

3DEXPERIENCE®

Transportation & Mobility OEMs segment

Q4-2020

DASSAULT SYSTEMES



The 3DEXPERIENCE® Company

- Solutions for Innovation & Business Transformation from Product to Consumer Experience
- 20,000 passionate people
- 4 Billion € revenue 2019, 88% Software

... and a true passion for the Transportation & Mobility sector



Partnering with innovation leaders in 11 industries



Investing for the Future ... with benefits for Automotive :

- Materials → Battery
- Cyber Physical Systems → Autonomous Driving
- Robots / Cobots → Generative Design
- Smart Cities → Mobility Services
- Value Chain → Collaborative Hub
- Internet of Experience → Industry 4.0

Growing from 3D design to 3DEXPERIENCE

▶ Partnering with the transportation industry for > 35 years



3D
Design

3D DMU
Digital Mock-up

ENOVIA 3D PLM
Product Lifecycle Management

3DEXPERIENCE

1982: First Automotive customers



2000: PLM & Digital Manufacturing



2014: Innovation platform

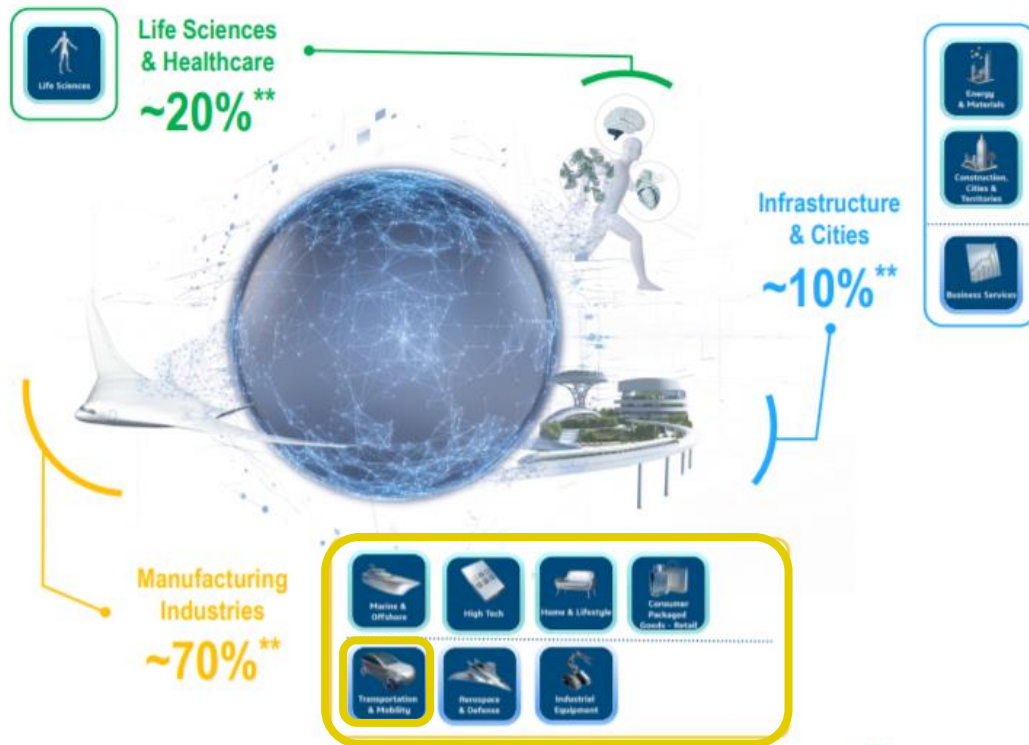


Dassault Systèmes Footprint

BEFORE



STARTING FROM 2020



* Approximate % of non-IFRS 2019 software revenue on a like-for-like basis (as if Meditata were consolidated in 2019 3DS figures)

** Approximate % of non-IFRS 2019 total revenue on a like-for-like basis (as if Meditata were consolidated in 2019 3DS figures)

To support a full digitalization strategy

New Experience Development (NED)

New Product Development (NPD)

Traditional development

Virtual product planning



Consumer in Business



Consumer to Business

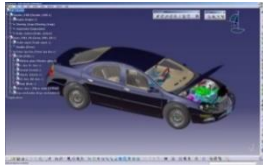


Technology centric planning

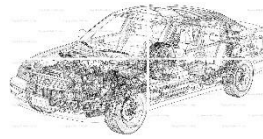
Virtual development



12 to 18 months

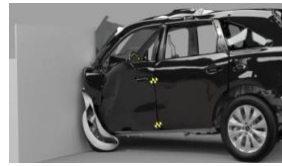


3 to 4 years



5 to 6 years

Virtual validation



<10 physical prototypes



100 physical prototypes



>700 physical prototypes

Virtual production



Smart production



Automated production



Mass manual production

Virtual sales



Online - 0 shop



Showroom - 0 product

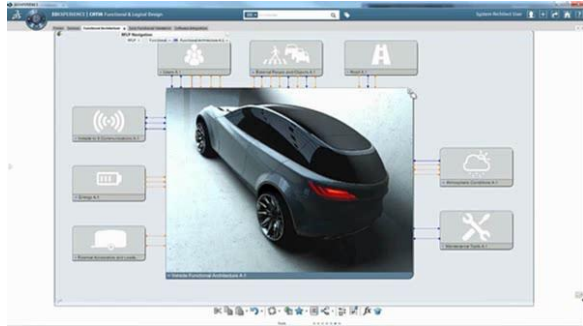


Traditional 4S shop

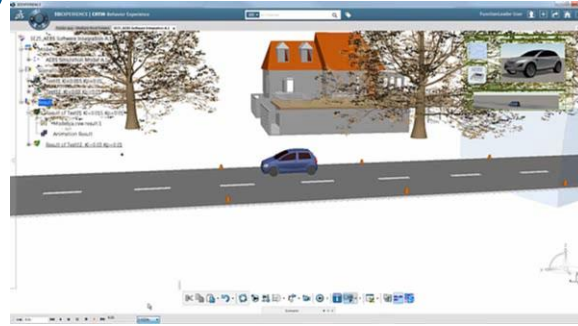
Providing Digital Continuity to Design, Validate & Experience



Systems Design



Virtual Validation

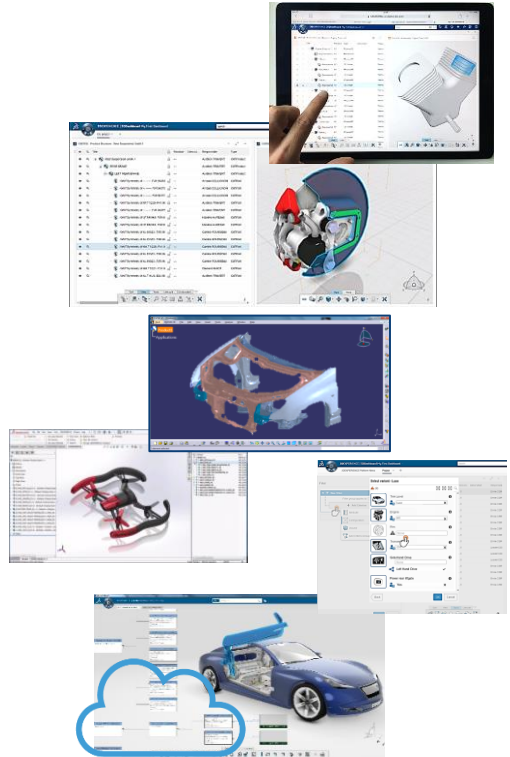


Usage Experience



3D For ALL

3D is a universal language. 3DEXPERIENCE provides access to 3D without needing specialist computers or skills.



Accessible on Smartphone

Accessible on Tablet

Accessible in Browser



Accessible on Workstation

Our Clients: Industry leaders and innovators

Transportation & Mobility

Aerospace & Defense

Marine & Offshore

Industrial Equipment

High-Tech

Consumer Goods - Retail

Consumer Packaged Goods - Retail

Life Sciences

Energy, Process & Utilities

Architecture, Engineering & Construction

Financial & Business Services

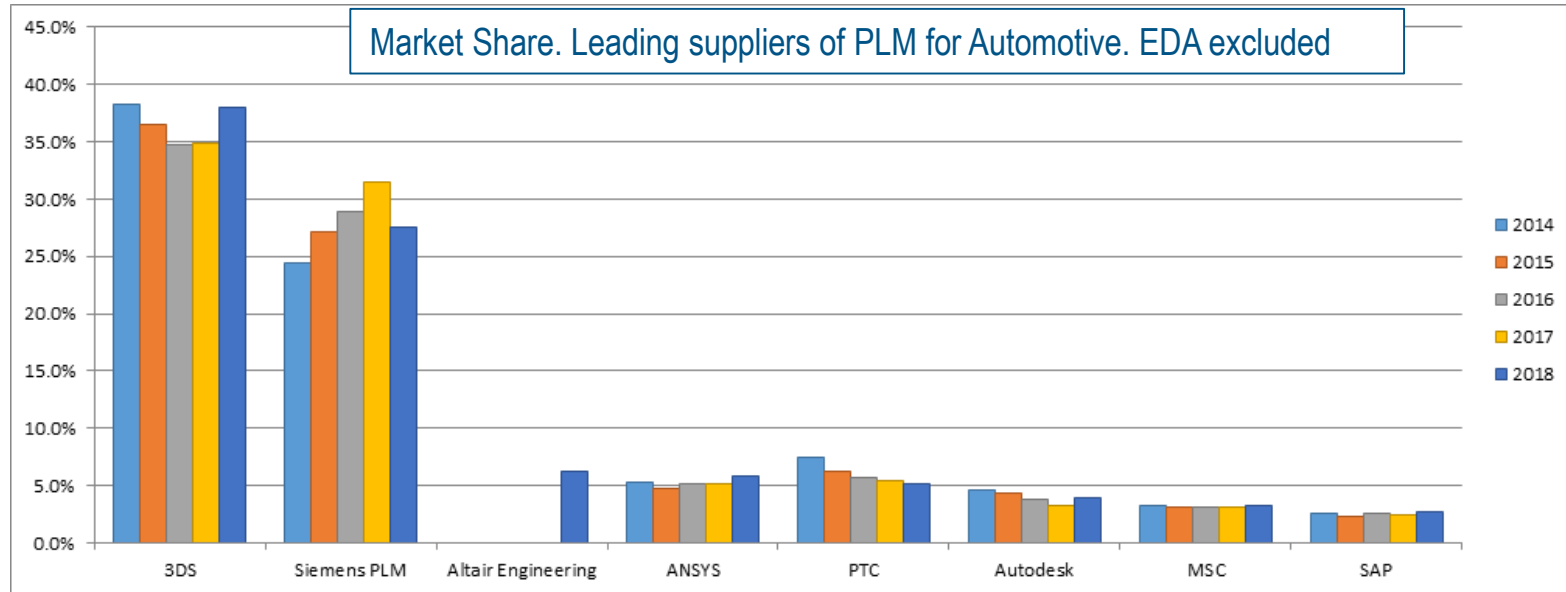
Natural Resources

Logos include: TOYOTA, Ford, HONDA, VW, KELL, brose, Valeo, FAW, Great Wall, faurecia, NIO, 蔚来, PSA, OPEL, RENAULT, HYUNDAI, MITSUBISHI MOTORS, SAIC, DONGFENG, MICHELIN, ASHOK LEYLAND, BOEING, DASSAULT, AIRBUS GROUP, SAFRAN, Bell Helicopter, NORTHROP GRUMMAN, LOCKHEED MARTIN, MBDA, KLM, DELTAMARIN, MEYER WERFT, ISONAVAL S.L., DSME, ORACLE USA, DOOSAN, BOSCH, MWV, BOBST GROUP, ABB, SANYO MACHINE WORKS, LTD., CLHHS, Valmet, VOLVO, SONY, ERICSSON, SAMSUNG, Google, Apple, Nikon, Panasonic, LG, PEGATRON, hp, Hisense, GUESS, UNITED COLORS OF BENETTON, GAP, PATEK PHILIPPE GENEVE, s.Oliver, Cartier, ROLEX, LUXOTTICA, adidas, P&G, Barilla, Coca-Cola, amcor, Tetra Pak, DANONE, L'ORÉAL, OCCITANE, OLYMPUS, Medtronic, GE Healthcare, SANOFI, J&J, Alkermes, Bayer, Pfizer, stryker, BASF, ALSTOM, SAMSUNG HEAVY INDUSTRIES, GE Power & Water, Dow, ExxonMobil, SIMEI, SAINT-GOBAIN, sh p, SKANSKA, ARUP, BNP PARIBAS, LA POSTE, pwc, IBM, consip, DHL EXPRESS, RioTinto, GOLD FIELDS, AEM, Cerrejón, Technip, LAFARGE, Dundee, DE BEERS, AngloAmerican, AGNICO EAGLE.

