



**3DEXPERIENCE®**

## Trucks & Bus Solutions



Christophe MONTJAULT  
T&M Business Consultant

# Agenda

DASSAULT SYSTEMES / 3DEXPERIENCE Introduction

Value Proposal for Transportation & Mobility / Trucks & Bus Segment

Customers References

Truck Solution end to end demonstration

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# DASSAULT SYSTEMES



## The 3DEXPERIENCE® Company

- 16,000 passionate people
- Solution for Business Transformation from Product to Consumer Experience

... and a true passion for the Automotive sector



## Partnering with innovation leaders in 11 industries

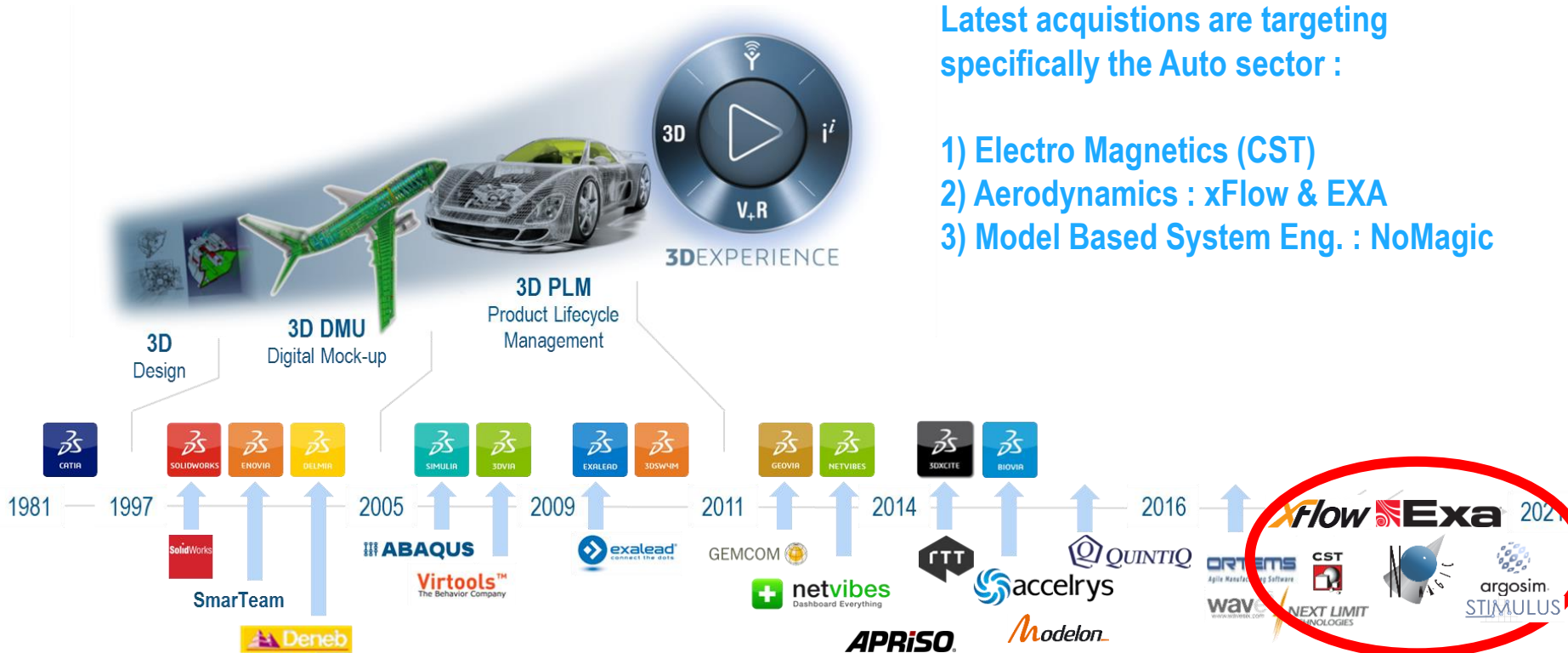


## Investing for the Future ... with benefits for Automotive/ Trucks & Bus :

- 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

# 39 years of sustainable innovation & investments

3DS.COM © Dassault Systèmes | Confidential Information | 11/19/2020 | ref.: 3DS\_Document\_2015

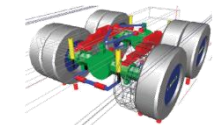


Latest acquisitions are targeting specifically the Auto sector :

- 1) Electro Magnetics (CST)
- 2) Aerodynamics : xFlow & EXA
- 3) Model Based System Eng. : NoMagic

# 3DEXPERIENCE Platform Applications

## 3D MODELING Applications



Industrial Design  
Real Time Rendering  
Mechanical Design  
Systems Engineering  
City Modeling  
Material Science

## SOCIAL & COLLABORATIVE Applications



Fast ideas sharing  
Ideas & project Management  
Requirement Management  
Social Monitoring  
Social Network



## INFORMATION INTELLIGENCE Applications



KPI monitoring  
Social Intelligence  
Customer Knowledge  
Customer Trends  
Connected Objects & Big Data

## SIMULATION & MANUFACTURING Applications



### Simulation Tests & Validation Manufacturing

- Model and Simulate
- Operations Management
- Scheduling, & Planning
- NC

## PLAY 3DEXPERIENCE



High-End Renderings & Animations  
User Experience (+ IHM)  
Virtual Clinics V+R  
Sales Configurator

