
AWS
re:Invent
NOV. 27 – DEC. 1, 2023 | LAS VEGAS, NV

MFG106

Product innovation and customer engagement with Ferrari and Autodesk

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Ferrari

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Fusion Machine Learning Manager
Autodesk

Agenda

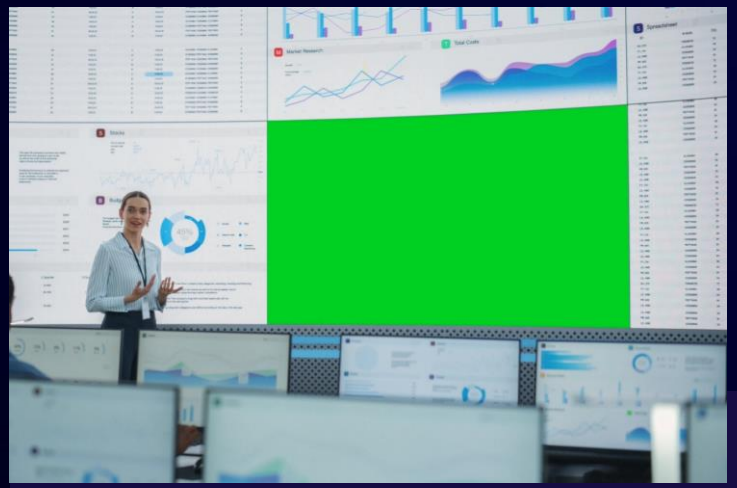
01 **Product engineering and development challenges**

02 **Embracing operational and product complexity**

03 **Hear it best from our customers:**

- Ferrari – Mauro Coletto and Giovanni Longobardi
- Autodesk – Heather Kerrick

Product development challenges



Performance and scalability

Data friction

Global collaboration

Model-based engineering (MBE) journey

Where are you today?

Value

0

Document-based

1

Models occasionally used

2

Models as official deliverables

3

Models automated and connected with Digital Threads

4

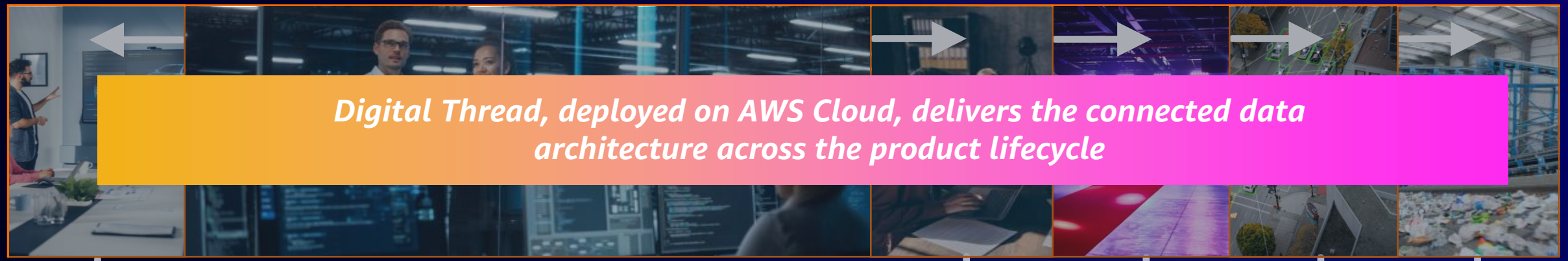
Model Based Engineering (MBE), complete product lifecycle

MBE journey

Product lifecycle

INCREASING COMPLEXITY

Strategic Planning | Product Planning | Product Design | Validation & Simulation | Production | Sales & Marketing | Service | Recycle & EOL

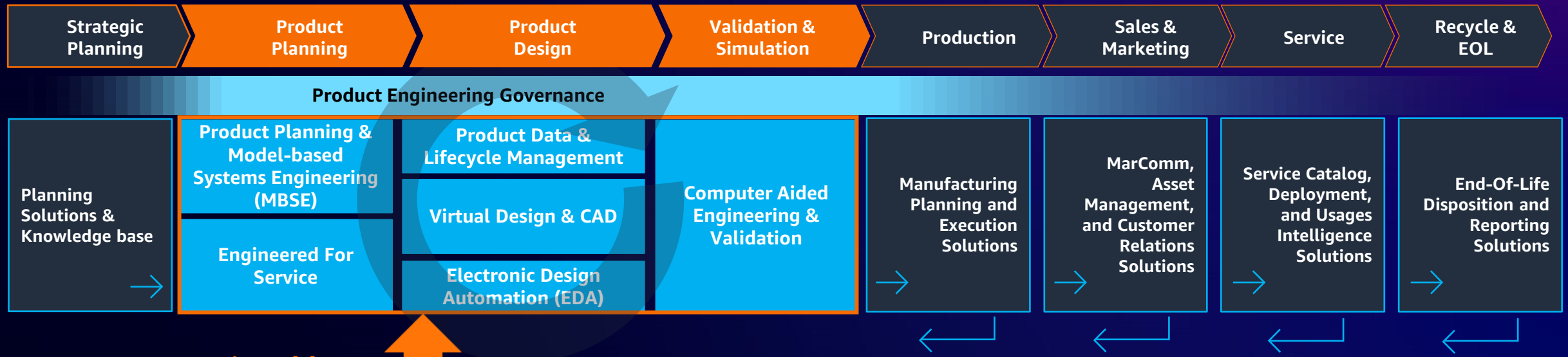


Digital Thread, deployed on AWS Cloud, delivers the connected data architecture across the product lifecycle

DATA & INTELLIGENCE

Product engineering and development

EMBRACING COMPLEXITY



AWS Services (*)

- Amazon AppStream
- Amazon SageMaker
- NICE DCV
- AWS IoT Core
- Amazon S3
- AWS Lambda
- Amazon RDS
- AWS ParallelCluster

AWS Solutions (*)

- Research & Engineering Studio (RES)
- Scale-Out Computing on AWS (SOCA)
- Twinflow

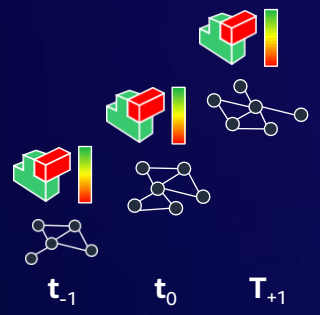
AWS Partners (*)

SIEMENS, AUTODESK, ptc, cadence, SYNOPSYS, Ansys, rescale, VERTEX SYSTEMS

(*) Sample List

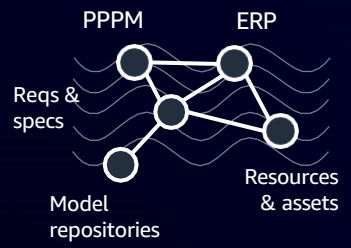
Key technology enablers

Secure global collaboration

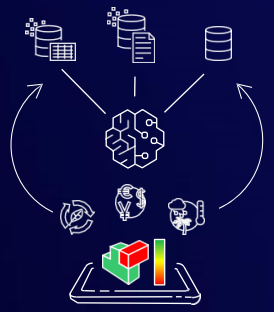


High-performance computation (HPC)

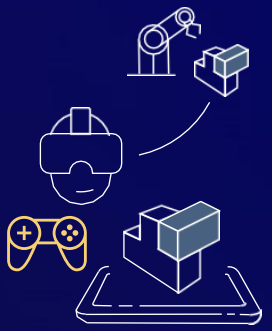
End-user computing (RD/VDI)



Data lake/data mesh/ Digital Thread



Automation & intelligence (AI/ML)



Spatial review/ X-reality

Artificial intelligence in product engineering and development

CAPABILITIES

- Speech to text conversion
- Advanced data search
- Ideation
- Design exploration
- Multidisciplinary optimization
- New materials

BENEFITS

Productivity

Innovation

Quality

Manufacturability

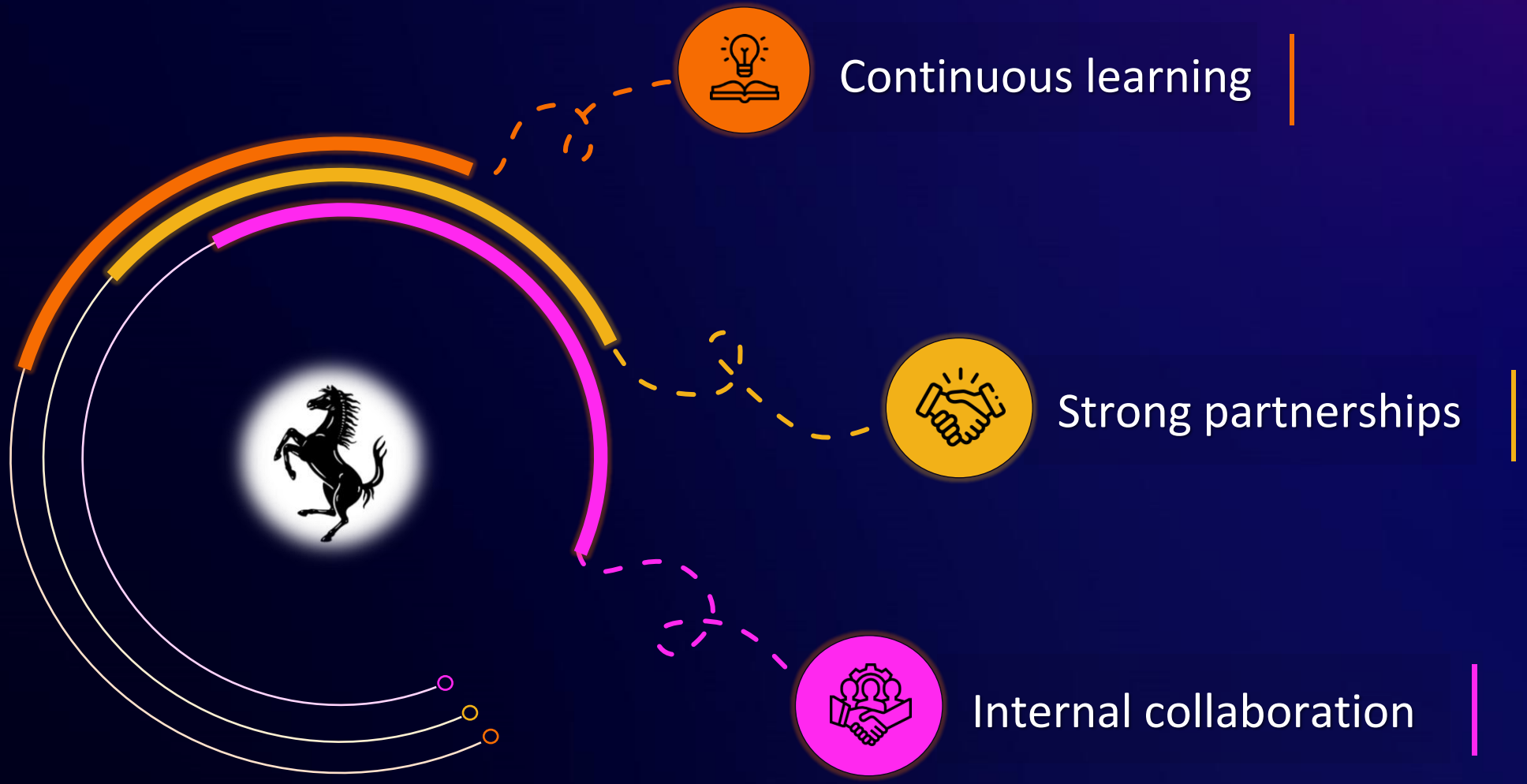
Sustainability

Ferrari

Mauro Coletto
Head of Business Analytics
and Data Science

Giovanni Longobardi
Cloud Operations Manager

The guiding principles



Continuous learning: Data-driven enviroment

ALL EMPLOYEES

DATA-DRIVEN DAYS

Inspirational and educational data-focused events open to all Ferrari employees

- Value of Data
- Machine Learning
- Data Visualization

1700 participants

BUSINESS OWNERS

ML BUSINESS EMBARK PROGRAM

For R&D, manufacturing, communication, marketing, sales, and lifestyle business leaders

