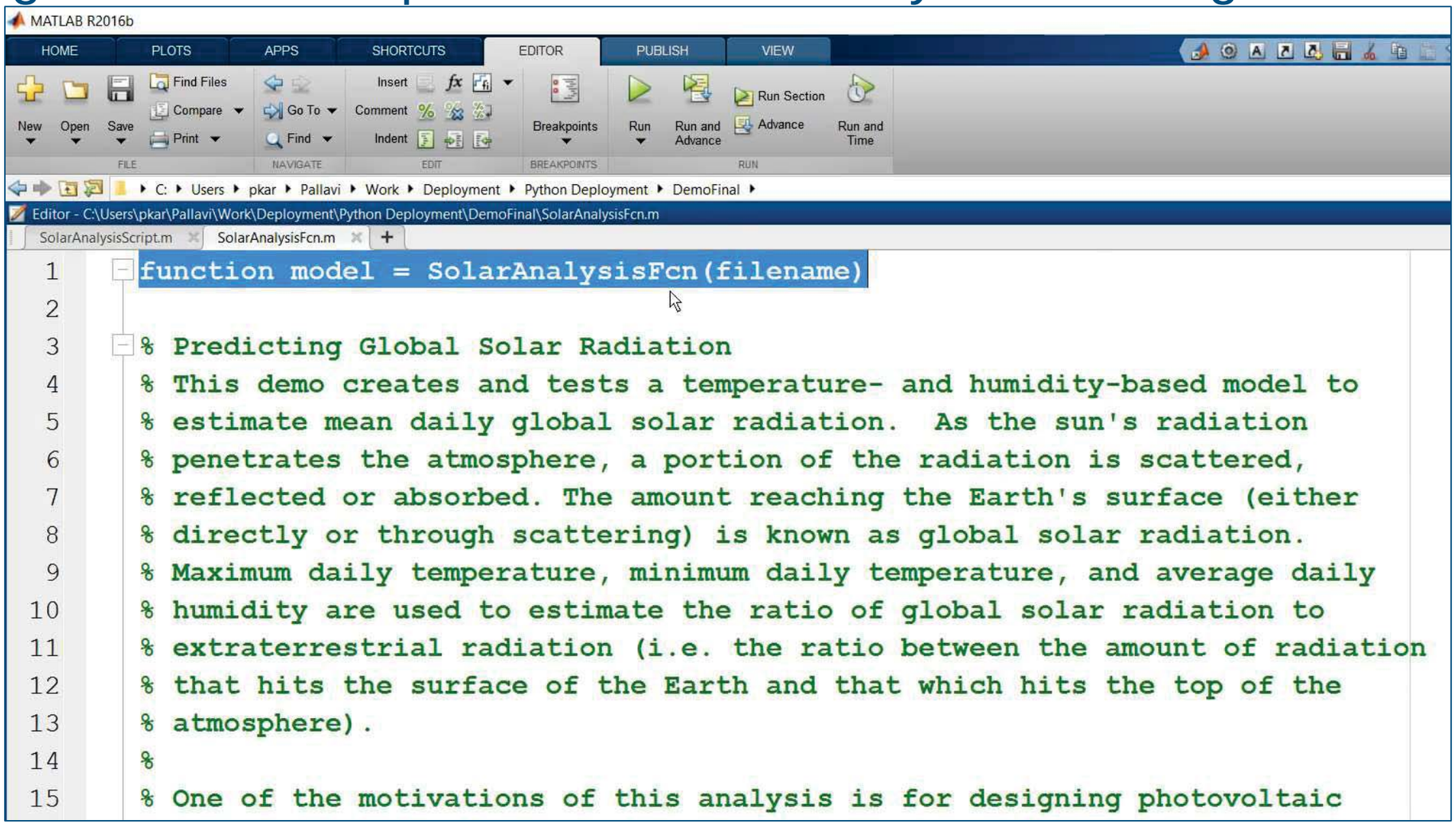
Using MATLAB Compiler SDK to create Python Packages



MATLAB *and MATLAB Production Server*

is the easiest and most productive environment to *take your enterprise analytics* or *IoT solution* from idea to production

Idea **Production**

Why MATLAB Production Server Matters to You

Domain Expert

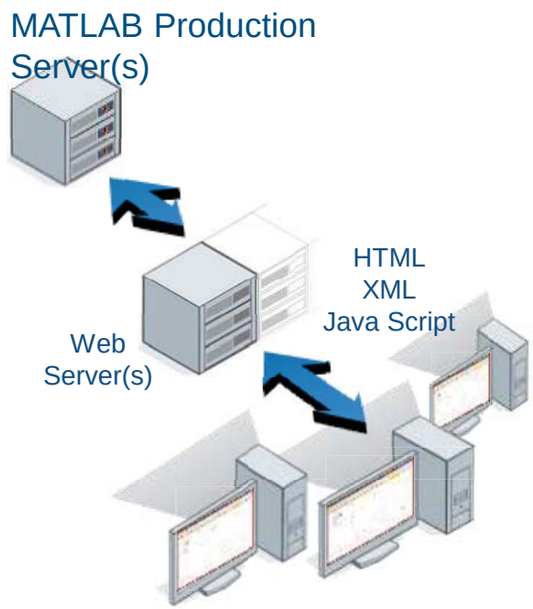
- ✓ MATLAB Production Server allow you to continue to work in the environment that you love
- ✓ No need to learn another programming language
- ✓ MATLAB Production Server integrates with enterprise IT infrastructure

Solution Architect

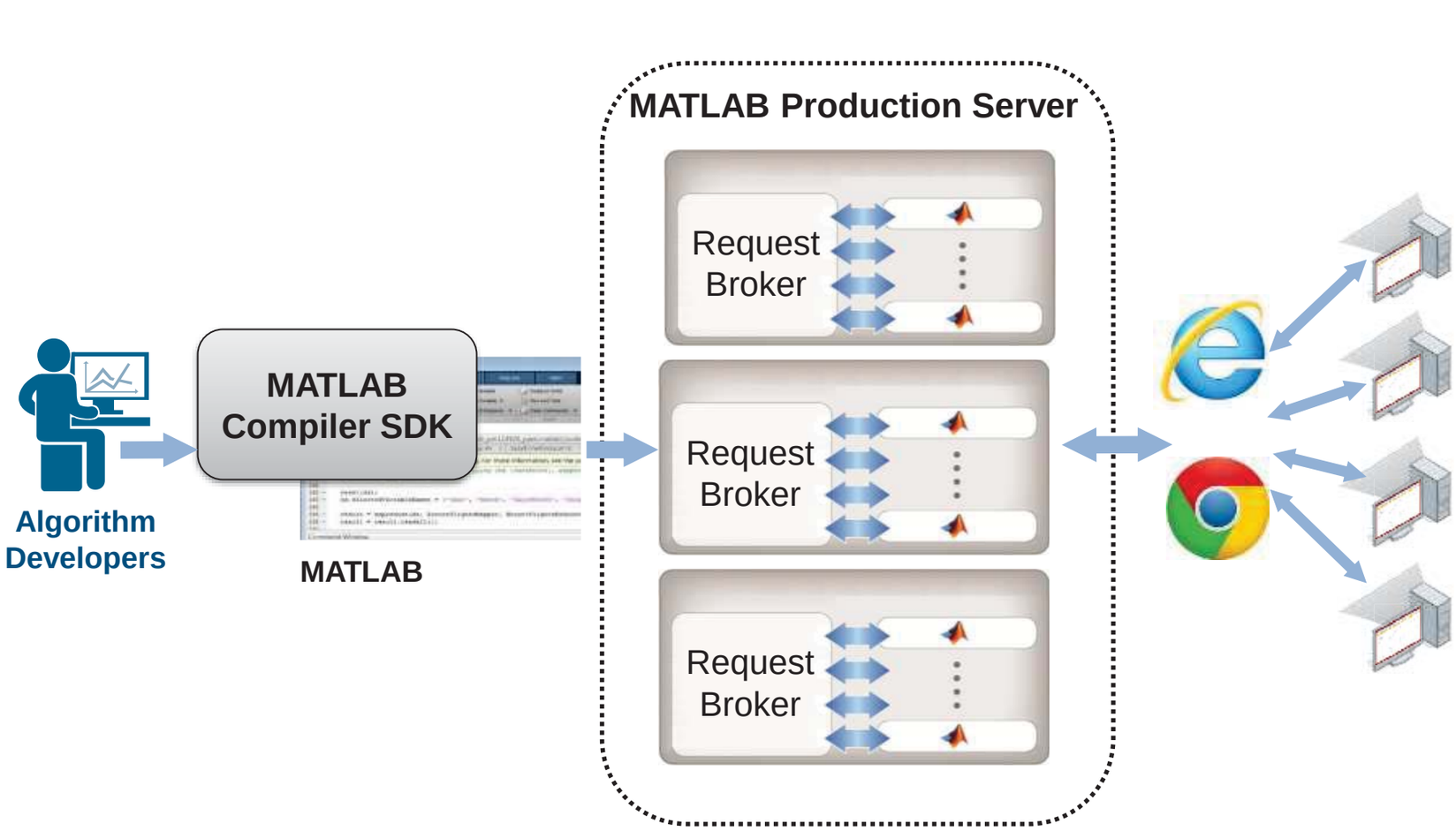
- ✓ MATLAB Production Server integrates MATLAB code into the enterprise IT fabric that you are comfortable with
- ✓ No need to re-code into another programming language
- ✓ Web and cloud friendly architecture

Scale Up with MATLAB Production Server™

- Directly deploy MATLAB programs into production
  - Centrally manage multiple MATLAB programs and runtime versions
  - Automatically deploy updates without server restarts
  - Most efficient path for creating enterprise applications
- Scalable and reliable
  - Service large numbers of concurrent requests
  - Add capacity or redundancy with additional servers
- Use with web, database and application servers
  - Lightweight client library isolates MATLAB processing
  - Access MATLAB programs using native data types



