

# MATLAB CONFERENCE 2017

## Integrating MATLAB Analytics into Enterprise Applications

David Willingham



Run this link....

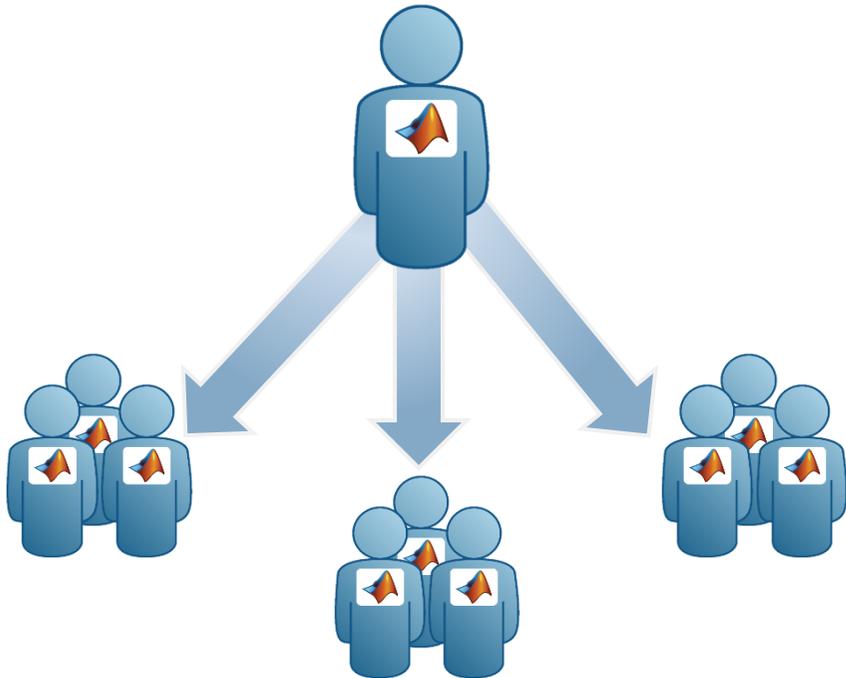
<http://bit.ly/matlabapp>

# Key Takeaways

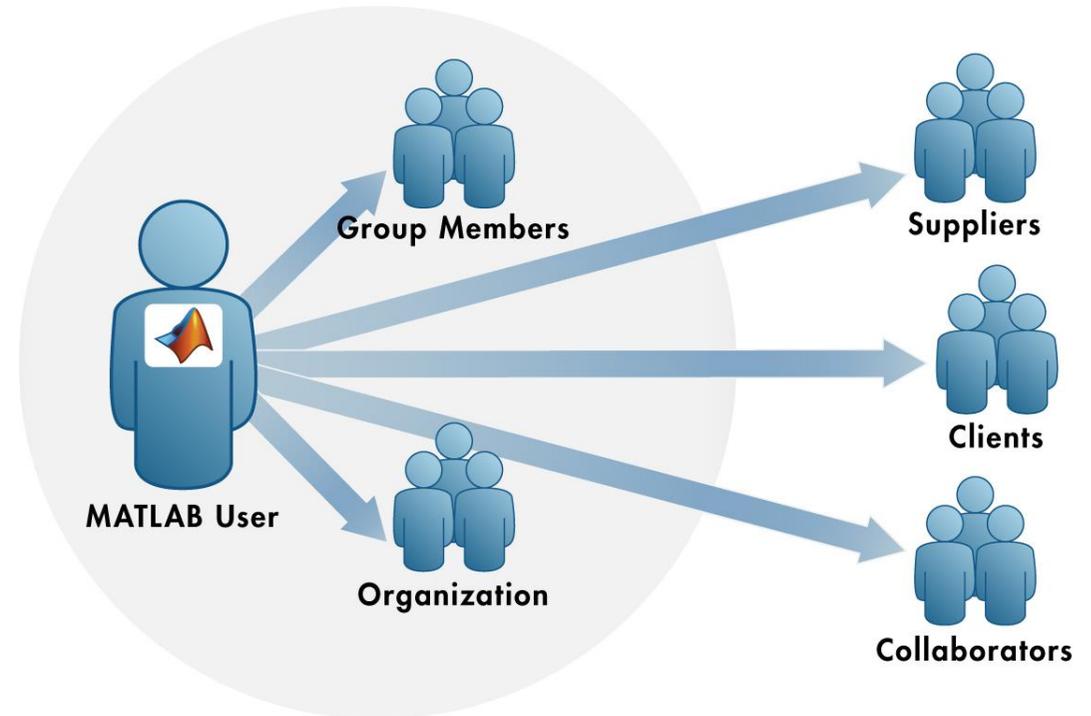
1. What is Enterprise Integration
2. What is an Enterprise Application
3. How MATLAB streamlines Enterprise Integration

# What is Enterprise Integration (Deployment)?

## Share With Other Users



## Share With Other People



# Jaguar Land Rover Standardizes on MATLAB for Developing, Packaging, and Sharing Engineering Tools

## Challenge

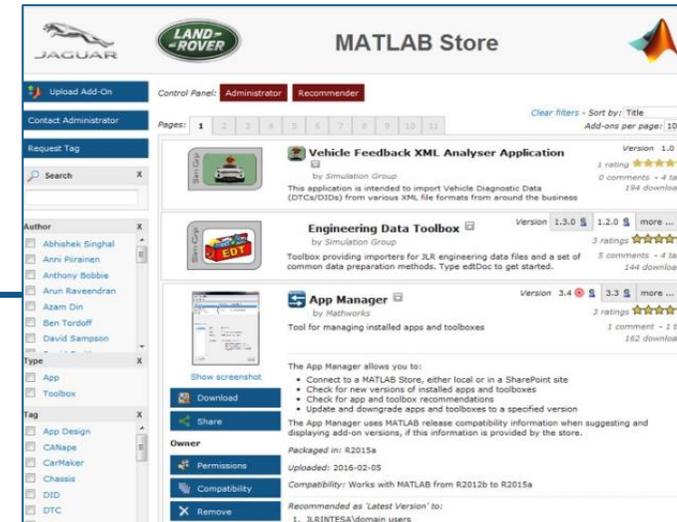
Minimize the use of disparate tools and manual processes for data analysis to reduce duplication of effort and increase productivity

## Solution

Standardize on MATLAB for developing engineering data analysis tools and work with MathWorks consultants to develop an app store for sharing and distributing those tools

## Results

- Tool quality improved and tool development time reduced
- Collaboration and engineering productivity increased
- Reliance on third-party software tools reduced

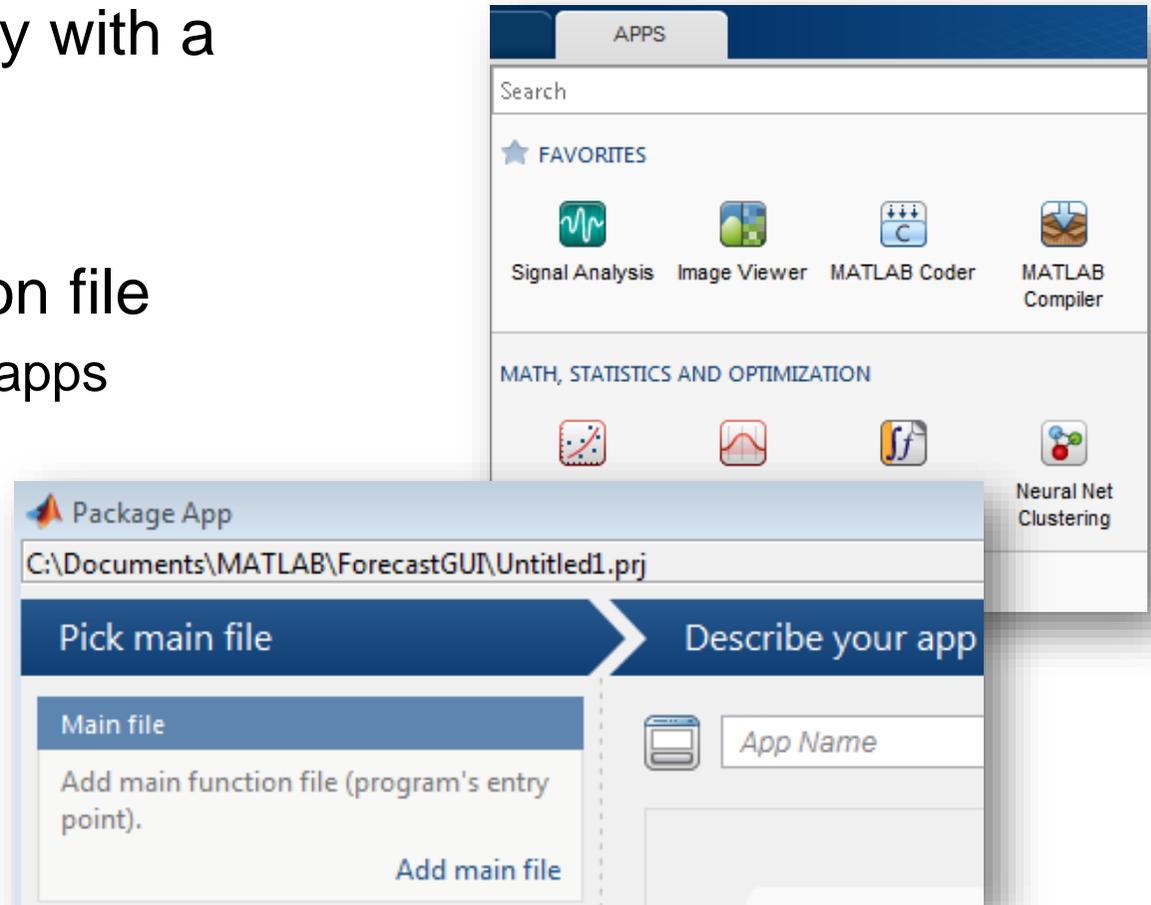


Jaguar Land Rover's MATLAB App Store, which provides one-click download and install of ready-to-use engineering tools, authored by their engineers for their engineers