# 3DEXPERIENCE Platform – Values & Foundations



**Unified user experience**

**Business Dashboarding**

**Deliver Experience**

**3D Search**



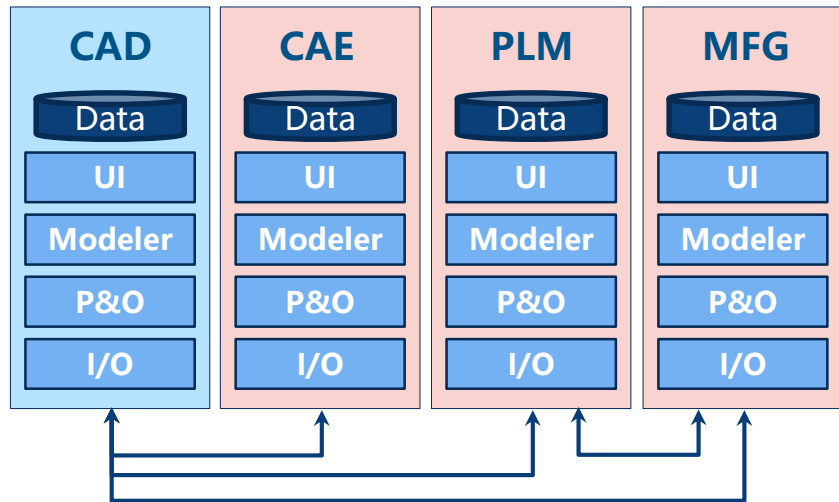
**Shared Services & Controlled TCO**

**Platform Openness**

**Designed for Cloud**

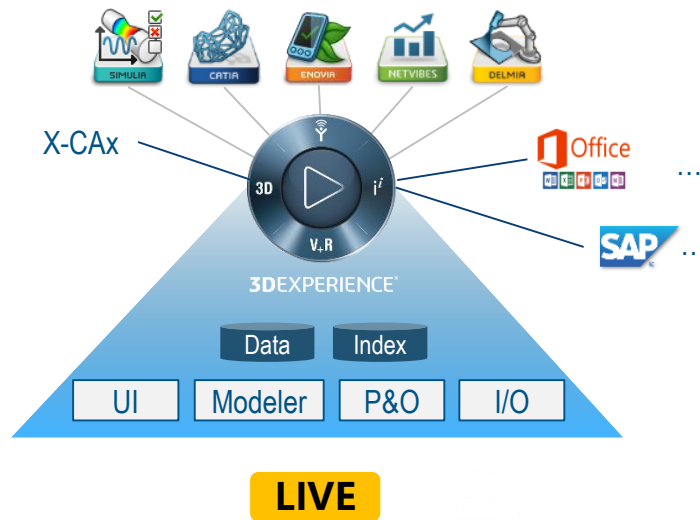
# Digitalization enabled by the 3DEXPERIENCE

**Simplification** with the platform  
**Silo'd applications**



**STATIC**

**Apps on a digital platform**





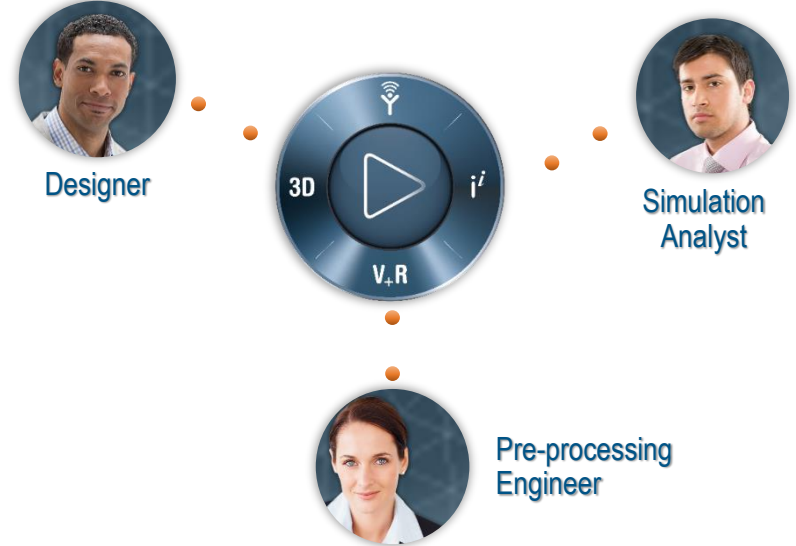
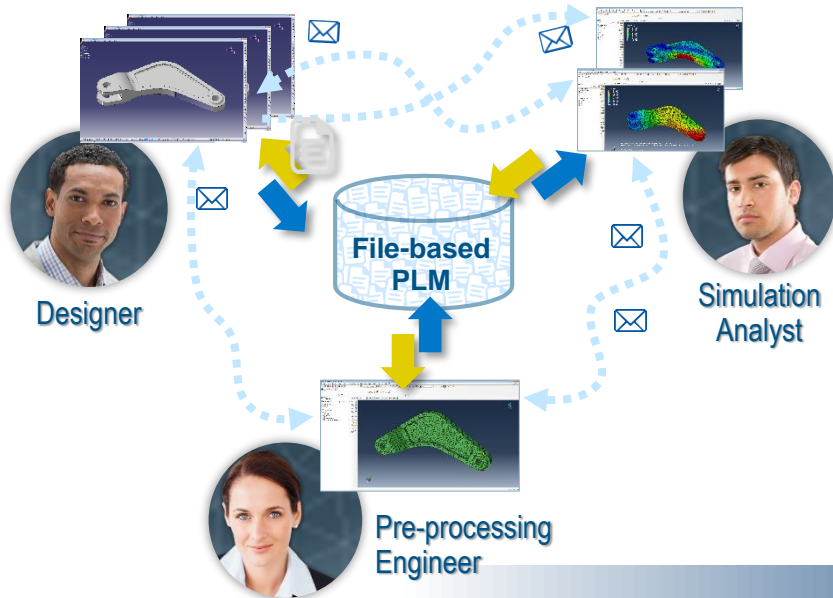
# 3DEXPERIENCE accelerate Digitalization

