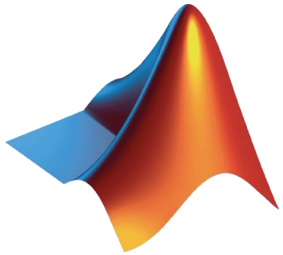
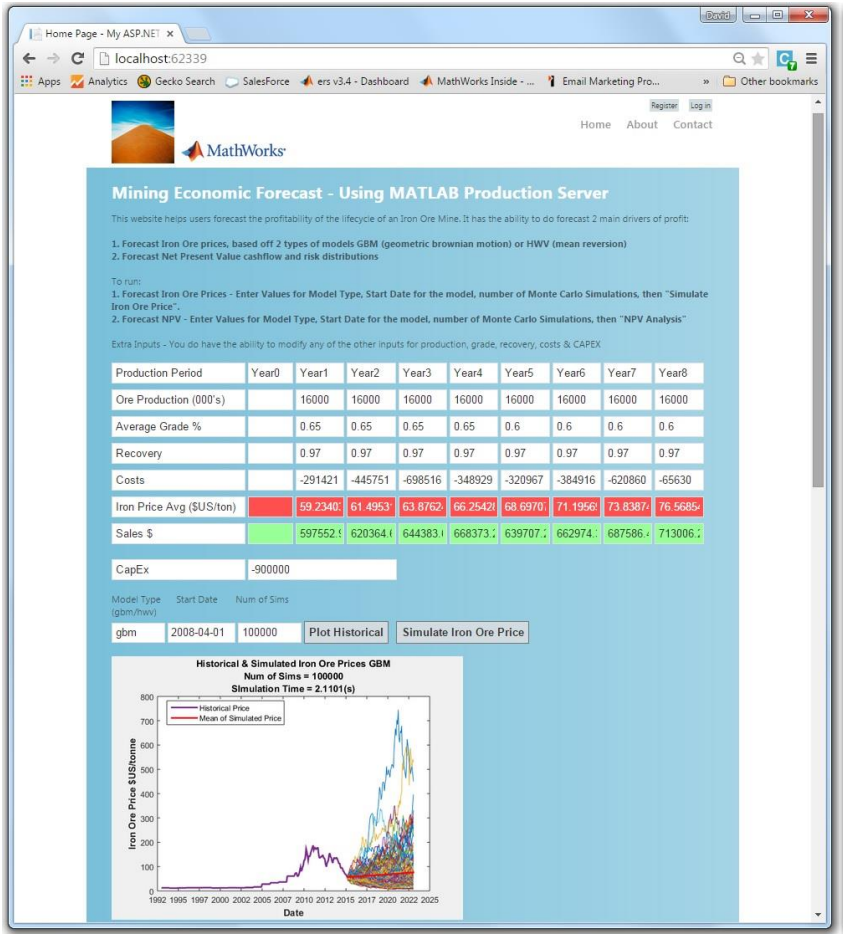
How to build a website powered by MATLAB



David Willingham
Senior Application Engineer – Data Analytics

Case Study – Mining Economics

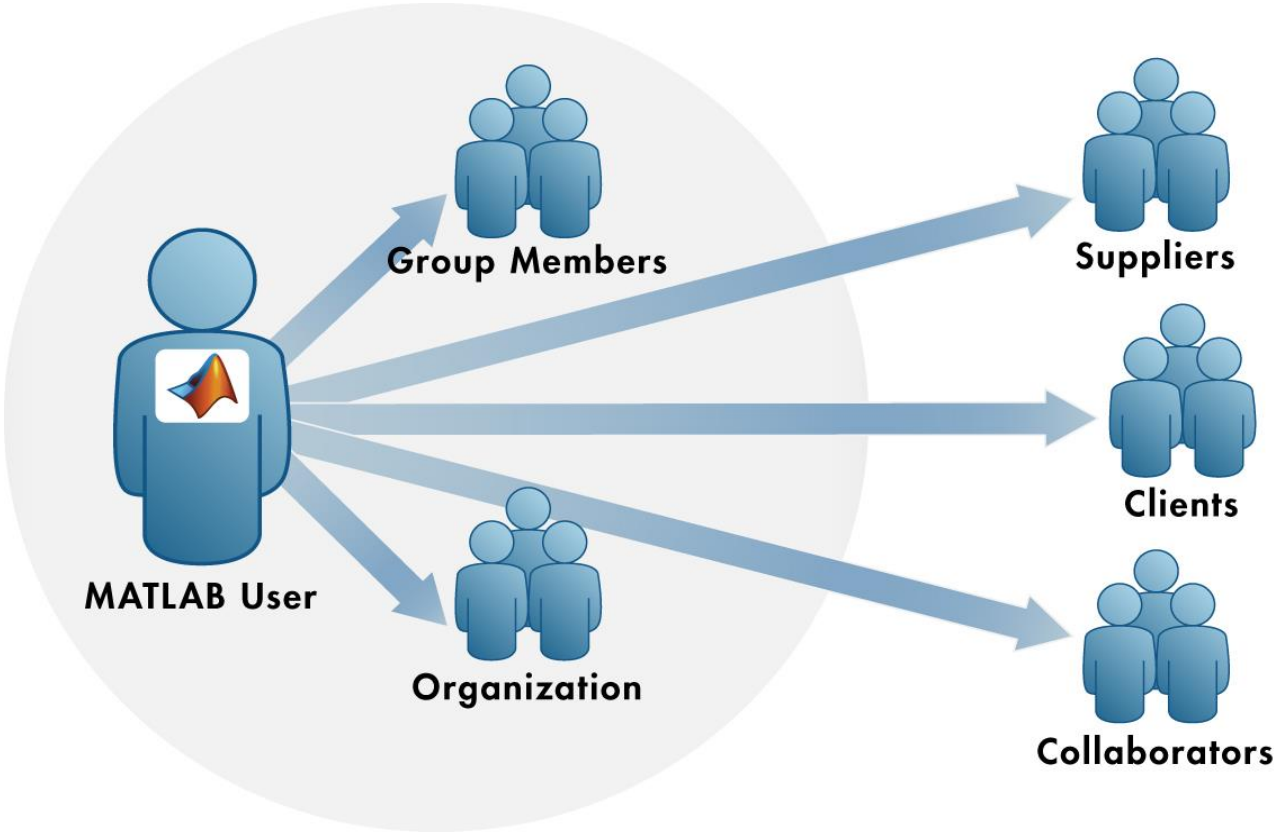
forecasting the profitability & financial risk of a mine



Case Study - Background

- Business Issues
  - An analyst has developed the forecasting models
  - Only he/she can run it
  - Turn around for simulating scenarios is slow
  - IP is lost if the analyst leaves
  - Concern about manual re-coding for deployment
  - Needs to be quick
- Business Solution
  - Automatically deploy the models to the web with MATLAB Compiler products
  - Other users can now interact and run various scenarios
  - From any laptop/PC or mobile device, instantly
  - IP will exist long after the analyst has developed it
  - No recoding of models necessary

