
AWS
re:Invent

MFG303

Rivian pushes the pace of automotive innovation with AWS

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Agenda

Rivian vision for sustainability and innovation in automobiles



The catalyzing moment



Key steps Rivian took and decisions made



Proof of concept to production



Where Rivian computer-aided engineering is today



Rivian

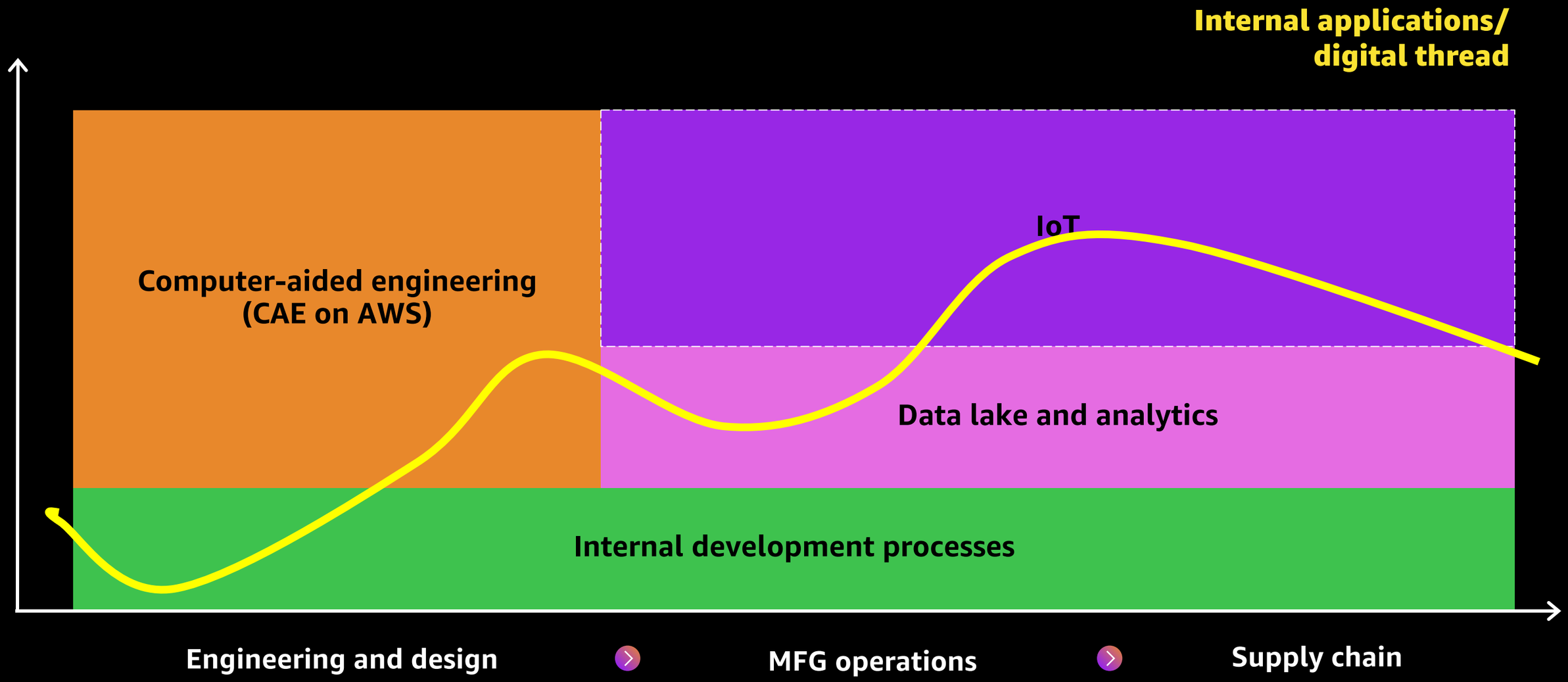
Keep the world adventurous forever

“Adventure is life.”

