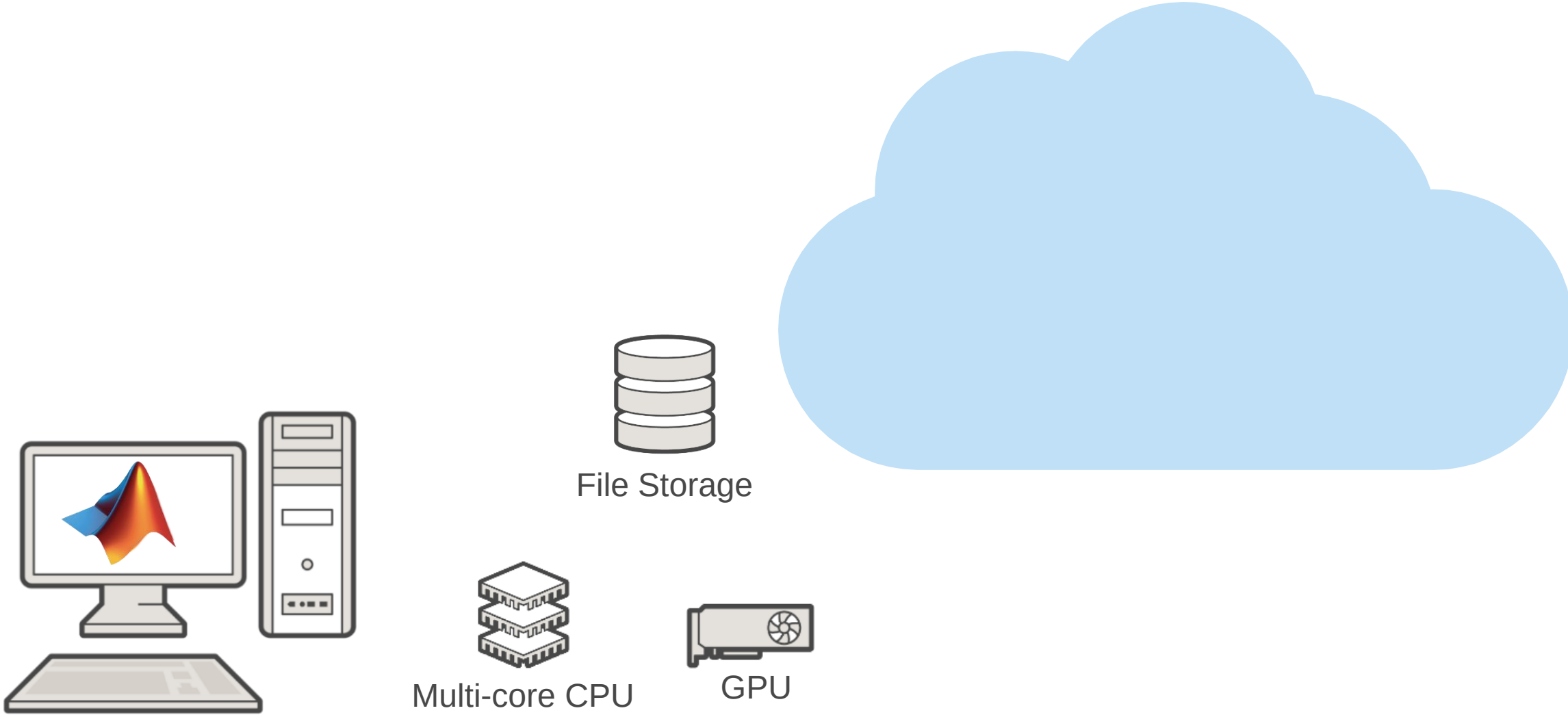
MATLAB EXPO

Configure and Use MATLAB in the Cloud to Develop, Scale and Deploy AI Applications

Hisham El-Masry
Senior Product Manager

MathWorks®

Cloud enables access to large data sets and compute resources



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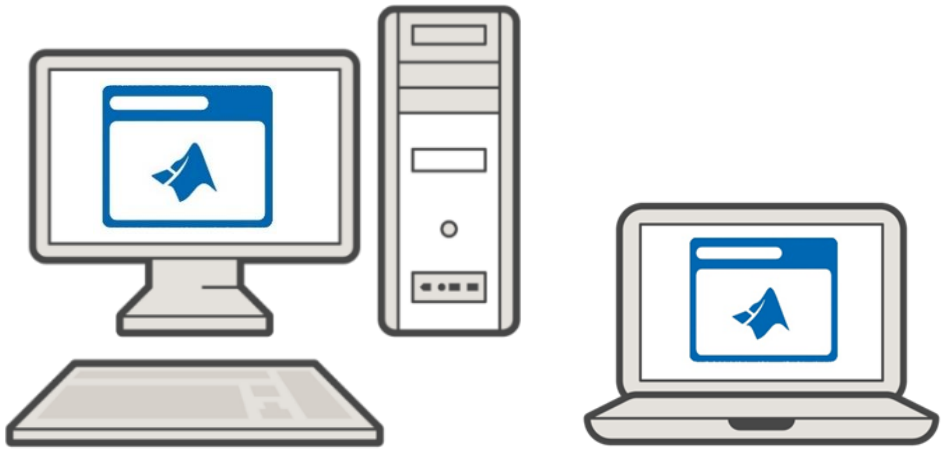
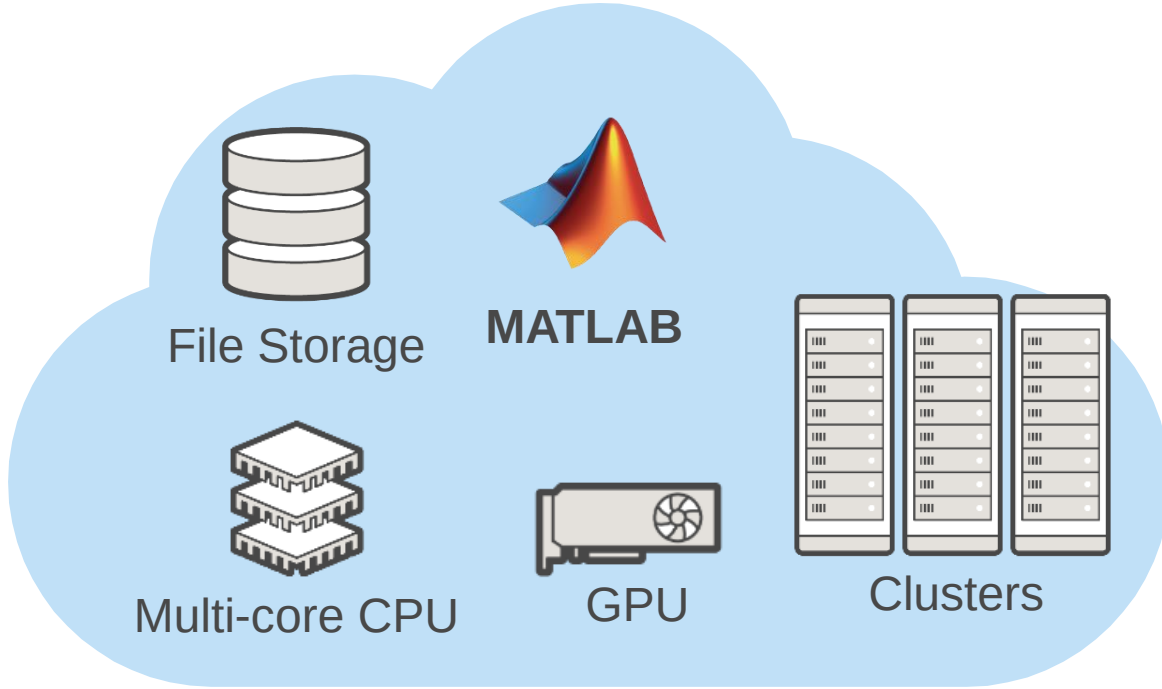
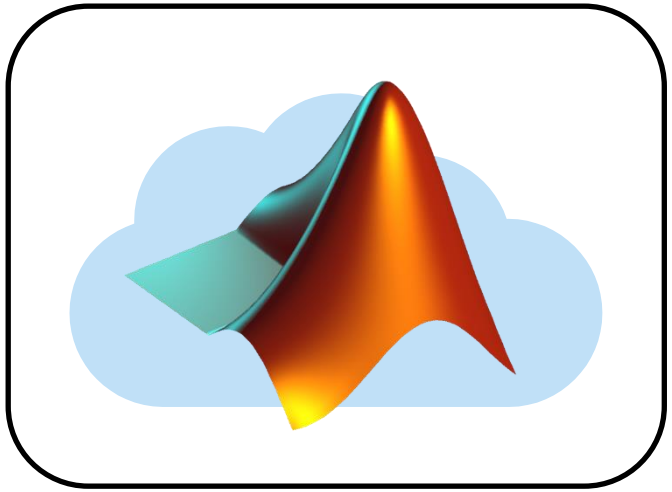
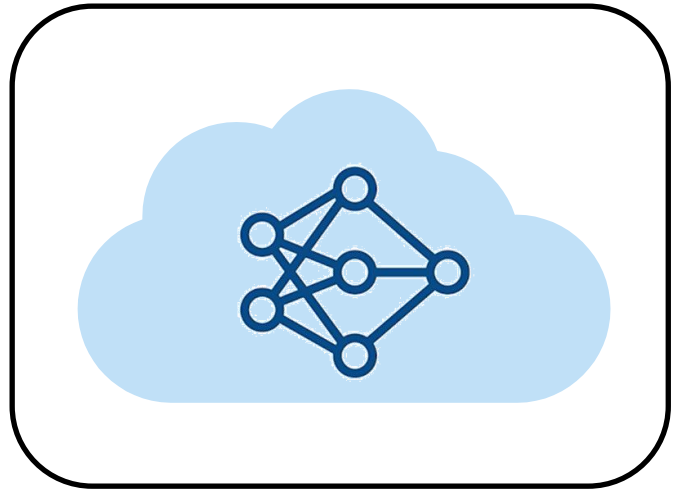