Customer examples: Financial customer advisory service

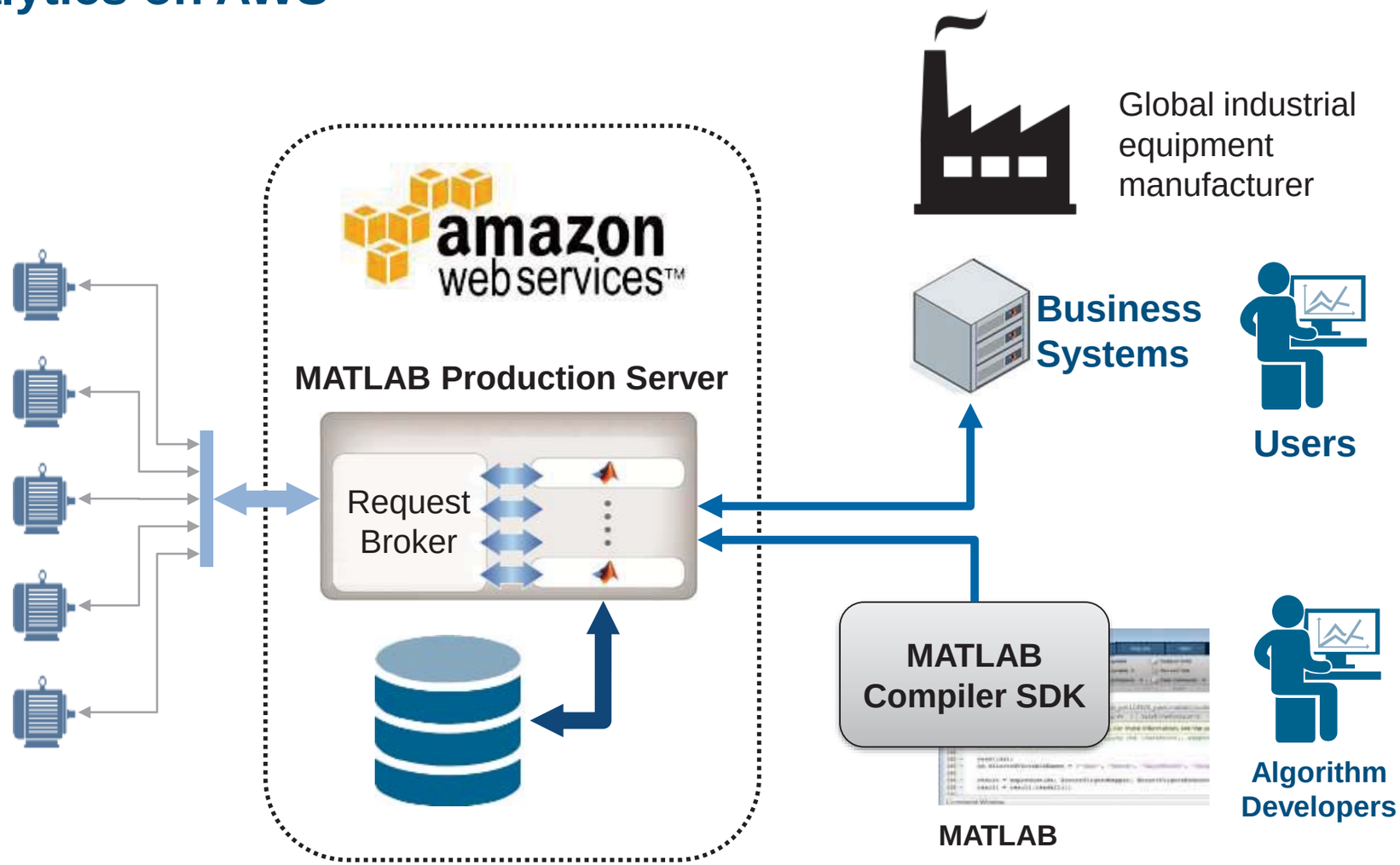


Global financial institution with European HQ

- 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

Industrial IoT Analytics on AWS

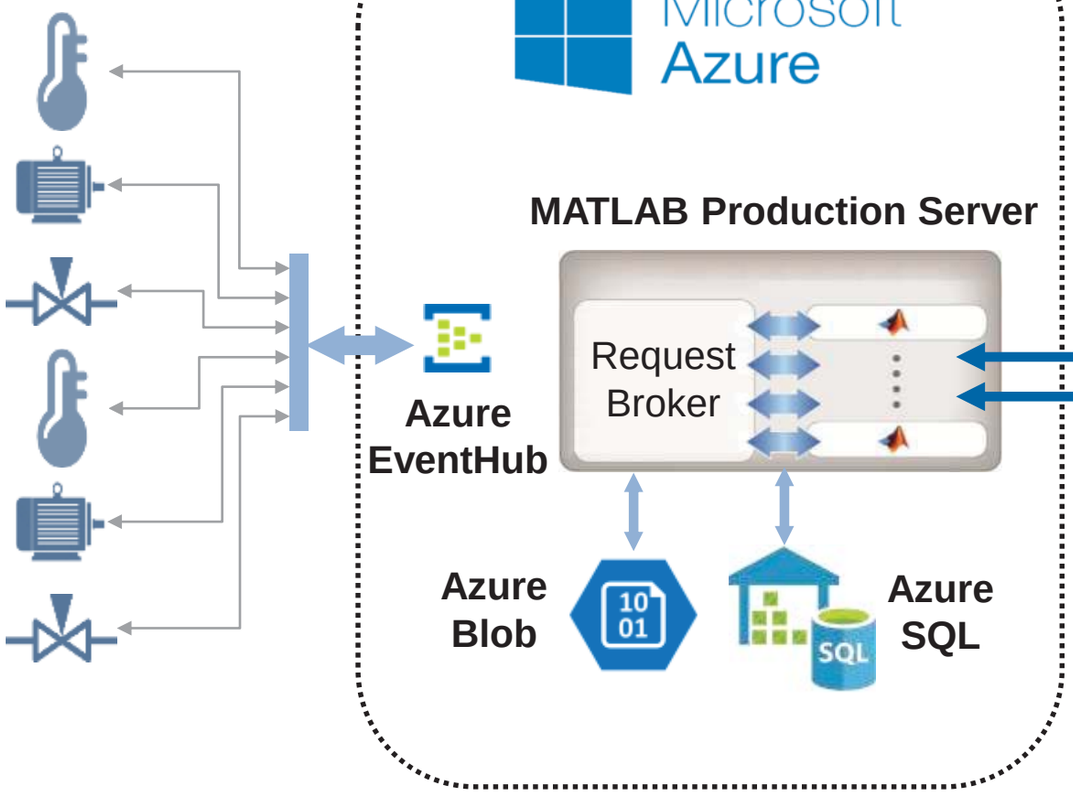
Industrial Equipment
- Networked communication
- Embedded sensors
- Data reduction



