

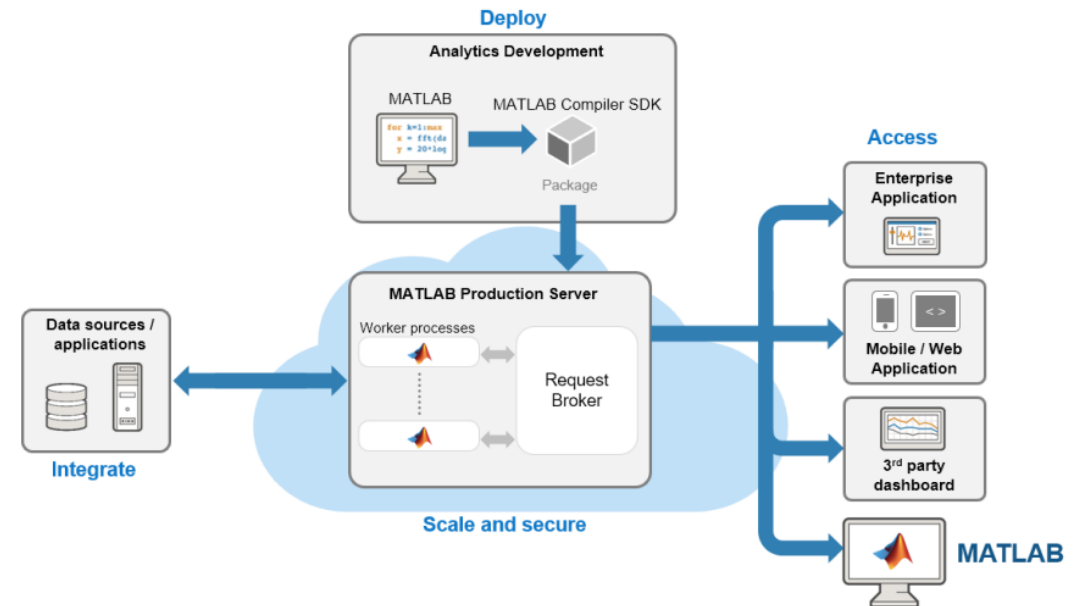
MATLAB Server Product Family Discussion

Terasoft

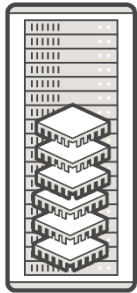
Application Engineer Team

Outlines

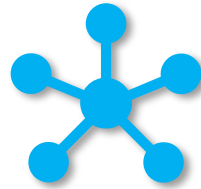
- High-Level introduction for server product family
- MATLAB Server Products Family
 - MATLAB Parallel Server
 - MATLAB Webapp Server
 - MATLAB Production Server
 - MATLAB Online Server
- Summary



MATLAB Server Products Family – High Level



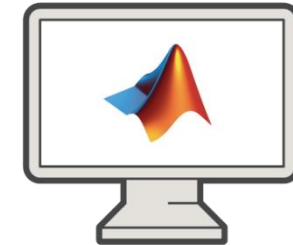
**Speed up
computation**



**Integrate with
enterprise
applications**



**Publish
Web Apps**



**Use MATLAB in
a browser**



**MATLAB
Parallel
Server**



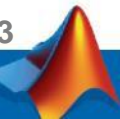
**MATLAB
Production
Server**



**MATLAB
Web App
Server**

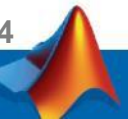


**MATLAB
Online
Server**

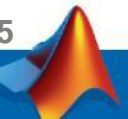


MATLAB Server Products Family – Use Case

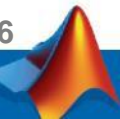
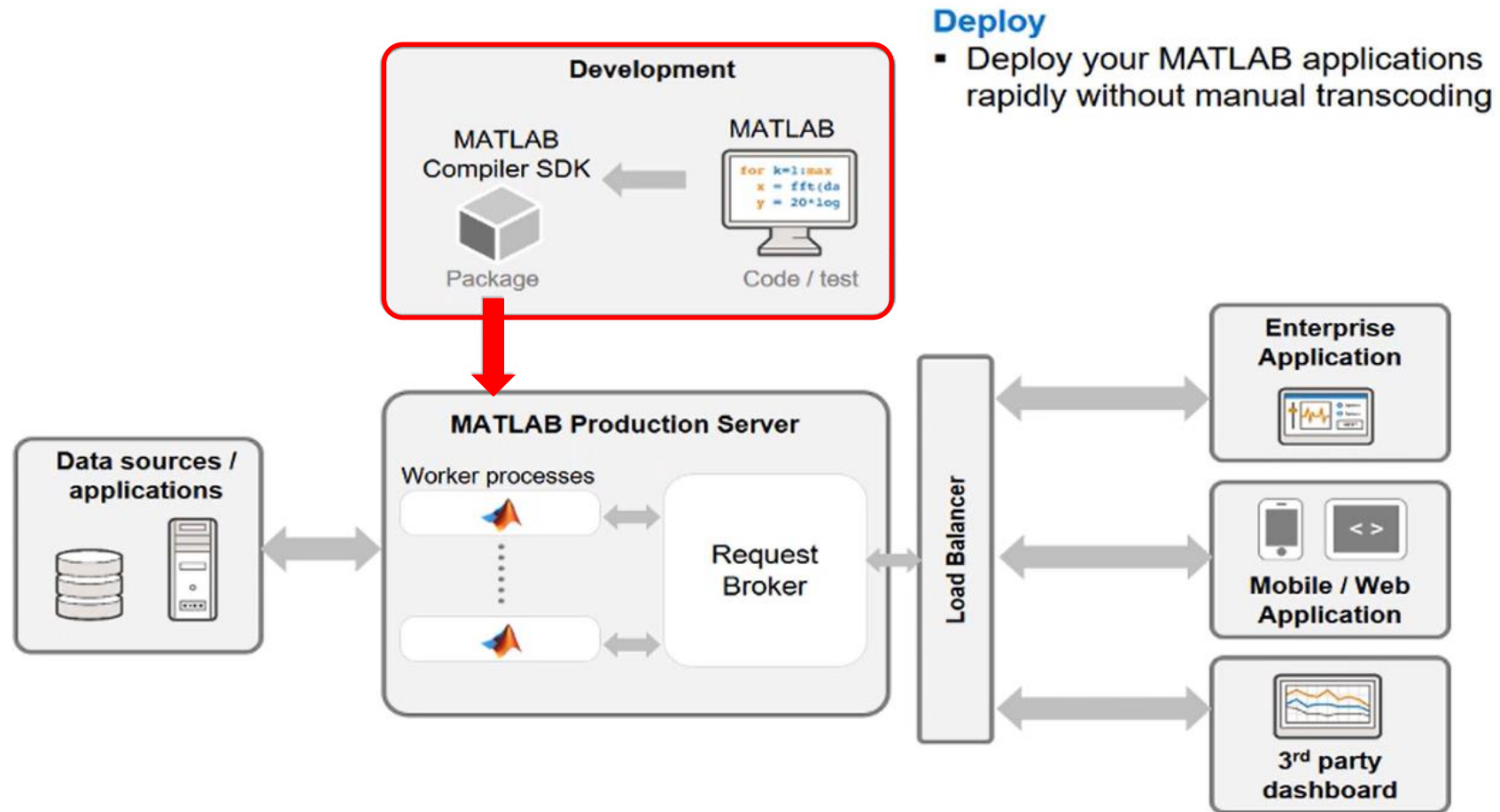
Use Case	MATLAB Parallel Server	MATLAB Production Server	MATLAB Web App Server	MATLAB Online Server
Speed up parameter sweeps, optimizations, and Monte Carlo runs	✓			
Speed up Big Data workflows (Tall Arrays, Datastores)	✓			
Run large memory distributed array calculations	✓			
Run MATLAB parallel language (parfor, parsim, spmd, parfeval) at scale	✓			
Integrate with streaming data / IIoT application		✓		
Integrate with 3P tool developed web application e.g. HTML/Javascript, Angular, React, ASP.NET, JSP, RESTful, etc.		✓		
Integrate with enterprise application (C/C++, Java, C#.NET, Python)		✓		
Integrate with mobile app (iOS, Android, Phonegap, Cordova)		✓		
Publish MATLAB Web App authored in App Designer			✓	
Centralize Hosting and Management of MATLAB				✓
Provide instant access to MATLAB for prototyping and code development				✓



MATLAB Production Server



MATLAB Production Server Typical Framework



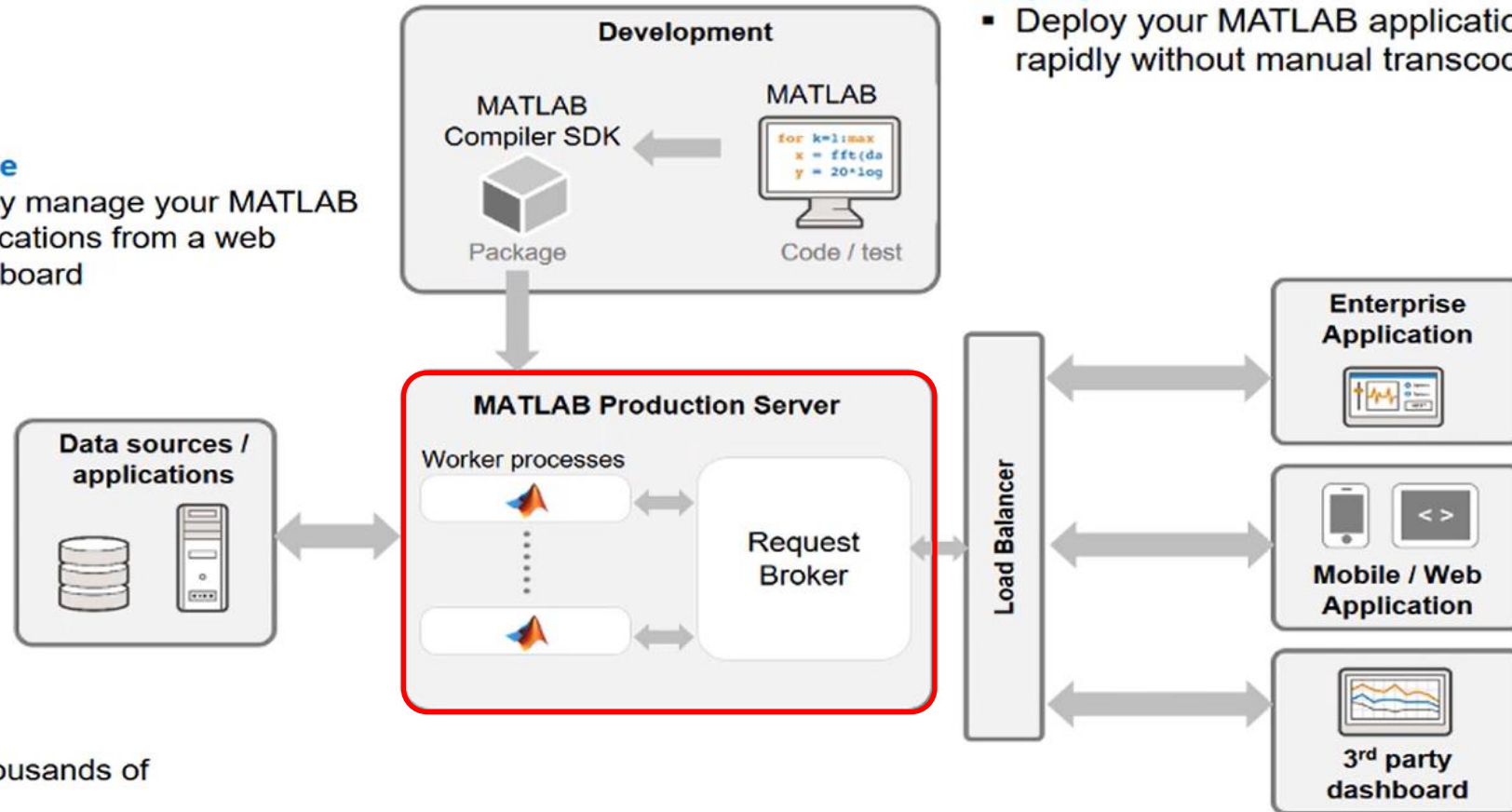
MATLAB Production Server Typical Framework