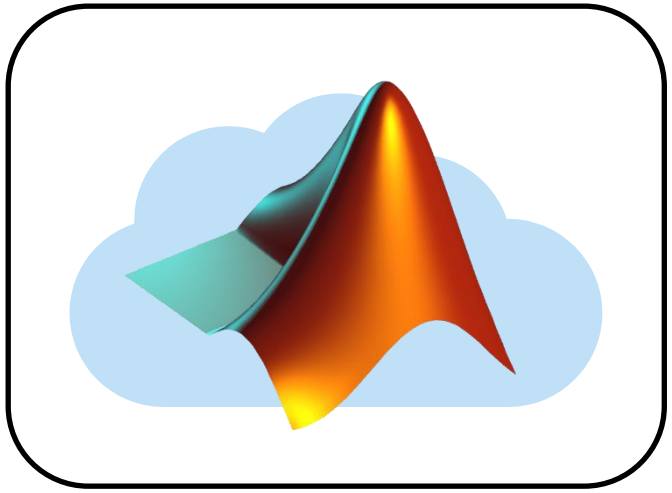
Today we will look at two main topics about the cloud



How to configure MATLAB in your Cloud environment



How to use MATLAB in your Cloud workflow



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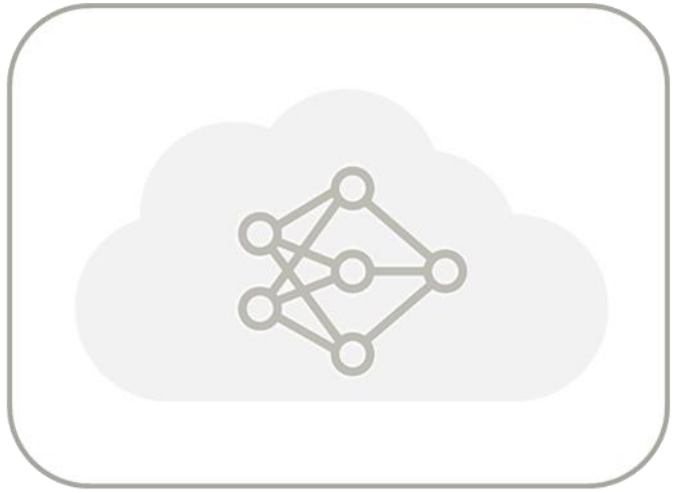

How to use MATLAB in your Cloud workflow

Four Primary Ways to Use MATLAB in the Cloud

Public Clouds

On-Premise/Private Cloud

Hosting Provider

MathWorks Cloud

Whatever your cloud environment, MATLAB can work and scale

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On-Premise/Private Cloud

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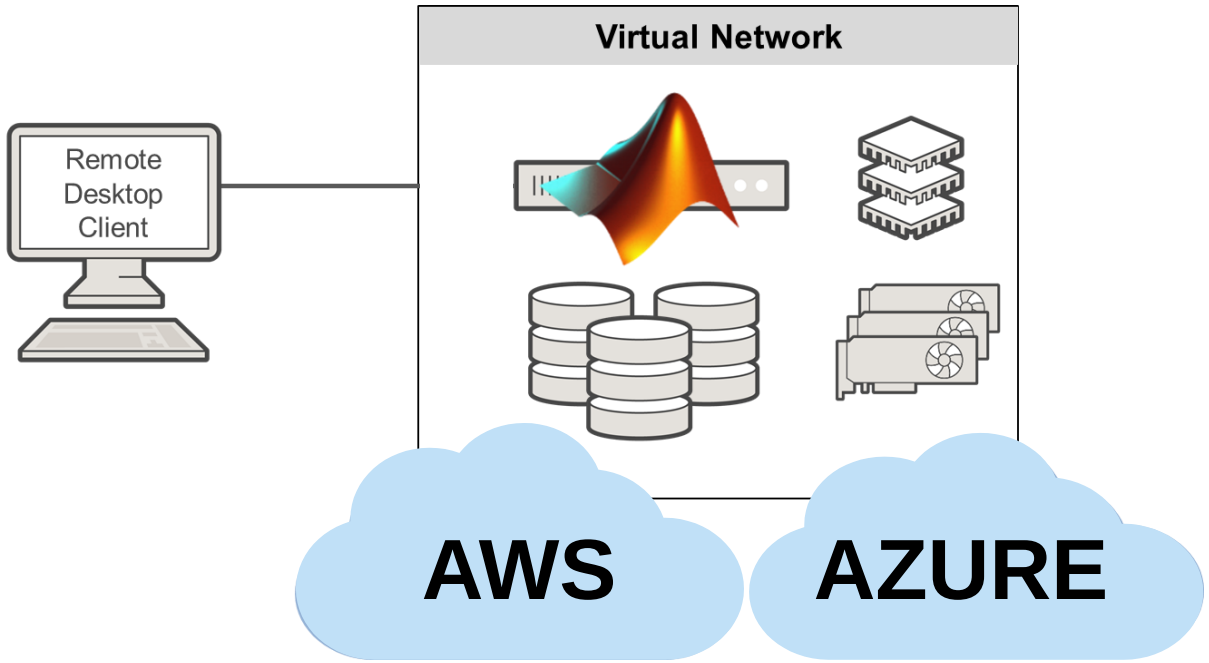
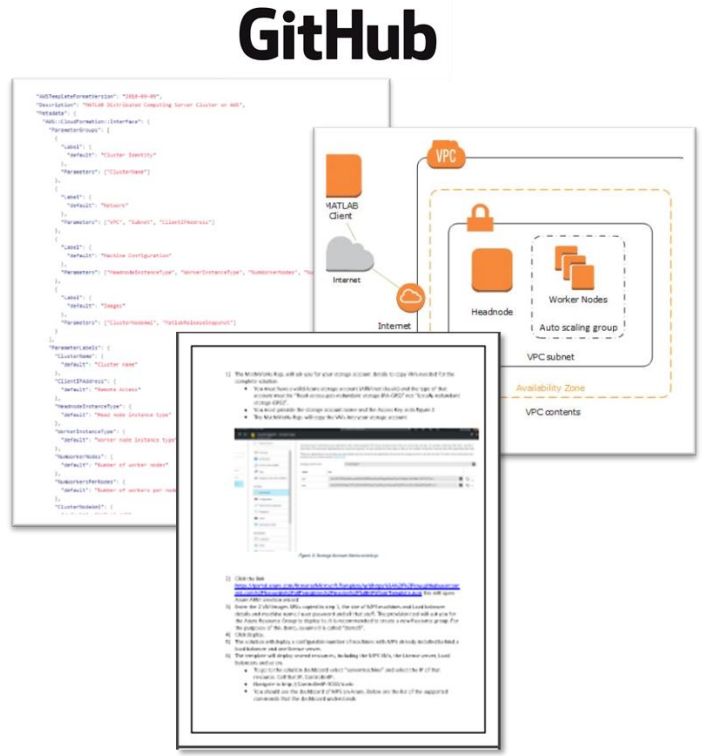
MathWorks Cloud