Building Automation IoT Analytics on Azure

Building/HVAC automation control system

- Variety of sensors and controls
- Networked communication
- Data reduction



Microsoft Azure

MATLAB Production Server

Azure EventHub

Request Broker

Azure Blob

Azure SQL

Global heavy duty electrical equipment manufacturer

Business Systems

Users

MATLAB Compiler SDK

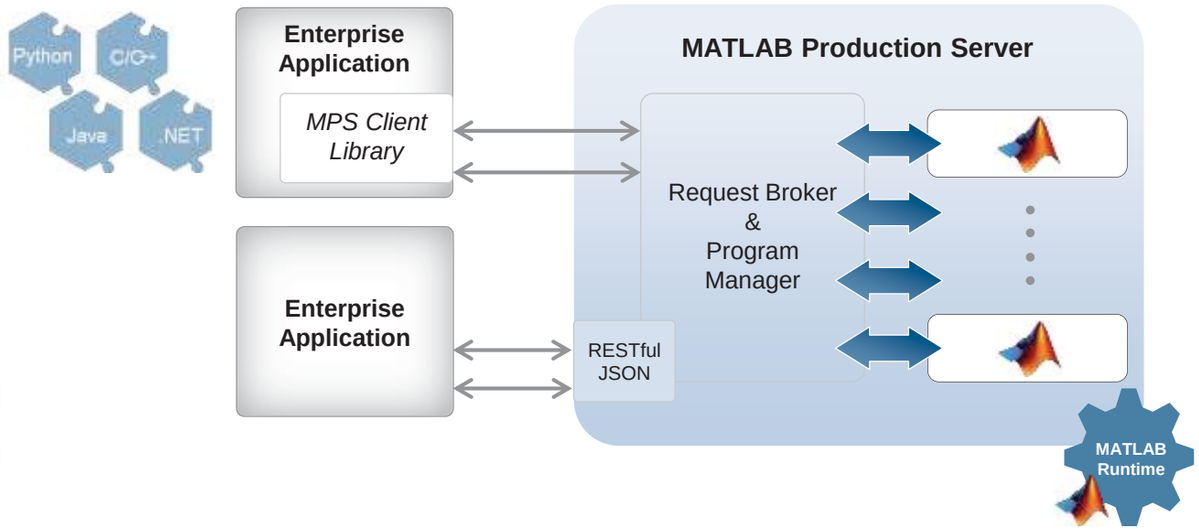
MATLAB

Algorithm Developers

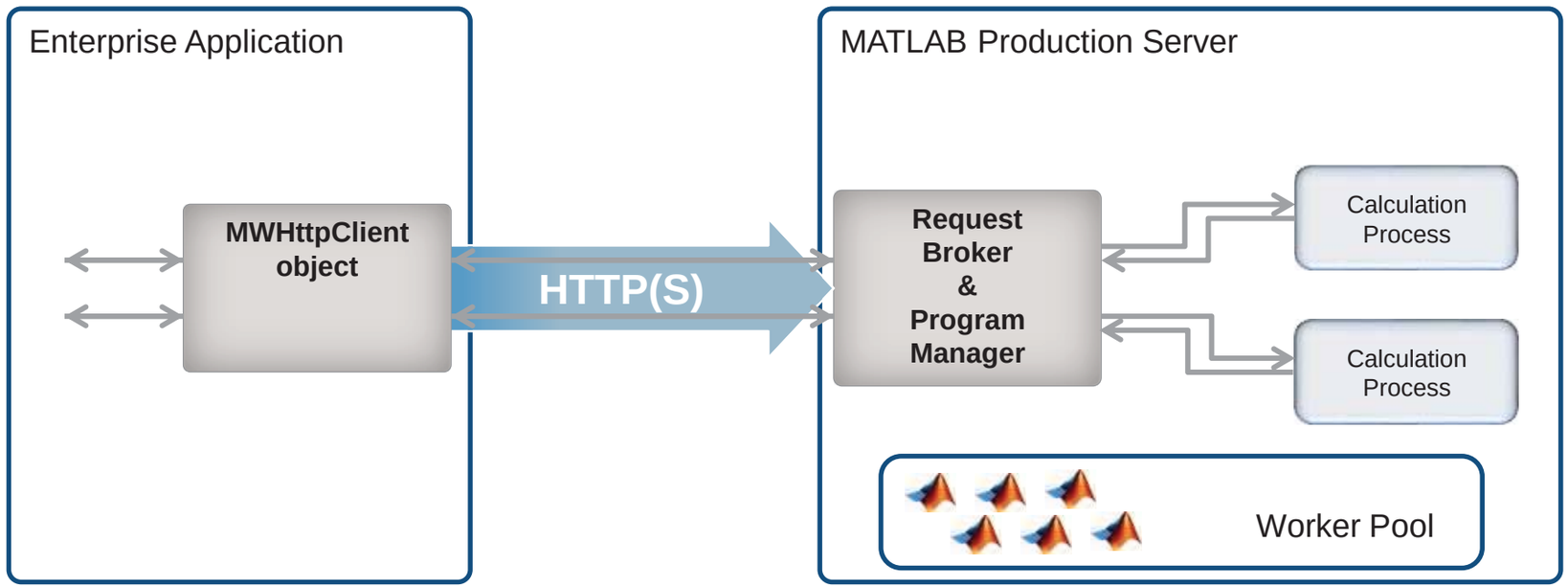
MATLAB Production Server

Enterprise Class Framework For Running Packaged MATLAB Programs

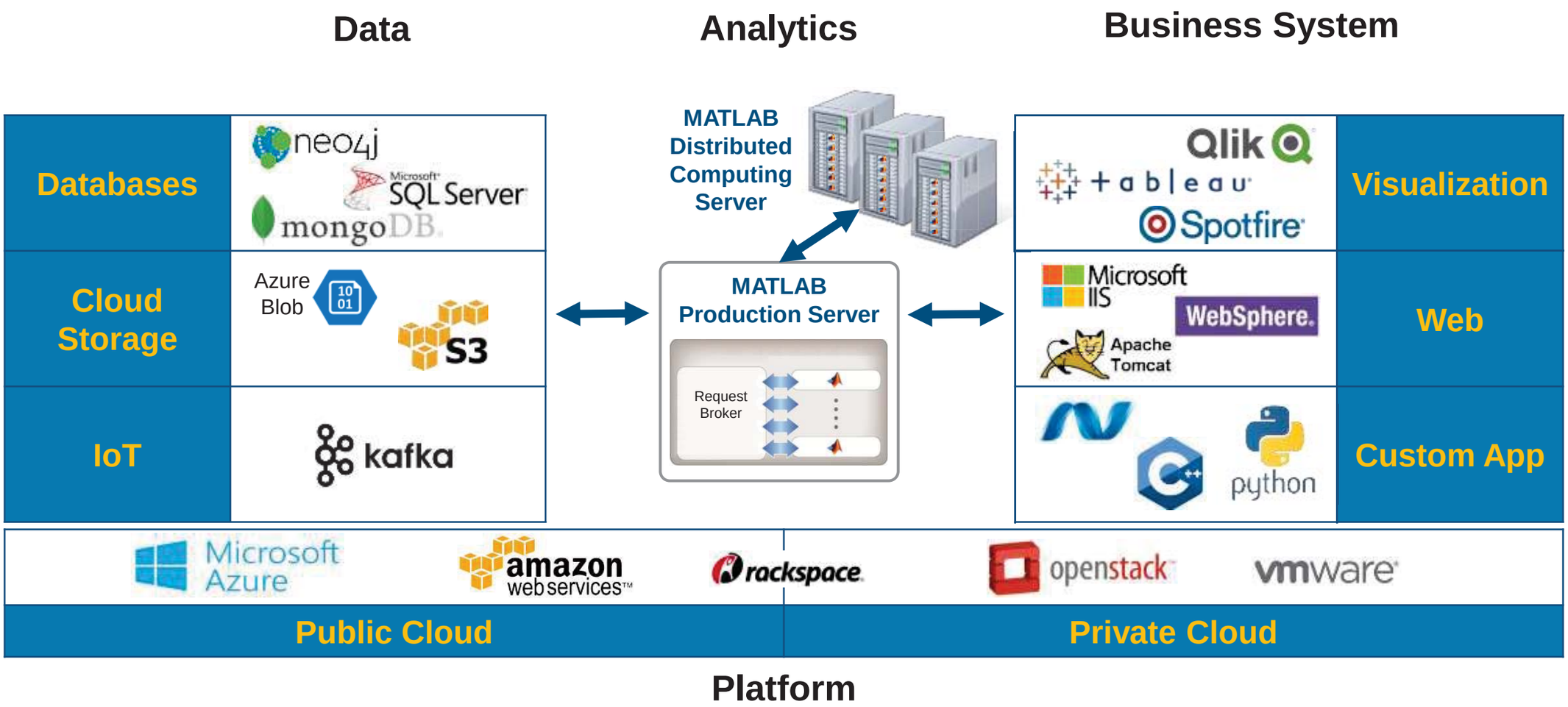
- Server software
  - Manages packaged MATLAB progr ams and worker pool
- MATLAB Runtime libraries
  - Single server can use runtimes fro m different releases
- RESTful JSON interface and lightweigh t client library (C/C++, .NET, Python, an d Java)