Share Programs Outside of MATLAB

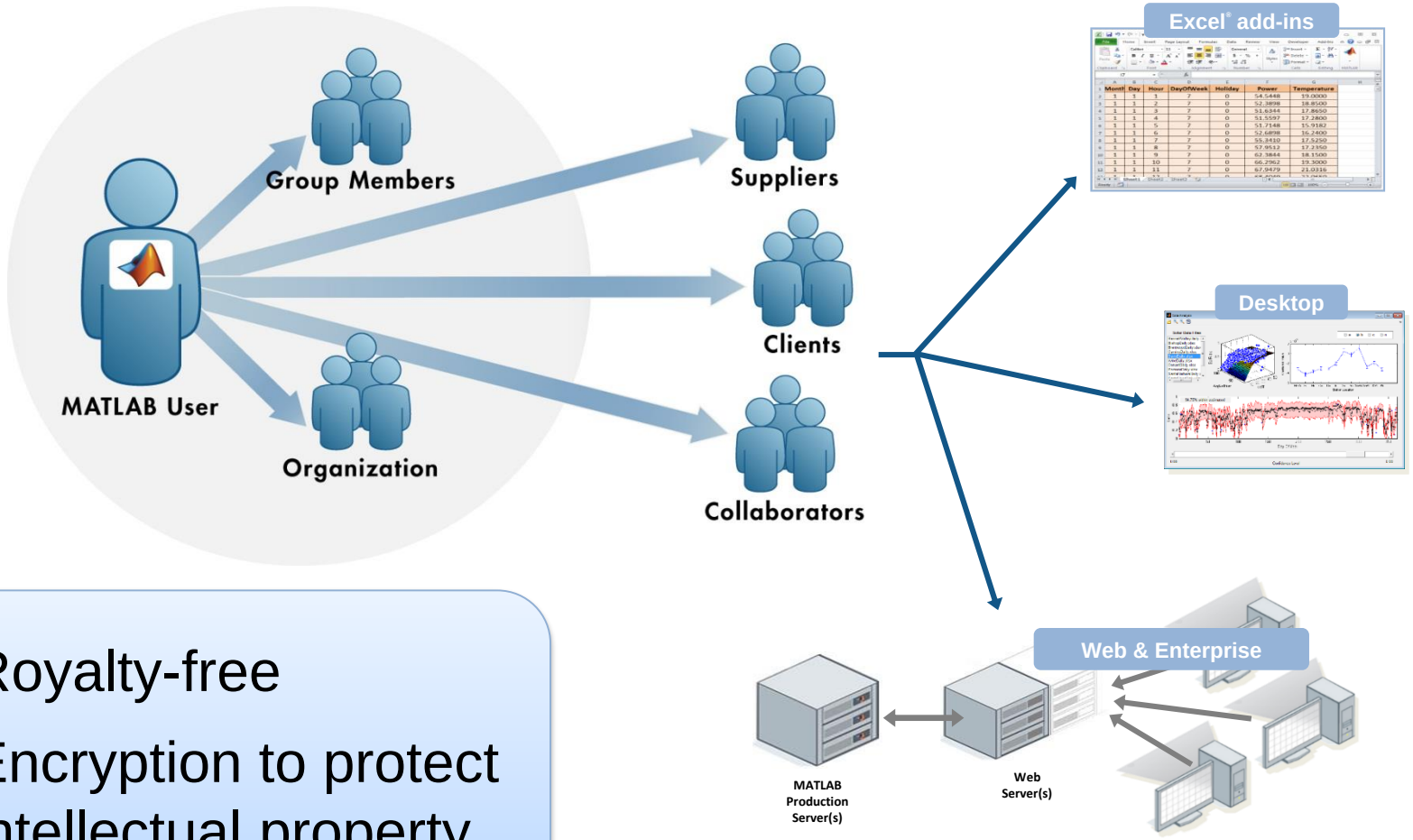


Deploy your MATLAB code to people who don't need MATLAB

Benefits of Deploying MATLAB Code

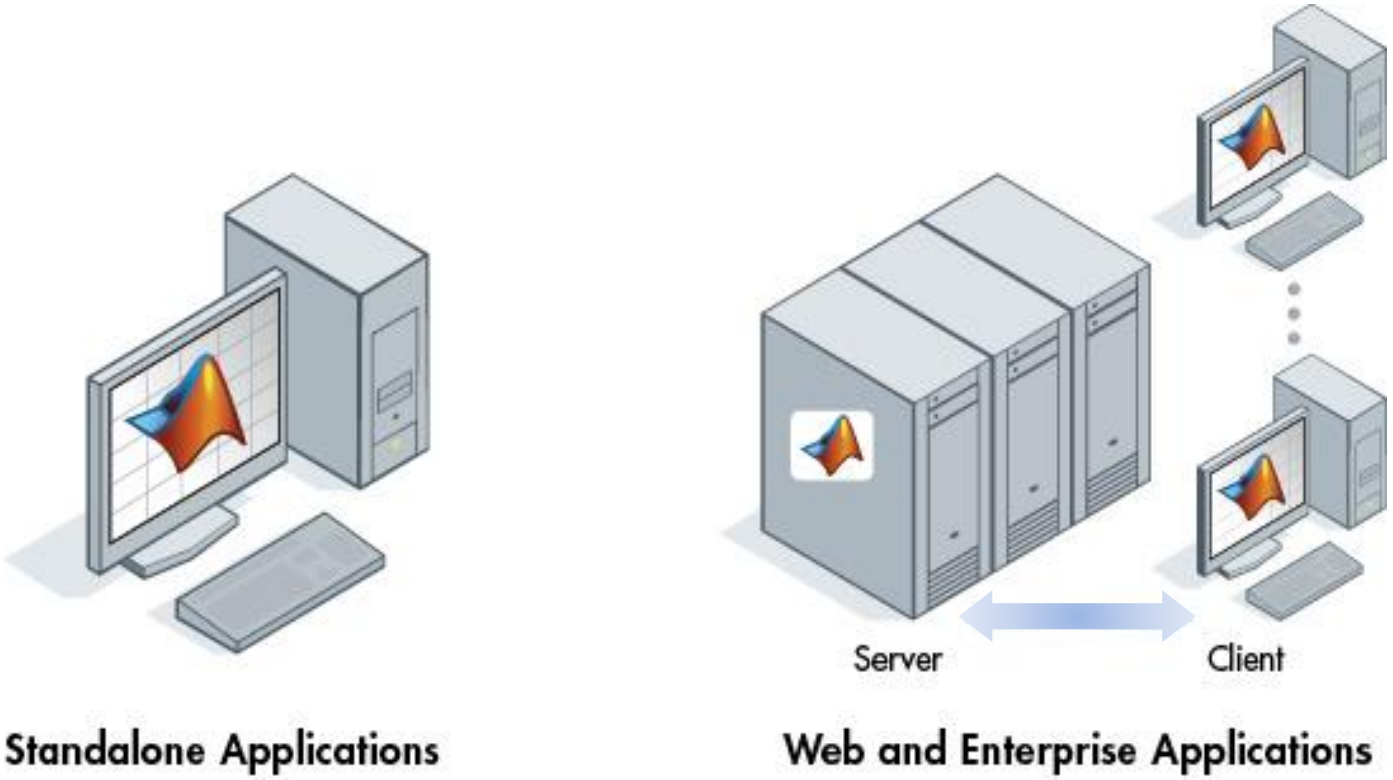
- Domain experts maintain ownership of ideas, algorithms, and applications
- Flexibility to integrate with different programming languages
- Implement a common algorithm on different platforms
- Avoid time consuming and error prone re-coding
- Easily adopt algorithm improvements throughout lifecycle

A Primer on Sharing MATLAB Programs

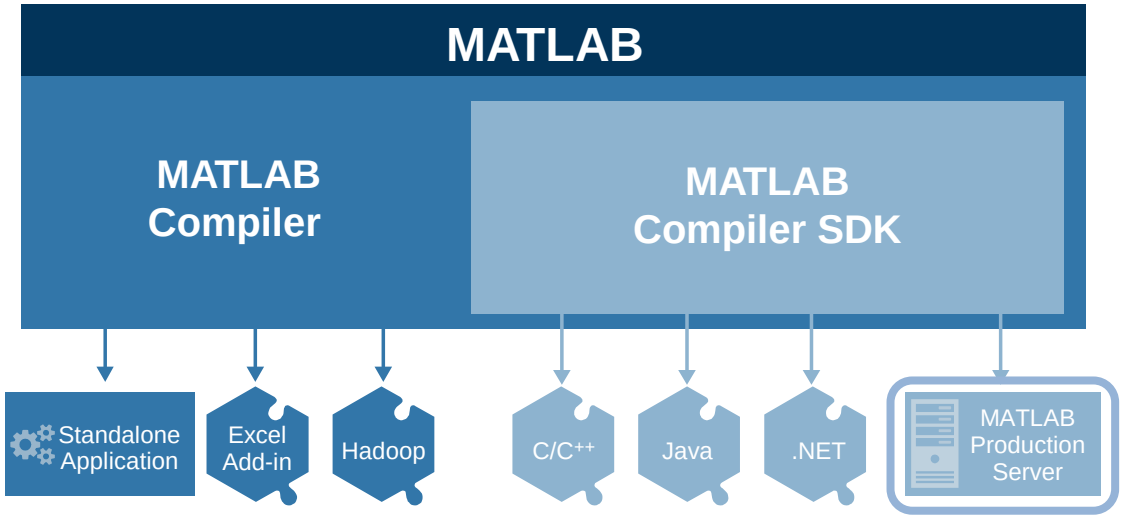


- Royalty-free
- Encryption to protect intellectual property

The Range of Application Platforms



Which Product will Fit Your Needs?



MATLAB Compiler for sharing MATLAB programs without integration programming

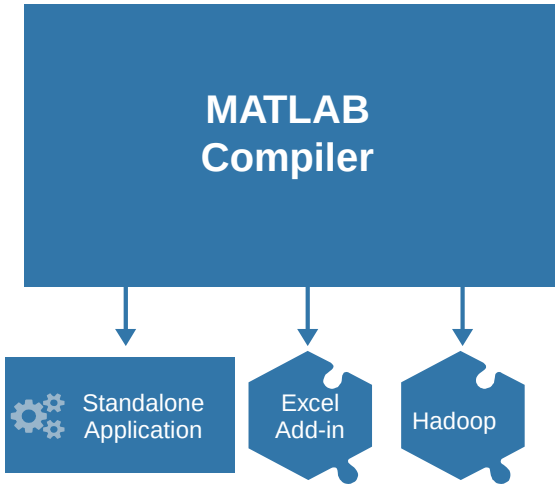
MATLAB Compiler SDK provides implementation and platform flexibility for software developers

MATLAB Production Server provides the most efficient development path for secure and scalable web and enterprise applications

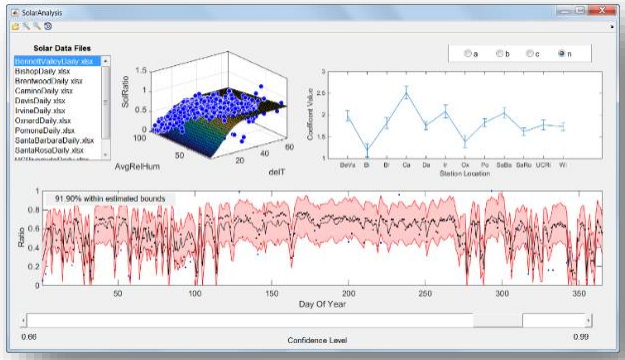
Using MATLAB Compiler

Compiled applications can be shared as:

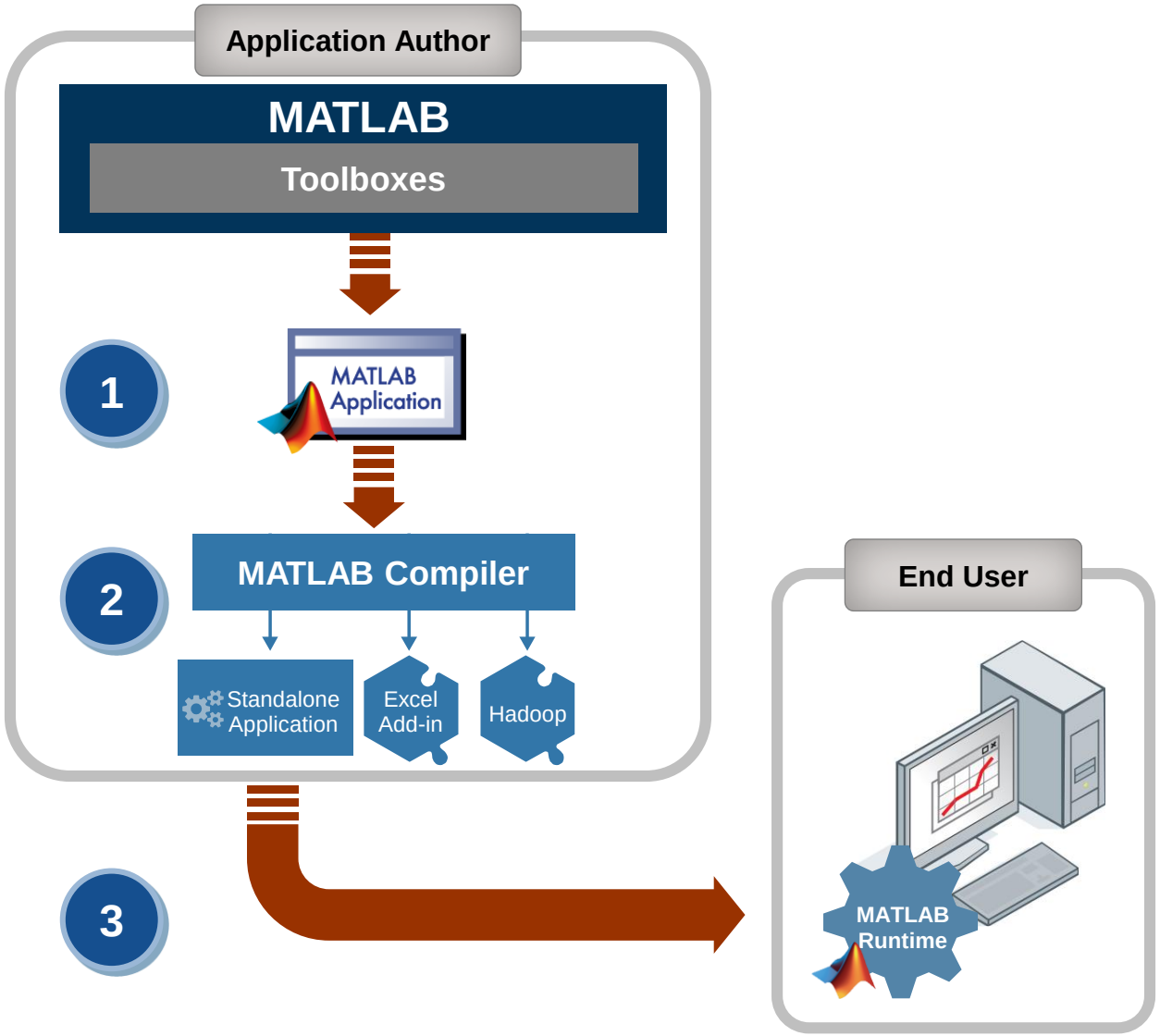
- Standalone desktop applications
- Add-ins for integration with Microsoft Excel® spreadsheets
- Components that run MATLAB code against Hadoop



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



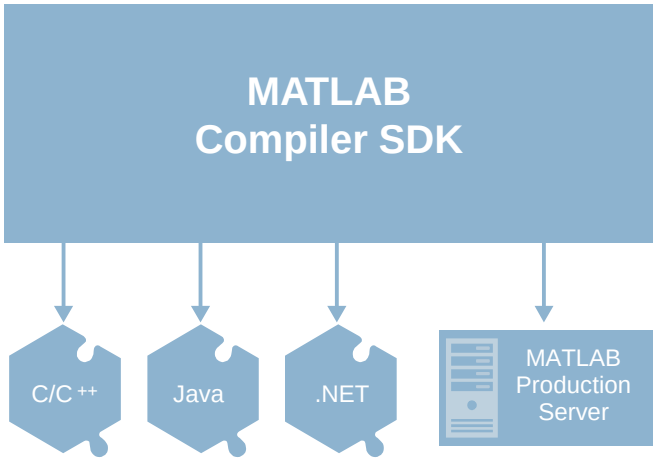
Sharing Standalone Applications



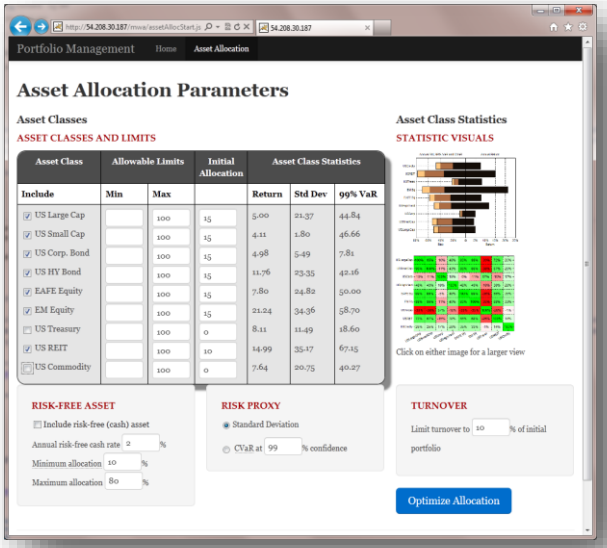
Using MATLAB Compiler SDK

Flexible toolkit for software developers

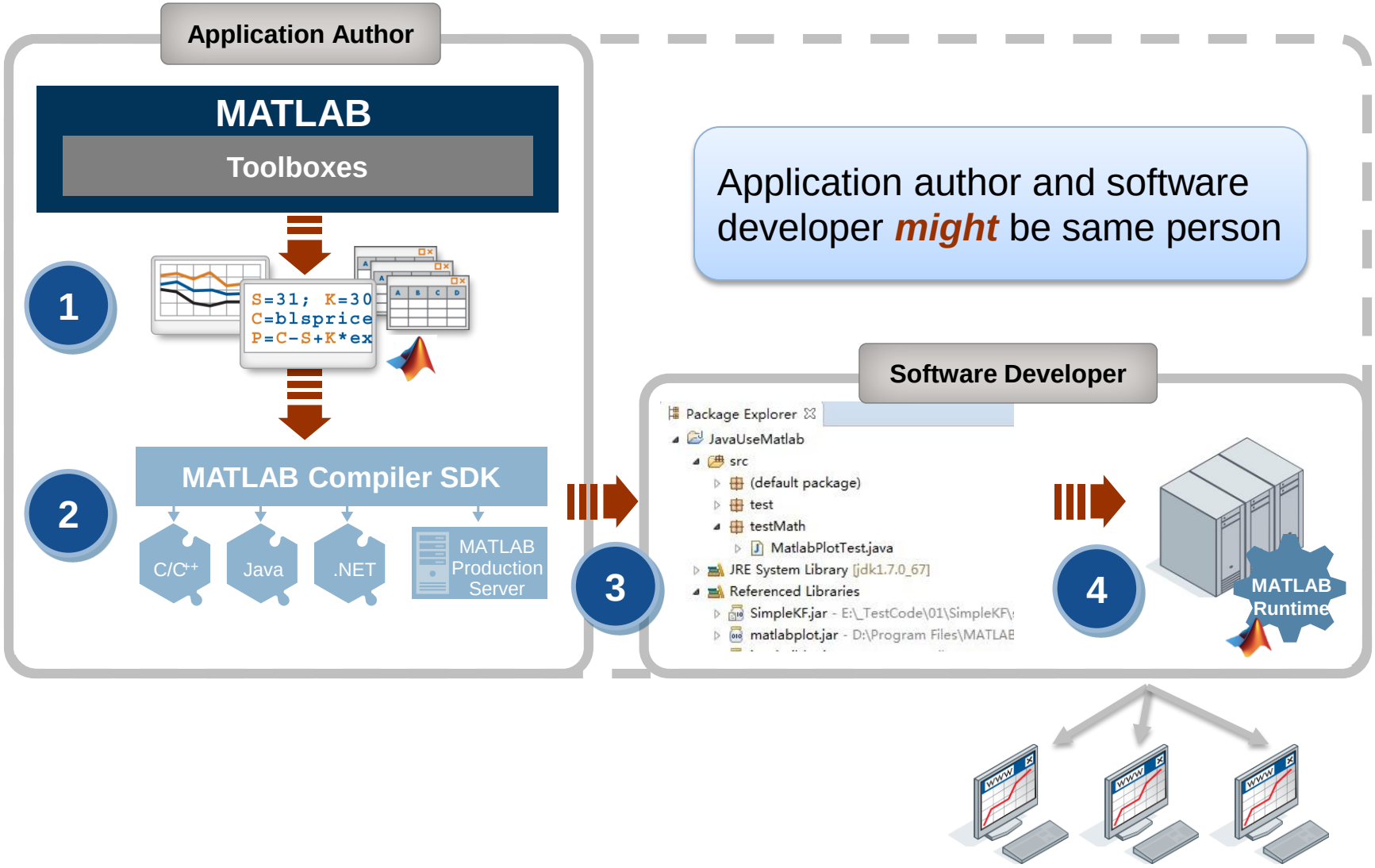
- Integrate with applications written in C/C++, .NET, Java
- Develop applications for MATLAB Production Server