Reference Architectures

Setup MATLAB on AWS or Azure easily with reference architectures



Supports Azure AWS and Microsoft Azure



Includes Cloud templates, Architecture diagram, Step-by-step instructions

https://github.com/mathworks-ref-arch

Whatever your cloud environment, MATLAB can work and scale

Public Clouds

On-Premise/Private Cloud

Hosting Provider

MathWorks Cloud

Reference Architectures

Cloud Data Services

Access your cloud data with connectors for MATLAB

	Support Provided By:	Data Services			
AZURE	**Datastore**	Blob Storage *(read, out of memory data)*			
	Database Toolbox *(standard ODBC/JDBC)*	Azure SQL Database	Azure Database for MySQL/PostgreSQL	SQL Data Warehouse	SQL Server Stretch Database
	Support Packages	Blob Storage: Blob, Table, File *(read/write/delete, encryption, access control)*	Data Lake *(read/write/delete, encryption, access control)*	CosmosDB: MongoDB, Cassandra, Table interfaces	
AWS	**Datastore**	Amazon S3 *(read, out of memory data)*			
	Database Toolbox *(standard ODBC/JDBC)*	Amazon Aurora	Amazon RDS for PostreSQL/MySQL/MariaDB/Oracle/SQL Server		
	Support Packages	Amazon S3 *(read/write/delete, encryption, access control)*	Amazon EFS *(NFS/Linux)*	Amazon Athena (*Query of S3 data*)	