Manage

- Easily manage your MATLAB applications from a web dashboard

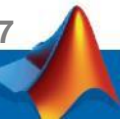
Deploy

- Deploy your MATLAB applications rapidly without manual transcoding

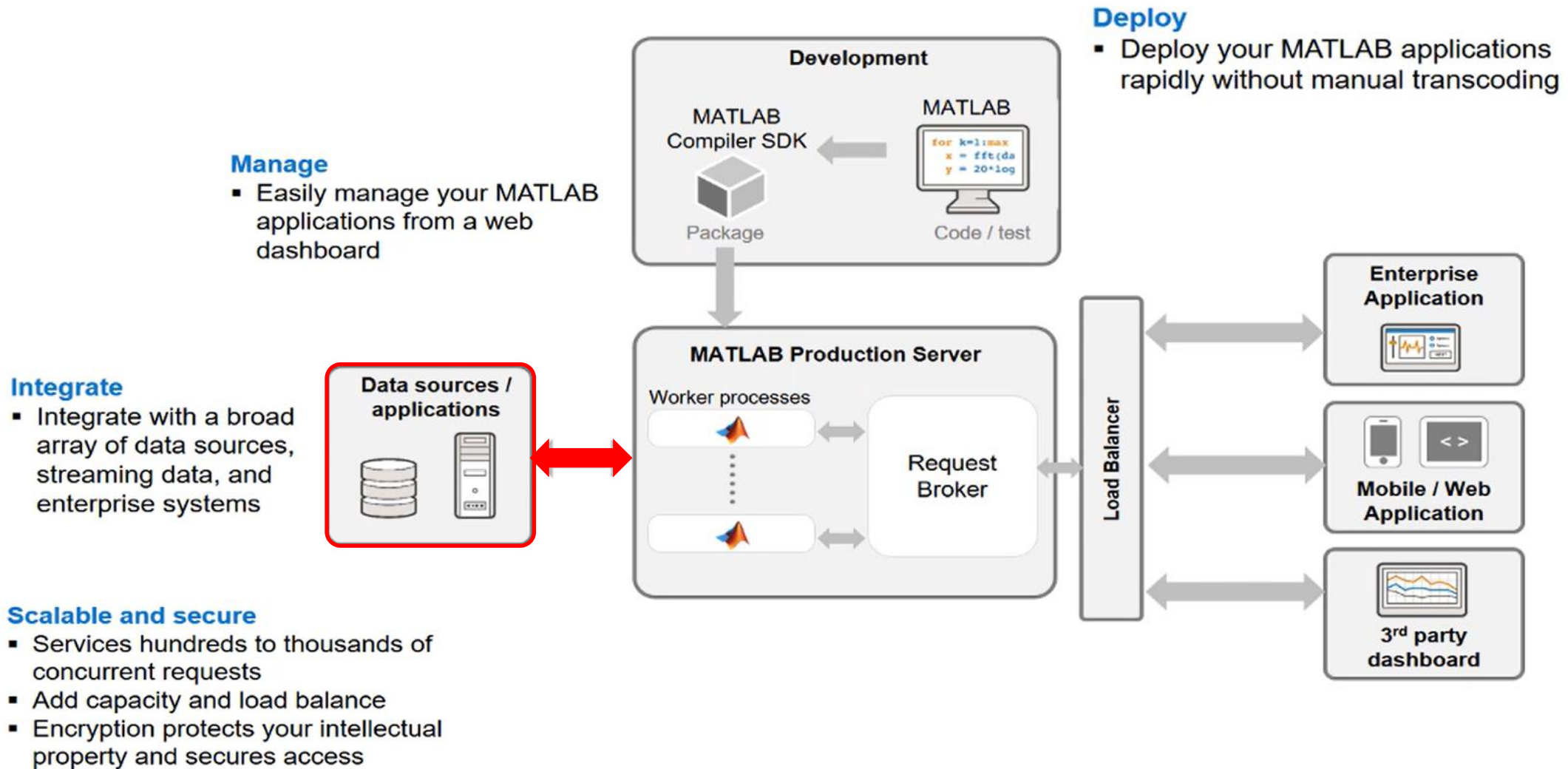


Scalable and secure

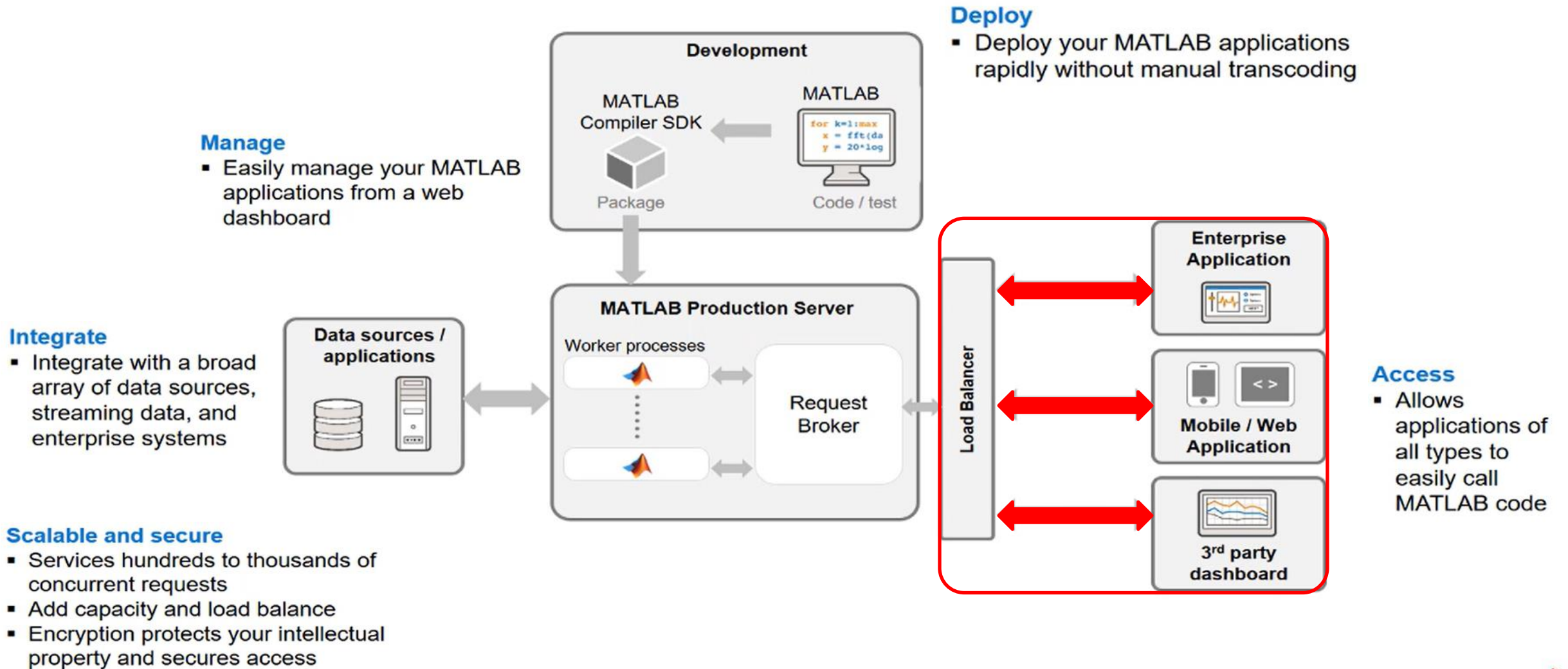
- Services hundreds to thousands of concurrent requests
- Add capacity and load balance
- Encryption protects your intellectual property and secures access



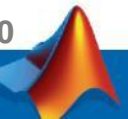
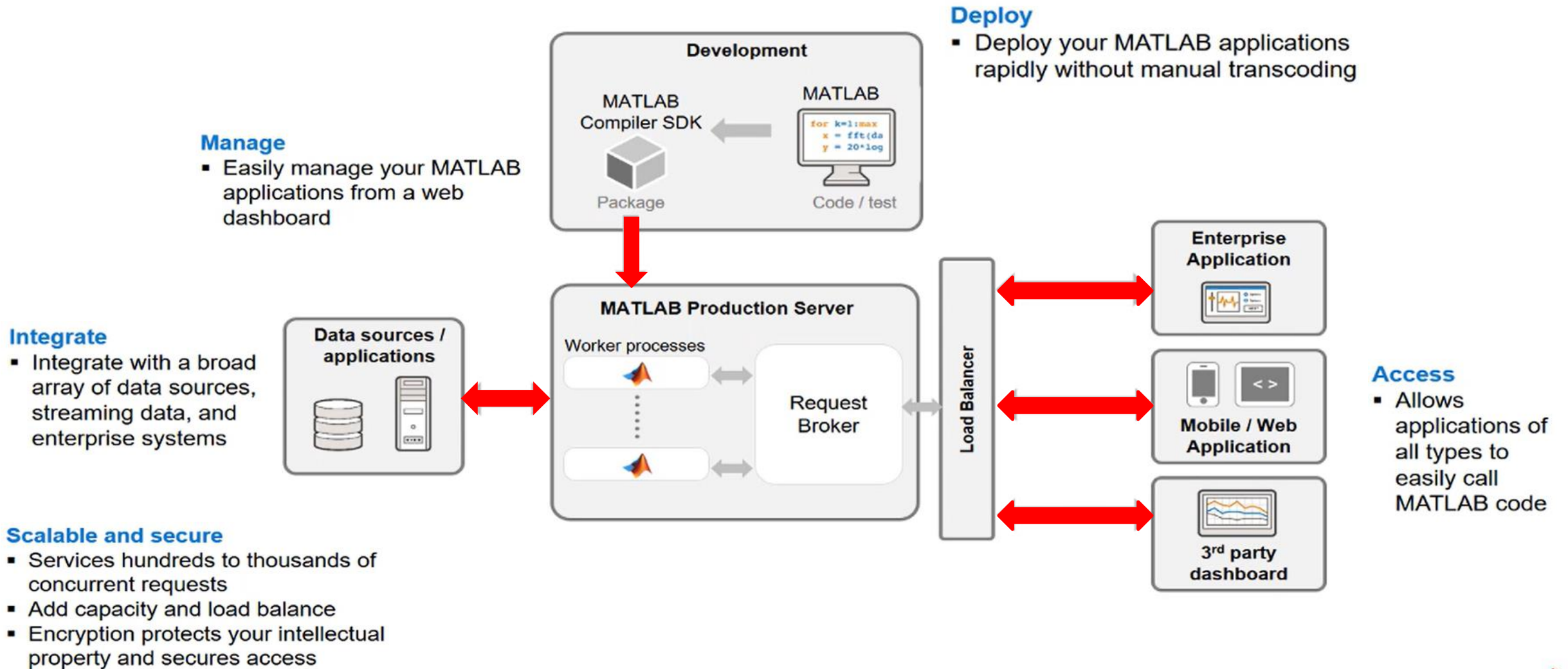
MATLAB Production Server Typical Framework



MATLAB Production Server Typical Framework



MATLAB Production Server Typical Framework



Manage Your Server Instances Using a Dashboard Interface

The screenshot displays the MATLAB Production Server Dashboard in a web browser. The browser tabs include 'MATLAB Production Serv...' and 'Electricity Demand Forec...'. The address bar shows 'localhost:9090/#localhost#overview_tab'. The dashboard header features the MathWorks logo, the title 'MATLAB Production Server Dashboard', and a 'Log out' button.

The left sidebar contains a 'Search Menu' and a navigation tree with the following items:

- Servers
 - localhost
 - Financial_Services
 - Main_Production**
- Applications
 - callPythonExampleFcn
 - getCVA
 - magicXLai
 - MonteCarloSimulation
 - mymagic_deployed
 - SolarAnalysisApp
- Help

The main content area is divided into two sections:

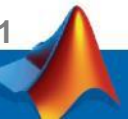
Server Information

Name localhost
Description localhost
IP Address localhost

Instances

+ Create New

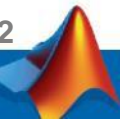
Name	Description	Status	Workers	HTTP	HTTPS	Actions
Financial_Services	Provided analytics for Financial Services Demos. Including "Scaling Computational Risk Applications"	● Stopped	2	9910		
Main_Production	Processes custom MATLAB algorithms for a number of different use cases. Including supporting several MATLAB Runtime versions.	● Stopped	3	9910		



Configuring MATLAB Production Server

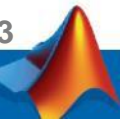
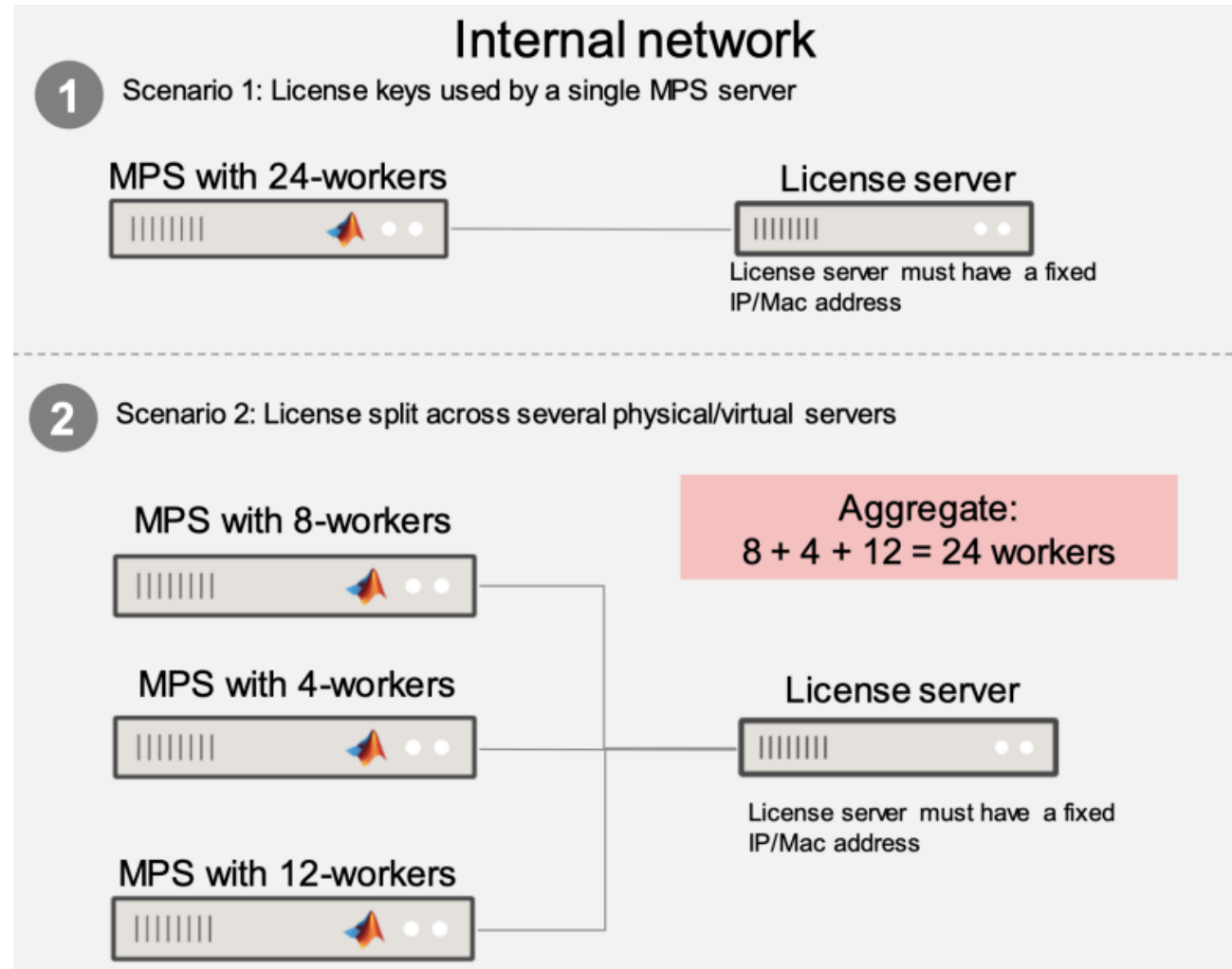
- Choosing between the command line and web dashboard to configure MATLAB Production Server