- How to drive an ML project
- Applied ML projects

50 participants

DATA SCIENTISTS

ML TECH PROGRAM

Technical trainings

- Computer vision models
- Forecasting models
- Recommending systems
- Anomaly detection
- Predictive maintenance

Partnership and strategic collaborations

Collaboration: Building an enterprise data experts community

FERRARI DATA SCIENCE HUB

- Connect data analysts, ML engineers, and data scientists across all departments
- Networking and support
- Training and regular workshops

The role of data at Ferrari

Ferrari federated platforms and analytics tools

APPLICATIONS

BUSINESS INTELLIGENCE TOOLS

DATA SCIENCE LAB

Digital Manufacturing Platform

Vehicle Data Platform

Connected Car

Customer Data Platform & NBA

Digital Channels Analytics

aws

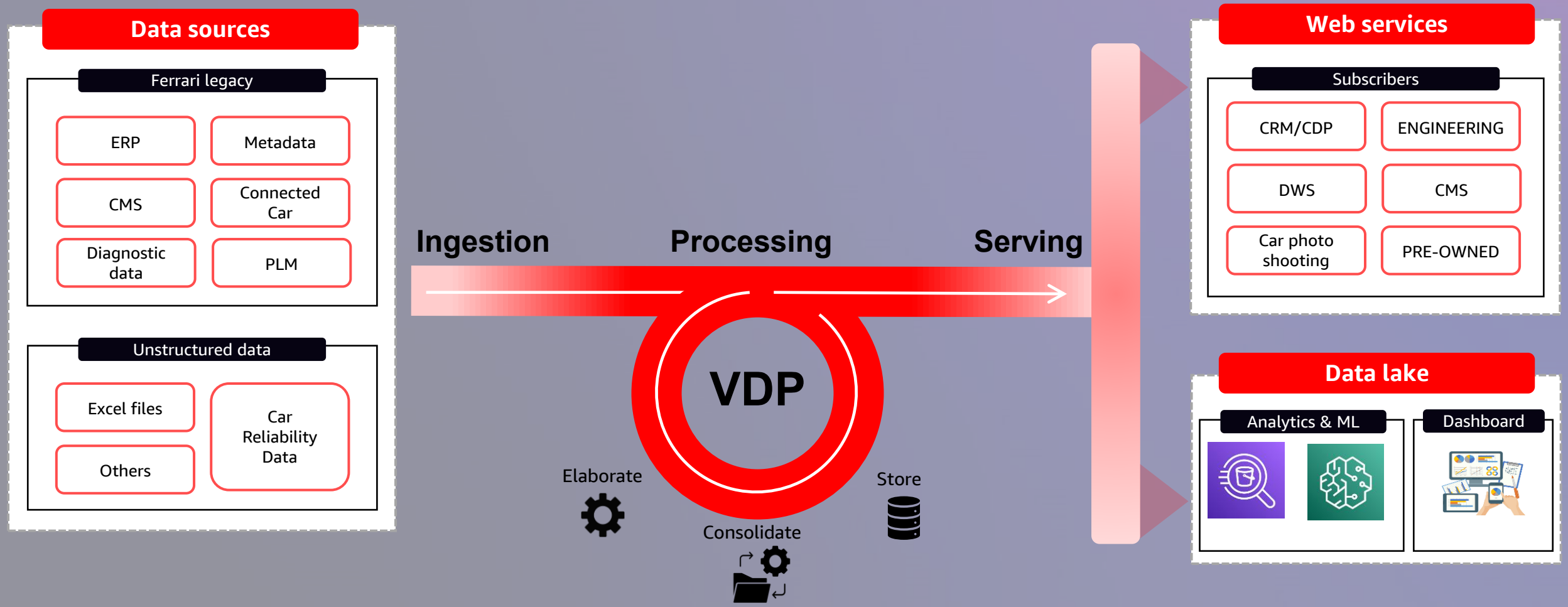
aws

DATA SOURCES

ERP HR PLM MES SAT CRM ...

IOT

Vehicle data platform infrastructure



The role of CAE at Ferrari

Why computer-aided engineering

Research & Development and Digital & Data Synergy

- Application support
- HPC support
- Enterprise architecture
- Operations & infrastructure

