



Automotive DevOps for Model-Based Design with Amazon Web Services and NXP

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MATLAB EXPO

Agenda

- Industry Overview
- Automotive DevOps Solution Overview
- Demo
- Wrap up
- Q&A

Industry View



“Software will be what differentiates players in the automotive industry within a few years. Incumbents must make significant shifts in technology, competitive dynamics, and talent.

- *McKinsey & Company*



Rewiring car electronics and software architecture for the 'Roaring 2020s'

August 4, 2021 | Article

Software's importance is increasing for the vast majority of industrial players.

Faulty software implementations can lead to severe financial and reputational challenges . . .

. . . but software also can open new valuation horizons

Millions of dollars at stake

64%

of large software programs face **cost overruns**

Risks to brand's reputation

78%

of large software programs face **schedule overruns**

Risk of vehicle recalls

>2 million

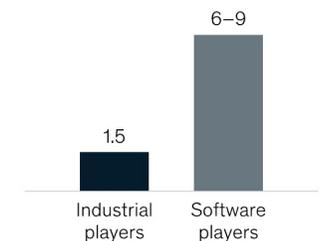
vehicles recalled by an OEM to address **software bugs** in the powertrain domain

Cybersecurity risks

>1 million

vehicles recalled by an OEM to address **vulnerability to hackers**

4–6×



Typical valuation, revenue multiple

Source: Robert N. Charette, "This car runs on code," IEEE Spectrum, February 2009, spectrum.ieee.org; McKinsey analysis

McKinsey
& Company

Enabling technologies for the software defined era

IoT



Scale to millions of vehicles & smart city infrastructure with managed IoT services

Data Lakes



Combine silos of data (CV, ADAS, manufacturing, enterprise) with data lake architectures

AI/ML



A comprehensive data strategy to uncover hidden value with AI/ML and deploy perception & path planning modules

Edge to Cloud



Holistic capabilities including 5G/MEC for next generation connected mobility services

HW Consolidation & Virtualization



By virtualizing the sensors, networking, and hardware interfaces, customers can achieve parity between cloud and vehicle

Vehicle Data Microservices



Provide a normalized, consistent, secure data access layer that allows developers to create new insights & microservices

Application Encapsulation



Containers provide self contained, isolated, easily distributable packages for development of virtual ECUs deployed to vehicles

Cloud Native Devops



As automotive companies are expanding their use of cloud native devops and CI/CD technologies to the embedded edge

Teams that adopt modern software practices are more agile and higher performing

Teams who automate software delivery with continuous delivery:

Source: 2019 DORA State of DevOps report

Deployment Frequency

Weekly-monthly



Hourly-daily

Change Lead Time

1-6 months



1-7 days

Change Failure Rate

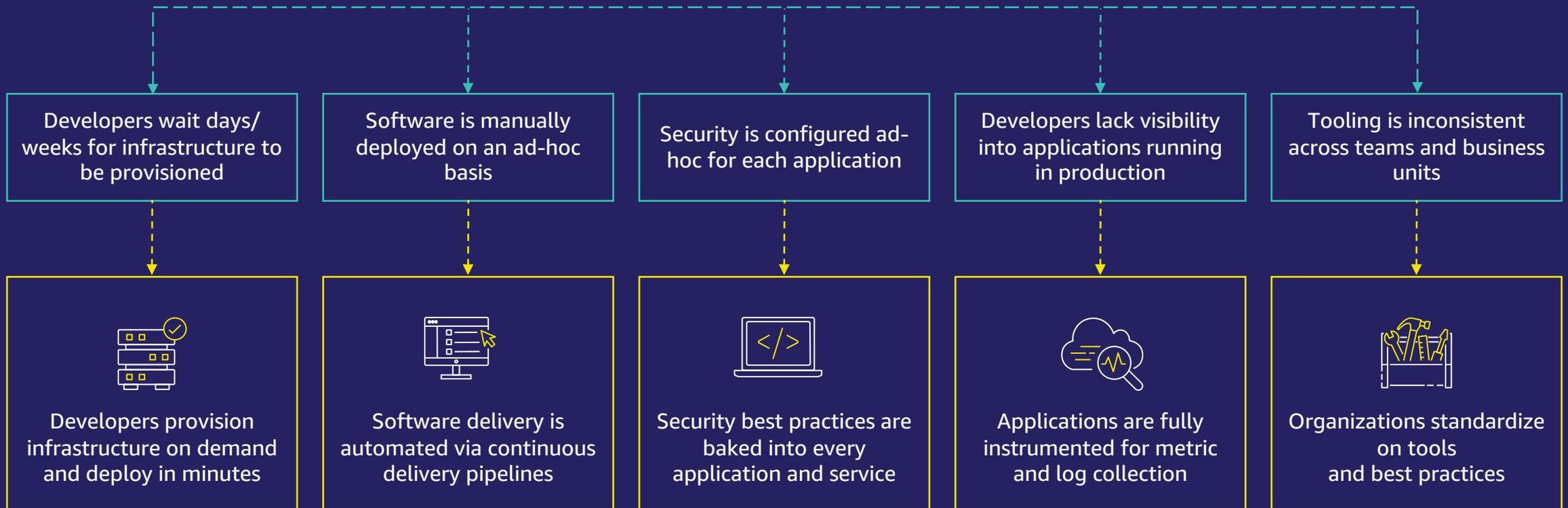
46-60%



0%-15%

Modern DevOps: what does good look like?