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3DS is leading in Automotive PLM

See CIA post.



Source: ARC Advisory Group PLM Global Market Study. Oct 2019

We include cutting edge technologies to serve your innovation purpose

Latest acquisitions are targeting specifically the Automotive sector :

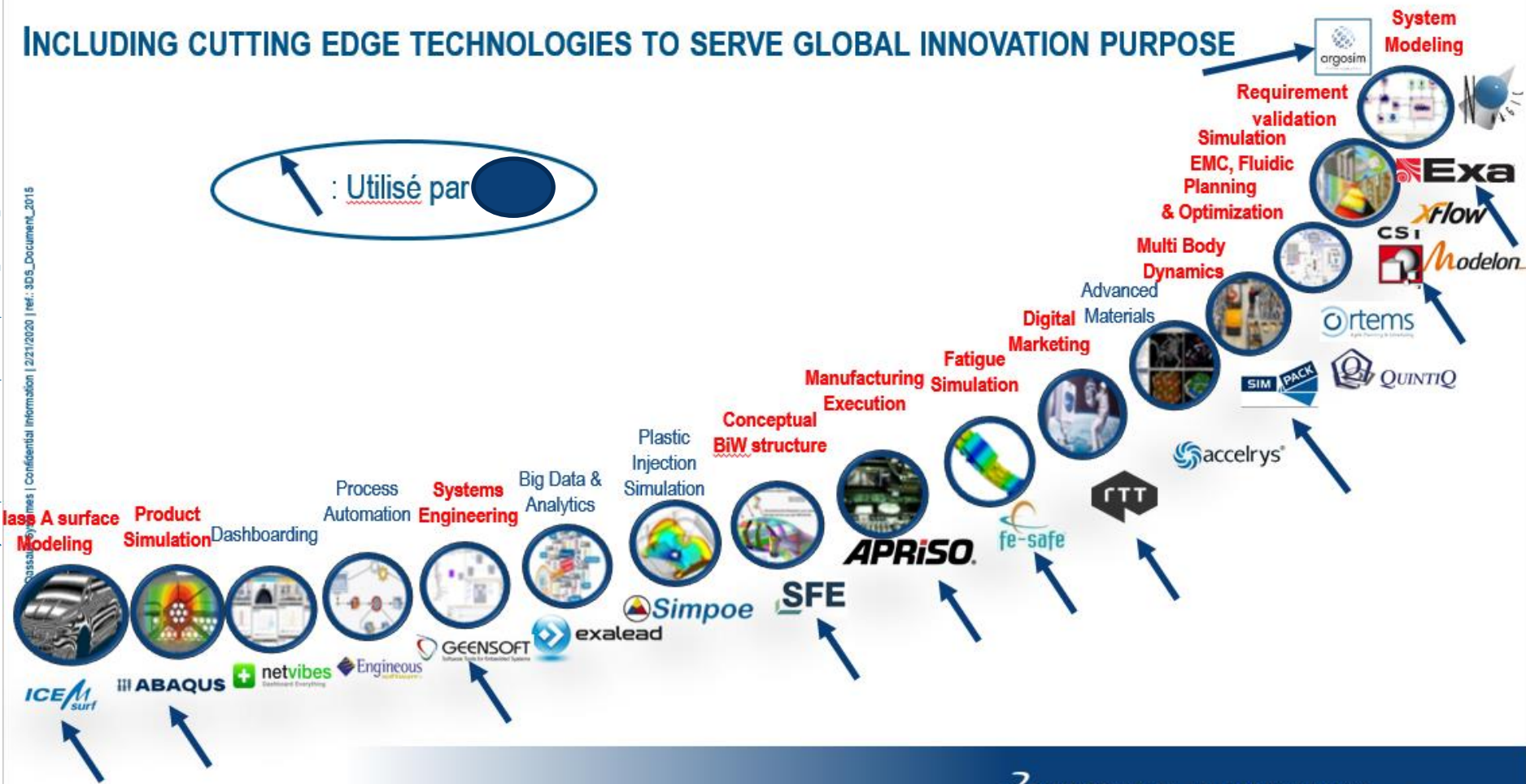
- 1) Electro Magnetics (CST, Opera)
- 2) CFD, Aerodynamics : xFlow & EXA
- 3) Model Based System Eng. : No Magic
- 4) Requirement validation: Stimulus

Research Systems | Confidential Information | 11/20/2020 | ref.: 3DS_Document_2015



INCLUDING CUTTING EDGE TECHNOLOGIES TO SERVE GLOBAL INNOVATION PURPOSE

: Utilisé par 





WHAT IS THE 3DEXPERIENCE PLATFORM?

It's a **Business Experience Platform**
available on premise and in public
or private cloud



To enable our clients to create
realistic /appealing **Experiences**
for their ultimate customers
or consumers

3DEXPERIENCE®

3DEXPERIENCE Platform – Values & Foundations



**Unified user experience
Web Client**



data-driven



Business Dashboarding



model-based



Deliver Experience



**Shared Services
& Controlled TCO**



Platform Openness

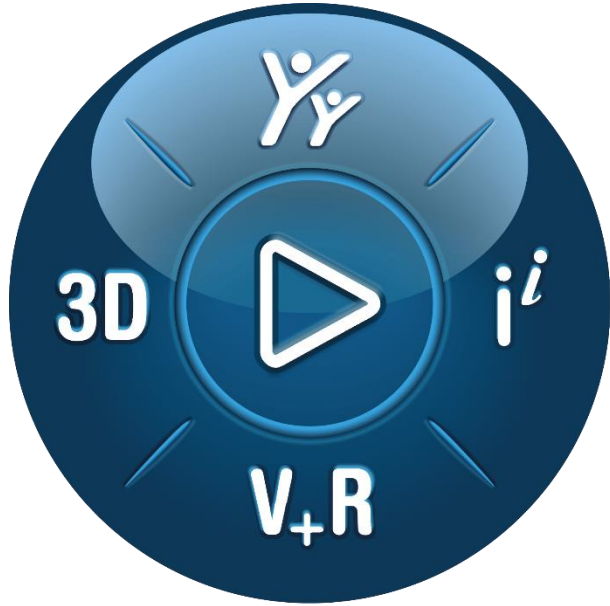


Designed for Cloud



Trends of Automotive Market
driving our solution offering

3DEXPERIENCE[®]



Trends of Automotive Market
driving our solution offering

3DEXPERIENCE®

Transportation & Mobility | INDUSTRY BUSINESS DRIVERS

Electric, Connected and Autonomous Vehicles



New Customer Experience



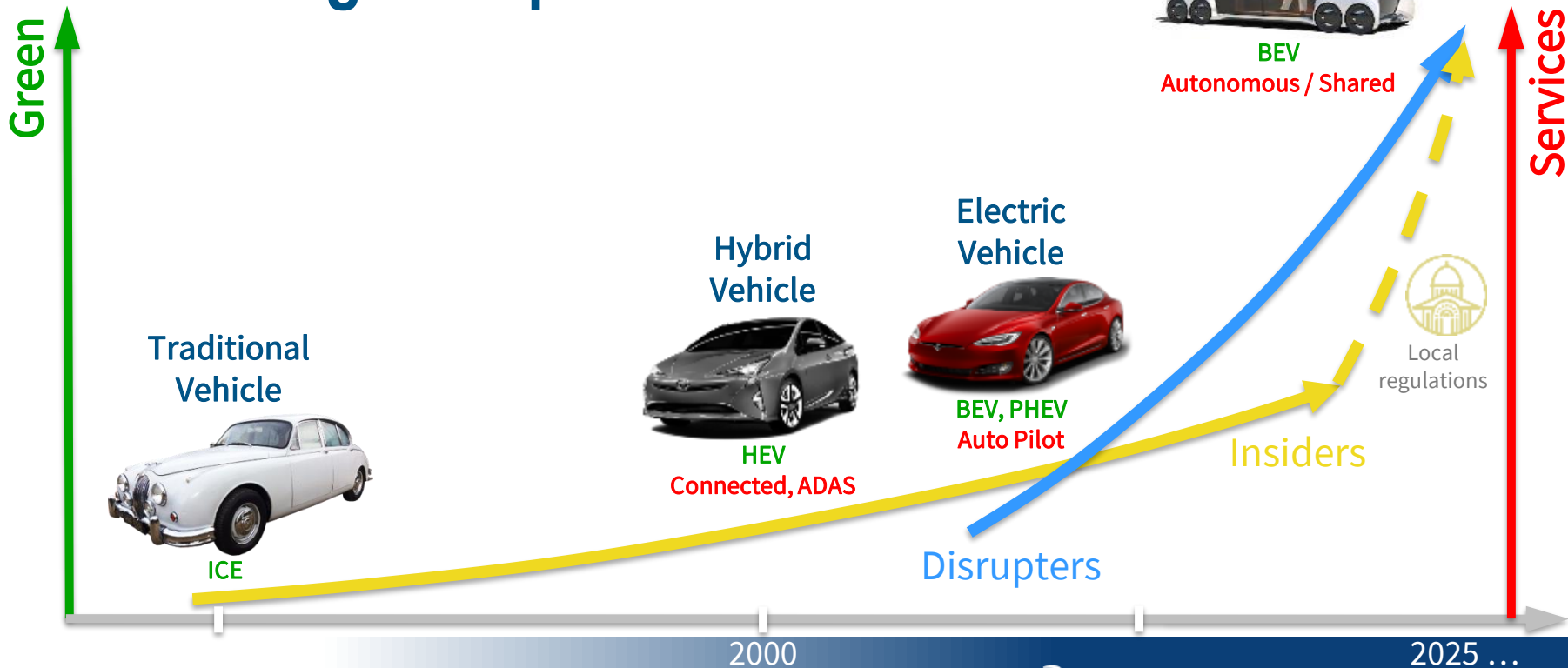
Quality, Costs, Regulations



Mass Production to Mass Customization

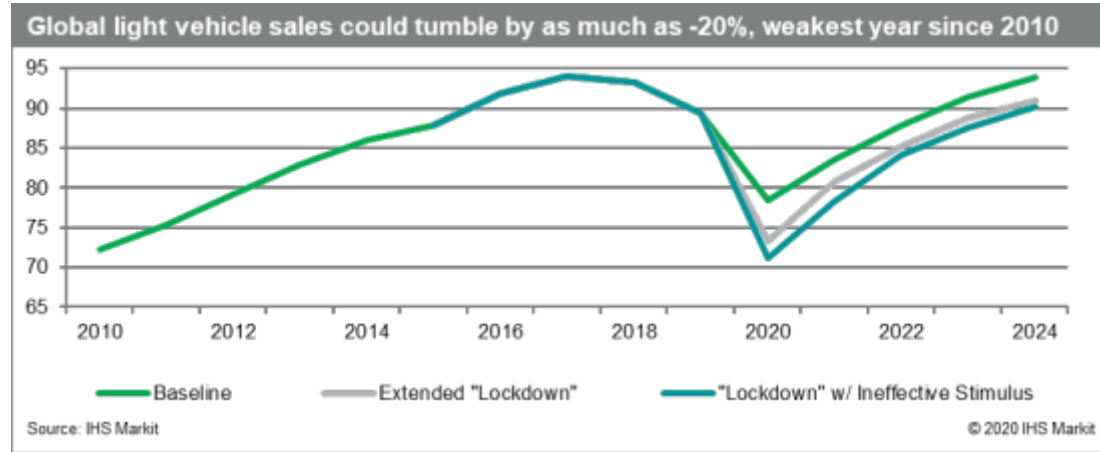


The world of mobility is being disrupted...