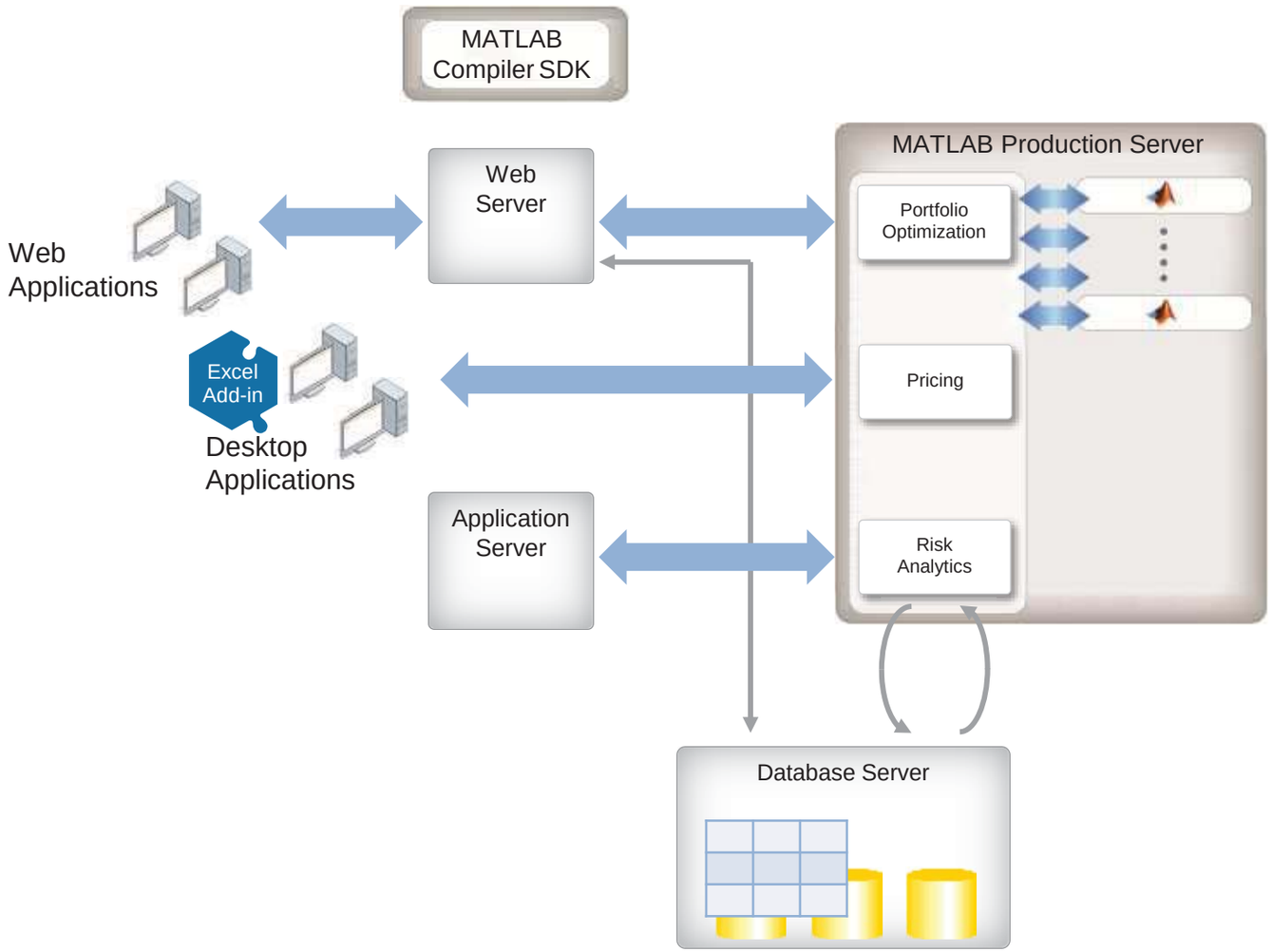
Calling Functions



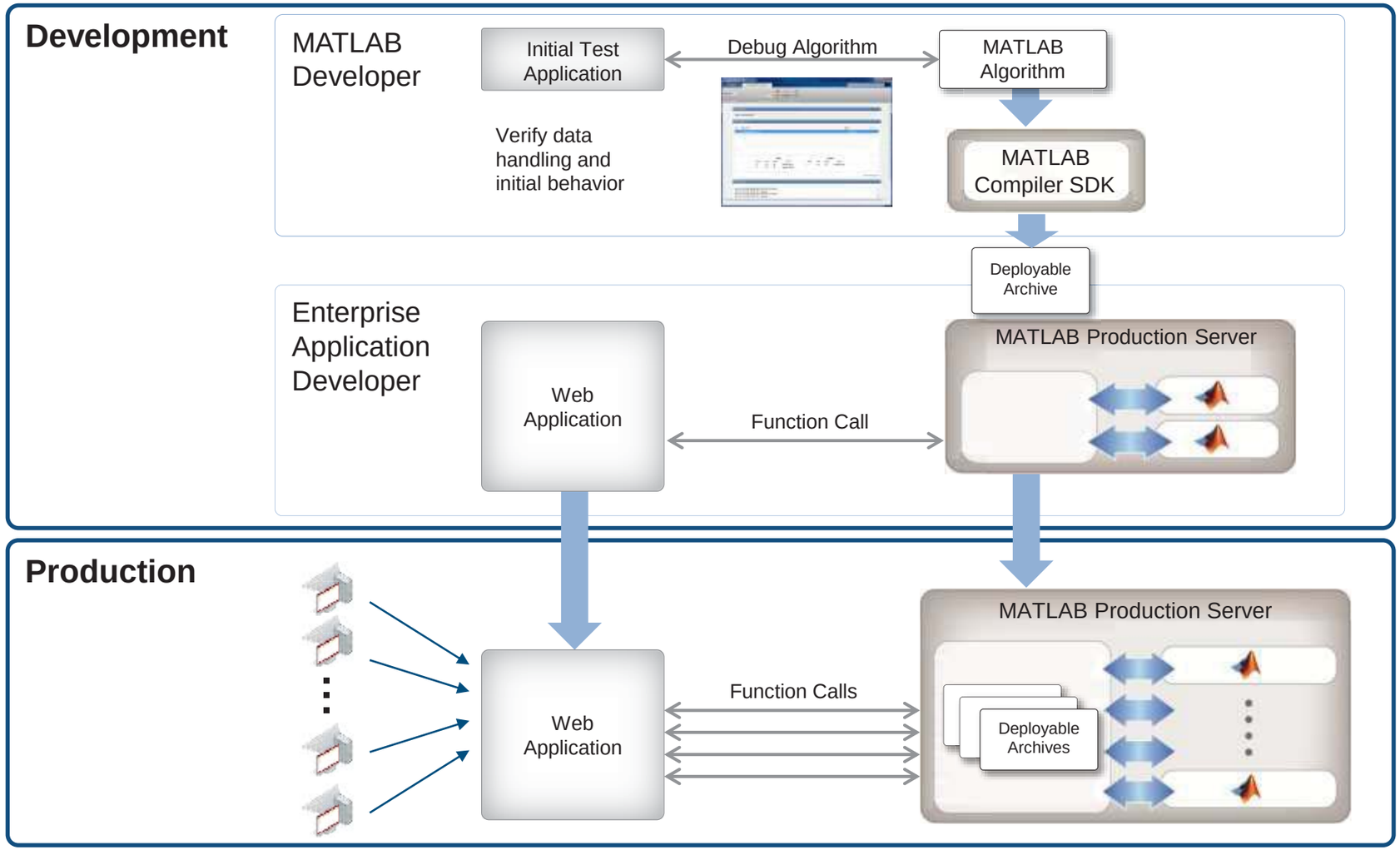
Technology Stack



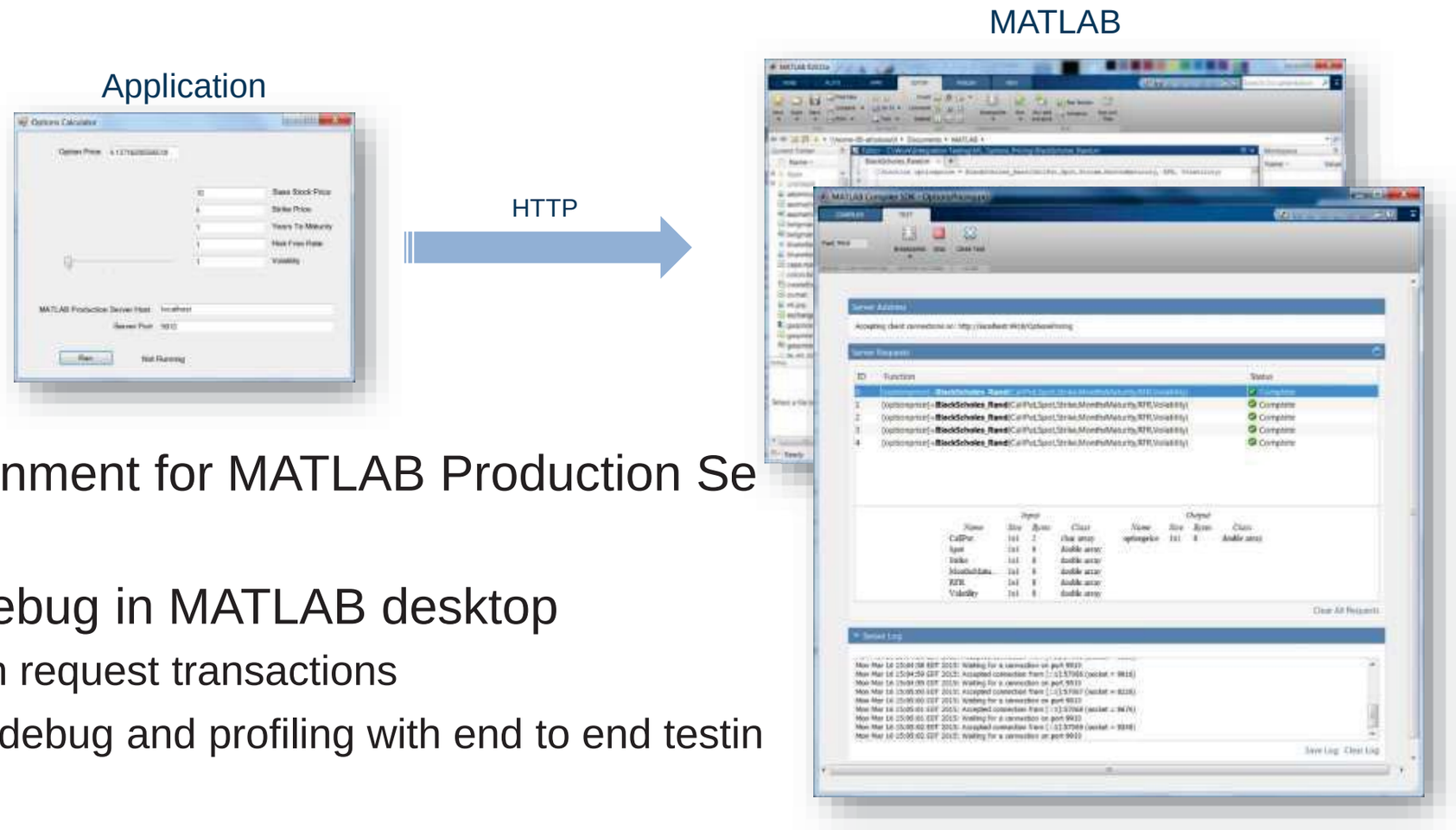
Example - Integrating with IT systems



Production Deployment Workflow

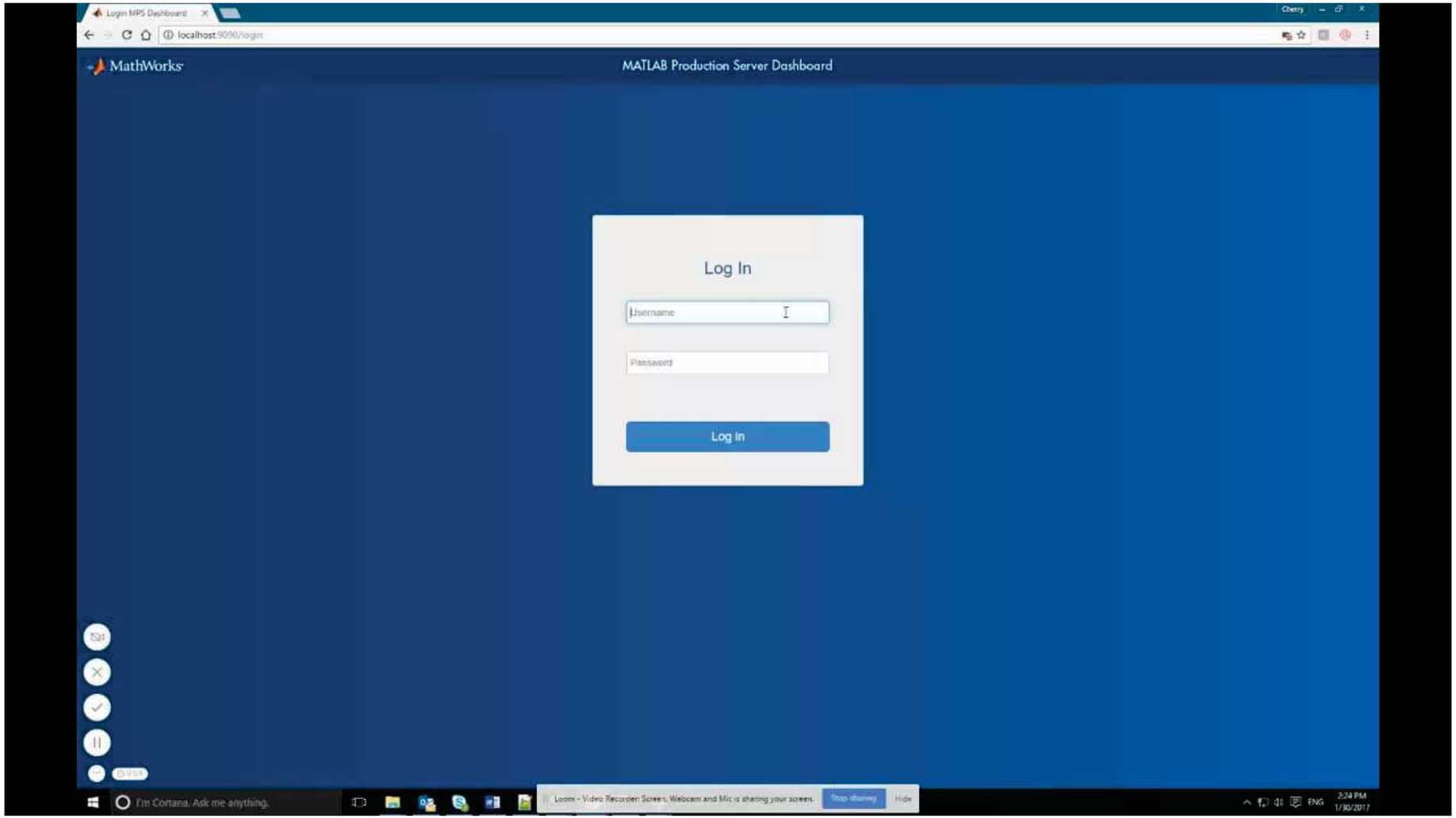


Develop and Test with MATLAB Compiler SDK



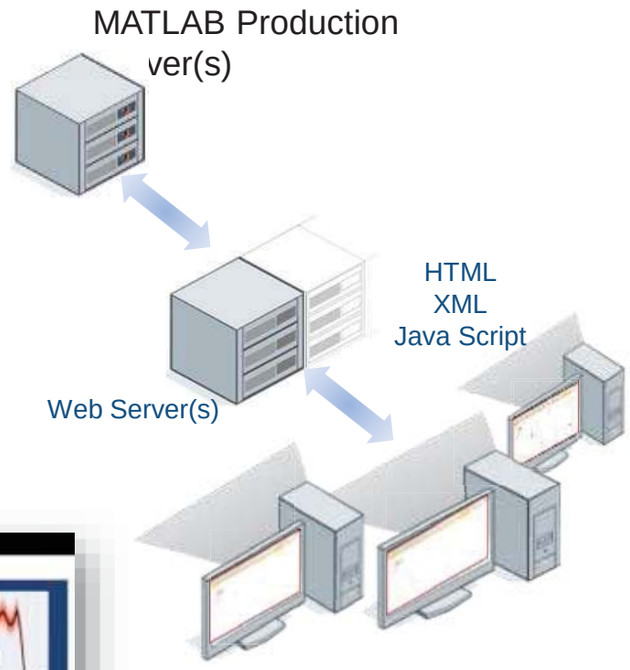
- Test environment for MATLAB Production Server
- Test and debug in MATLAB desktop
  - Details on request transactions
  - MATLAB debug and profiling with end to end testing