Develop a custom application server or deploy with MATLAB Production Server



Integrating MATLAB-based Components



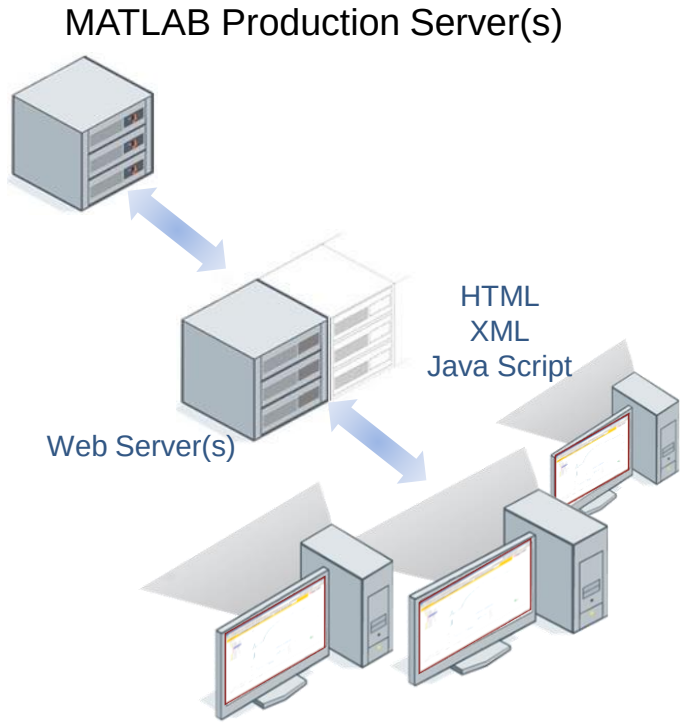
Scale up with MATLAB Production Server

Most efficient path for creating enterprise applications

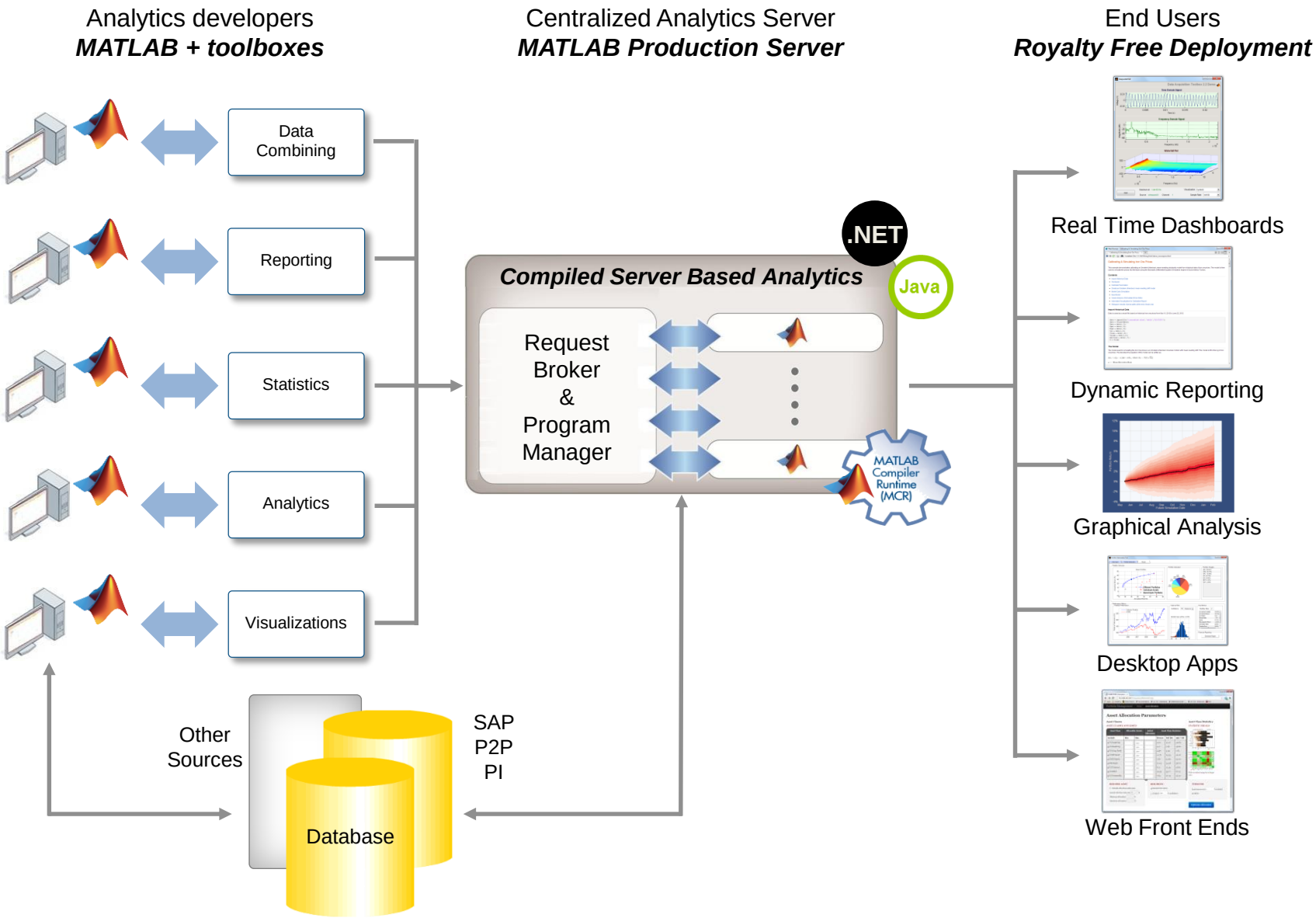
Deploy MATLAB programs into production

- 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

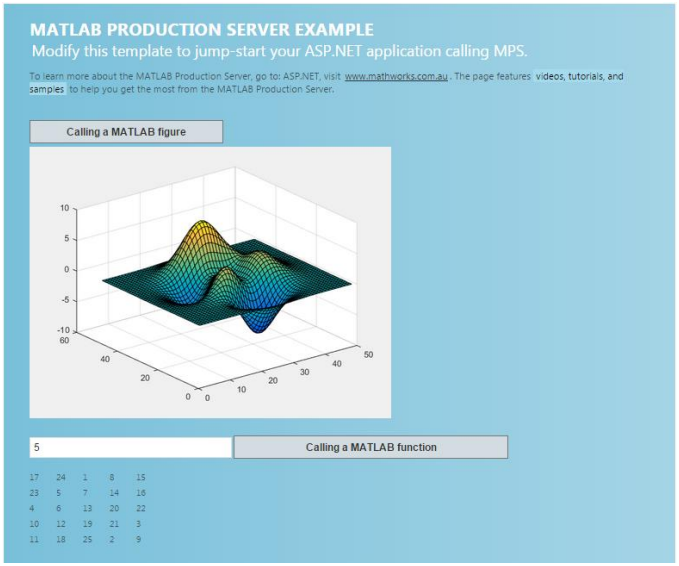


Enterprise Use Case Workflow

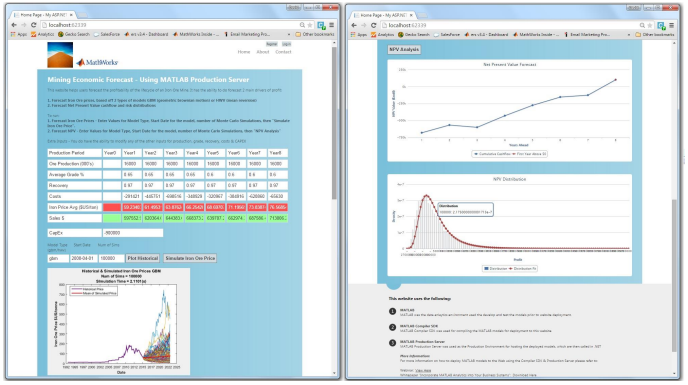


Website deployment – Hello World

- Two Hello World Examples:
  1. Output a matrix
  2. Output a MATLAB figure



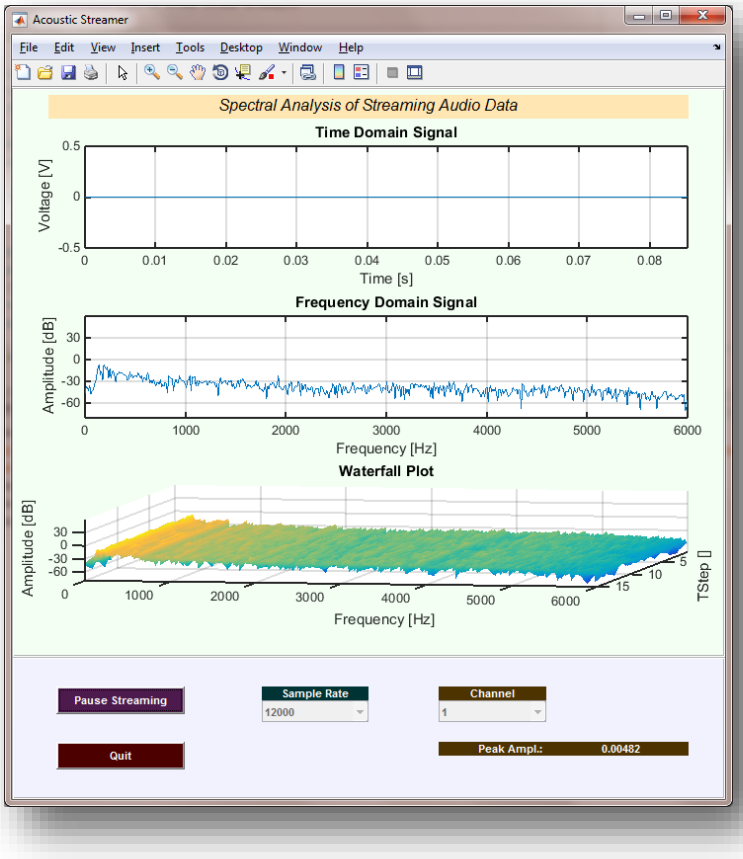
Case Study – Mining Economics



- Inputs
  - Table of Mining Production Values
  - Type of model
  - Number of Simulations
- Outputs
  - Monte Carlo Simulation of Iron Ore Price Forecast
    - With MATLAB Figures
  - Net Present Value Cashflow and Risk profile
    - With 3rd party interactive web charts

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



Learn more …

Product and Solutions home pages

- http://www.mathworks.com/products/compiler/
- http://www.mathworks.com/products/matlab-compiler-sdk/
- http://www.mathworks.com/products/matlab-production-server/
- http://www.mathworks.com/solutions/desktop-web-deployment/

Other useful links

- http://www.mathworks.com/examples/
- http://www.mathworks.com/videos/
- http://www.mathworks.com/company/events/webinars/index.html
- http://www.mathworks.com/company/newsletters/technicalarticles.html

Thank you

Customer stories and supplemental information on following slides

Customer Stories

UniCredit Bank Austria Develops and Rapidly Deploys a Consistent, Enterprise-Wide Market Data Engine

Zero-coupon yield curve plot in UniCredit Bank Austria's UMD environment.

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

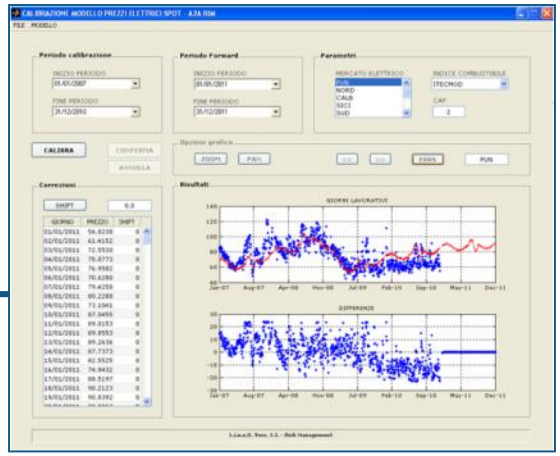
- Development time reduced by 50%
- Risk management improved across the bank
- Operational, audit, and maintenance costs reduced

" 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

Link to user story

A2A Develops Comprehensive Risk Management Solution for Energy Markets



A2A's application for calibrating and forecasting electricity spot price, a component of the Risk Management Dashboard.

Challenge

Manage and mitigate risk across markets in a large utility company

Solution

Use MATLAB and companion toolboxes to process data, develop risk and pricing models, and deploy an interactive dashboard for analysts

Results

- Hour-long calculations completed in 30 seconds
- Development time halved
- Pricing model development accelerated

"When you deal with numbers all day and work with sophisticated analytical models, having an integrated environment is invaluable. With MATLAB we visualize data, conduct back-testing, and plot graphs to see the results of changes we make, all in one environment, and that saves time."

Simone Visonà
A2A

Link to user story

Commerzbank Develops Production Software System for Calculating Derived Market Data

Commerzbank headquarters in Frankfurt.

Challenge

Compute a variety of derived market data from raw market data

Solution

Use MATLAB to read data from a data management system in a Windows and Linux architecture, perform analyses and optimizations, visualize results, and deploy mission-critical calculations

Results

- Integration with existing system simplified
- Implementation time reduced by months
- Updates made in days, not weeks

"Our solution required a Windows client and Linux server software. We used MATLAB to rapidly develop both by taking advantage of distributed computing, a MEX-file interface to access our financial data, and fast, built-in functions for optimization, regression, and more."

