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

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Agenda

• Industry Overview
• Automotive DevOps Solution Overview
• Demo
• Wrap up
• Q&A
“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
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:

- **Deployment Frequency**
  - Weekly–monthly
  - Hourly–daily

- **Change Lead Time**
  - 1–6 months
  - 1–7 days

- **Change Failure Rate**
  - 46–60%
  - 0%–15%

Source: 2019 DORA State of DevOps report
Modern DevOps: what does good look like?

Challenges + Solutions

- Developers wait days/weeks for infrastructure to be provisioned
- Security is configured ad-hoc for each application
- Developers lack visibility into applications running in production
- Tooling is inconsistent across teams and business units

- Software is manually deployed on an ad-hoc basis
- Security best practices are baked into every application and service
- Applications are fully instrumented for metric and log collection
- Organizations standardize on tools and best practices

Developers provision infrastructure on demand and deploy in minutes
Software delivery is automated via continuous delivery pipelines
Security best practices are baked into every application and service
Applications are fully instrumented for metric and log collection
Organizations standardize on tools and best practices
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.

**Global / Security / Data Privacy**
Global fleet requires managed service for complex operations, attain data and security compliance across the globe.
ISO 26262–V-Model

ISO 26262-6:2018 prescribes ways to identify and mitigate safety risks for automotive applications.

https://about.gitlab.com/solutions/iso-2622/
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

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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

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MATLAB Model

Code Generation offloaded to AWS

AWS generated code reused locally

NXP MBDF "HCP"

NXP S32G2 GoldBox
Arm Cortex-A53

Local Developer Environment
npx-mathworks

Source: Succeeded
Pipe execution ID: a516dd98-8233-4b8d-818f-f3dcb9815098

CodeCommit_Source
AWS CodeCommit
Succeeded - Just now
c6359066

CodeCommit_Source: clear mex

Disable transition
Summary
End-to-end solution helps development organizations go faster

**AWS CodePipeline**

**AUTHOR**
- AWS Cloud9
- AWS IDE Toolkits
- AWS SDKs

**SOURCE / ARTIFACT**
- AWS CodeCommit
- AWS CodeArtifact
- Amazon ECR & ECR Public
- Amazon CodeGuru

**BUILD & TEST**
- AWS CodeBuild

**DEPLOY**
- AWS CodeDeploy
- AWS X-Ray
- Amazon CloudWatch
- AWS Config
- AWS Managed Service for Grafana
- AWS Managed Service for Prometheus

**MONITOR**

**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.
Thank you

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