From file-based... **ELECTRONIC**

to 3DEXPERIENCE platform-based... **DIGITAL**

Time required to find optimum design **x hours**

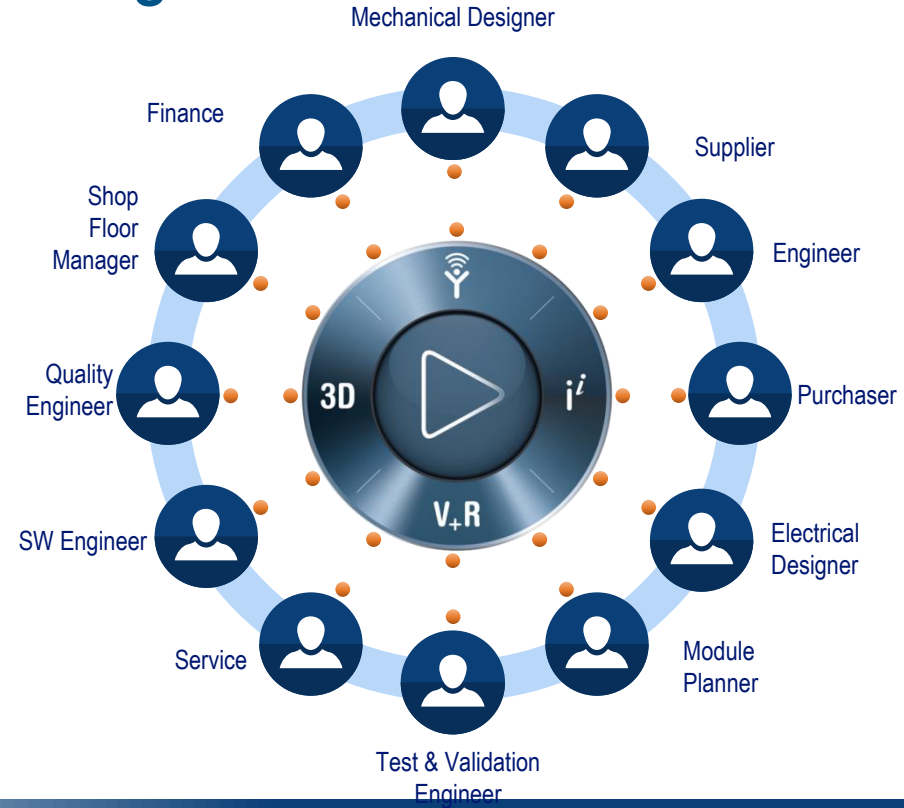
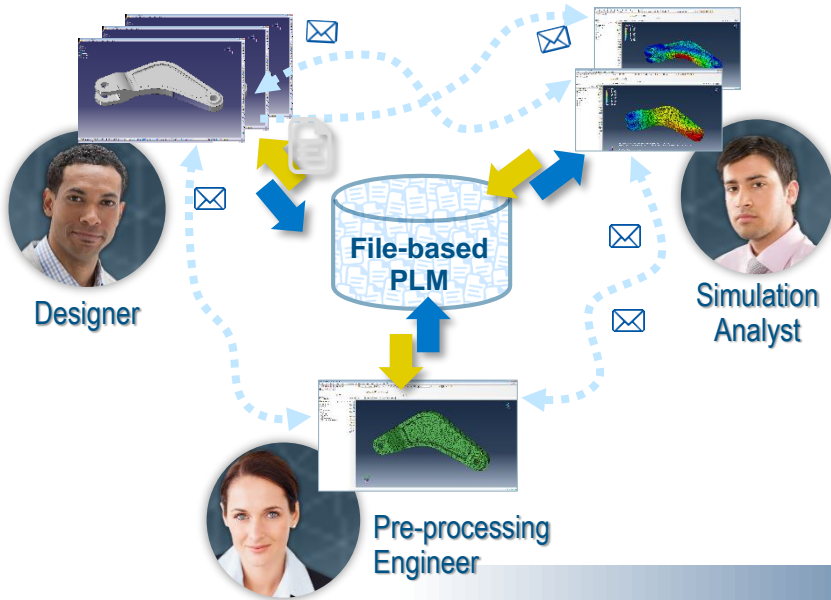
Time required to find optimum design **Few minutes**



# 3DEXPERIENCE accelerate Digitalization

From file-based... **ELECTRONIC**

Time required to find optimum design **x hours**



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Truck Solution end to end demonstration

# Understand challenges shaping the future of mobility ...

ref.: 3DS\_Document\_2015

Assault Systems | Confidential Information

Business changes

Business Drivers



**Connected and Automated Mobility**



**Tailored-made for Business**



**New Regulations (Emission, Safety)**



**New Mobility Business Models**



**Quality and Reliability (Lower TCO)**



**ADAS**



**Modularization**



**Digital & Functional Twins**



**Mobility as a service**



**Agile Production & Operation**

# ... to develop the right Automotive Solution strategy

ref.: 3DS\_Document\_2015

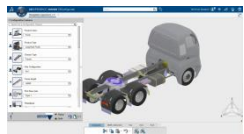
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# 3DEXPERIENCE : 6 differentiators for Trucks & Bus



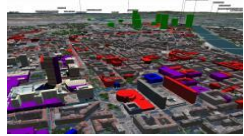
**Modularization** : Maximize margin while developing tailored transportation solutions



**Globalization** : Develop new markets, increase local sourcing. Improve Collaboration with partners



**Smart Truck** : Technology & Connectivity represent a great potential to differentiate and sell more services



**Smart City & Mobility Services** : Develop new usage & services



**Innovation** : Keep leadership to invent the transportation of the future, alternative powertrain, lighter and smarter.



**Lean Production & Operation** : Optimize end to end value chain from demand planning to Truck delivery ... and Operation

# 3DEXPERIENCE : 6 differentiators for Trucks & Bus



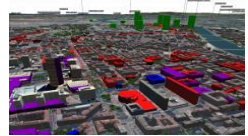
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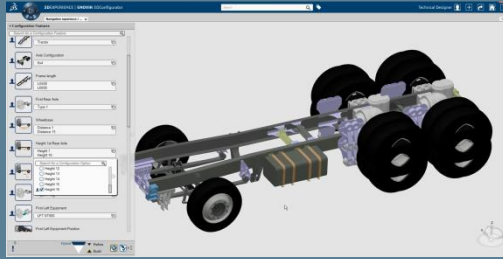
**Lean Production & Operation** : Optimize end to end value chain from demand planning to Truck delivery ... and Operation

# Challenges in 6 numbers !

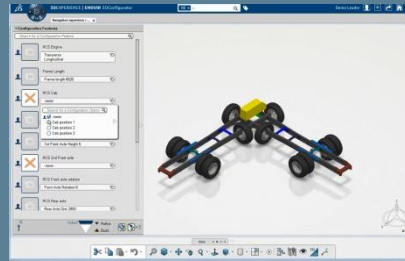
10 000	: Parts
800 > 1000	: Tech. Variants Specifications
$10^{30}$ to 50	: Theoretical variant combination
60 000	: Possible positions of left rear wheel
1.2	: identical truck produced / year
< 10 weeks	: from order to deliver



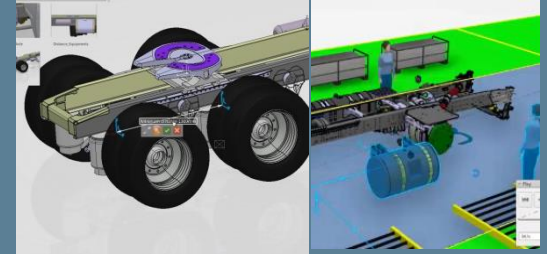
# Modularization



Configuration Management

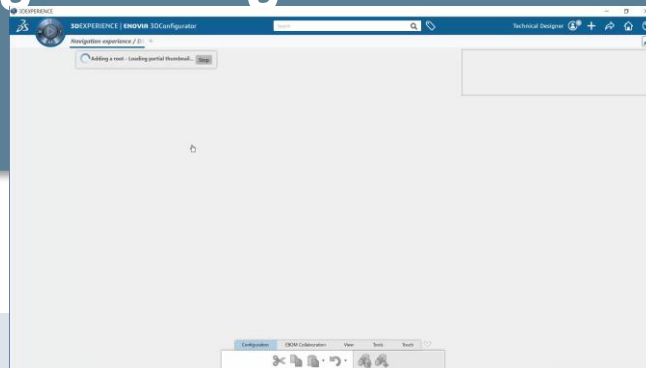


“Center of the World”