For the complete list, go to https://www.mathworks.com/cloud.html

Whatever your cloud environment, MATLAB can work and scale

Public Clouds

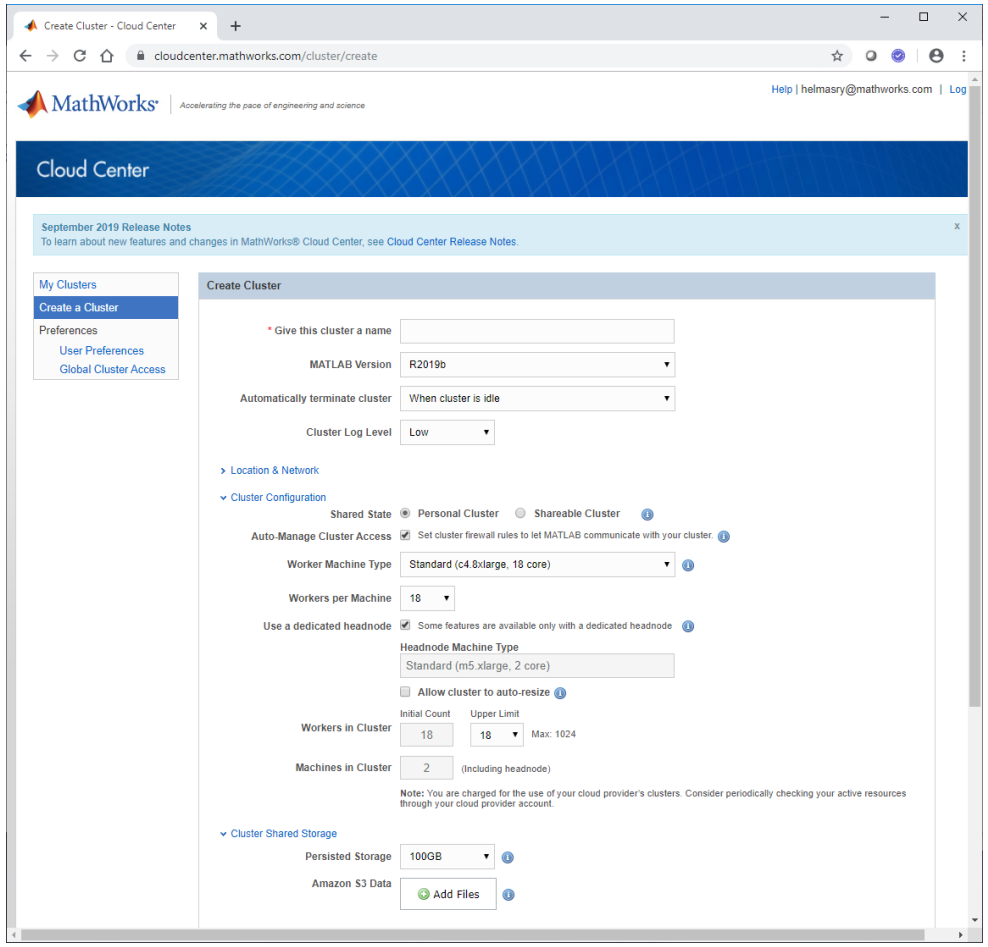
On-Premise/Private Cloud

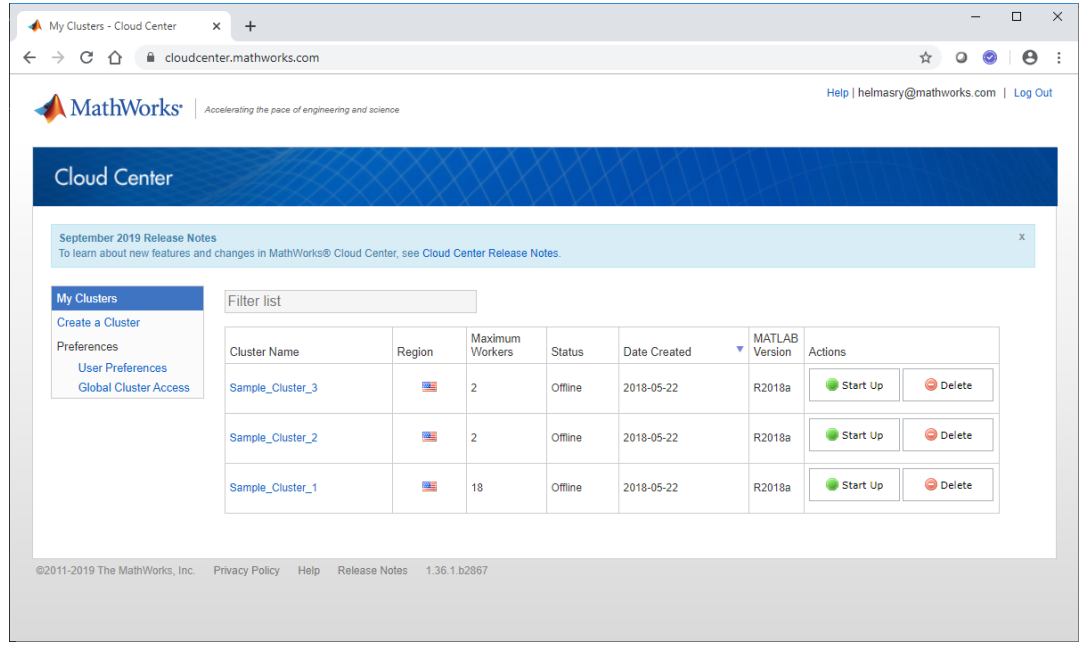
Hosting Provider

MathWorks Cloud

- **Reference Architectures**
- **Cloud Data Services**
- **Cloud Center**

Create and manage your AWS cluster with Cloud Center





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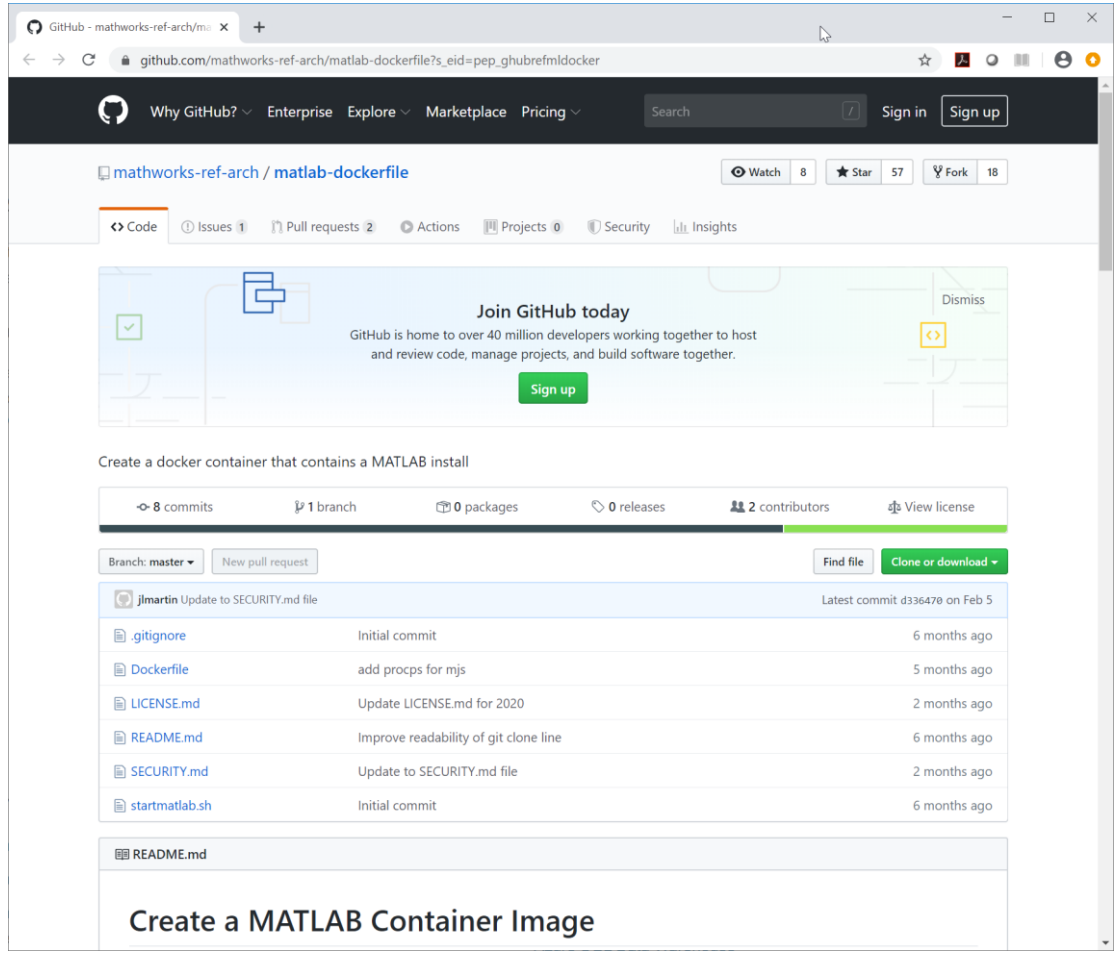
MATLAB Dockerfile

NVIDIA NGC **Deep Learning Container**

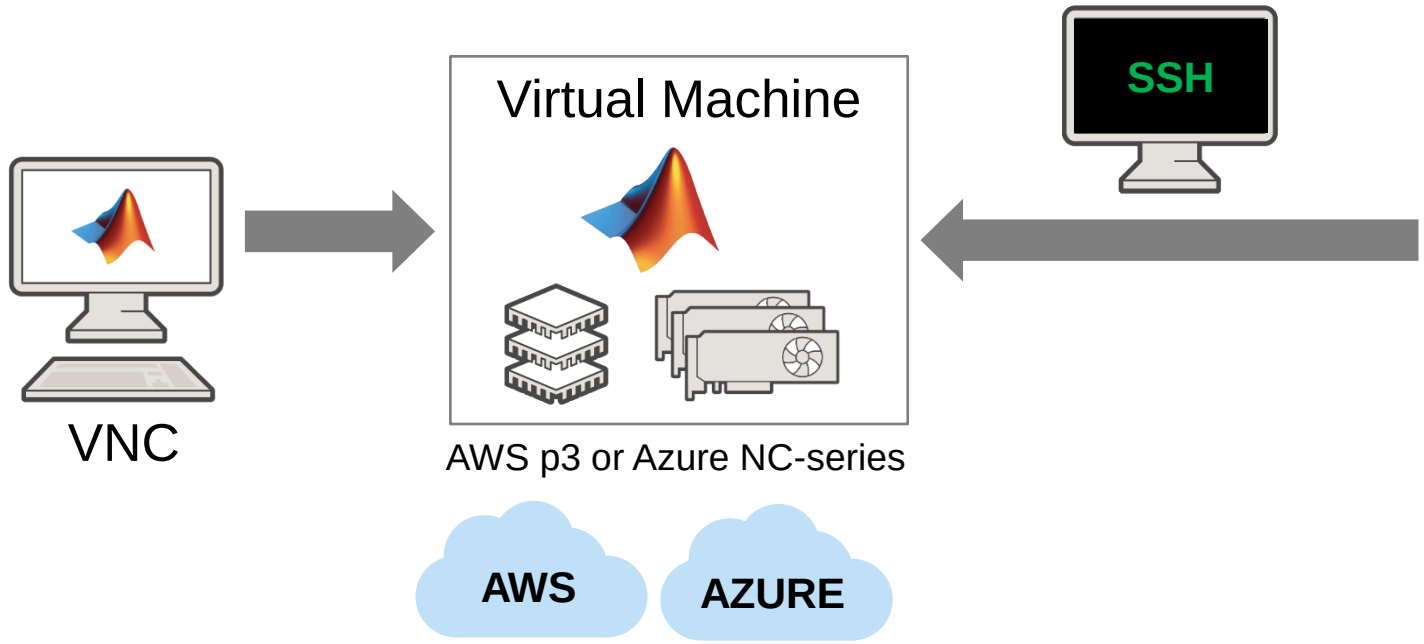
Create a MATLAB container image with the MATLAB Dockerfile reference architecture