Challenges + Solutions



Automotive Development Challenges

Hyperscale



Thousands of cores of compute for development and validation. TBs of data to collect, ingest and store every day translates into PB scale data processing, storage and management problem.

Agility & Speed



Optimized software engineering to reduce development and validation costs and enable faster Time to Market. Future proof R&D cycles. Integrated and Agile to rapidly innovate

Cost



PB scale data storage and large scale compute costs, managing fleet operations, significant capex of on-prem compute, lack of AV expertise requires significant human investment

Safety



Safety of the passengers and surrounding environment are top of the mind for all of our customers and their end customers as the decision are moving to vehicles from humans

Ecosystem Play

Interoperability and seamless Integration of multiple first party and third party workload specific tools.



SW Defined

More software, from different vendors, additional non-functional requirements, integration issues, testing coverage

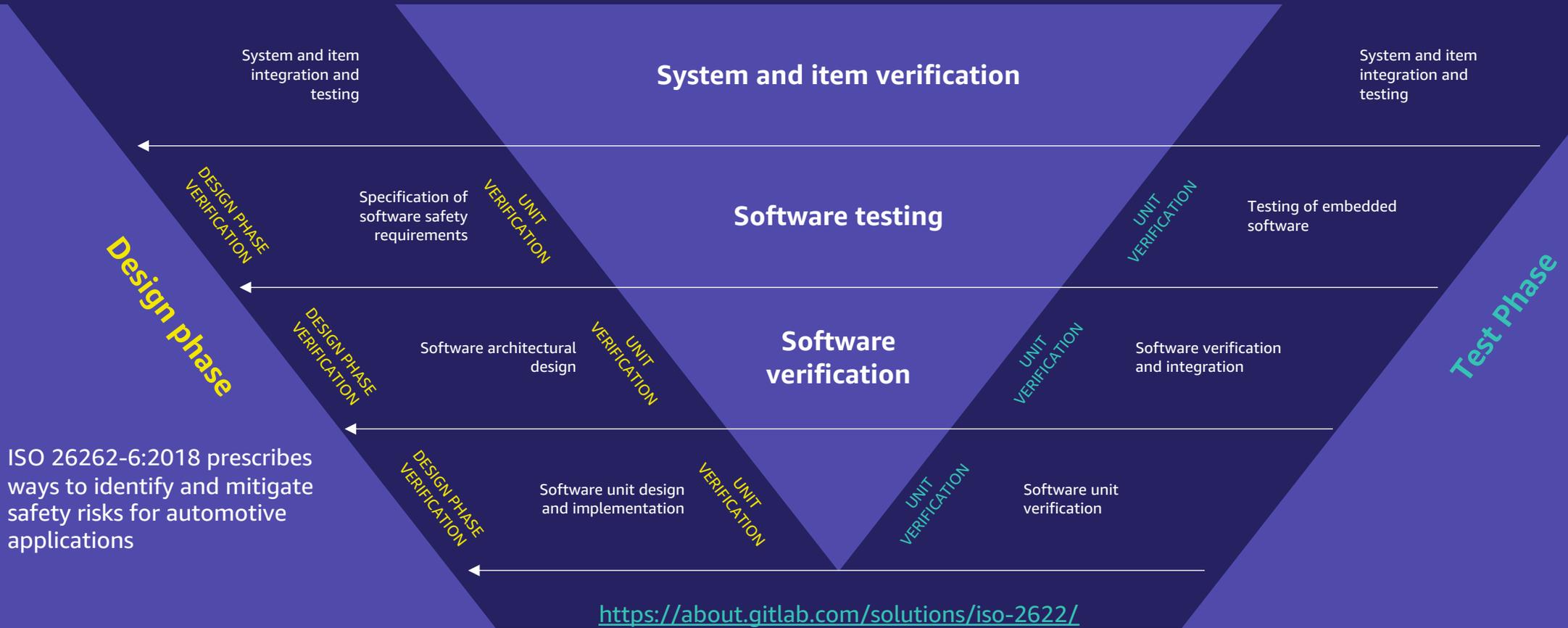
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Global / Security / Data Privacy

Global fleet requires managed service for complex operations, attain data and security compliance across the globe