Enable engineers to virtually assess new car design and performance

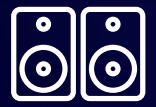
Business

CAE users

Optical simulation

FEM

CFD



Multibody

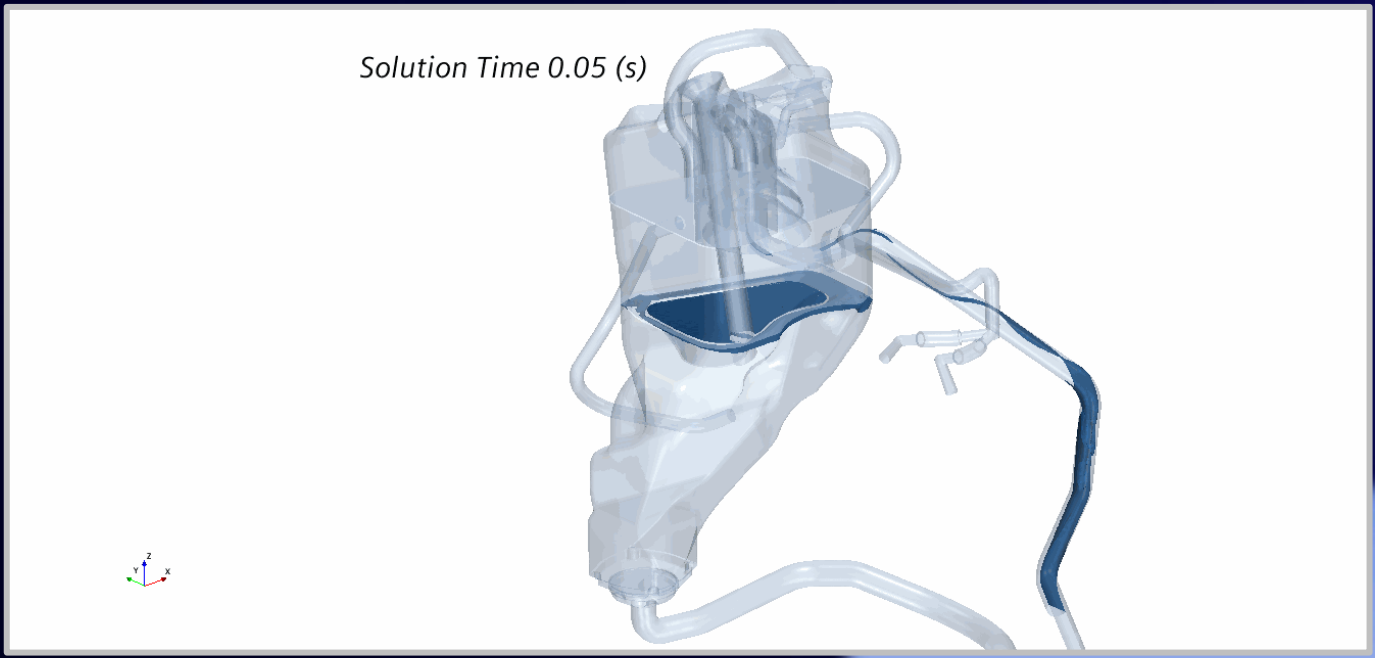
Electromagnetic simulation

Improve scalability for peak management

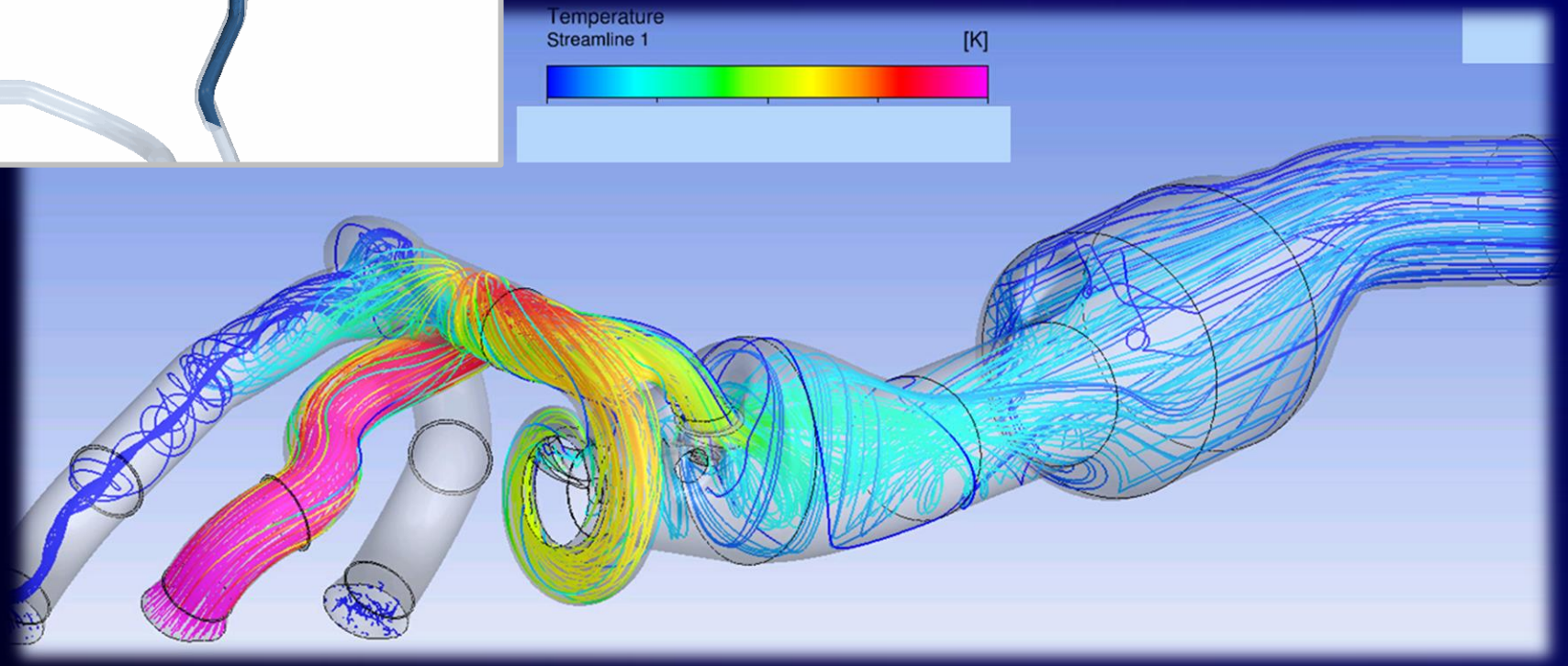
Reduce computational time

Enhance user experience

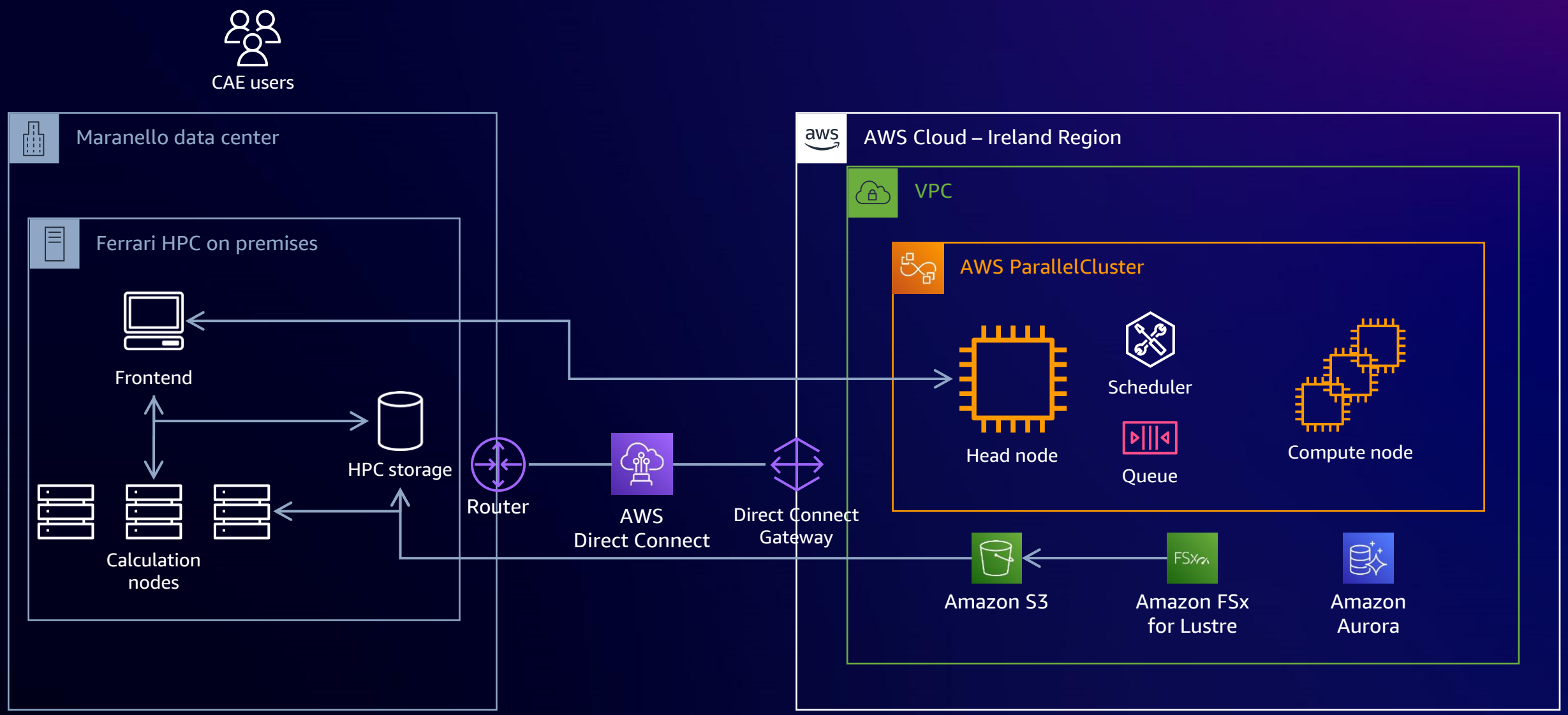
Virtual prototyping examples



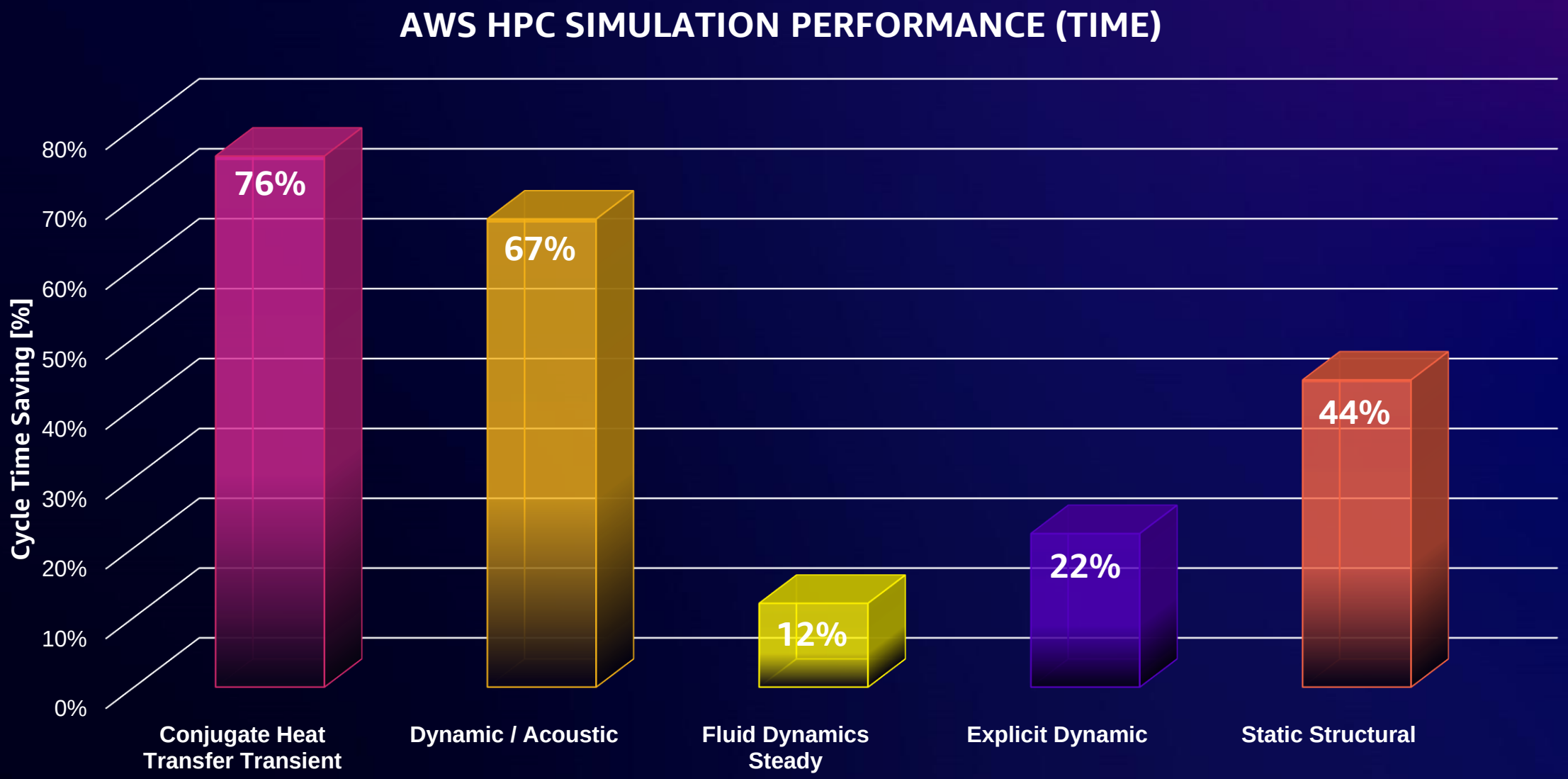
Simulations on cloud HPC
Structural
Computation fluid dynamics
Electronic/electromechanical/thermal simulation
Multiphysic simulation
Optical simulation



Ferrari HPC hybrid architecture

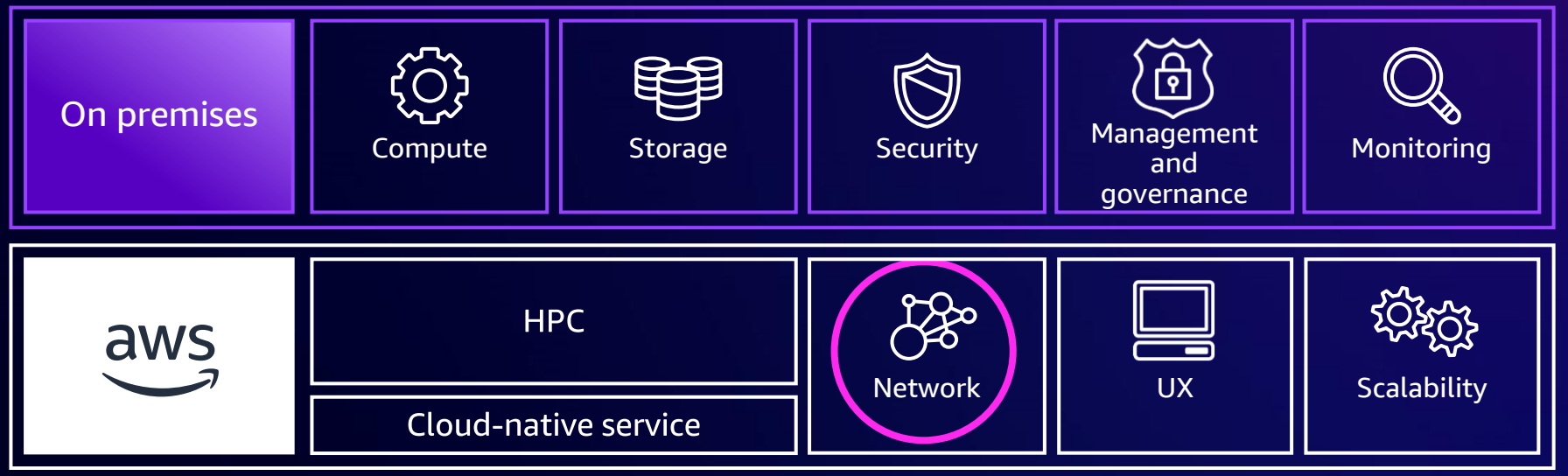


Benchmark results



Benchmark summary

Benchmark summary



Improvement

- 4x data transfer → Improved 75% of our use cases
- End user experience
- Scalability

Benchmark summary

Improvement

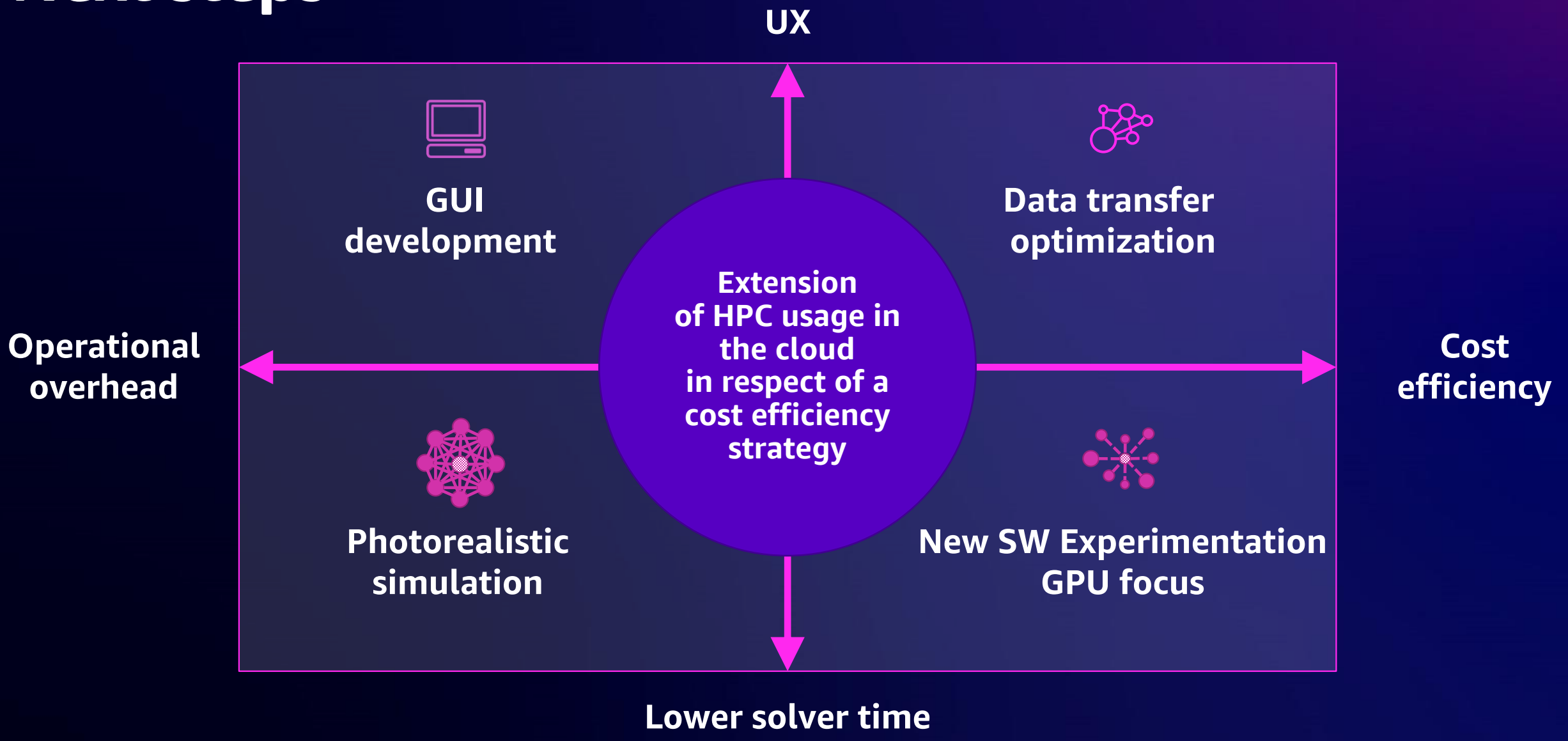
- 4x data transfer
- End user experience → Improved 91% of our use cases
- Scalability