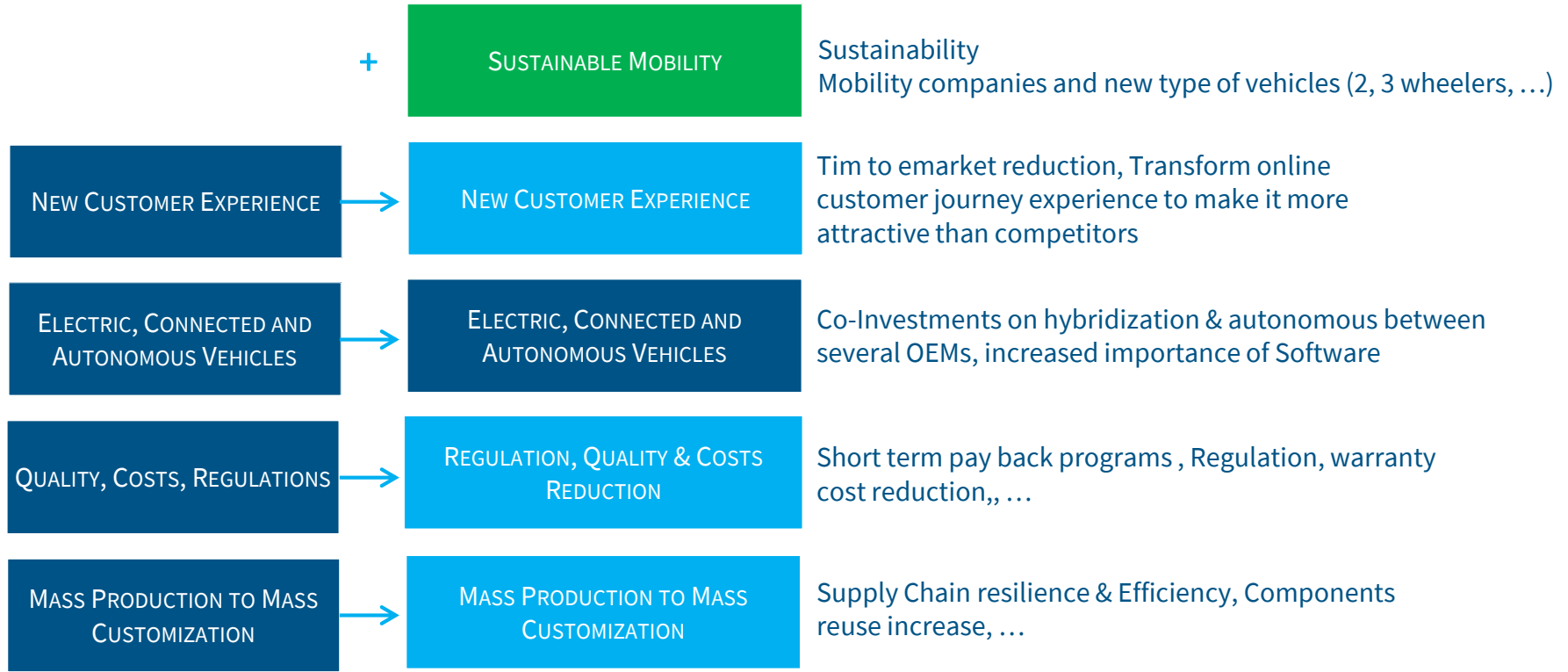
Transportation & Mobility Industry Context :A Disruption Period

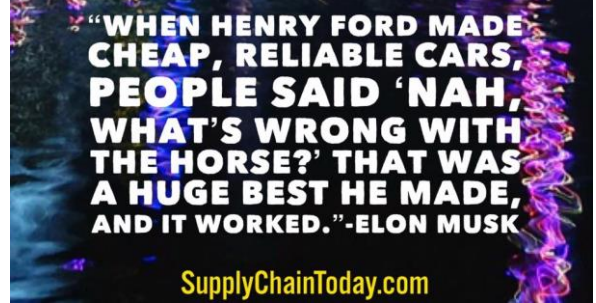
- Sudden stop of customer purchases impacts global vehicles production
- Today's challenges represent a real **opportunity to reshape the industry's mindset** and retool processes.



- It is not only the time to build the **mobility industry of tomorrow**, but also to focus on programs with **short term payback**.
- Dassault Systèmes' 3DEXPERIENCE platform allows OEMs to reinvent development of cars, improve productivity and adapt to new customer demands.

Transportation & Mobility Business Drivers





Why 2017 will go down as the beginning of the end of the internal combustion engine

- The Washington Post

Electric car sales in China set to reach record-breaking 700,000 units in 2017

- Autocar

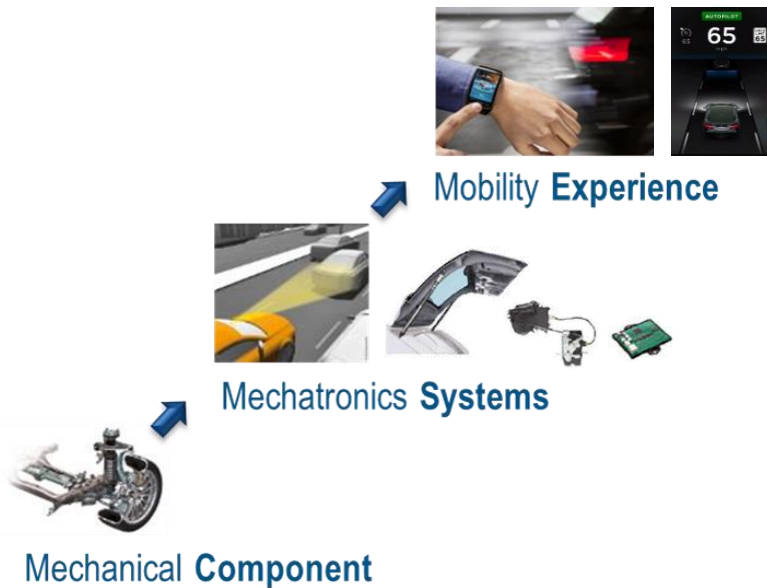
*Karl Iagnemma,
cofounder & president of nuTonomy*

Fast-paced Innovation

80% of automotive innovation driven by **Electronics & Software**



Shift from Automotive Product to **Mobility Experience Business**

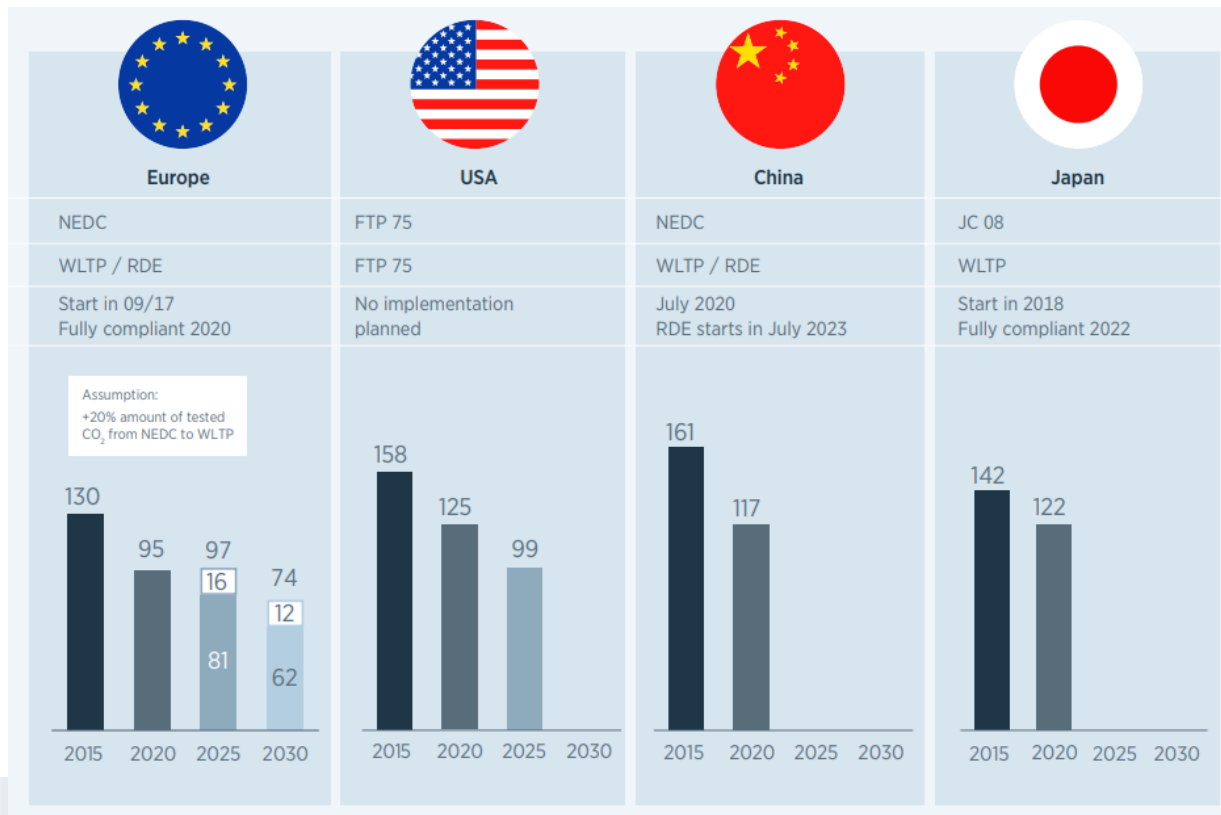


This block contains several elements representing the Mobility Experience Business:

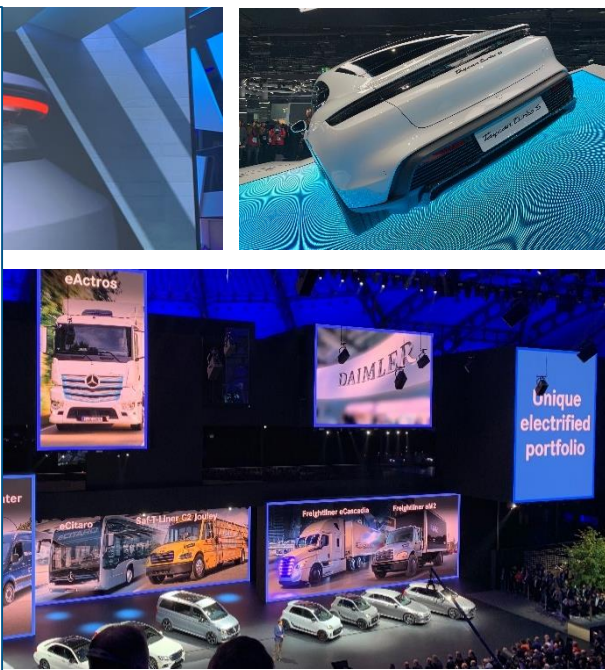
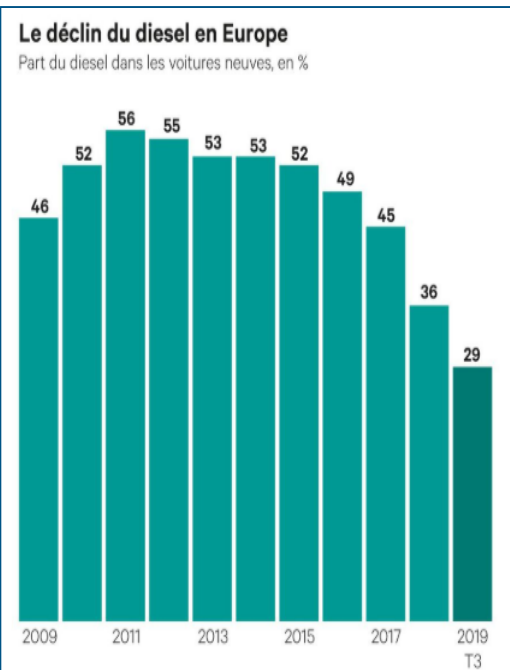
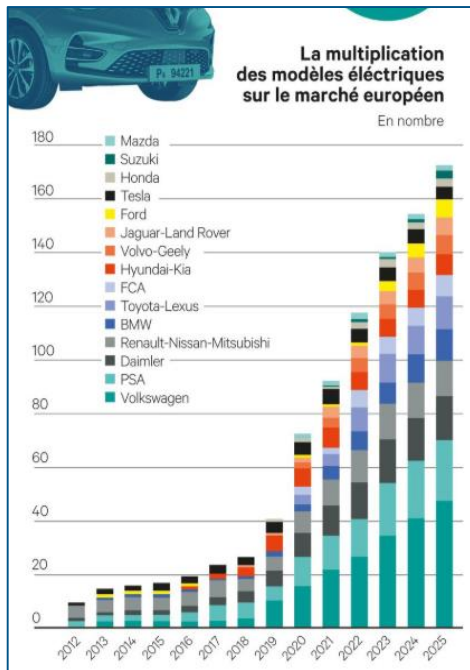
- Four blue icons at the top: **Electro-mobility** (car with plug), **Autonomous Driving** (car with steering wheel), **Connected Experience** (car with Wi-Fi symbol), and **Mobility as a Service** (car with person icon).
- A central image of a hand holding a tablet displaying a notification: "Meeting at the restaurant at 12:00. Link & Go will pick you up at 11:35".
- A 3D rendering of a futuristic car interior with a large screen and a person's hands on the controls.
- A 3D rendering of a city street with various colored icons (P, G, etc.) overlaid on buildings and roads.
- A data visualization dashboard with multiple charts: a bar chart, a line graph, a pie chart, and a donut chart, all with green and yellow color schemes.