Product Process Integration

## Configured Digital Truck “Digital Mock-up”



# 3DEXPERIENCE : 6 differentiators for Trucks & Bus



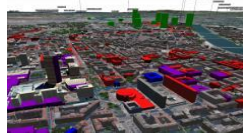
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**Lean Production & Operation** : Optimize end to end value chain from demand planning to Truck delivery ... and Operation

# Global / Cross Brand Collaboration (Use case : Renault – Nissan)



Engineering Collaboration

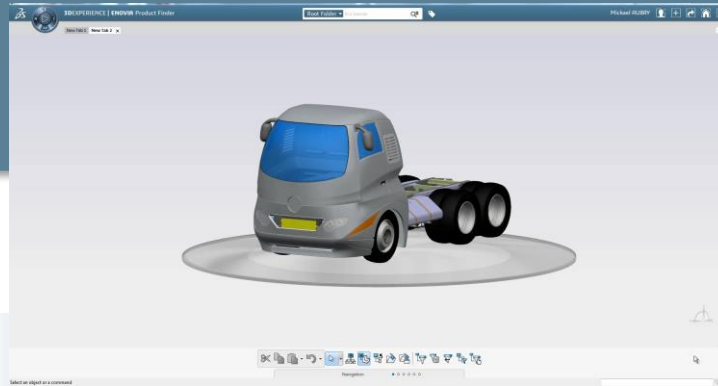


Partnerships

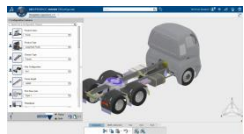


Cross Brand Collaboration

## Digital Truck Referential “Digital Mock-up”



# 3DEXPERIENCE : 6 differentiators for Trucks & Bus



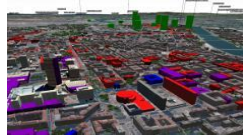
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**Smart City & Mobility Services** : Develop new usage to differentiate and sell more & services

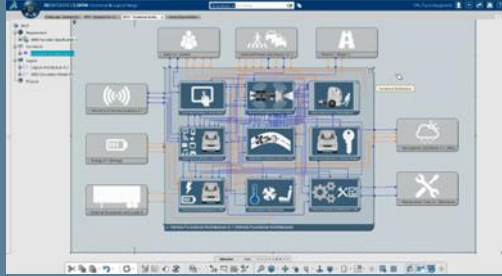


**Innovation** : Keep leadership to invent the transportation of the future, alternative powertrain, lighter and smarter.



**Lean Production & Operation** : Optimize end to end value chain from demand planning to Truck delivery ... and Operation

# Smart Safe & Connected Truck



System Modeling

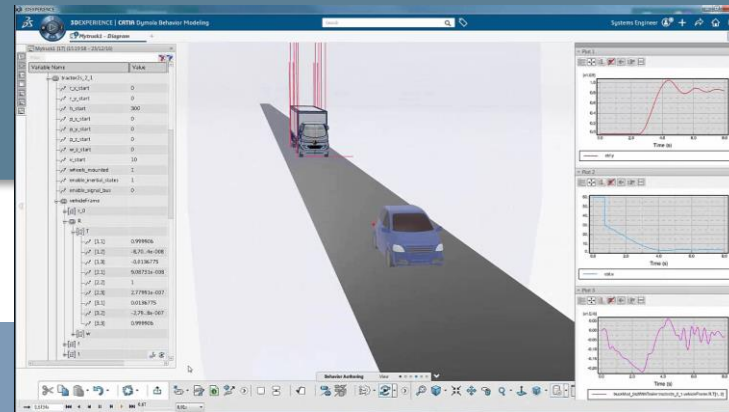


Virtual Validation

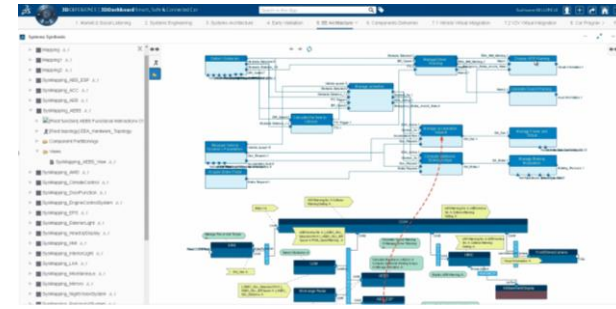
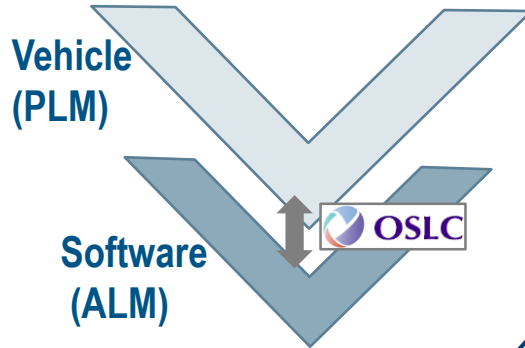


Real Time Experience

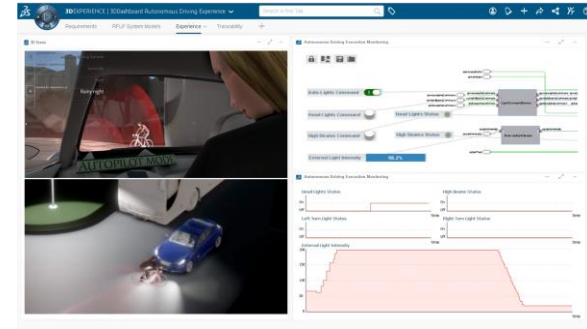
## Functional Truck Referential “Digital Mock-up”