ISO 26262-V-Model

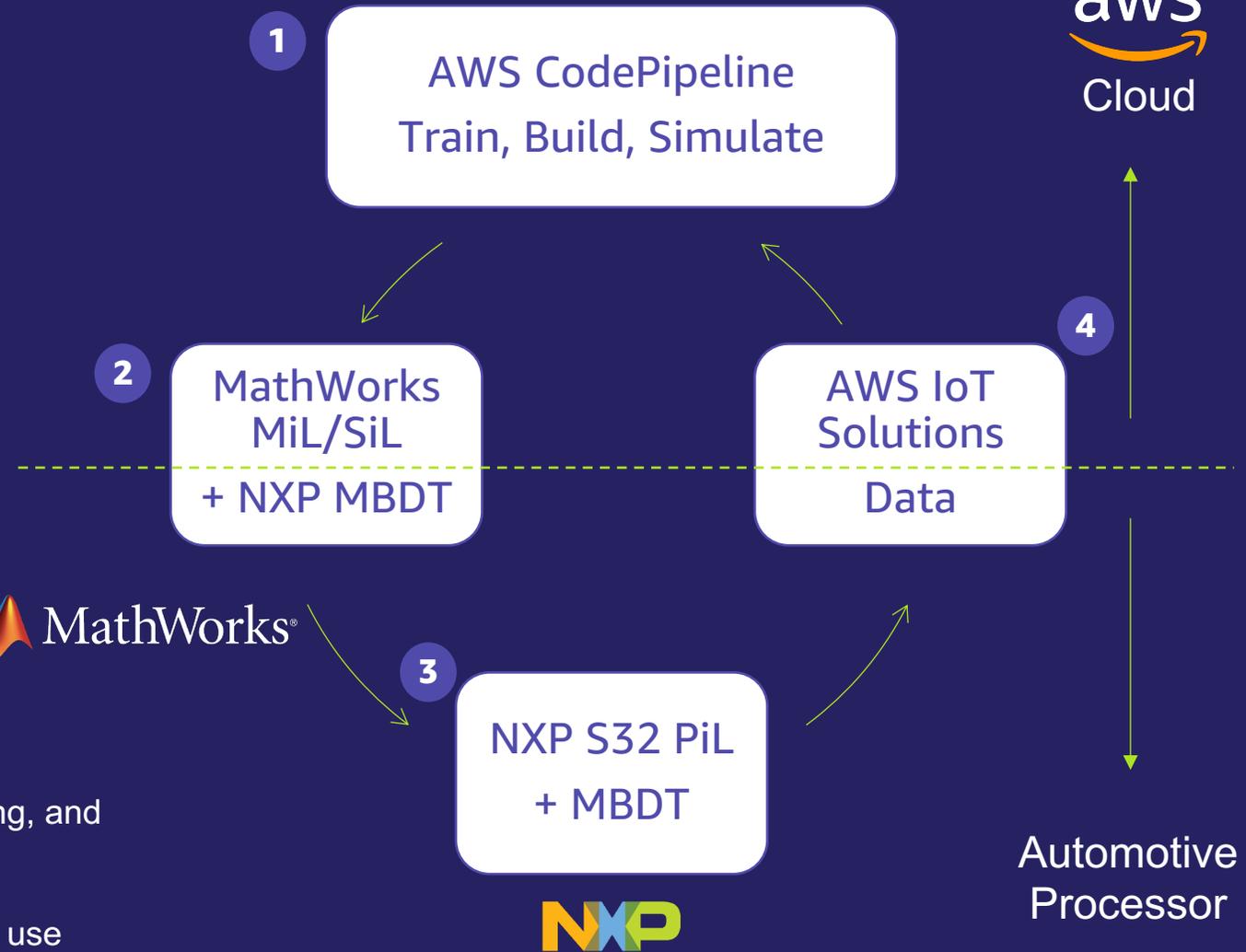


Overview

- The Automotive DevOps model-based design solution incorporates:
 - AWS Developer Tools
 - MathWorks® model-based design tools
 - Vehicle control algorithms executing on NXP Automotive processors
- The solution allows users to develop and simulate in the cloud, and then easily deploy to Automotive silicon for algorithm validation.

Major components supporting the solution include:

- 1 **AWS CodePipeline:** Build and simulate models in the cloud
- 2 **MathWorks with NXP® MBDT:** tools for designing, simulating, and implementing automotive software and system models
- 3 **NXP GoldBox:** execute algorithm on Automotive processor, use profiler to measure execution time
- 4 **AWS IoT Solutions:** publish data to the cloud



MiL = Model in the Loop
SiL = Software in the Loop
PiL = Processor in the Loop
MBDT = Model-based Design Toolbox Add On



