



INDIA | MAY 25, 2023

# HPC on AWS - Solving complex problems with pay-as-you-go infrastructure

Sandeep Sovani, Ph.D.

Global Head of GTM for Engineering Simulation  
AWS

Gopal Musale

Regional Manager, Cae Coe  
Tata Technologies Limited

# HPC is all around us

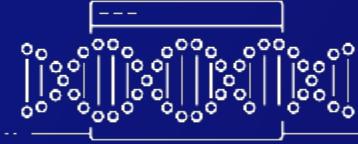
## HIGH PERFORMANCE COMPUTING (HPC)



Build designs faster with computational fluid dynamics (CFD) simulations



Fast-track drug discovery and structure-based drug design



Advance genomics insights using predictive, real-time, or retrospective data applications



Run geoscientific simulations and seismic processing and iterate models faster



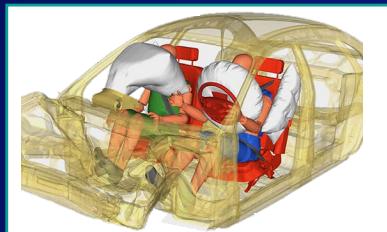
Conduct grid-computing simulations and identify portfolio risks and hedging opportunities



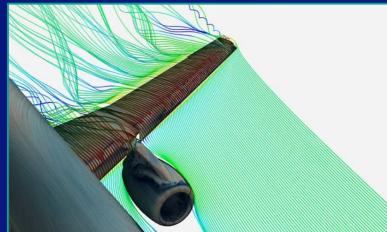
Process complex workloads and analyze massive data pipelines to further research

# Simulation is at the core of product engineering

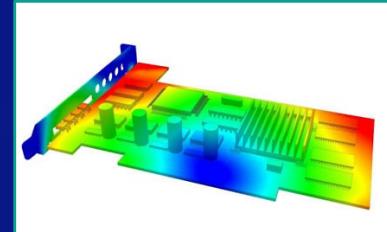
ALL MAJOR INDUSTRIES RELY ON SIMULATION



Crash<sup>1</sup>



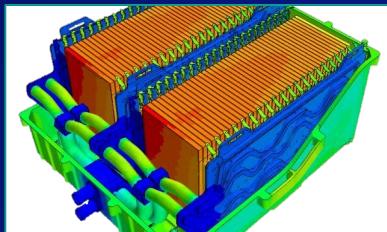
Aerodynamics<sup>3</sup>



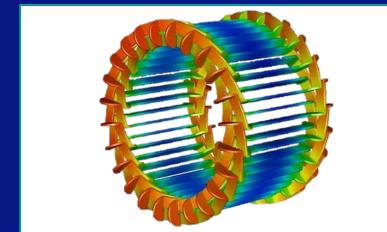
Thermal/Cooling<sup>3</sup>



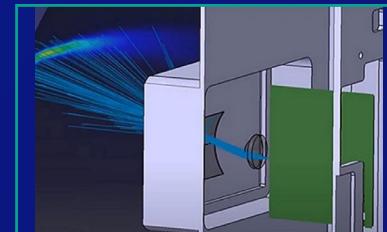
Engine<sup>1</sup>



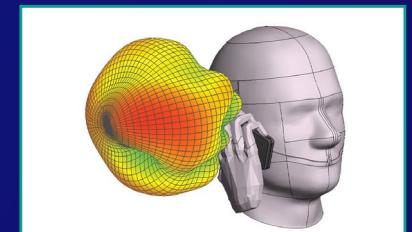
Battery<sup>2</sup>



Electric Motor<sup>3</sup>



Sensors<sup>3</sup>

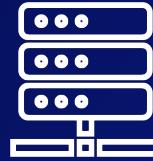


Antennas<sup>1</sup>

Images from AWS Partners:

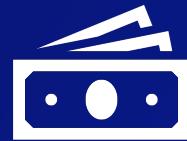
1. [www.altair.com](http://www.altair.com)
2. [www.plm.automation.siemens.com](http://www.plm.automation.siemens.com)
3. [www.ansys.com](http://www.ansys.com)

# 8 benefits of the cloud for engineering simulation



## Massive Capacity

No waiting; Higher Productivity



## Pay Per Use

Business Flexibility



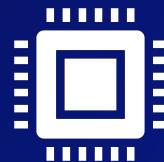
## Elasticity

Business Agility



## Economy of Scale

Lower TCO



## Latest Technology

Best ROI on Software Licenses



## Disaster Resilience

Business Continuity



## Global Presence

Enable Your Global Team



## Sustainability

Achieve Sustainability Goals

**“For every \$1 spent on HPC, businesses see \$507 in incremental revenues and \$47 in incremental profit.”**

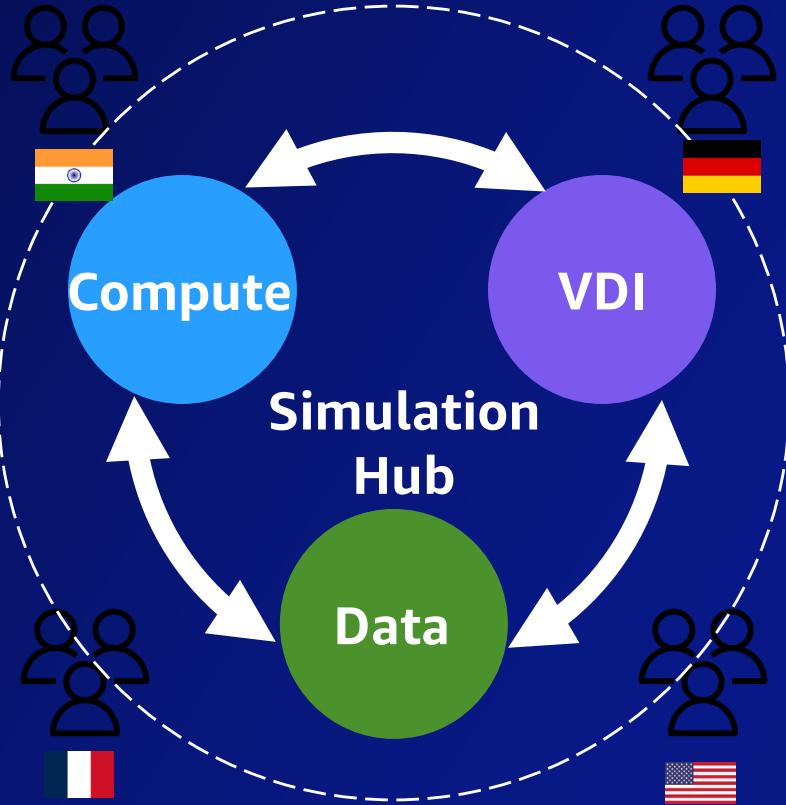
**Hyperion ROI Study**

(<http://www.hyperionresearch.com/roi-with-hpc/>)