Benchmark summary

Improvement

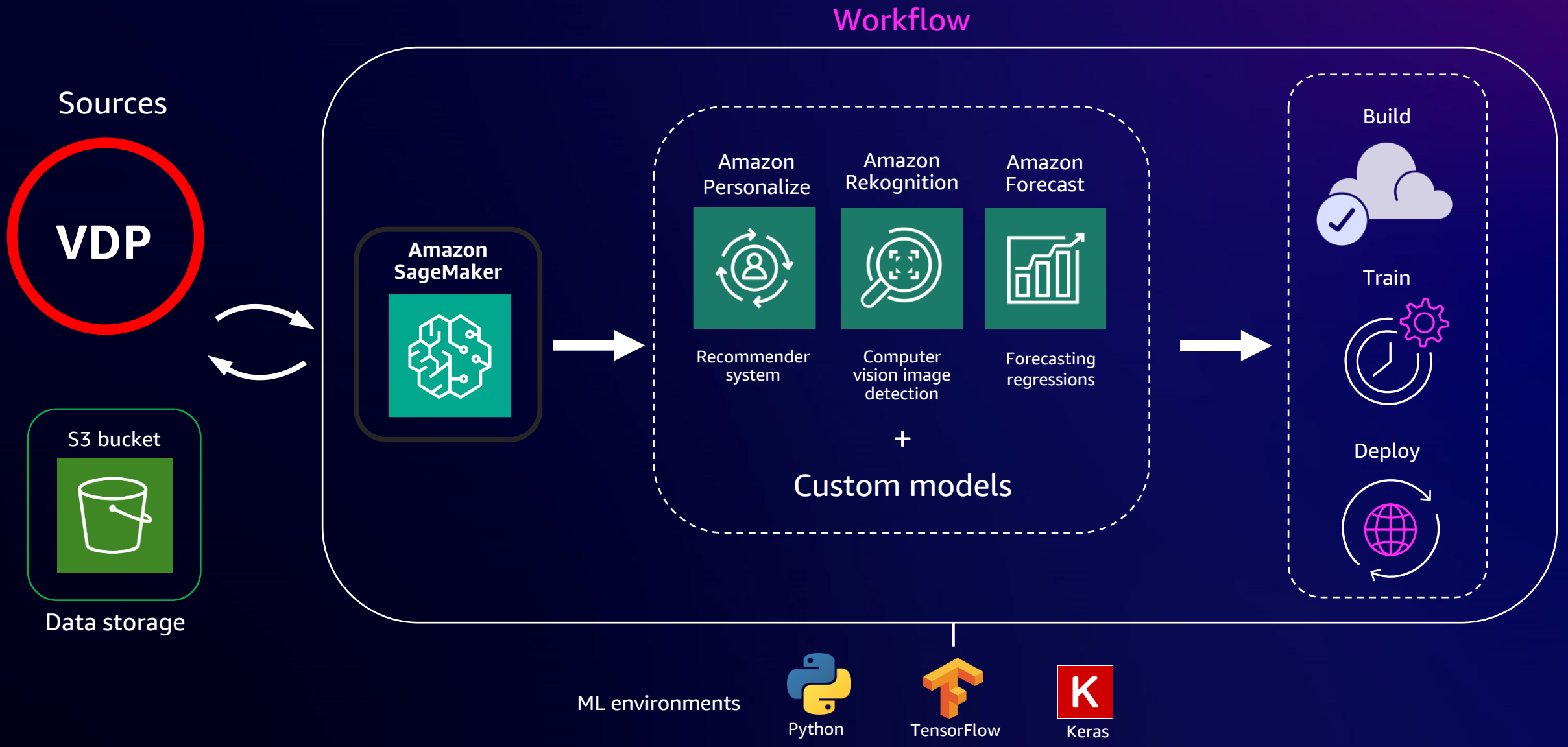
- 4x data transfer
- End user experience
- Scalability → Improved 100% of our use cases

Next steps



Ferrari machine learning use cases

Machine learning architecture

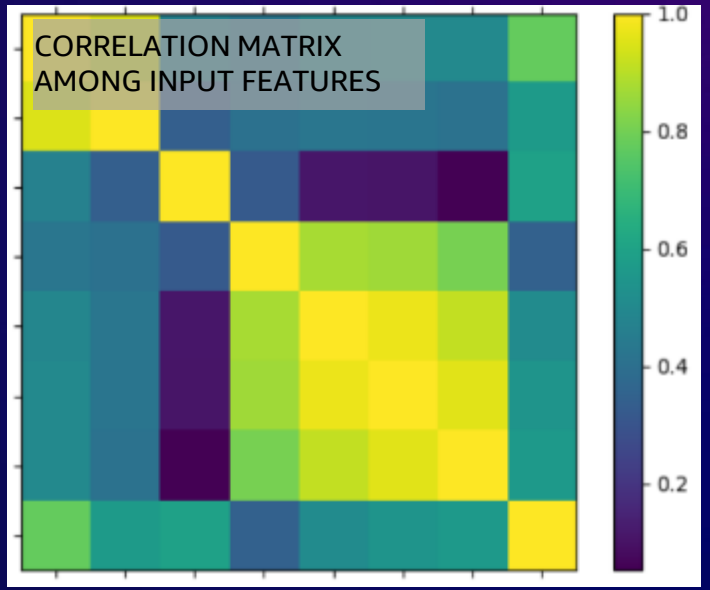


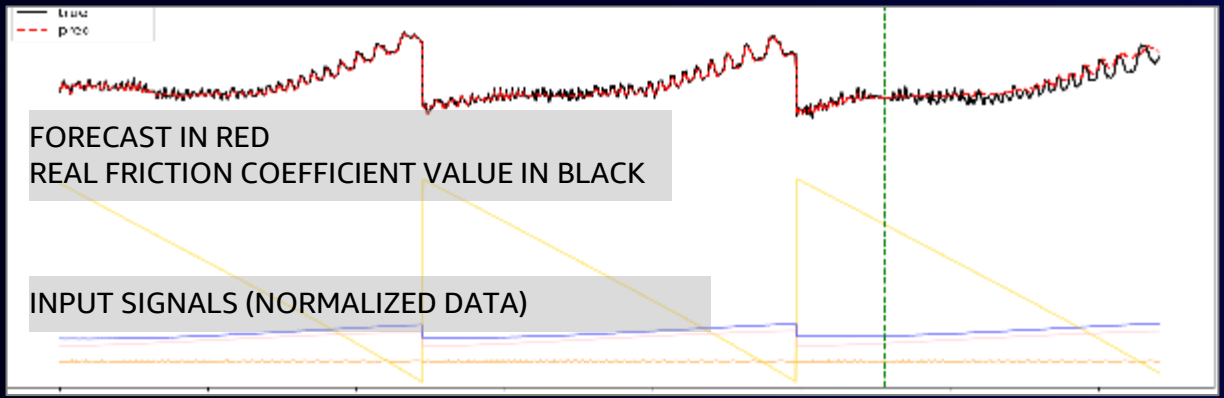
ML use case example: Friction coefficient forecast

Challenge: Estimate the friction coefficient between disk and pad to optimize the vehicle dynamics

Solution: An ML model built on test benchmark data that can be used as a vehicle control system

- Must deal with **50Hz sampled data**
- Must be suitable for **general vehicle usage**
- Simulation data useful to build a more robust model
- Must be **deployable on the vehicle**





Computer vision for content auto-labelling

Goal: Introduce an Automatic Tagger, with human supervision, to make unlabelled data from owned and earned media available for deeper analysis/indexing/consumption pipelines

CAR MODEL CLASSIFICATION

Car Model:
Ferrari Roma

Car Model:
Ferrari 458
Spider

Car Model:
Ferrari
Portofino

PIPELINE

Custom labels

Label detection

Face comparison

Celebrity recognition

OBJECT DETECTION

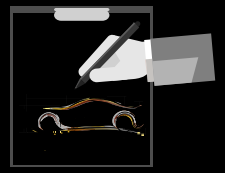
- Cars: **6**
- People: **6**
- Settings: **OUTDOOR**
- …

Generative AI: A potential game changer

EXPERIMENTAL PHASE: LEVERAGE GENERATIVE AI TO CREATE WEIGHT- AND COST-OPTIMIZED PARTS

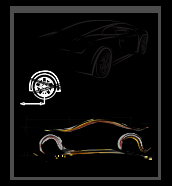
Traditional approach

Part design **takes weeks** based on **multiple iterative design and testing cycles conducted by engineers.** No foundation models can currently perform this task. Algorithms available based on reinforcement learning.



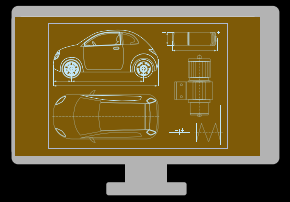
Design

Testing



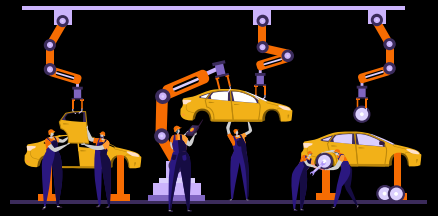
Adaptation

Generative AI approach



Algorithm creates several models and automatically tests them against constraints

Best designs are further evolved **until absolute best is found**



Engineers review results and finalize the shape for production and physical testing

Value at stake of generative AI

2–3x quicker design process of complex parts, accelerating overall product development process