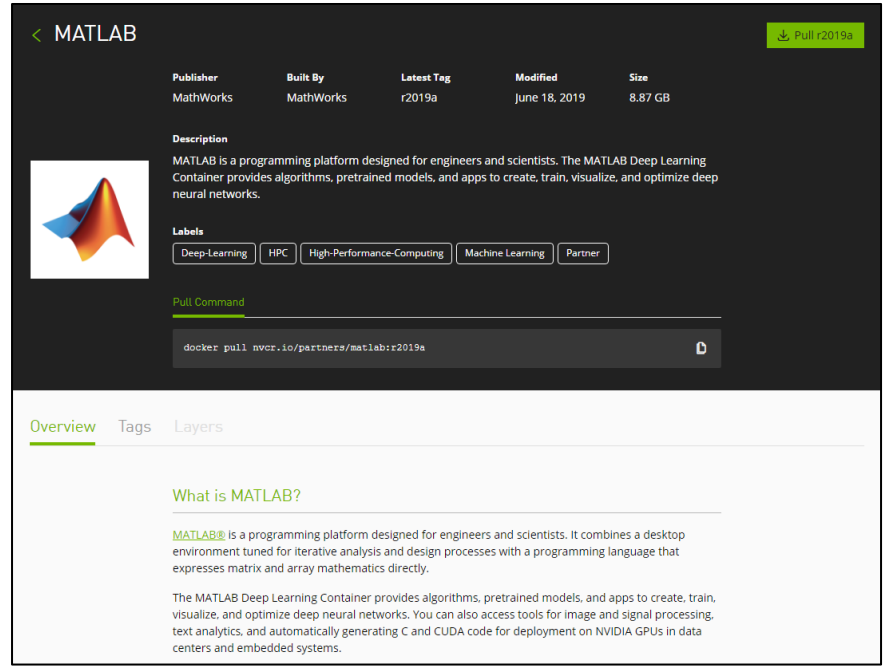
https://github.com/mathworks-ref-arch/matlab-dockerfile

MATLAB Deep Learning Container for NVIDIA GPU Cloud

- Preconfigured Docker container
- MATLAB + 9 Toolboxes for Deep Learning
- Several Pretrained Convolutional Neural Networks



NVIDIA GPU Cloud container registry



https://ngc.nvidia.com/catalog/containers/partners:matlab

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NIMBIX

PENGUIN COMPUTING

rescale

SABALCORE

Uber Cloud

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MATLAB Online
MATLAB Drive

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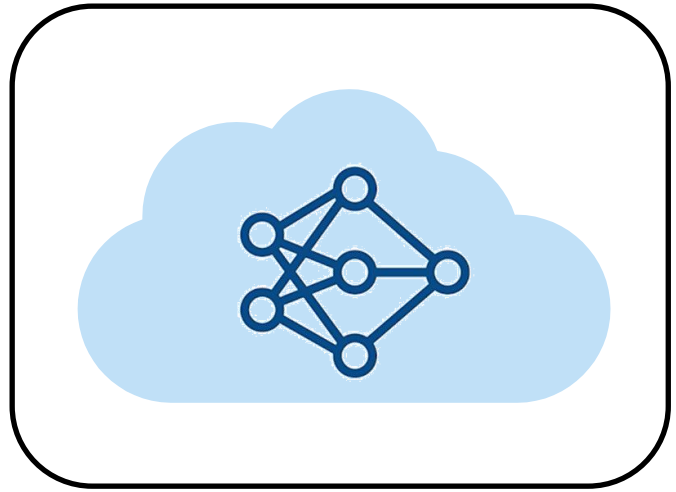

**How to use MATLAB in
your Cloud workflow**

Technical Computing Artificial Intelligence Workflow

Access and Explore Data

- Files
- Databases
- Sensors

Preprocess Data

- Working with Messy Data
- Data Reduction/ Transformation
- Feature Extraction

Develop Predictive Models

- Model Creation e.g. Machine Learning
- Parameter Optimization
- Model Validation

Integrate Analytics with Systems

- Apps
- Enterprise Systems
- AWS
- AZURE

Access and Explore Data | **Preprocess Data** | **Develop Predictive Models** | **Integrate Analytics with Systems**

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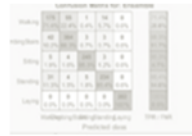


Apps

Enterprise Systems

MATLAB Excel .NET C/C++ .exe Java .dll

AWS

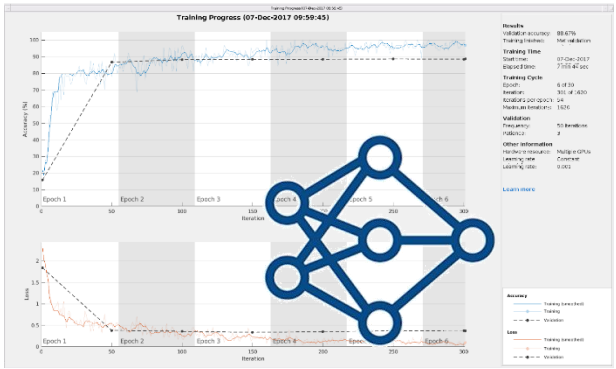
AZURE

Leverage datastores to handle big data on public clouds such as Azure Blobs or Amazon S3 buckets

```
setenv('AWS_ACCESS_KEY_ID', access_key_id);
setenv('AWS_SECRET_ACCESS_KEY', access_key);
```

```
ds = imageDatastore(fileLoc);
```

```
[trainDS, valDS, testDS] = splitEachlabel(ds,…
      0.7, 0.15, 0.15, 'randomized');
```




```
Net = trainNetwork(trainDS, layers, trainOpts);
```

Access and Explore Data

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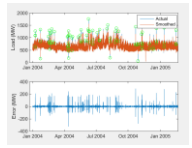
Working with Messy Data



Data Reduction/ Transformation

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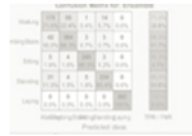