—R. J. Scaringe, CEO, Rivian



Rivian initiatives on AWS



On-premises hardware failure and AWS proof of concept

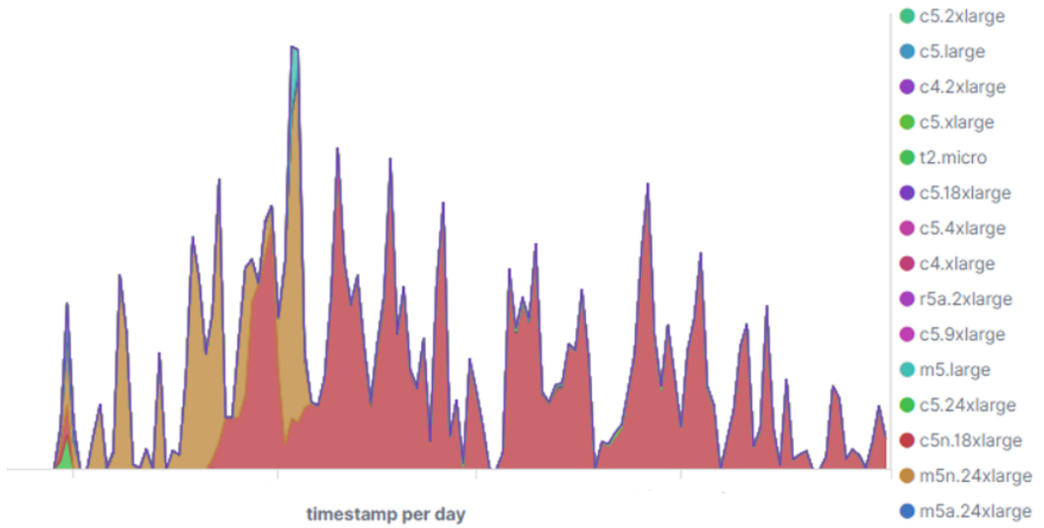
RAPID RESPONSE TO BUSINESS CONTINUITY ISSUE

Half of Rivian on-premises HPC clusters failed

Capability required in **6 weeks,** however remediation for on-premises would **take 6 months**

Proof of concept delivered on AWS in **3 weeks**

Recovered analysis capability **ahead of schedule**



CONSIDERATIONS

Rapid deployment

Application performance

Agility: scale on demand

Adopting a DevOps approach to CAE

AMAZON BEST PRACTICES AND AWS PARTNER STAFF AUGMENTATION

With the question of performance answered, must pivot to production

Critical requirements

- Self-service
- Resource optimizations
- Agility to evolve R&D environment as needs change
- Capability to optimize AWS infrastructure budget automatically (spot / on-demand / reserved)
- Capability to provide monthly reports
- Ability to optimize jobs automatically