In addition to avoiding duplication of effort, the MATLAB App Store enables engineers to become productive more quickly. New engineers can get the tools they need to do their jobs within minutes.

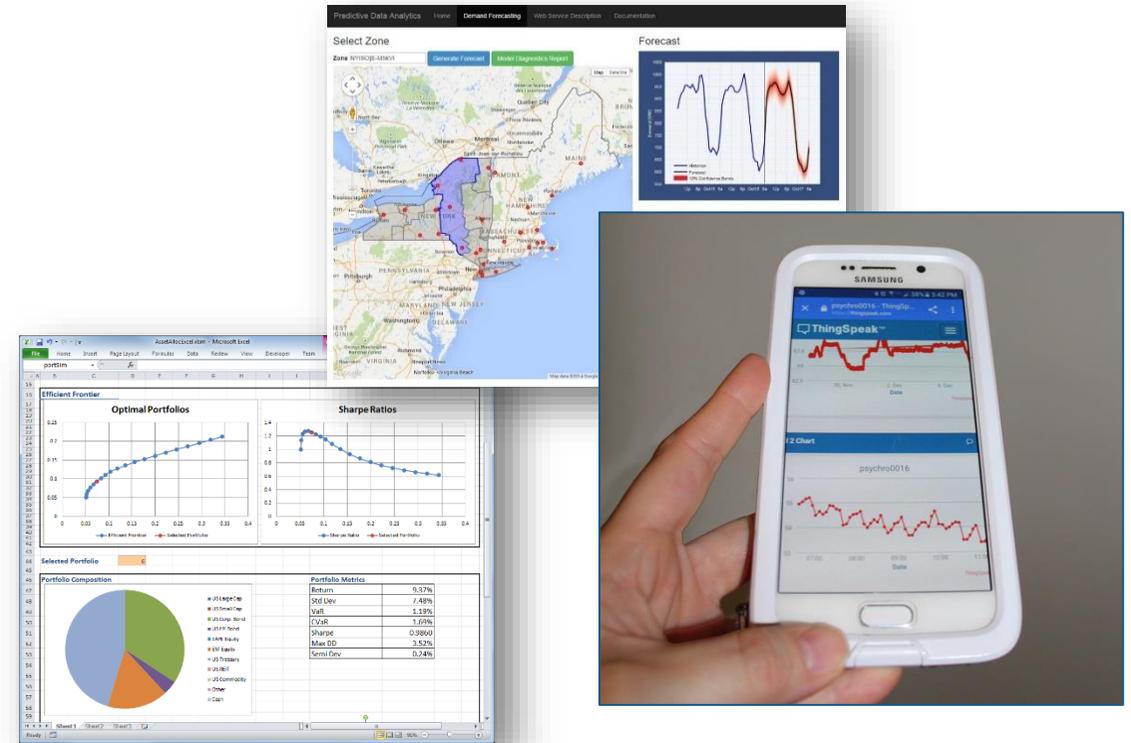
# Share with other Users - App Packaging

- 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



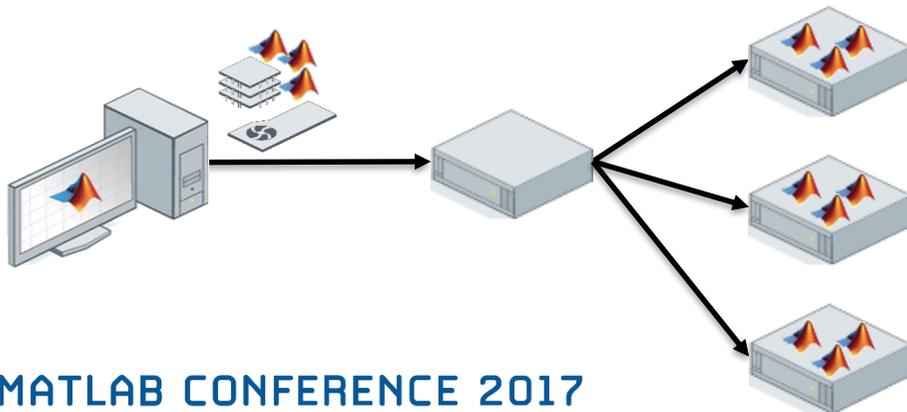
# Share with other People

- Desktop / Web app
- Dashboard
- Mobile app



# What is an Enterprise Application?

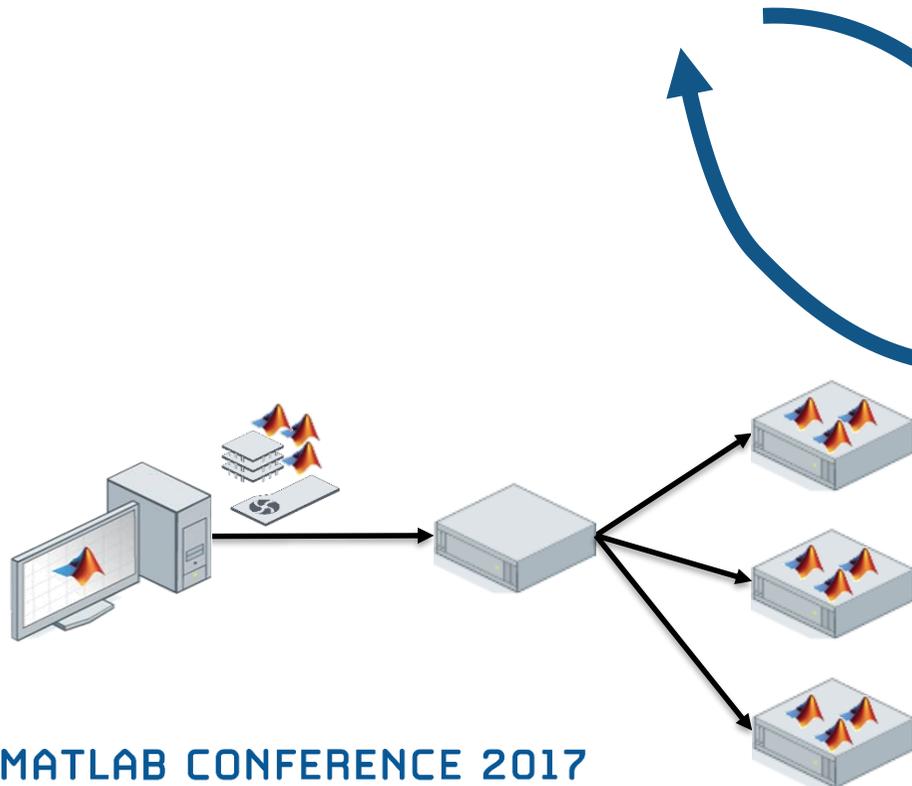
- Deploying (or integrating) to an end application or device