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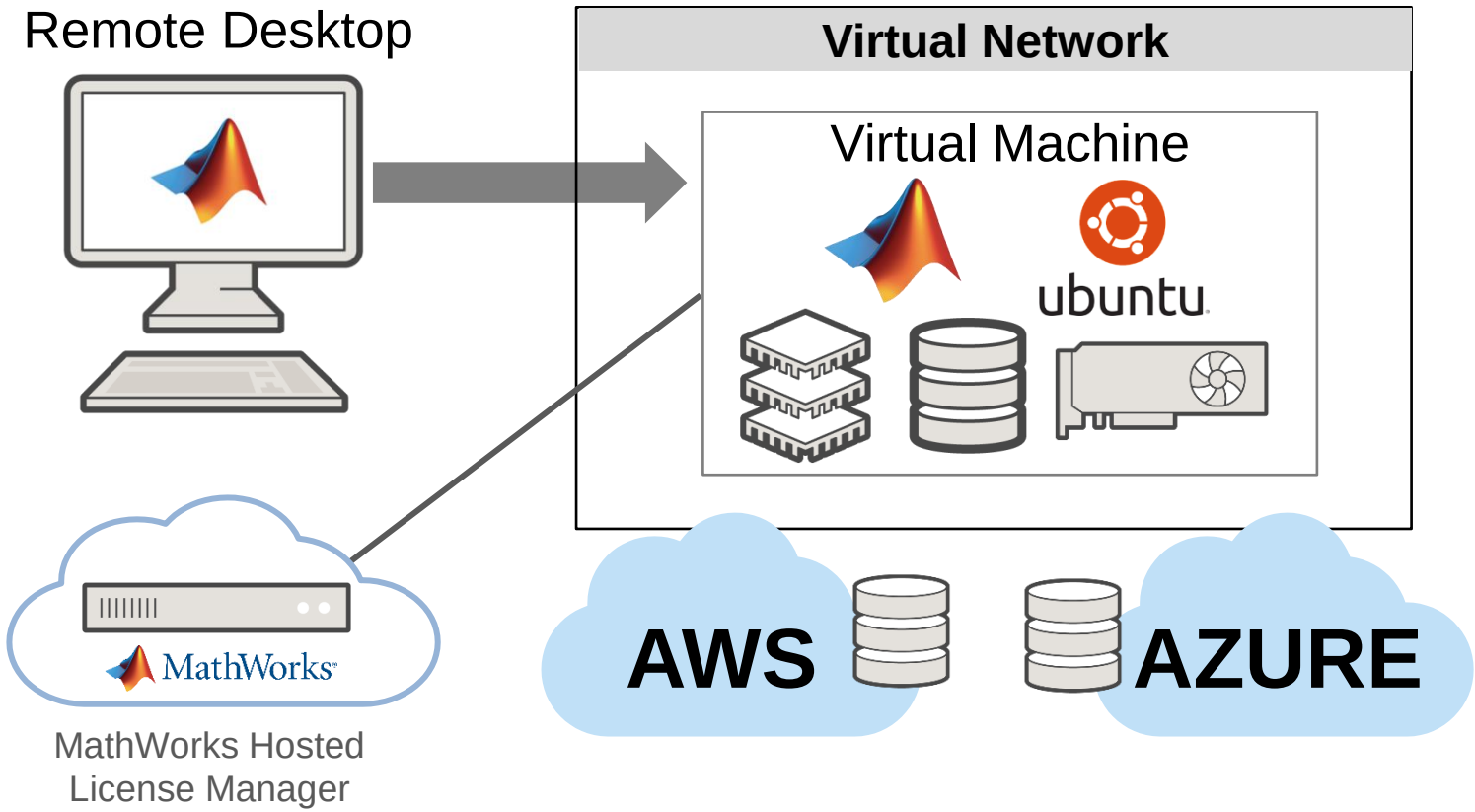
AZURE

Using MATLAB reference architecture to develop analytics on cloud stored data



Use cases in the cloud:

1. Data analytics on cloud-stored data
2. Access to high-end multi-core VMs, GPUs, FPGAs
3. Prototyping parallel algorithms and models on one VM before scaling to a cluster
4. Use a compute cluster for preprocessing of data large sets of data

https://github.com/mathworks-ref-arch/matlab-on-aws
https://github.com/mathworks-ref-arch/matlab-on-azure

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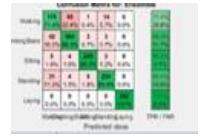

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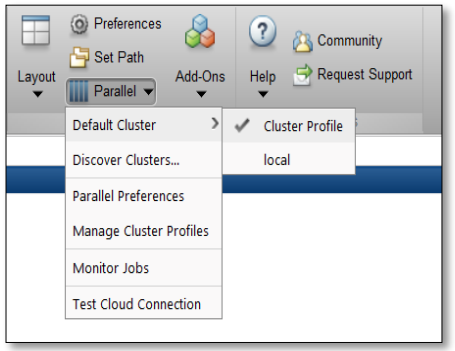
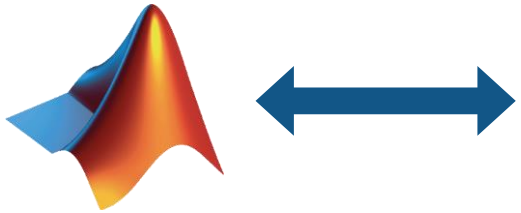
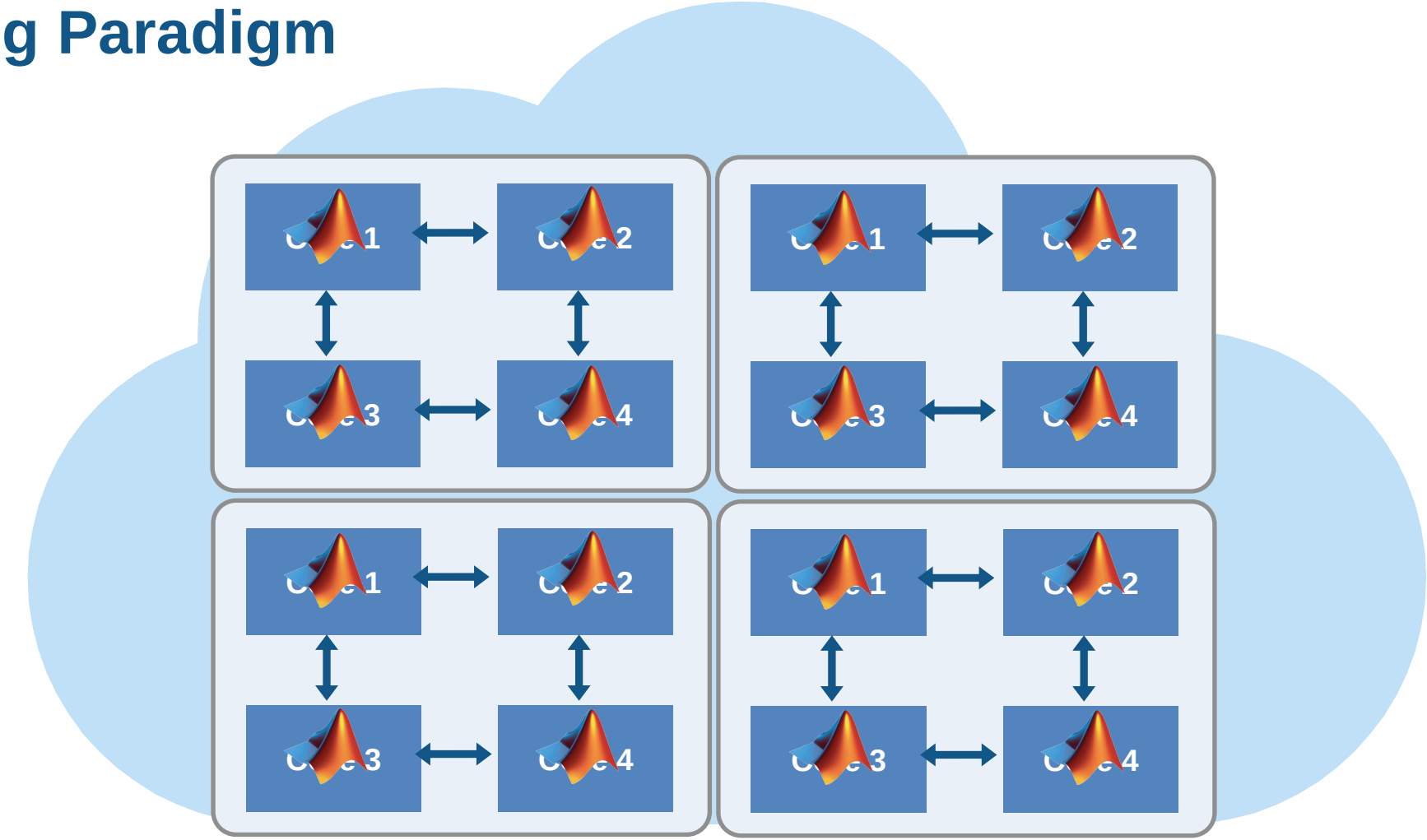
AZURE