CONSIDERATIONS

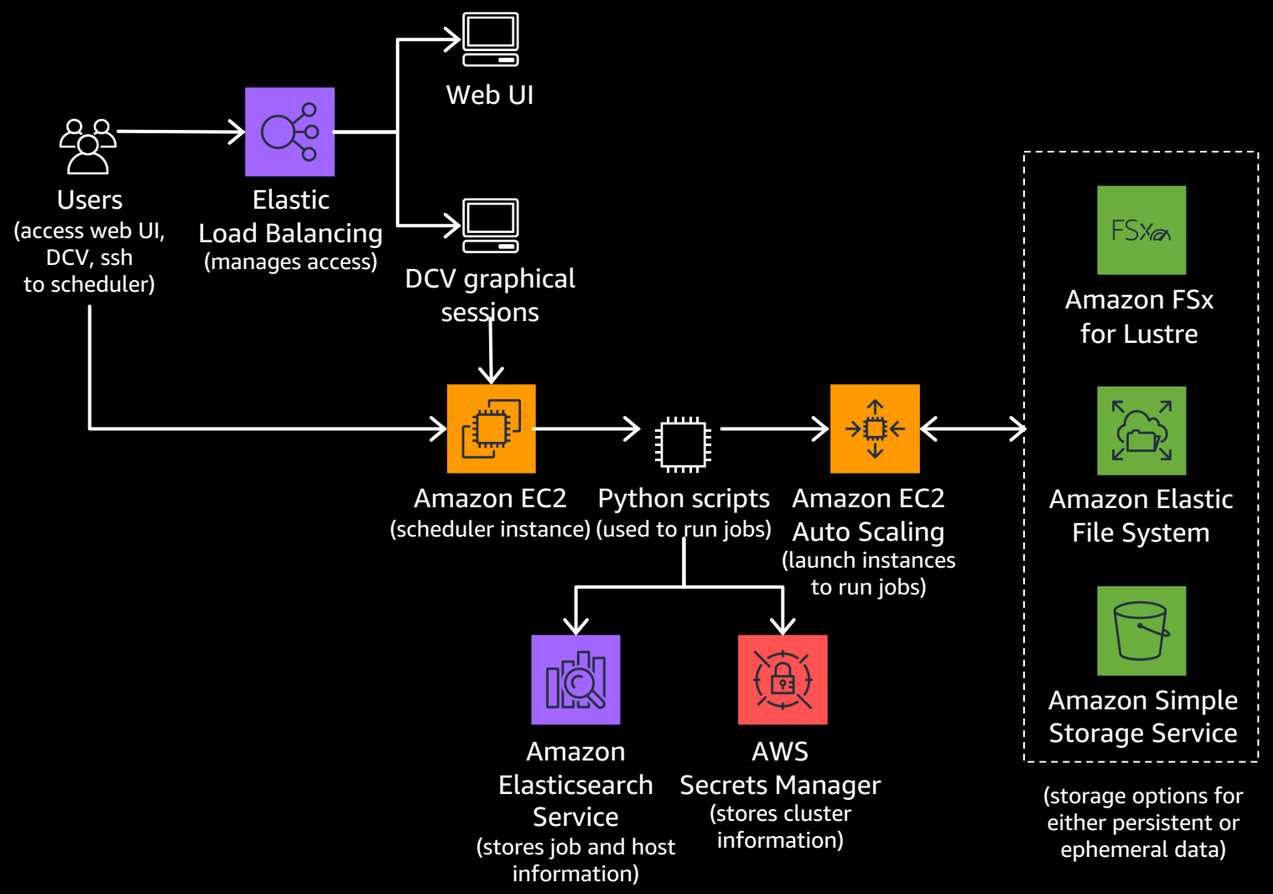
AWS expertise

Engineer / analyst usability

Speed of implementation

AWS costs to operate

Rivian CAE environment



Based on AWS reference implementation

- Scale-Out Computing on AWS (SOCA) open-source project
- More information is available at https://aws.amazon.com/solutions/implementations/scale-out-computing-on-aws/

TENETS

- **Democratize advanced simulation and modeling via automation, simplifying use for both end users and system administrators**
- **Processes, automation, and convenience are as important as performance**
- **Leverage the existing Amazon Web Services ecosystem of services**

User interaction with Rivian HPC

NO DEPENDENCY ON INFRASTRUCTURE—TEAM SCENARIOS

Rivian network/VPN

Aero group



Workstation/tablet

Job

Input

Safety group



Workstation/tablet

Job

Input

Durability group



Workstation/tablet

Job

Input

Rivian HPC

Unlimited storage for tools and projects
Persistent storage for applications, data, and desktops

Resources checks
Before creating per user HPC

Exclusive high-performance compute
On-demand CPU's, GPU's, FPGA's, Lustre

2D/3D cloud desktop
Sessions are accessed with a web browser or the native client application

Mike Brenda Rob

- User/project/group
- Budget
- Application license

Mike Brenda Rob

Result



Collaborative support model

RIVIAN

Third-party applications

LS-DYNA | Abaqus | Star-CCM+ | OptiStruct

Scale-out computing on AWS

Cloud workstations | Cluster analytics | Web portal | Scheduling | User actions

SCRIPTS

AWS infrastructure

EC2 | FSx | EFS | ...