WW adoption of CO2 regulation / WLTP

Massive pressure in Europe, Asia to follow soon



OEMs announce shift towards electric cars...



... & move out of Diesel

Automotive Market shift

- Move from Mechanical to SW.
- Need to streamline and be more efficient

A double change is needed:

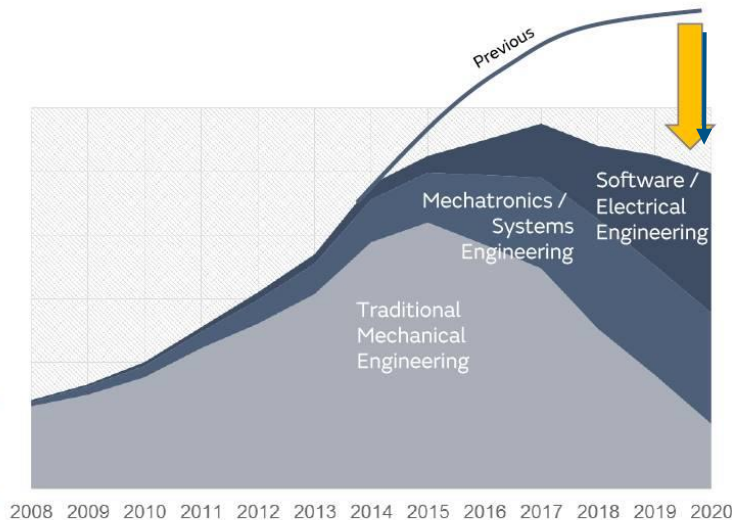
- Build the future
- Optimize current operations

Delivering our promise to drive efficiency in mechanical areas, and grow mechatronics and software capability



5

Engineering Resource Heads and ED&T



- Carefully selected to maintain and grow skills

- Obsessed with streamlining traditional mechanical engineering, optimising prototyping and simulation

- Driving efficiency to self fund and make headroom for growth in software and mechatronics skills

JLR communication to Analysts

We are transforming our efficiency to reduce cost and improve product quality

ENCE[®] Company

New mobility players shaking the market

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A comprehensive set of solutions for OEMs and suppliers

3DEXPERIENCE[®]

From Product Engineering to Experience Engineering & Manufacturing

Lean Production

Global Validation for Proven performance



PLANNING



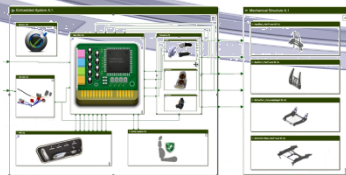
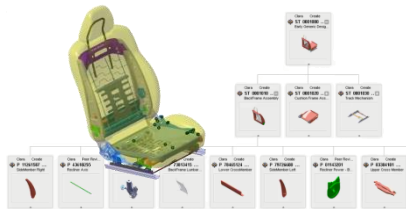
RUN



Sell an **Experience**



Manage with **Seamless Global Collaboration**



Design as a **System**

Think it for **Consumers**



Transportation & Mobility Industry Solution Priorities

#3 Vehicle Electrification

E-motors
Battery Development
Generative Design (Simulation based Design)

“Reduction of warranty cost by 20%”



#2 Model Based System

System Architecture
ADAS & Autonomous Driving
E/E & SW Development



“Reduction of development cost by 30%”



#4 Mass Personalization Manufacturing & Operations

Digital Manufacturing
Production Scheduling



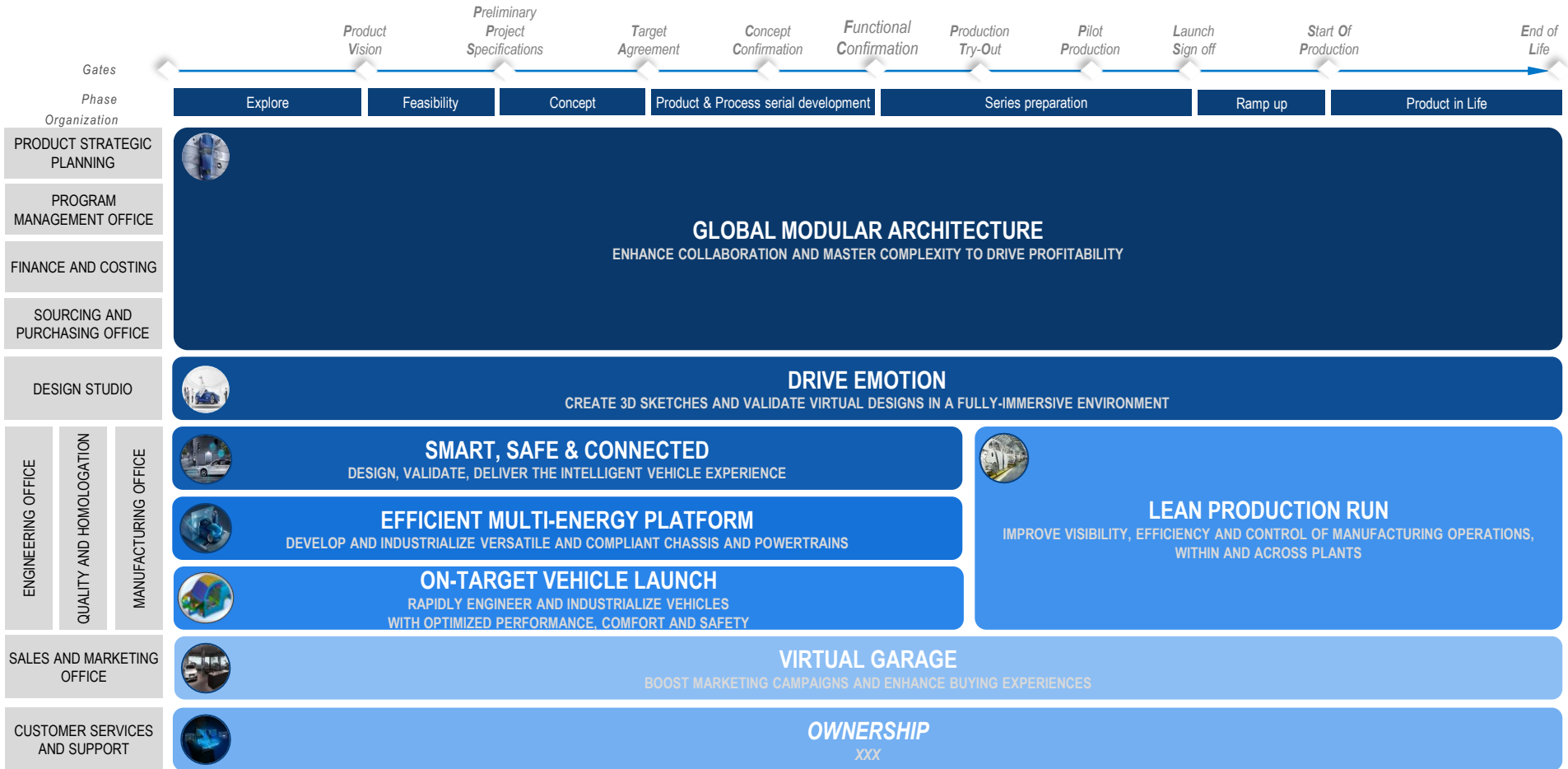
“reduced cost per vehicle, increased market share”

#1 Innovation Collaborative Platform

Engineering & Manuf. data management
Configuration & Change
Program / Risk / Cost / Issue Management



*“Lead time reduction by 30%, 40%
Reduction of change request”*



TRANSPORTATION & MOBILITY REFERENCES



LEAN PRODUCTION RUN
IMPROVE VISIBILITY, EFFICIENCY AND CONTROL OF MANUFACTURING OPERATIONS, WITHIN AND ACROSS PLANTS



VIRTUAL GARAGE
BOOST MARKETING CAMPAIGNS AND ENHANCE BUYING EXPERIENCES



ON-TARGET VEHICLE LAUNCH
RAPIDLY INDUSTRIALIZE VEHICLES FOR OPTIMIZED MANUFACTURING

MOBILITY OPERATIONS
IMPROVE MARGINS THROUGH NEW BUSINESS MODELS



EFFICIENT MULTI-ENERGY PLATFORM
DEVELOP VERSATILE PLATFORMS WITH OPTIMIZED COMFORT AND SAFETY

BID TO WIN
WIN NEW, PROFITABLE OPPORTUNITIES, DESIGN TO VALUE, DELIVER ON TARGET



SMART, SAFE & CONNECTED
DESIGN, VALIDATE, DELIVER THE INTELLIGENT VEHICLE EXPERIENCE

GIM canoo LIGHTYEAR
ELECTRO-MOBILITY ACCELERATOR
ENABLES EV INNOVATORS TO ACCELERATE INNOVATIONS TO MARKET AT COMPETITIVE COST AND OPTIMAL QUALITY



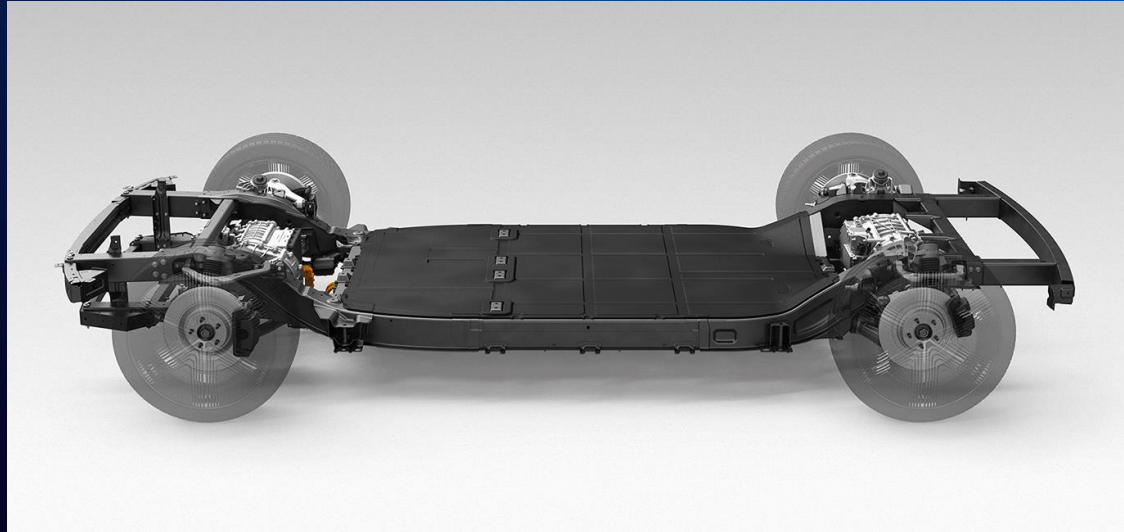
GLOBAL MODULAR ARCHITECTURE
ENHANCE COLLABORATION AND MASTER COMPLEXITY TO DRIVE PROFITABILITY