	Command Line	Web Dashboard
Ease of use	Requires some familiarity	Easiest
Automate with scripting	Yes	No
Create server instances	Yes*	Yes*
Monitor instances/performance	Static numeric data	Dynamic graphical chart
Manage applications	Yes	Yes
Configure settings	Yes	Yes
Start/stop servers	Yes	Yes
Run as a service	Yes	No**



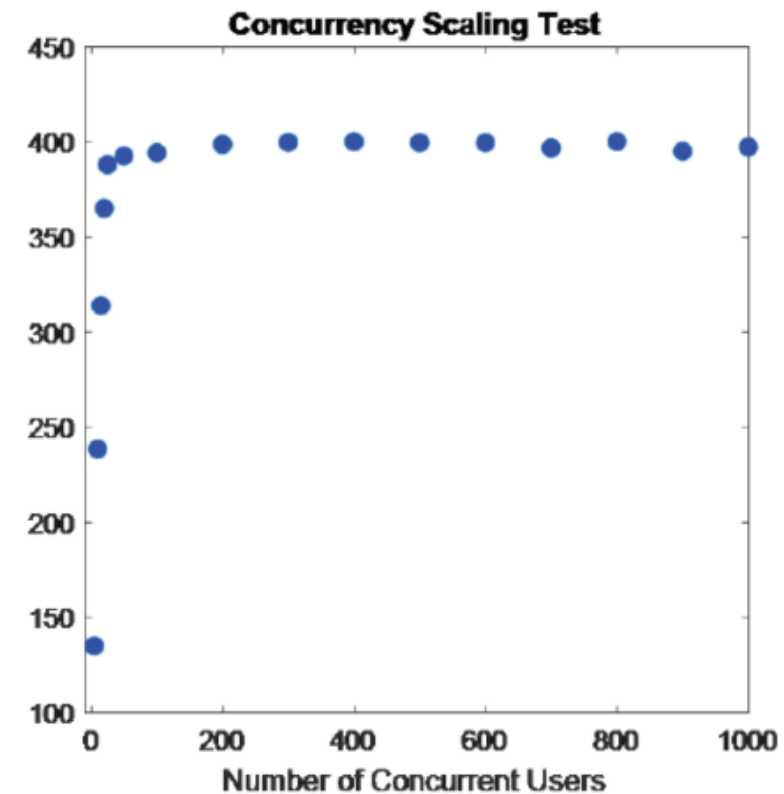
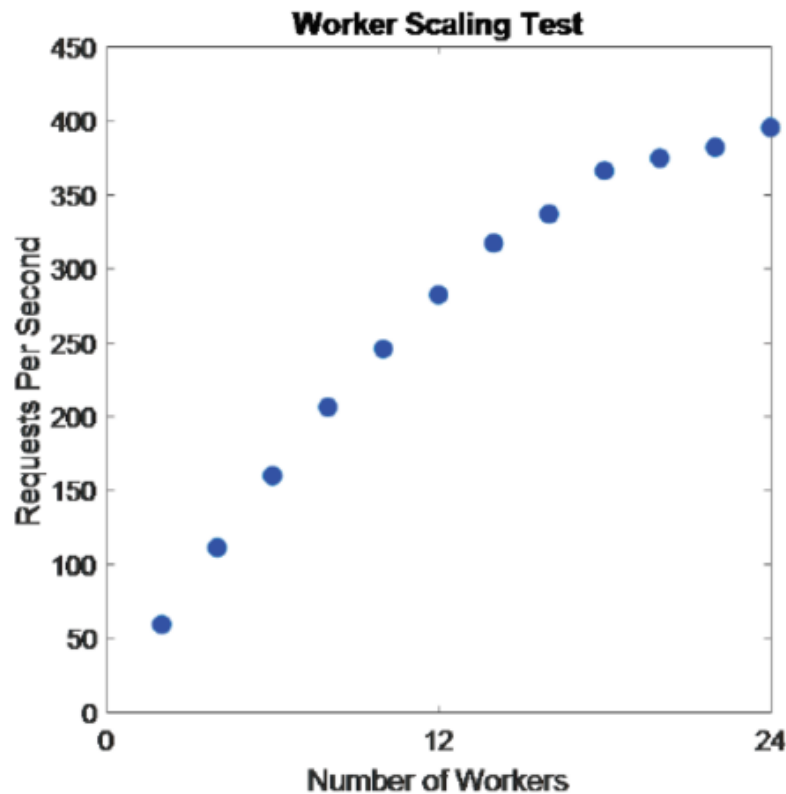
MPS License Management Options

- MathWorks recommends one worker per core
- Separate machine for license server is recommended.
- Workers may be split among multiple physical or virtual machines.
- MPS instances must have constant communications with the licensing server. If lost, MPS will cease responding to requests after 2.5 hours grace period.

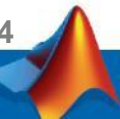


Capacity Management and Server Sizing

- MPS continued serving approximately 400 requests per second even as the number of concurrent users hit 1000.



MATLAB Production Server performance with a medium load (Fast Fourier transform) running on a 24-core Intel Xeon with 128GB RAM.



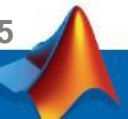
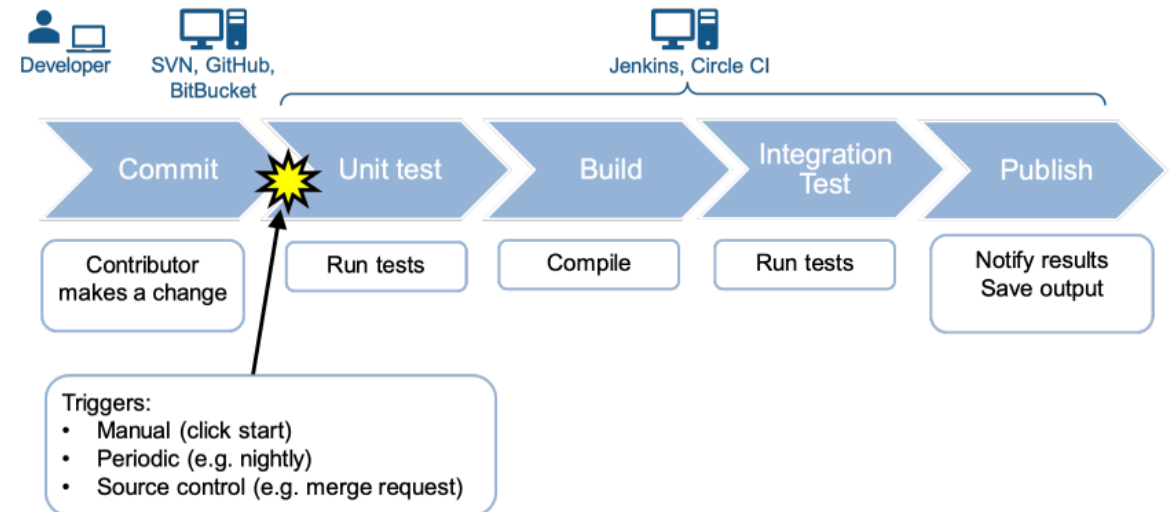
Integration with CI/CD Pipelines (Jenkins)

- Add an Execute Shell build step to launch MATLAB and run your unit tests

- "c:\Program Files\MATLAB\R2019b\bin\matlab.exe" -nodisplay -r "runALL_THE_TESTS"

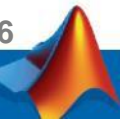
- Add another batch command build step to call MATLAB Compiler SDK to generate the deployable archive

- "c:\Program Files\MATLAB\R2019b\bin\mcc.bat" -W CTF: -U <path\filename.m>

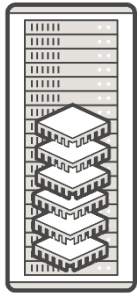


Benefits of MATLAB Production Server

- 節省安裝、管理多台MATLAB Runtime(MCR)機器的時間
- 集中化管理模型和演算法，讓組織成員可以呼叫統一的版本
- 兼容多版本的MATLAB Runtime (MCR)，可使用不同版本MATLAB開發
- 佈署時不需重啟Server，降低對產線其他運算的影響
- 提供Dashboard，方便管理與監控所有運作
- Server Log統一在管理介面中查詢和顯示
- 容易嵌入CI/CD流程



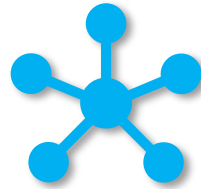
MATLAB Server Products Family – High Level



**Speed up
computation**



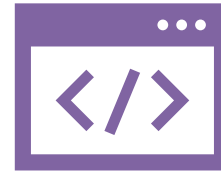
**MATLAB
Parallel
Server**



**Integrate with
enterprise
applications**



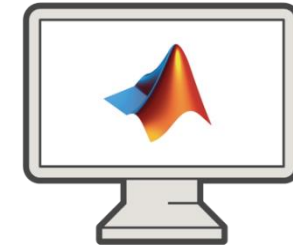
**MATLAB
Production
Server**



**Publish
Web Apps**



**MATLAB
Web App
Server**



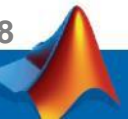
**Use MATLAB in
a browser**



**MATLAB
Online
Server**



MATLAB Online Server



MATLAB Online Server - host MATLAB Online on your infrastructure



MATLAB USERS

No Downloads, No Installs



Instant access for **casual users, new employees, student interns**

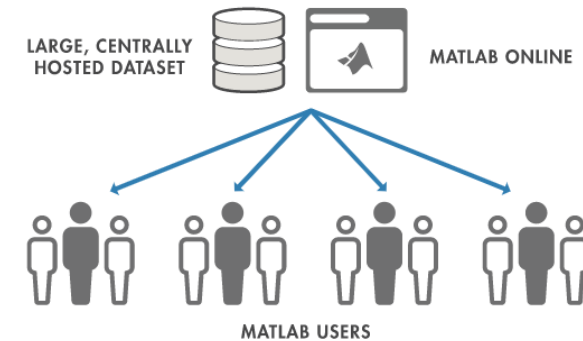


On-the-go use, access on **Chromebooks**



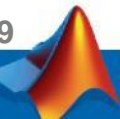
Collaborative review of MATLAB artifacts in **group settings (ex. conf. room)**

Co-locate MATLAB with Data



Remove need to download large datasets

Preserve data integrity, comply with organizational and industry regulations

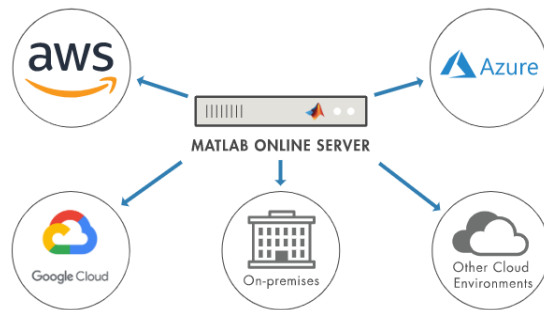


MATLAB Online Server - host MATLAB Online on your infrastructure



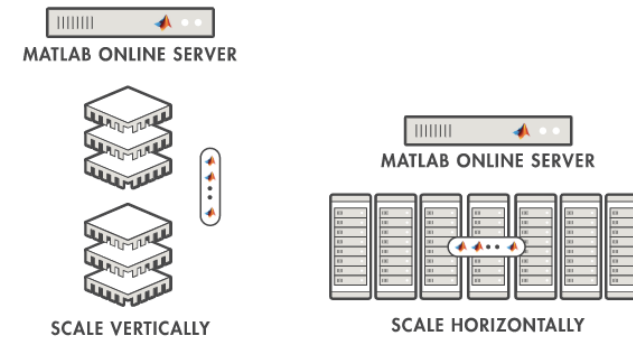
IT TEAMS

Centrally manage MATLAB



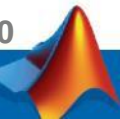
Configure to run on VMs or bare-metal instances on environment of choice: on-prem, AWS, Azure, Google Cloud