# Autonomous Driving Roadmap



## • Virtual Car Experience



- ALM-PLM Integration
- OSLC Support
- MBSE

- R-F-L-P
- Modelica
- Autosar
- FMI, ReqIF

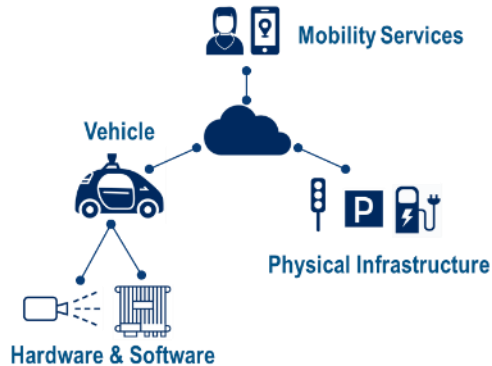
# Autonomous & Connected Vehicle

90% of automotive innovation driven by **Electronics & Software**

**NEW Mobility Experiences**



**NEW Value Networks**



**NEW Ways of Working**

**Waterfall**  
Discontinuous



**Agile**  
Continuous integration



**DevOps**  
Continuous delivery



# 3DEXPERIENCE : 6 differentiators for Trucks & Bus



**Modularization** : Maximize margin while developing tailored transportation solutions



**Globalization** : Develop new markets, increase local sourcing. Improve Collaboration with partners



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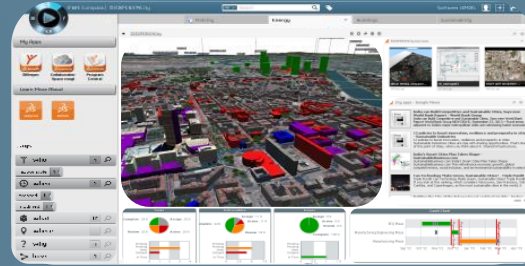
**Lean Production & Operation** : Optimize end to end value chain from demand planning to Truck delivery ... and Operation



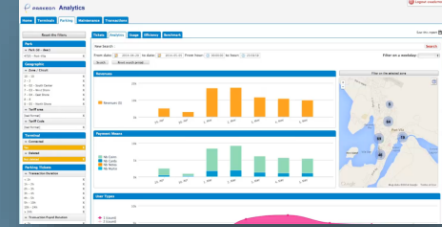
# Smart Cities & Mobility Services



Citizen sentiment analysis

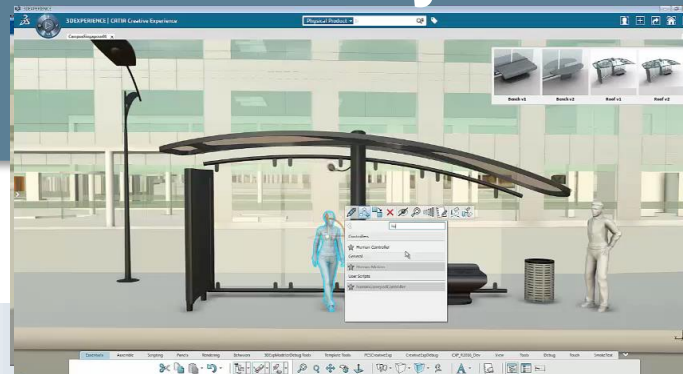


Digital City Referential



Transportation Data Analytics

## Virtual Storyboard



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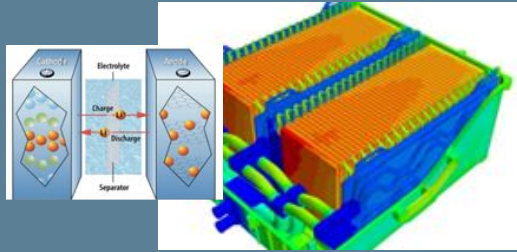


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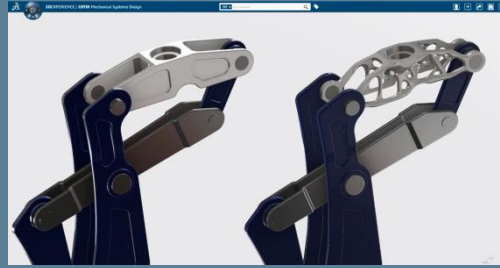


**Lean Production & Operation** : Optimize end to end value chain from demand planning to Truck delivery ... and Operation

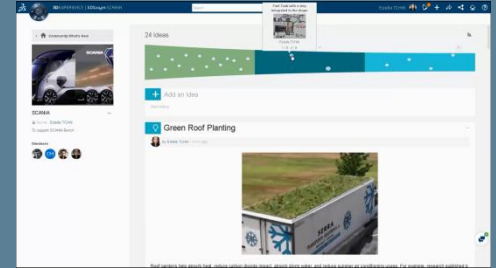
# Innovation :



Multi-Physics / Multi-Scale  
Simulation

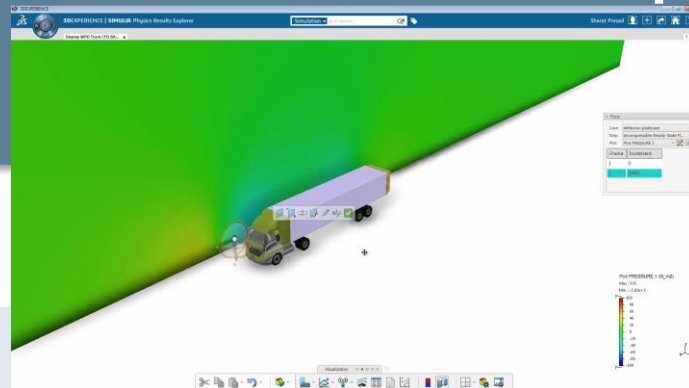


Automated Engineering



Social Innovation

## Innovation & Scientific platform

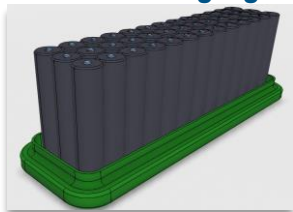


# Electrification

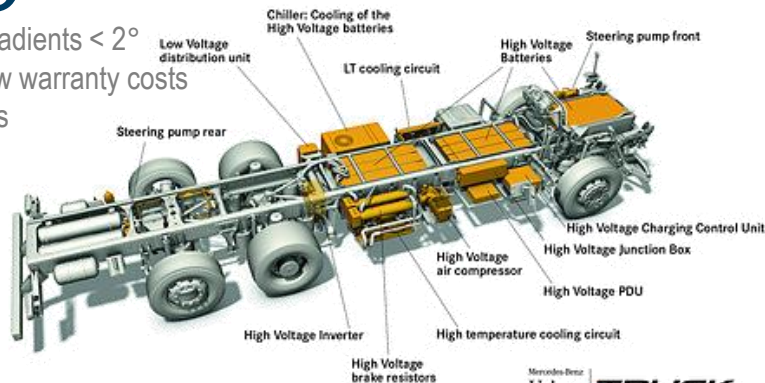
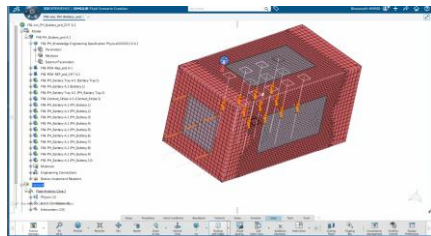
## *Introduction of new systems presents new technological challenges*