Julian Zenglein
Commerzbank

Link to user story

Fulcrum Asset Management Develops Custom Quantitative Risk Management System

Challenge

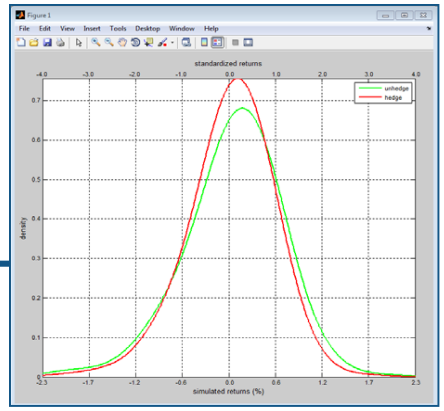
Develop an accurate, scalable, and fast risk engine for fund management

Solution

Use MATLAB to import financial data from multiple sources, develop sophisticated risk models, and run optimizations and scenarios analysis on multicore processors

Results

- Optimizations and calculations accelerated
- Risk measurement accuracy improved
- Integration with databases and datafeeds streamlined



Distribution of standardized and unstandardized simulated portfolio returns before and after hedging.

"With MATLAB we developed a risk management system that helps us implement our strategies, hedge our risks more efficiently, and respond rapidly to changes in the market. MATLAB enables us to incorporate our ongoing research and the experience of our fund managers into the risk engine."

Athanasios Bolmatis
Fulcrum

Link to user story

Microtech Develops and Tests Implantable Blood Pressure Sensor

Microtech's submillimeter sensor, dotting the "I" on a U.S. penny.

Challenge

Create and test an implantable blood pressure sensor

Solution

Use MATLAB to develop algorithms for generating and analyzing ultrasound waves, create standalone analysis software, and control lab equipment for automated testing

Results

- Development time halved
- Hardware updates streamlined
- Productivity increased by 20%

"Using MATLAB to develop both real-time ultrasound signal processing algorithms and automated measurement software eliminates the need for a dedicated C/C++ programmer as well as the risk of introducing bugs when the algorithm is rewritten."

Dr. Yonathan Kozlovsky
Microtech

Link to user story

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

Link to user story

STIWA Increases Total Production Output of Automation Machinery

STIWA's shopfloor management system, based on MATLAB, AMS ZPoint-CI, and AMS Analysis-CI.

Challenge

Apply sophisticated mathematical methods to optimize automation machinery and increase total production output

Solution

Use AMS ZPoint-CI to collect large production data sets in near real time and use MATLAB to analyze the data and identify optimal trajectories

Results

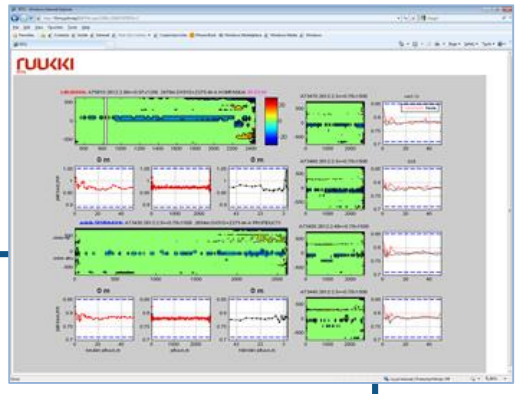
- Total cycle time reduced by 30%
- Large data sets analyzed in seconds
- Deployment to multiple machines streamlined

"Our shopfloor management system AMS ZPoint-CI collects a huge amount of machine, process, and product data 24 hours a day. By analyzing this data immediately in MATLAB and AMS Analysis-CI we have achieved a tenfold increase in precision, a 30% reduction in total cycle time, and a significant increase in production output."

Alexander Meisinger
STIWA

Link to user story

Ruukki Metals Improves Steel Manufacturing Processes with Standalone and Web-Based MATLAB Applications



Ruukki's web-based MATLAB application

Challenge

Enable operators to correctly set up steel coil processing lines in the manufacturing plant.

Solution

Build applications in MATLAB that enables operators to select and apply the proper settings, analyze production metrics from multiple databases, track individual coils, and refine the process

Results

- Off-gauge coil length reduced from several meters to less than 50 centimeters
- Process efficiency increased
- Waste reduced

"Since deploying this application and the standalone executable that we created with MATLAB and MATLAB Compiler, we have seen fewer misalignments, less scrap, and significant increases in efficiency and consistency at the plant."