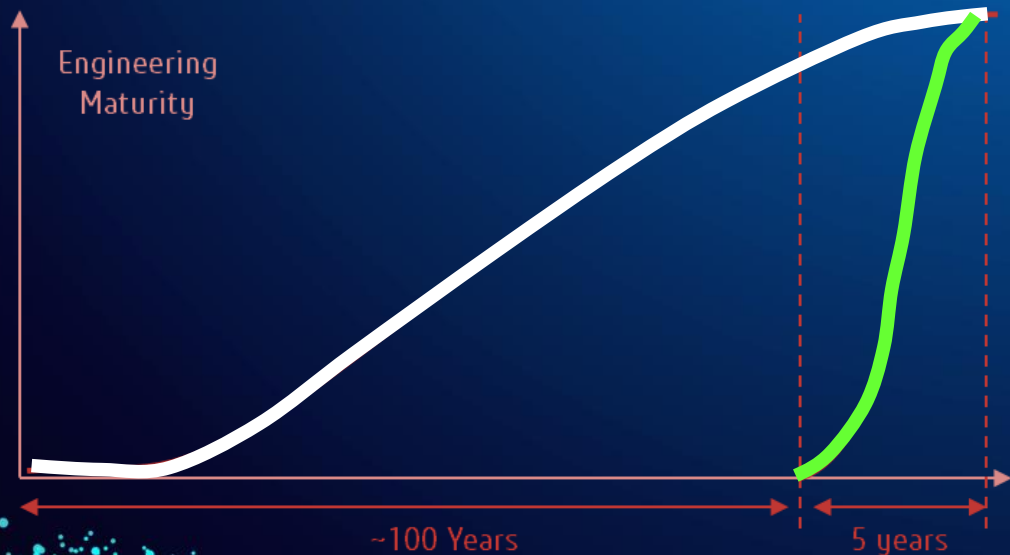
DRIVE EMOTION
CREATE 3D SKETCHES AND VALIDATE VIRTUAL DESIGNS IN A FULLY-IMMERSIVE ENVIRONMENT



Architecture & Technologies evolution



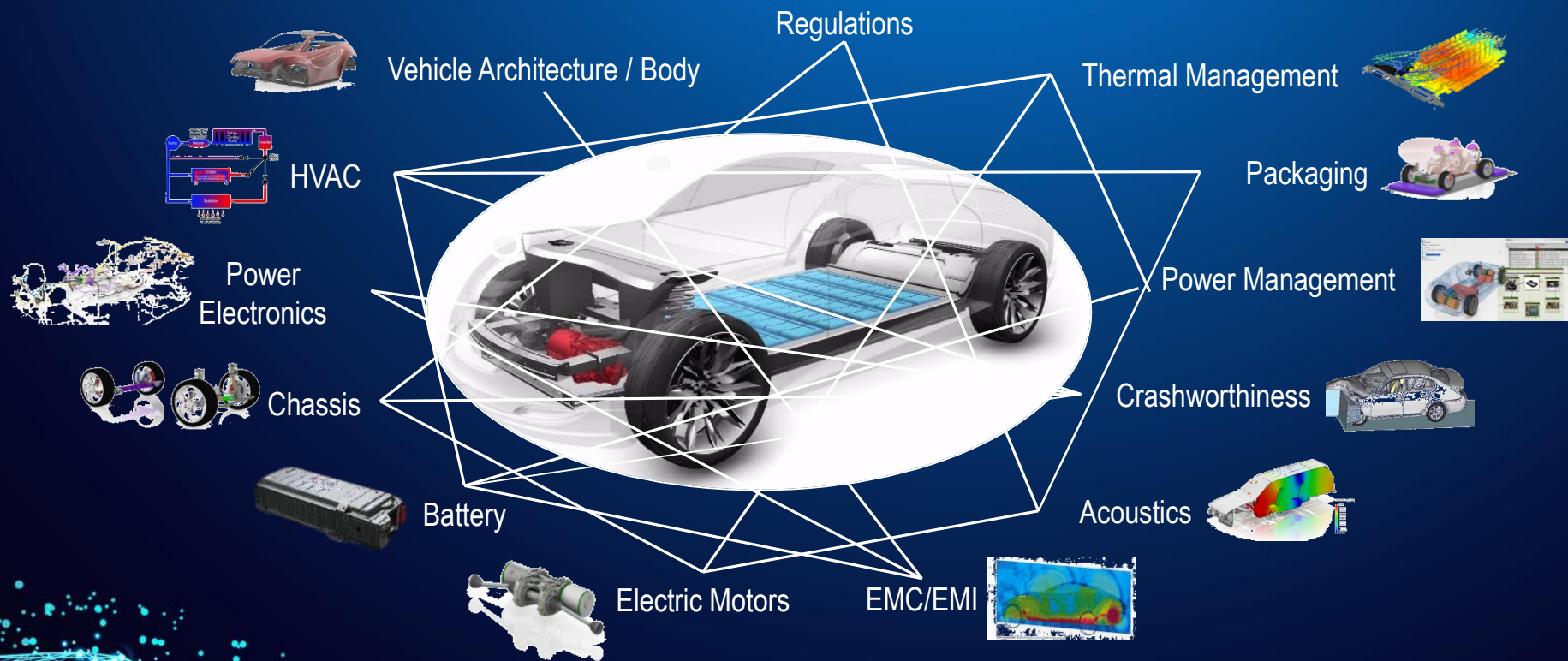
A faster technology ramp-up is required



Years



Facing new technological challenges



Needing new type of high end simulations

Sensor Positioning



PowerFLOW

Vehicle Aerodynamics

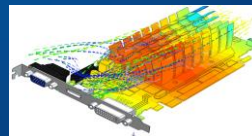
PowerFLOW



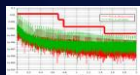
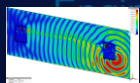
Real designs need to perform in the real world.

Thermal Management

PowerFLOW

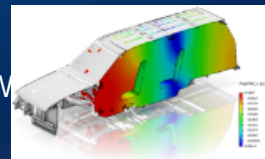


Power Electronics

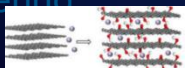
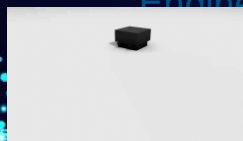


Acoustics

PowerFLOW



Battery

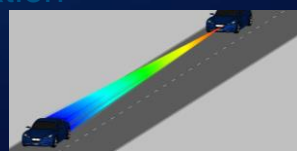


Electric Motors

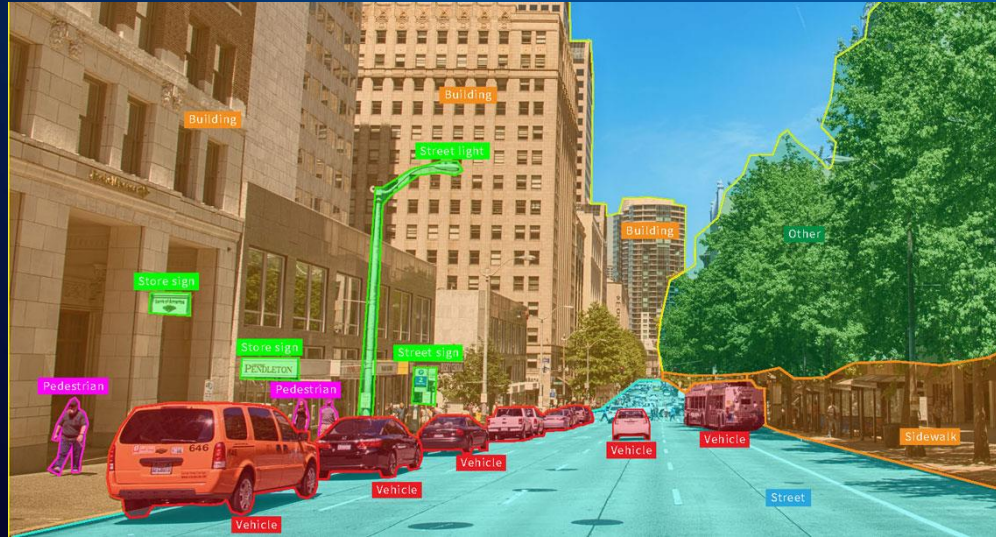


xflow

Connected Vehicle Communication



Cyber Physical Systems



2



Roadmap to Cyber Physical System

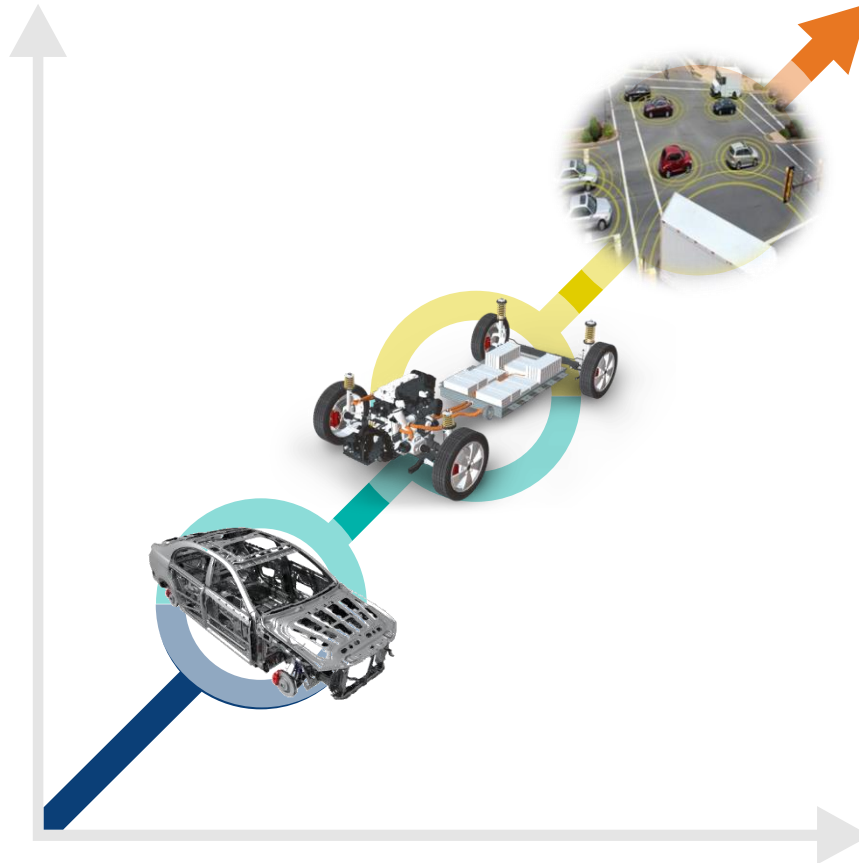
CYBER PHYSICAL SYSTEM

Integration of software-intensive and physical processes interacting together in an unpredictable world

