Mechatronics Product Verification.
Innovations by T-Systems.

Functional DMU: Mechanics/electrics integration and simulation of electronics & ECU software.

Jürgen Mohrmann.

DaimlerChrysler EDM | CAE Forum 2007-07-18.

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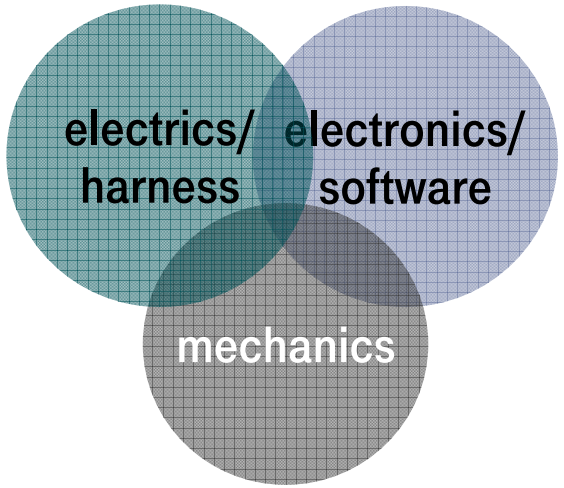
What is a Functional DMU?
Definition.

The term **Digital Mock-Up** (DMU) denotes a virtual model which represents the **structure and the geometry** of a product. Today, DMUs are used for geometric integration to analyse collisions, clash and clearance as well as to perform assembling simulation.

In addition to that **Functional DMUs** (FDMUs) shall contain **behavioural models** to perform behaviour simulation interactively in real-time. The behaviour is described on the mechatronic system level, i.e. the mechanical, electronic and software level.



Example: Anti-lock brake as a mechatronic system

Imagine that a virtual model of a car is rendered on a computer display. The user is moving the brake pedal with the mouse – a sensor information is sent to the virtual ECU (electronic control unit) – it interprets the input value given the logic defined by the software which is running on the ECU and sends an information to an actuator – finally a mechanic movement of the discs is displayed.

What is a Functional DMU?
Motivation.

Excerpt of a Functional DMU Workshop @ PS-iViP Symposium 2006:

Actual state of DMU launch and usage Capability of 3D navigation and und space inquiry, e.g. to visualize a complete airplane with ability to select harness within the 3D space.	Complete 3D vehicle representation is available, but e.g. identification/selection of harness in 3D is missing.
DMU: lightweight format versus functional overload It is hardly to realize algorithms for interpretation and simulation in a monolithic system. For this purpose, a service oriented architecture has to prefer. But the visualization front end must have the ability, to represent the functional behavior.	Service oriented architecture (SOA) preferred for presentation of functional behavior.
System- and Interface problems In the geometric area, the interface problems are have been solved in a wide range. In a long-term view of 5 to 10 years (or further), with a sufficient request it could be possible to reduce the today existing interface problems for CAE, ECAD, e.g too.	**Interface problems exist today.**

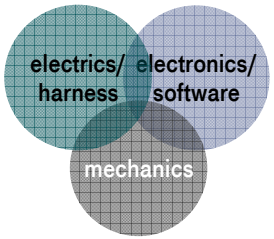
What is a Functional DMU?
Example.

Source: Siemens Medical CO PS MD Zachmann/Supplieth

Example for functional DMU (dynamic) by Siemens Medical Systems:

Real **T**ime **C**ontrol – 3D (RTC-3D)

Mechatronics Prototype.
1. Step.



Mechatronics Prototype – 1. Step:

Mechanical DMU (3D geometry of complete vehicle in JT)
+ electrical information (harness in KBL) for
3D data viewing & verification with a standard JT Viewer (VisView Pro)
+ access to complete electrical schematic definitions (in 2D)

Customer Benefits?