# AWS: Best HPC cloud platform for 5 years running



# Build your simulation hub on AWS

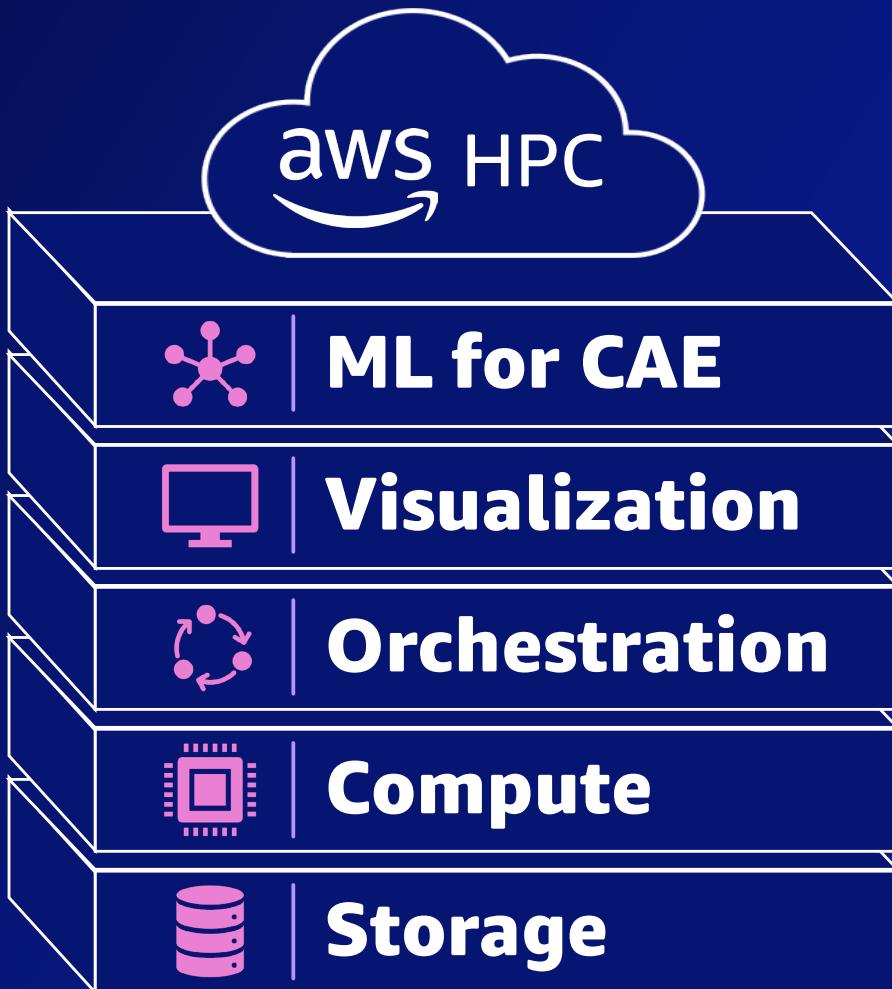


**200+ Fully Managed Services, 1000's of Features**

- |  |  |  |
|--|--|--|
| <input checked="" type="checkbox"/> Servers (600+ Types)   | <input checked="" type="checkbox"/> Cluster Orchestration  | <input checked="" type="checkbox"/> WAN Connections        |
| <input checked="" type="checkbox"/> Graphics Servers       | <input checked="" type="checkbox"/> Job Scheduling         | <input checked="" type="checkbox"/> VPC                    |
| <input checked="" type="checkbox"/> Gigabit Interconnect   | <input checked="" type="checkbox"/> HPC Web Interface      | <input checked="" type="checkbox"/> Subnets                |
| <input checked="" type="checkbox"/> Machine Images         | <input checked="" type="checkbox"/> Visualization Service  | <input checked="" type="checkbox"/> Route Tables           |
| <input checked="" type="checkbox"/> Serverless Apps        | <input checked="" type="checkbox"/> Application Streaming  | <input checked="" type="checkbox"/> NAT Gateways           |
| <input checked="" type="checkbox"/> Infrastructure as Code | <input checked="" type="checkbox"/> Work Spaces            | <input checked="" type="checkbox"/> Internet Gateways      |
| <input checked="" type="checkbox"/> Auto Scaling           | <input checked="" type="checkbox"/> Block Storage          | <input checked="" type="checkbox"/> Transit Gateways       |
| <input checked="" type="checkbox"/> Auto Formation         | <input checked="" type="checkbox"/> Object Storage         | <input checked="" type="checkbox"/> Access Control Lists   |
| <input checked="" type="checkbox"/> Activity Tracking      | <input checked="" type="checkbox"/> File System            | <input checked="" type="checkbox"/> Security Groups        |
| <input checked="" type="checkbox"/> Resource Monitoring    | <input checked="" type="checkbox"/> High Perf. File System | <input checked="" type="checkbox"/> VPN                    |
| <input checked="" type="checkbox"/> Control Tower          | <input checked="" type="checkbox"/> Data Syncing           | <input checked="" type="checkbox"/> Firewalls              |
| <input checked="" type="checkbox"/> Dashboards             | <input checked="" type="checkbox"/> Backups                | <input checked="" type="checkbox"/> Security Inspection    |
| <input checked="" type="checkbox"/> License Manager        | <input checked="" type="checkbox"/> Intelligent Tiering    | <input checked="" type="checkbox"/> Threat Detection       |
| <input checked="" type="checkbox"/> Disaster Recovery      | <input checked="" type="checkbox"/> Cost Monitoring        | <input checked="" type="checkbox"/> Identity Management    |
| <input checked="" type="checkbox"/> Access Management      | <input checked="" type="checkbox"/> Budget Management      | <input checked="" type="checkbox"/> Active Dir. Connection |
| <input checked="" type="checkbox"/> Console                | <input checked="" type="checkbox"/> Notification Service   | <input checked="" type="checkbox"/> Credential Mgmt.       |

... and many more

# AWS HPC stack



Physics enabled machine learning

Visualization gold standard services

Broadest HPC orchestration services portfolio

600+ compute instances

Broadest storage services portfolio

# Amazon EC2 | Compute platform for every workload

## Instance types for engineering simulation

### HPC Optimized Instances

AMD	intel	aws
EPYC Milan	Ice Lake	Graviton 3E
<b>hpc6a.48xl</b>	<b>hpc6id.32xl</b>	<b>hpc7g.16xl (Coming Soon)</b>
96 Cores	64 Cores	64 Cores
4 GB/Core	16 GB/Core	2 GB/Core
100 Gbps	200 Gbps	200 Gbps

### Compute, Memory, Network Optimized Instances

C7gn	C7g	C6i	M6i
R6i	X2iezn	C5n	M5zn

### GPU Based Instances

P4d	G5	DL1	Trn1
F1	Inf1	VT1	

- Choice of processor (Graviton, Intel, AMD)
- Up to 400 Gbps network bandwidth
- < 15 micro-seconds network latencies

# Amazon FSx for Lustre | Fully managed storage

FULLY MANAGED SHARED STORAGE BUILT ON THE WORLD'S MOST POPULAR HIGH-PERFORMANCE FILE SYSTEM



Sub-ms latencies, **hundreds of GB/s throughput**, millions of IOPS



Concurrent access for thousands of instances, **100,000s of cores**



**Amazon S3**  
Object storage built to retrieve any amount of data from anywhere.



**Amazon Elastic Block Store (EBS)**  
Easy to use, high performance block storage at any scale.



**Amazon Elastic File System (EFS)**  
Simple, serverless, set-and-forget, elastic file system.

# End-to-end HPC workflow management



## AWS ParallelCluster

### HPC Cluster Orchestration

One-stop shop for HPC cluster setup, spin-up/down, storage integration, scheduler integration, and multi-cluster management.



## AWS NICE EnginFrame

### Job Management Client

Submit, administer, and visualize engineering simulation jobs from single interface, whether on-premises or on the cloud.