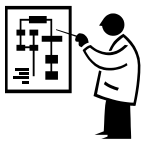
Mika Judin
Ruukki Metals

Link to article

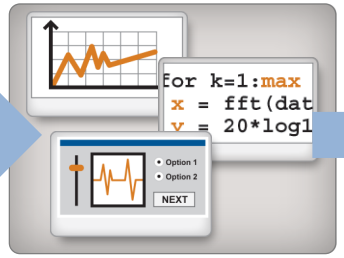
Supplemental Material

Typical Workflows for Coder and Compiler

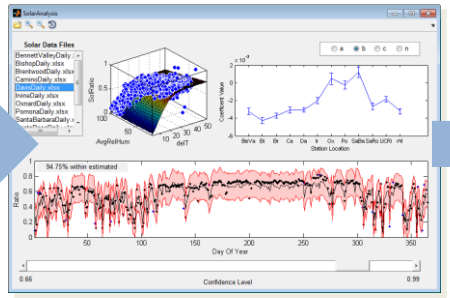
Technical Computing: MATLAB Compiler process



Quants, researchers, scientists, engineers …



… use MATLAB algorithms, graphics, and UI's …



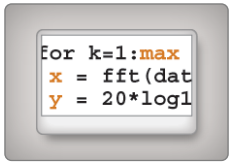
… to create a software application …

… used by a person.

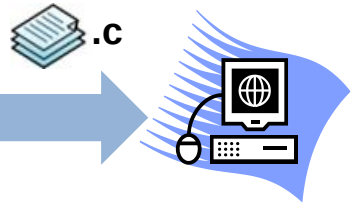
Model-based Design: MATLAB Coder process

NOTE - Several images come from Google. Need legit source.

Algorithm or embedded engineers …



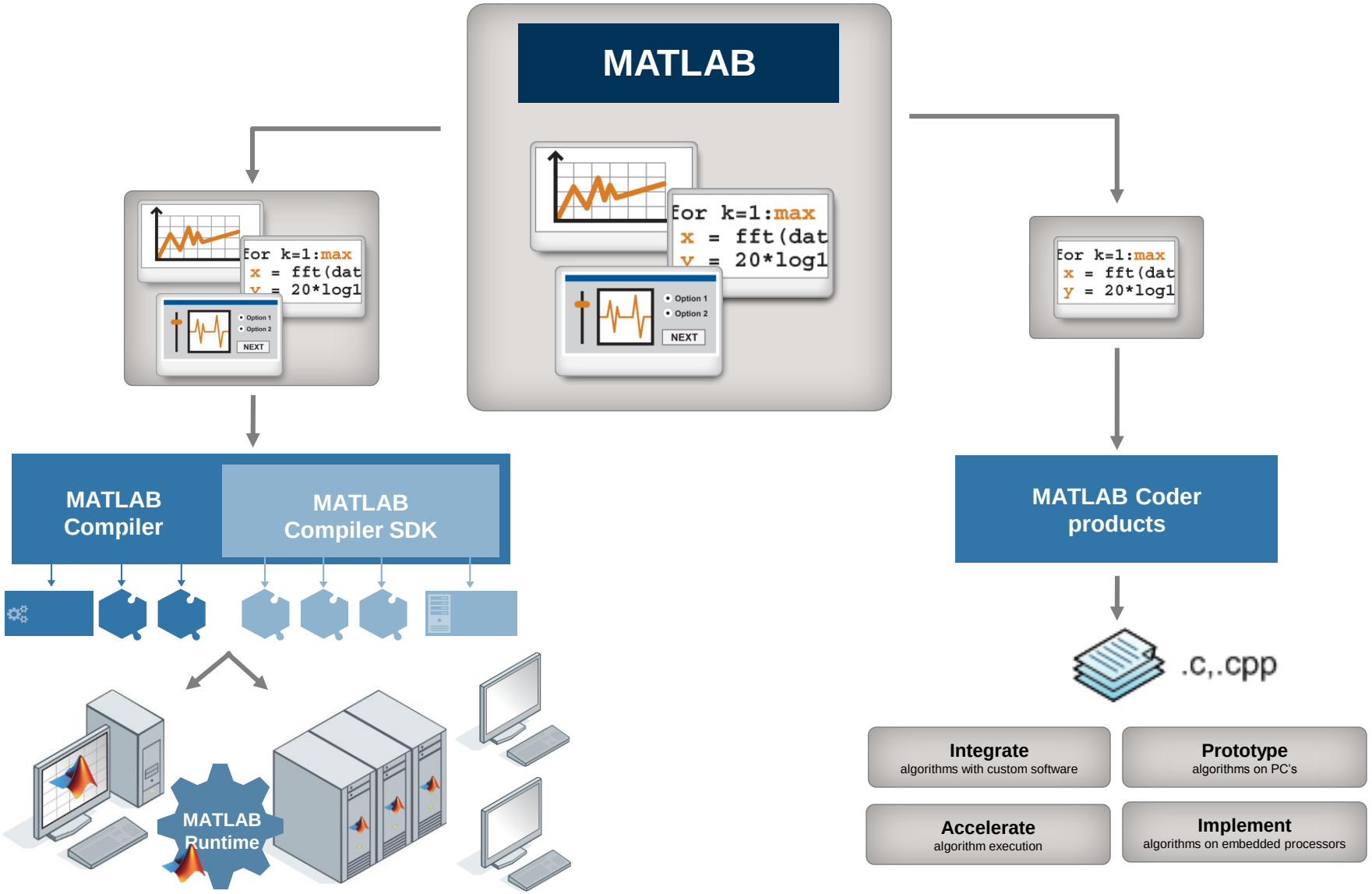
… generate C code from MATLAB algorithms …



… to create prototypes for system simulations…

… eventually integrated in a machine.

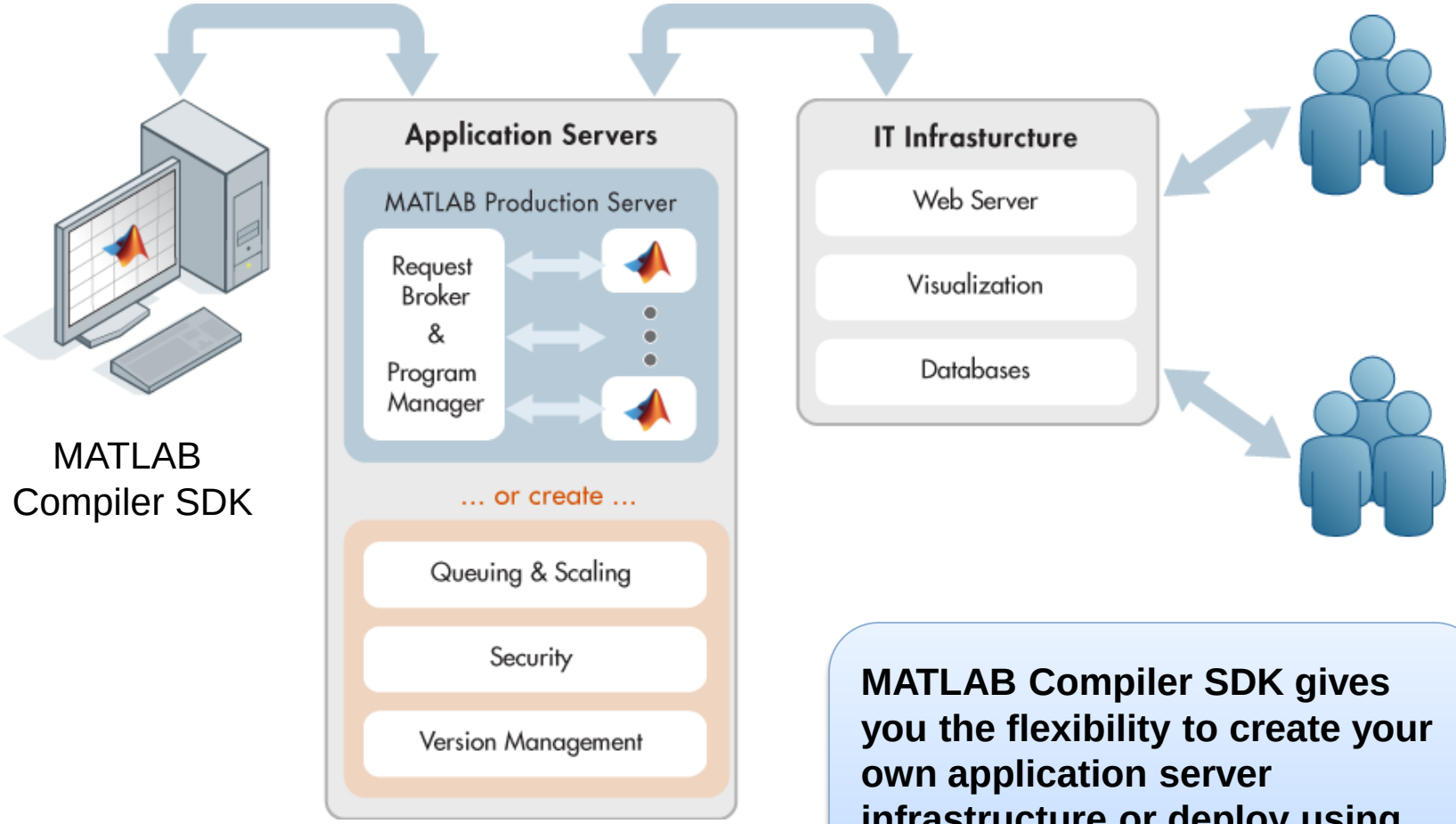
Advising on Deployment or Code Generation