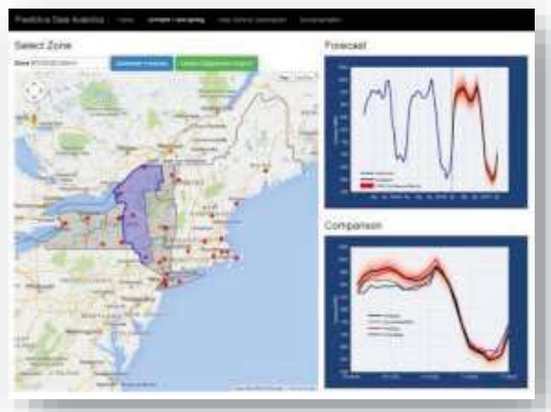
Web Management Dashboard – New in R2017a



Load Forecasting Demo

Energy load forecasting demo





MATLAB at Scale

MATLAB Production Server

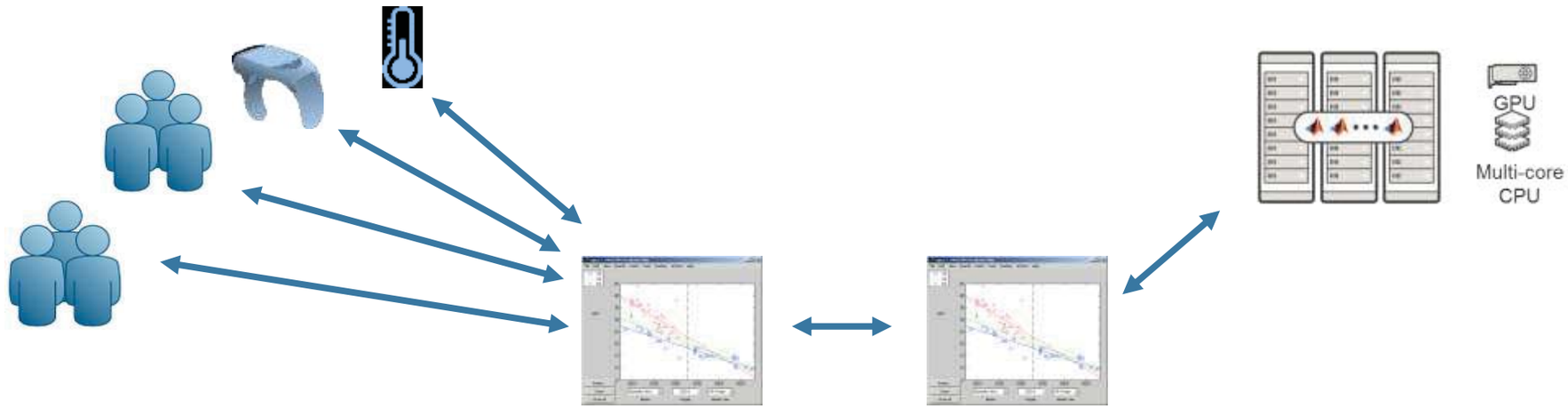
Application server for MATLAB

- Front-end scalability
- Manage large numbers of requests to run short-running deployed MATLAB programs

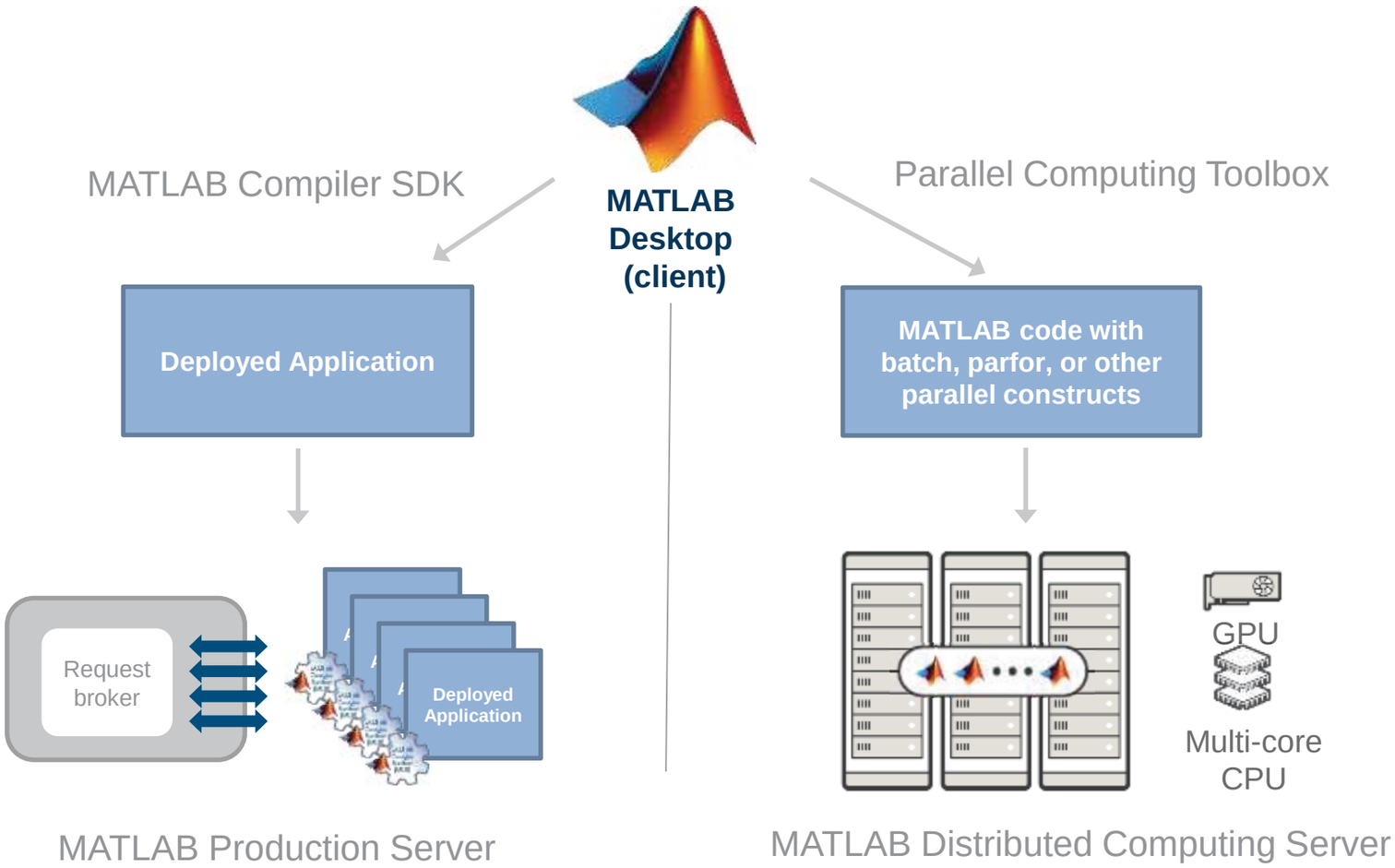
MATLAB Distributed Computing Server

Cluster framework for MATLAB/Simulink

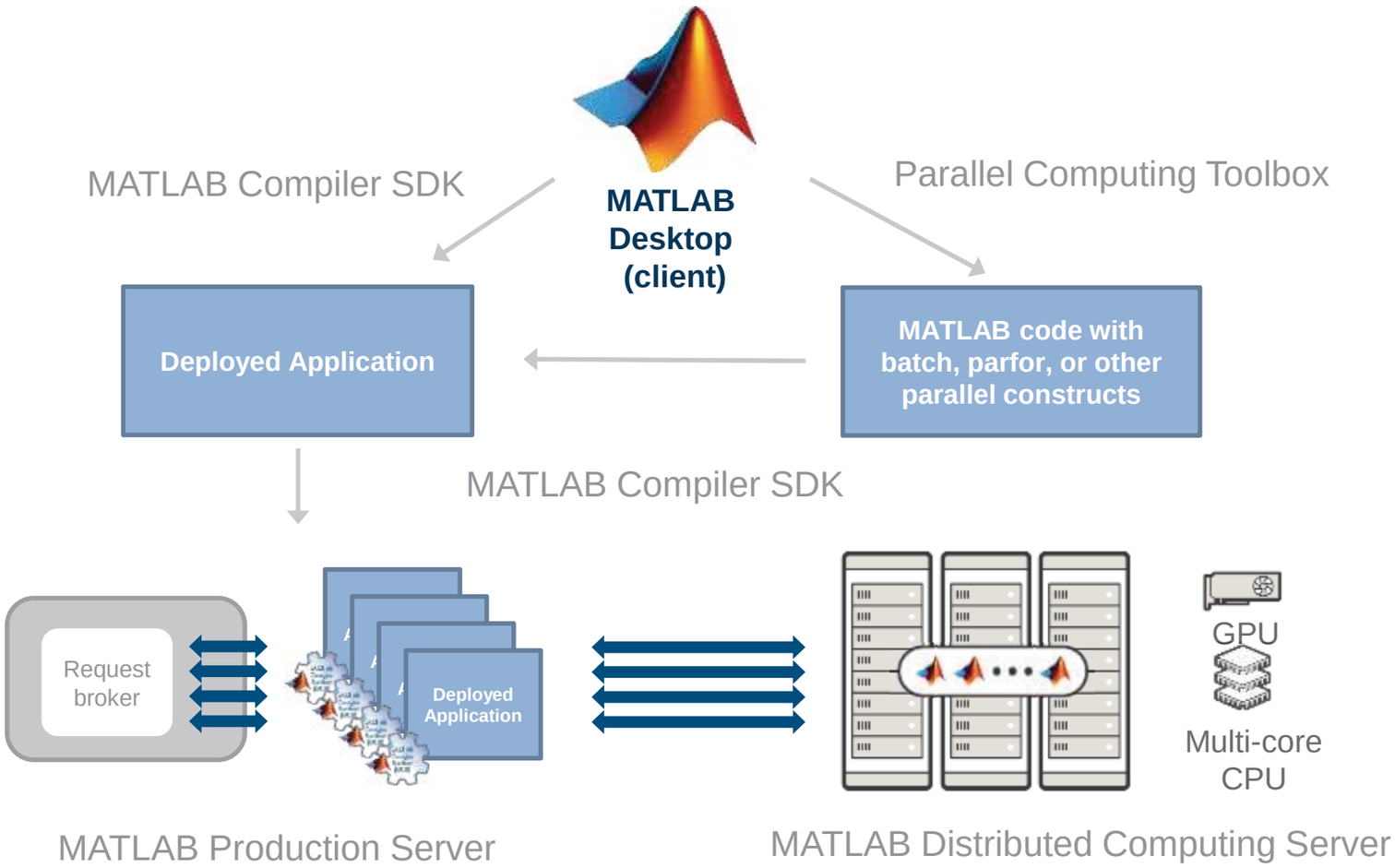
- Back-end scalability
- Speed up computationally intensive programs on computer clusters, clouds, and grids