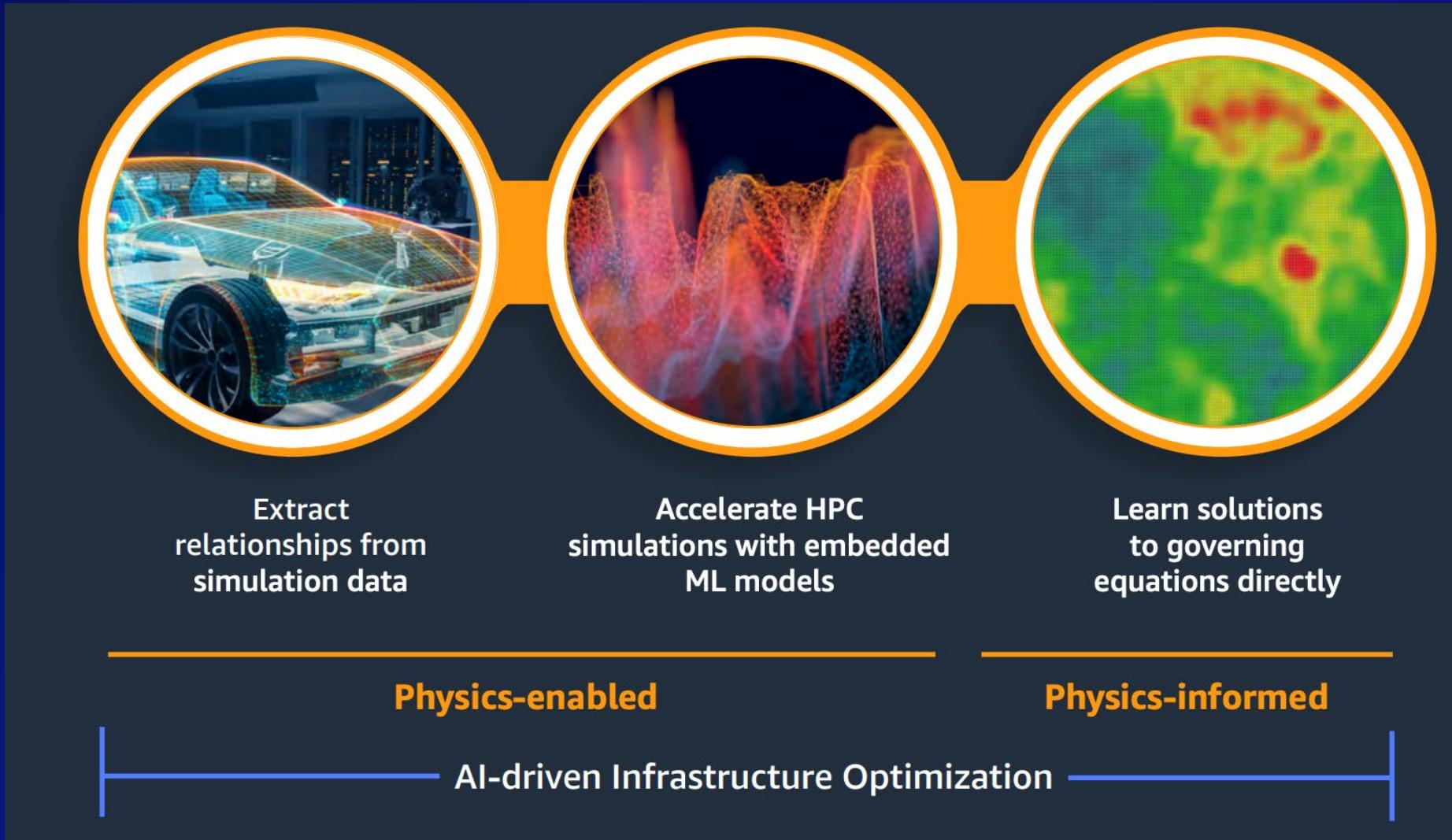
## AWS NICE DCV

### Virtual Desktops

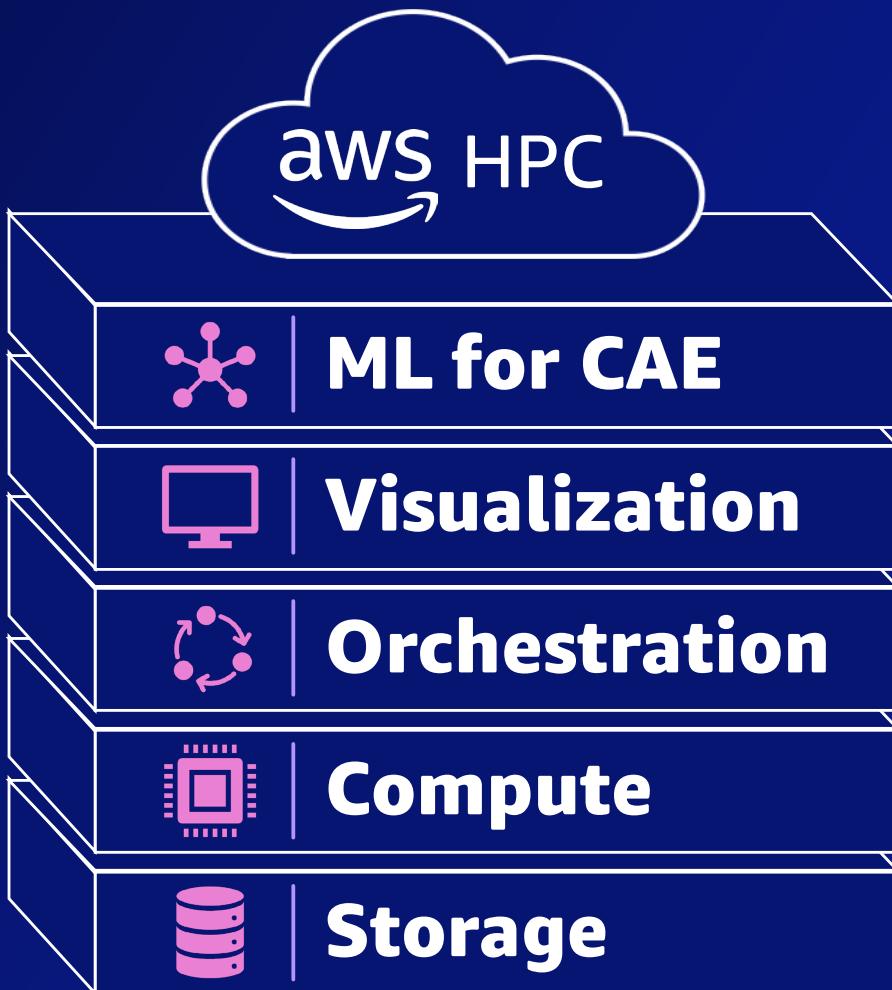
Visualization engine purpose-built for engineering workloads.

Stream pixels, not data.

# Physics-enabled machine learning for CAE



# AWS HPC stack



Physics enabled machine learning

Visualization gold standard services

Broadest HPC orchestration services portfolio

600+ compute instances

Broadest storage services portfolio

# Boeing

*Press release*

## Boeing and AWS Join Forces to Transform Aerospace Design and Manufacturing

*Boeing will migrate applications out of on-premises data centers to AWS and create a technology foundation that will strengthen engineering and manufacturing processes.*



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# Volkswagen Group

Simulation on NVIDIA GPU's on AWS is a game-changer for aerodynamic development in the automotive industry.