- Deploying to a High Performance Computing (HPC) Server

# What is an Enterprise Application?

- MATLAB Enterprise Production Deployment**  
**MATLAB Production Server™**

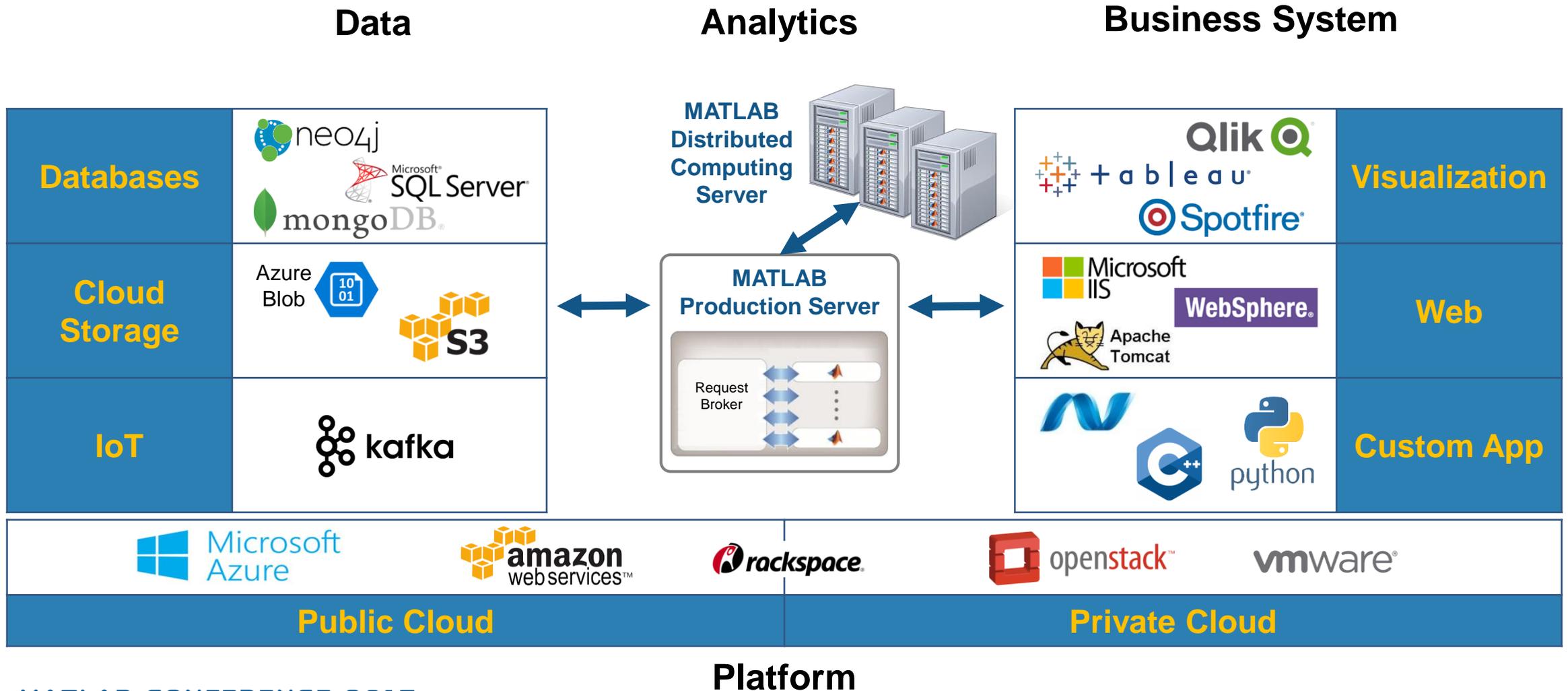


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- MATLAB High Performance Computing**  
**MATLAB Distributed Computing Server™**

# Enterprise Technology Stack



Run this Link...