- Maintain temperature gradients  $< 2^{\circ}$
- Predict aging to keep low warranty costs
- New safety requirements

### Cells Packaging

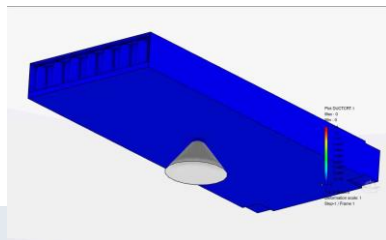


### Cooling



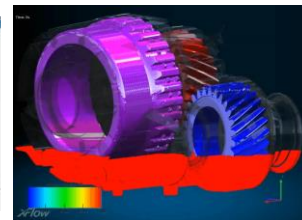
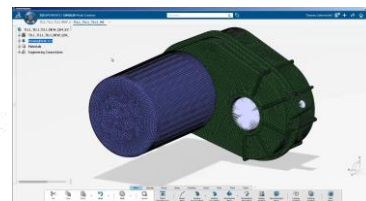
Mercedes-Benz  
Urban eTRUCK

### Battery Pack Safety

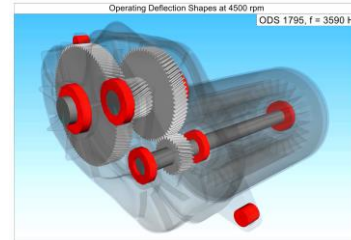


## Electric Drive

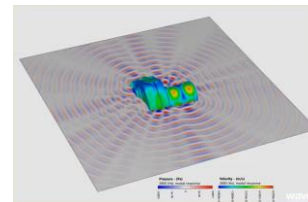
### Lubrication



### Multi-Body Simulation



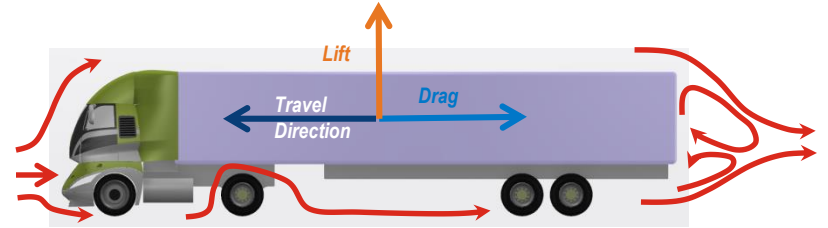
### Vibro-acoustics Analysis



# Validate it for Safety & Performances

## Reduce Fuel Consumption : CFD Analysis

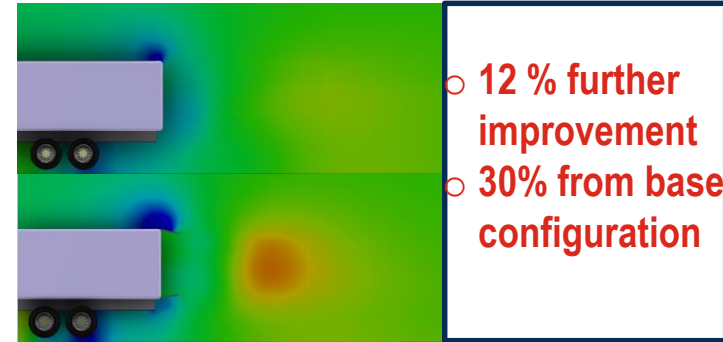
- ▶ Study the dynamics of air flow around vehicles
  - ▷ Evaluate the drag and lift forces on vehicles
  - ▷ Evaluate how the drag and lift forces are affected by vehicle shape and configuration in various operating conditions (Air speed, direction etc.)



Base Configuration



Configuration 1

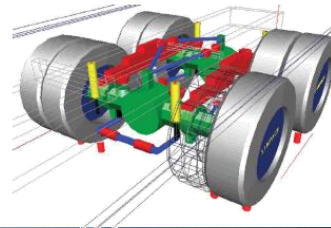


Configuration 2

# Validate it for Safety & Performances

## ► Improve safety

- Detailed air spring models
- Beam based leaf springs with contact and friction
- Flexible body generation within SIMPACK
- Importation of flexible bodies from FEM codes
- Easy implementation of user specific code



### Electronic Stability Program (ESP) for Trucks on the Daimler Driving Simulator

**DAIMLER** **ESP FOR COMMERCIAL VEHICLES**

The Electronic Stability Program and its sensors to be an integral component in the reduction of traffic accidents. Electronic "roll-over control" and "roll-over control" have been available since 2007 for commercial vehicles. The system used for trucks and buses has two basic functionalities. The "roll-over control" functionality reacts on the yaw rate and ESP systems. Sensors measure the steering wheel angle, the yaw velocity and the lateral acceleration of the vehicle and feed the values into a simple vehicle model. As soon as this model detects a tip

difference between the steered and measured vehicle path, either in an oversteering or an understeering direction, individual wheels are braked to generate a moment around the vehicle's vertical axis, which stabilizes the vehicle movement (Fig. 2). For commercial vehicles, especially when loaded, these levels of adhesion are usually only reached on roads with a low coefficient of friction, for trucks and buses traveling on dry road surfaces, it is more important to prevent them from reaching the roll-over limit (Fig. 3).

The "roll-over control" functionality limits the lateral acceleration of the vehicle to a pre-defined value which is dependent on the vehicle mass. When the vehicle reaches this maximum value, all the wheels of the loaded vehicle and the trailer are braked to reduce speed.

For Daimler trucks, the system is integrated into the electronic braking system and is called "Roll-Over Stability System" or a safety package together with other systems like lane-keeping assistant and active cruise control. However, until now the system was only

Fig. 2 ESP roll-over control

Fig. 3 ESP roll-over control

6 | SIMPACK News | September 2010



Fig. 3: ESP roll-over control in reality and the respective SIMPACK model simulation

REALISTIC WIND AND RAIN

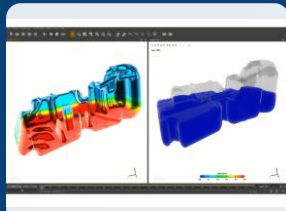


to reveal what no physical test can: real-world vehicle performance.