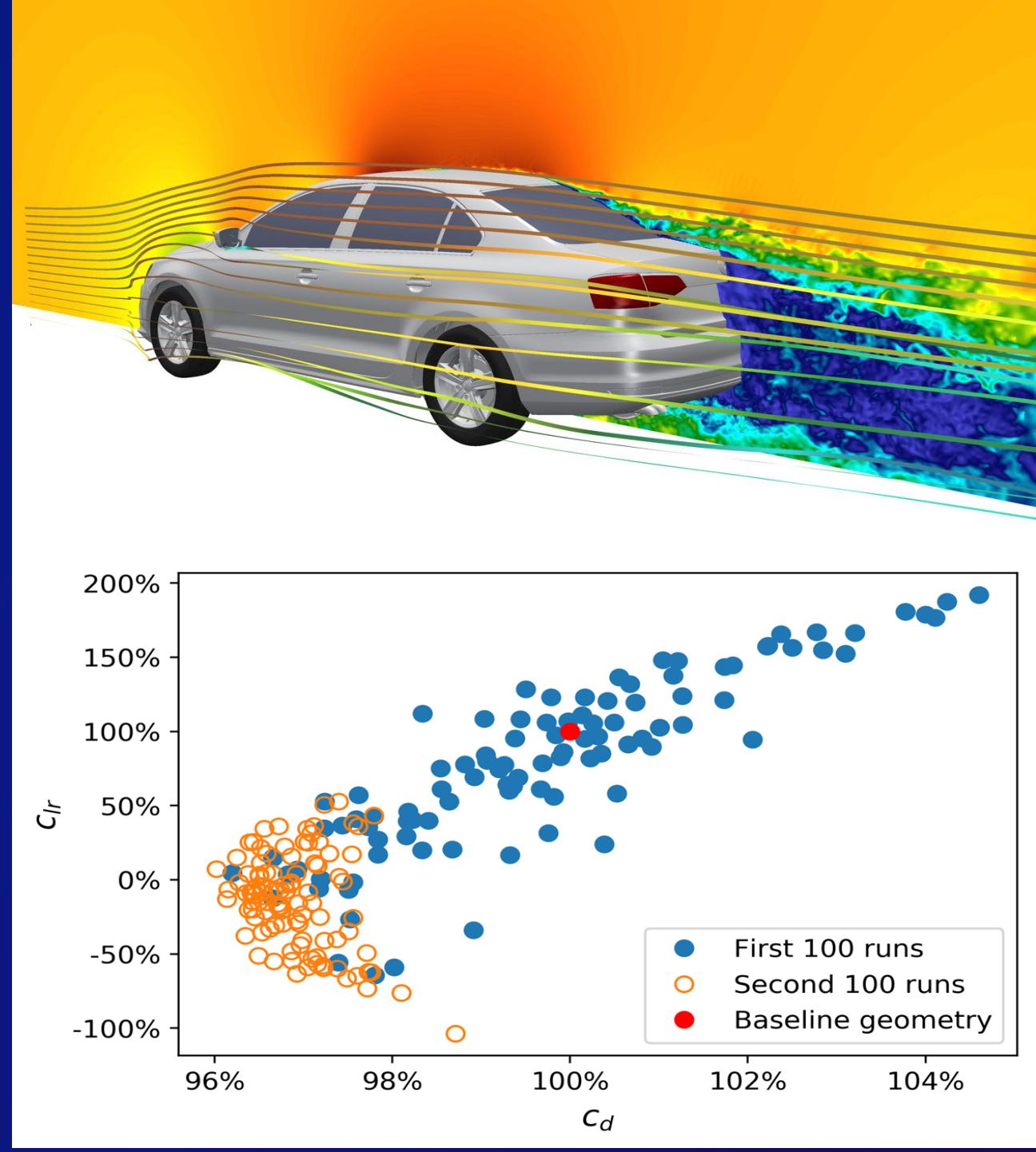
We were able to run 200 car shape variants in a time frame that would normally correspond to only a few runs with our current operational tools

Dr. Henry Bensler, head of CAE Methods at Volkswagen Group Research

<https://aws.amazon.com/partners/success/volkswagen-aq-altair/>



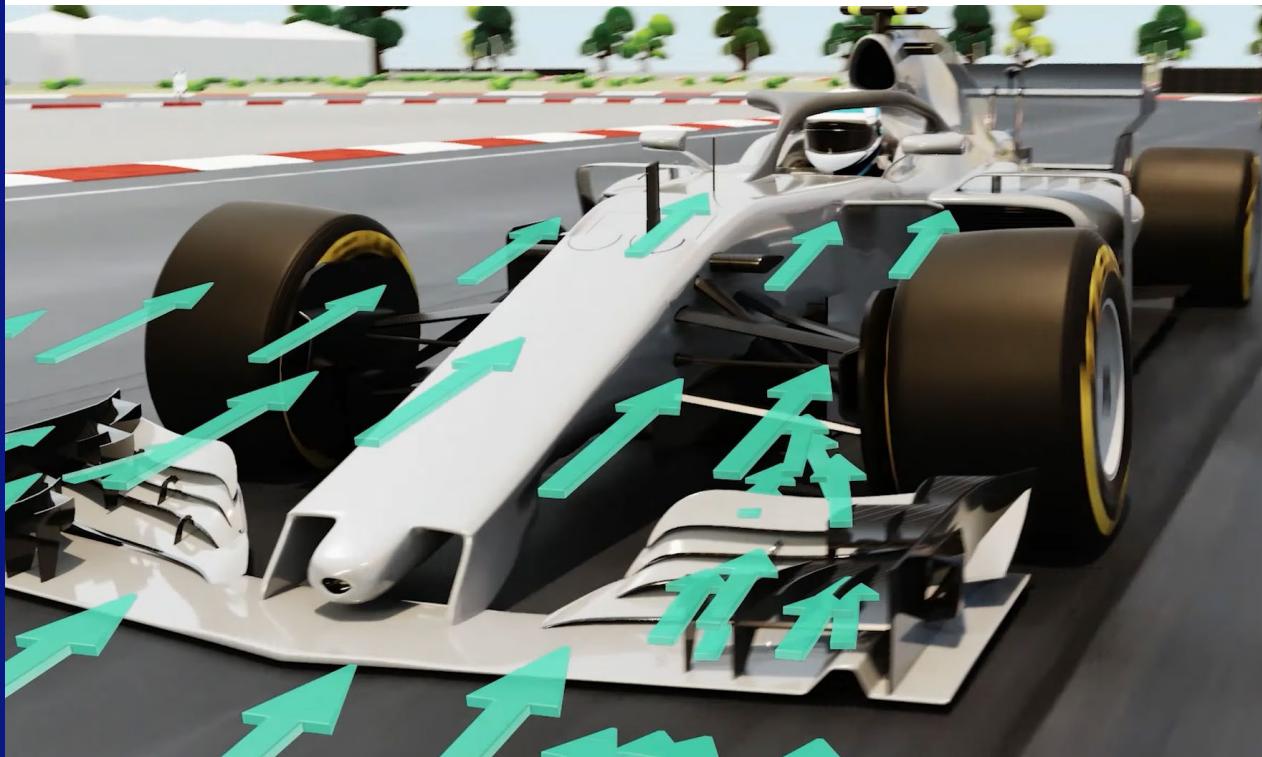
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# Formula 1

"We had already seen that Graviton2-based C6gn instances provided us the best price performance for some of our CFD workloads. We have now found Graviton3 C7g instances to be 40% faster than the Graviton2 C6gn instances for those same simulations. We're excited that EFA will be standard on this instance type, and given this much-improved price performance, we expect Graviton3-based instances to become the optimal choice to run all of our CFD workloads."

**Pat Symonds**  
CTO at Formula 1



Formula 1 Redesigns Car for Closer Racing and More Exciting Fan Experience by Using AWS HPC Solutions

Reference: <https://aws.amazon.com/solutions/case-studies/formula-1-graviton2/>

# AGENDA

1. Tata Technologies (TTL)
2. Trigger
3. Tata Technologies landscape
4. GAP
5. Infosec requirement
6. Virtual validation
7. AWS experience

# We're part of Tata Group – One of India's most respected organizations



## Tata Group: Founded in 1868

More than 150 years of commitment  
to business excellence and  
business ethics



## Revenue \$128+ Bn

68% of which is generated  
in geographies outside  
India



## Employment 935,000

Spanning more than 100 operating  
companies in 100 countries  
across 6 continents

## Business Sectors



IT &  
Communications



Steel &  
Materials



Energy



Engineering  
Services



Services &  
Hospitality



Consumer  
Products



Chemicals

# We're engineering a better world



## Vision

To engineer a better world



**Safer and greener products** for our environment



**Better** learning and growth opportunities for our talent



**Better** returns for our shareholders



**Better** value for our customers



**Better** community service and upliftment



## Mission

Help the world to drive, fly, build, and farm by enabling our customers to realize better products



## Values

We live by our core values :

/ A global mindset



/ One team with customers



/ A can-do attitude



# About Tata Technologies

WE ARE BUILDING BETTER BUSINESSES

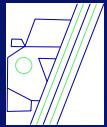
\$473.5 million  
sales revenue FY22

11,000+ innovative  
professionals

3 active regions  
around the world

11 legal entities  
international operations

**Making a difference. That's better.**



**35**  
Leading automotive  
OEMs



**18**  
Leading industrial  
heavy machinery OEMs



**18**  
Leading  
aerospace  
OEMs



**19**  
Prominent tier  
1 suppliers

**17**  
Prominent New  
Age OEMs



Tata Technologies is a young company in a very exciting line of business. A line of business that not only has its place in India, but all over the world. We decided that this company would not be all things to all people but would focus itself in the niche area of providing solutions to manufacturing companies. I would like to see Tata Technologies being acclaimed as one of the most innovative and successful design companies in the world. Your participation will be seen in the world over as a leader in the field we start.