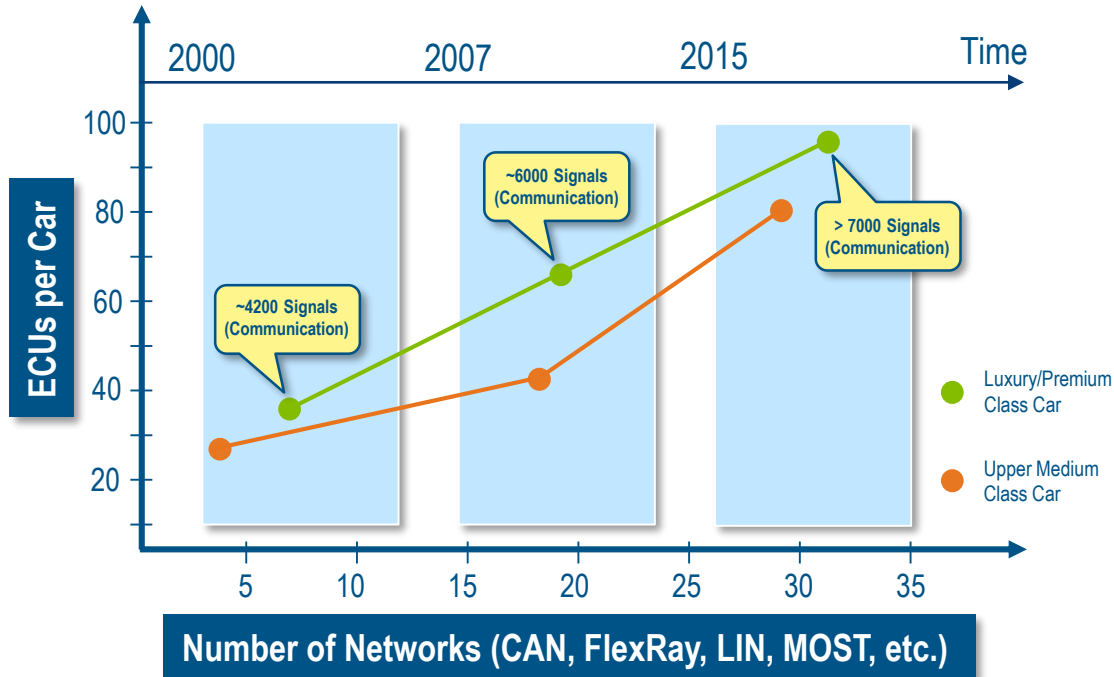
MECHATRONICS

Multidisciplinary integration of mechanical and electronic systems

MECHANICAL



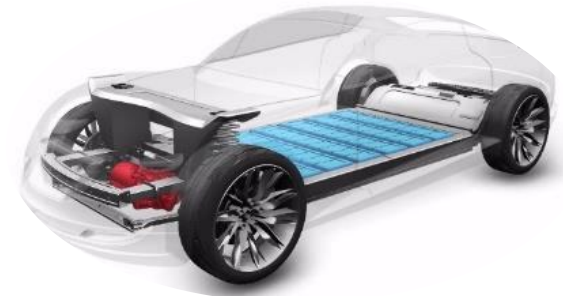
Automotive Complexity – Electronics & Software



Configuration Complexity

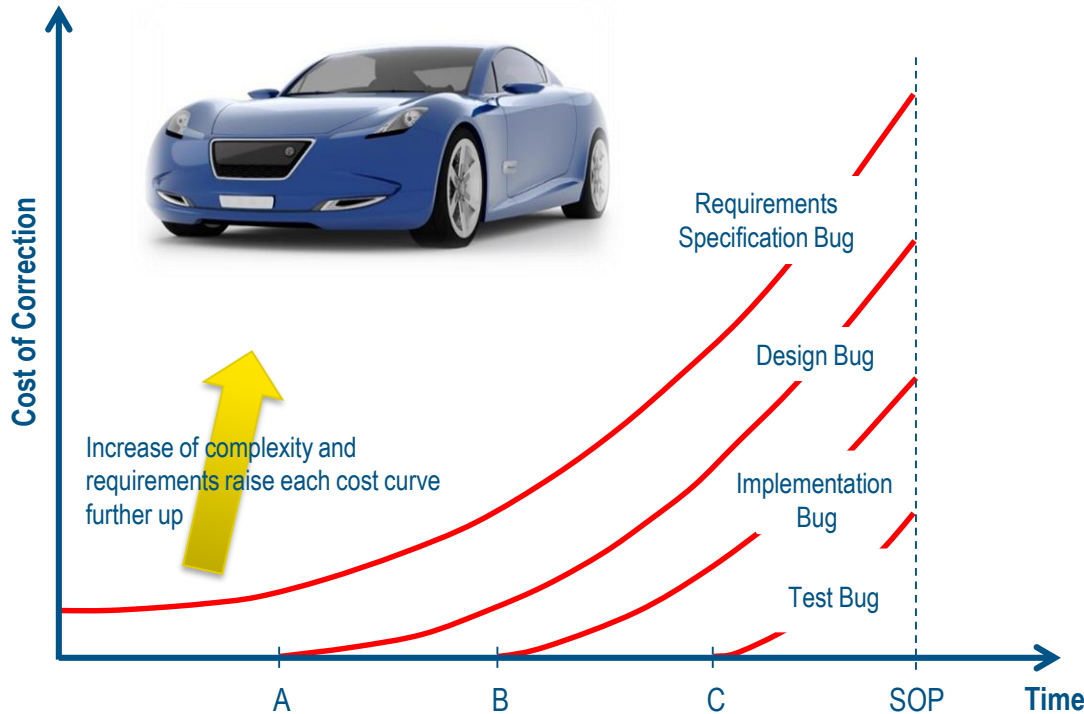
„32 system function components with 1.200 parameters can lead up to **30.000 configurations per ECU.**“

Source:
AUTOSAR Methodology @ BMW (B. Jäger)
9th AUTOSAR Open Conference, Gothenburg



Source: Architekturgesteuerte Elektrik/Elektronik Baukastenentwicklung im Automobil (L. Brandt)

Systems Complexity – The Cost of Correction



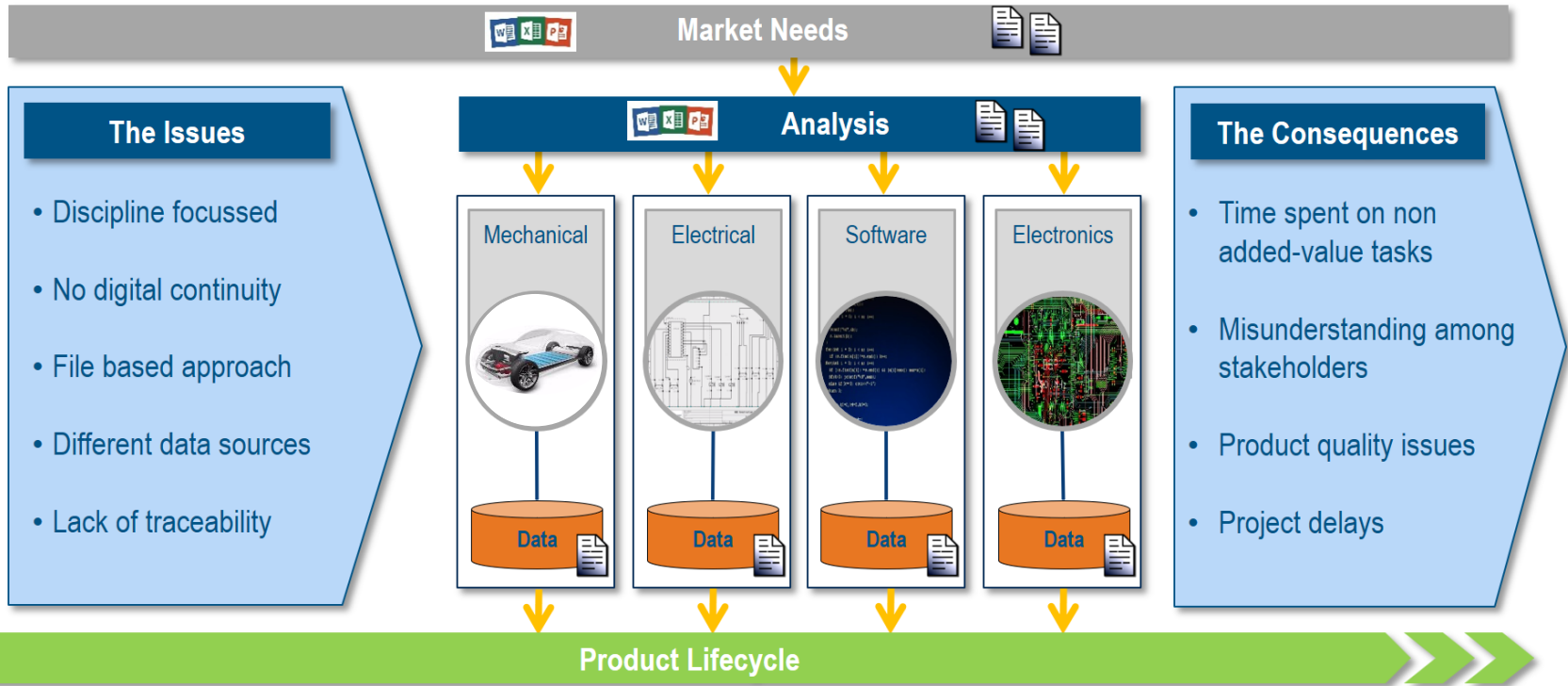
Rule of Thumb

“Cost of correction increases at a subsequent stage by a factor of ~ 10 ”

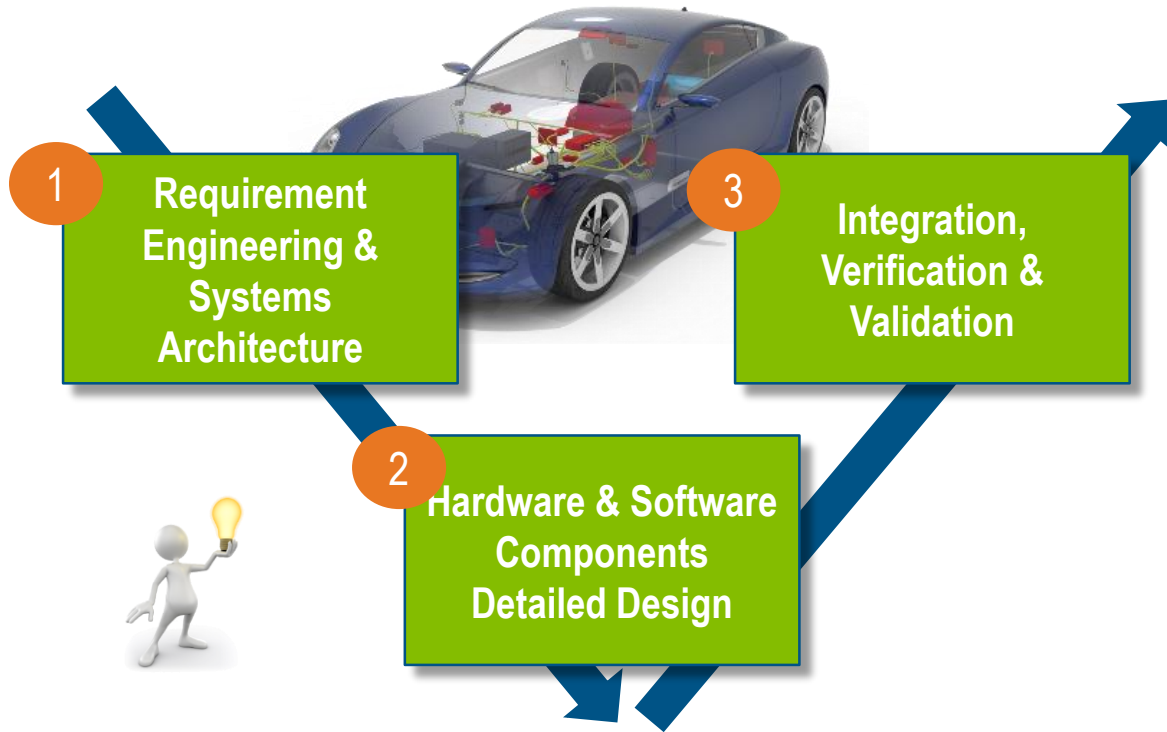
Example:

Fixing a requirements bug uncovered in the design phase is ~ 10 times more expensive than uncovering & fixing it in the requirements phase already

A Key Problem – Thinking in “Discipline Silos”



Systems Engineering – Break the Silos!



- 1 How to better **consolidate stakeholders needs** and **early validate best solution concepts**?
- 2 How to improve **multi-disciplines collaboration** and **OEM/Suppliers exchanges**?
- 3 How to decrease **Integration & Validation time & cost**?