Optimize hardware resource usage



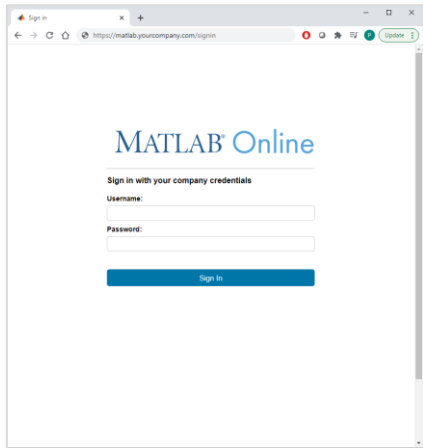
Scale vertically (on a single instance) or horizontally (across a cluster)

Provide access to specialized hardware resources





https://matlab.yourcompany.com



Login

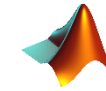
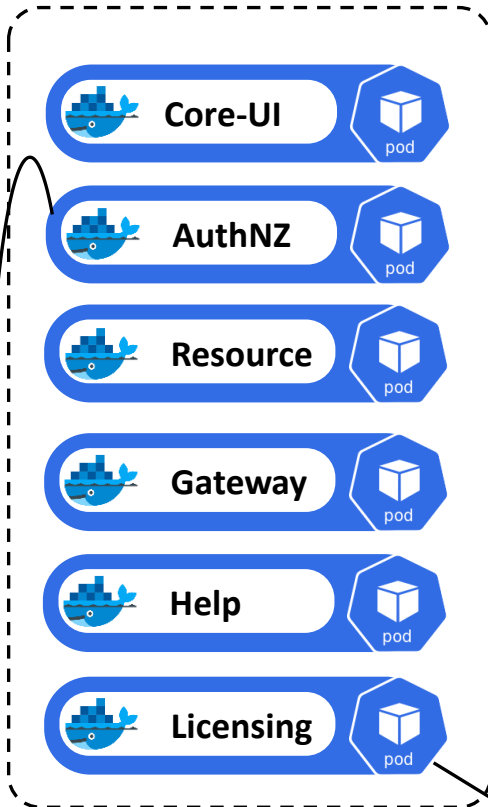


Kubernetes

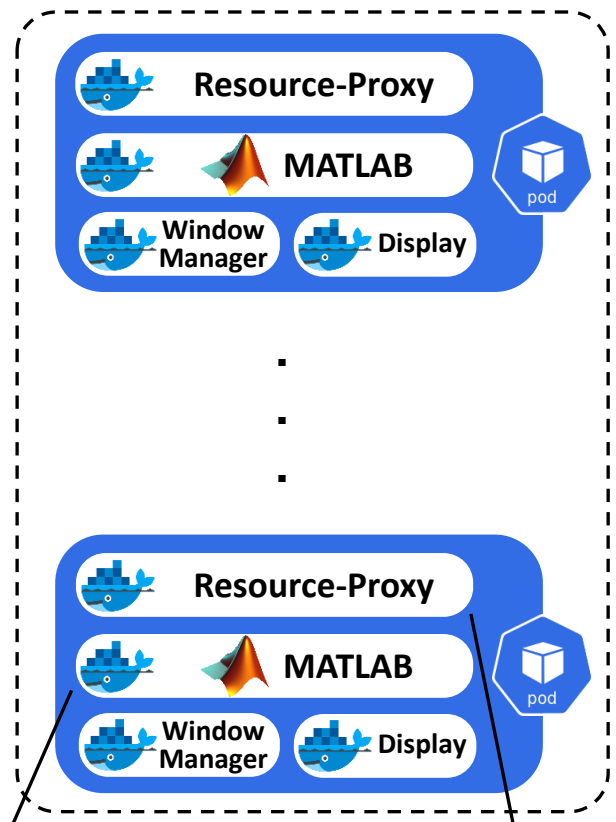


Ingress Controller

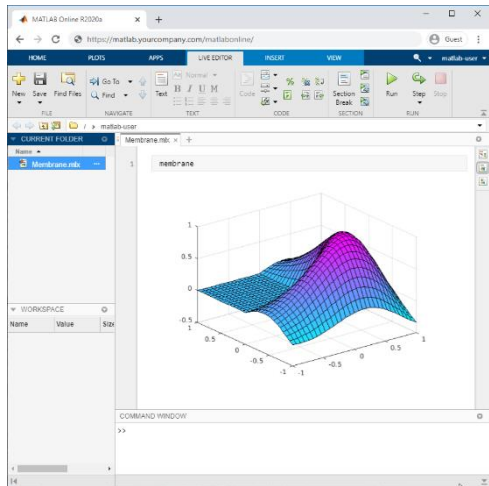
Core Services



MATLAB Compute



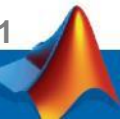
a MATLAB compute pod is assigned



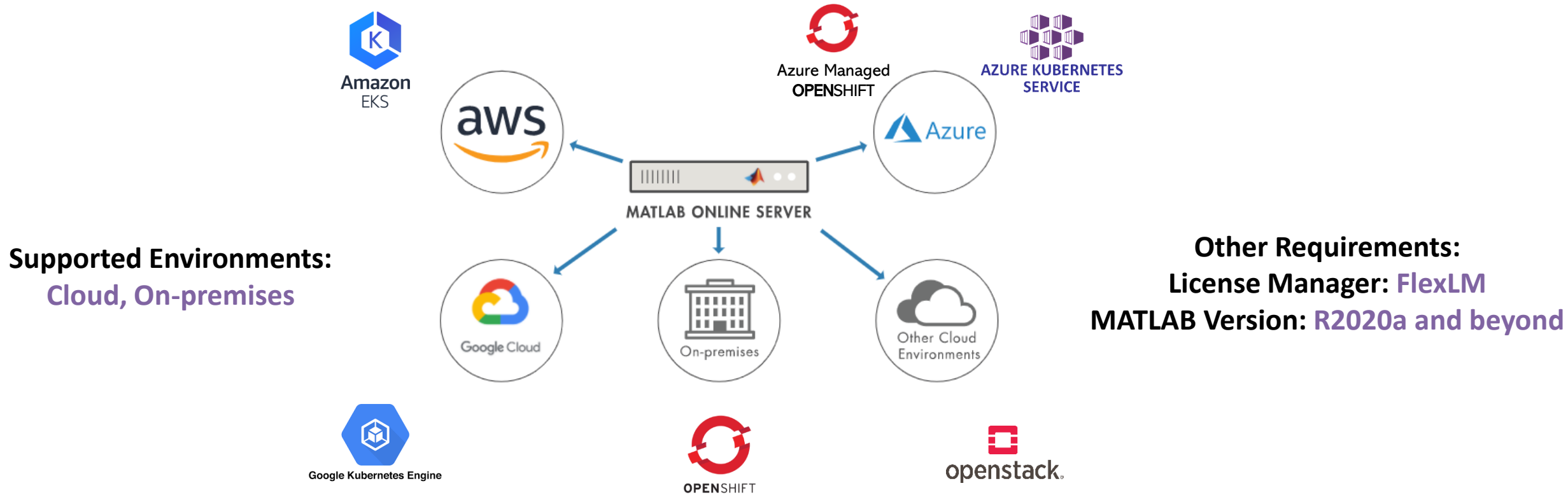
Identity Providers:
LDAP - SAML

License Management:
FlexLM

User File Storage and Shared Files:
NFS



Architecture: deployed as a set of Docker microservices on Kubernetes



Supported Environments:
Cloud, On-premises

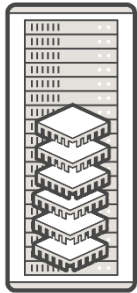
Other Requirements:
License Manager: FlexLM
MATLAB Version: R2020a and beyond

Infrastructure Integrations:
File System: NFS
Identity Providers: LDAP, SAML

Operating System/Distributions:
Orchestration: Kubernetes 1.16 to 1.20; OpenShift 4.x
Containers: Ubuntu 16.04, 18.04; Red Hat 7.x
Server: Ubuntu 16.04, 18.04, 20.04; Red Hat 7.x



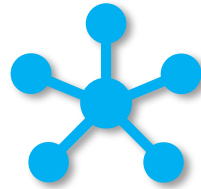
MATLAB Server Products Family – High Level



**Speed up
computation**



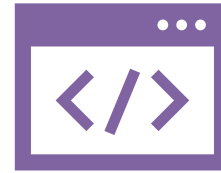
**MATLAB
Parallel
Server**



**Integrate with
enterprise
applications**



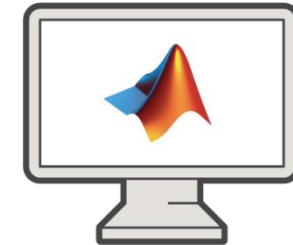
**MATLAB
Production
Server**



**Publish
Web Apps**



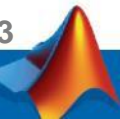
**MATLAB
Web App
Server**



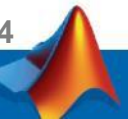
**Use MATLAB in
a browser**



**MATLAB
Online
Server**

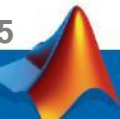
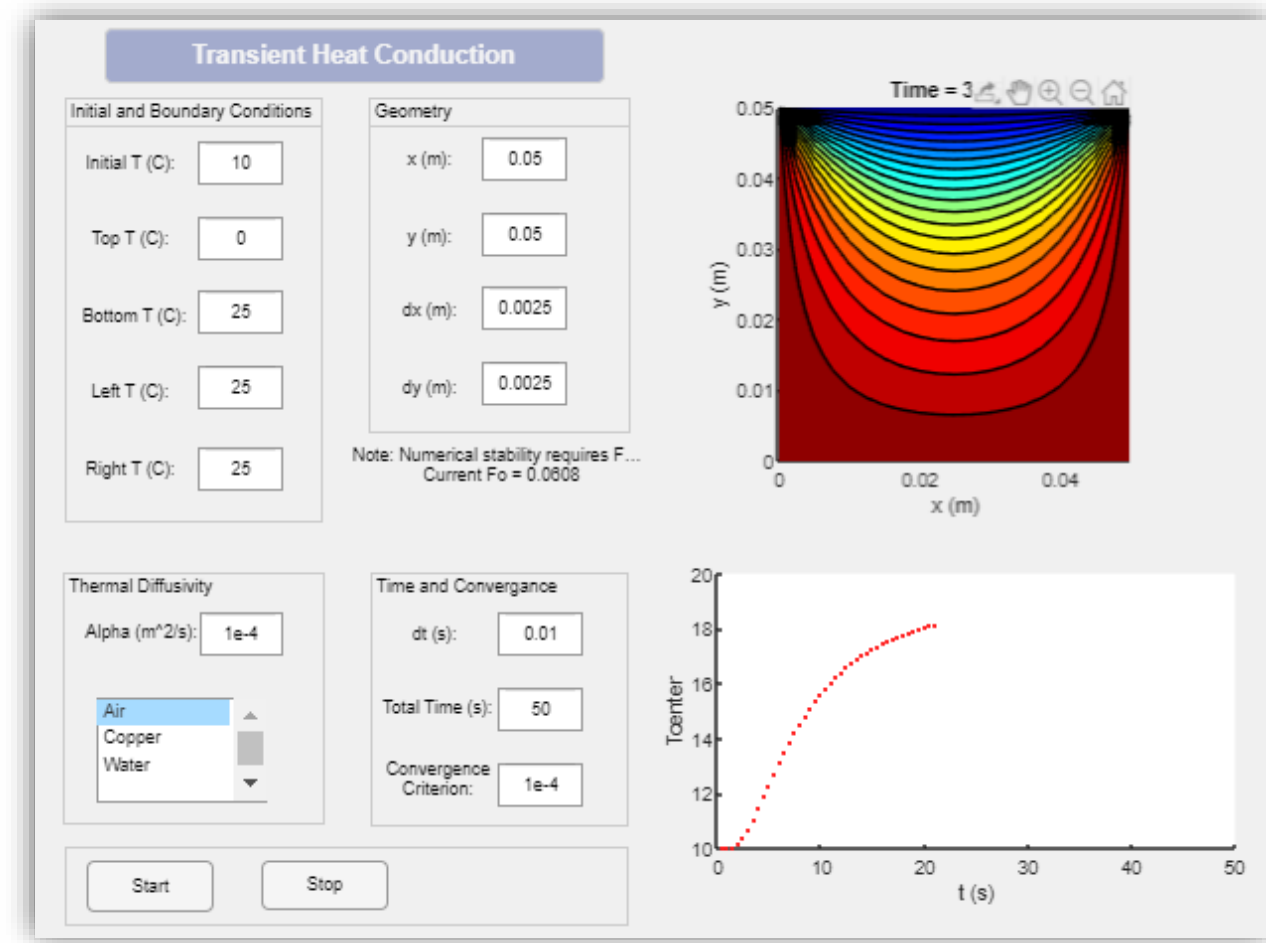


MATLAB Webapp Server



Share your work using MATLAB Web Apps

- MATLAB web apps is a **sharing workflow**
- Share MATLAB apps and Simulink simulations as **interactive web apps** with users who do not have MATLAB or Simulink license
- End users **within the organization** can run MATLAB web apps using a **browser**

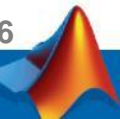


Share your MATLAB apps and Simulink simulations as MATLAB Web Apps

The screenshot displays the MATLAB Web Apps interface in a browser window. The address bar shows the URL `ah-sbalakri.dhcp.mathworks.com:9000/webapps/home/index.html`. The page title is "MATLAB Web Apps" and there are buttons for "Manage Apps" and "Sign Out: Suresh (Author)".