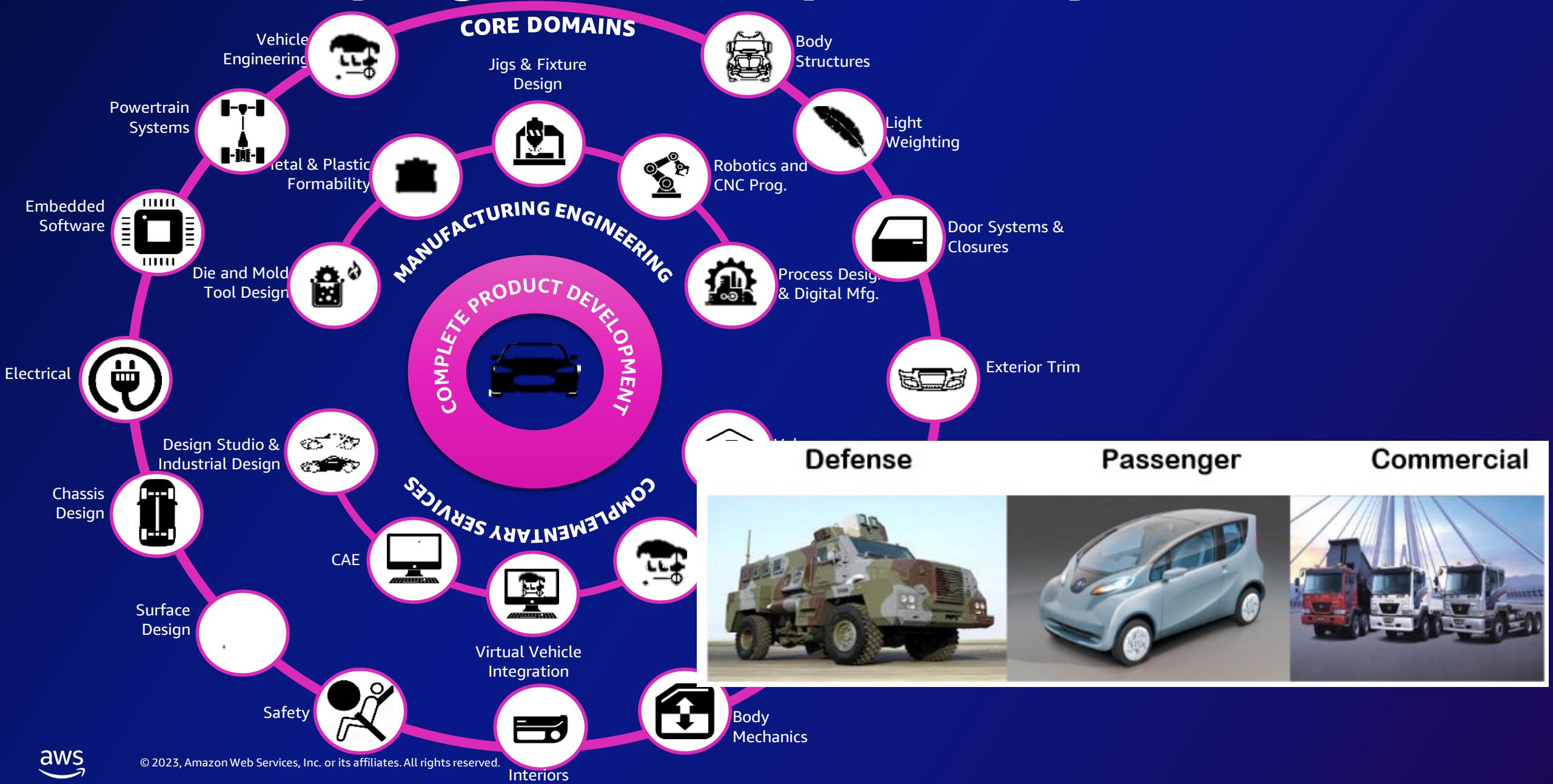
**Mr. Ratan Tata**

Chairman Emeritus of the Tata Group



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# Full vehicle program development expertise



# Noteworthy large full vehicle auto programs



# Need of the hour - trigger

## FULL VEHICLE PROGRAM

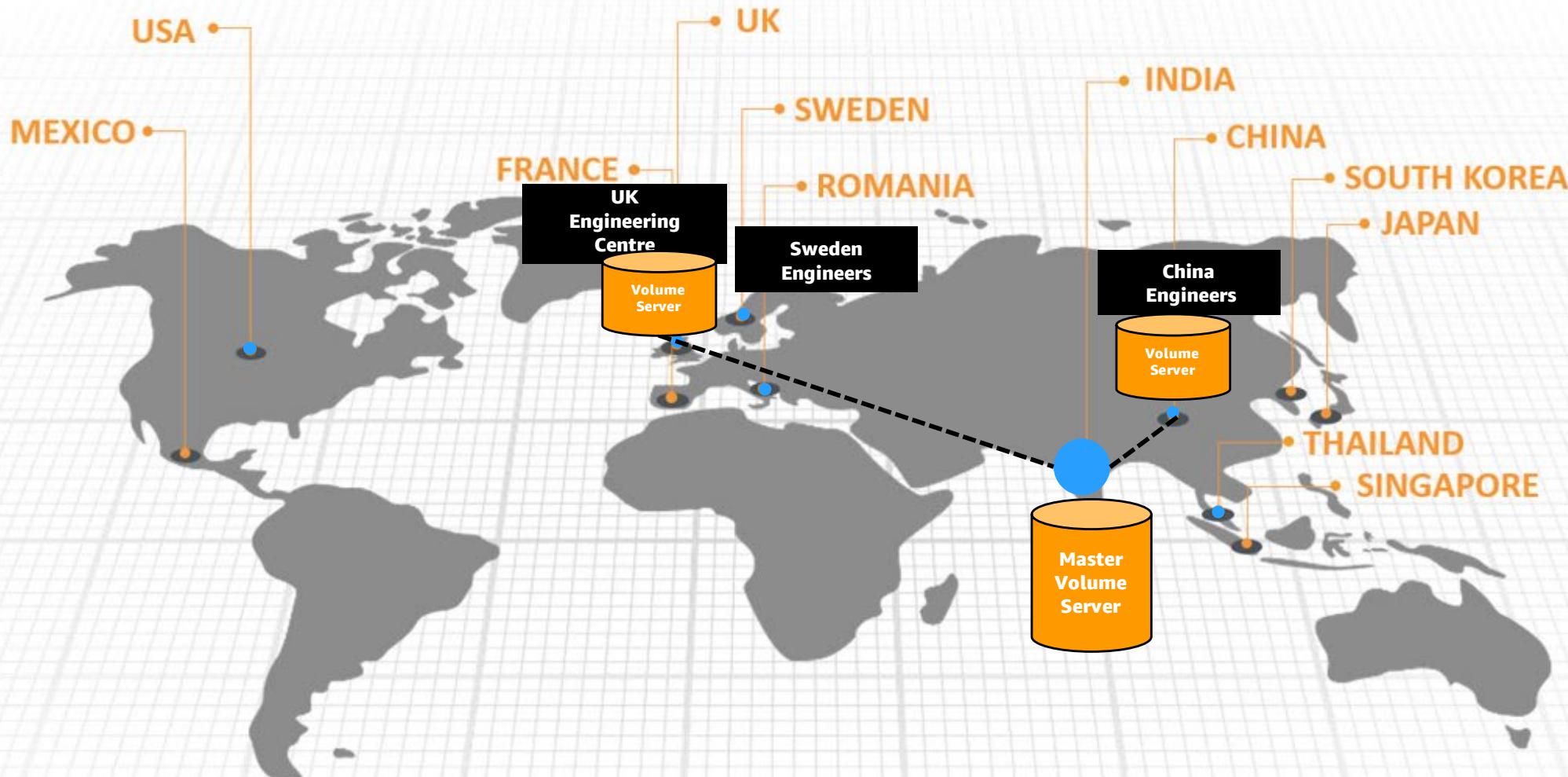
- International OEM
- Global Car
- Multi-million-dollar
- Turnkey program