Autodesk

Heather Kerrick
(she/her)
Senior Manager, Fusion Machine Learning
Autodesk

Our software helps innovators design, build, and manufacture like never before

Our industries

Architecture, engineering, and construction

Manufacturing

Media and entertainment

Our company

Founded
1982

Headquarters
San Francisco, CA

Employees (2023)
13,700+ worldwide

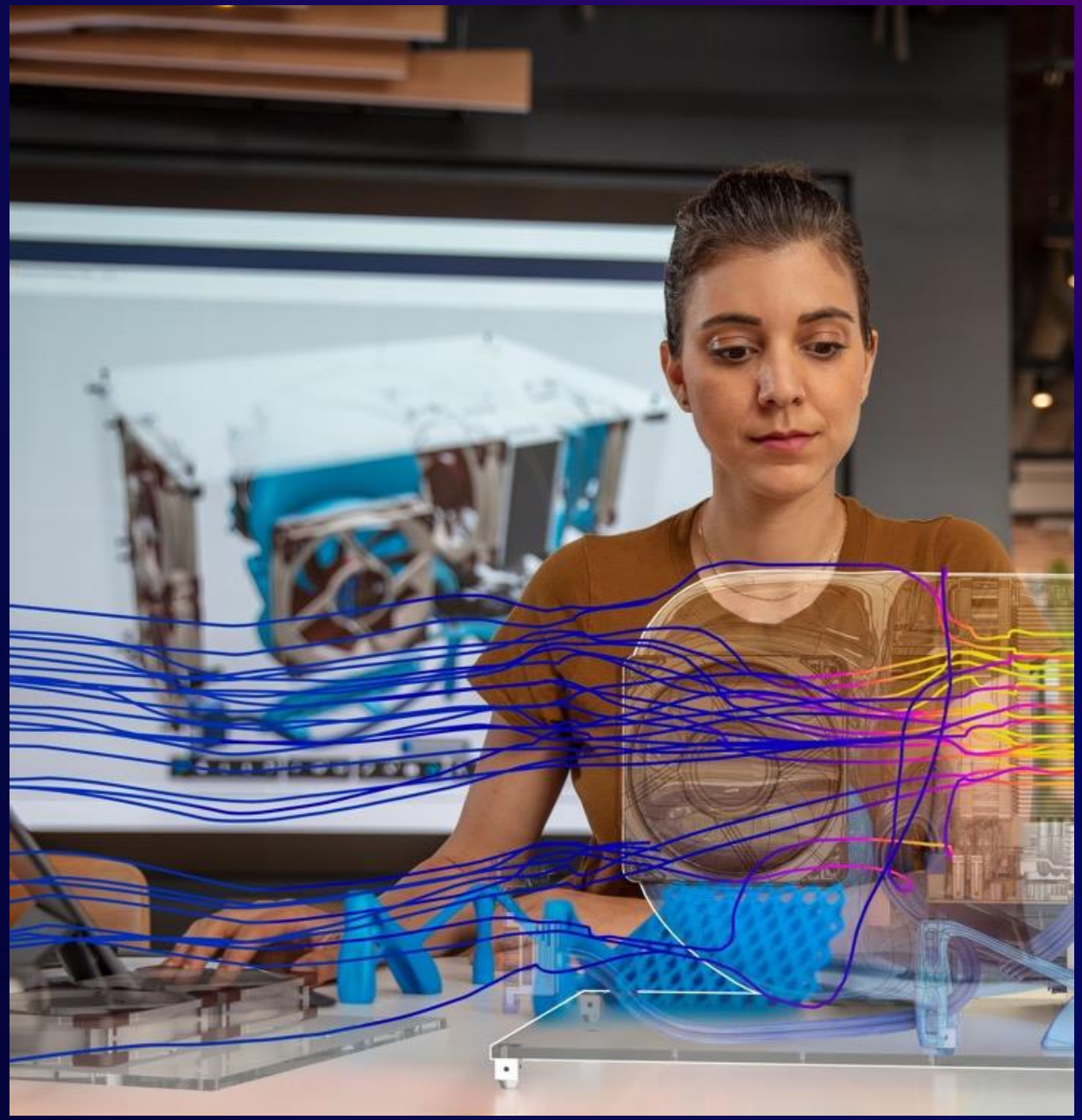
In FY23*

$5.01B
Total revenue
(up 14% year on year)

6.74M
Total subscribers
(up 11.6% year on year)

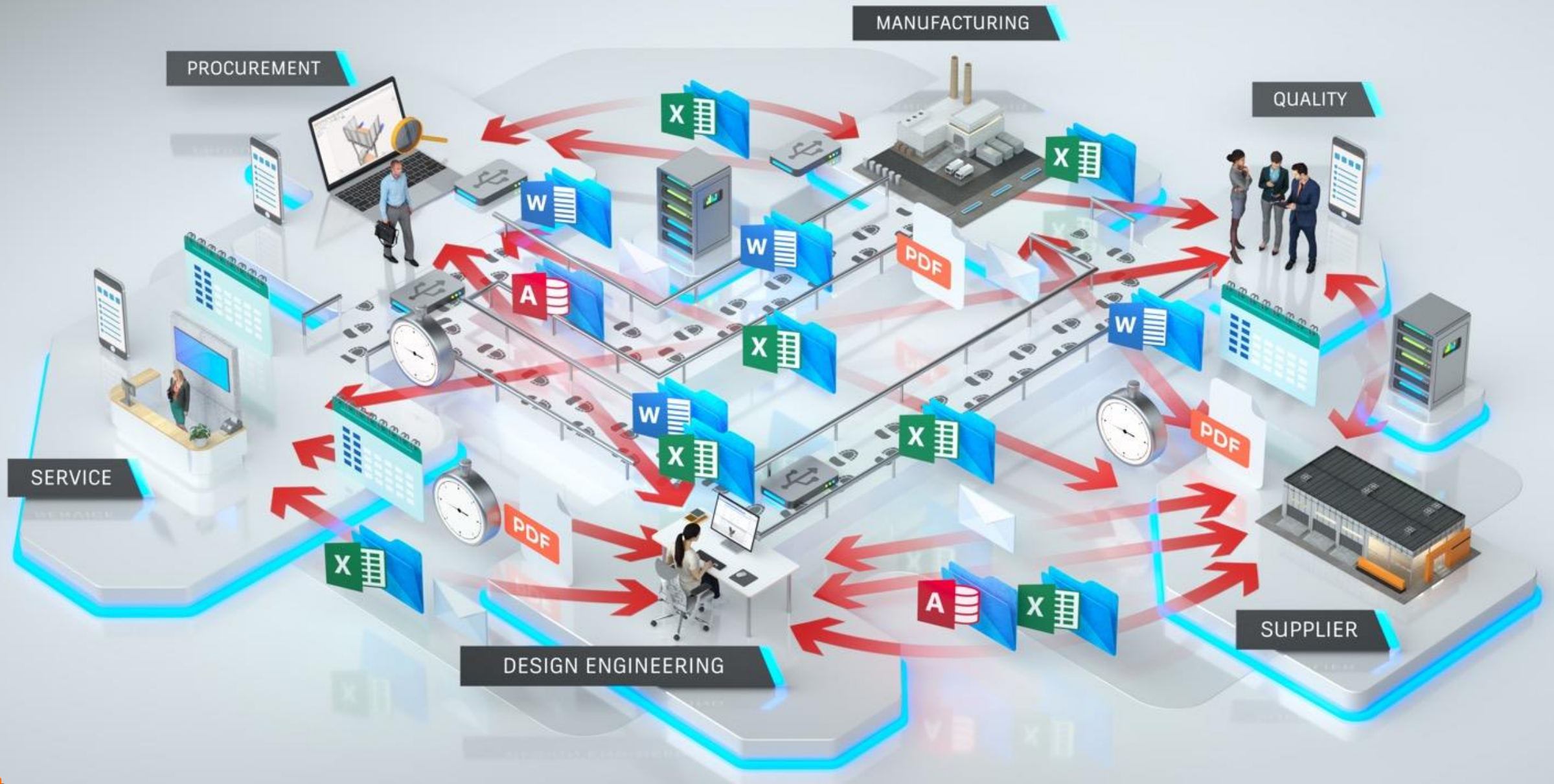
$1.2B
R&D investment
(20% of net revenue)

**Figures are from our fiscal year 2023, which began February 1, 2022 and ended January 31, 2023.*



Autodesk is changing how the world is designed and made


Increase size of wheel. Please design a new fender for the larger wheel
Fusion


MANUFACTURING
PROCUREMENT
QUALITY
SERVICE
DESIGN ENGINEERING
SUPPLIER
X
W
A
PDF

Developer Requirements

High performance

Secure

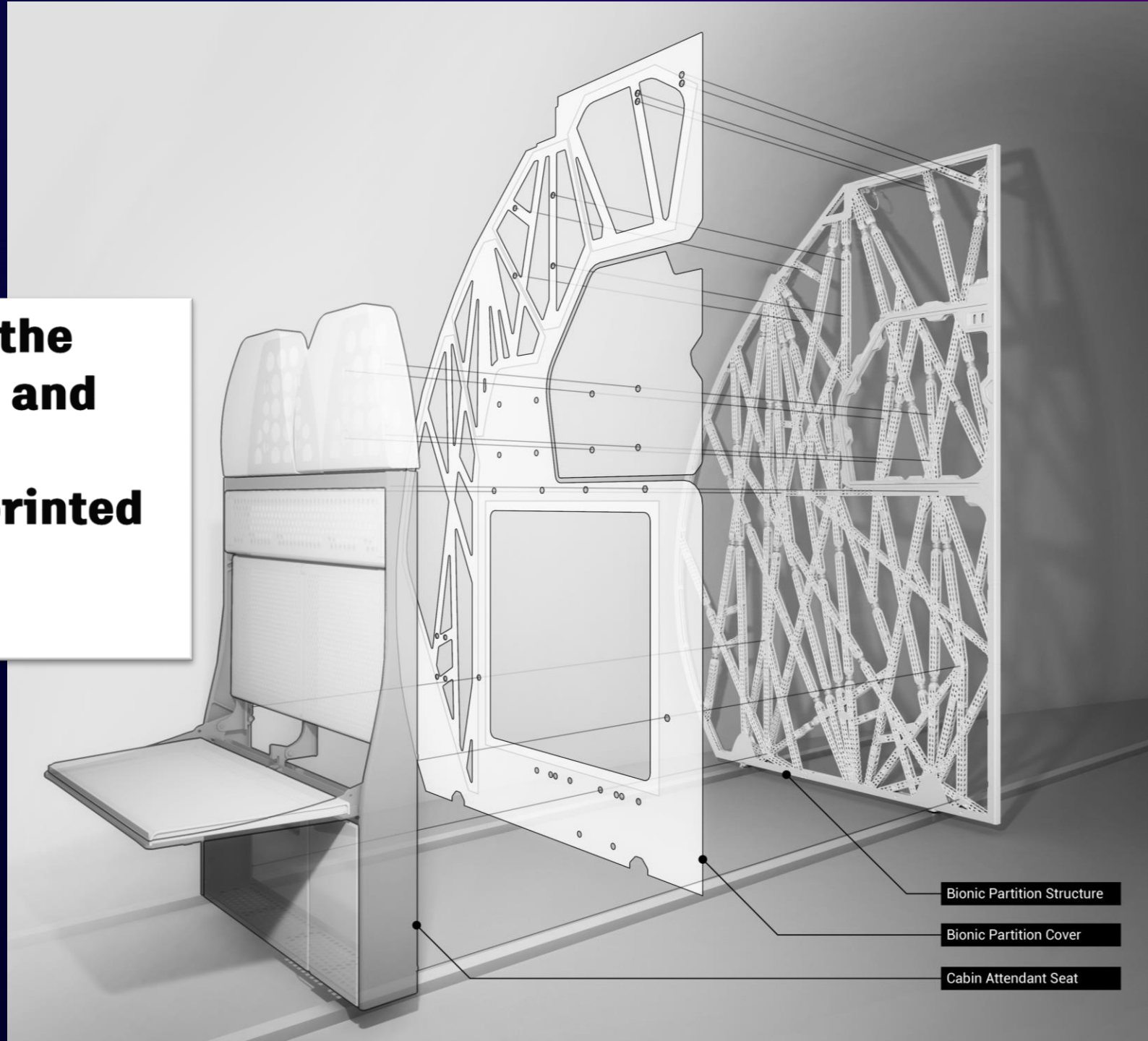
Reliable

Flexible

Scalable

Autodesk and Airbus show the future of aerospace design and manufacture in pioneering generatively designed 3D printed partition

1 DEC 2015



AUTODESK.