MATLAB Compiler SDK and MATLAB Coder

	MATLAB Compiler MATLAB Compiler SDK	MATLAB Coder
Output	Software components	Portable and readable C source code
MATLAB language support	Full	Subset
Additional libraries	MATLAB Runtime	None
Supported toolboxes	Most toolboxes	Some toolboxes
License model	Royalty-free	Royalty-free
Extensions	MATLAB Production Server	Embedded Coder

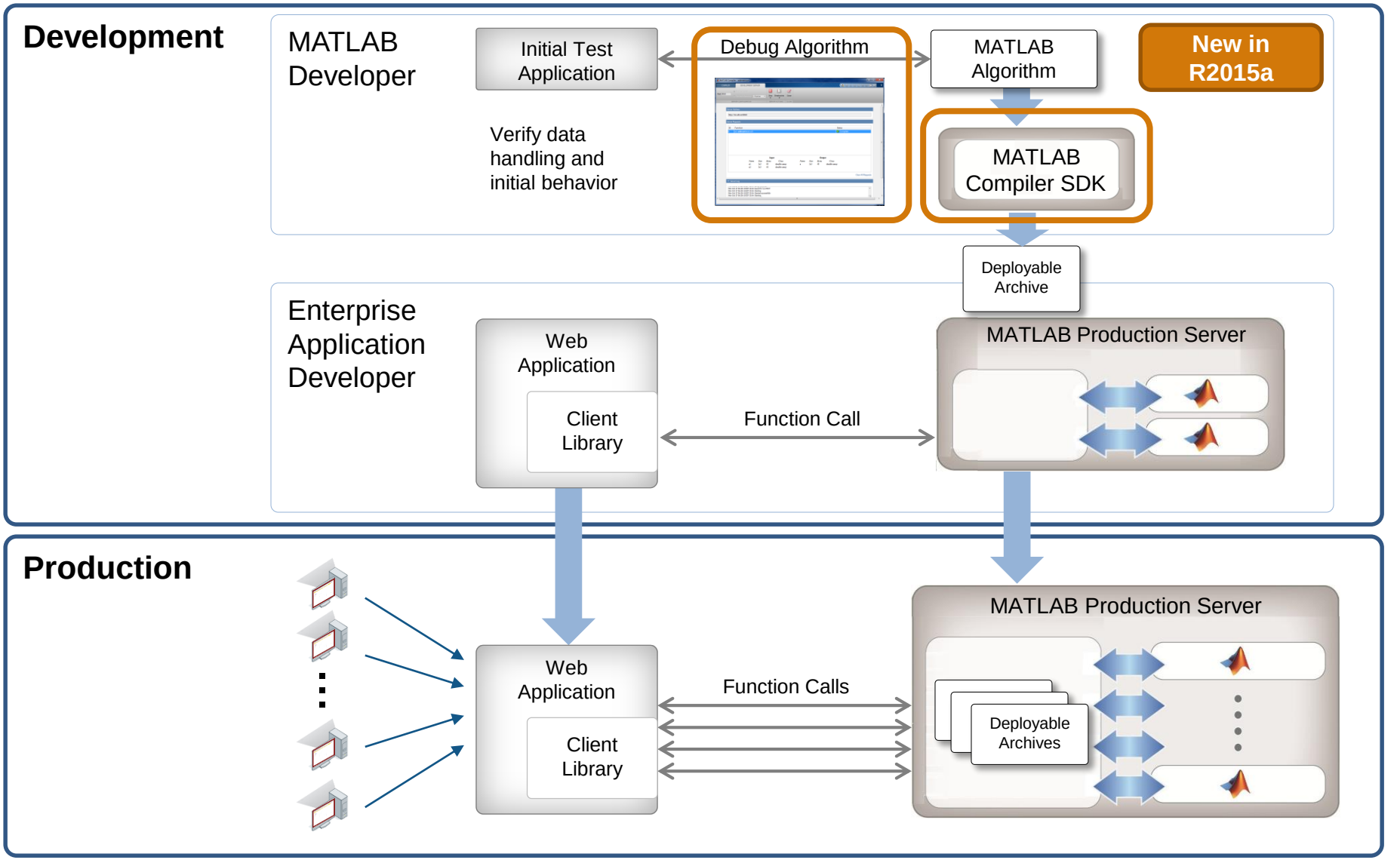
Options for Web/Enterprise Application Servers



MATLAB Compiler SDK

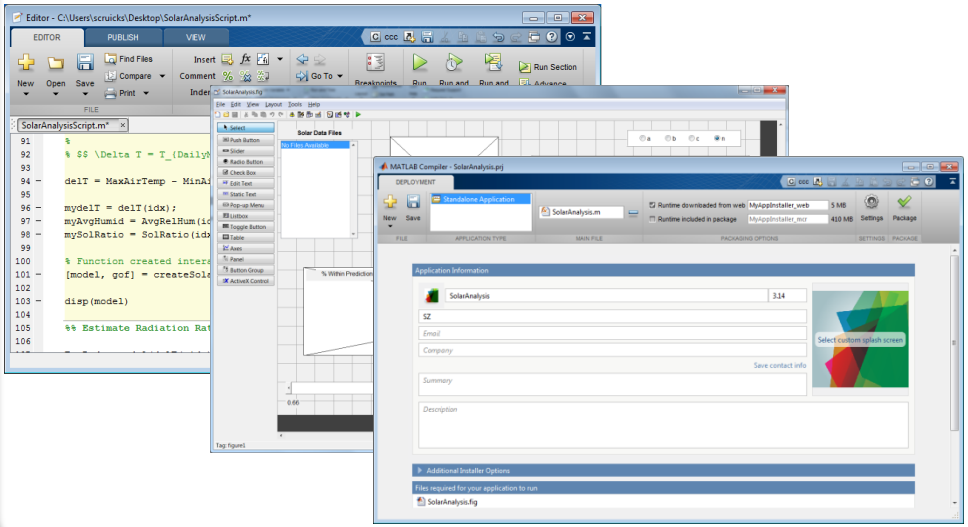
MATLAB Compiler SDK gives you the flexibility to create your own application server infrastructure or deploy using MATLAB Production Server