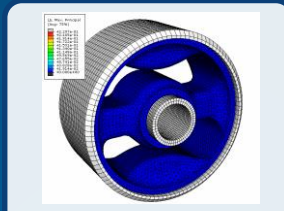
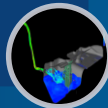
# Simulation



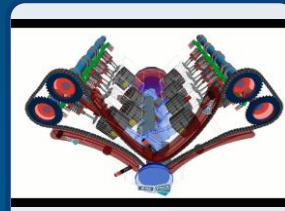
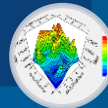
Light Weighting



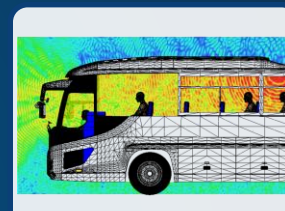
Fuel Tank  
Sloshing  
Refueling



Optimization



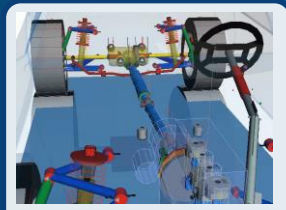
Multi Body  
Simulation



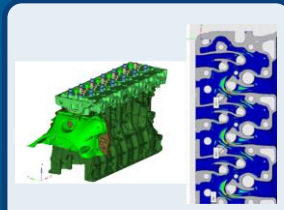
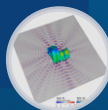
Electromagnetic  
Simulation



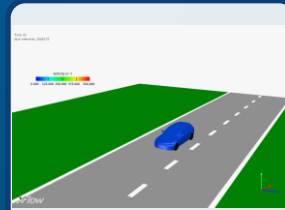
Roll Over  
Analysis



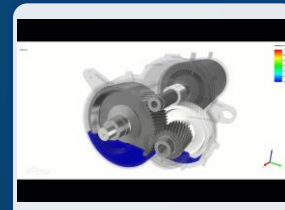
Vehicle N&V



Durability



Fluid Dynamics



Lubrication





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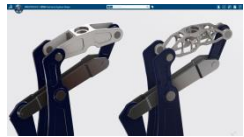
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**Lean Production & Operation** : Optimize end to end value chain from demand planning to Truck delivery ... and Operation

# Lean Production & Operation



Digital  
Manufacturing

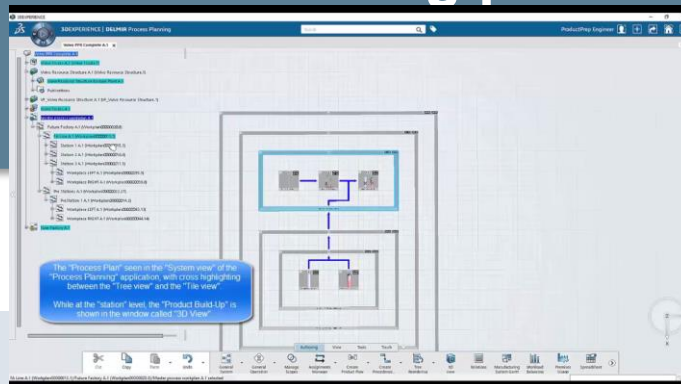


Manufacturing Operations  
Management



Demand Planning  
& Supply Chain

## Manufacturing platform



Supply Chain  
Planning &  
Operations

Optimize



Industrial Engineering

Engineer



Manufacturing Operations Management

Operate

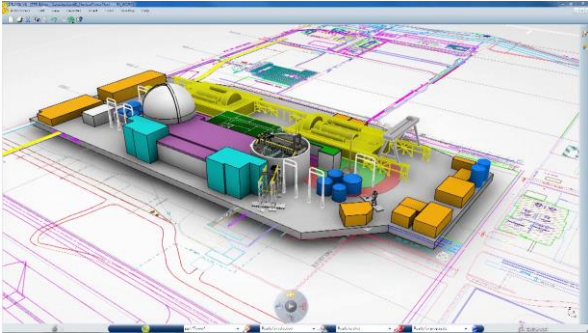


Factories

Field

# ENGINEER

## Model & Simulate Global Industrial Operations



### What

- ▷ Creates executable process plans insuring manufacturability
- ▷ Validates process plans through simulation & virtual certification

### Why

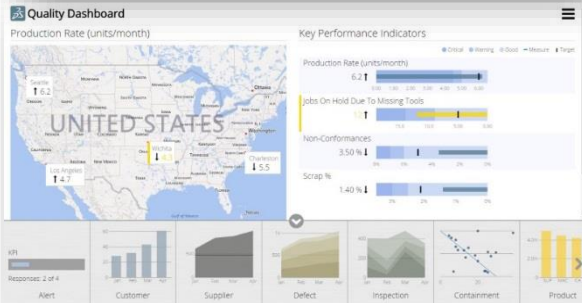
- ▷ New product introduction lead time ⬇️
- ▷ Right first time ⬆️
- ▷ Manufacturing engineering efficiency ⬆️

### How

- ▷ Process Planning; Assembly Process & Ergonomic Simulation; 3D Work Instructions; Machine & Robotics Programming
- ▷ Single 3D data model across engineering and manufacturing

# OPERATE

## Execute Global Industrial Operations



### What

- ▷ Orchestrates all shopfloor activities
- ▷ Provides comprehensive, actionable intelligence, traceability and reporting

### Why

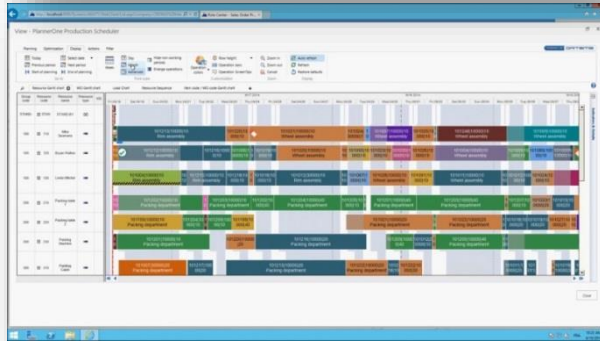
- ▷ Manufacturing efficiency ↑
- ▷ Cost of non-quality ↓
- ▷ Inventory and WIP ↓

### How

- ▷ Visibility, control, synchronization across operations
- ▷ Global enterprise solution enables best practices (leading edge IIoT equipment, brownfield factories, recent acquisitions ...)