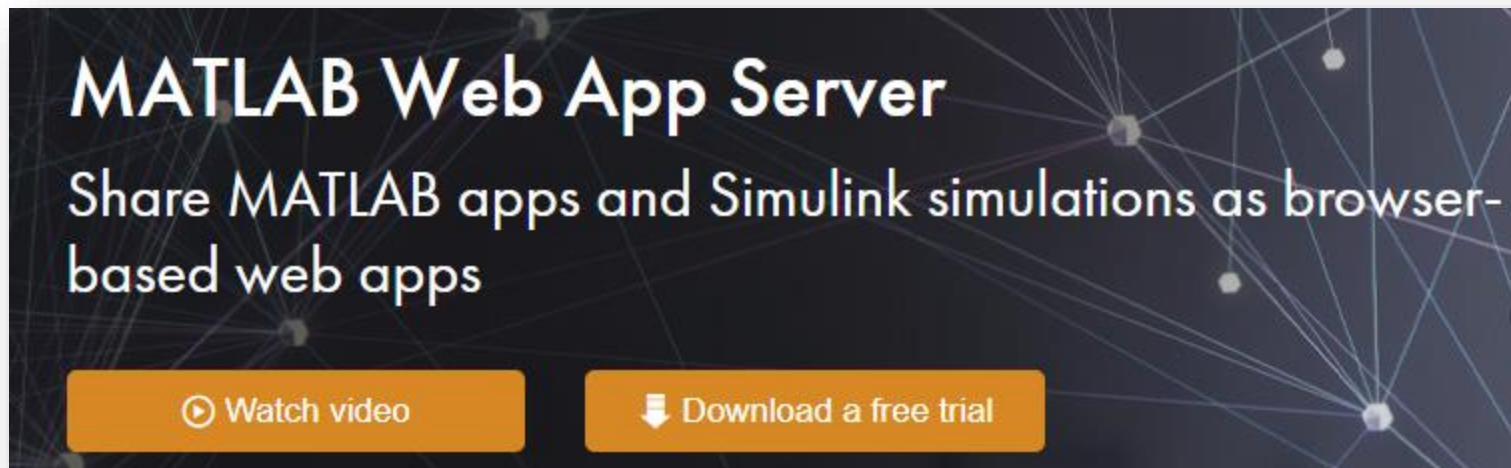
The interface features a grid of 12 web application cards, each with a unique icon, title, author, description, and version number:

- BloodPressure** by MATLAB AppDesigner Examples: Blood pressure comparisons of a population sample. version 1.0
- FlightLandingSimulator** by MATLAB AppDesigner Examples: version 1.0
- Graphics_Comet** by MATLAB Graphics Team: Graphics app for Animated line and comet. version 1.0
- GraphicsCharts_3D** by MATLAB Graphics Team: Some commonly used charts with interactions. version 1.0
- Line Tracking** by Guy Rouleau: Simulation of a robot tracking a black line on white background. version 1.0
- Mass Spring Damper**: version 1.0
- Mortgage** by MATLAB AppDesigner Examples: Calculate your monthly payment for a mortgage. You will need to enter amount, interest rate and loan... version 2.1
- NFLPlayersApp** by MATLAB Connector Team: version 1.0
- PatientsDisplay** by MATLAB AppDesigner Examples: version 1.0
- PulseGenerator** by MATLAB AppDesigner Examples: version 1.0
- TMDDsim** by MathWorks SimBiology Team: Simulation of a TMDD model with SimBiology. version 2.0
- TransientConduction** by Dave Garrison: This web app performs transient heat conduction analysis for various materials. version 1.0



MATLAB Web App Server lets you host and share MATLAB apps and Simulink simulations as interactive web apps

- An out of box server solution:
 - Supports easy deployment of MATLAB apps created using App Designer
 - Meets organization's IT policies and standards
 - Manages MATLAB Web Apps and associated MATLAB Runtime versions

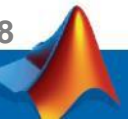
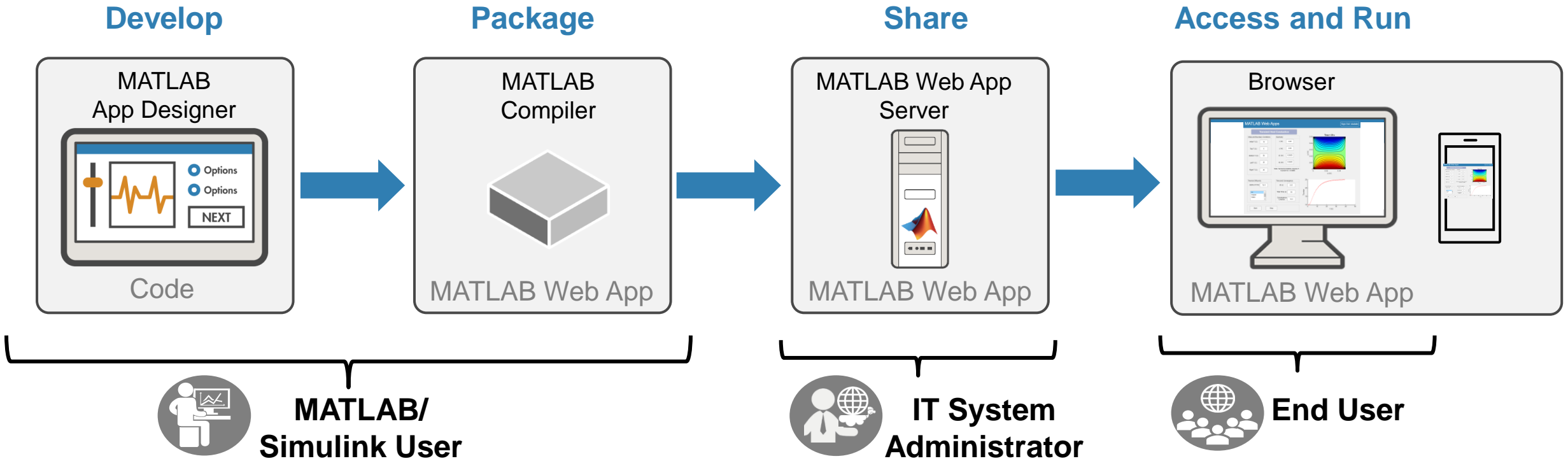
A promotional banner for MATLAB Web App Server. The background is dark blue with a network of white lines and dots. The text is white and orange. At the bottom, there are two orange buttons with white text and icons.

MATLAB Web App Server
Share MATLAB apps and Simulink simulations as browser-based web apps

[▶ Watch video](#) [⬇ Download a free trial](#)



MATLAB Web Apps workflow



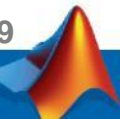
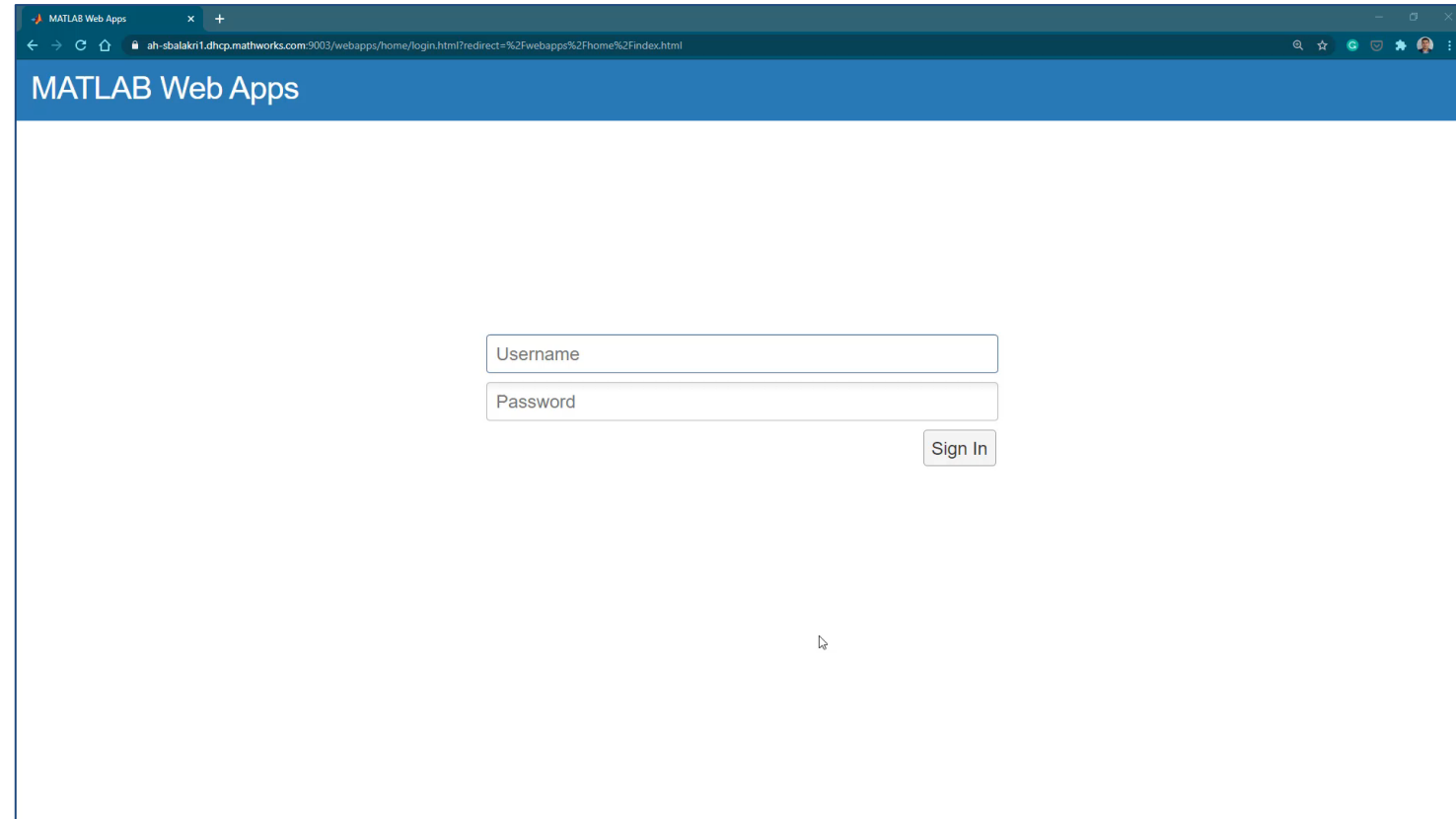
Mechanism to secure and control access to applications

Server-level

R2020a

Benefits:

- Integrate with your existing authentication servers (LDAP, OIDC)
- Allows to assign roles
 - **Author** can upload, delete and run the apps
 - **User** can run the apps



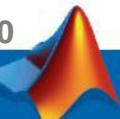
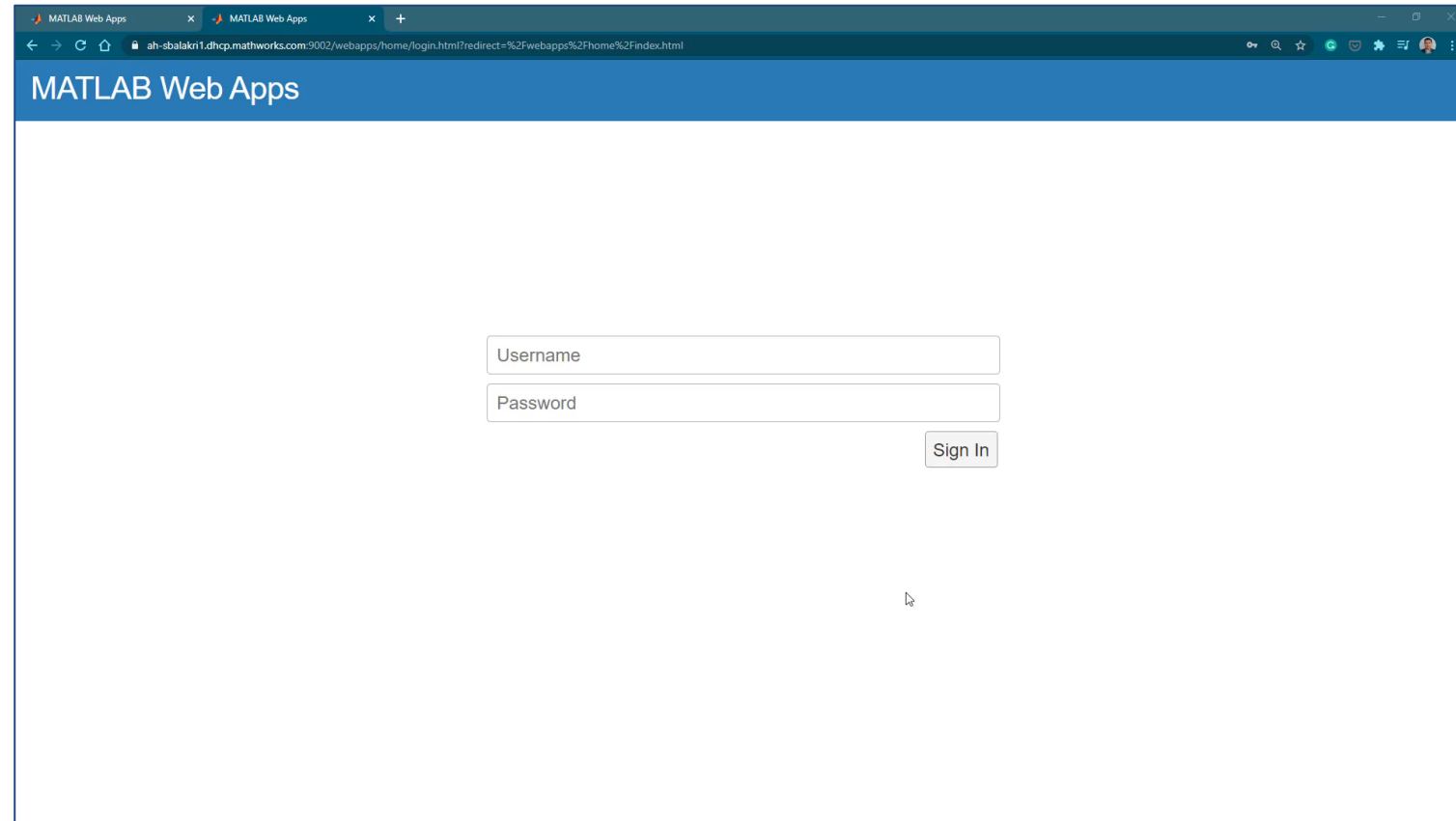
Mechanism to secure and control access to applications