Automotive DevOps Demonstration



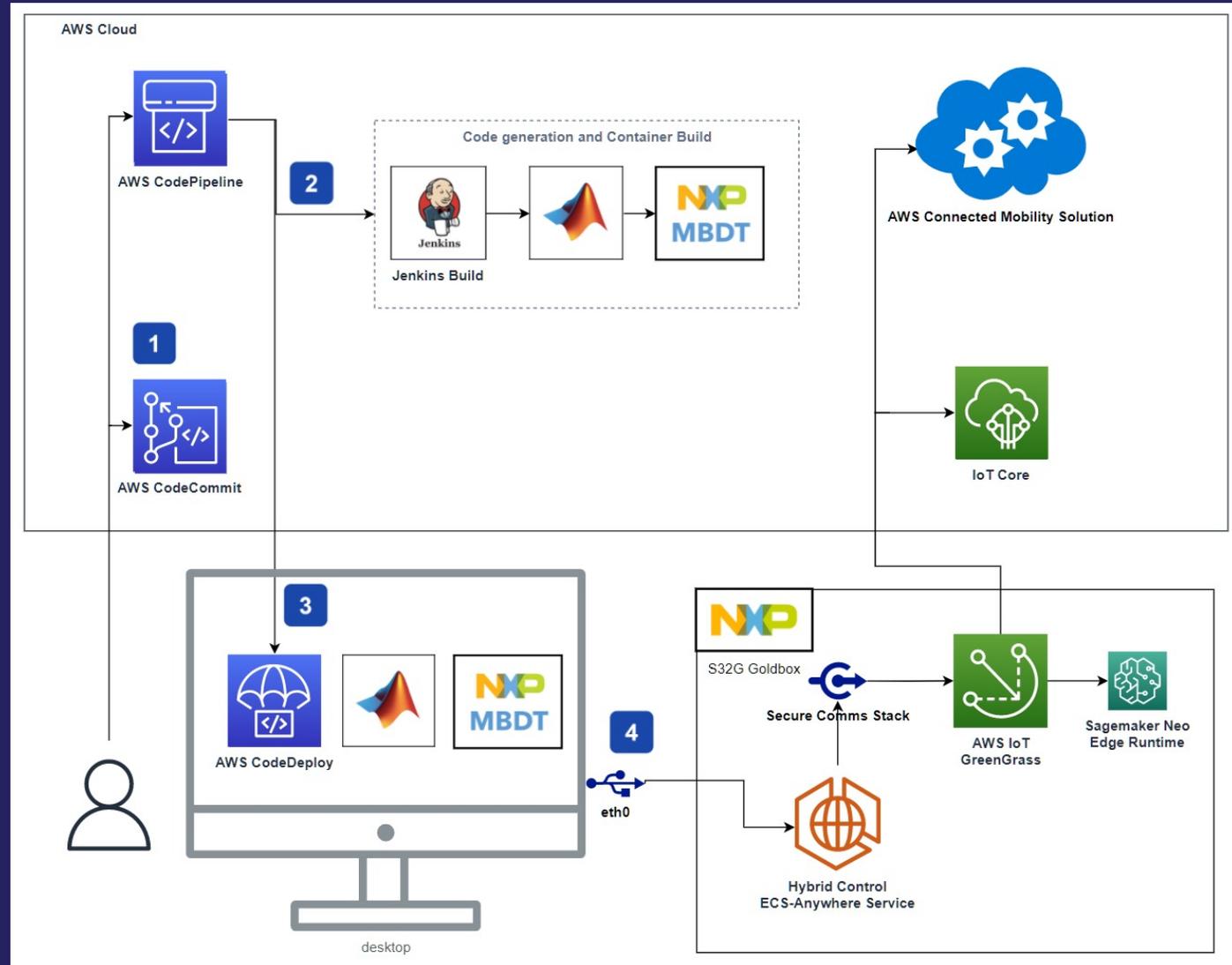
Let's walk through the Demonstration: "Local Desktop"