<http://bit.ly/spotfirematlab>

User: jb

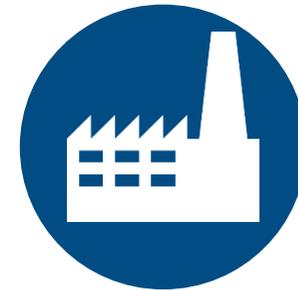
PW: matlab

# 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



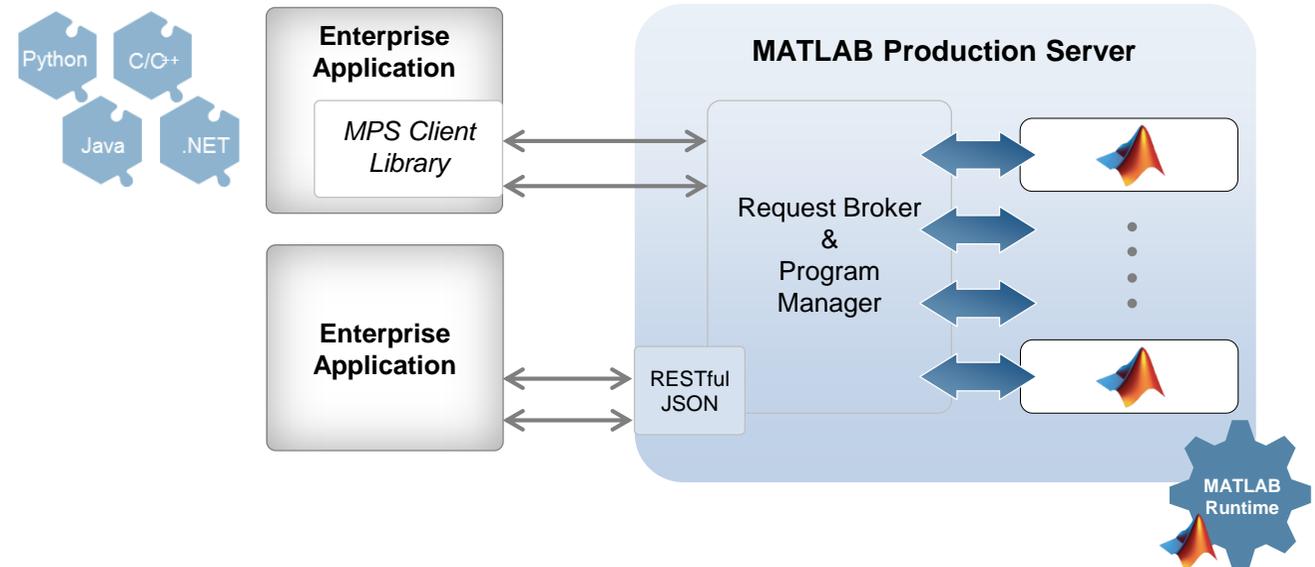
## Solution Architect

- ✓ 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

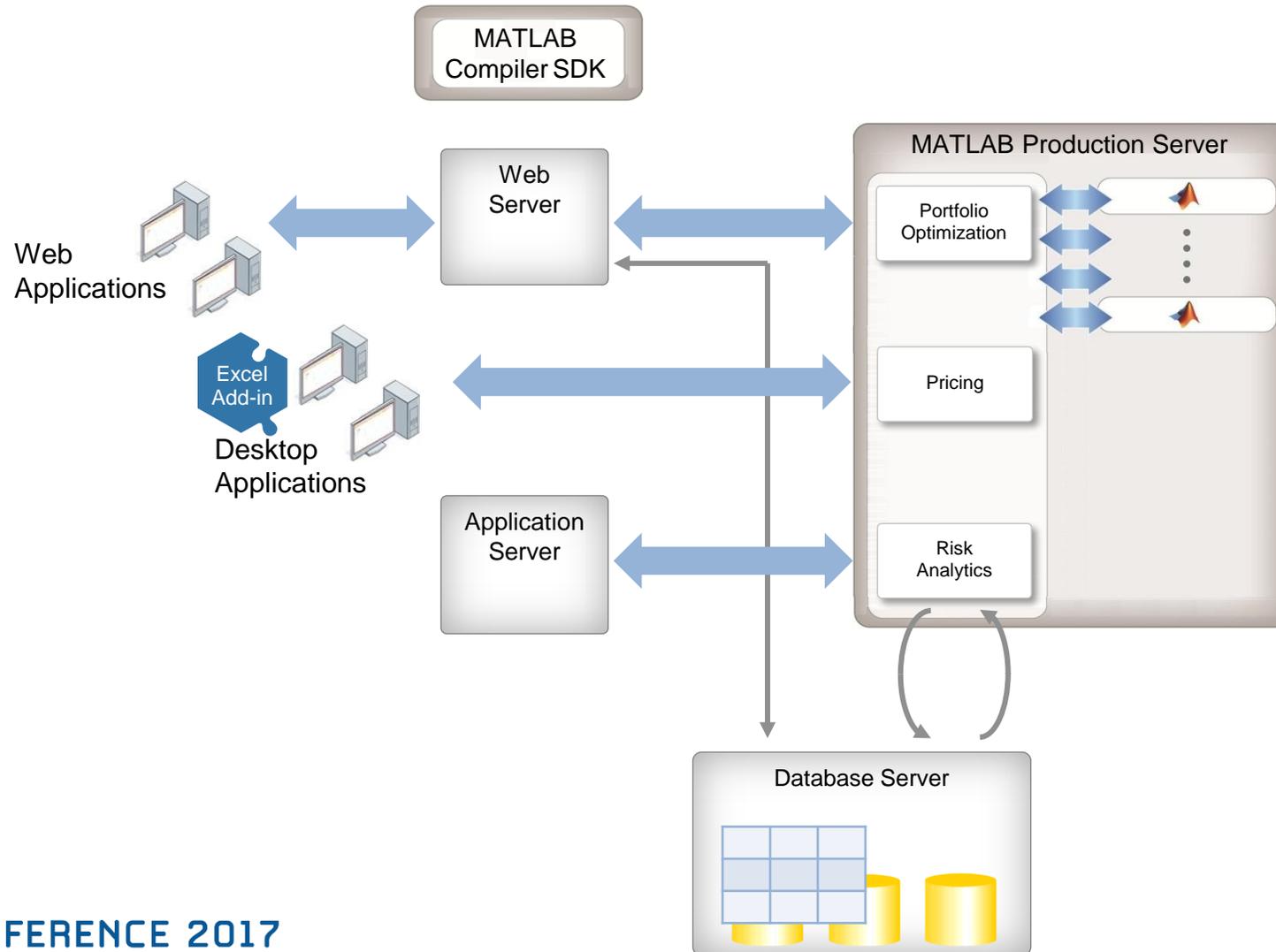
# MATLAB Production Server

## Enterprise Class Framework For Running Packaged MATLAB Programs

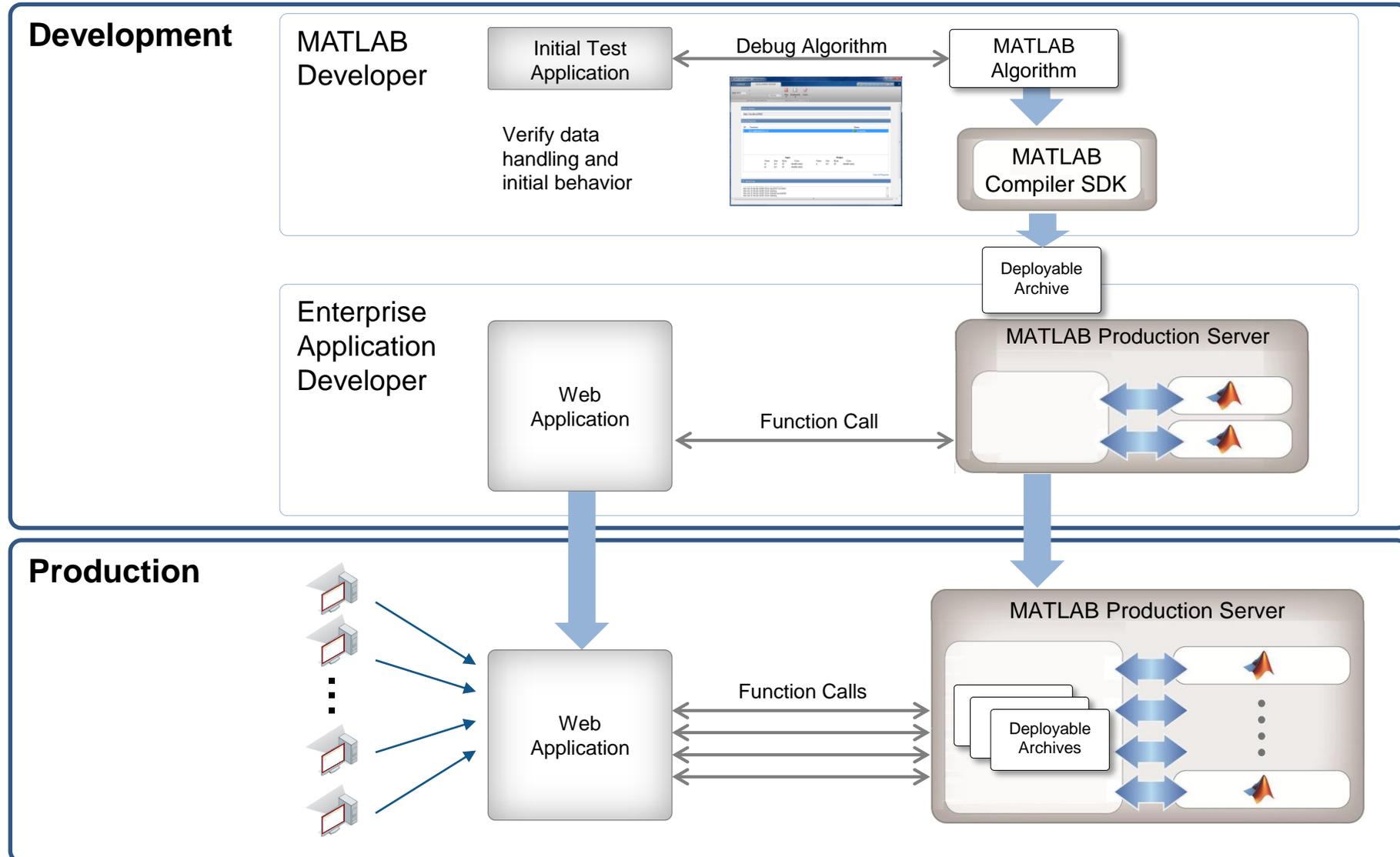
- Server software
  - Manages packaged MATLAB programs and worker pool
- MATLAB Runtime libraries
  - Single server can use runtimes from different releases
- RESTful JSON interface and lightweight client library (C/C++, .NET, Python, and Java)