Parallel Computing Paradigm



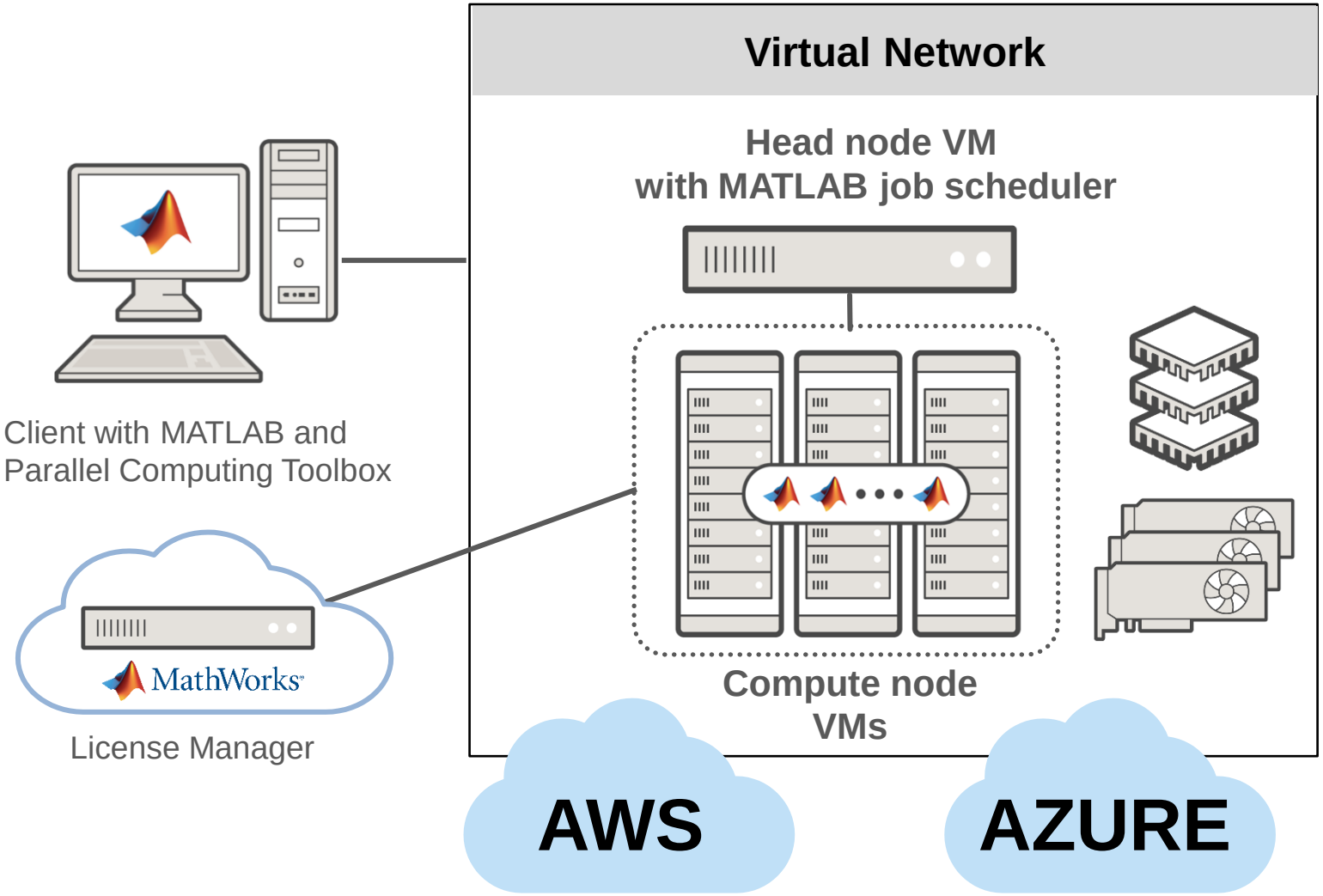


MATLAB Desktop (client)



Cluster of computers

Speed up your parameter sweeps and simulation runs



MATLAB Parallel Server Cloud Reference Architecture

Use cases in the cloud:

1. Parameter sweeps
2. Monte Carlo runs
3. Optimization
4. Distributed array calculations

https://github.com/mathworks-ref-arch/matlab-parallel-server-on-aws
https://github.com/mathworks-ref-arch/matlab-parallel-server-on-azure

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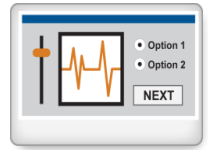


Enterprise Systems

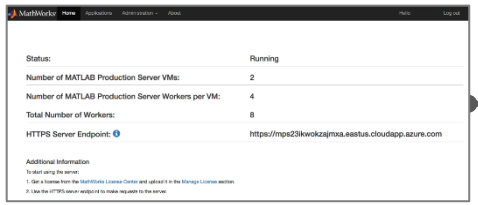
MATLAB Excel .NET C/C++ .exe Java .dll

AWS

AZURE

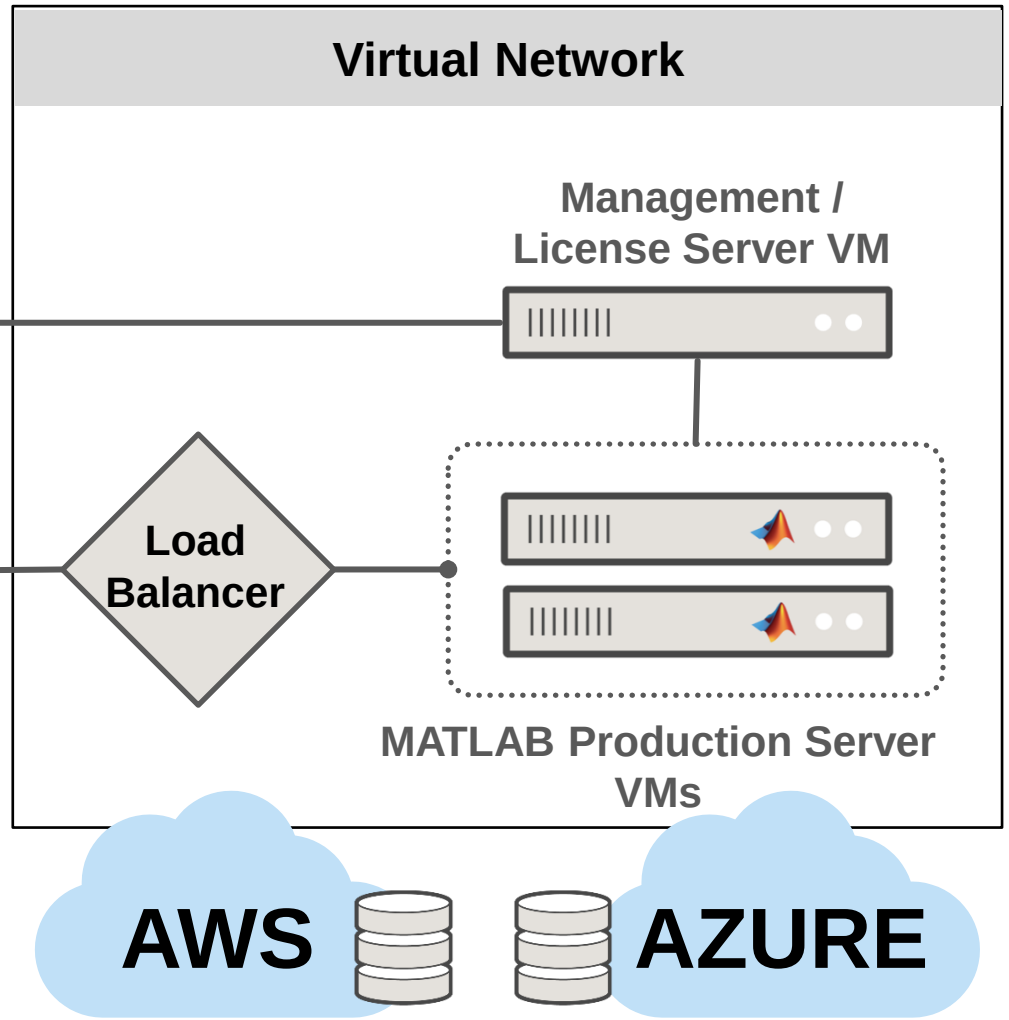
Deploy, scale, and integrate your analytics with operational systems