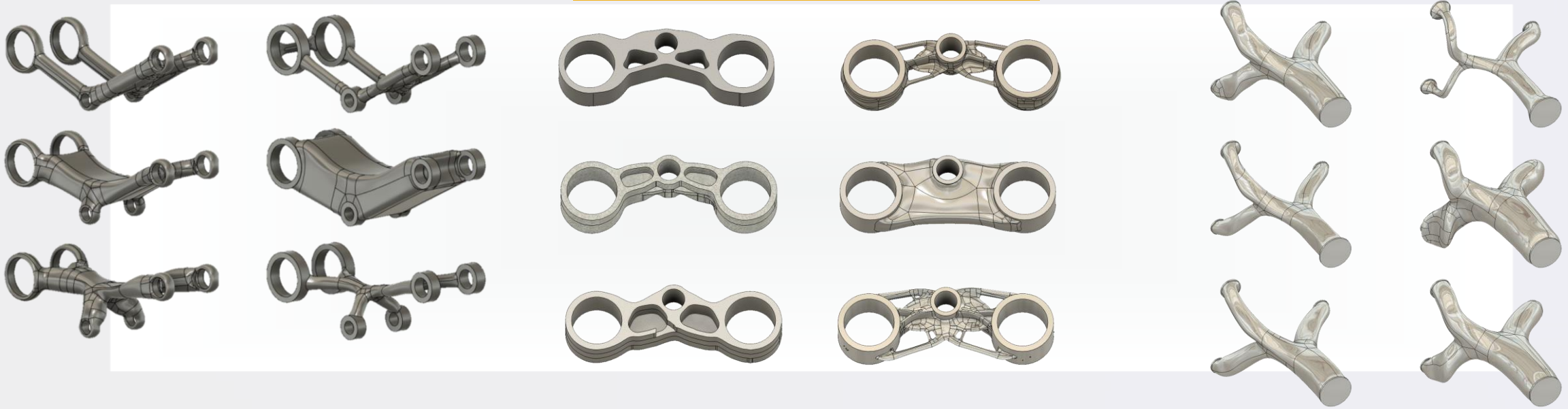
Multiple generative design technologies

DIFFERENT TOOLS FOR DIFFERENT OBJECTIVES

Form and function exploration with Automated Modeling

Generative design for structural components

Generative design for fluid paths



Multiple manufacturing methods

MANUFACTURING-READY DESIGN

Additive manufacturing	Die casting	3 & 5 axis milling	2.5 axis milling	2 axis cutting
				

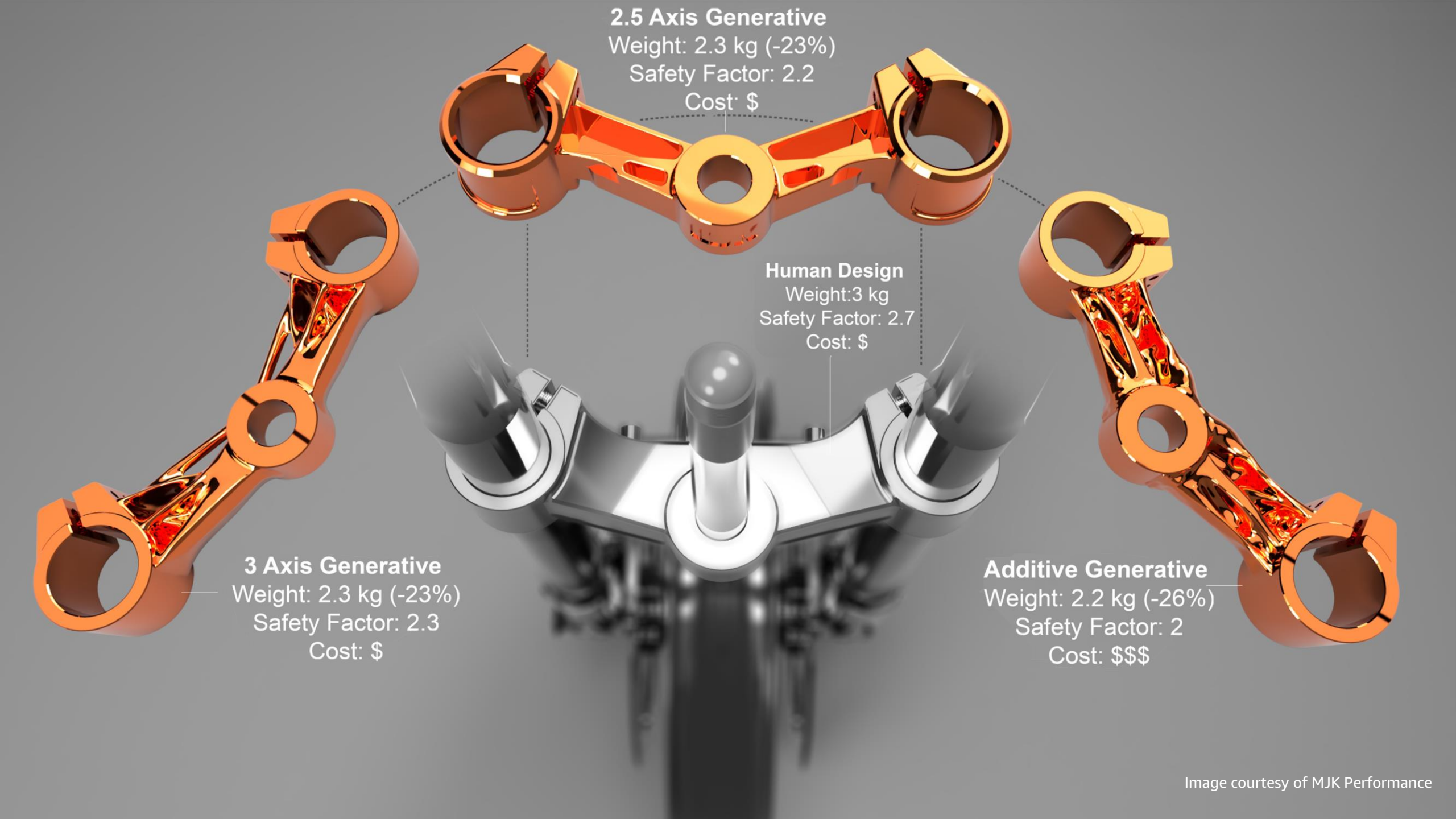
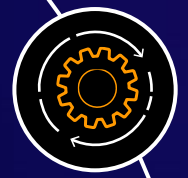


Image courtesy of MJK Performance

Performance Improvements Summary

GENERATIVE DESIGN FOR STRUCTURAL COMPONENTS

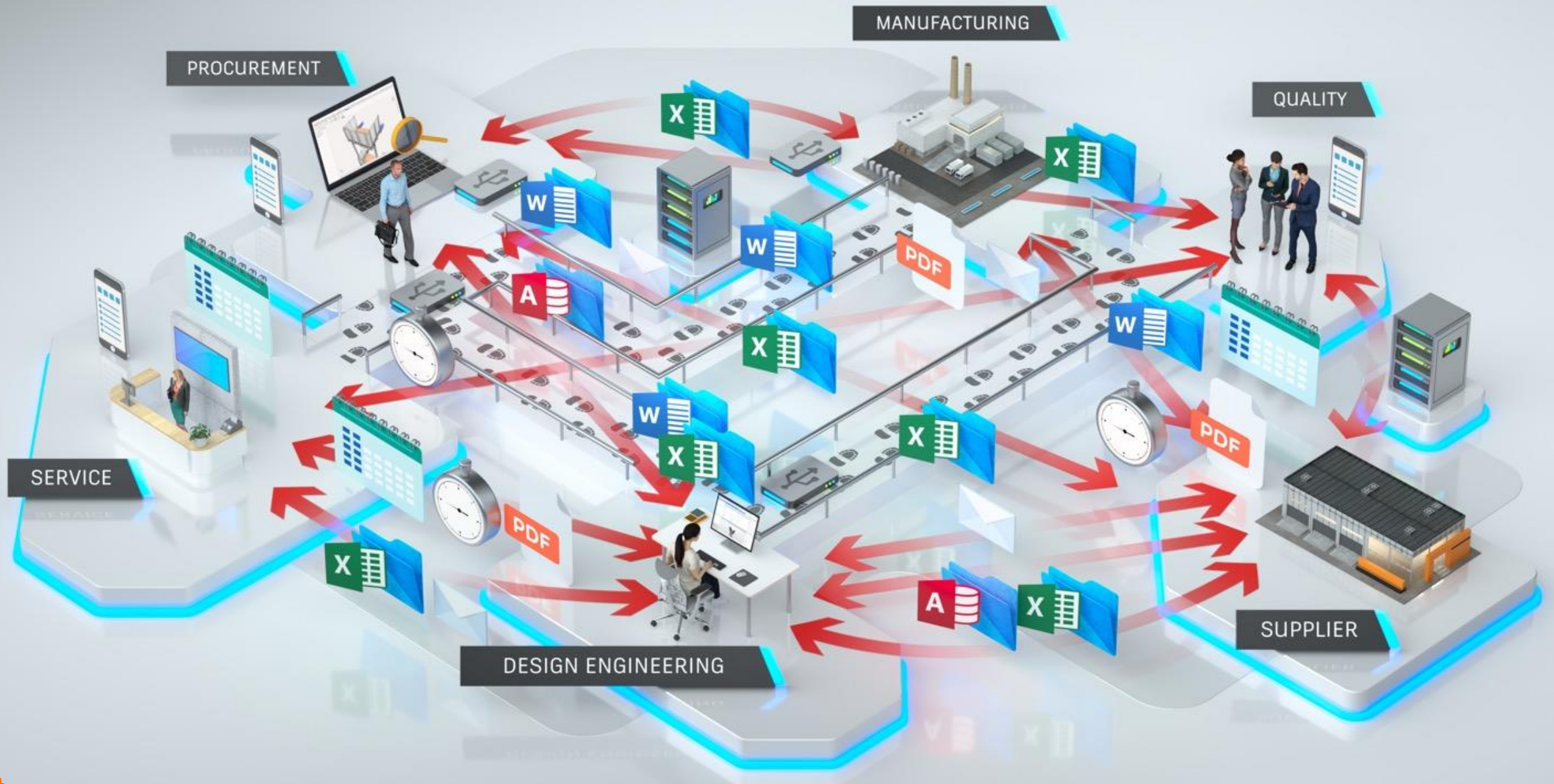


1.7x
Faster solve times

6
fully supported MFG Methods

22%
increase in converged studies

50%
reductions in failed studies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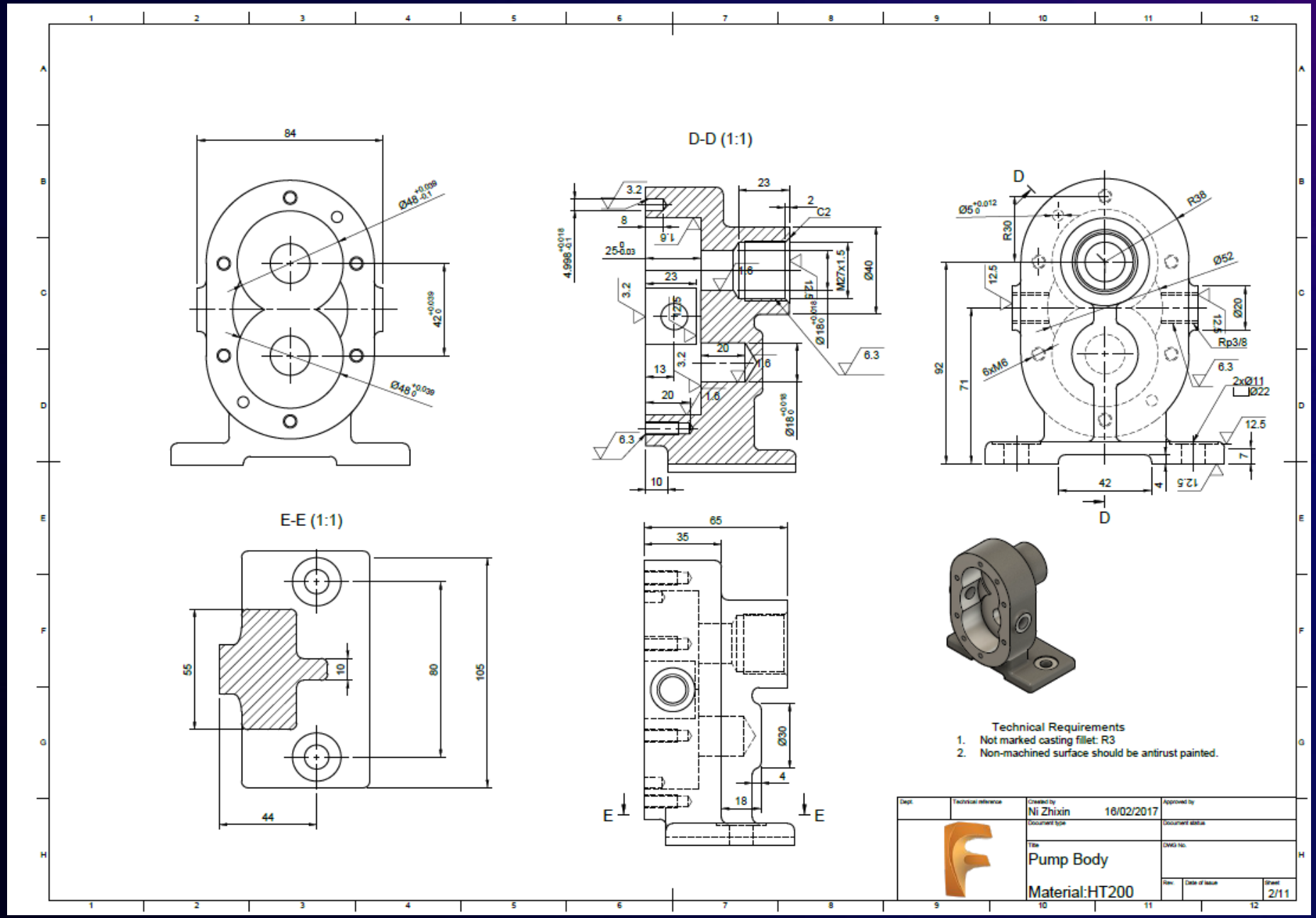