## REQUIREMENTS

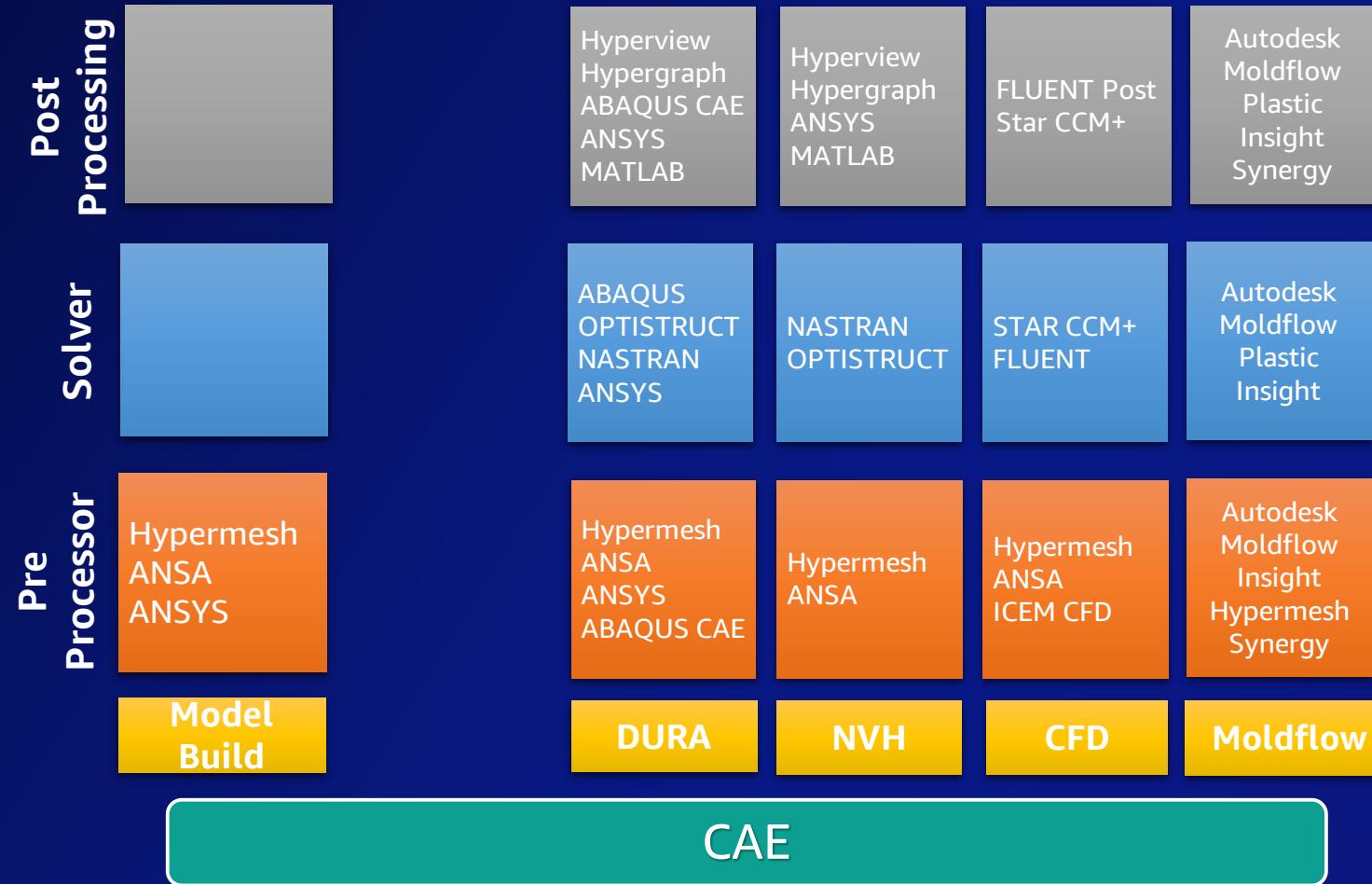
- Extremely challenging timeline
- Worlds first – Fastest EV program development
- Quick ramp-up of man and machine
- Existing computing power was not sufficient
  - Existing projects
- Predominantly lead by Virtual Validation (CAE)



# Tata Technologies computing landscape



# Infrastructure



GAP @ Peak 800 Cores @ 18months

## Hardware

- Workstations with up to 24-core/192Gb RAM for Pre-, Post Processing, and Debug runs

## HPC for Solver

- 1500 cores Intel E5-2697 v2 2.7 GHz Processors
- 5.33 GB DDR3 RAM per core
- 1TB SSD Hard-disk on Master Node
- 56 Gbps FDR Infiniband interconnect



# Information security (INFOSEC)



Compliance,  
Audits & Business  
Continuity



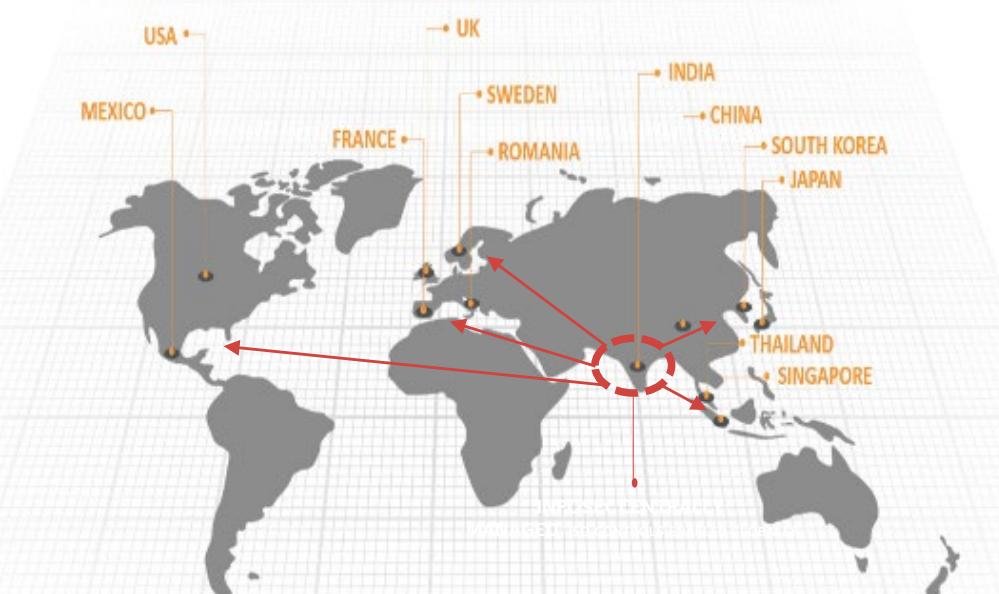
Security  
Assurance  
&  
Consulting



Information  
Asset Protection



Global  
Threat Monitoring



## OBJECTIVES

- Protection of Customer information
- To comply and abide by all our contractual conditions and obligations
- To prevent the use of any non-compliant software at Tata Technologies
- To create awareness and provide information security training to all users and measure the effectiveness of such trainings
- To obtain feedback from external customers regarding Information security at Tata Technologies and implement