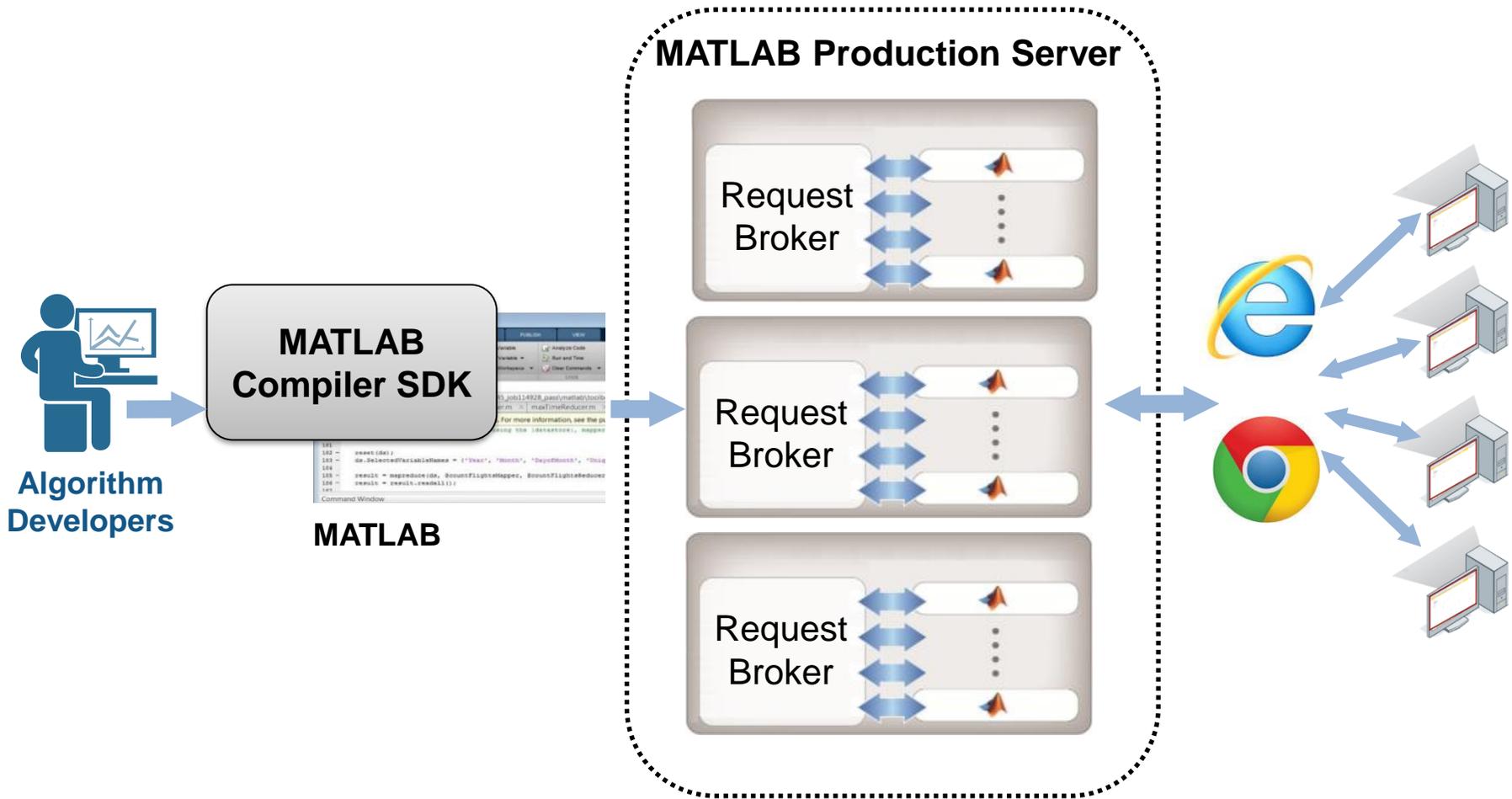
# Integrating with IT systems



# Production Deployment Workflow



# Customer example: Rabobank

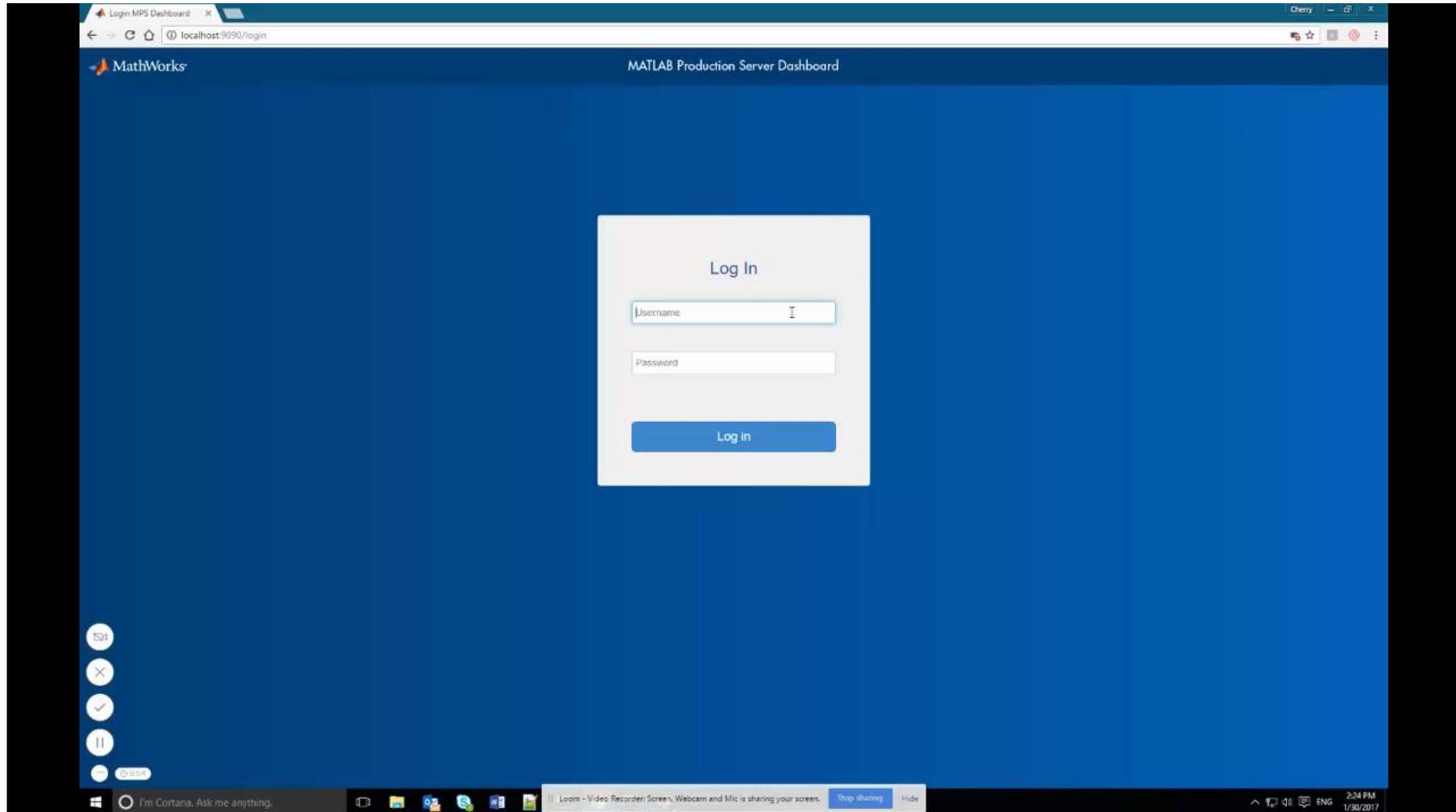


Global financial institution with European HQ

- 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

# MATLAB Production Server Live Example

# Web Management Dashboard – New in R2017a

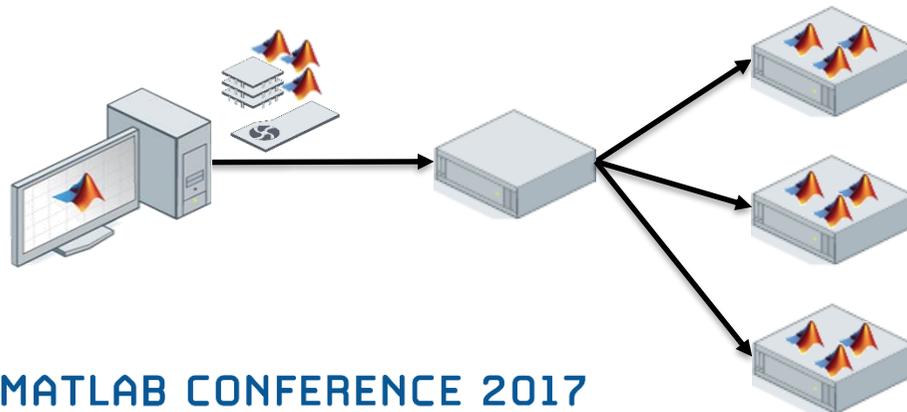


# What is an Enterprise Application?

- MATLAB Enterprise Production Deployment**  
**MATLAB Production Server™**



- MATLAB High Performance Computing**  