Third-party support

Remote NOC



Cluster Administrators

AWS support

Cloud support engineers



Rivian technical account manager



Where we are today

Achieved concurrent engineering with no dependencies on infrastructure

APPLICATION	ON-PREMISES RESULT	AWS RESULT	PERCENTAGE SPEED-UP
Elements	18 hours	8 hours	56%
Siemens	140 minutes	90 minutes	35%
Ansys	35 minutes	28 minutes	20%

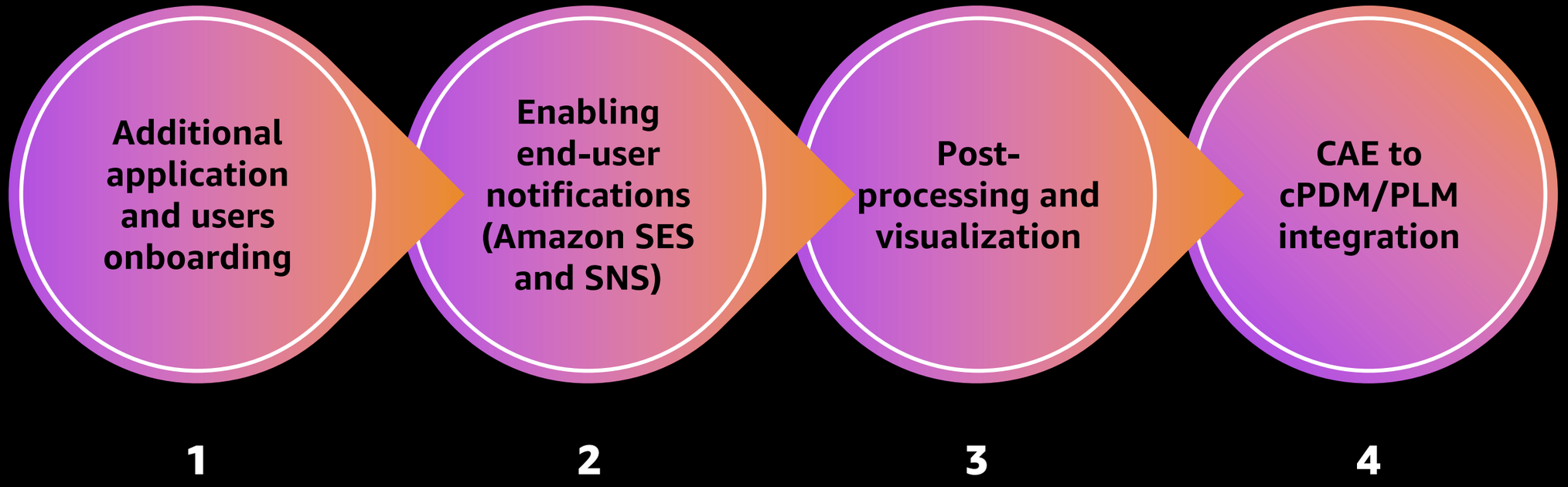
> "Quick update: the PT-Scotch final decomposition decreased solve time by 45 minutes for the test case (~8%)—making the same switch on another one of our vehicles was even more beneficial: 13% decrease in solve time.
>
> It's always great to find easy-to-implement gains like this—thanks for helping us out!"
>
> **Andrew d'Hooge**
> **Senior Vehicle Aerodynamicist**

Lessons learned

1. Open minds and an agile approach to enable users to fail fast or succeed
2. To fully benefit from AWS interconnect, commercial independent software vendors must be involved
3. Integration with other enterprise systems (e.g., Active Directory) shouldn’t be underestimated
4. Trusted managed services partners are critical to mitigate initial complexity when migrating users and applications
5. Collaborative engagement with users and top-down buy-in from line of business



Next steps


Additional application and users onboarding
Enabling end-user notifications (Amazon SES and SNS)
Post-processing and visualization
CAE to cPDM/PLM integration
1
2
3
4

Thank you!



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