1 Commit: AWS CodeCommit

2 Build: AWS CodePipeline

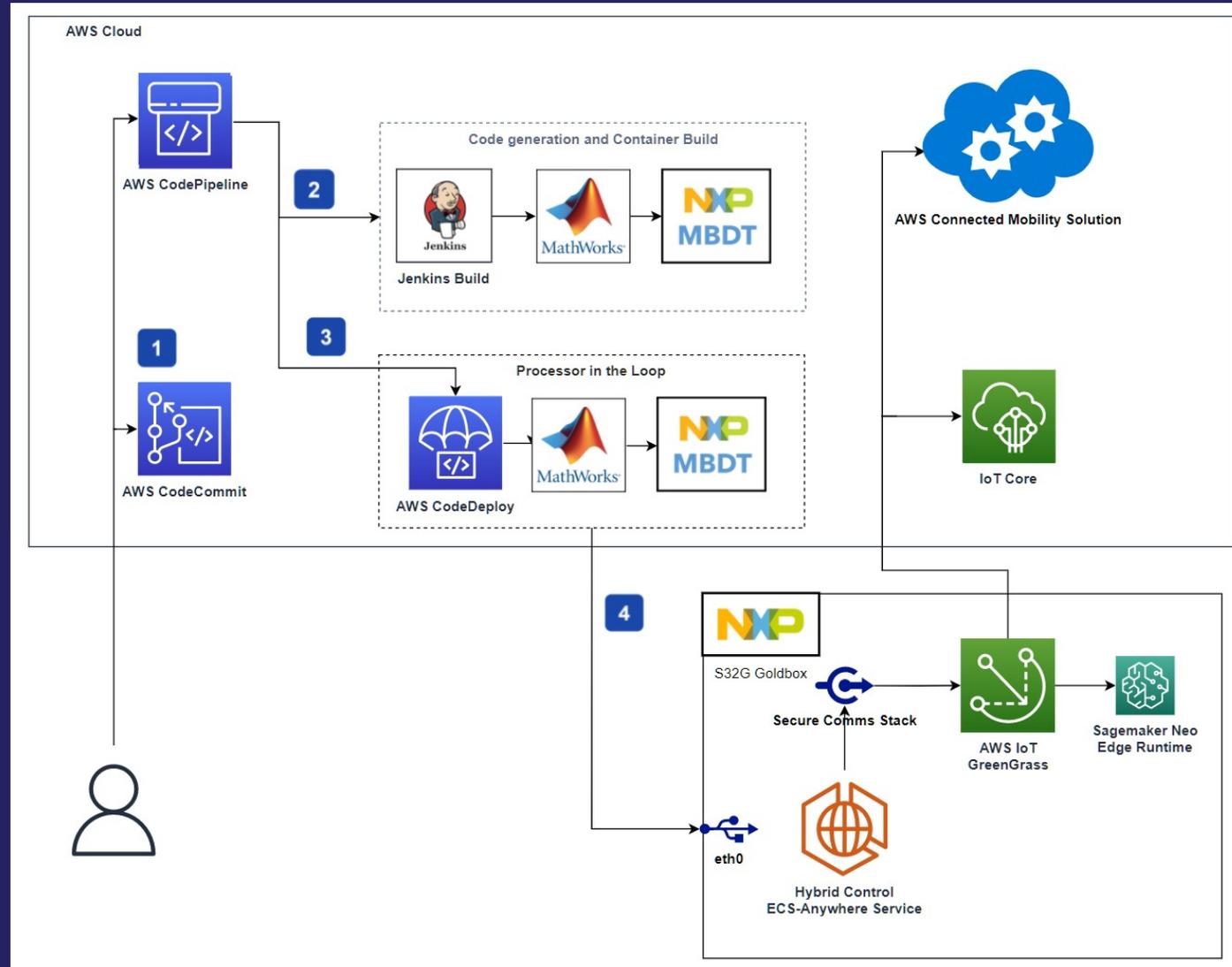
3 Deploy: AWS CodeDeploy

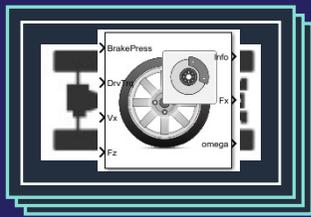
4 PiL Simulation: Simulink + NXP S32G



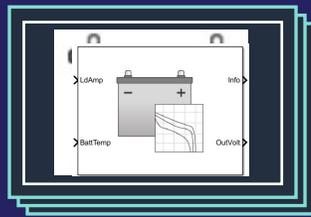
Let's walk through the Demonstration: "Cloud Desktop"

- 1 Commit: AWS CodeCommit
- 2 Build: AWS CodePipeline
- 3 Deploy: AWS CodeDeploy
- 4 PiL Simulation: Simulink + NXP S32G