**MATLAB Distributed Computing Server™**

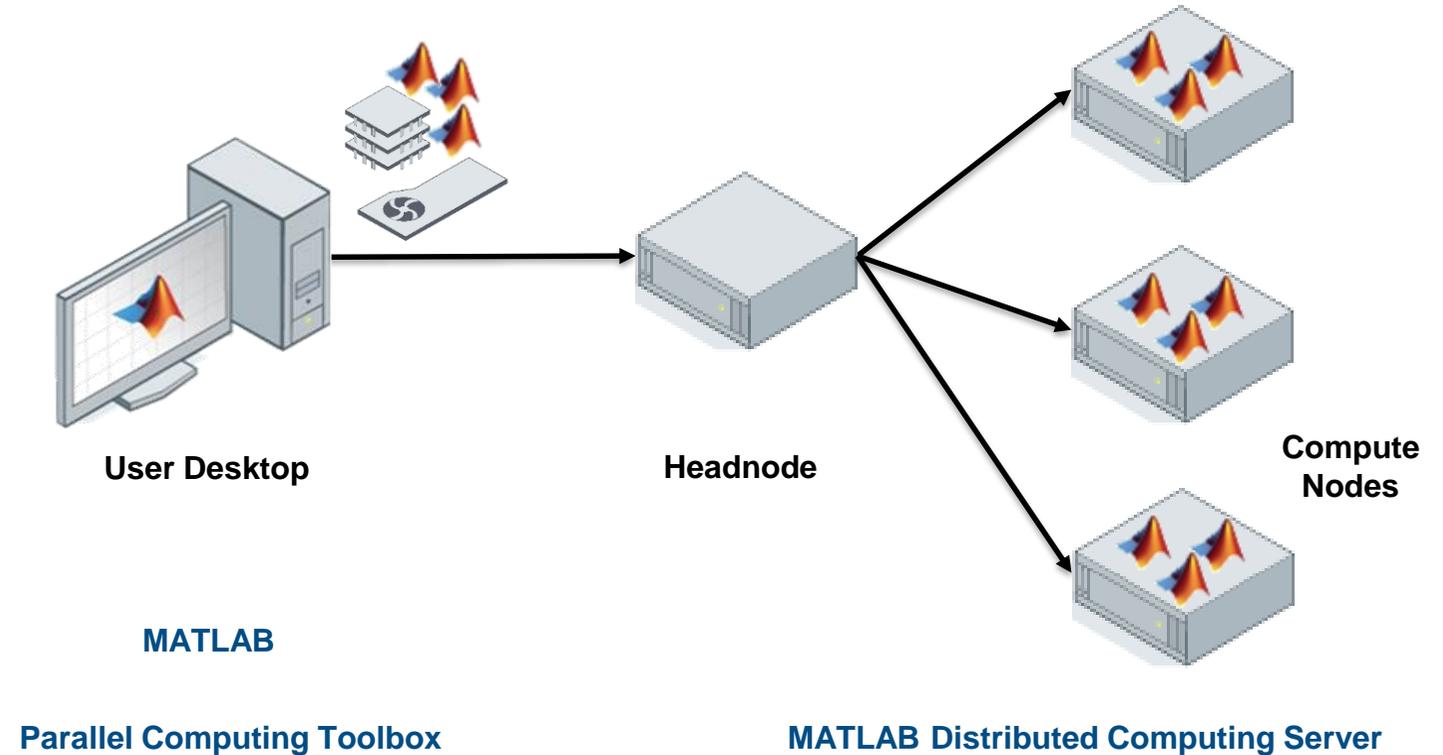


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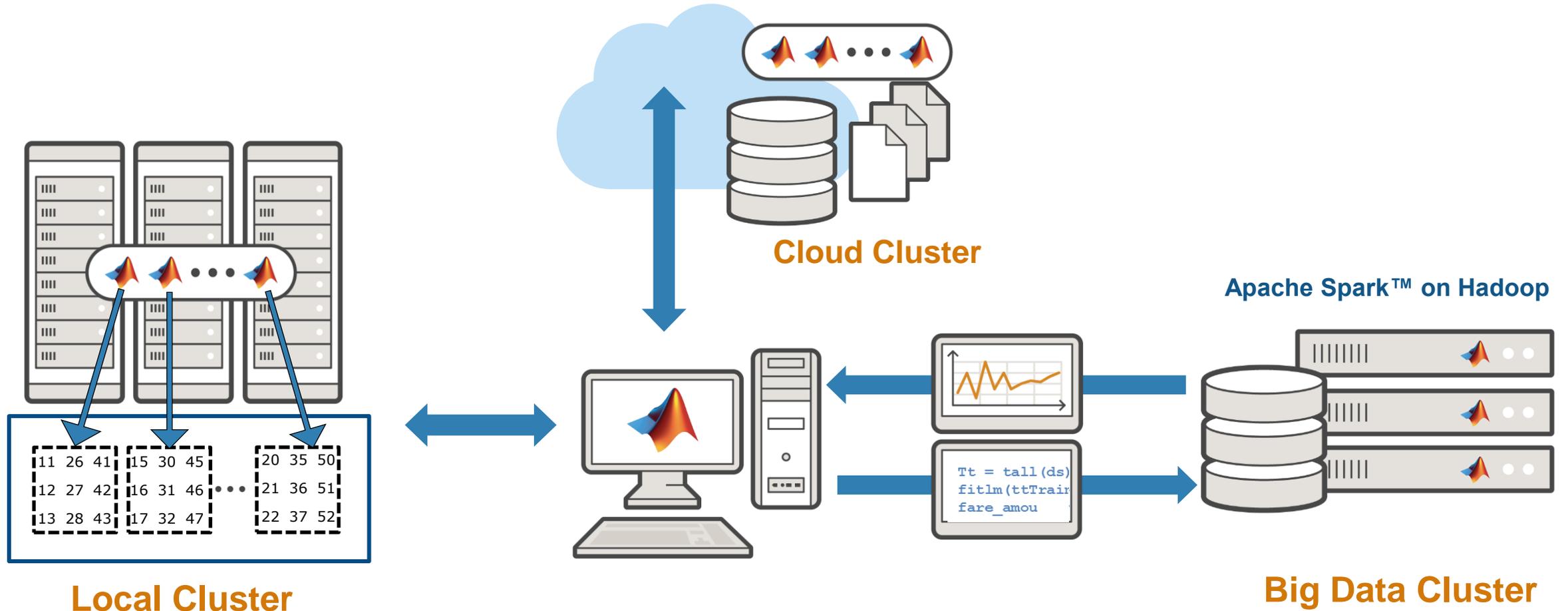
# MATLAB High Performance Computing

## MATLAB Distributed Computing Server

- Prototype on the desktop
- Integrate with existing infrastructure
- Access directly through MATLAB



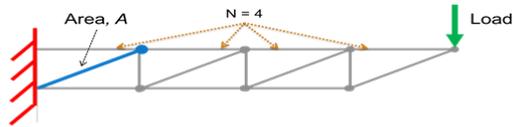
# HPC & Big Data capabilities in MATLAB



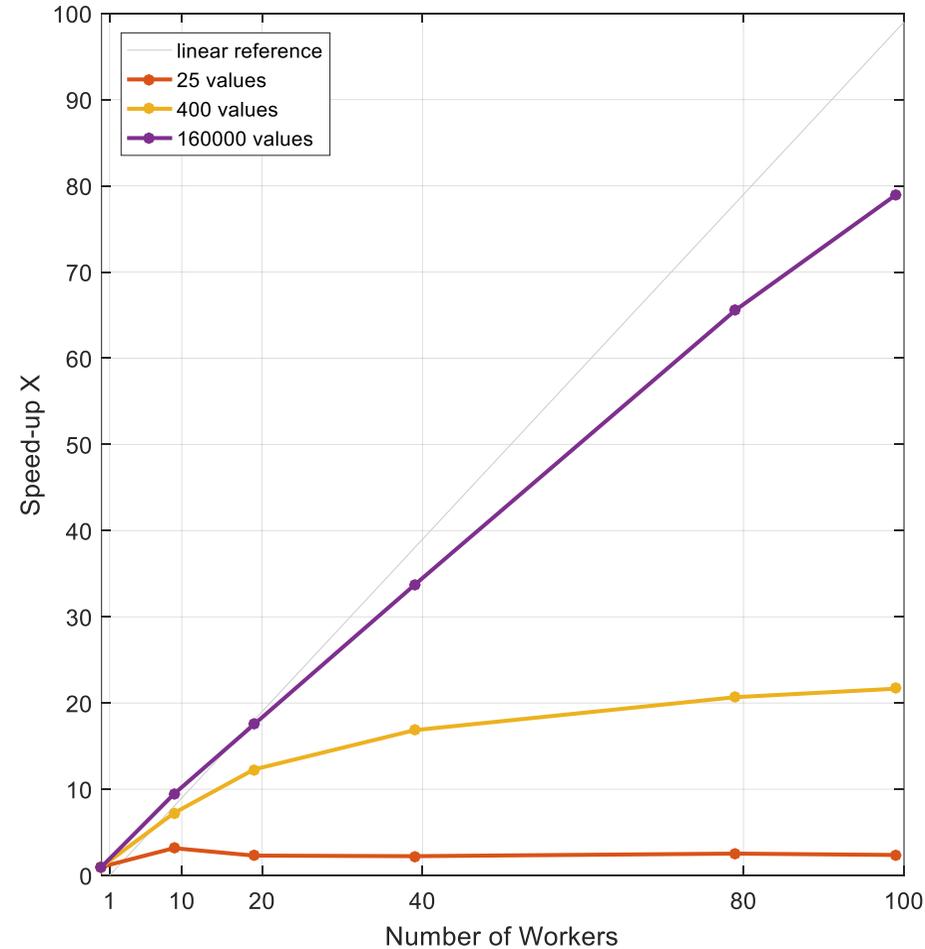
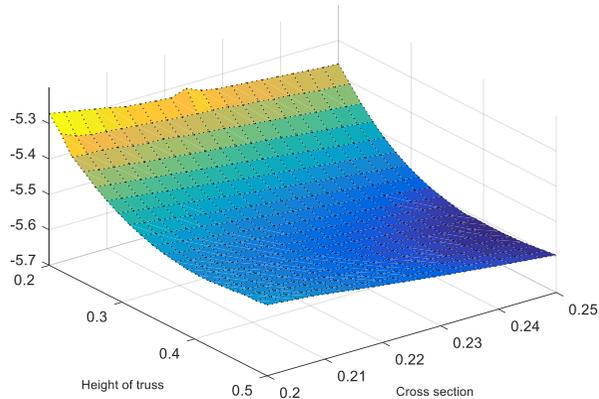
# Why parallel computing matters