Cloud console



MATLAB Production Server request endpoint

```
https://hostname:9920/app/predictload
```

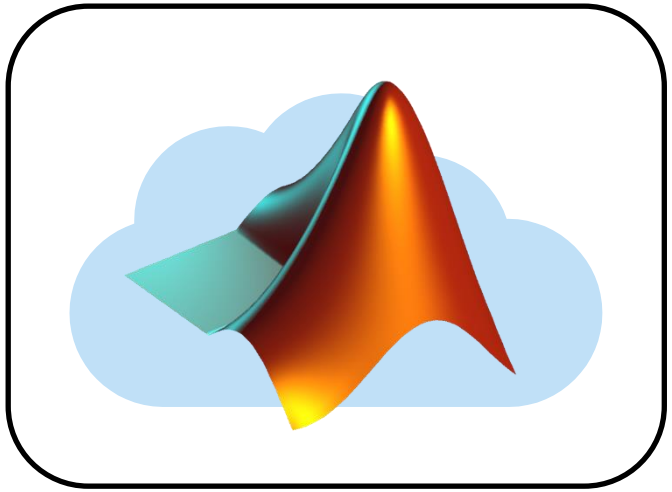


MATLAB Production Server Cloud Reference Architecture

Use cases in the cloud:

1. Deploy AI models or algorithms as microservice APIs
2. Scalable deployed models and analytics
3. Support hundreds to thousands of concurrent requests
4. Integration with operational systems: IoT / streaming data analytics

https://github.com/mathworks-ref-arch/matlab-production-server-on-aws
https://github.com/mathworks-ref-arch/matlab-production-server-on-azure



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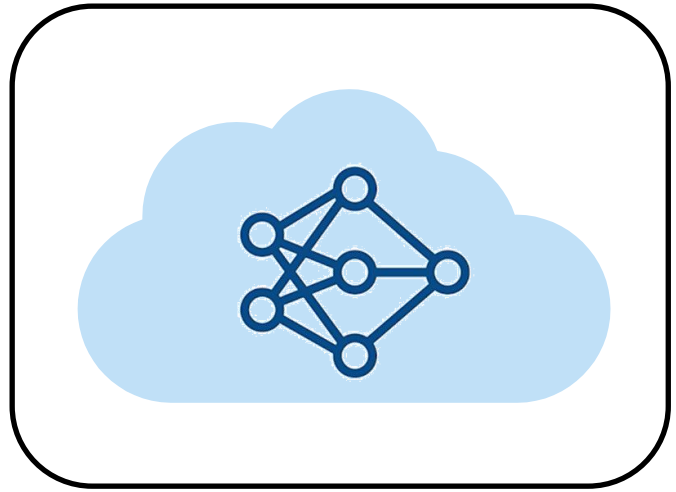

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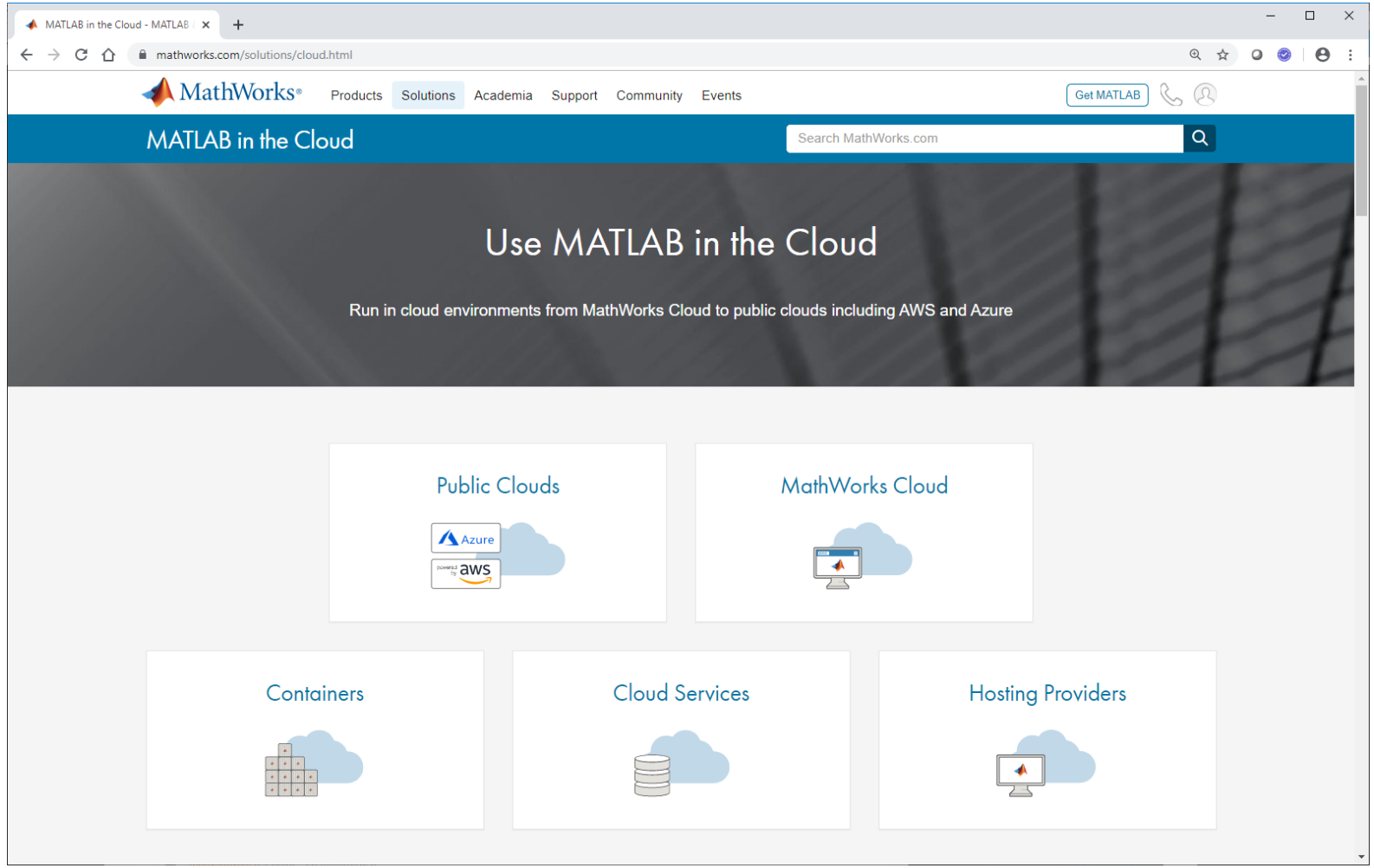

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