ABC-Table-BG v1 v8 v5

ABC-Table-BG v1 v8 Drawing v2*

DESIGN

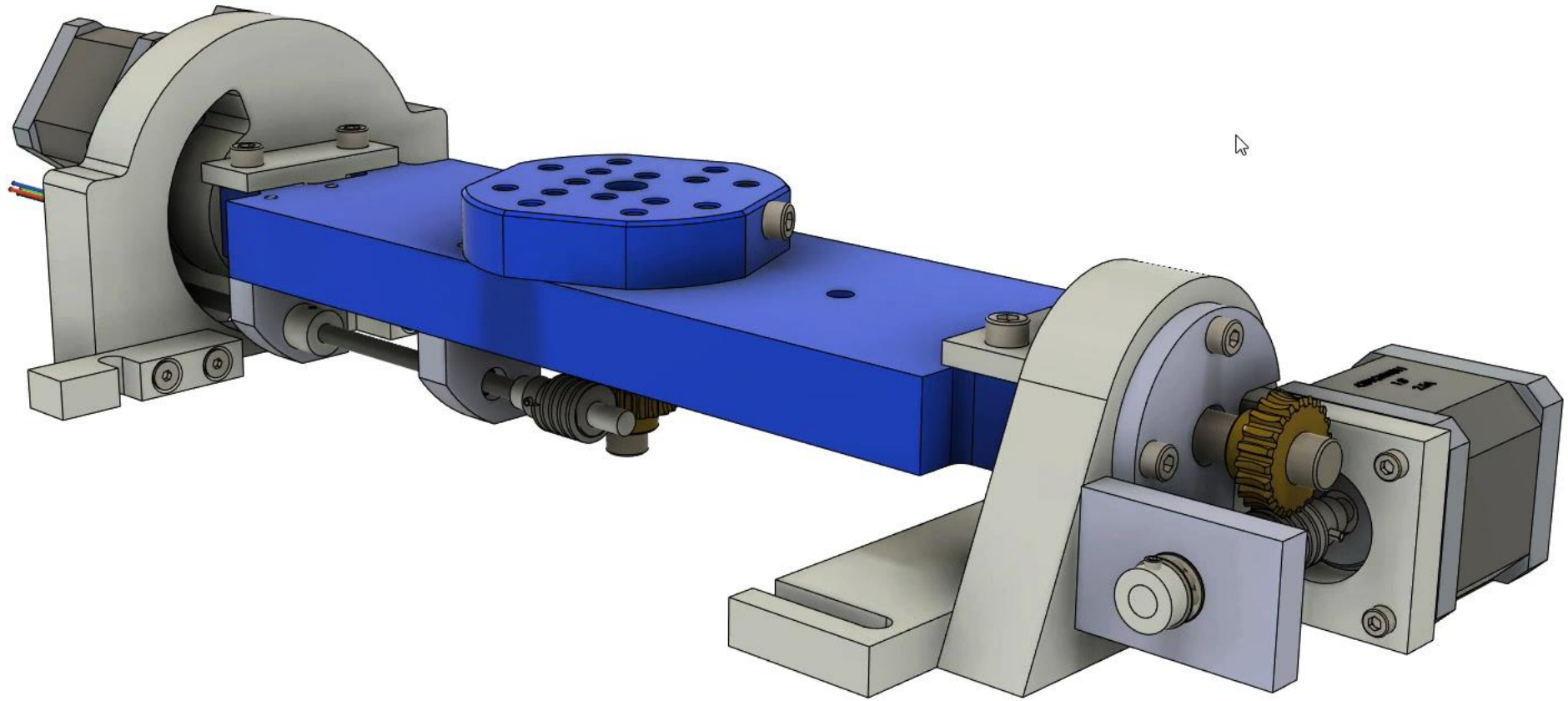
SOLID SURFACE MESH FORM SHEET METAL PLASTIC UTILITIES MANAGE

CREATE AUTOMATE MODIFY ASSEMBLE CONFIGURE CONSTRUCT INSPECT INSERT SELECT

BROWSER

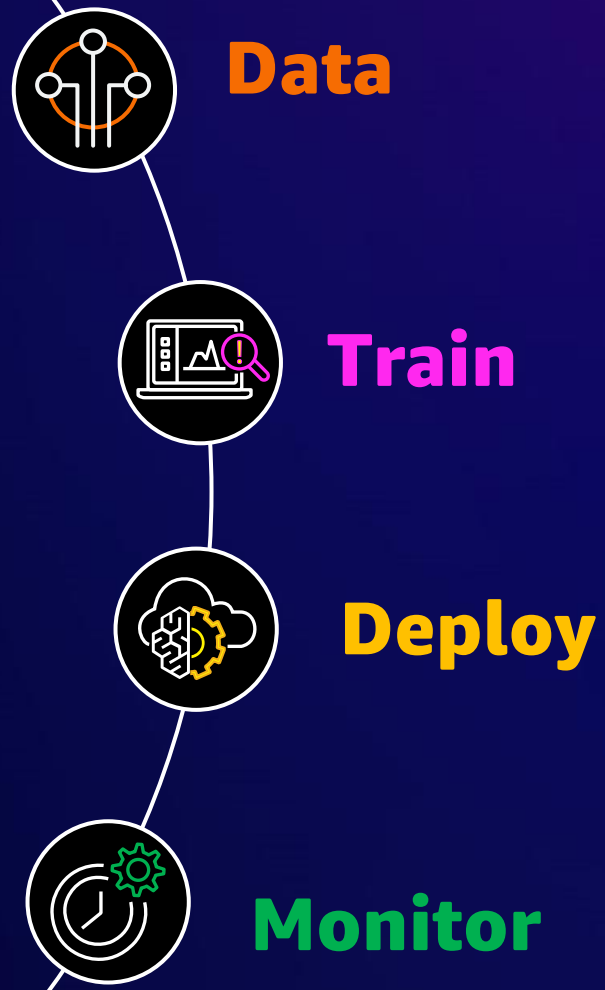
- ABC-Table-BG v1 v8 v5
  - Document Settings
  - Named Views
  - Origin
  - AAchseBG:1
  - TischACHalterL:1
  - TischACHalterR:1
  - CAchseBG:1
    - Origin
    - CWelle:1
    - AufspannPlatte:1
    - Stellring:1
    - socket head cap screw_din_D...
    - socket set screw cone point_d...
    - 320_007_00_schneckenraeder...
  - SAntriebA Gear:1
    - Origin
    - Screw Motor:1
    - NemaHalterL:1
    - socket head cap screw_din_D...
    - socket head cap screw_din_D...
    - socket head cap screw_din_D...
    - socket head cap screw_din_D...
    - socket head cap screw_din_D...
    - socket head cap screw_din_D...
    - socket head cap screw_din_D...
    - 320_107_00_schnecken_a_17...
    - AxialLager13x6x5 bearing:1
    - AxialLager13x6x5 bearing:2
    - StellRing6:1
    - StellRing6:2
    - AAntriebsWelleZapfen:1
    - LagerHalterA:1
    - socket head cap screw_din_D...
    - socket head cap screw_din_D...
    - socket set screw cone point_d...

COMMENTS



Autodesk Machine Learning Platform

ENABLE MACHINE LEARNING
DEVELOPMENT AND DEPLOYMENT



THE PLATFORM

Help engineers and researchers leverage data; develop and train new models; deploy, monitor and retrain models in production

Autodesk Machine Learning Platform

THE VALUE

- Off-the-shelf ML models easier to use
- Access to increasingly powerful compute
- Train without copying data
- Control what data is where & who has access

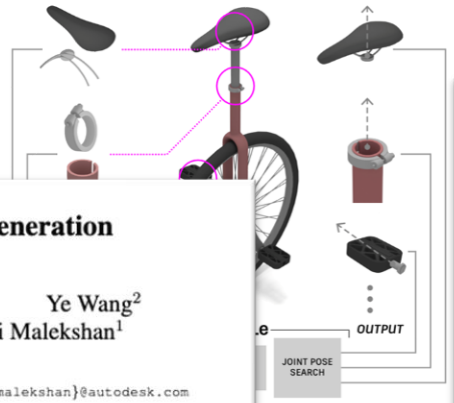
Advancing the state of the art

JoinABLe: Learning Bottom-up Assembly of Parametric CAD Joints

Karl D.D. Willis[1] Pradeep Kumar Jayaraman[1] Hang Chu[1] Yunsheng Tian[2] Yifei Li[2]
Daniele Grandi [1] Aditya Sanghi[1] Linh Tran[1] Joseph G. Lambourne[1]
Armando Solar-Lezama[2] Wojciech Matusik[2]
[1]Autodesk Research [2]MIT CSAIL

Abstract

Physical products are often complex assemblies combining a multitude of 3D parts modeled in computer-aided design (CAD) software. CAD designers build up these assemblies by aligning individual parts to one another using constraints called joints. In this paper we introduce JoinABLe,



BRepNet: A topological message passing system for solid models

Joseph G. Lambourne
Autodesk Research

Karl D.D. Willis
Autodesk Research

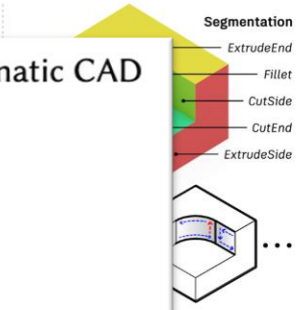
Pradeep Kumar Jayaraman
Autodesk Research