## Scaling case study with a compute cluster

$$M\ddot{x} + C\dot{x} + Kx = F$$



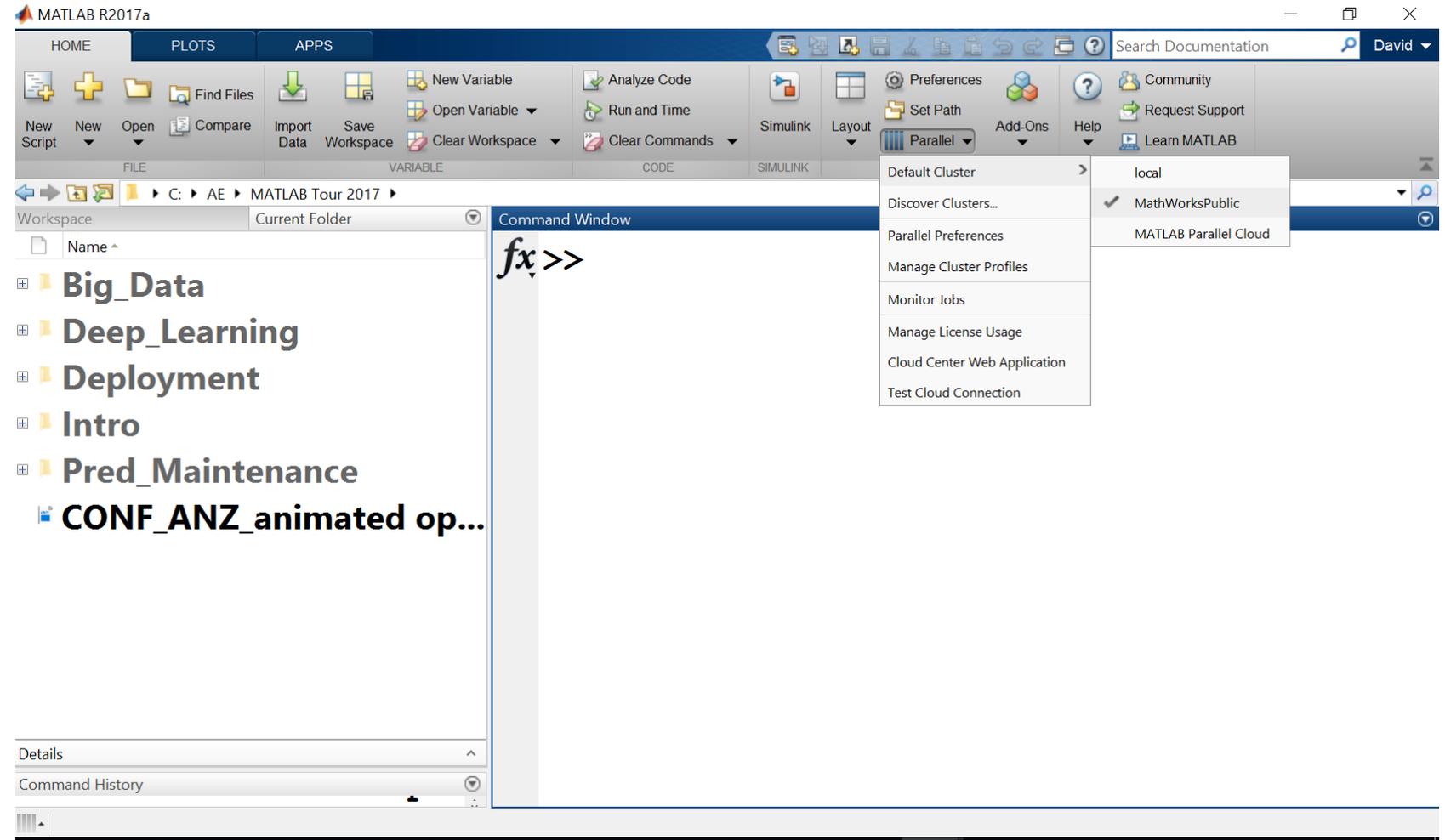
Log of Maximum Y Deflection  
(12 segments)



Workers in pool	Compute time (minutes)		
	160e3 values	400 values	25 values
1	140	0.38	0.03
10	15	0.05	0.01
20	8.0	0.03	0.01
40	4.2	0.02	0.01
80	2.1	0.02	0.01
100	1.8	0.02	0.01

Processor: Intel Xeon E5-class v2  
16 physical cores per node  
MATLAB R2016a

# Example – Connecting to a 256 node cluster



# MATLAB HPC on Azure using MATLAB Distributed Computing Server

*“Running **MATLAB Distributed Computing Server** on a cluster of Azure VMs provides user-friendly, high performance computing at very low cost compared to the total cost of ownership of providing an equivalent MDCS capability on on-premises servers deployed in our own data centres.”*

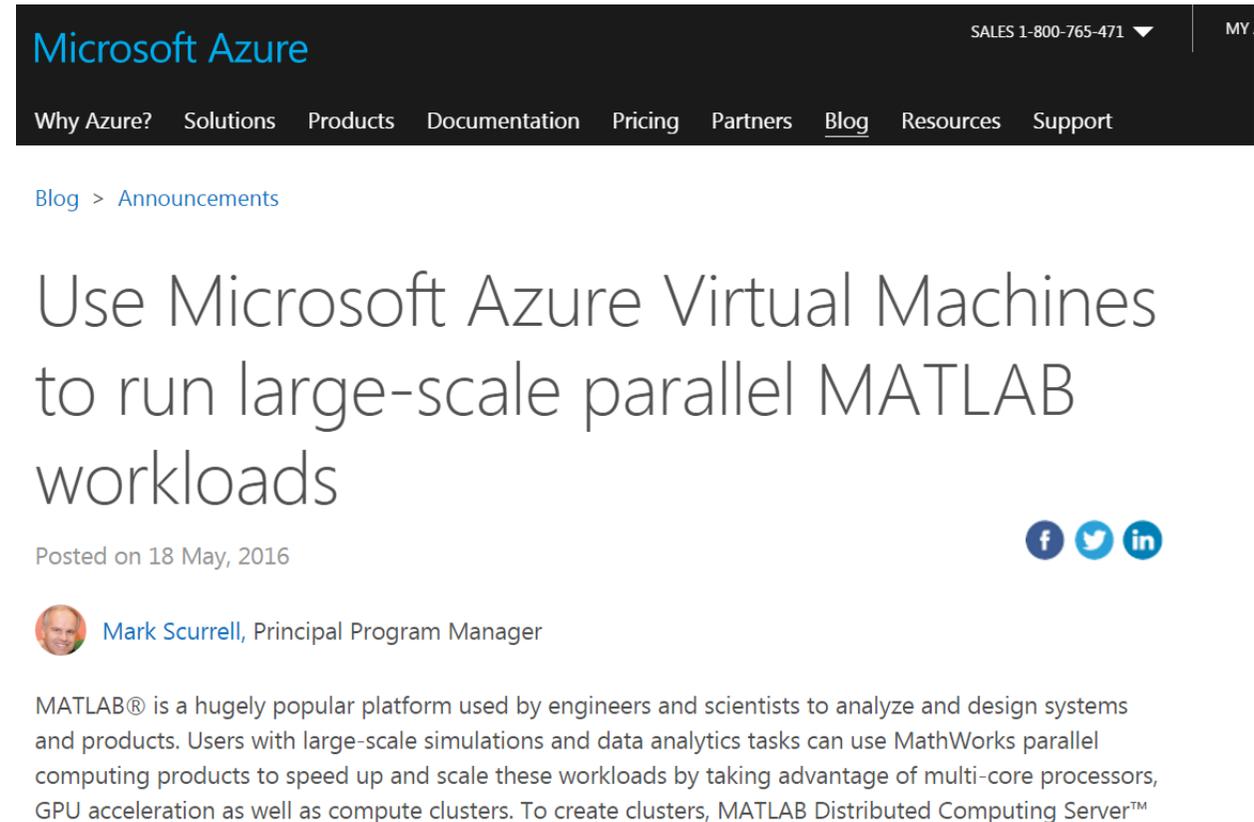
*James Mann*

*Solution Architect*

*Aberdeen Asset Management PLC*

- Story [here](#)

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The screenshot shows the Microsoft Azure website's blog page. At the top, the navigation bar includes 'Microsoft Azure', 'SALES 1-800-765-471', and 'MY'. Below the navigation bar, there are links for 'Why Azure?', 'Solutions', 'Products', 'Documentation', 'Pricing', 'Partners', 'Blog', 'Resources', and 'Support'. The main content area features the breadcrumb 'Blog > Announcements' and the article title 'Use Microsoft Azure Virtual Machines to run large-scale parallel MATLAB workloads'. The article is dated 'Posted on 18 May, 2016' and is authored by 'Mark Scurrell, Principal Program Manager'. The article text states: 'MATLAB® is a hugely popular platform used by engineers and scientists to analyze and design systems and products. Users with large-scale simulations and data analytics tasks can use MathWorks parallel computing products to speed up and scale these workloads by taking advantage of multi-core processors, GPU acceleration as well as compute clusters. To create clusters, MATLAB Distributed Computing Server™'.