# OPTIMIZE

## Schedule and Predict Industrial Operations



### What

- ▷ Real time analytics for efficient decision making and re-scheduling
- ▷ Back office analytics for continuous improvement
- ▷ Predictive analytics to anticipate

### Why

- ▷ On Time Delivery 📍
- ▷ On Time in Full 📍

### How

- ▷ Platform for all needs: Strategic to tactical decision support
- ▷ KPI-based planning with real-time decision support
- ▷ Record-breaking optimization processing speed

# Agenda

DASSAULT SYSTEMES / 3DEXPERIENCE Introduction

Value Proposal for Transportation & Mobility / Trucks & Bus Segment

Customers References

Truck Solution end to end demonstration



ASHOK LEYLAND



## Ashok Leyland

Ashok Leyland is the second largest manufacturer of commercial vehicles in India, and the fourth largest manufacturer of buses in the world

### Business Values

- **Reduction of design lead time** by managing the variant complexity through design in configured context method
- **Cross-functional integration for earlier and quicker decision making** through a single information platform – across design, manufacturing and sourcing

### Solution

- **3DEXPERIENCE** Platform, with **CATIA**, **ENOVIA** apps





Net sales by product segment 2016, %



- Trucks 60%
- Buses 10%
- Engines 2%
- Service-related products 20%
- Used vehicles 6%
- Other 2%

- Leader in sustainable transportation services (250 000 connected)
- HQ in Sweden – global business except North America
- Trucks – Buses – Engines – all configured to order
- Part of VW Truck & Bus – 12 Billion Euro / year (10,4% Op. Result)

## Business Drivers

“We will continue to broaden our efforts to become the leader in sustainable transport.”

HENRIK HENRIKSSON PRESIDENT AND CEO, SCANIA AB

- ✓ Global Growth
- ✓ Innovation & New business areas
- ✓ Digitalization
- ✓ Sustainable transport system

## Solution Offer

- Partnership for future innovation “all in ”3DEXPERIENCE
- ISE - MODULAR GLOBAL AND SECURE
- CATIA, ENOVIA, SIMULIA, DELMIA, 3DEXCITE, APRISO



## 3DEXPERIENCE Values : Voice of the customer

VELIZY-VILLACOUBLAY, France — October 11, 2017 — [Dassault Systèmes](#) (Euronext Paris: #13065, DSY.PA) today announced an agreement with Scania, formalizing the process to deploy the 3DEXPERIENCE platform and other solutions for innovation now and in the future.

The cooperation aims to enable cost-efficient design, testing and validation of the complete range of Scania's high-quality modular products. It will improve realistic simulations of functional properties and processes, such as engineering, manufacturing, service and sales. This will further support Scania in providing the right products at high quality to customers, as

continuous introduction of design changes,” said **Michael Thel, Engineering Director, Scania.**

“This requires a comprehensive repository of designs that can be joined together in building the applications of the customer’s choice. The 3DEXPERIENCE platform will help improve simulation for faster validation of our vehicles. It will also enable full traceability and digital continuity from design to manufacturing throughout our unique virtual product development processes.”

Vice President, Transportation & Mobility Industry, Dassault Systèmes. “The 3DEXPERIENCE platform and its ‘Modular Glocal & Secure’ industry solution experience provide digital continuity to accelerate innovation, improve product quality and performance, and reduce costs in the context of mass customization and complexity. Scania will experience these benefits across its entire value stream.”



# Agenda

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Let's drive the 3DS Truck !



# Truck & Bus tailors - Storyboard

Sales Configuration to illustrate 3DExcite capabilities for Truck Industry

Sales Configuration

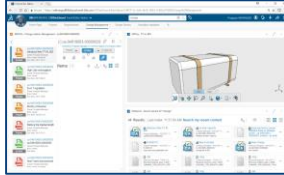
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Dashboard, show Project, tasks and requirements for a new truck with long range, Change A

Project Management and Requirements

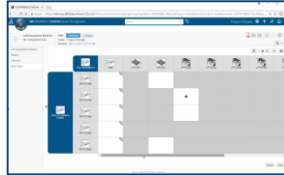
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Create new option and product configuration derivate from an existing configuration

Modular architecture and Configuration

2



Add Fuel Tank. show non persistent clash analysis.

Physical Architecture Optimization

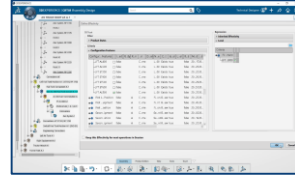
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Promote change, put effectivity on Physical product and Propagate.

Product collaboration and Validation

4

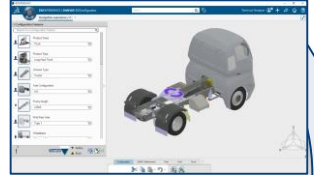


Compare New Variant with old one Through 3D configurator.

Create new 120% configuration for engineering study

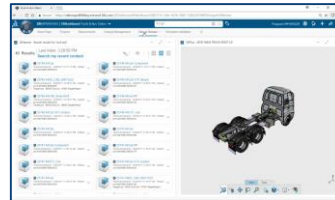
3D configuration & Analysis

5



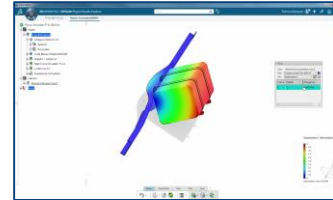
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Design in PPR context  
Concept Study in 3D : Space/ Part Bin/Tools in Product  
Verify-Visualize the assembly sequence, station by station



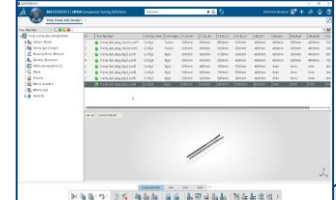
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Validation with Virtual Presentation  
Design Review of new Fuel Tank and release Change. Capabilities to perform on Mobile Device



7

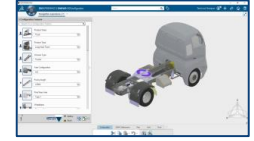
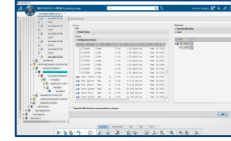
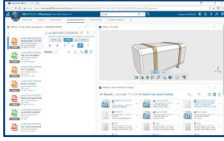
Simulation Analysis  
Simulate constraint and validate the bracket for the new fuel tank with full capacity, Dynamic behaviors



6

Frame Generation  
Frame generation by parameter and Component Family Definition

# Truck & Bus tailors – Process & Roles



Sales Configuration

Project Management and Requirements

Modular architecture and Configuration

Physical Architecture Optimization

Product collaboration and Validation

3D configuration & Analysis

0

1

2

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**Dashboarding, Rules & Change management**

**Collaboration & Configuration Management**



**Manufacturing Process**



**Product Review**



**Design Engineering**



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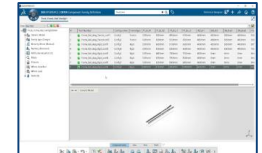
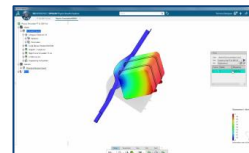
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Design in PPR context

Validation with Virtual Presentation

Simulation Analysis

Frame Generation



 **Program Manager**

 **Design**

 **Process**

 **Service**

 **Simulation**

 **Marketing**