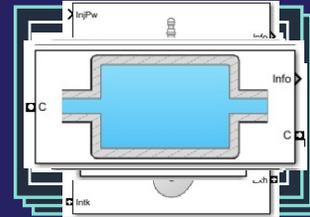




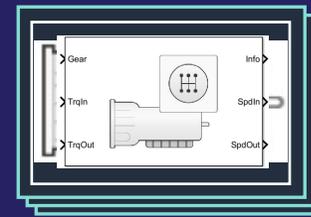
Drivetrain



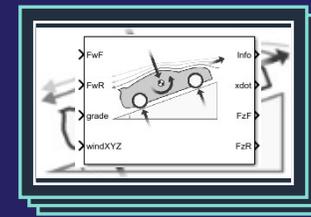
Energy Storage and Auxiliary Drive



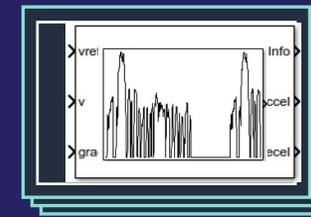
Propulsion



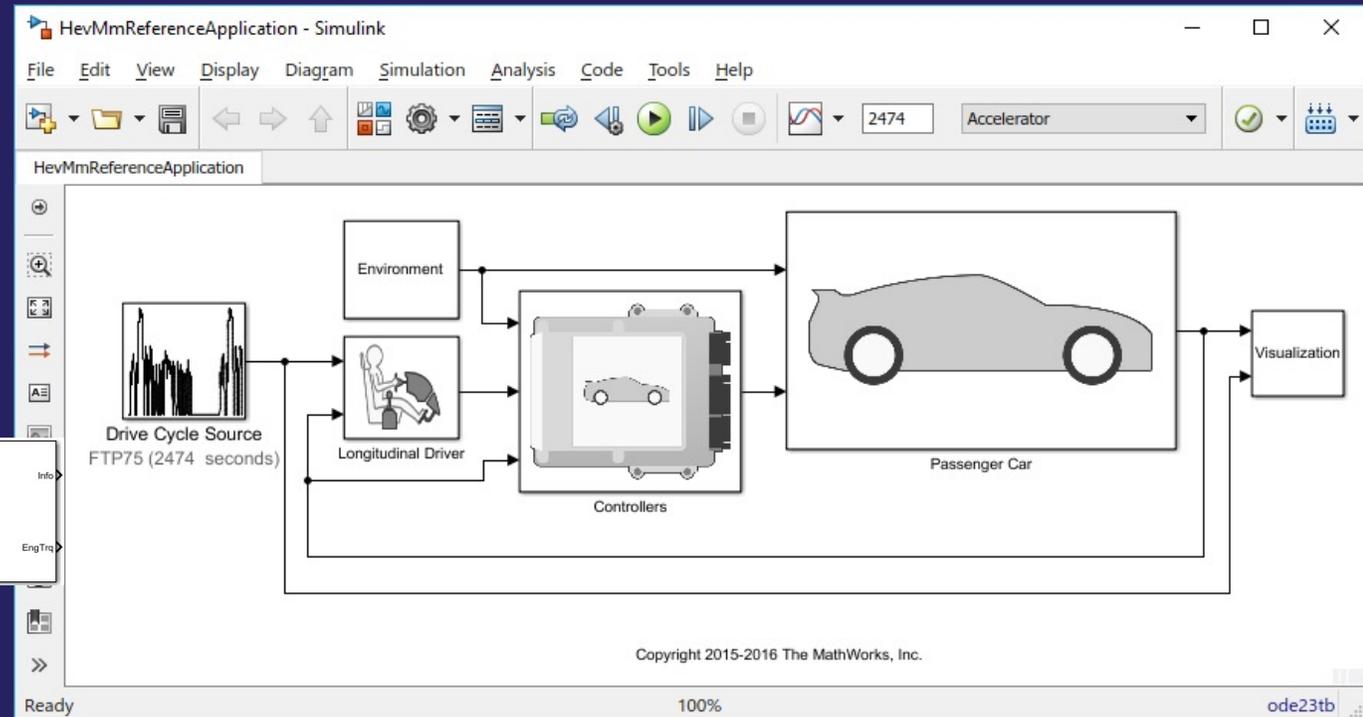
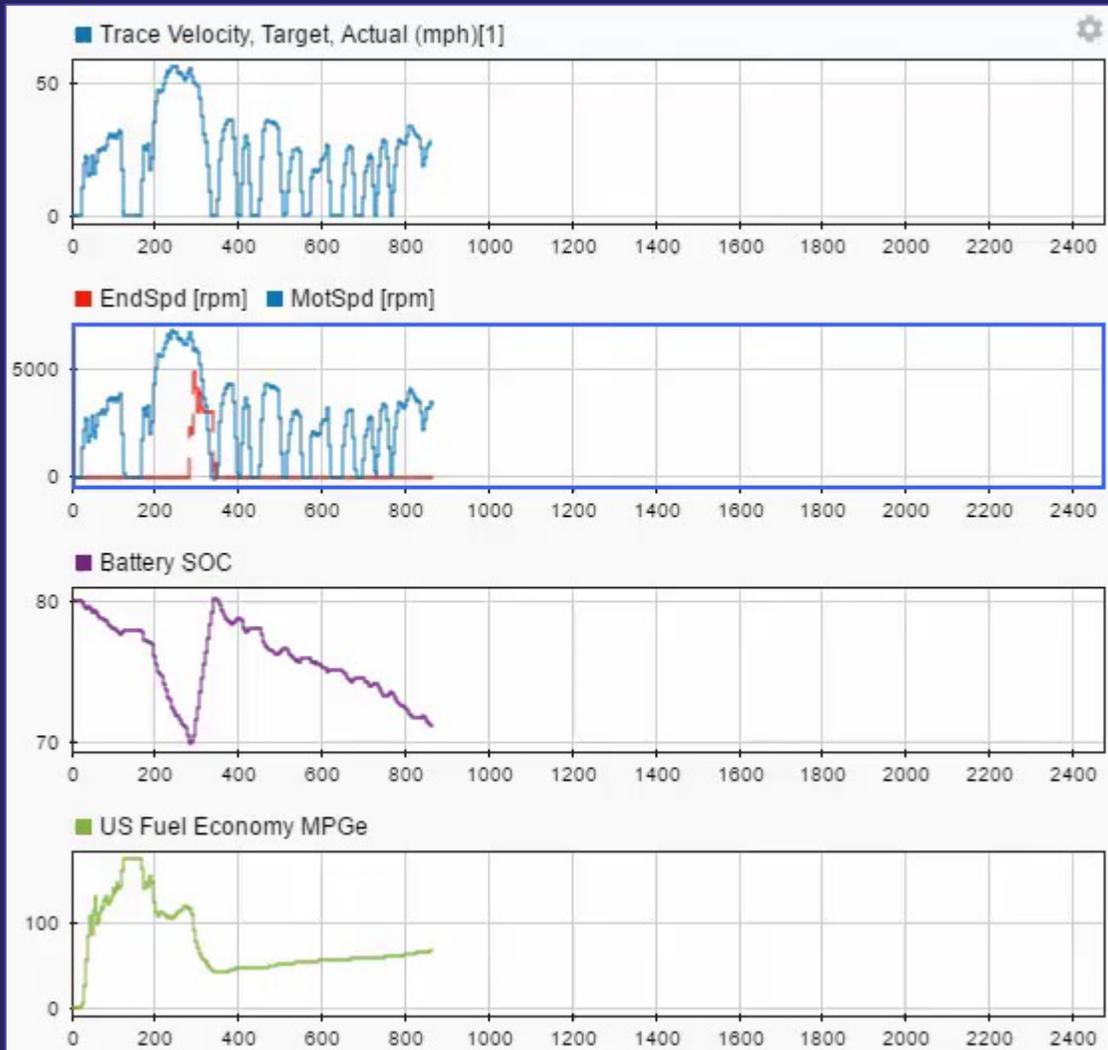
Transmission