Systems Engineering – A cultural Business Change

1 How to better **consolidate stakeholder needs** and **early validate best solution concepts**?



Deploy **Systems Thinking Approach**

2 How to improve **multi-disciplines collaboration** and **OEM/Supplier exchanges**?

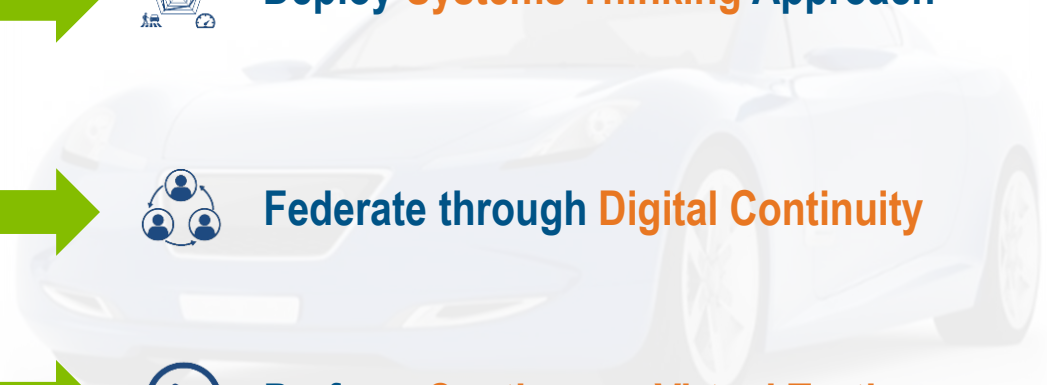


Federate through **Digital Continuity**

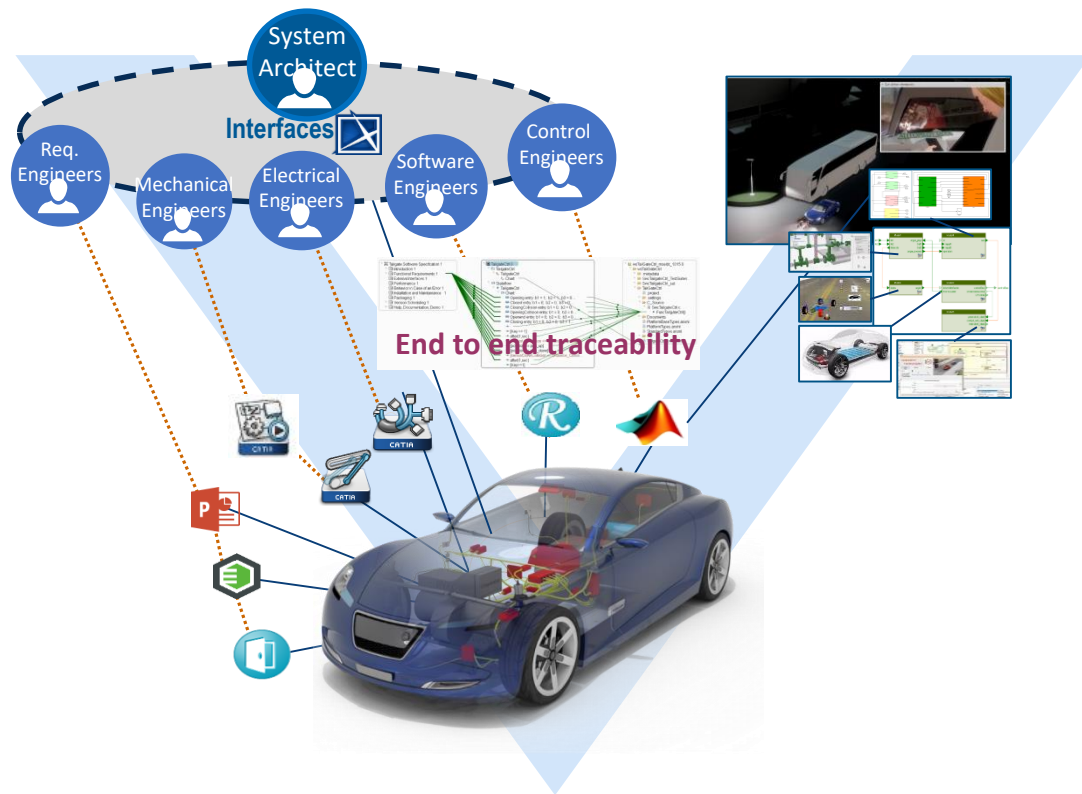
3 How to decrease **Integration & Validation time & cost**?



Perform **Continuous Virtual Testing**



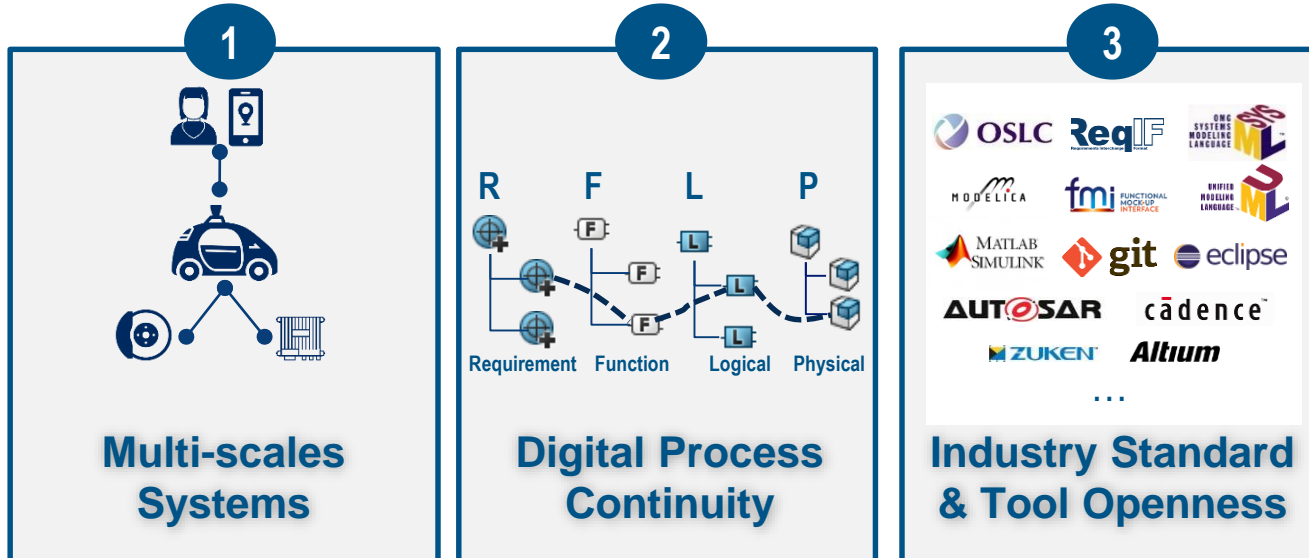
Model Based Systems Engineering



► Key principles:

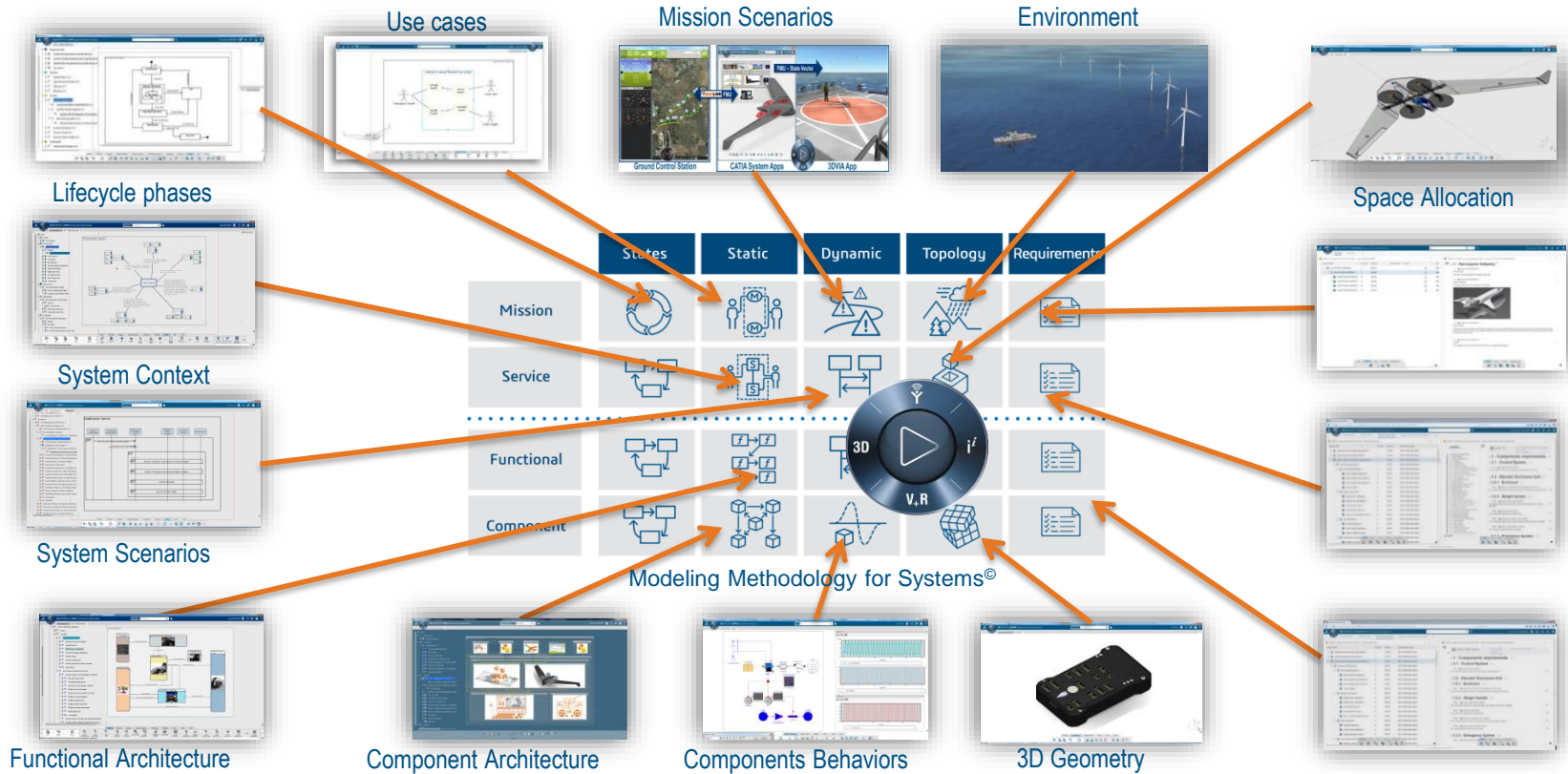
- Different disciplines working together on single source(s) of truth
 - Federate models and data without duplication.
- Provide traceability throughout models / toolchain
- Common configuration management, integrations, and model transforms – across programs
- Perform integration & validation all along the V Cycle, continuously

Dassault Systemes Strategy for MBSE



3DEXPERIENCE Twin

Model Based Systems Engineering needs a platform approach



Stakeholder / System / Design Requirements

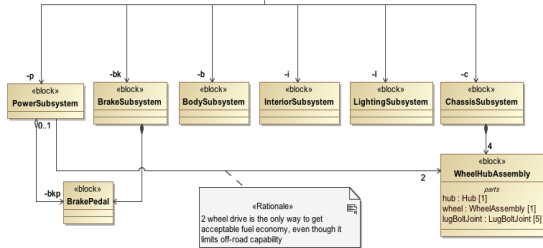
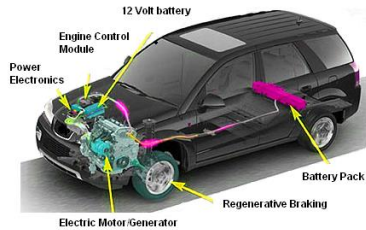
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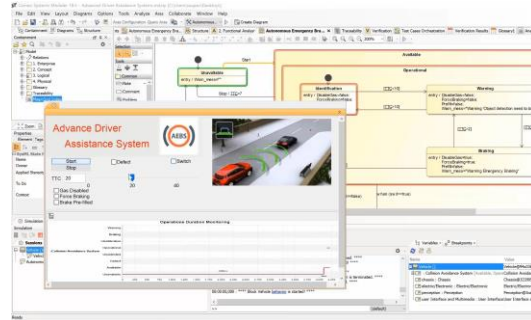
Model-Based Systems Engineering

Modeling

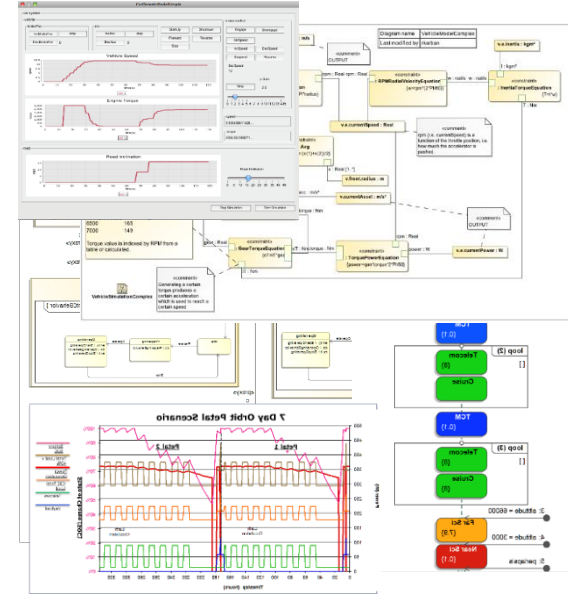
Example of a Hybrid SUV



Simulation



Analysis



Open Platform for Systems & Software

Navigate, collaborate and trace engineering assets coming from multi-sources & multi-formats in one unified 3DDashboard.