## Network

- Next Gen Firewall
  - URL Filtering
  - Email Encryption
  - VPN
  - Secure Wi-Fi
- Anti-Malware & IPS
  - Secure Office
  - Connectivity
  - AntiSpam



## Server

- Server Anti-Malware
  - Server Virtualisation
  - Virtual Patching
  - Server Monitoring



## End-Users & Devices

- Endpoint Encryption
  - Patch Mgmt
- Endpoint Antivirus Mgmt
- Software Asset Mgmt
  - ISO 27001
  - SIRT
- Email & Web Security
  - Device Control

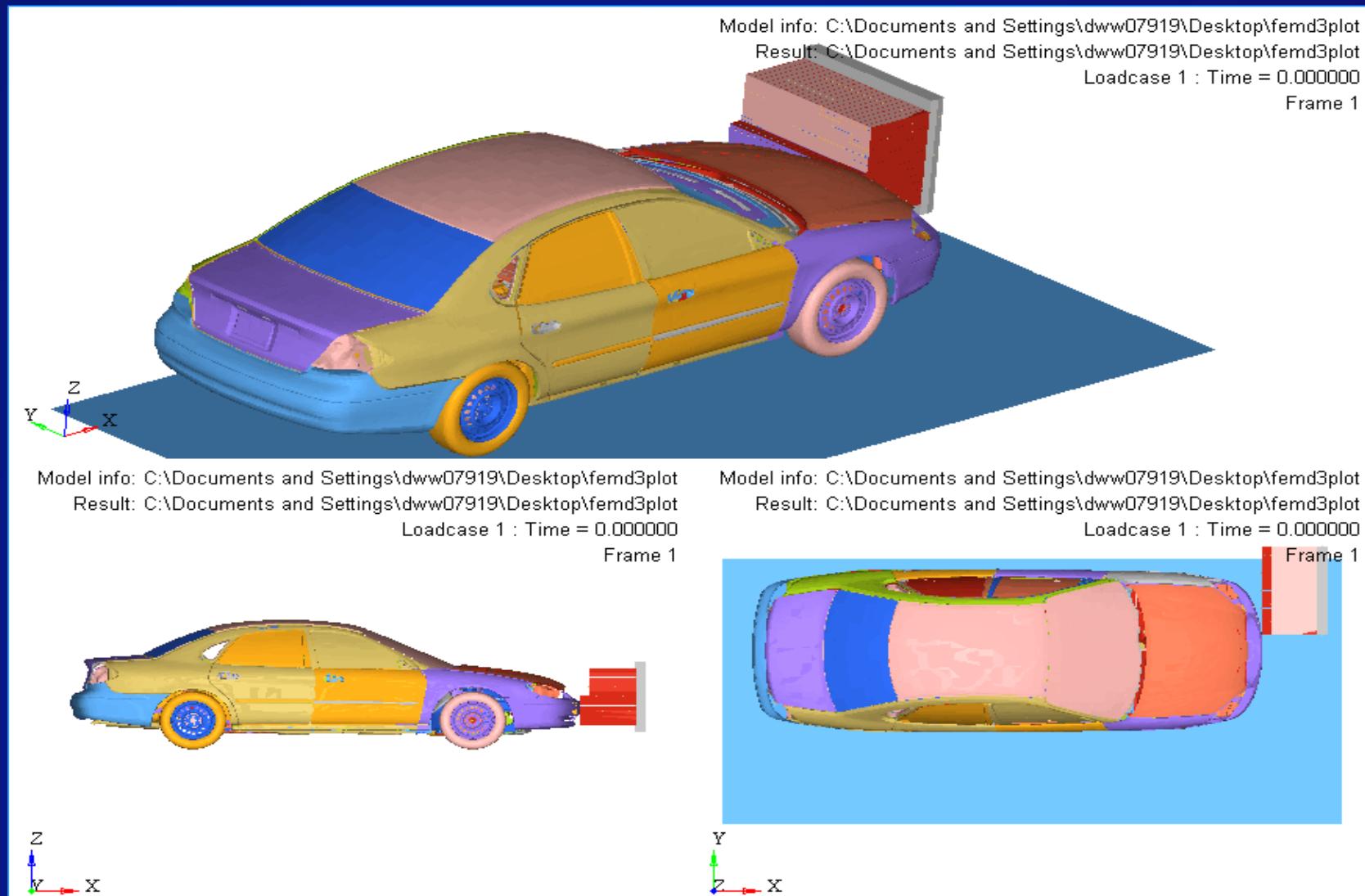
**"Zero Tolerance for Non-Compliance"**



# Highly non-linear explicit solution

## Structural Model Details

Entity	Count
Nodes	5000000
0-D Elements	8000
1-D Elements	28000
2-D Elements	4800000
3-D Elements	1500000
Components	10000
Properties	2000
Material	500