# MATLAB executing in Spark on Hadoop

Local disk  
Shared folders  
Databases

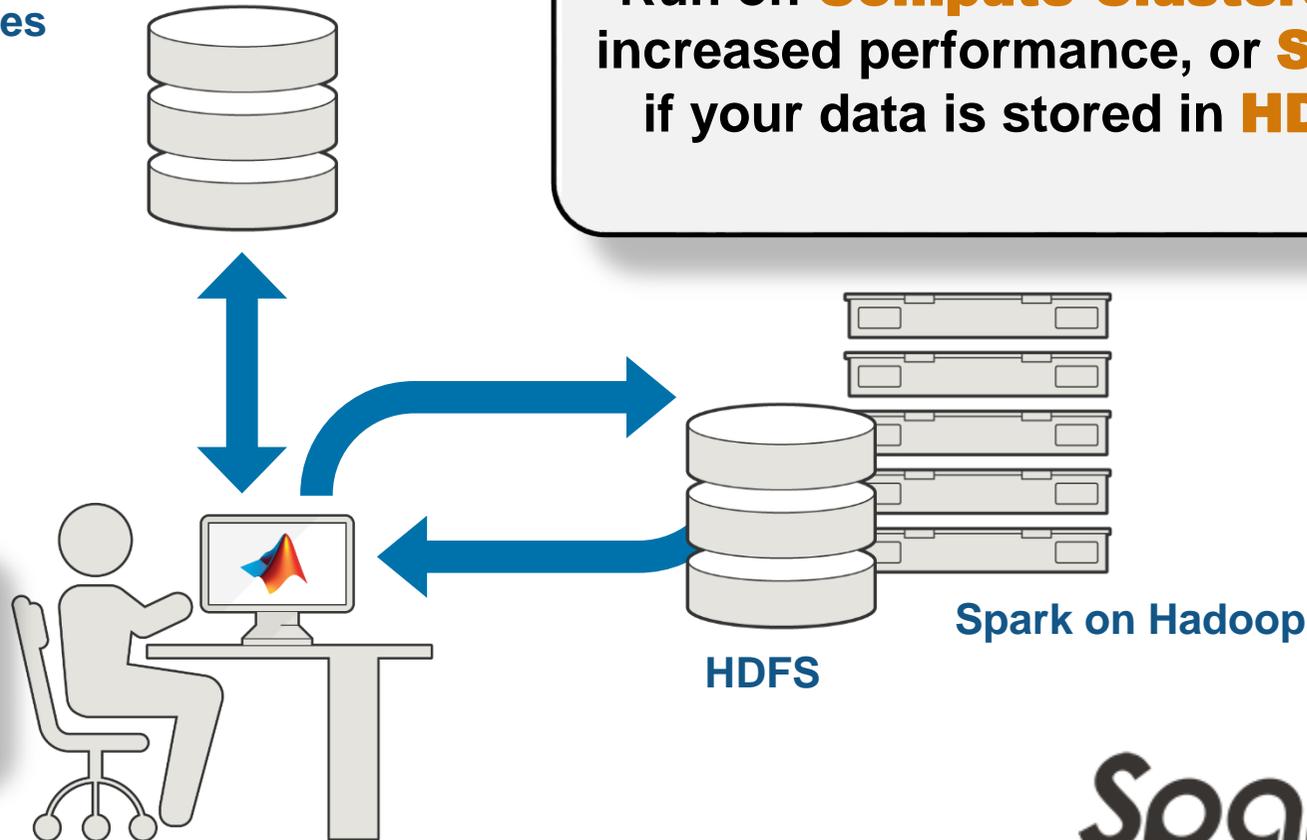
Run on **Compute Clusters** for increased performance, or **Spark** if your data is stored in **HDFS**



Process out-of-memory data on your **Desktop** to analyze, develop analytics



**Parallel Computing Toolbox** for increased performance



# Example: Running on Spark and Hadoop

Live Editor - /mathworks/home/hgorr/predictTaxiFare.mlx

predictTaxiFare.mlx

## tall Arrays for Big Data in MATLAB

### Predict Cost of Taxi Ride in New York City

Analyze data from .csv files containing taxi trip information, separated by month. The data set is available from the [City of New York](#).

VendorID,	tpep_pickup_datetime,	tpep_dropoff_datetime,	passenger_count,	trip_distance,	pickup_longitude,	picku
2,	2015-01-07 07:40:20,	2015-01-07 08:04:45,	6,	9.12,	-73.9524536132812,	40.78
2,	2015-01-21 22:49:50,	2015-01-21 23:17:11,	6,	5.63,	-74.0083694458008,	40.73
1,	2015-01-05 23:04:30,	2015-01-05 23:15:00,	1,	2.9,	-73.8632125854492,	40.76
1,	2015-01-11 22:20:43,	2015-01-11 22:23:02,	1,	0.8,	-73.9577560424805,	40.76
2,	2015-01-24 00:34:59,	2015-01-24 00:38:39,	1,	0.65,	-73.9916687011719,	40.73
1,	2015-01-25 19:09:57,	2015-01-25 19:18:02,	1,	1.5,	-73.9983825683594,	40.72
1,	2015-01-02 23:24:13,	2015-01-02 23:27:30,	1,	1,	-73.9963912963867,	40.75
2,	2015-01-21 06:46:23,	2015-01-21 06:47:56,	1,	0.63,	-73.9913635253906,	40.77
2,	2015-01-23 19:32:33,	2015-01-23 19:49:56,	3,	2.52,	-73.999382018043,	40.73

Set up execution environment

```
numWorkers = 16;

setenv('HADOOP_HOME', '/mathworks/test/hadoop');
setenv('SPARK_HOME', '/mathworks/test/spark');

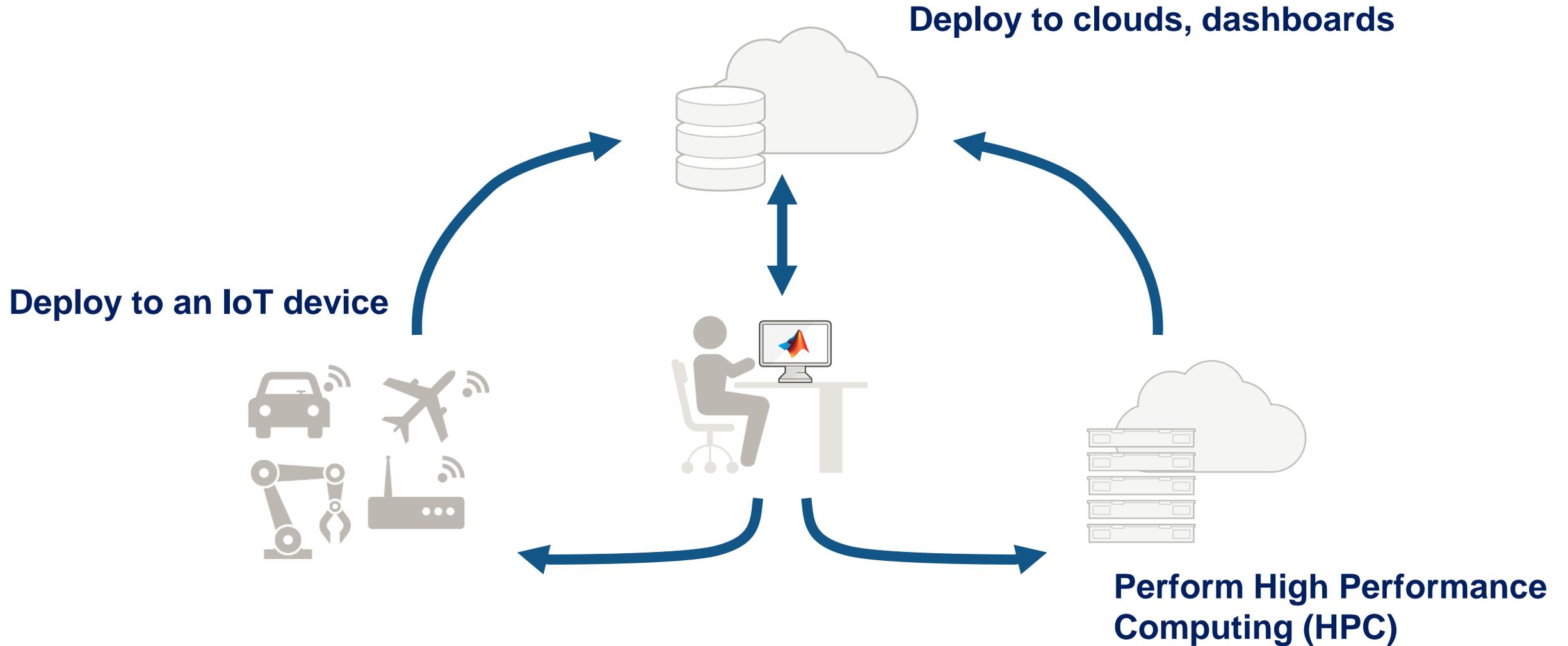
cluster = parallel.cluster.Hadoop;
cluster.SparkProperties('spark.executor.instances') = num2str(numWorkers);
```

# Key Takeaways

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2. What is an Enterprise Application
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# Key Take Away

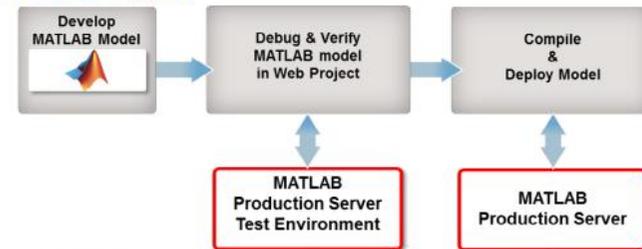
## MATLAB Streamlines Enterprise Integration



# 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](#)

## MATLAB developer:



## Web developer:

