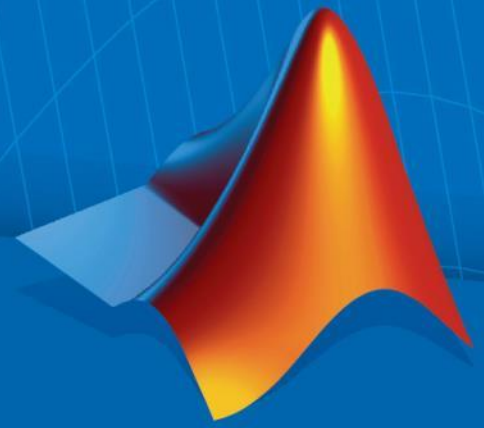
TeraSoft
www.terasoft.com.tw



MATLAB Server Product Family Discussion

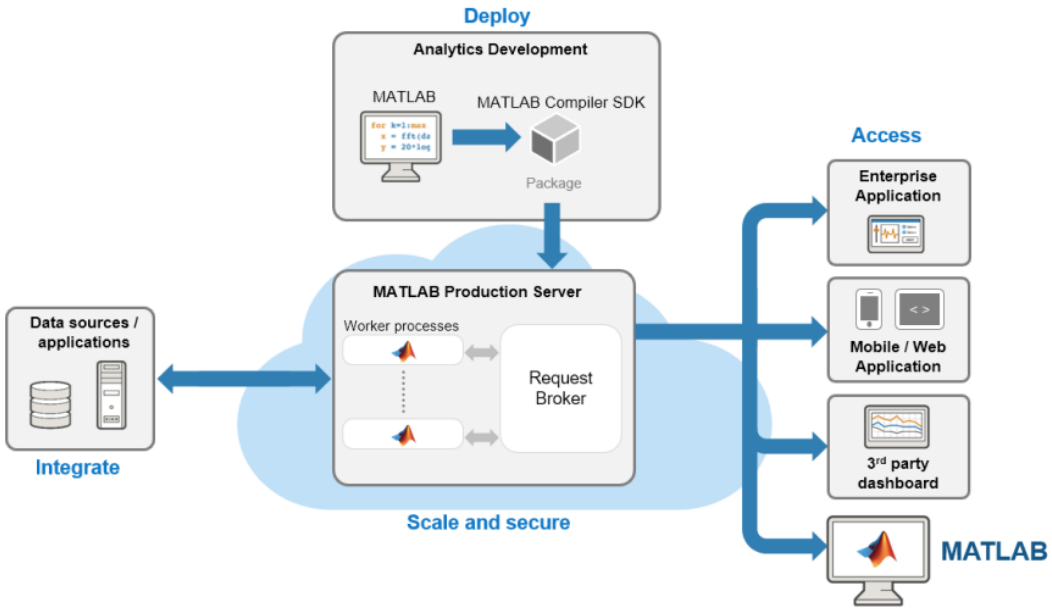
Terasoft

Application Engineer Team

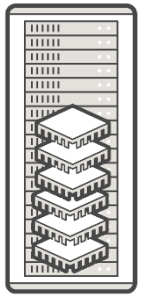
MathWorks®
Accelerating the pace of engineering and science

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

MATLAB Parallel Server

Integrate with enterprise applications

MATLAB Production Server

Publish Web Apps

MATLAB Web App Server

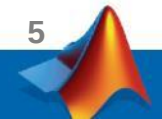
Use MATLAB in a browser

MATLAB Online Server

MATLAB 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				✓

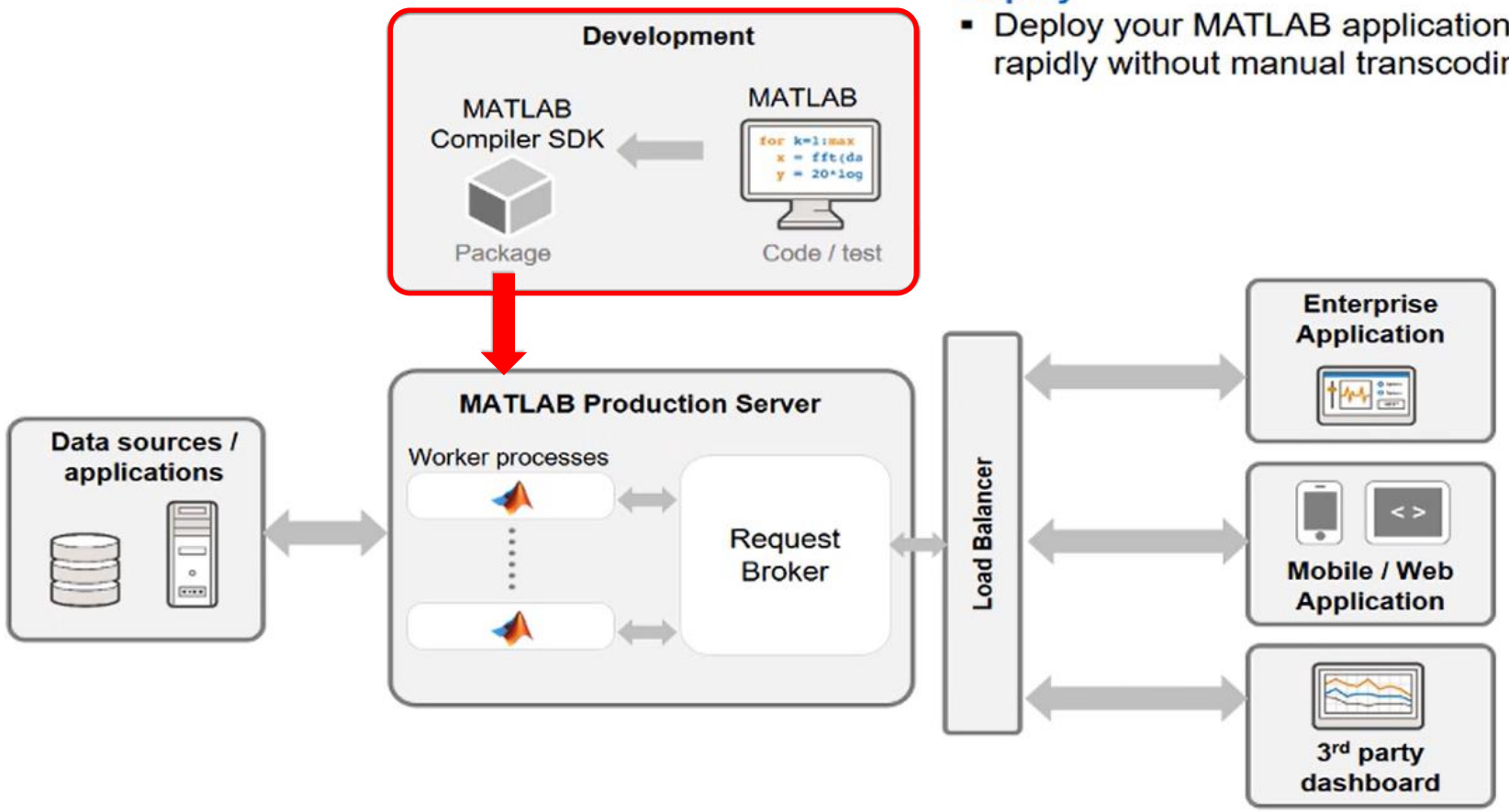
MATLAB Production Server



MATLAB Production Server Typical Framework

Deploy

- Deploy your MATLAB applications rapidly without manual transcoding



MATLAB Production Server Typical Framework

Deploy
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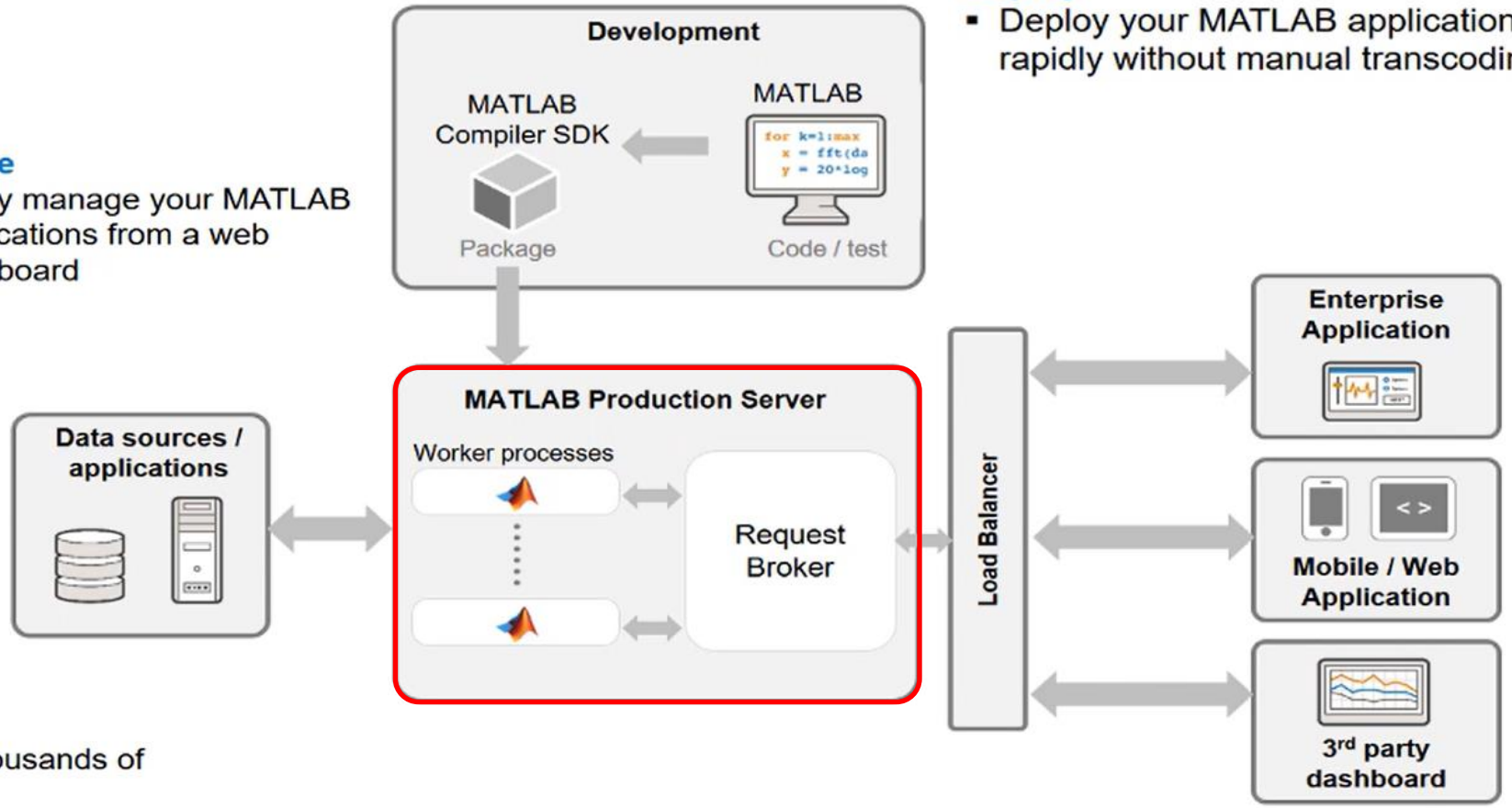
Manage
- Easily manage your MATLAB applications from a web dashboard



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

Deploy
- Deploy your MATLAB applications rapidly without manual transcoding

Manage
- Easily manage your MATLAB applications from a web dashboard

Integrate
- Integrate with a broad array of data sources, streaming data, and enterprise systems

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- Services hundreds to thousands of concurrent requests
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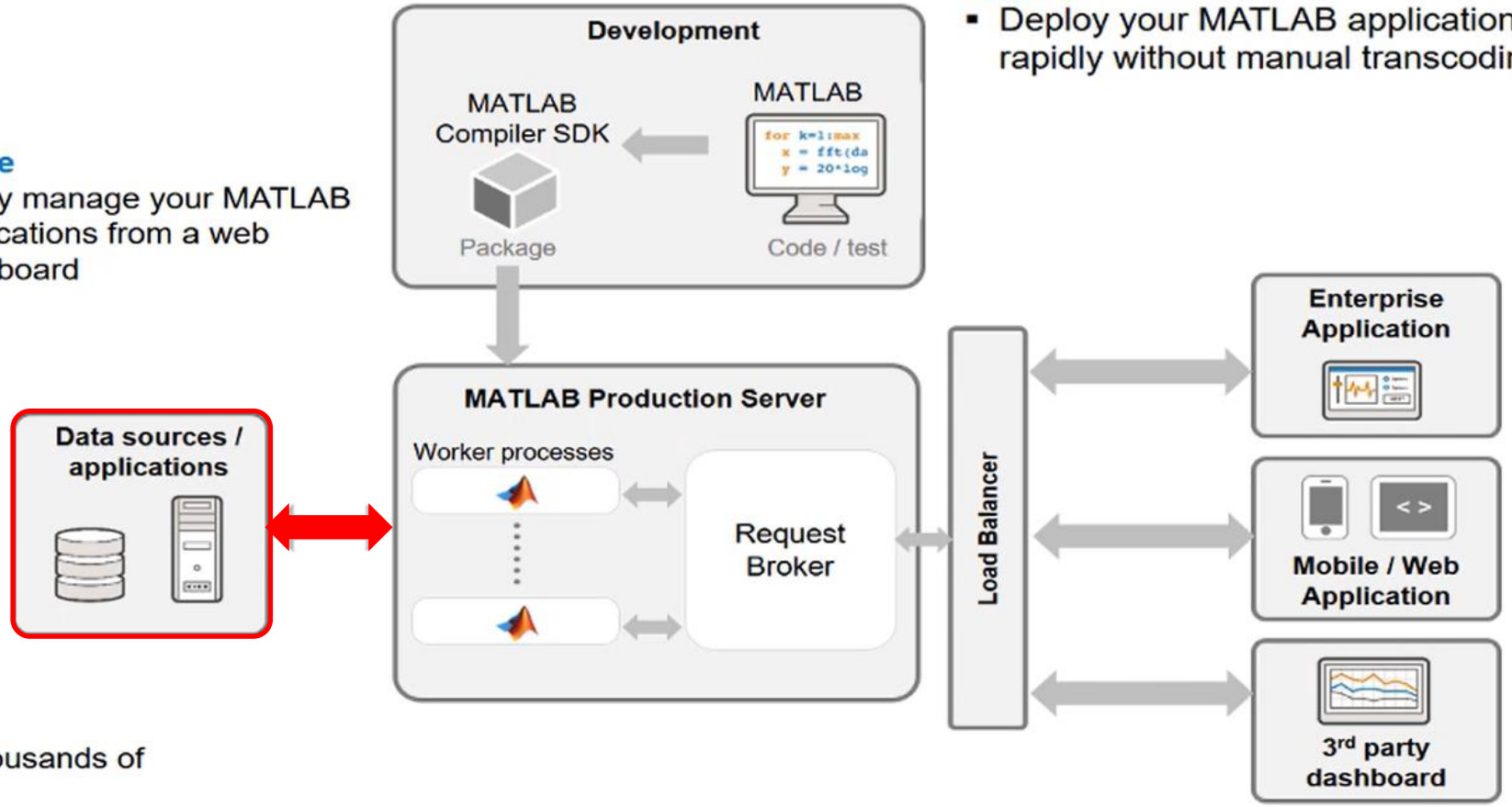

MATLAB Production Server Typical Framework

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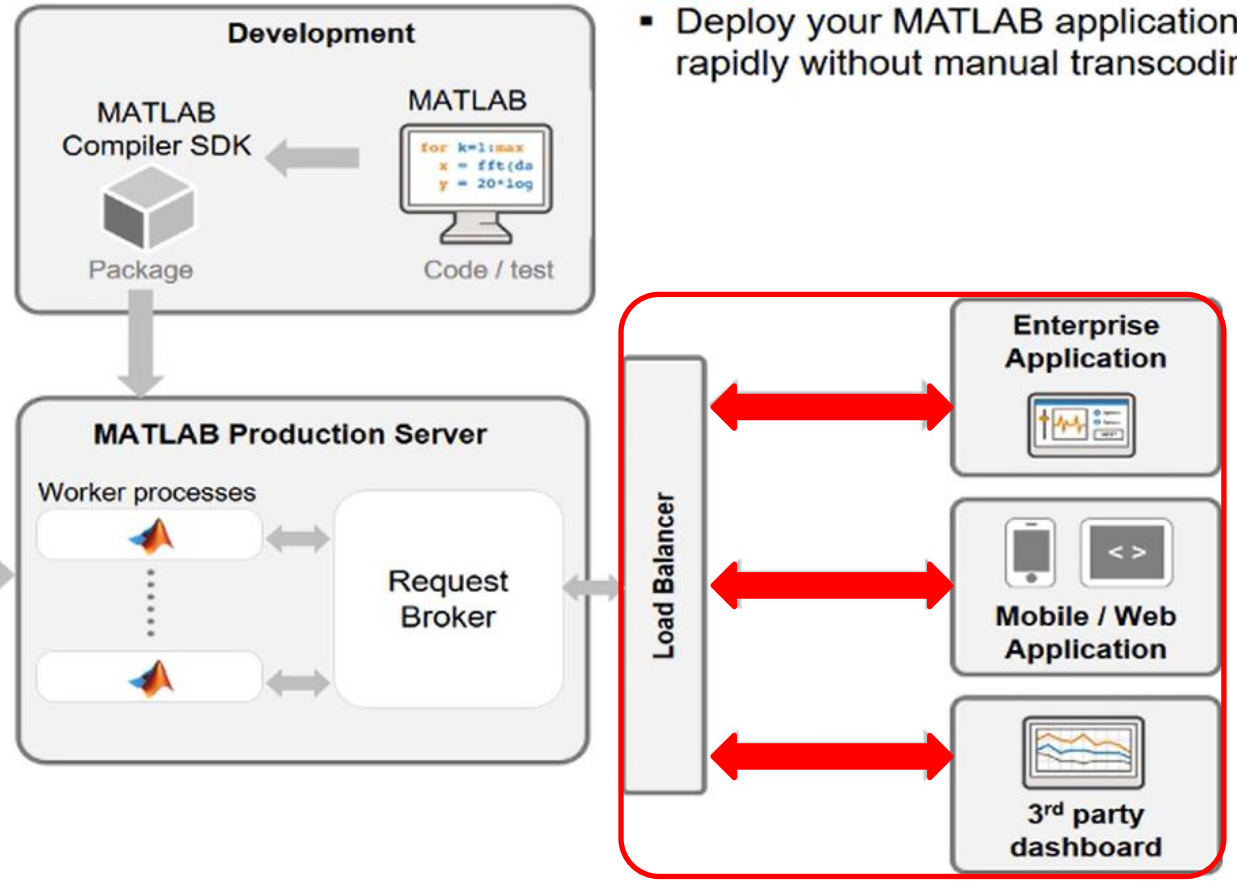

Integrate
- Integrate with a broad array of data sources, streaming data, and enterprise systems

Access
- Allows applications of all types to easily call MATLAB code

Scalable and secure
- Services hundreds to thousands of concurrent requests
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MATLAB Production Server Typical Framework

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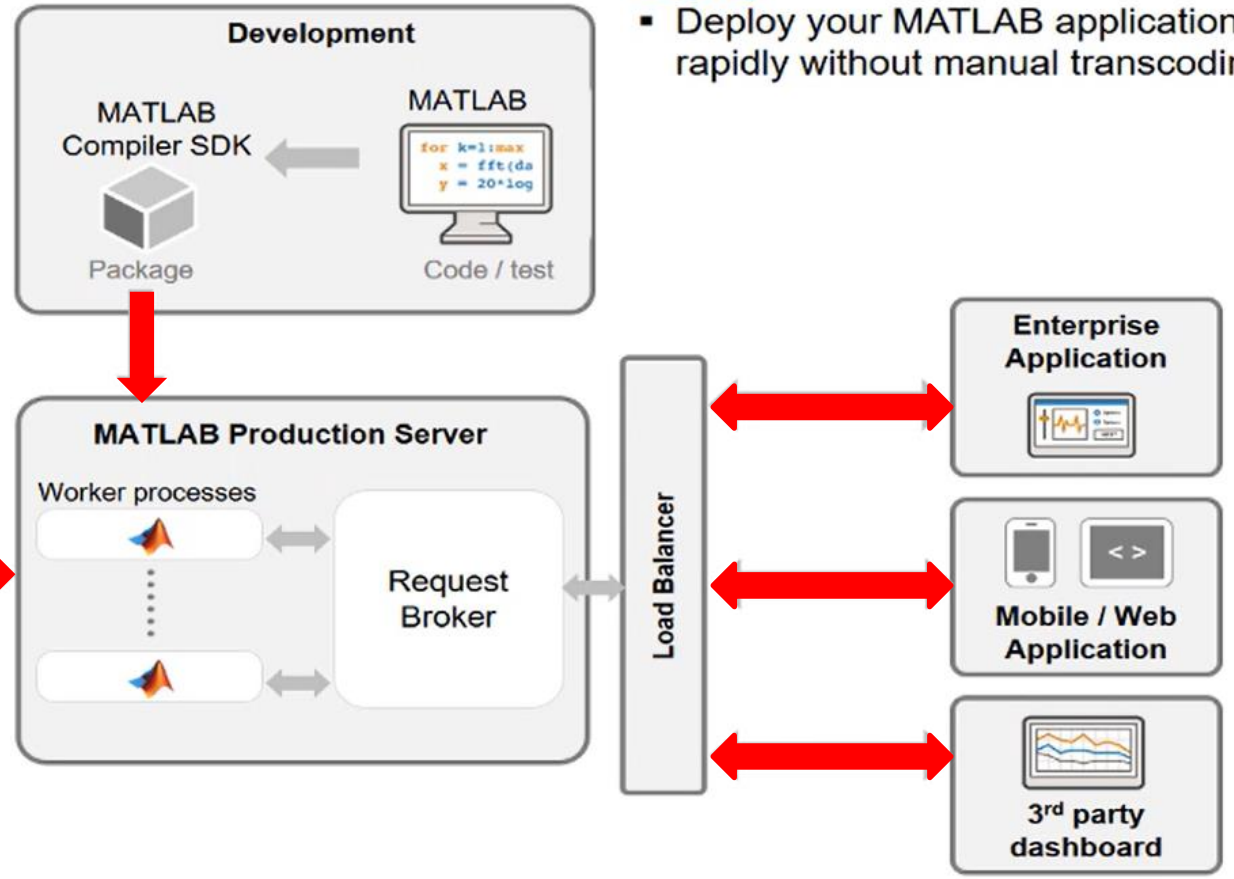

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Access
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Scalable and secure
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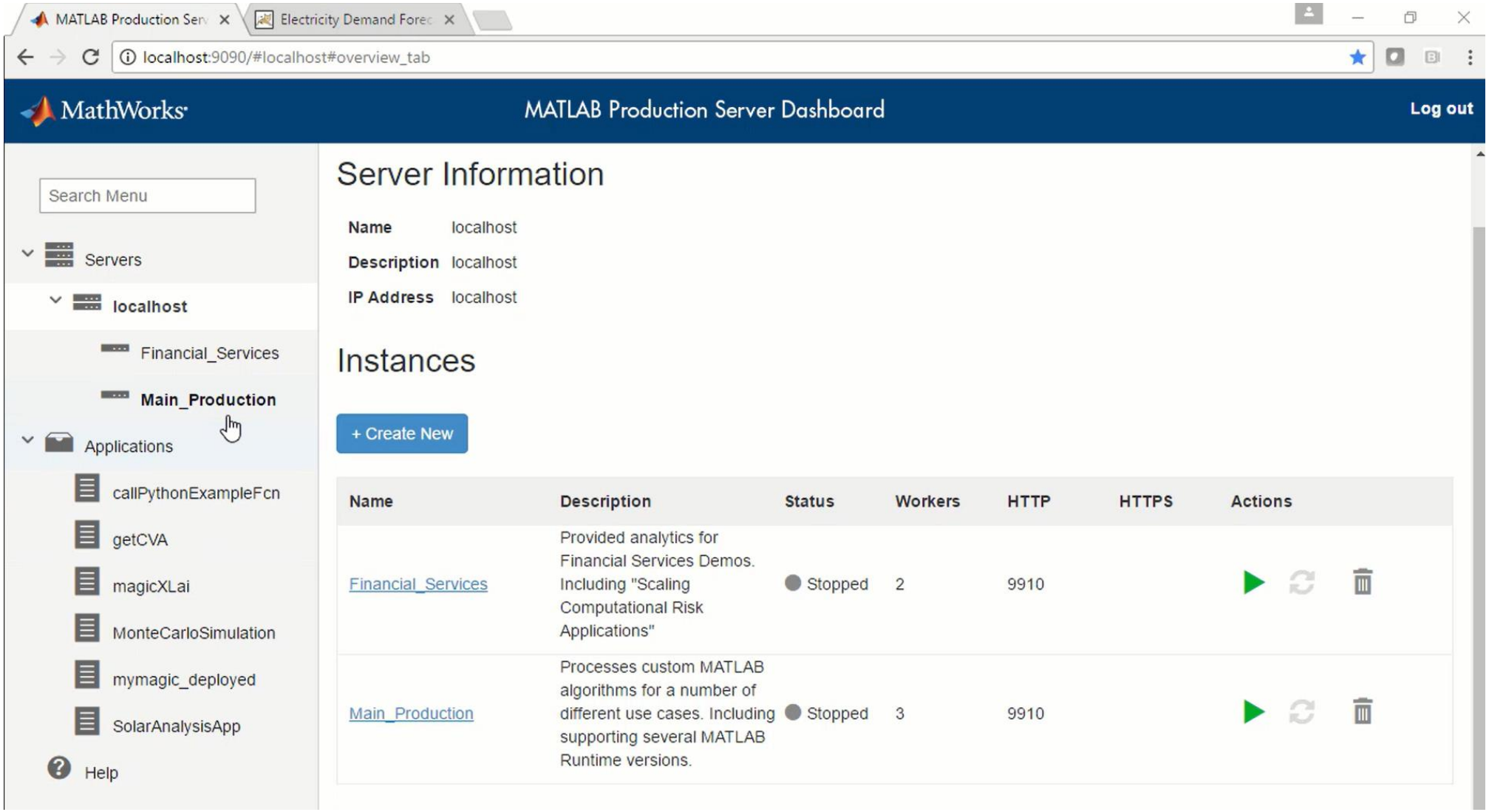
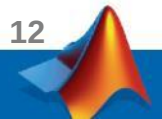
Manage Your Server Instances Using a Dashboard Interface



Configuring MATLAB Production Server

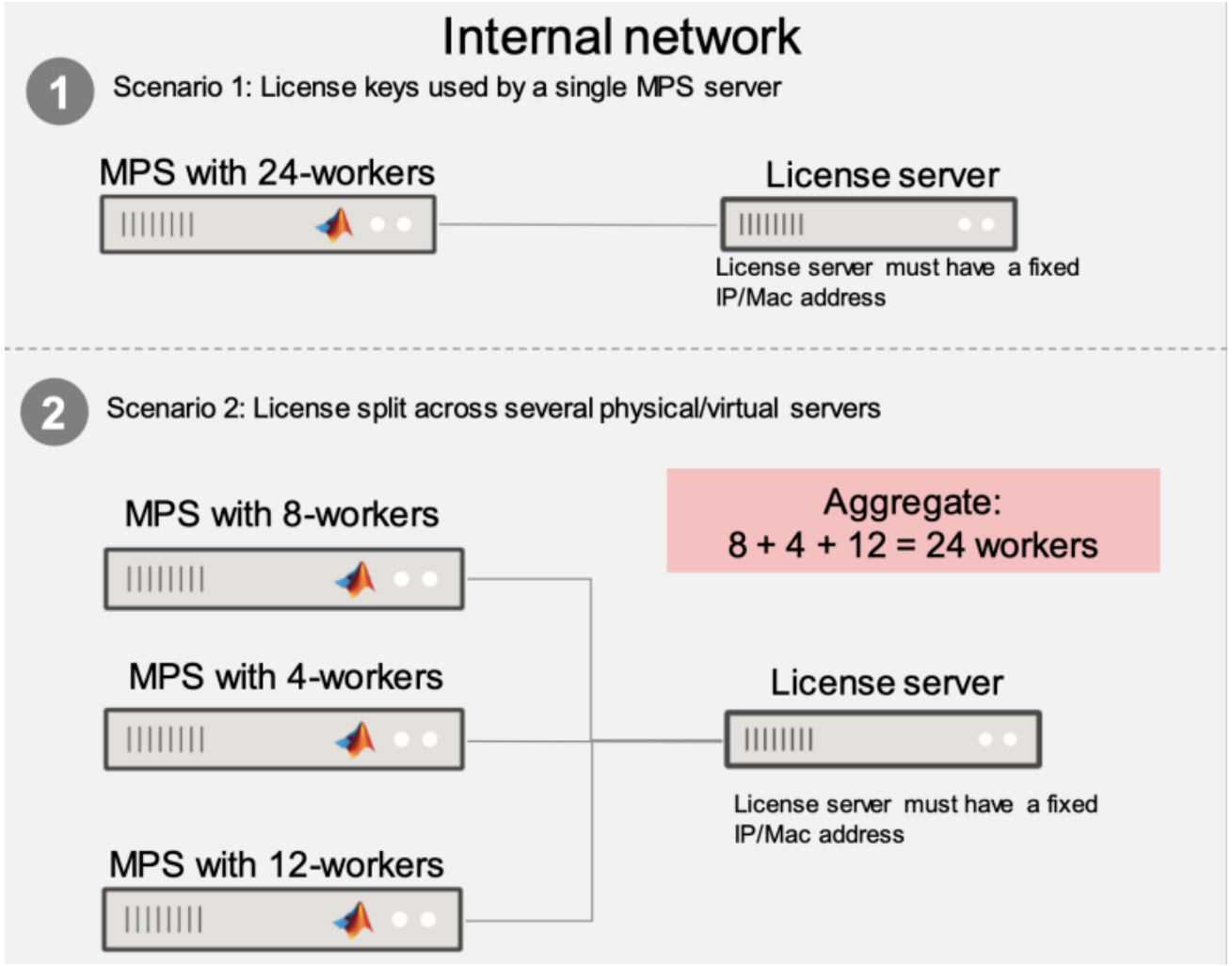
- Choosing between the command line and web dashboard to configure MATLAB Production Server

	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**



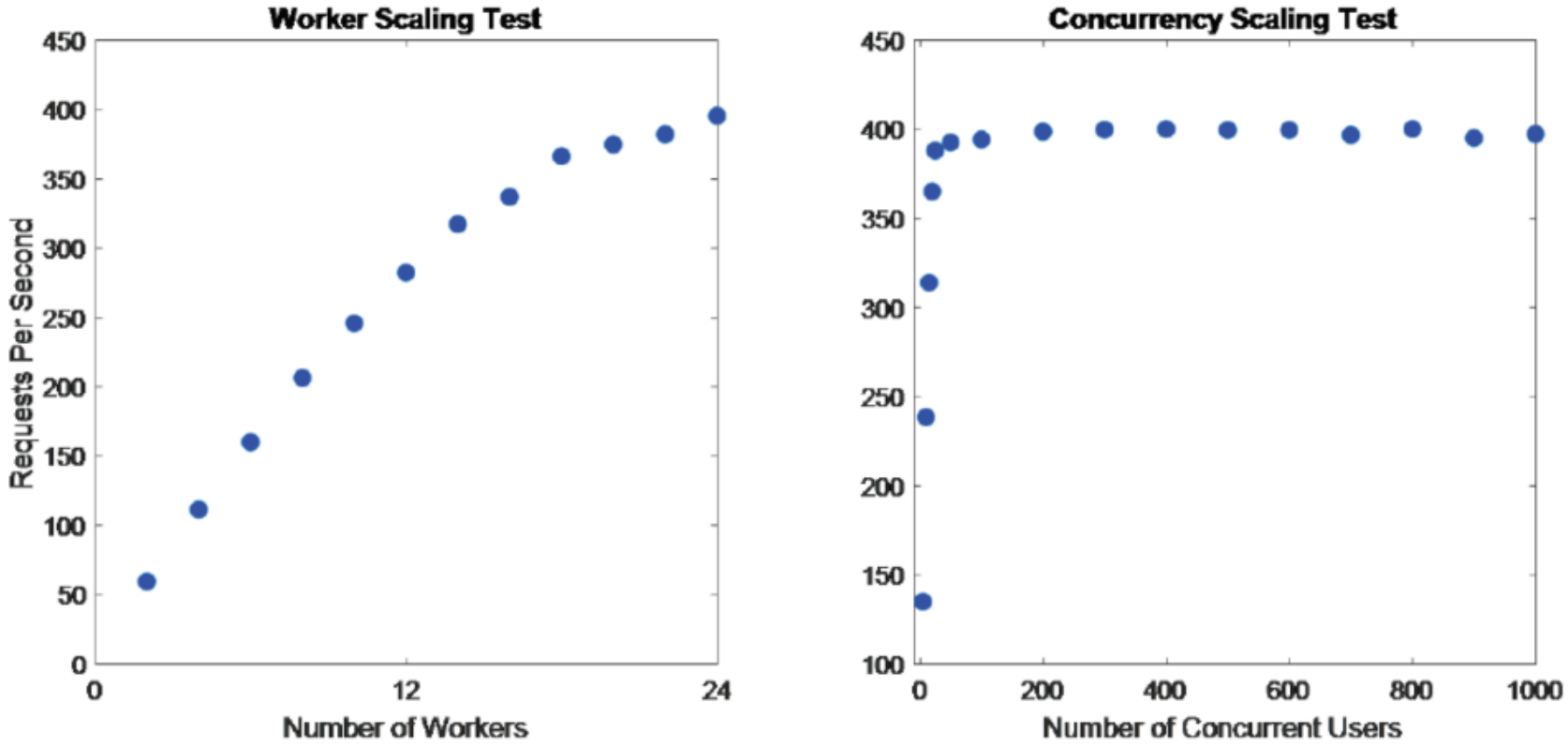
MPS License Management Options

- 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

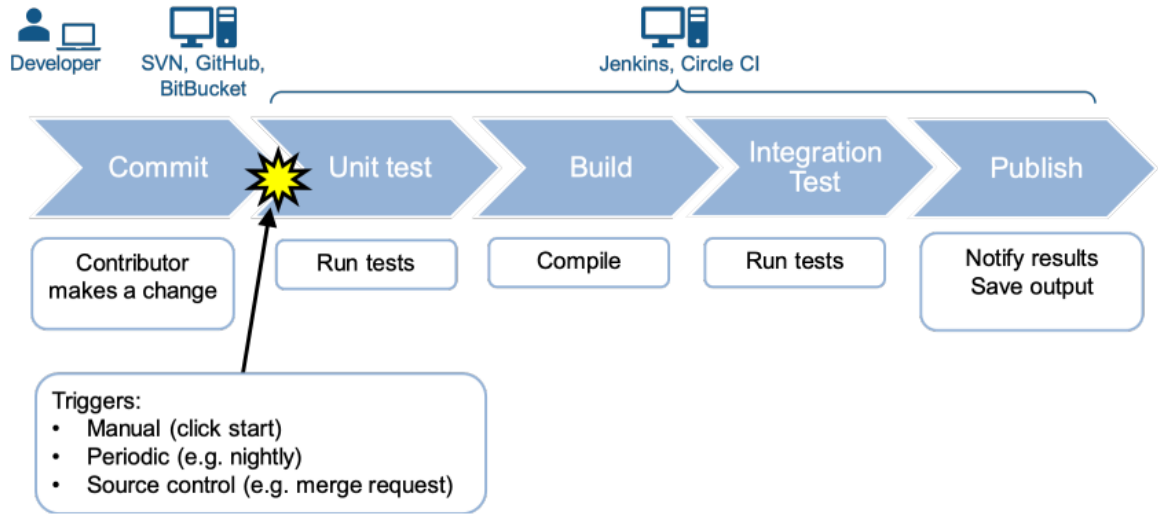
- MPS continued serving approximately 400 requests per second even as the number of concurrent users hit 1000.

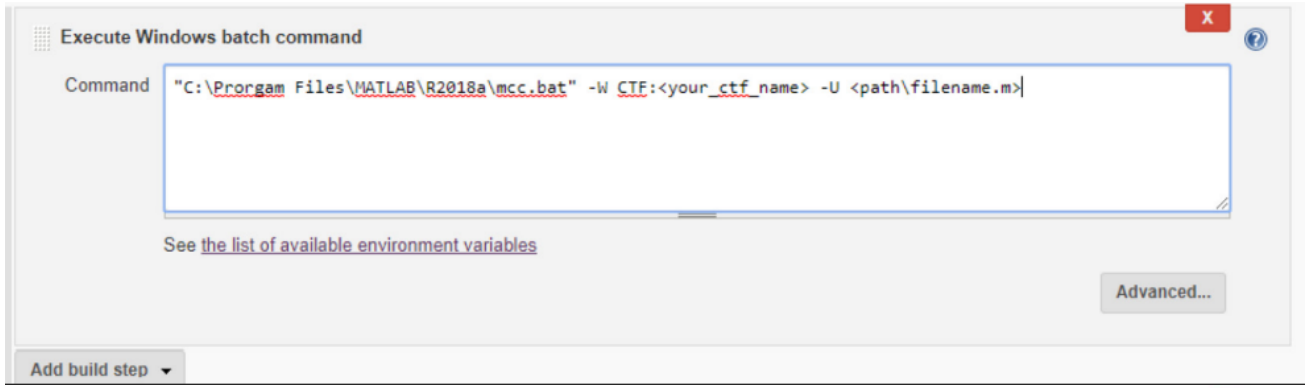


MATLAB Production Server performance with a medium load (Fast Fourier transform) running on a 24-core Intel Xeon with 128GB RAM.

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>`

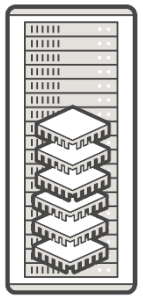




Benefits of MATLAB Production Server

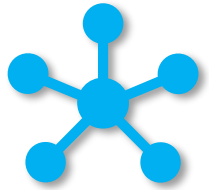
- 節省安裝、管理多台MATLAB Runtime(MCR)機器的時間
- 集中化管理模型和演算法，讓組織成員可以呼叫統一的版本
- 兼容多版本的MATLAB Runtime (MCR)，可使用不同版本MATLAB開發
- 佈署時不需重啟Server，降低對產線其他運算的影響
- 提供Dashboard，方便管理與監控所有運作
- Server Log統一在管理介面中查詢和顯示
- 容易嵌入CI/CD流程

MATLAB Server Products Family – High Level



Speed up computation

MATLAB Parallel Server



Integrate with enterprise applications

MATLAB Production Server

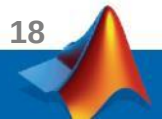
Publish Web Apps

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

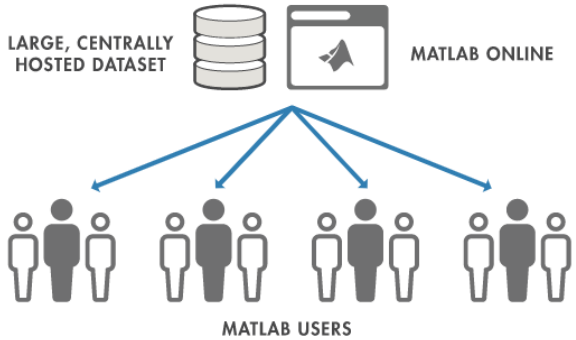
No Downloads, No Installs

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



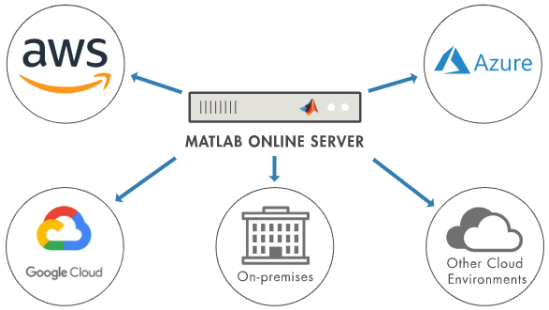
Remove need to download large datasets

Preserve data integrity, comply with organizational and industry regulations

MATLAB Online Server - host MATLAB Online on your infrastructure

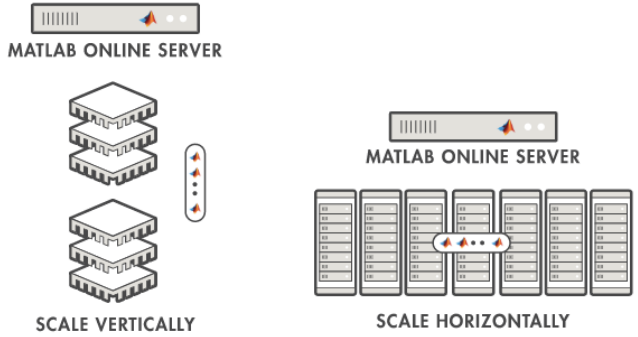
IT TEAMS

Centrally manage MATLAB



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

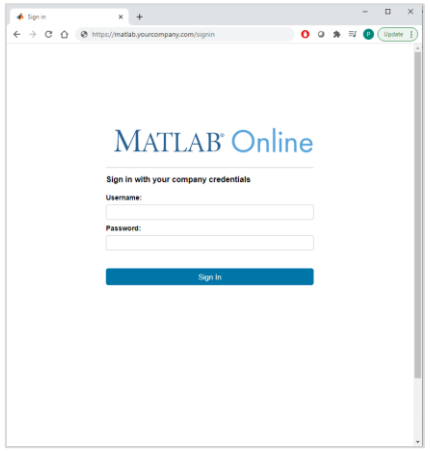
Optimize hardware resource usage



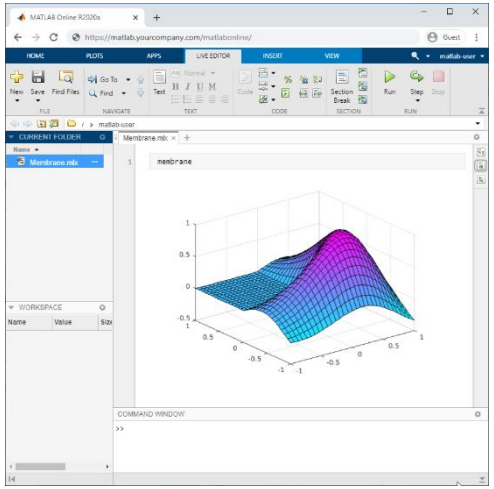
Scale vertically (on a single instance) or horizontally (across a cluster)

Provide access to specialized hardware resources

https://matlab.yourcompany.com



Login



a MATLAB compute pod is assigned

Kubernetes

Ingress Controller

Core Services

- Core-UI (pod)
- AuthNZ (pod)
- Resource (pod)
- Gateway (pod)
- Help (pod)
- Licensing (pod)

MATLAB Compute

- Resource-Proxy, MATLAB, Window Manager, Display (pod)
- Resource-Proxy, MATLAB, Window Manager, Display (pod)

Identity Providers:

LDAP - SAML

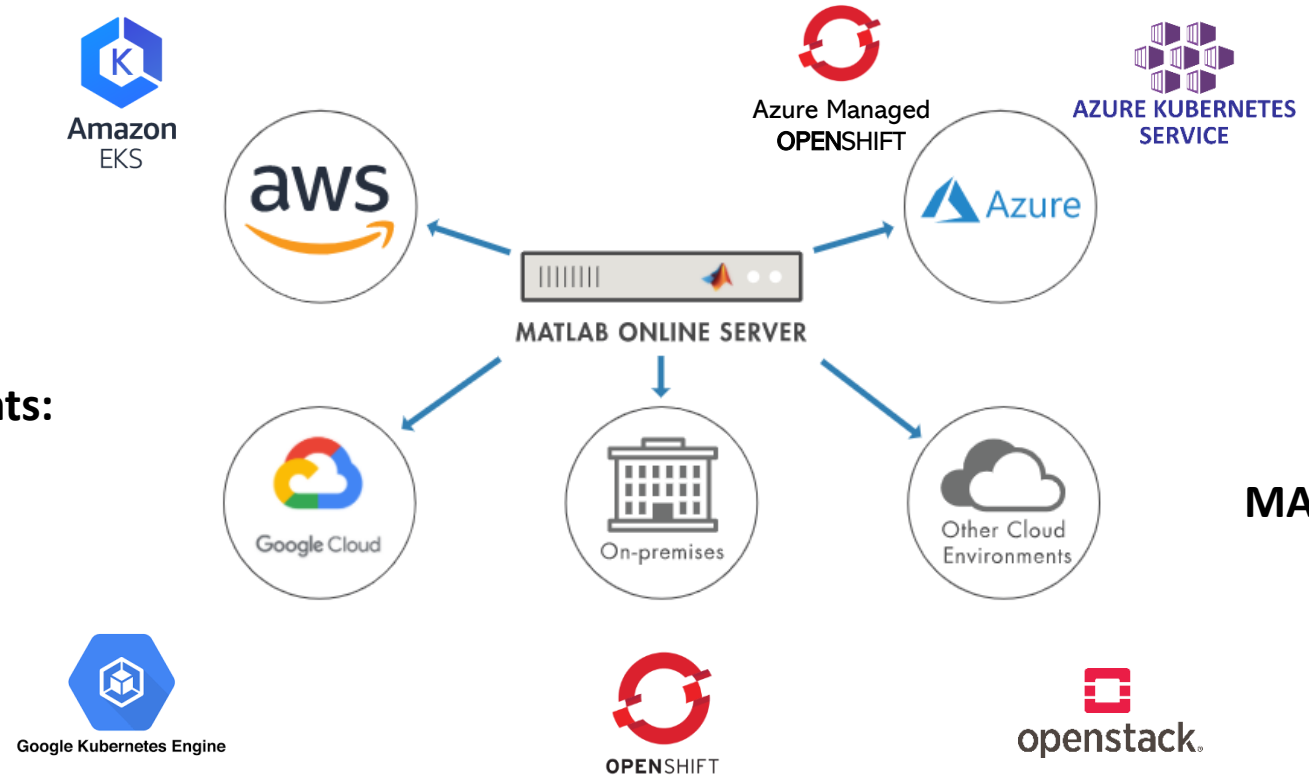
License Management:

FlexLM

User File Storage and Shared Files:

NFS

Architecture: deployed as a set of Docker microservices on Kubernetes



Supported Environments:
Cloud, On-premises

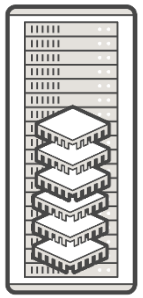
Other Requirements:
License Manager: FlexLM
MATLAB Version: R2020a and beyond

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

Details of Product Requirements & Platform Availibility

MATLAB Server Products Family – High Level



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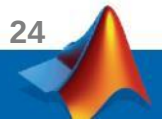
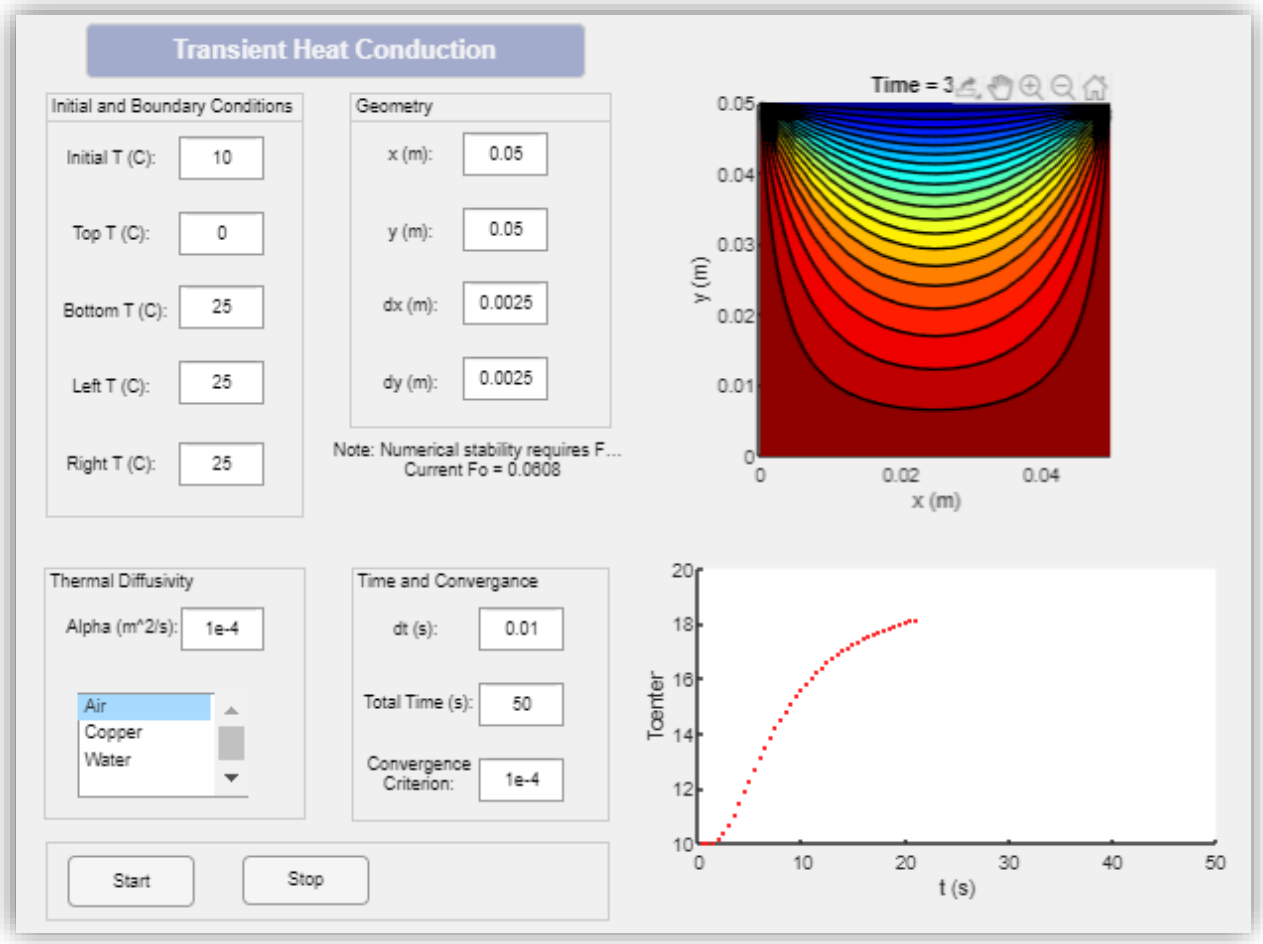
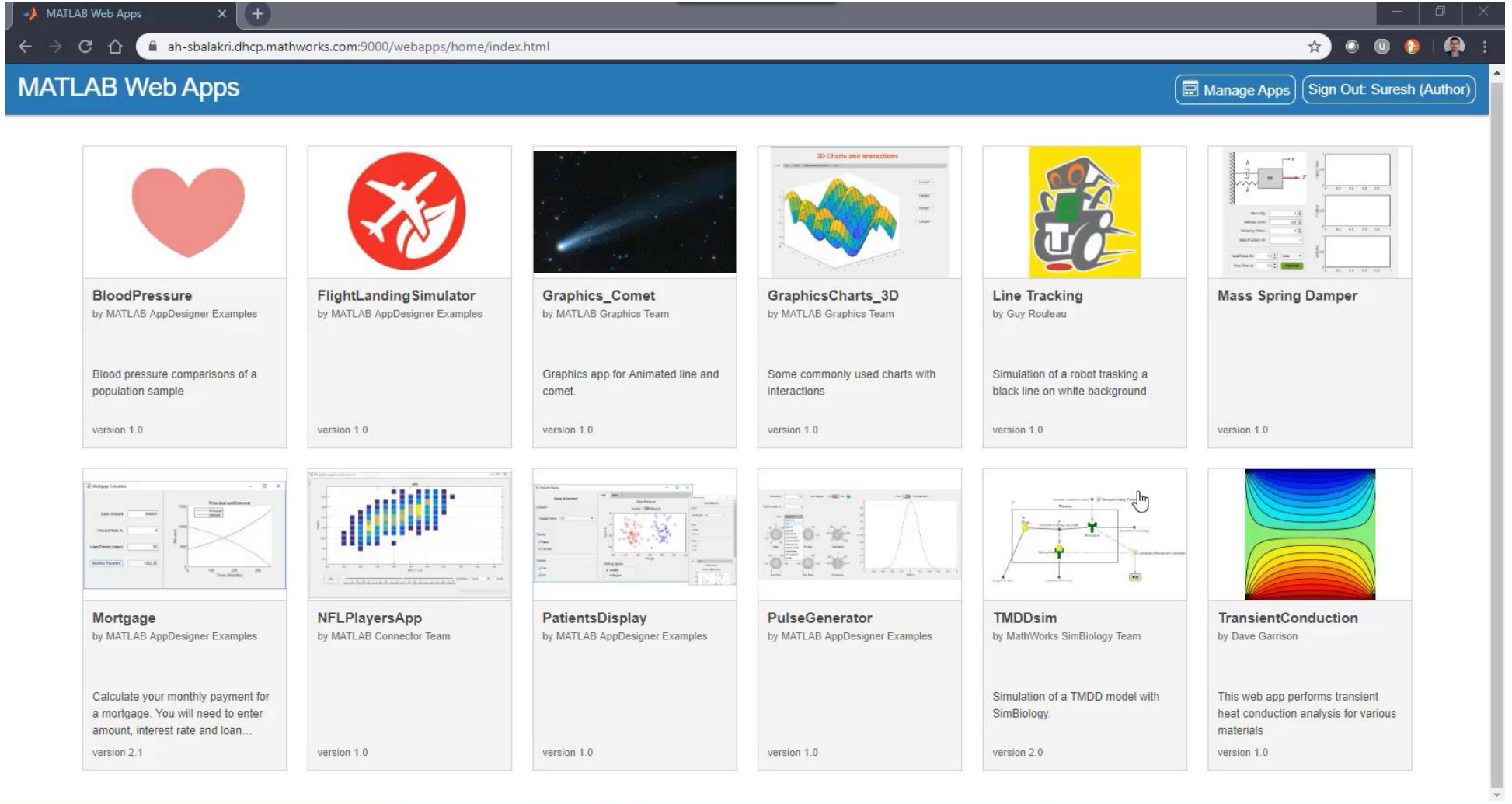


Share your work using MATLAB Web Apps

- 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

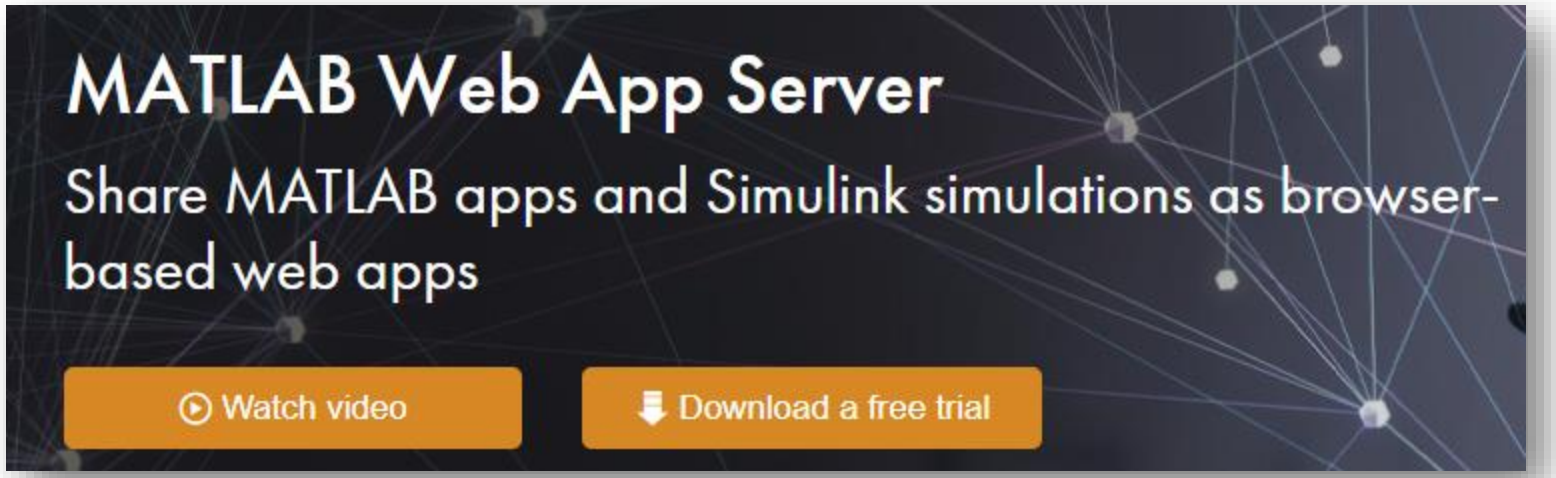


Share your MATLAB apps and Simulink simulations as MATLAB Web Apps

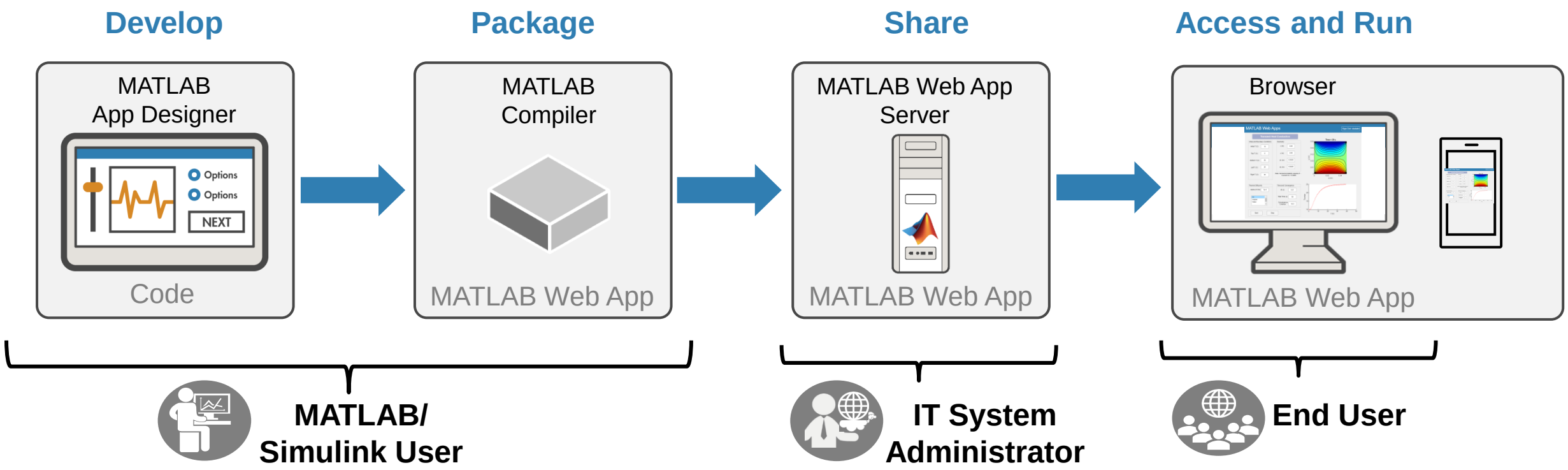


MATLAB Web App Server lets you host and share MATLAB apps and Simulink simulations as interactive web apps

- 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



MATLAB Web Apps workflow



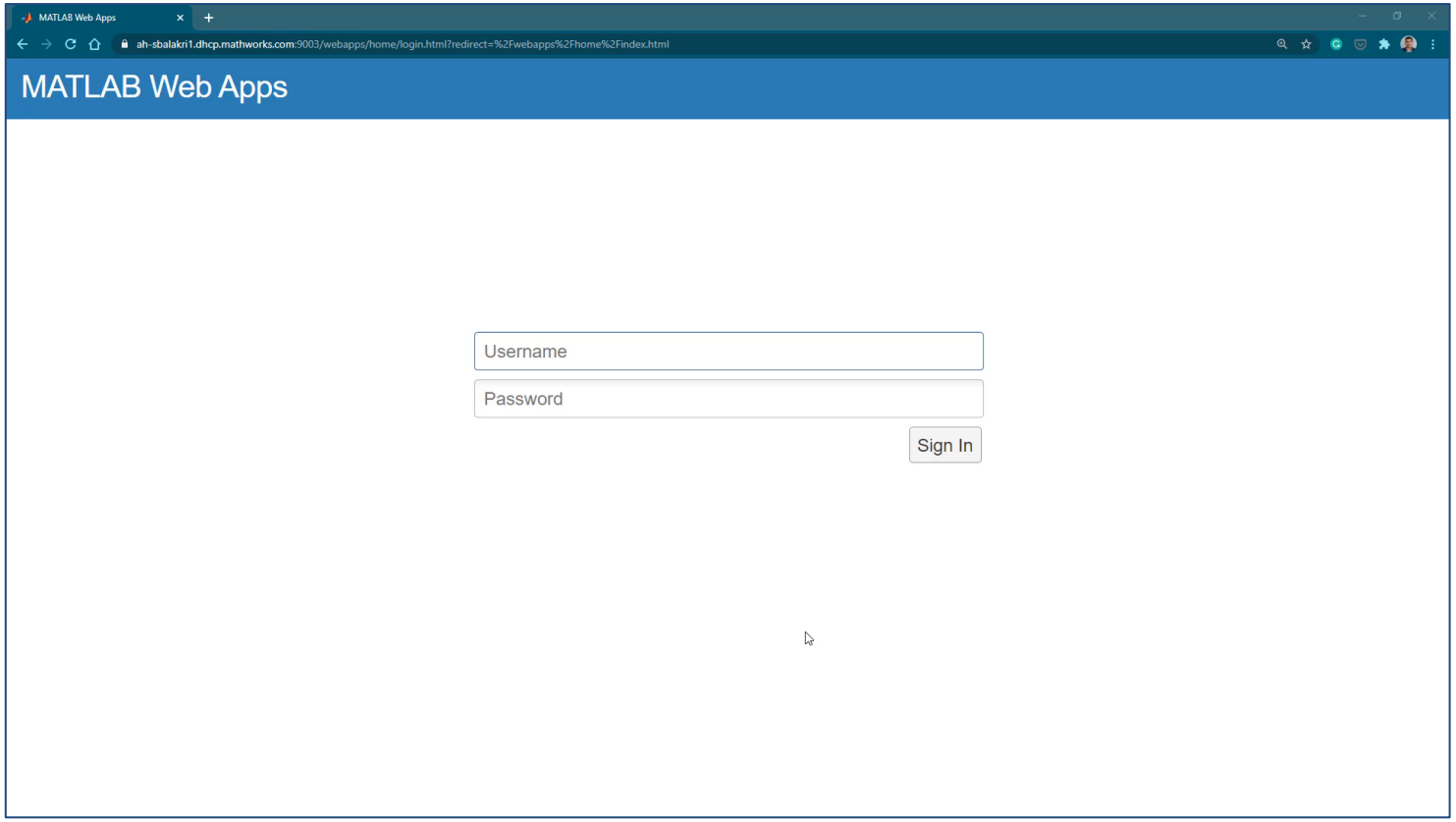
Mechanism to secure and control access to applications

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



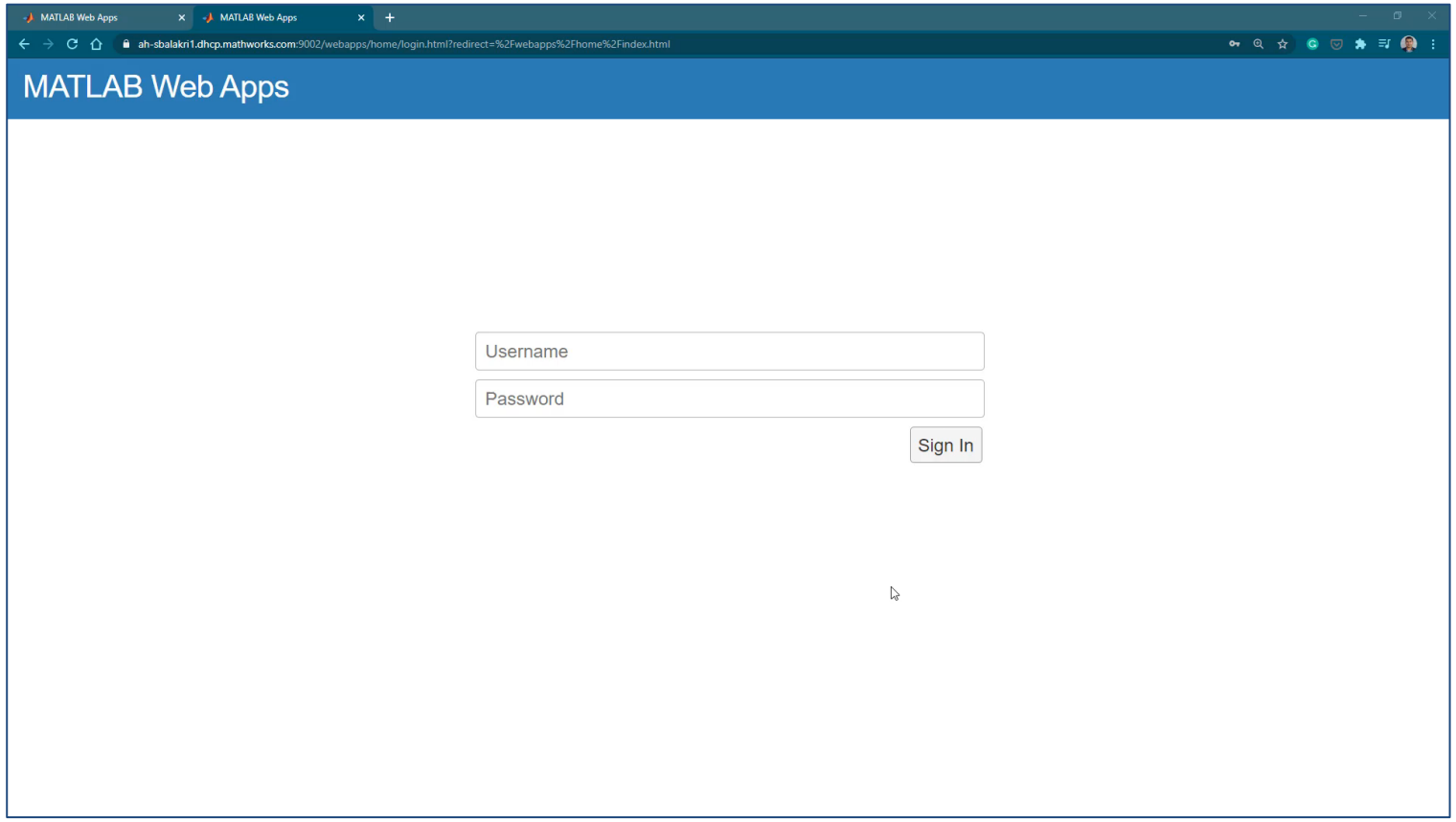
Mechanism to secure and control access to applications

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

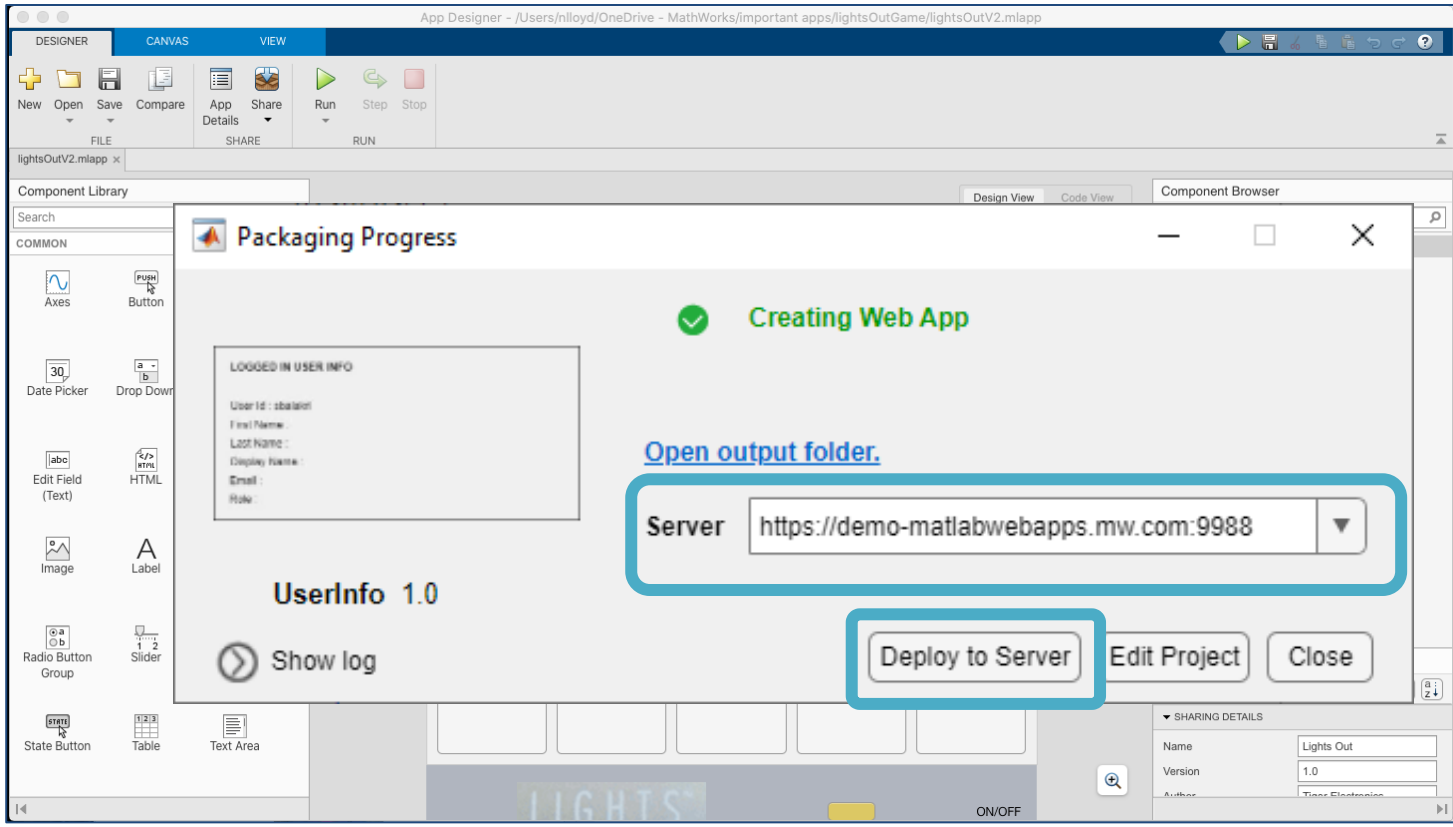


Directly upload your web apps from App Designer

R2021b

Benefits:

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

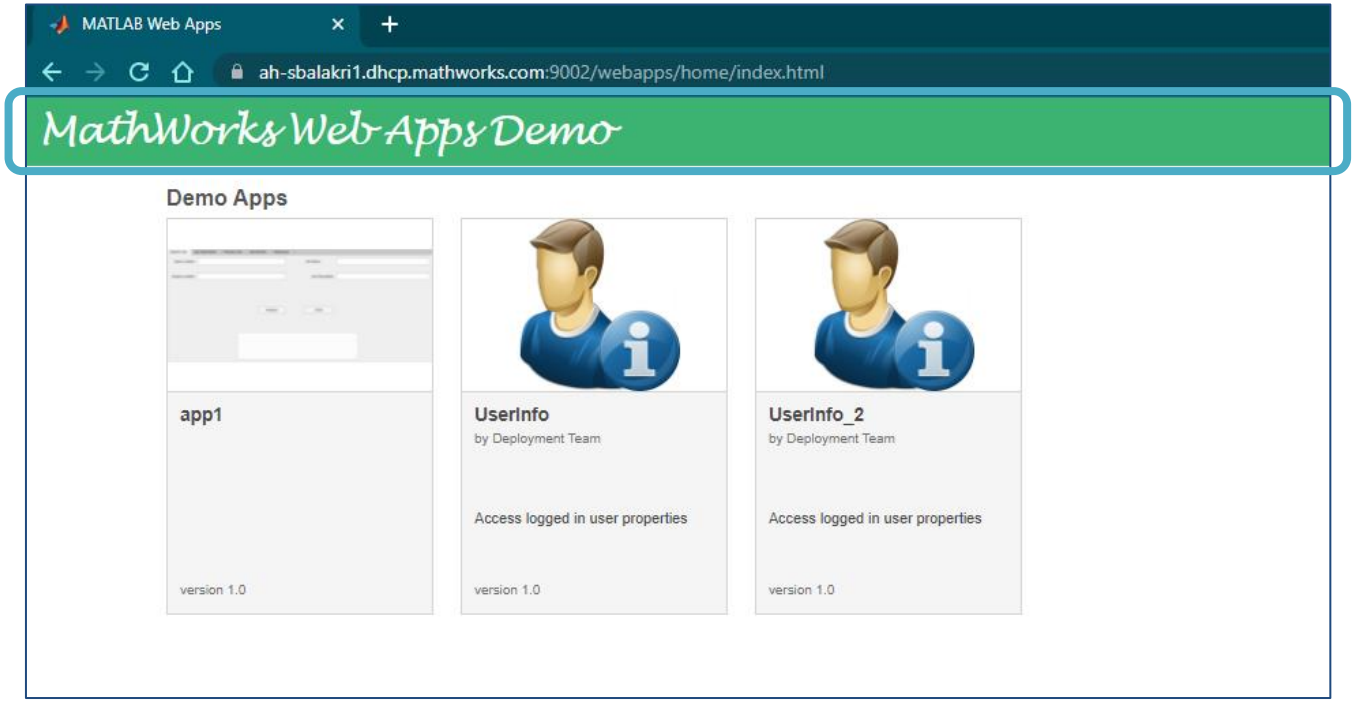


Customize MATLAB Web App Server Apps Home Page

R2021b

Benefits:

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

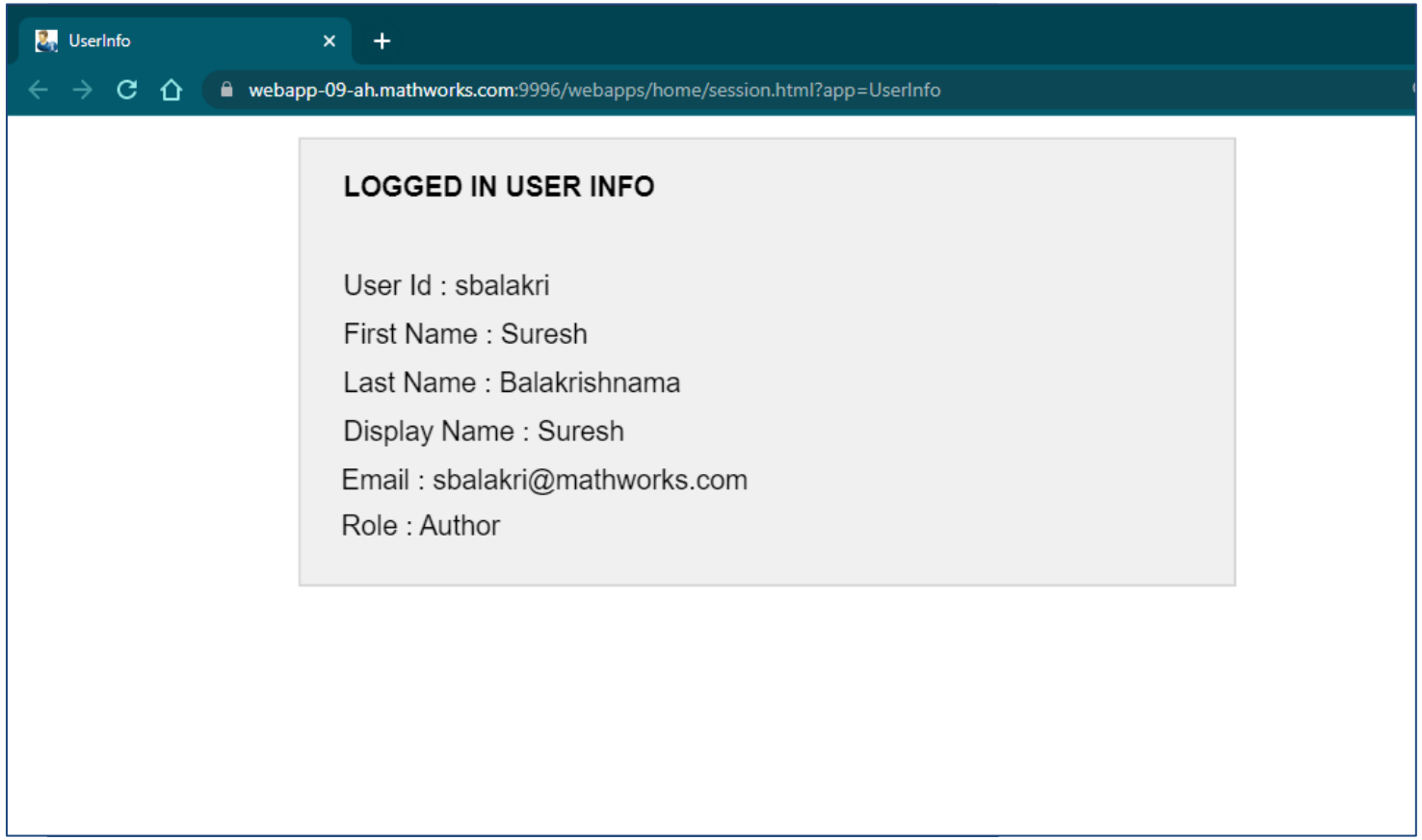


Customize MATLAB Web App behavior based on User

R2022a

Benefits:

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



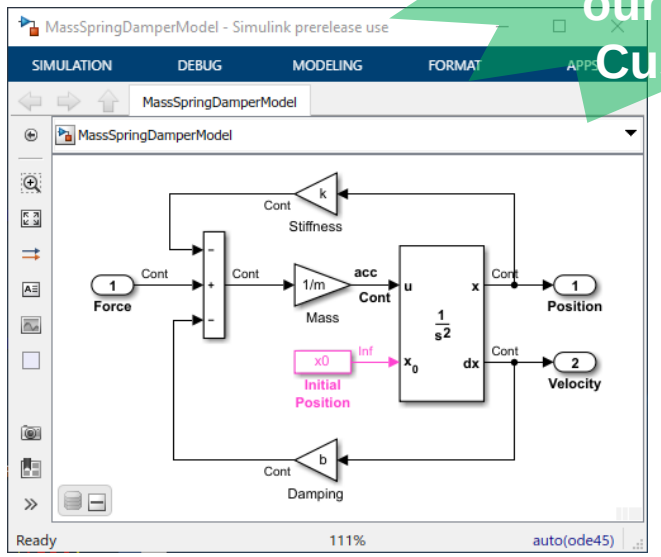
Share Simulink simulations

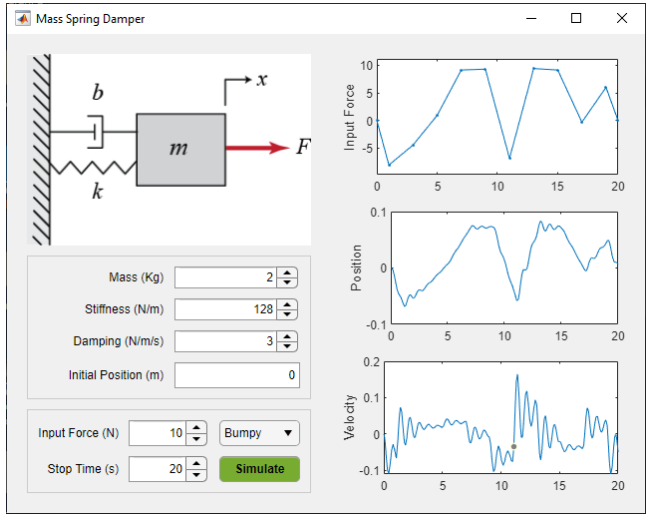
MATLAB WebApp Server supports Simulink

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

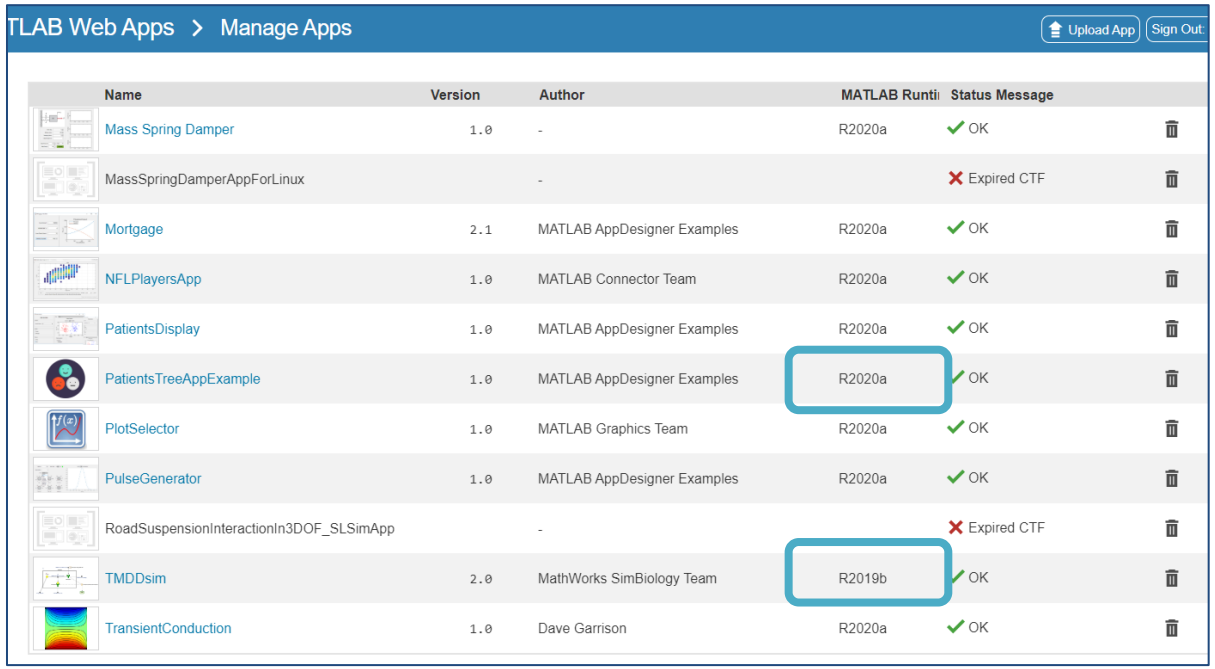




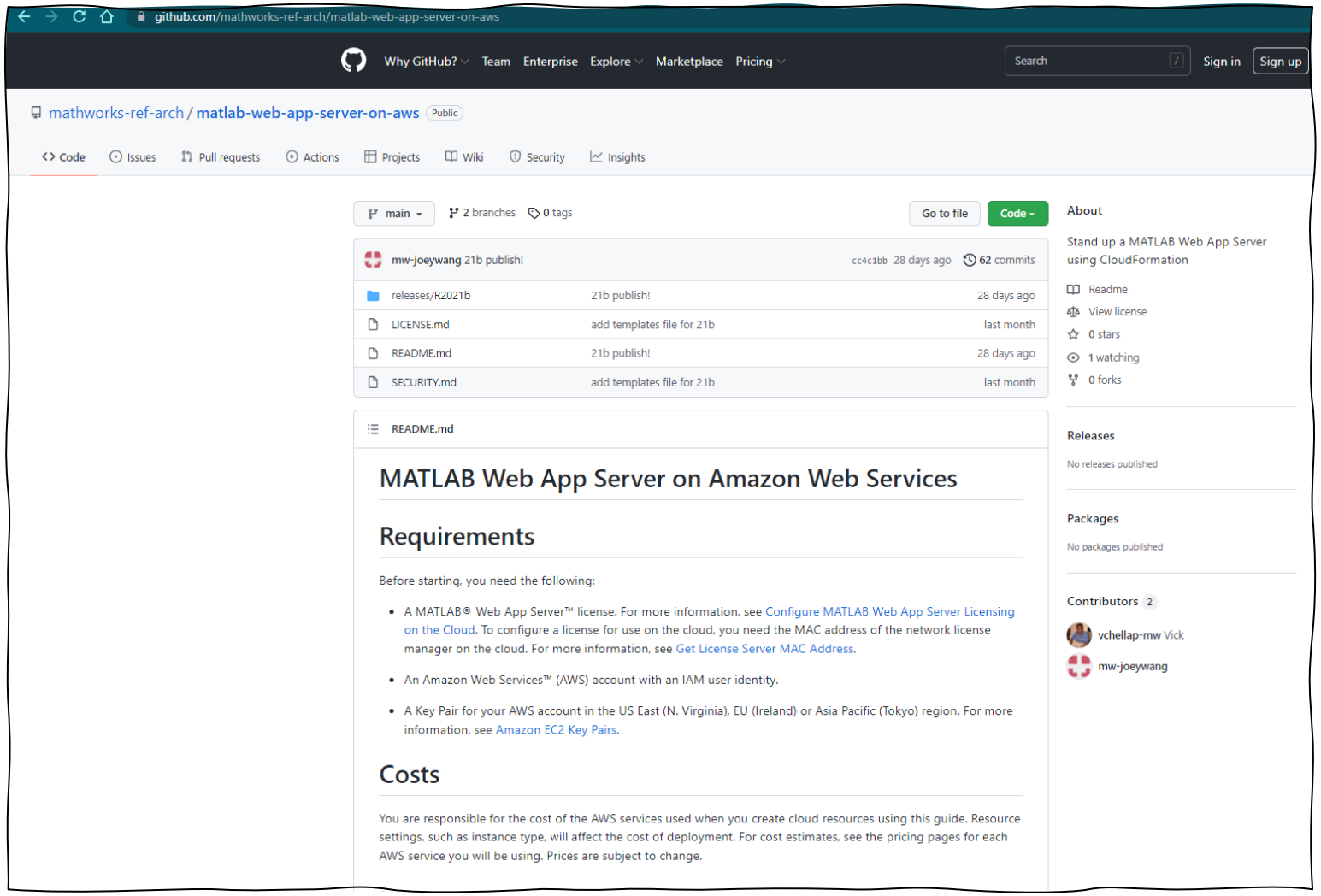
Deploy apps developed in multiple releases of MATLAB or Simulink to one central server

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



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

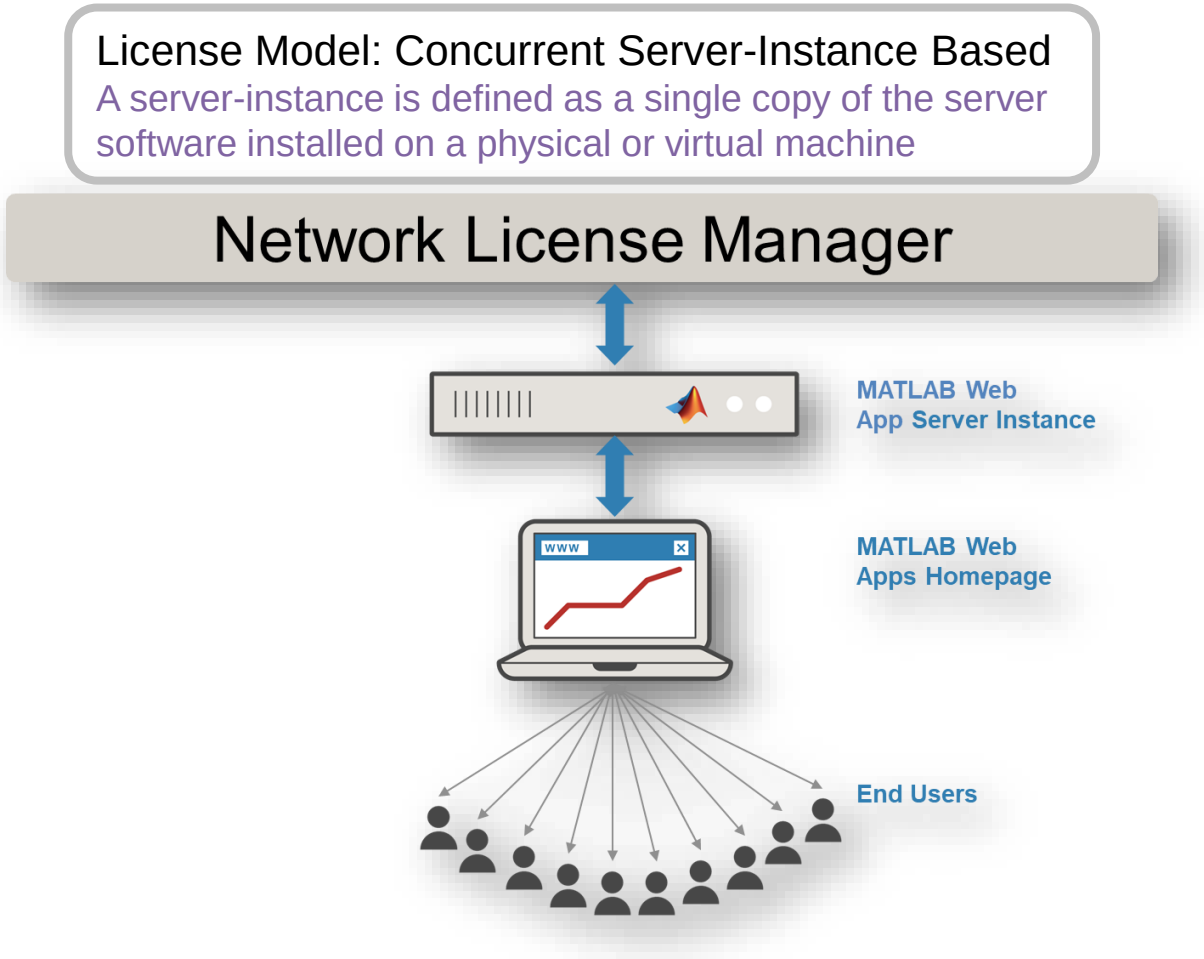


Flexible license model

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



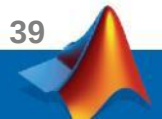
Comparison of Options

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

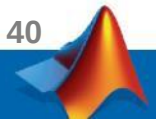
Supported Platforms	Windows, Linux, Mac
Hardware Requirements	• Minimum 60 GB of disk capacity to accommodate the server software installation and log files • Minimum 1GB RAM per worker • Allocation of 1 processor core (or virtual core) per 4 workers
Software Requirements	• An installation of MATLAB 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 Serer 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

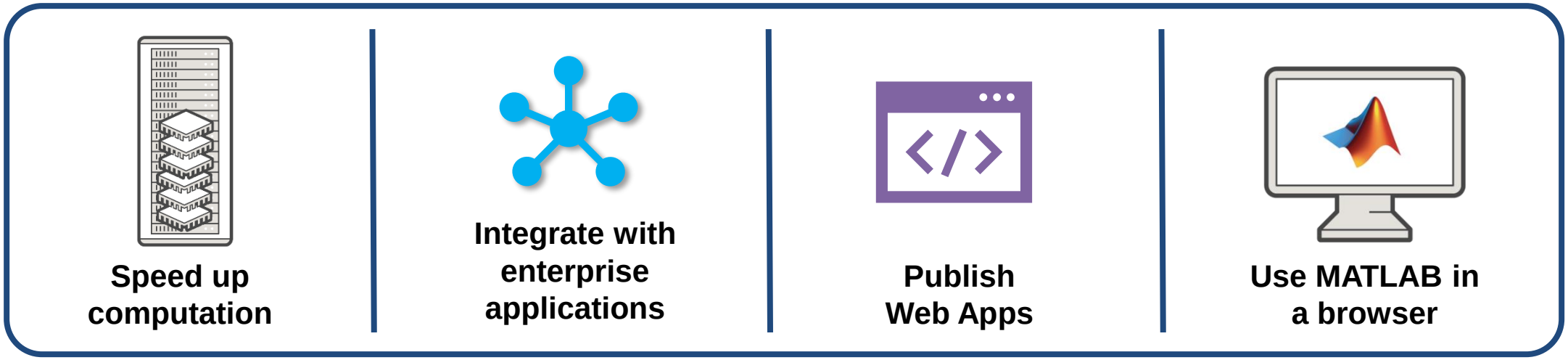
IT ADMINISTRATORS

- 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



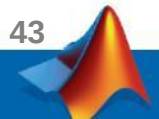
MATLAB Parallel Server

MATLAB Production Server

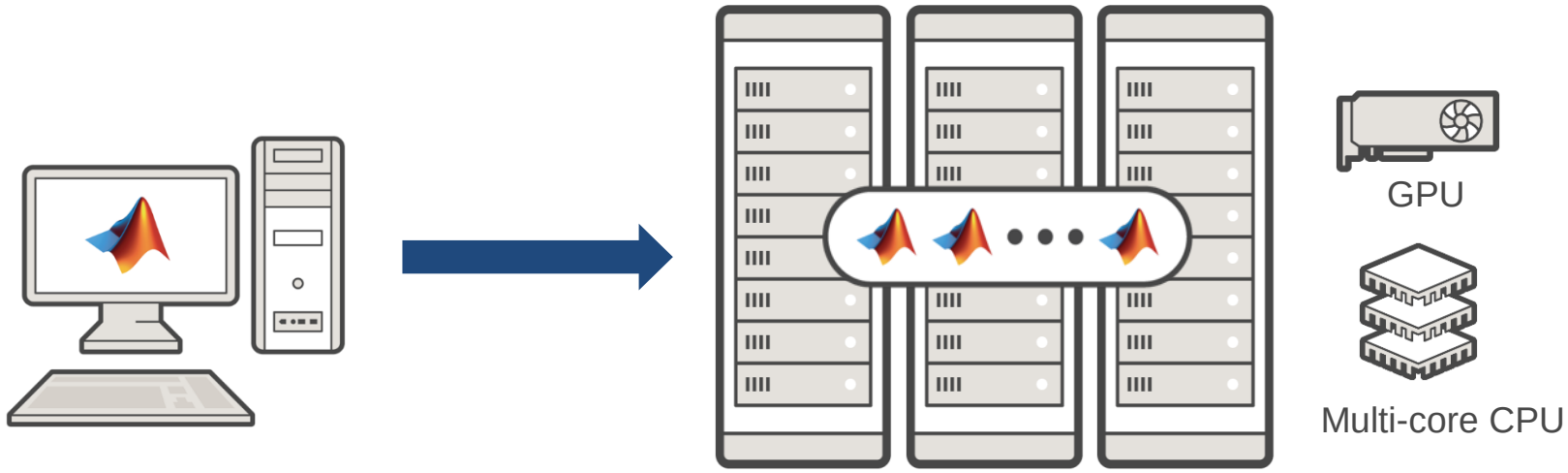
MATLAB Web App Server

MATLAB Online Server

MATLAB Parallel Server

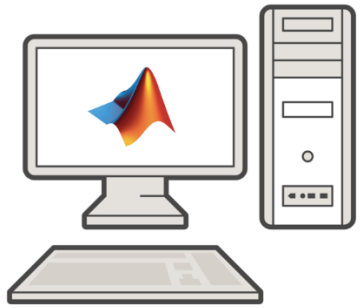


Parallel computing scale on desktop, clusters, and clouds

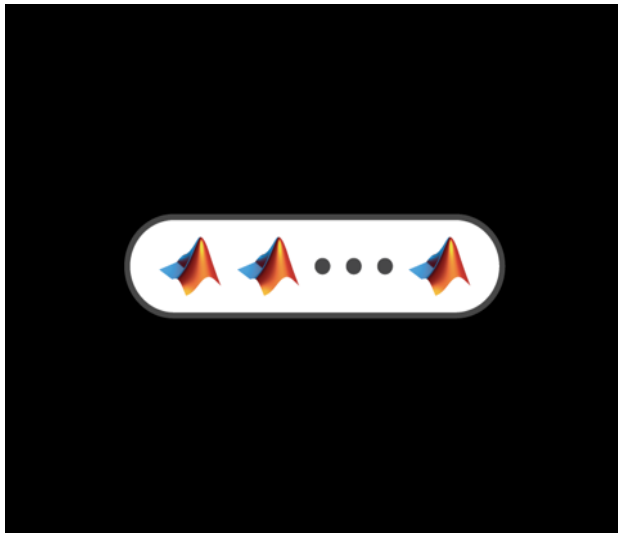


- Prototype on the desktop
- Integrate with infrastructure
- Access directly through MATLAB

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



Workstation



Cluster

GPU

Multi-core CPU

Researcher:

- Wants scale
- Needs something ready-to-use

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

Workstation

Cluster
(for MATLAB)

GPU

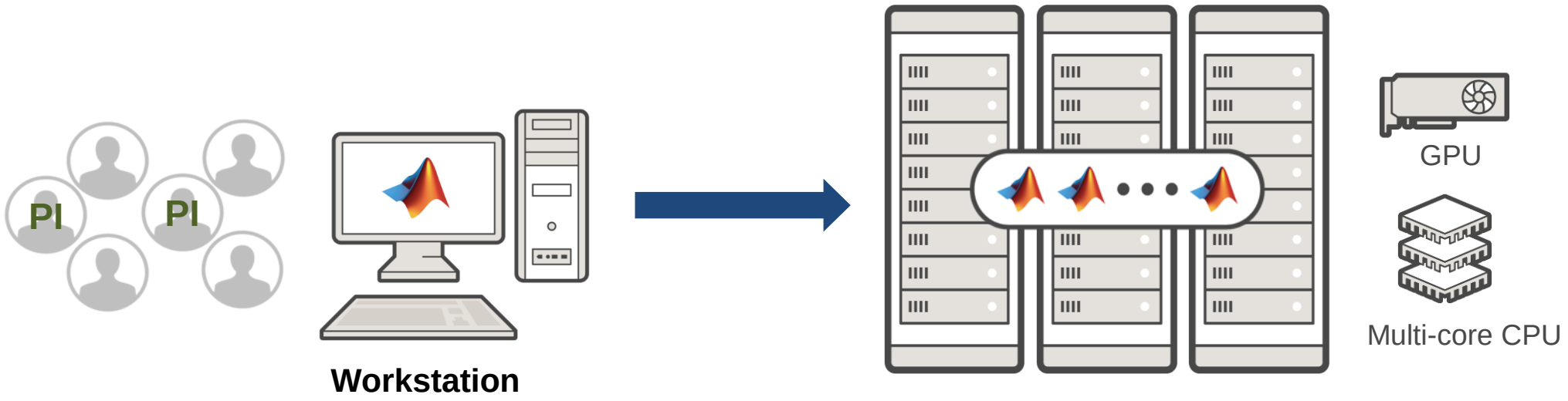
Multi-core CPU

PI

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

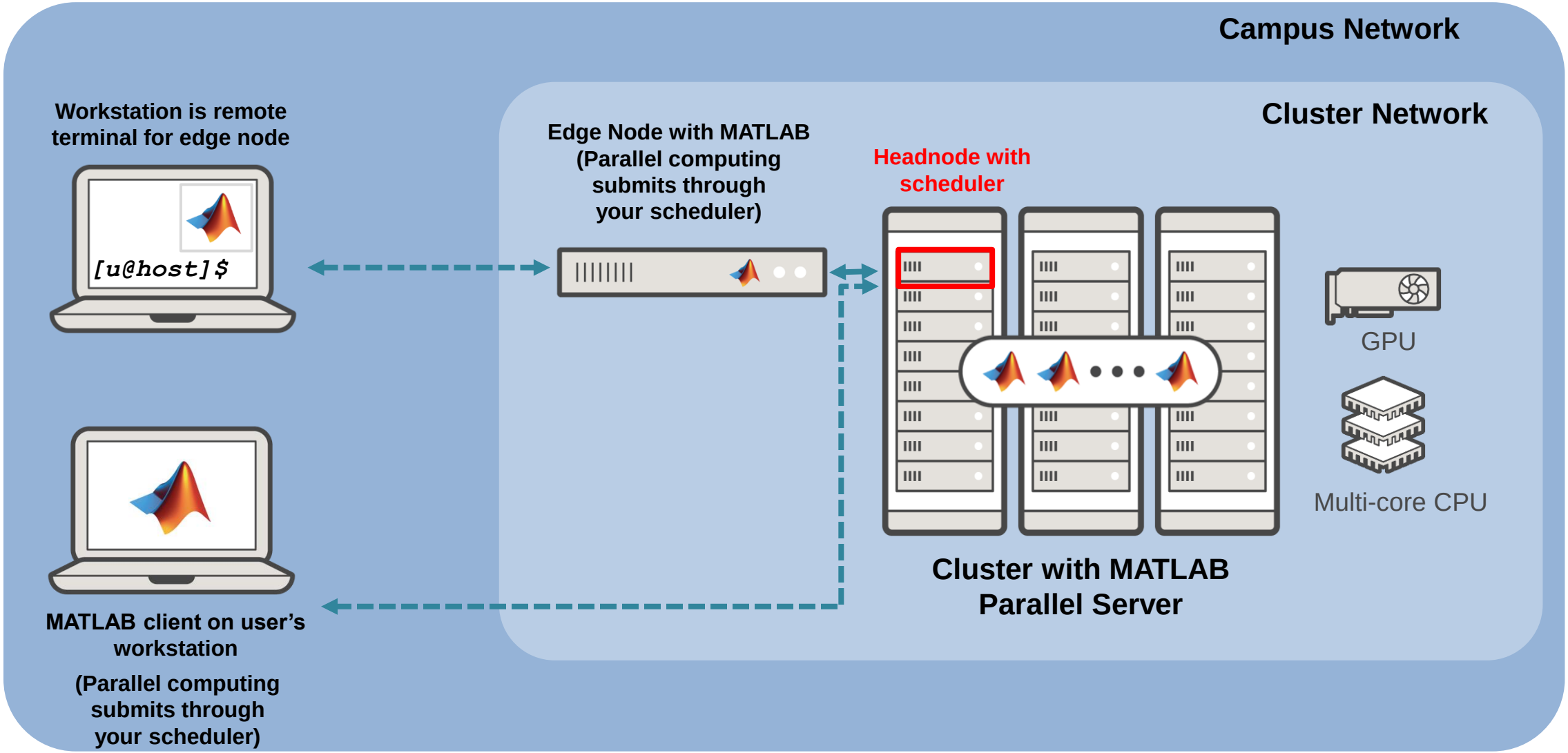
- Wants to enable Institute for all applications
- Maintains scheduled environment

MATLAB Parallel Server supports your needs for scale

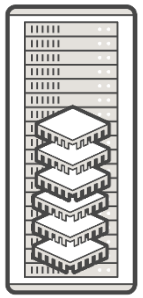
Who manages cluster	Environment	Set-up for each new cluster	Hardware cost	Next steps for person managing cluster	Licensing
Researcher	Cloud at the press of a button	Cloud Center (AWS)	AWS/Azure cost	• Contact license admin to get MathWorks Account linked to MATLAB Parallel Server • Get access to cloud 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	• 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

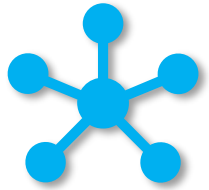
Multiple workflows for IT clusters - your scheduler is in control



MATLAB Server Products Family – Q&A



Speed up computation



Integrate with enterprise applications

Publish Web Apps

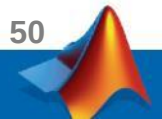
Use MATLAB in a browser

MATLAB Parallel Server

MATLAB Production Server

MATLAB Web App Server

MATLAB Online Server



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