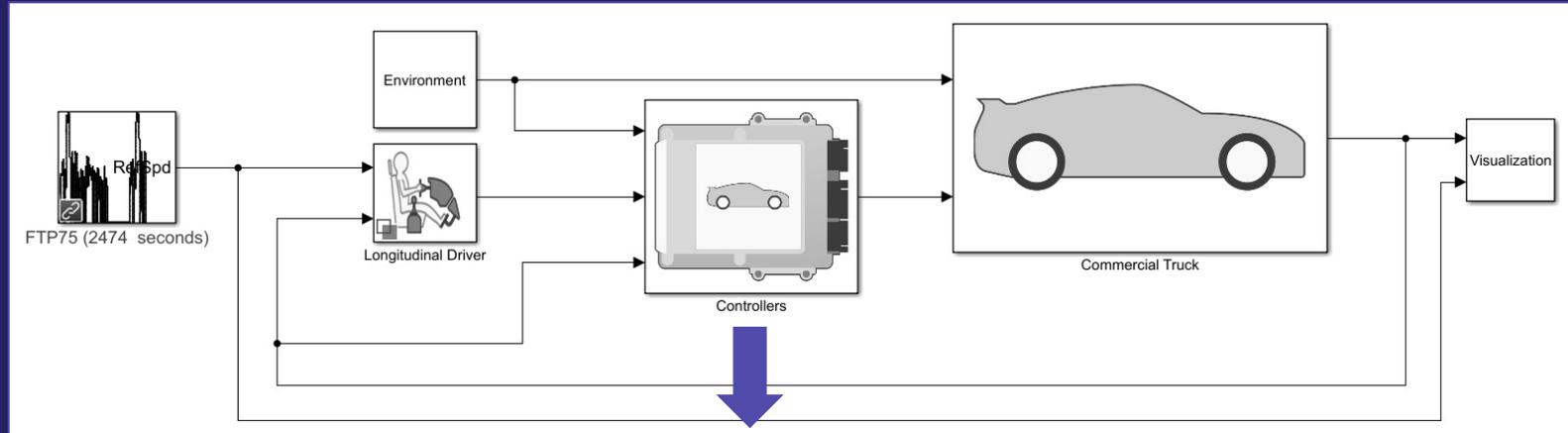
Vehicle Dynamics



Vehicle Scenario Builder



MATLAB Model



Code Generation offloaded to AWS

AWS

NXP MBDT "HCP"

Local Developer Environment

AWS generated code reused locally



NXP S32G2 GoldBox
Arm Cortex-A53

Demo





Developer Tools
CodePipeline

- ▶ Source • CodeCommit
- ▶ Artifacts • CodeArtifact
- ▶ Build • CodeBuild
- ▶ Deploy • CodeDeploy
- ▼ Pipeline • CodePipeline
 - Getting started
 - Pipelines
 - Pipeline**
 - History
 - Settings
- ▶ Settings

Go to resource

nxp-mathworks

Source Succeeded
 Pipeline execution ID: [a316dd98-8233-4b8d-818f-f3dcb9815098](#)

CodeCommit_Source

AWS CodeCommit

Succeeded - Just now
c6359066

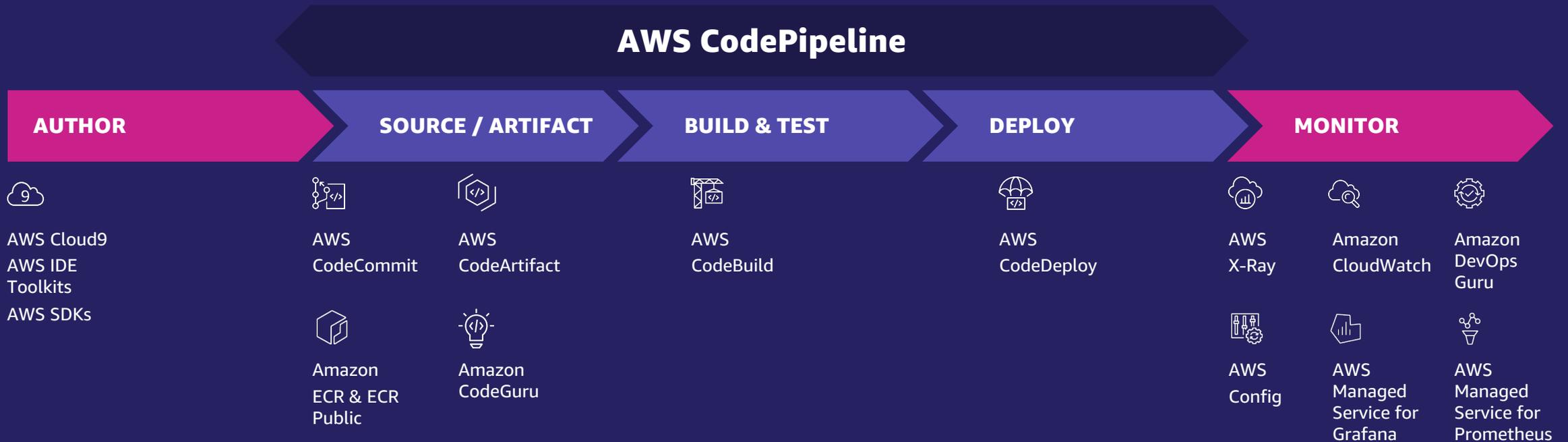
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Summary