My Requirements

My Tasks

My Deliveries

My Collaborative Reviews

Data Connectors



ADOPTION - 3DEXPERIENCE references in Automotive

3DEXPERIENCE®

3DS presence at traditional players (non exhaustive)...

: 3DEXPERIENCE & V6
Architecture customers



1.1 Car & Light Truck
OEMs



1.2 Racing Cars



1.3 Motorcycles



1.4 T&M Industry
Suppliers



1.5 Trucks and
Buses



1.6 Trains

..and at EV Startup selecting 3DEXPERIENCE (Non exhaustive)



PSA

Challenges & Business Drivers

- Facilitate multi-disciplines collaboration
- Enable development of driverless car, address exponential increase of requirements
- Systematic testing of all detail requirements

Benefits

- 5 to 7% Productivity gains yearly through R&D transformation:
- Reduction of physical tests
- Avoid physical prototype cost for passive safety (200K€ per proto)*
- Full coverage of requirements by virtual tests,
- Enhanced innovations capabilities,.../...
- 2.000 OPEL employees fully operational with The 3DEXPERIENCE after 1 year deployment

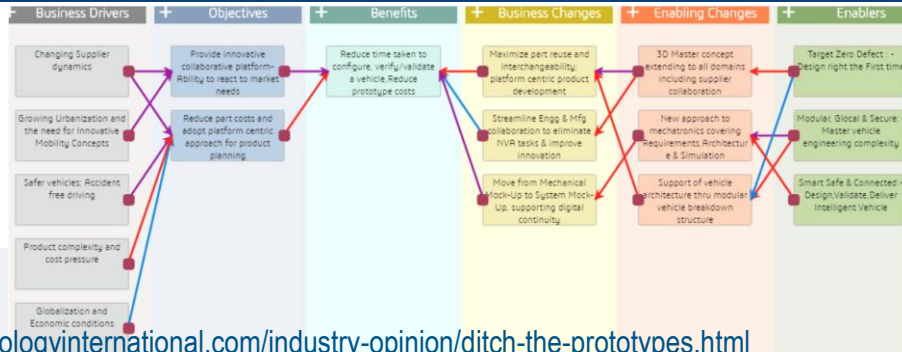


Activity : GROUPE PSA (+OPEL) is one of top 10 WW car makers, selling products under the brands Peugeot, Citroën and DS : Employees 184000



Solutions :

- Target Zero Defect
- Modular Glocal Secure
- Smart Safe & Connected



Dassault Systèmes
Named Key Supplier
by Groupe PSA for its
Digital Transformation

The 3DEXPERIENCE® Company

AUDI

Activity :Premium Brand in Passenger Cars, part of VW Group
AUDI AG designs, engineers, produces, markets and distributes premium cars

Revenue: 60.1B€, Employees: 90k

Challenges & Business Drivers

AUDI's strategy 2025 focuses on :

1)digitalization, 2)sustainability and 3)urbanization.



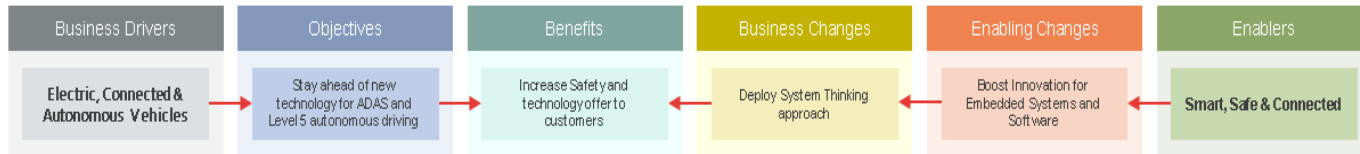
Benefits

Holistic Systems Engineering approach
Enable cross-department Collaboration
Introduce ASIL and ISO26262
Establish systems architecture framework



Solution :

Smart Safe & Connected



Not a Public reference

Challenges & Business Drivers

Quality cost & regulation

Supplier integration

Increasing complexity in car projects



Benefits

Zero physical prototype for passive safety (250K\$ per physical prototype)*

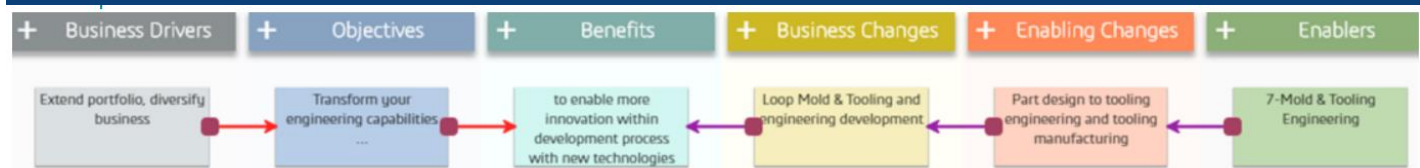
Process-oriented workflow

Increased quality

Enable cross-department Collaboration

Activity :Premium Brand in Passenger Cars,
Becoming a tech company for premium mobility
and premium services

Revenue: 75.3B€, Employees: 125k



Solution

- CATIA SFE CONCEPT
- Mold and Tooling design

TESLA

Activity : After 10 years in the market, Tesla ranked as the world's best selling plug-in passenger car manufacturer in 2018. Employees : 42000+

Challenges & Business Drivers

- . BOM management, . Configuration management, . Supplier integration
- . Greater Integration across Product Development Phases

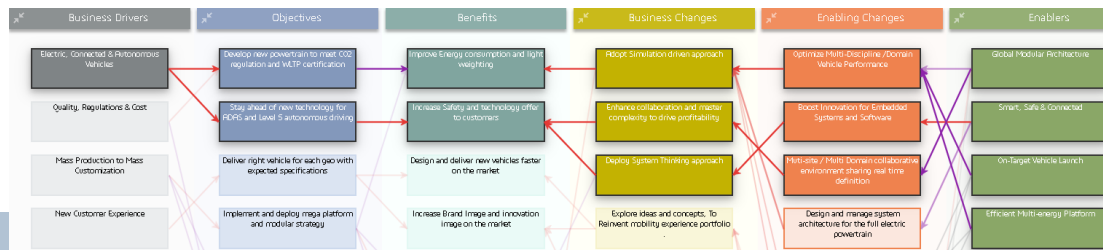


Benefits

- Manage vehicle variants
- Track supplier performance
- Track projects / recall / customer information within a single source of data
- Modular based development.

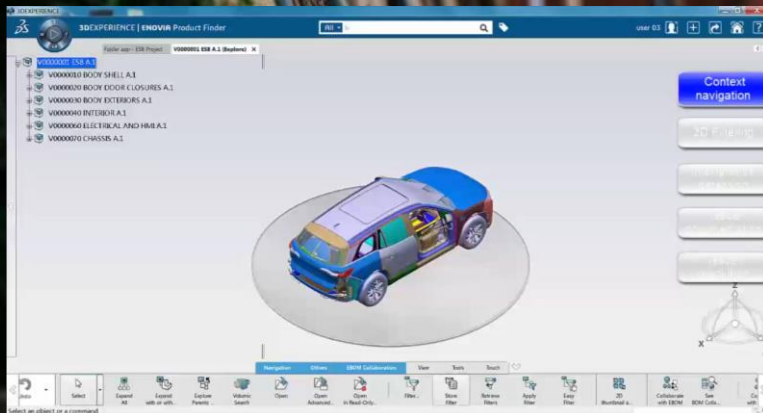
Solution :

- T&M Global Modular Architecture
- T&M Efficient Multi-Energy Platform
- T&M On-Target Vehicle Launch





- Decision to move to 3DEXP in 2016
- Now: Complete Engineering team up and running with 3DEXPERIENCE platform
 - **Global** : 3 Continents, more than one thousand users connected
 - **Online** : double digit **performance** improvement
 - **End to End** Engineering Coverage



WHY CHOOSE 3DEXPERIENCE ?

“TRADITIONAL CENTRALIZED ORGANIZATIONS ARE BECOMING INEFFICIENT. YOU NEED A DECENTRALIZED BUSINESS MODEL AND TOOLS THAT SUPPORT A UNIFIED DATA MODEL ACROSS THE NETWORK.”



Link to DS Customer Story :
<https://www.3ds.com/insights/customer-stories/canoo>

canoo

A SMARTER WAY TO MOVE FROM A TO B



- ▶ “The cloud-based platform enabled us to seamlessly transition to a work from home environment, in both our US and China locations. Our designers and engineers are able to stay connected in real time and keep moving on their projects.” (April 2020)

▶ Phil Weicker

Co-founder and Head of Powertrain & Electronics,
CANOO

3DEXPERIENCE & V&A Architecture customers

Priority #3: New PLM - countermeasure

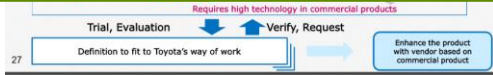


TOYOTA

- Enhance the product with vendor, in addition to utilize the know-how which is incorporated in the existing one

Commercial PDM : Product of Dassault Systèmes (© Same as CATIA, high affinity)

A Platform to empower
40,000 Engineering users



A Global and very Large Players

Business transformation
With > 7000 users in
Production
Including 2000 at OPEL



A successful Business Recovery

18 000 users in production
LCI running innovation project
on Cloud



A major player in mass production and
electric vehicle in Europe

Major decision after 12
Months evaluation, because
we share the same vision



SCANIA

A leader in Modularization

MBSE approach to win the
Autonomous Driving race



A Leader in vehicle Technology

Step by step platform adoption
to reach global Collaboration

TESLA

A Catalyst of the future of mobility

TOYOTA

Adopts 3DEXPERIENCE Platform



The automotive industry is now undergoing a major transformation. OEMs are facing challenges of survival and sustainable growth. TMC decided to adopt 3DEXPERIENCE POWER'BY to reinvent its traditional car development and drastically improve its productivity.



Business Values:

Car electrification, smart & connected cars, new competition, AI, consumer digitalization, IoT

Values:

- ▶ **Simultaneous** development by timely sharing latest data
- ▶ **Single version of truth** across R&D, design, production, sales, customer services, alliance companies & suppliers

Ambition:

- ▶ Global deployment including suppliers for more than **40,000 users** (deployment ramp-up 2019-2023)
- ▶ **Lead time reduction**
- ▶ **Business transformation** (digital engineering)
- ▶ **Seamless collaboration** with oversea sites, worldwide suppliers and business partners

Solution:

3DEXPERIENCE POWER'BY



3DEXPERIENCE

Thank you



“ *Dassault Systèmes provides business & people with 3DEXPERIENCE universes to imagine sustainable innovations capable of harmonizing product, nature and life.* ”

 DASSAULT
SYSTEMES