App-level

R2021a

Benefits:

- Starting in R2021a, apply app level policies to access control individual app
- Organize and group apps into folder per team
- Configure user access per folder or individual app
- Users can only see and run the specific authorized apps

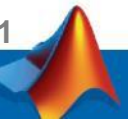
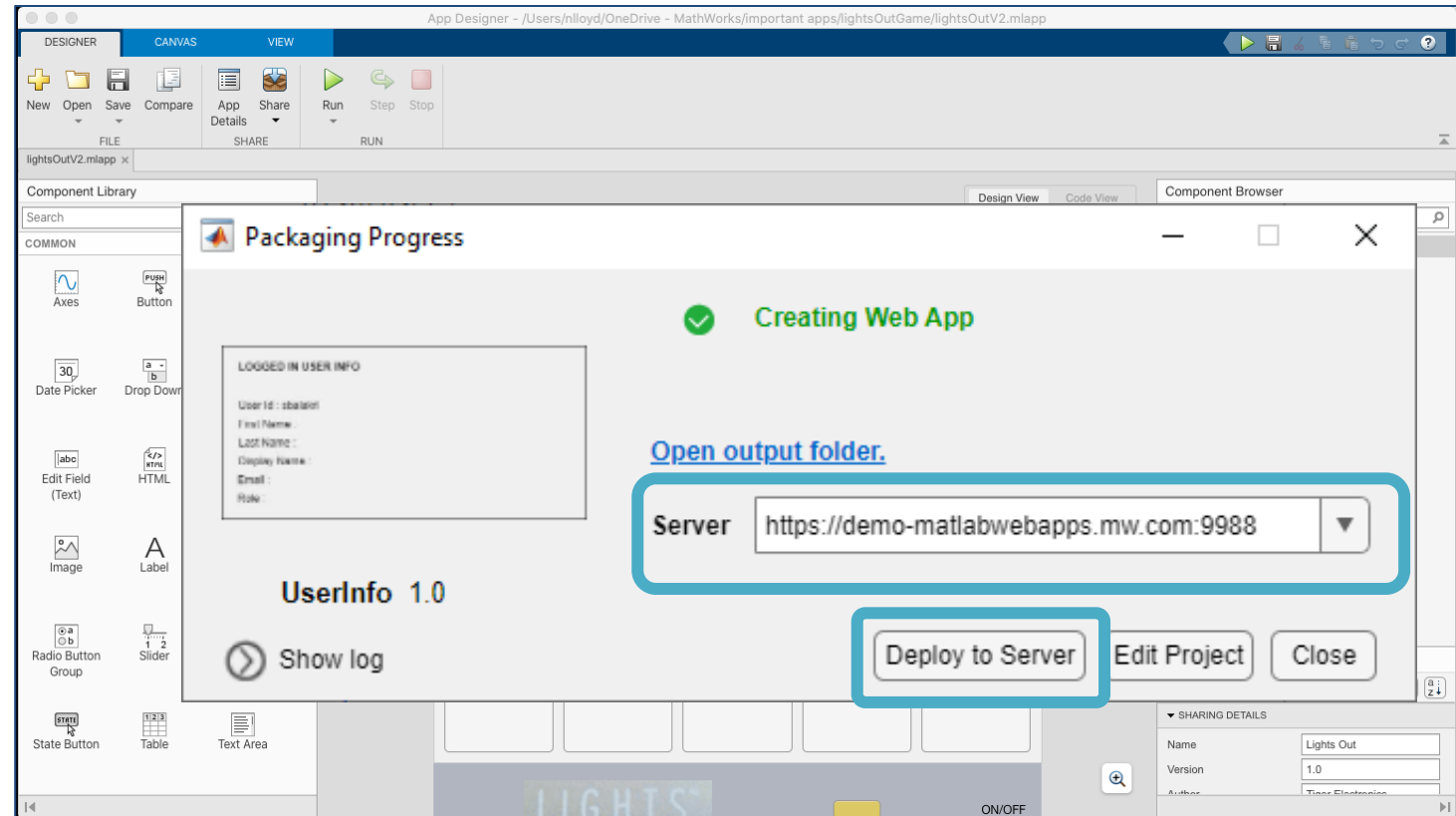


Directly upload your web apps from App Designer

R2021b

Benefits:

- Authoring environment allows you to develop and deploy
- Upload directly to the web app server by providing the URL and port number

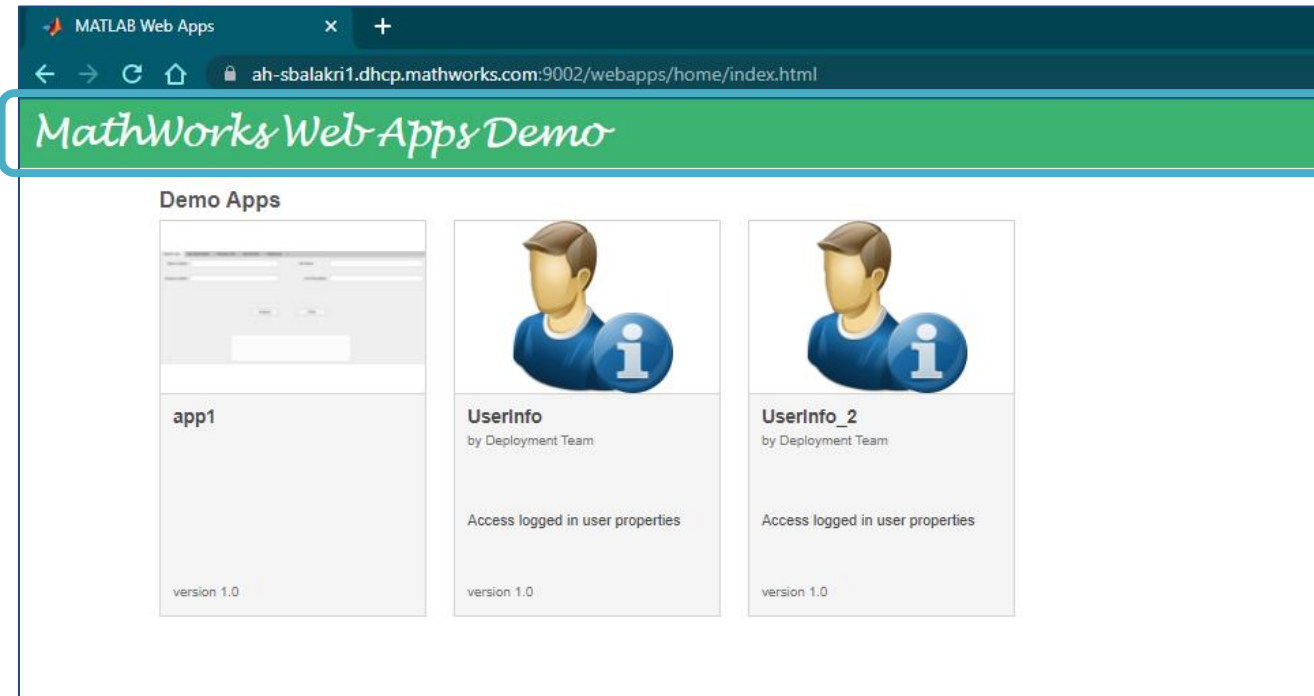


Customize MATLAB Web App Server Apps Home Page

R2021b

Benefits:

- Change the title of MATLAB Web App Server
- Change the color, text font and size adhering to your organization's policy

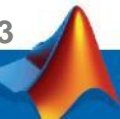
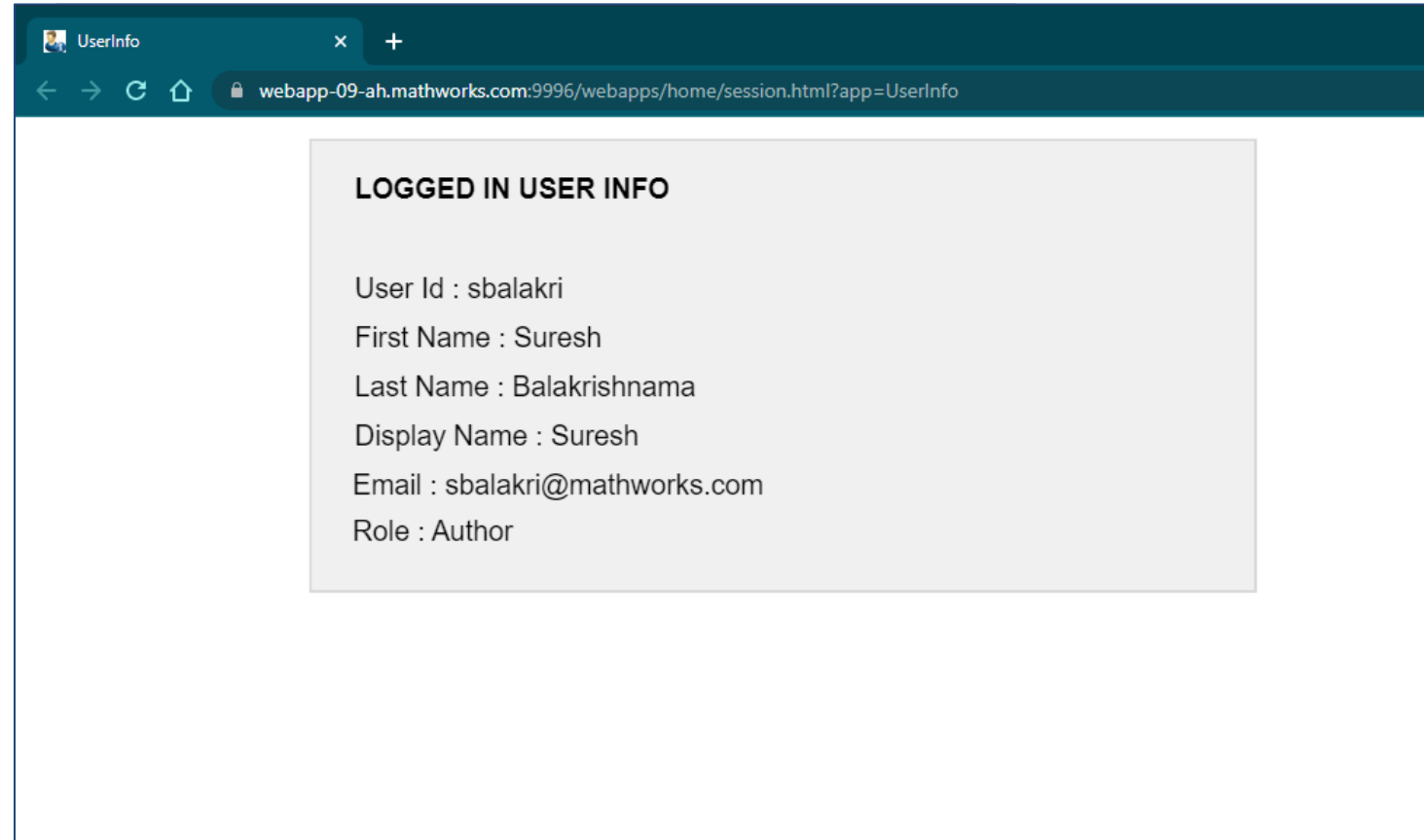


Customize MATLAB Web App behavior based on User

R2022a

Benefits:

- Use *compiler.UserInfo* function to retrieve user-specific details.
- Pass the retrieved user info to access a data source or other applications.



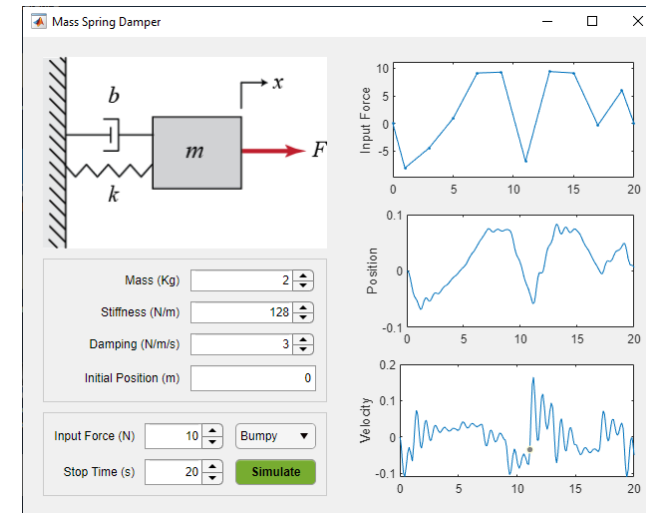
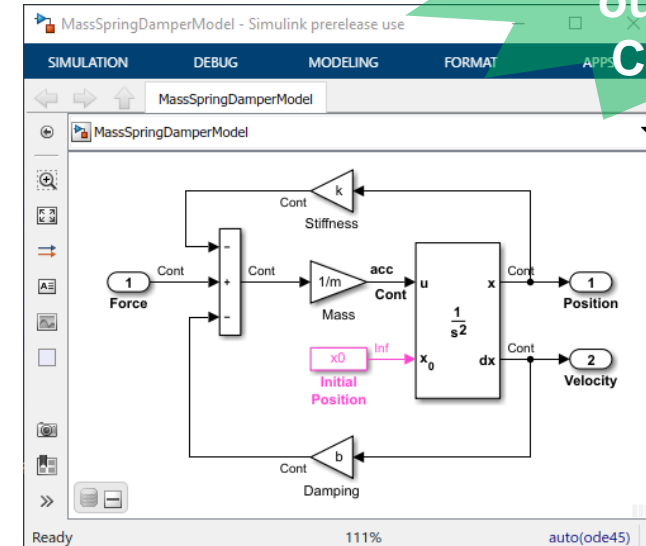
Share Simulink simulations

MATLAB WebApp Server supports Simulink

A long-standing request from our Simulink Customers!

Benefits:

- End users do not require a Simulink license
- End users can use a web app to choose tunable parameters and run the simulation from a browser
 - MATLAB Apps that call `sim()` can be deployed as web apps
- Simulink Compiler can generate a “Starter” app to get you started














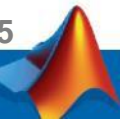
Deploy apps developed in multiple releases of MATLAB or Simulink to one central server

Benefits:

- App developers using multiple versions of MATLAB and Simulink supported with single server
- Easy migration of apps after an upgrade
- Apps developed in 5 prior versions of MATLAB
 - Starting from R2019b

TLAB Web Apps > Manage Apps Upload App Sign Out

Name	Version	Author	MATLAB Runtime	Status Message
 Mass Spring Damper	1.0	-	R2020a	✓ OK
 MassSpringDamperAppForLinux	-	-	-	✗ Expired CTF
 Mortgage	2.1	MATLAB AppDesigner Examples	R2020a	✓ OK
 NFLPlayersApp	1.0	MATLAB Connector Team	R2020a	✓ OK
 PatientsDisplay	1.0	MATLAB AppDesigner Examples	R2020a	✓ OK
 PatientsTreeAppExample	1.0	MATLAB AppDesigner Examples	R2020a	✓ OK
 PlotSelector	1.0	MATLAB Graphics Team	R2020a	✓ OK
 PulseGenerator	1.0	MATLAB AppDesigner Examples	R2020a	✓ OK
 RoadSuspensionInteractionIn3DOF_SLSimApp	-	-	-	✗ Expired CTF
 TMDDsim	2.0	MathWorks SimBiology Team	R2019b	✓ OK
 TransientConduction	1.0	Dave Garrison	R2020a	✓ OK



Deploy MATLAB Web App Server to the cloud using MathWorks reference architecture

The screenshot shows the GitHub repository page for 'mathworks-ref-arch/matlab-web-app-server-on-aws'. The repository is public and has 2 branches and 0 tags. The main branch is selected. The repository description is 'Stand up a MATLAB Web App Server using CloudFormation'. The repository has 0 stars, 1 watching, and 0 forks. The repository contains the following files:

File	Commit	Time
releases/R2021b	21b publish!	28 days ago
LICENSE.md	add templates file for 21b	last month
README.md	21b publish!	28 days ago
SECURITY.md	add templates file for 21b	last month

The README.md file is displayed, showing the following content:

MATLAB Web App Server on Amazon Web Services

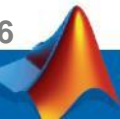
Requirements

Before starting, you need the following:

- A MATLAB® Web App Server™ license. For more information, see [Configure MATLAB Web App Server Licensing on the Cloud](#). To configure a license for use on the cloud, you need the MAC address of the network license manager on the cloud. For more information, see [Get License Server MAC Address](#).
- An Amazon Web Services™ (AWS) account with an IAM user identity.
- A Key Pair for your AWS account in the US East (N. Virginia), EU (Ireland) or Asia Pacific (Tokyo) region. For more information, see [Amazon EC2 Key Pairs](#).

Costs

You are responsible for the cost of the AWS services used when you create cloud resources using this guide. Resource settings, such as instance type, will affect the cost of deployment. For cost estimates, see the pricing pages for each AWS service you will be using. Prices are subject to change.



Flexible license model

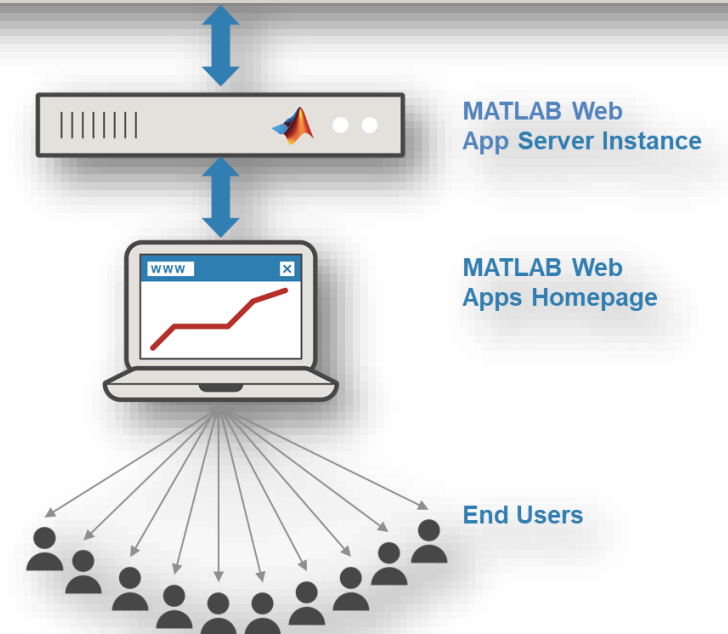
Designed to support both user and business needs

Benefits:



- End user do not need MATLAB or Simulink license
- License model does not count number of apps deployed or users accessing the apps
- Full control to IT administrators to add users per need

License Model: Concurrent Server-Instance Based
A server-instance is defined as a single copy of the server software installed on a physical or virtual machine

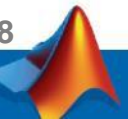
Network License Manager



Comparison of Options

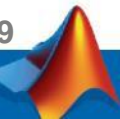
Features	Development version included in MATLAB Compiler	MATLAB Web App Server
Authentication		
MATLAB/Simulink Release Supported	Single	Multiple
End-Users	32	Unlimited*

* Dependent on server hardware



MATLAB Web App Server System Requirements

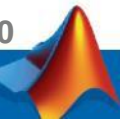
Supported Platforms	Windows, Linux, Mac
Hardware Requirements	<ul style="list-style-type: none">• Minimum 60 GB of disk capacity to accommodate the server software installation and log files• Minimum 1GB RAM per worker• Allocation of 1 processor core (or virtual core) per 4 workers
Software Requirements	<ul style="list-style-type: none">• An installation of MATLAB Runtime is required. MATLAB Runtime starting from R2019b up until the most recent release is supported.• MATLAB Compiler™ is required to package MATLAB apps as web app archives (.ctf files) to run on MATLAB Web App Server
Supported Browsers	Google Chrome™, Safari, Firefox®, Microsoft Edge®



MATLAB Web App Server Sizing Guide

Using the 1GB Memory and 0.25 core per end user requirement rule
Assuming number of **expected** users accessing the web apps = 50

Number of concurrent / simultaneous users accessing web apps	Expected capacity for concurrent / simultaneous users	Core (rounded, 0.25 core X number of concurrent users)	Memory (GB) (1 GB X number of concurrent users)	Recommended Machine Type
50	100 %	13	50	16 core, 64 GB
40	80 %	10	40	10 core, 40 GB)
30	60 %	8	30	8 core, 32 GB
25	50%	7	25	7 core, 32 GB



Benefits of using MATLAB Web Apps workflow



MATLAB/Simulink User

- Deploy enhancements to the end users faster
- Spend less time managing application distribution
- Control the use of a single version of the application



IT ADMINISTRATORS

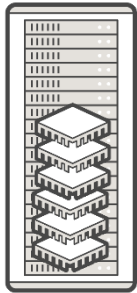
- Eliminate the need to install application for each end user
- Provides a central hosting location for all web apps
- Deploying and sharing application is streamlined and easier



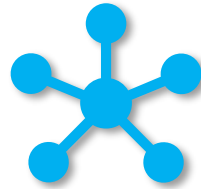
END USERS

- Easily access and run web apps from a browser
- Eliminates the dependency on IT team for application installation

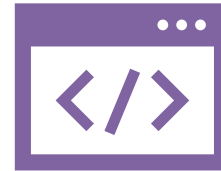
MATLAB Server Products Family – High Level