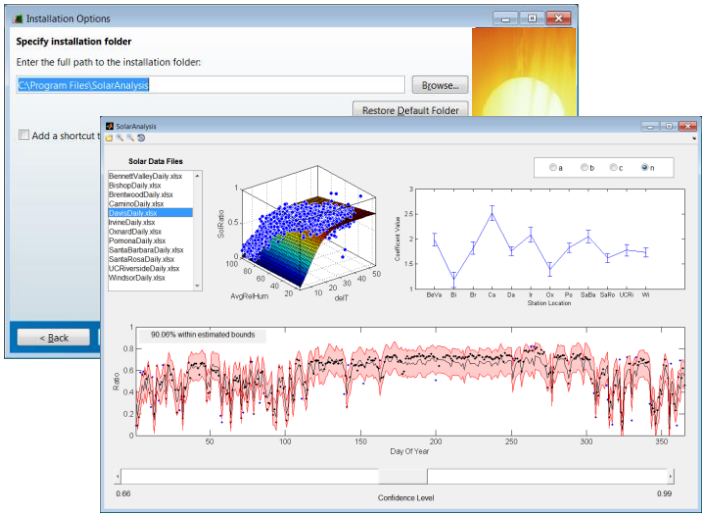
Production Deployment Workflow



Typical Process for Standalone Applications

Application author





1.) Create MATLAB algorithms

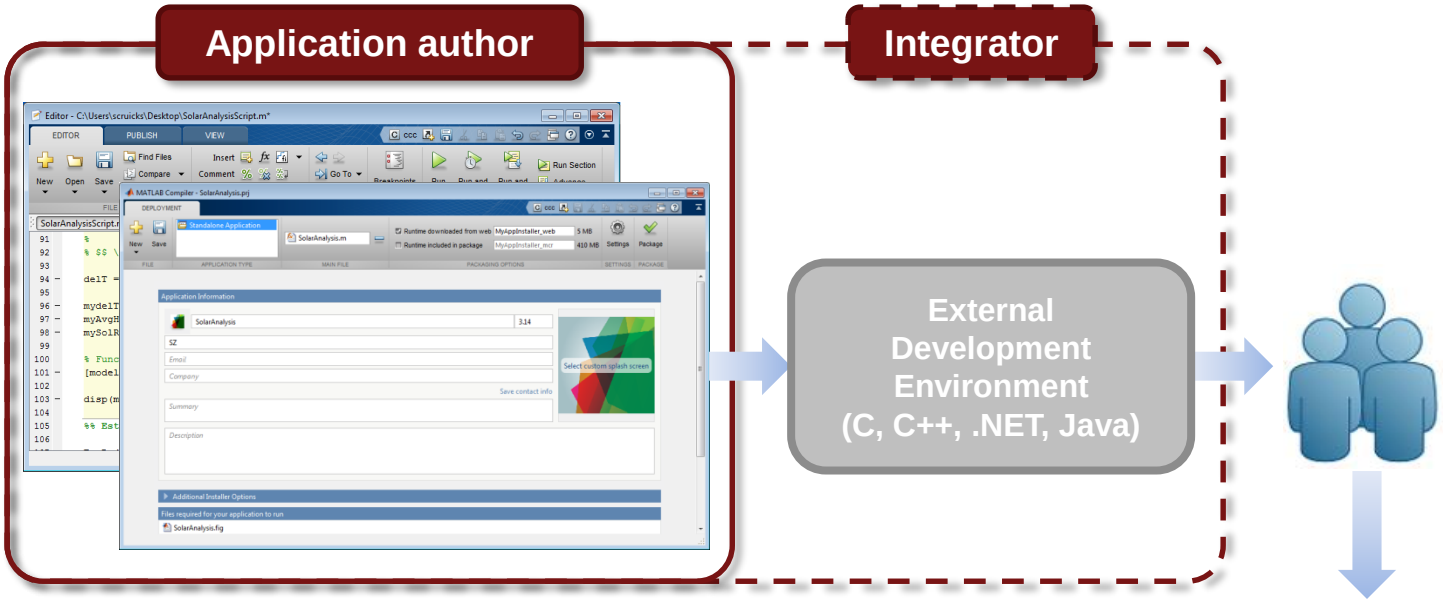
2.) Define the user interface

3.) Package the application using MATLAB Compiler

4.) Give the application installer to someone

They will install the application … and run it on their desktop

Typical Process for Integrated Applications



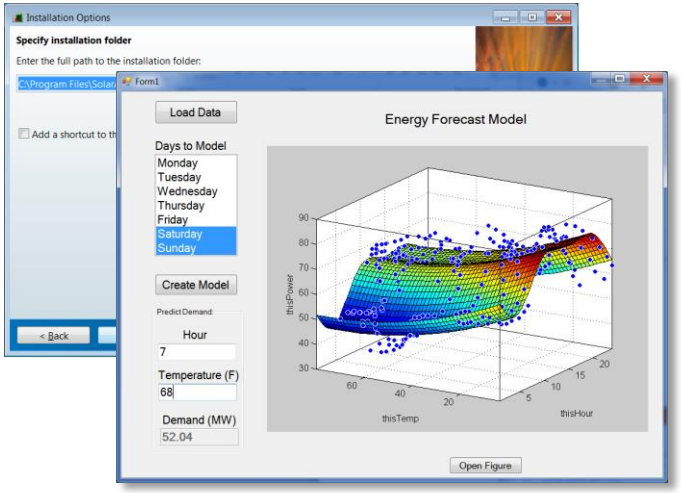
1.) Create MATLAB algorithms

2.) Package component libraries using MATLAB Compiler SDK

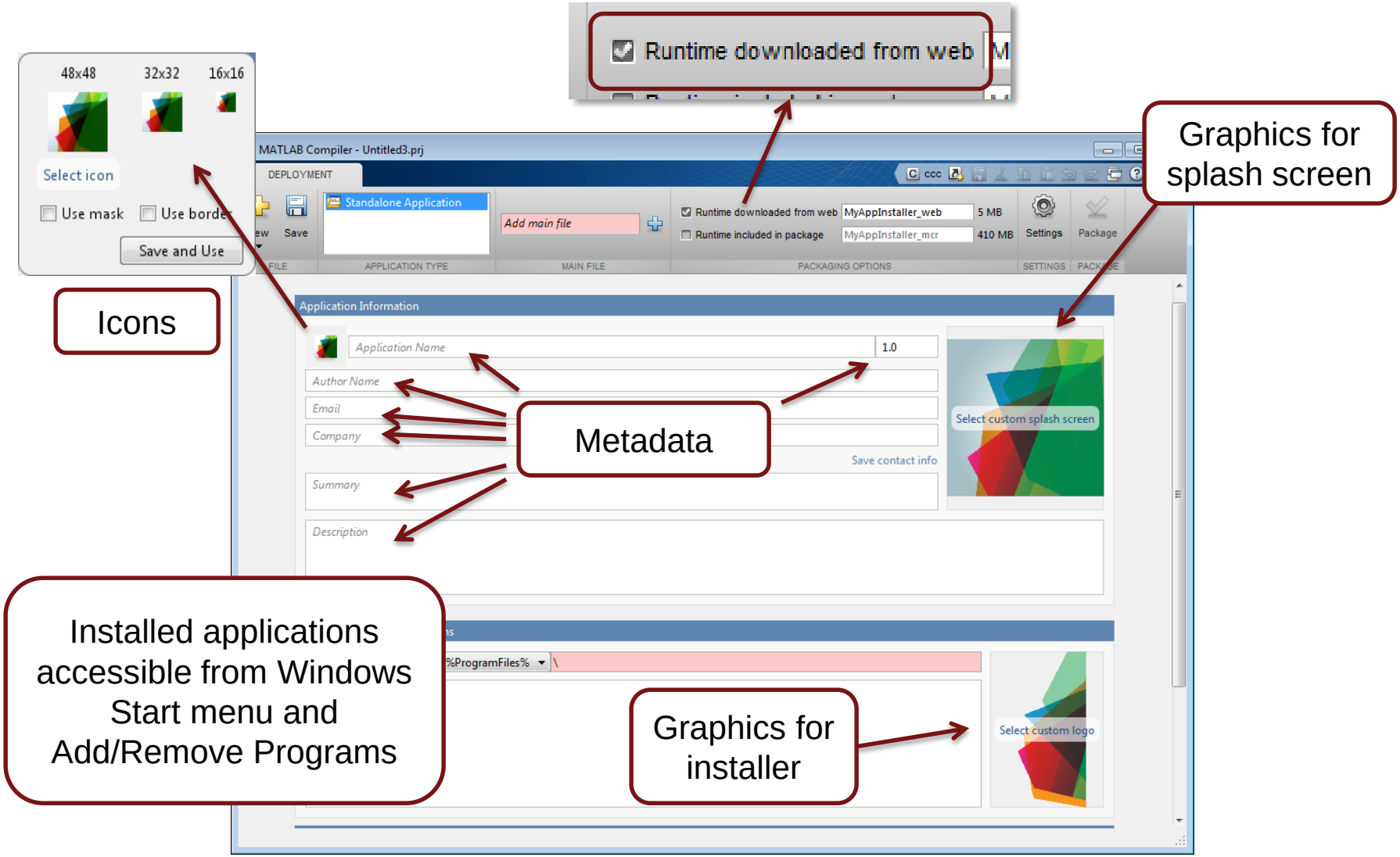
3.) Use an external development environment to develop integrated application, including user interface

4.) Give the final application to someone

They will install the application on desktops or servers … for their own use or for use by others

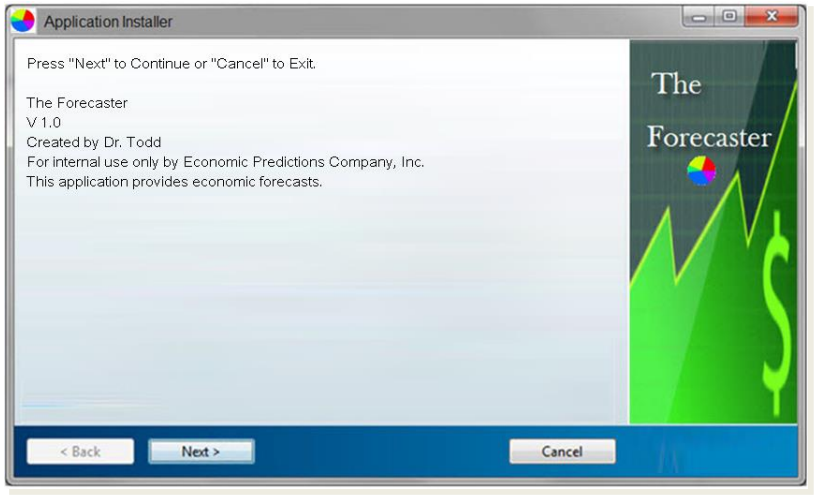


Customizations for your Applications

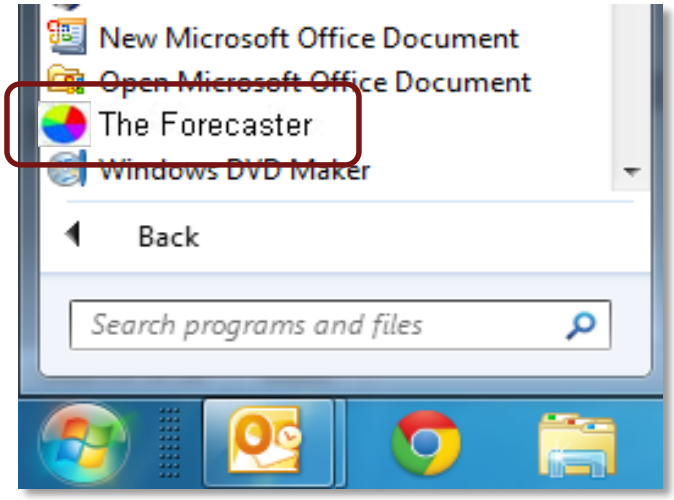


End Customer sees a Professional Application

Installer



Application in Start menu



Splash Screen

Icon