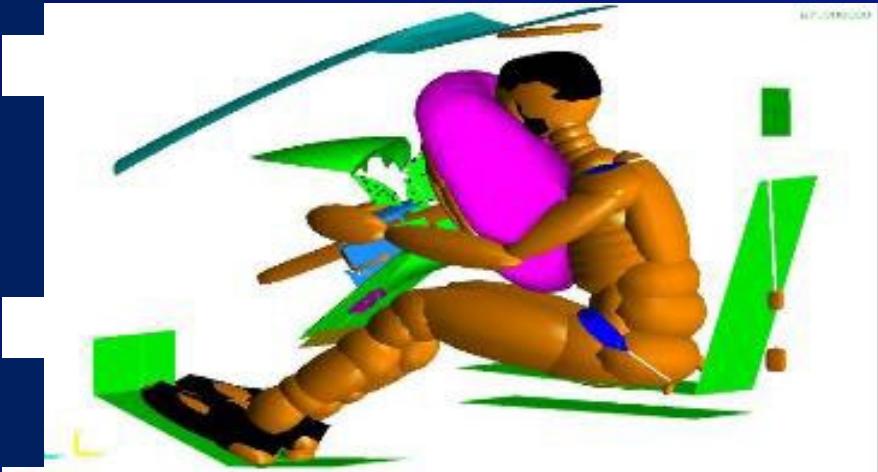


# DOE – Design Of Experiments & Optimization

INFLATOR  
175KPA,210KPA

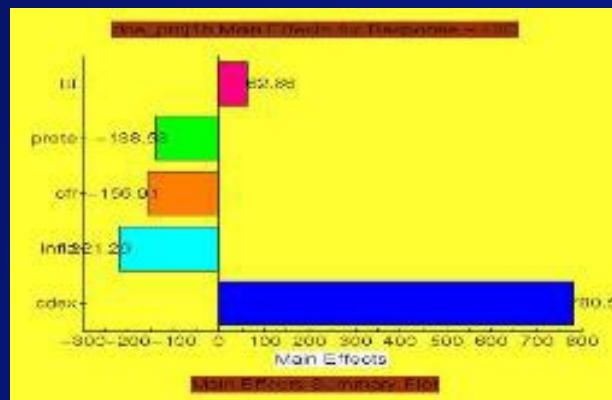
VENT  
2 HOLES OF  
30MM,35MM,40MM

FIRING TIME  
8MS, 10MS,12MS

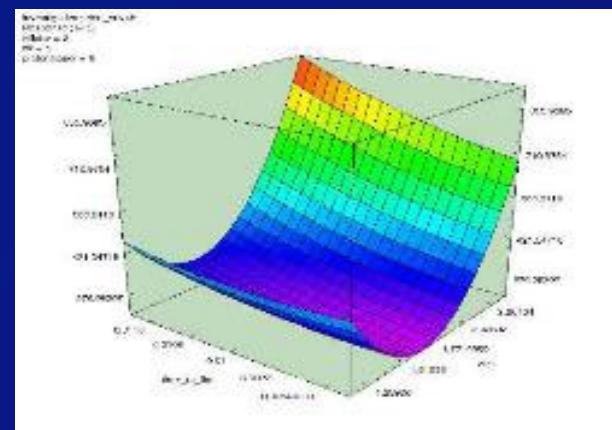


CFR  
3KN,4KN  
DEGRESSIVE  
4/3KN

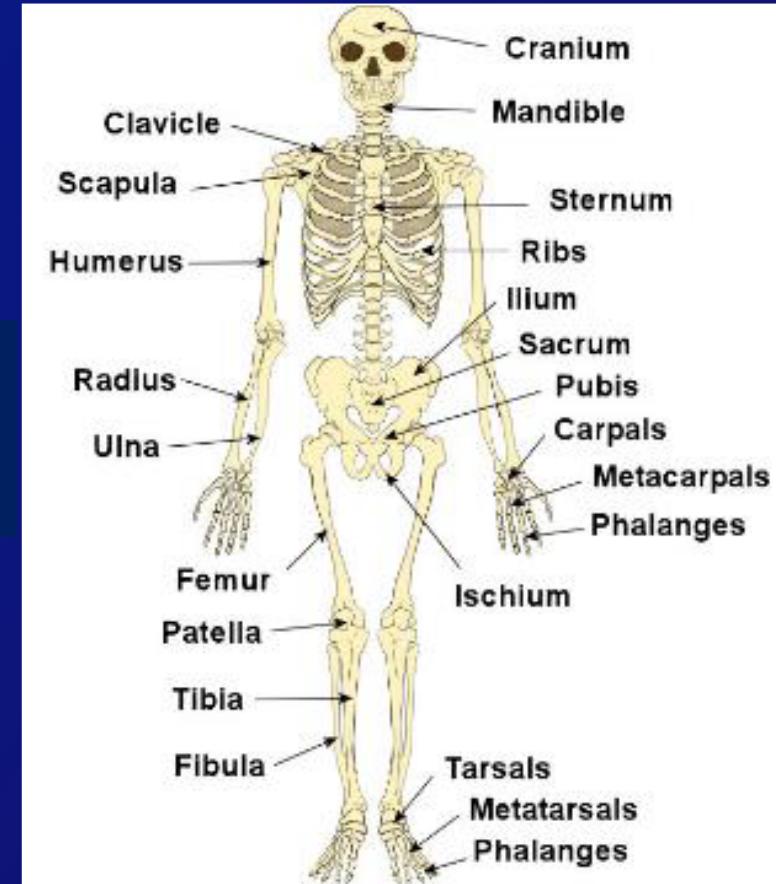
PRETENSIONER  
BUCKLE ONLY  
RETRACTOR ONLY  
RETRACTOR + BUCKLE



Main effects chart

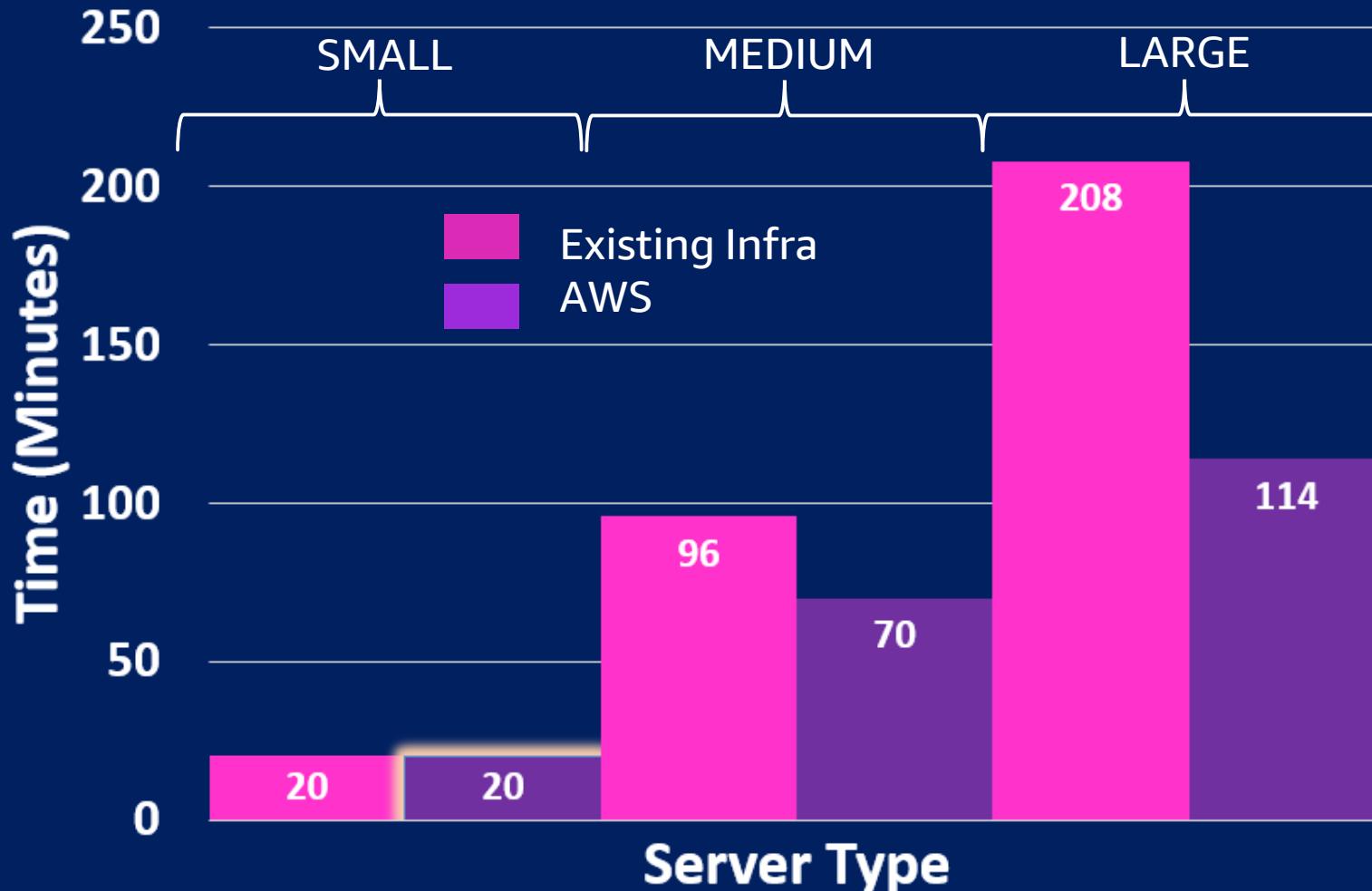


Contour surface chart



# Statistics

## AWS vs. Existing Infrastructure



Existing Infra - 1528hrs  
AWS - 980hrs

Savings - 36%

# AWS experience

Swift

Solutions Architect

Closing Commercials

Understanding Need

Issue Resolution

INFOSEC

Flexible

Computing Power

Queuing System

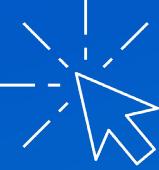
Connectivity to TTL Network

Seamless

Usage CAE Software

Accessing INDIA – CHINA - UK

Competitive Edge

skillbuilder.aws 

# Your time is now

## Build in-demand cloud skills your way



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# Thank you!

Sandeep Sovani, Ph.D.  
Global Head of GTM for  
Engineering Simulation  
AWS

Gopal Musale  
Regional Manager, Cae Coe  
Tata Technologies Limited



Please complete the  
session survey