End-to-end solution helps development organizations go faster



MODEL

AWS CloudFormation



Cloud Development Kit (AWS CDK, CDK8s, CDK-terraform)



AWS Serverless Application Model (SAM)



Automotive DevOps Model-Based Design



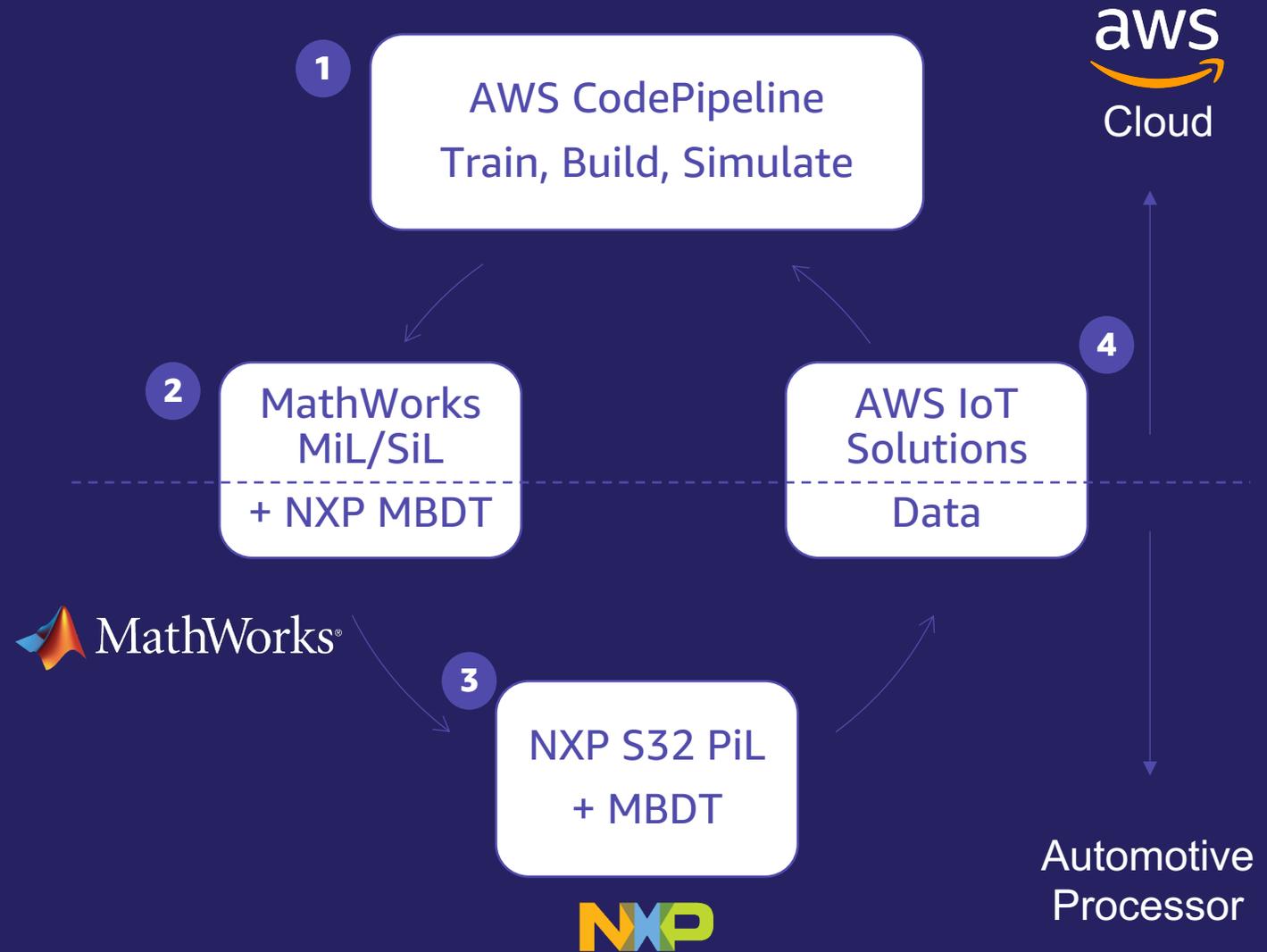
Design, build and simulate in the cloud. Engineers use model-based systems engineering (MBSE) to manage system complexity, improve communication, and produce optimized systems



Deploy to the Automotive Edge. NXP's S32G Vehicle Network Processors interface with all the vehicle functional domains and provide secure processing (AI/ML) and network acceleration for vehicle edge services.



Integration with AWS CodePipeline and AWS IoT Greengrass enables a DevOps workflow built on AWS.



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Thank you



Find us on LinkedIn or visit us at:
aws.amazon.com/automotive →