Aditya Sanghi
Autodesk Research

Peter Meltzer
UCL, Computer Science

Hooman Shayani
Autodesk Research

Abstract



CLIP-Forge: Towards Zero-Shot Text-to-Shape Generation

Aditya Sanghi[1] Hang Chu[1] Joseph G. Lambourne[1] Ye Wang[2]
Chin-Yi Cheng[1] Marco Fumero[1] Kamal Rahimi Malekshan[1]
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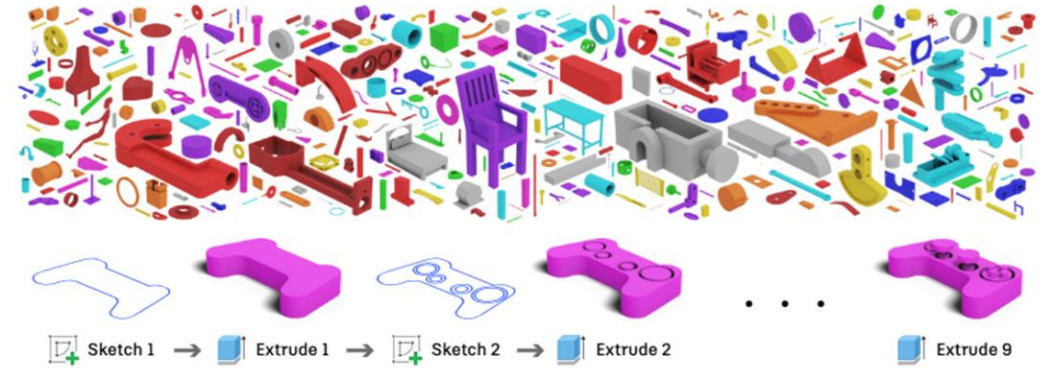
Fusion 360 Gallery: A Dataset and Environment for Programmatic CAD Construction from Human Design Sequences

KARL D.D. WILLIS, Autodesk Research, USA
YEWEN PU, Autodesk Research, USA
JIELIANG LUO, Autodesk Research, USA
HANG CHU, Autodesk Research, Canada
TAO DU, Massachusetts Institute of Technology, USA
JOSEPH G. LAMBOURNE, Autodesk Research, United Kingdom
ARMANDO SOLAR-LEZAMA, Massachusetts Institute of Technology, USA
WOJCIECH MATUSIK, Massachusetts Institute of Technology, USA




Generative AI

AUTODESK Kia Inspiration Wheel Designer

Concept Generator

Concept

Dynamic

ADD NEW CONCEPT

AUTODESK Kia Inspiration Wheel Designer

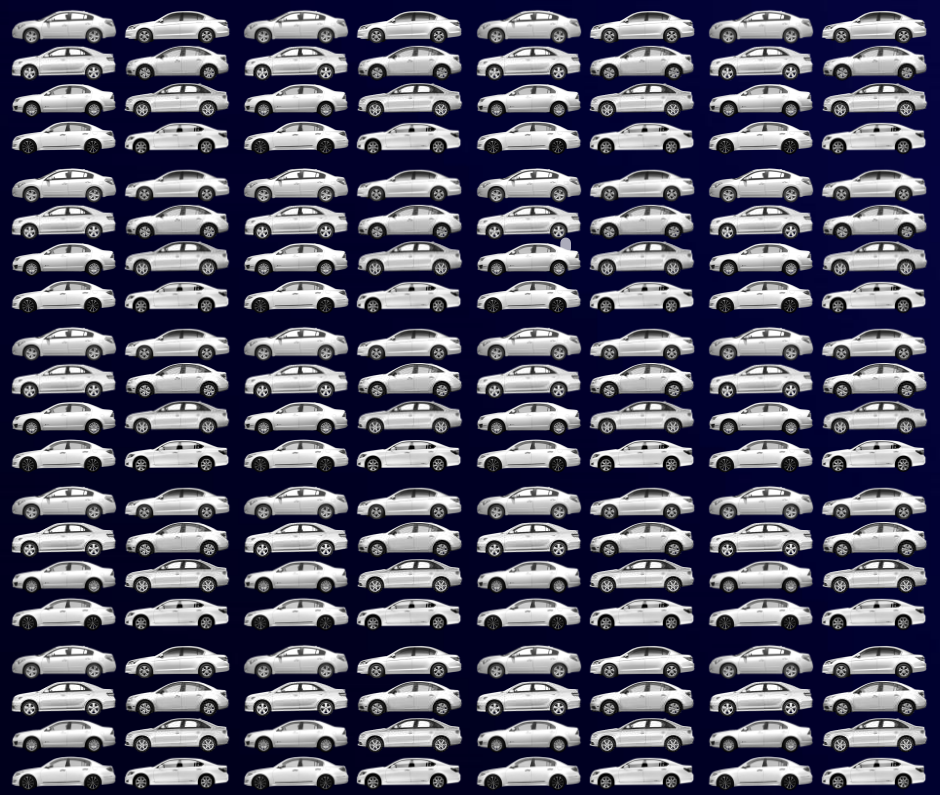
Designs

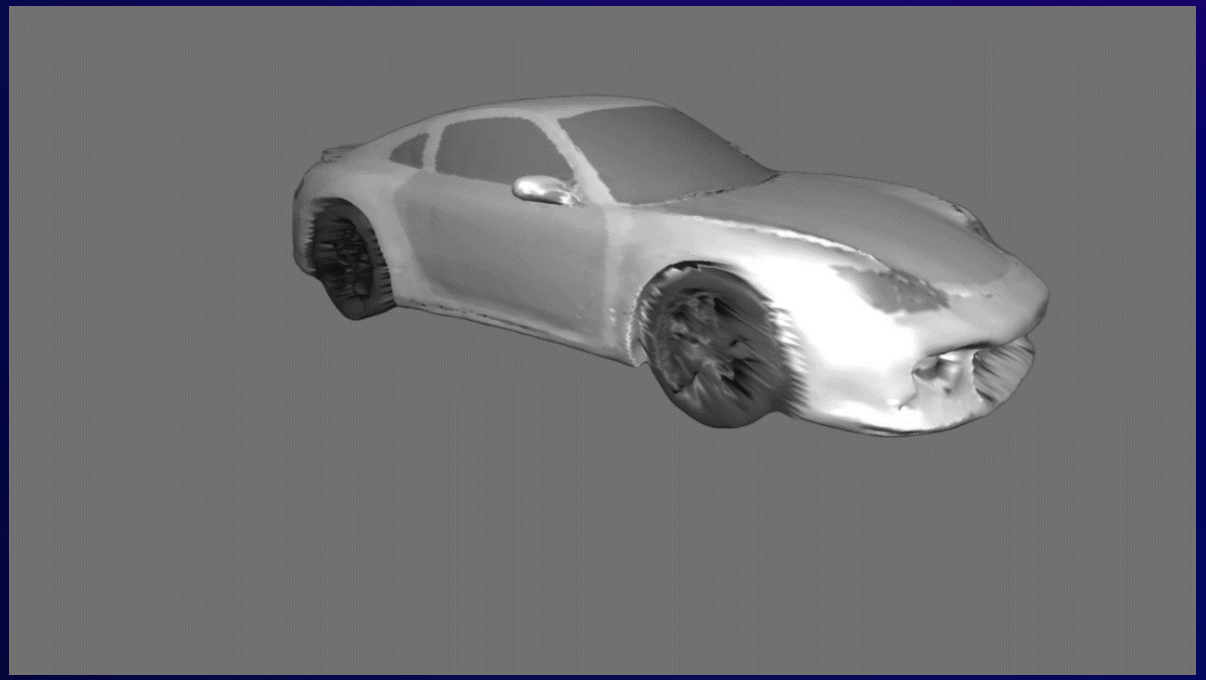
3D

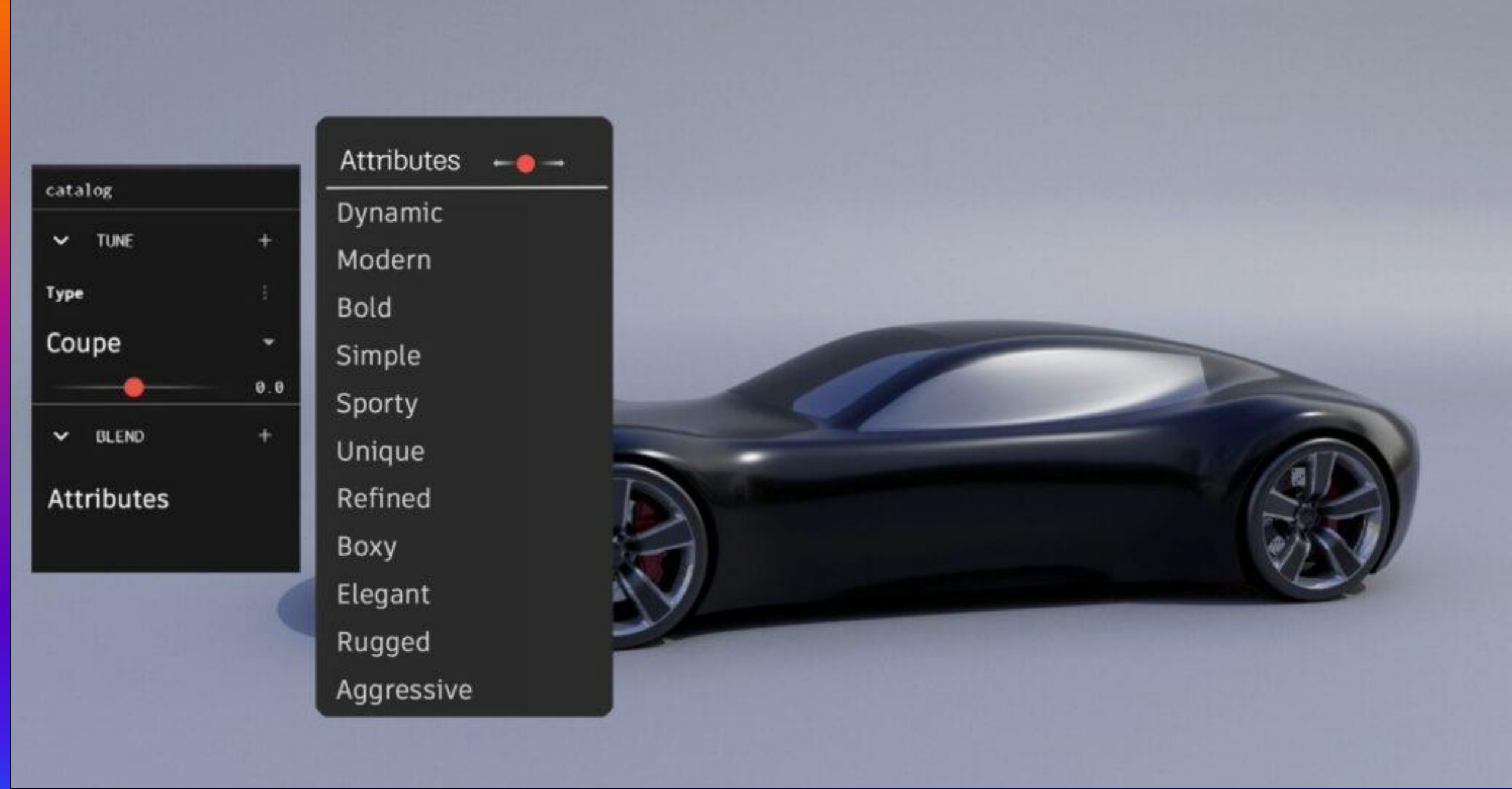
3D

3D

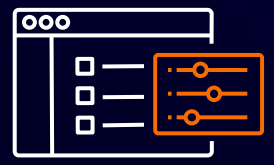
Blank AI





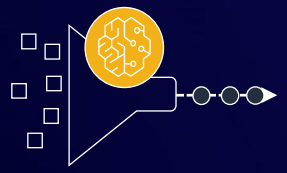


Accelerating product engineering and development with AWS



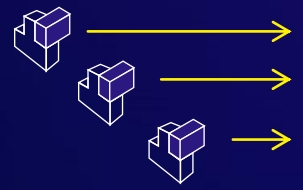
Time to market

Reduce time to market through effective digital thread throughout value-chain and across enterprises



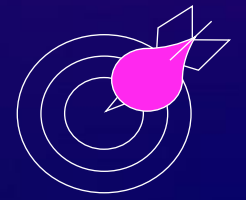
Innovation pipeline

Increased ability to iterate on alternatives through efficient digitalization and smart digital validation



Product and engineering capacity

Improved throughput through collaborative engineering, knowledge reuse, effective digital thread



Quality, iteration, and rework

Reduce design iterations through cross-functional collaboration and new technologies like AI/ML

Thank you!

Please complete the session survey in the mobile app

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