Distinct Offerings Scale Application Access and Computation



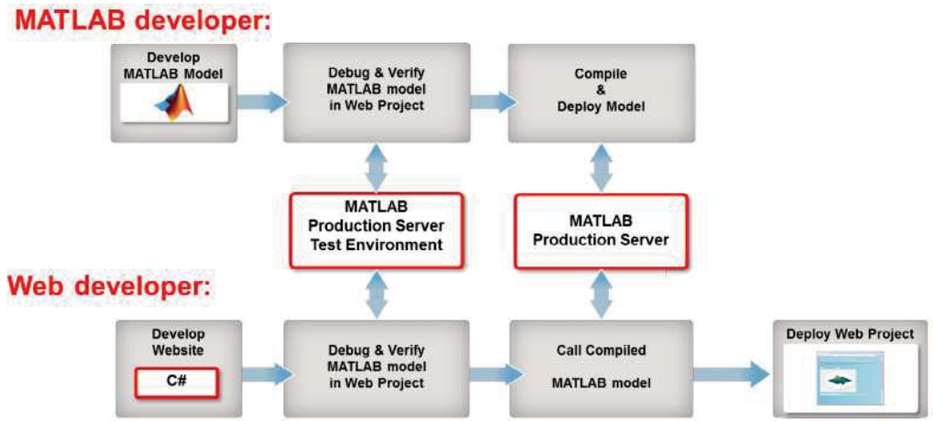
Distinct Offerings Scale Application Access and Computation

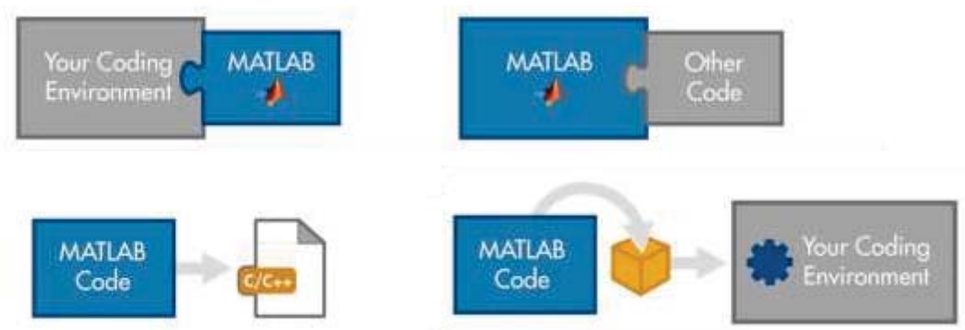


Parallel workers on remote hardware

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



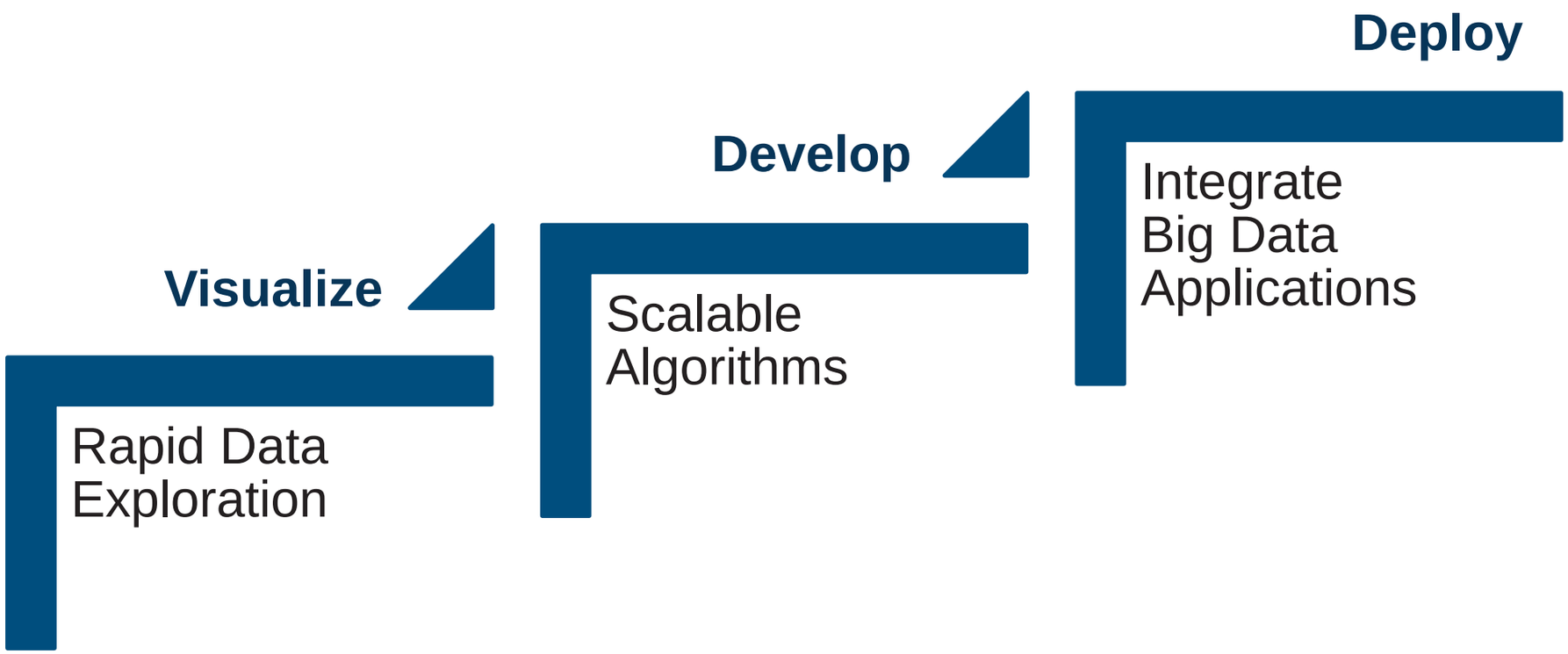


Supplemental Slides

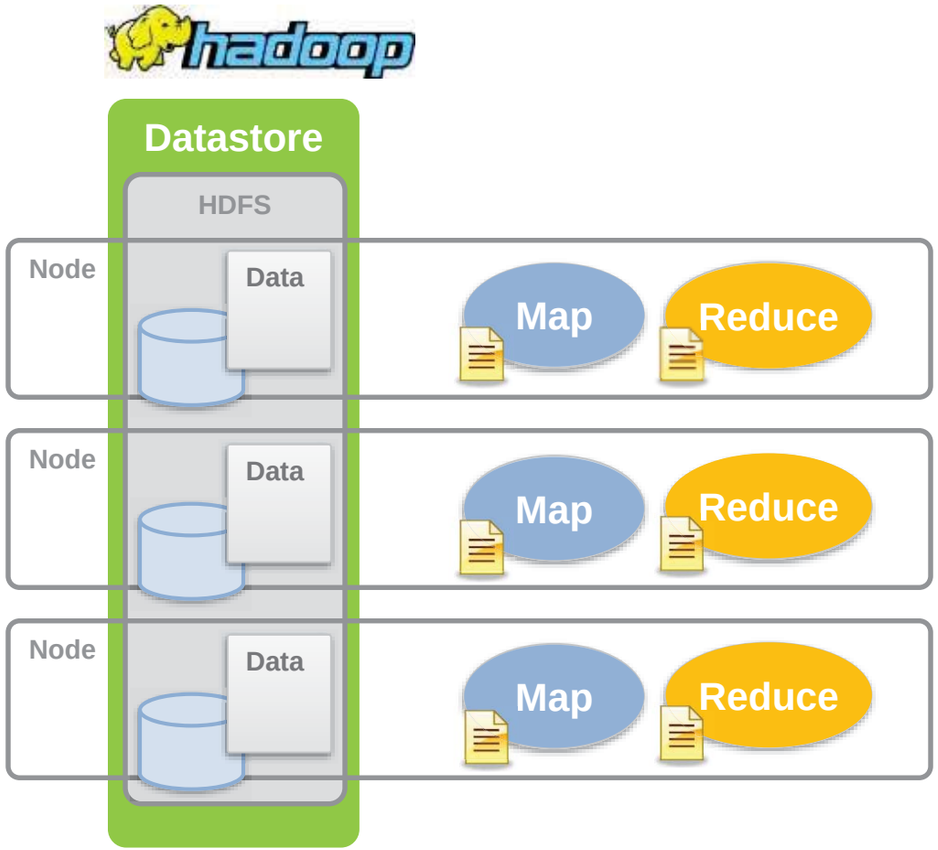
Use the following slides for more detailed discussions on various implementations using MATLAB Production Server.