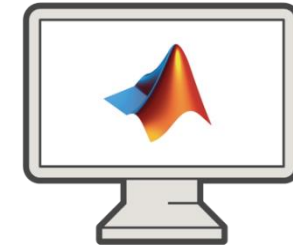
**Speed up
computation**



**Integrate with
enterprise
applications**



**Publish
Web Apps**



**Use MATLAB in
a browser**



**MATLAB
Parallel
Server**



**MATLAB
Production
Server**



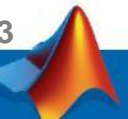
**MATLAB
Web App
Server**



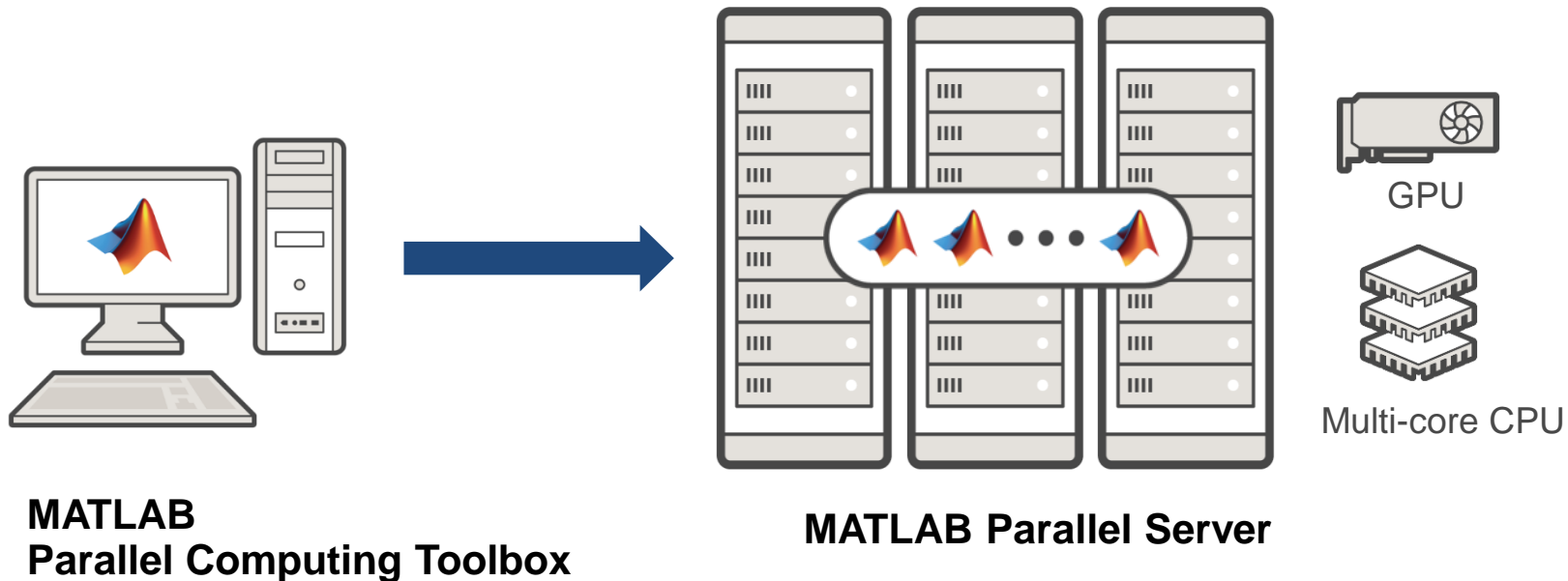
**MATLAB
Online
Server**



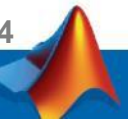
MATLAB Parallel Server



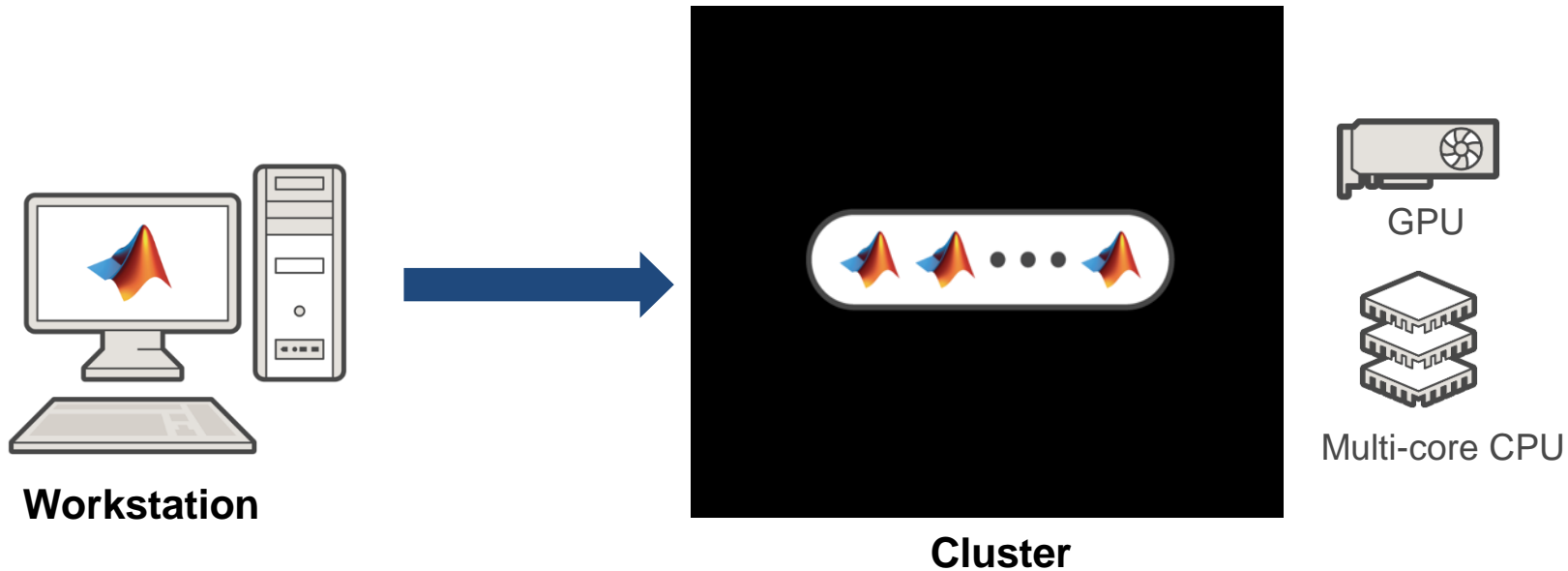
Parallel computing scale on desktop, clusters, and clouds



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

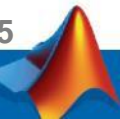


Campus-Wide needs and wants for scale vary with your staff

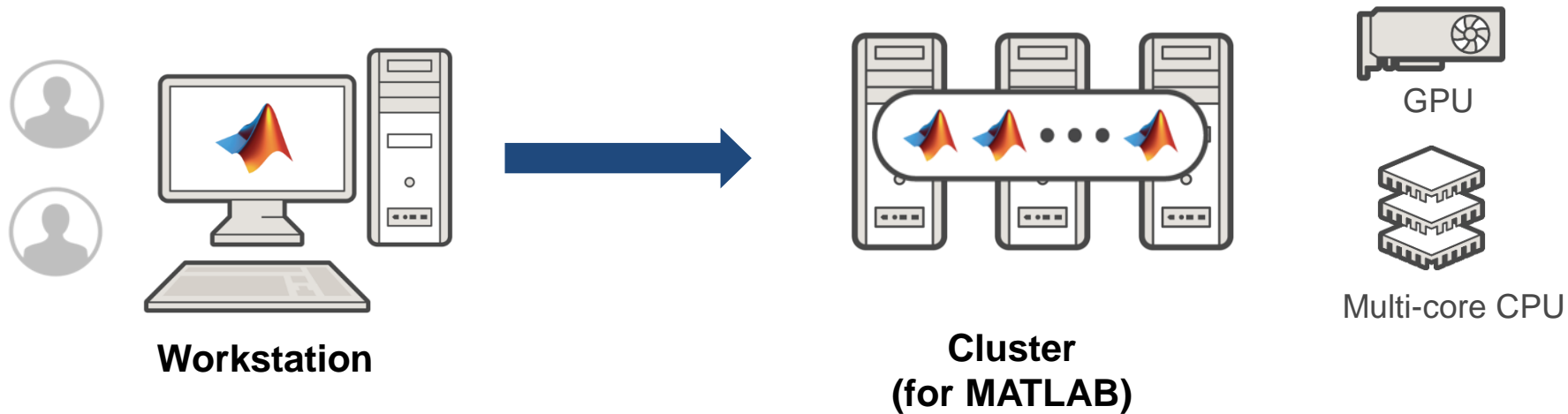


Researcher:

- Wants scale
- Needs something ready-to-use

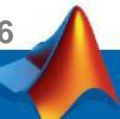


Campus-Wide needs and wants for scale vary with your staff

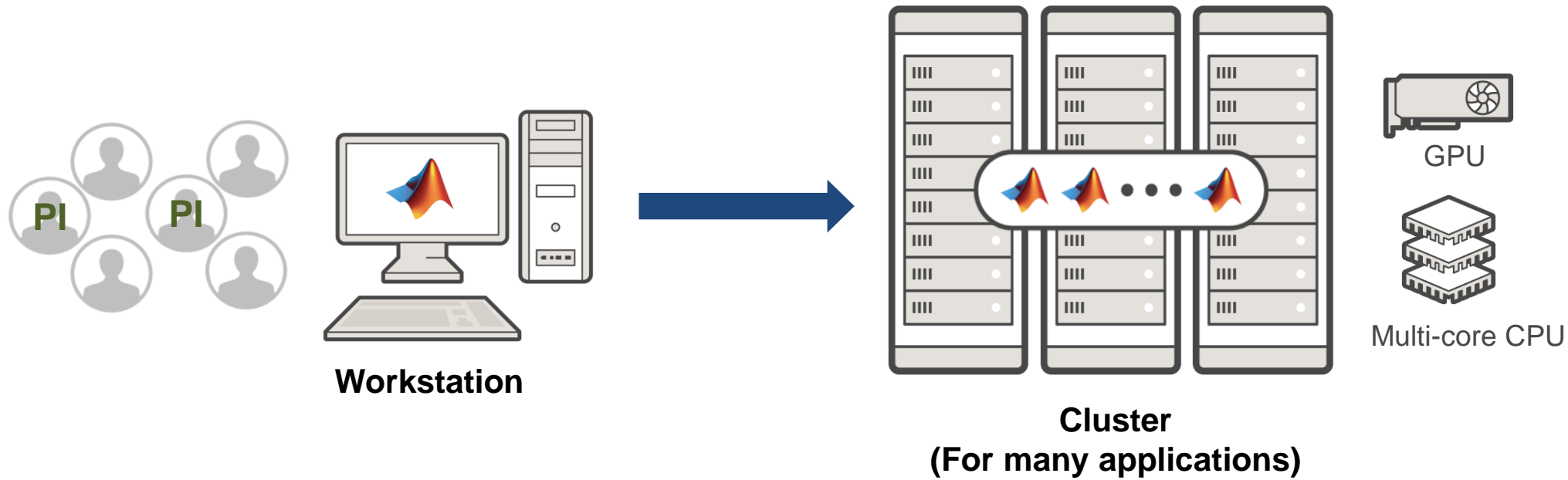


PI, Group Lead

- Wants scale for team
- Has some hardware to dedicate

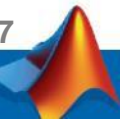


Campus-Wide needs and wants for scale vary with your staff



Campus IT

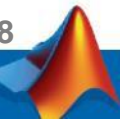
- Wants to enable Institute for all applications
- Maintains scheduled environment



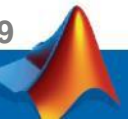
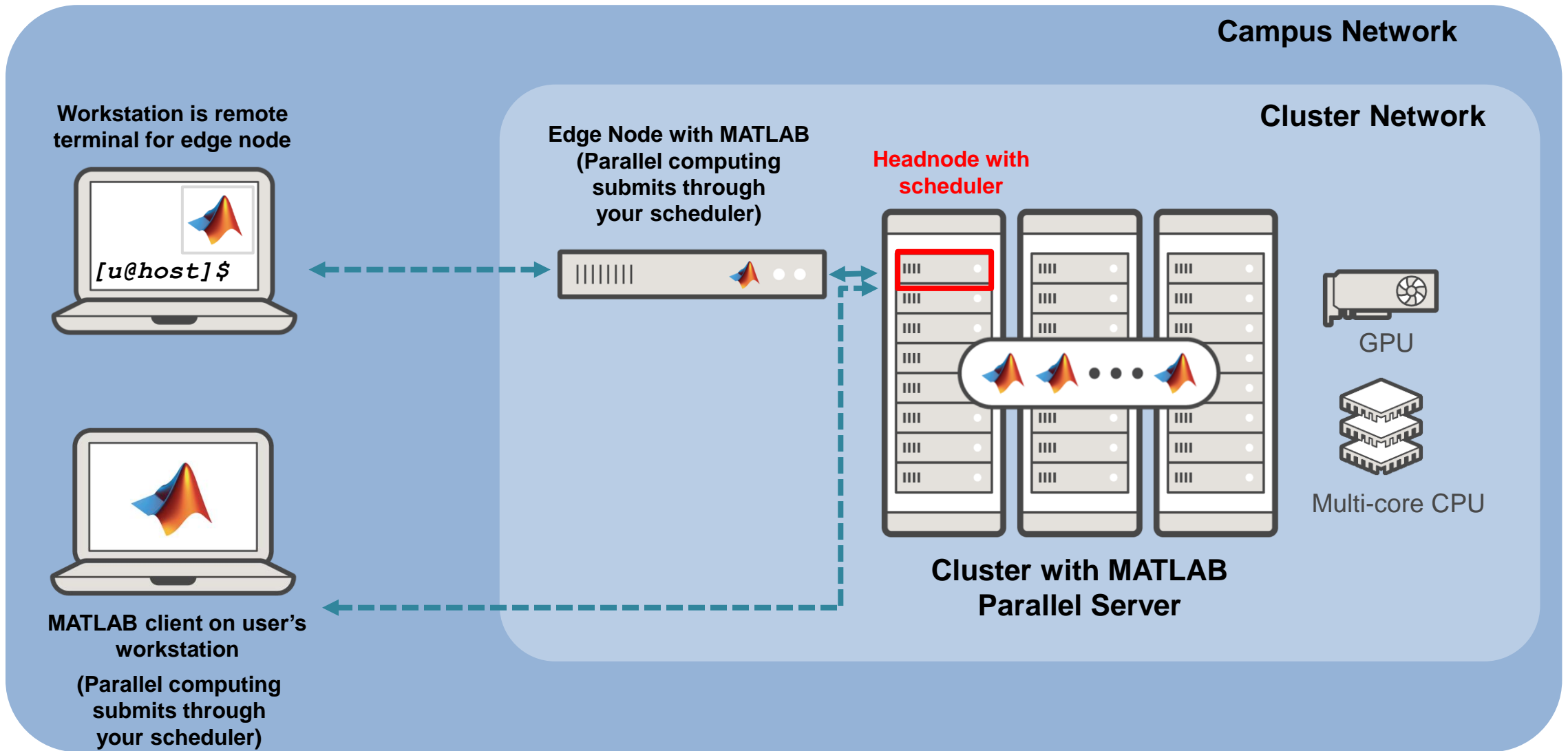
MATLAB Parallel Server supports your needs for scale

Who manages cluster	Environment	Set-up for each new cluster	Hardware cost	Next steps for person managing cluster	Licensing
Researcher	Cloud at the press of a button	Cloud Center (AWS)	AWS/Azure cost	<ul style="list-style-type: none"> • Contact license admin to get MathWorks Account linked to MATLAB Parallel Server • Get access to cloud services 	Unlimited - Covered by MATLAB Parallel Server for Campus-Wide License
Researcher	Cloud from templates	AWS Reference Architecture OR Azure Reference Architecture			
PI, Researcher, Group lead	Small cluster for MATLAB users	Integrate MATLAB Job Scheduler for Online Licensing	None, if you already have machines available	<ul style="list-style-type: none"> • Contact license admin and get added as an administrator • Get added as an end-user for MATLAB Parallel Server if using online licensing 	
Campus IT	Shared Clusters and Custom Clouds	Integrate MATLAB with Third-Party Schedulers	None, assumed owned by University		

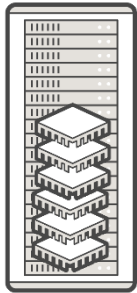
Installation Support can help with all options



Multiple workflows for IT clusters - your scheduler is in control



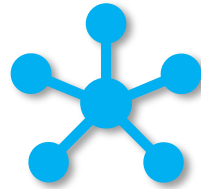
MATLAB Server Products Family – Q&A



**Speed up
computation**



**MATLAB
Parallel
Server**



**Integrate with
enterprise
applications**



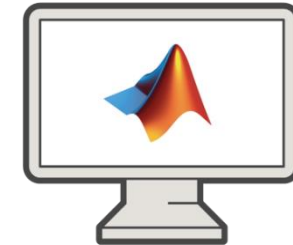
**MATLAB
Production
Server**



**Publish
Web Apps**



**MATLAB
Web App
Server**



**Use MATLAB in
a browser**



**MATLAB
Online
Server**

