DevOps for Software and Systems:
Putting Algorithms and Models in Operation

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John Deere saved costs by using MATLAB and Simulink to model damage calculations in the cloud.
Companies are transforming their businesses

Selling physical assets

Selling uptime, logistics support

Revenue from one-off sales

Subscription based pricing models

Selling products with fixed functionality

Selling products that are updated in the field
Companies are transforming their businesses

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- Revenue from one-off sales
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Digital Products and Services
- Fleet Management
- Predictive Maintenance
- Smart Machine Optimization
- Anomaly Detection

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“Approximately half of all AI models never make it into production due to lack of ModelOps”
DevOps

“A set of practices and culture that combine software development (Dev) and IT operations (Ops)”
Model
“A MATLAB algorithm, or a mathematical, machine learning, deep learning, or Simulink model”

DevOps
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Model + DevOps

“Model” “A MATLAB algorithm, or a mathematical, machine learning, deep learning, or Simulink model”

“DevOps” “A set of practices and culture that combine software development (Dev) and IT operations (Ops)”

Model  DevOps

“Set of best practices, workflows, and tools that combine model development and model operations”
Realize the business value of your models by applying DevOps processes and deploying them into production

Model DevOps
Model DevOps brings agile processes to both data-driven and physics-based models

Model DevOps

- **Code-based**: • Optimization • Financial
- **Data-driven**: • Machine Learning • Deep Learning
- **Physics-based**: • Mechanical • Electronic • Hydraulic
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**Code-based:**
- Optimization
- Financial

**Data-driven:**
- Machine Learning
- Deep Learning

**Physics-based:**
- Mechanical
- Electronic
- Hydraulic

- Docker containers
- Software component
- Edge systems
- Embedded devices
What are some of the challenges of working with models?

- Integrating with design, build, test, and development toolchains
- Getting access to data on-premises and in the cloud
- Collaborating with other departments, for example IT, data scientists, production operations
MATLAB and Simulink work with your organization’s development platforms and toolchain
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Operationalize your models on embedded, edge, or IT systems without recoding

Link: Continuous Integration plugins
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Data science platform

Source Control

CI/CD

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Data science platform
DOMINO

Source Control

CI/CD

Development

Build

Test

Plan

Design

Deploy

Operations

Release

Feedback

Monitor

Operate

Embedded

NVIDIA CUDA

C/C++

SOC/PLC

FPGA

Edge

C/C++

ARM

x86

IT/OT Systems

MATLAB

Excel

C/C++

.exe

.NET

dll

Python

{ RESTful API }

Logging / Dashboard

CI/CD

Continuous Integration plugins

Link: Continuous Integration plugins
Model Based Design maps nicely onto the Model DevOps workflow
Data is essential for both development and operations

Data Sources
- JDBC/ODBC
- AWS S3, Azure BLOB
- CosmosDB, Athena, DynamoDB
- Azure Data Lake

MathWorks GitHub repository: https://github.com/mathworks-ref-arch
Data is essential for both development and operations

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Big Data Analytics
- cloudera
- databricks
- Apache Spark
- hadoop
- Google BigQuery

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- Azure Data Lake

Data Sources
- Databases
- Files
- Parquet

MathWorks GitHub repository: https://github.com/mathworks-ref-arch
Diverse teams across Engineering, IT, Line of Business, and Operations must collaborate to achieve success in Model DevOps.
Engineering, Data Science, IT, and Operations teams must collaborate to ensure success.

MATLAB & Simulink can be integrated into your development environment and leverage data from a variety of data sources.

MATLAB & Simulink models can be deployed into a variety of platforms: embedded, edge, IT/OT, and cloud.

Summary

Model DevOps
is a **Leader** in the 2021 Gartner Magic Quadrant for Data Science and Machine Learning Platforms for the Second Year in a Row


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How can we help you apply Model DevOps into your organization?
Thank you