Challenges of Big Data

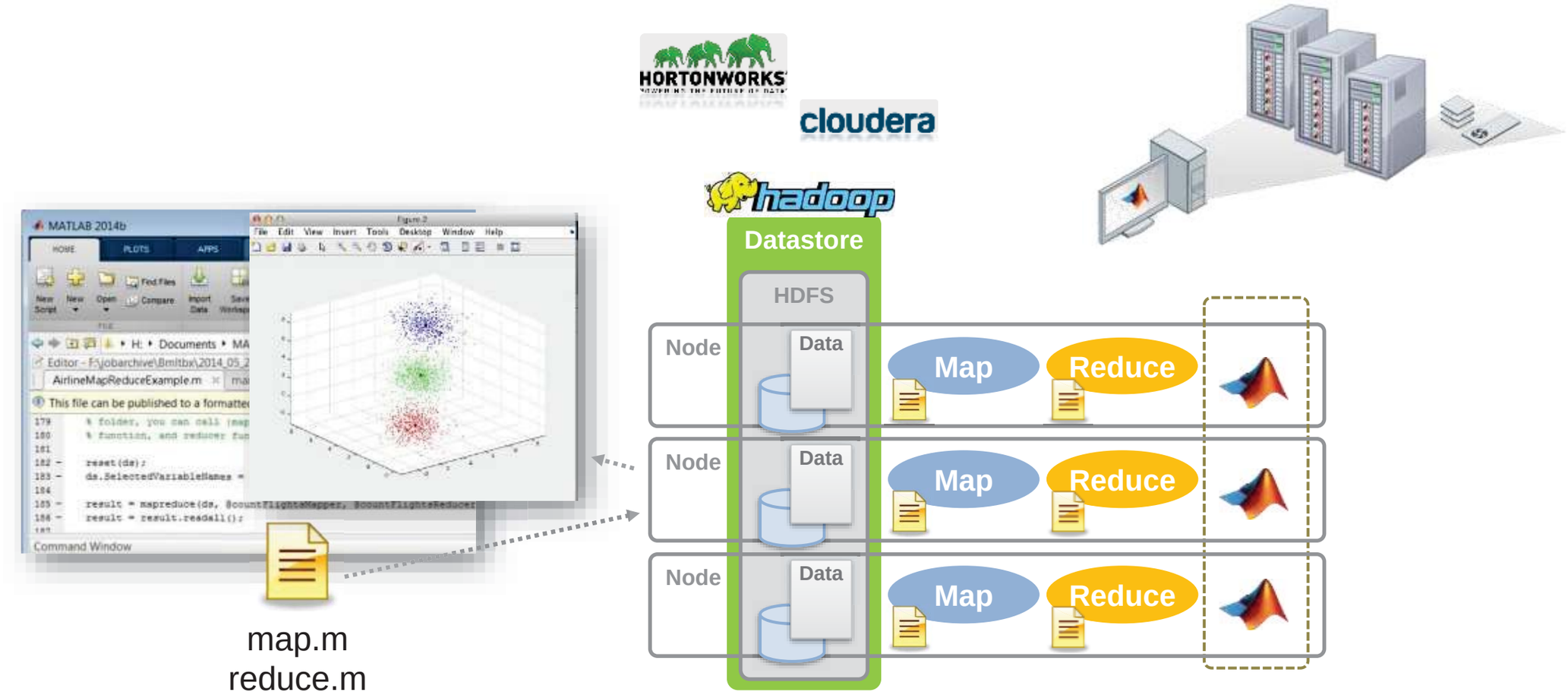
“Any collection of data sets so large and complex that it becomes difficult to process using … t raditional data processing applications.” *(Wikipedia)*



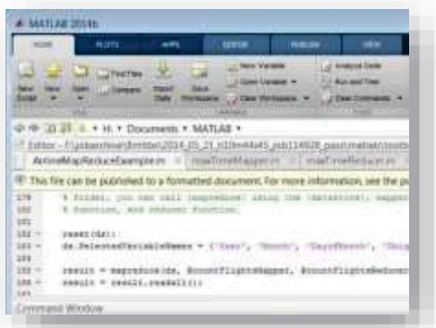
Hadoop: The Big Data Platform



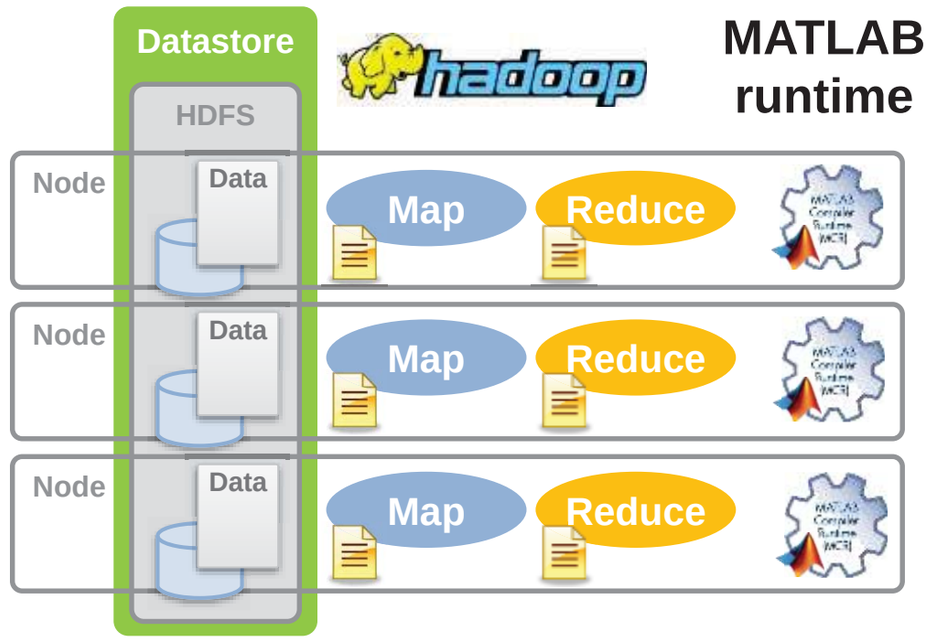
Matlab Integration with Hadoop clusters



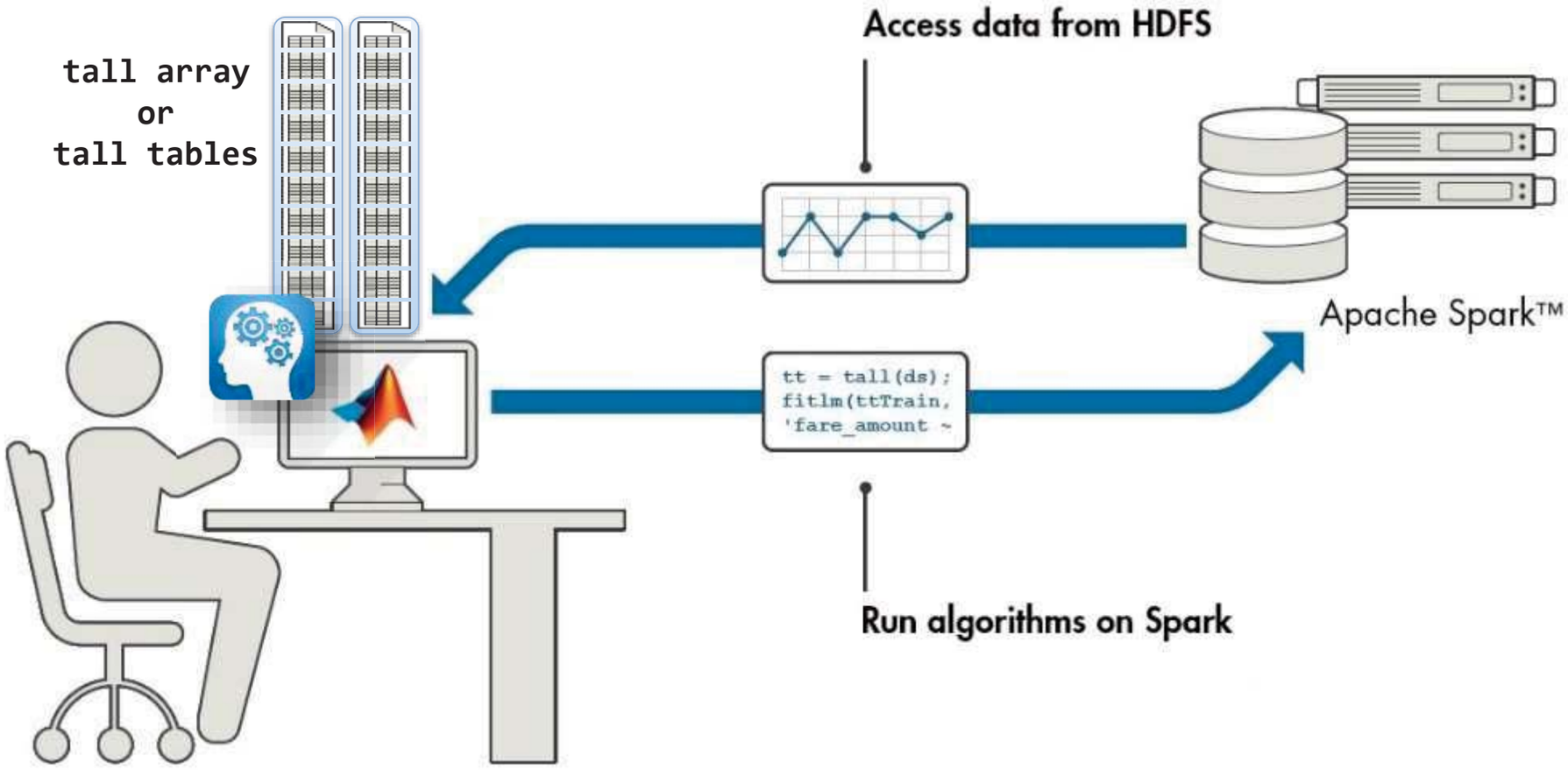
Deploy Applications with Hadoop



Compile MATLAB
Map Reduce
Code



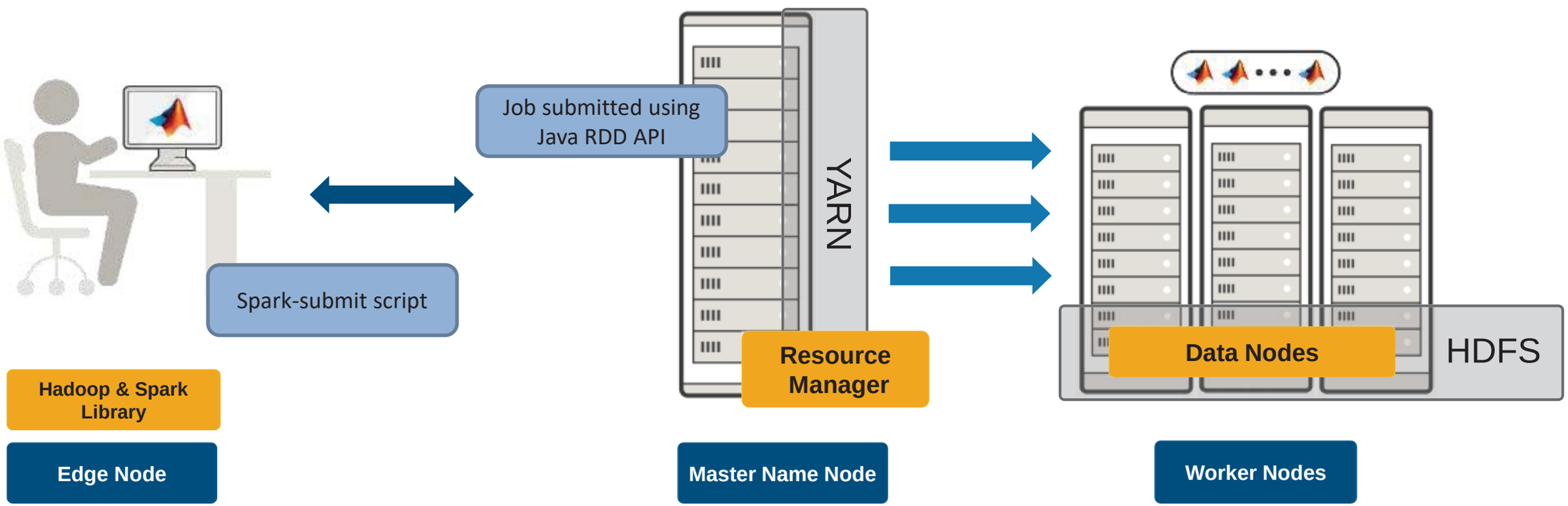
Use MATLAB with Spark on Gigabytes and Terabytes of Data



Run MATLAB scripts on SPARK & HADOOP

MATLAB workers on worker nodes in the cluster

- MDCS workers (working from MATLAB)



Example: Running on Spark enabled Hadoop

Desktop Code

PCT, Datastore, tall

```
% Define the Execution Environment.
% Desktop
mr = mapreducer(gcp);

% Access the data.
ds = datastore('C:/datasets/taxiData/*.csv');
tt = tall(ds);
```

Spark + Hadoop Code

Spark Connection

Cluster Config for Spark

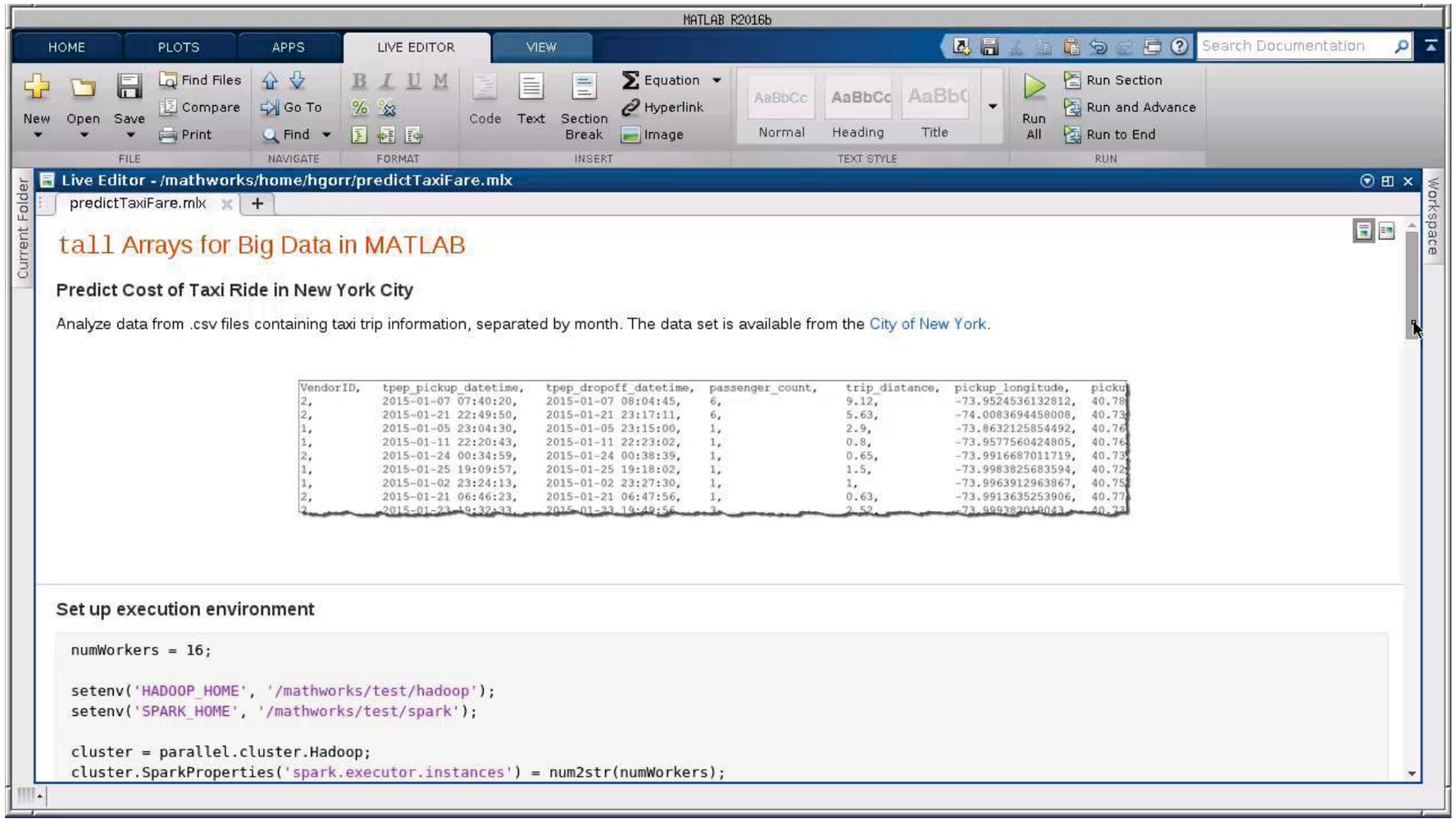
Hadoop Access

```
%% Define the Execution Environment.
% Hadoop/Spark Cluster
setenv('HADOOP_HOME', '/dev_env/cluster/hadoop');
setenv('SPARK_HOME', '/dev_env/cluster/spark');

numWorkers = 16;
cluster = parallel.cluster.Hadoop;
cluster.SparkProperties('spark.executor.instances') = num2str(numWorkers);
mr = mapreducer(cluster);


% Access the data
ds = datastore('hdfs://hadoop01:54310/datasets/taxiData/*.csv');
tt = tall(ds);
```

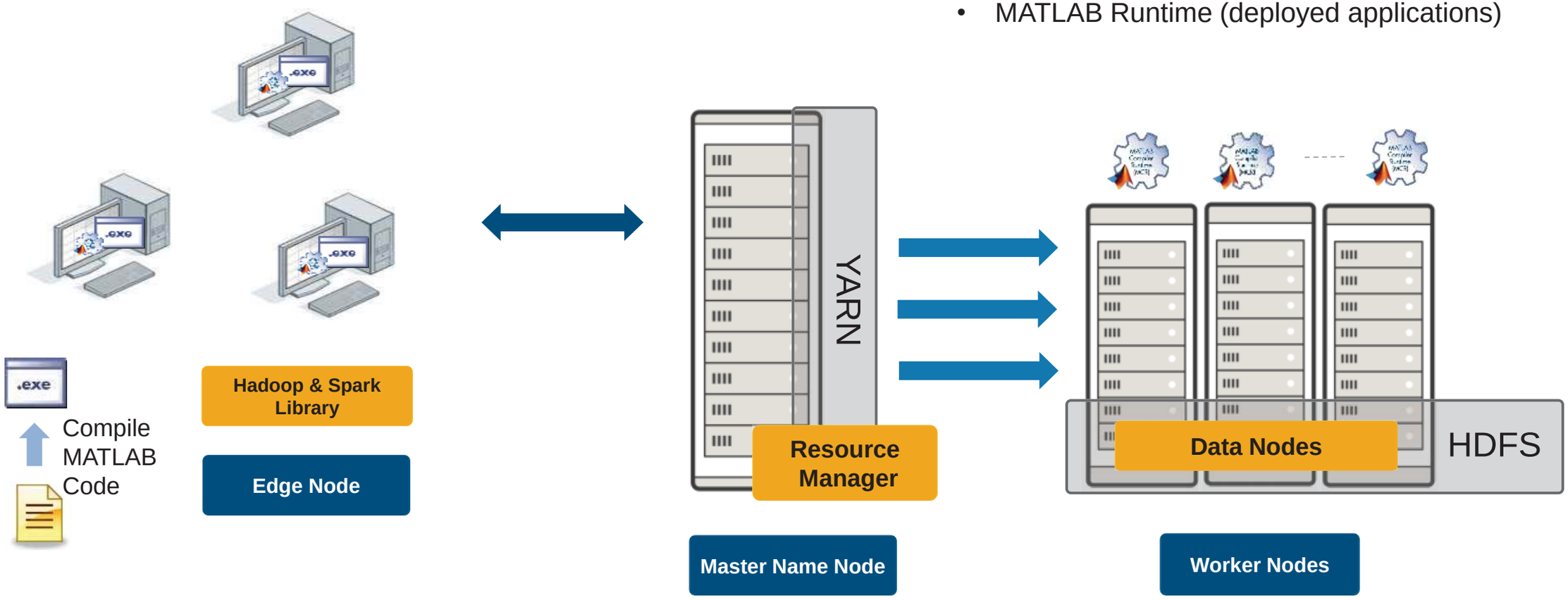
Example: Running on Spark and Hadoop



Run MATLAB scripts on SPARK & HADOOP

MATLAB workers on worker nodes in the cluster

- MATLAB Runtime (deployed applications)



Deploying Spark Applications

```
plot(result);
legend('Actual Fare','Predicted Fare','Difference');
savefig(f1,'Predicted-vs-Actual.fig');
```