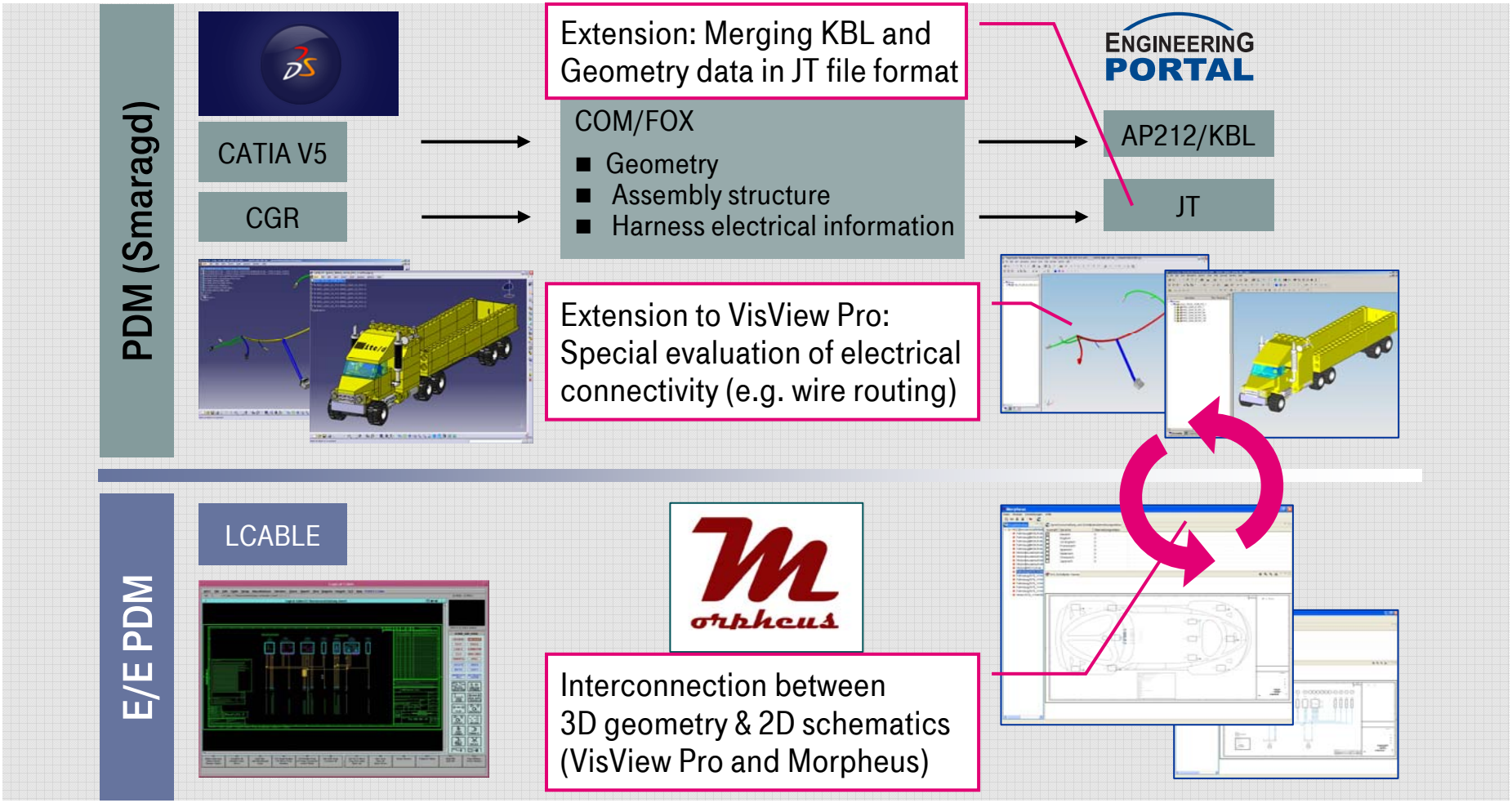
Improvement of Business process
- Mechatronics data integration, verification and functional approval
- Better product quality → higher customer satisfaction

Improvements in
- Quality: manage complexity by easy-to-use, intuitive visualization
- Time: faster verification of product changes
- Cost: use of already licensed standard tools

Re-Use
- JT viewing technology (strategic decision of DC)
- COM/FOX as data conversion platform for CATIA V5 → JT

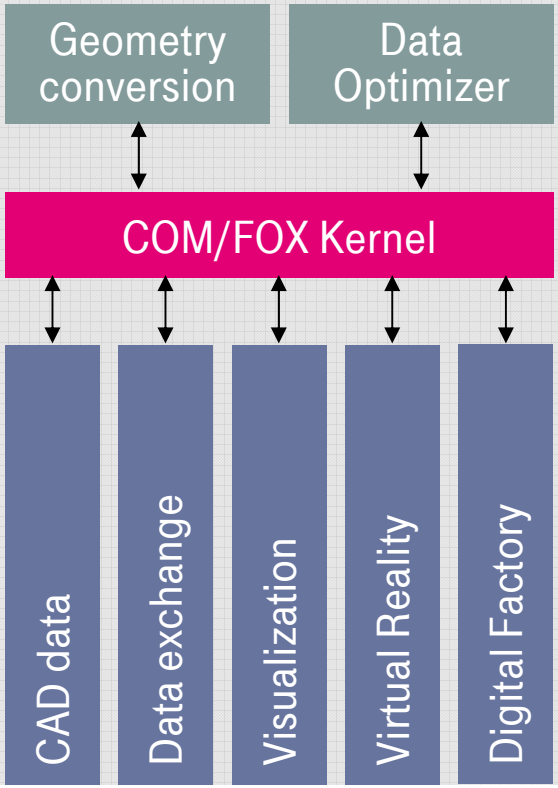
ENGINEERING PORTAL

Mechatronics Prototype.
Mechatronics Prototype (1. Step).



Mechatronics Prototype.
Basic product COM/FOX.

Solution for CAD data conversions and – optimizations for the data exchange between various CAx systems and applications.



COM/FOX:
The automated conversion enables an optimal re-use of the CAx data in the development process.

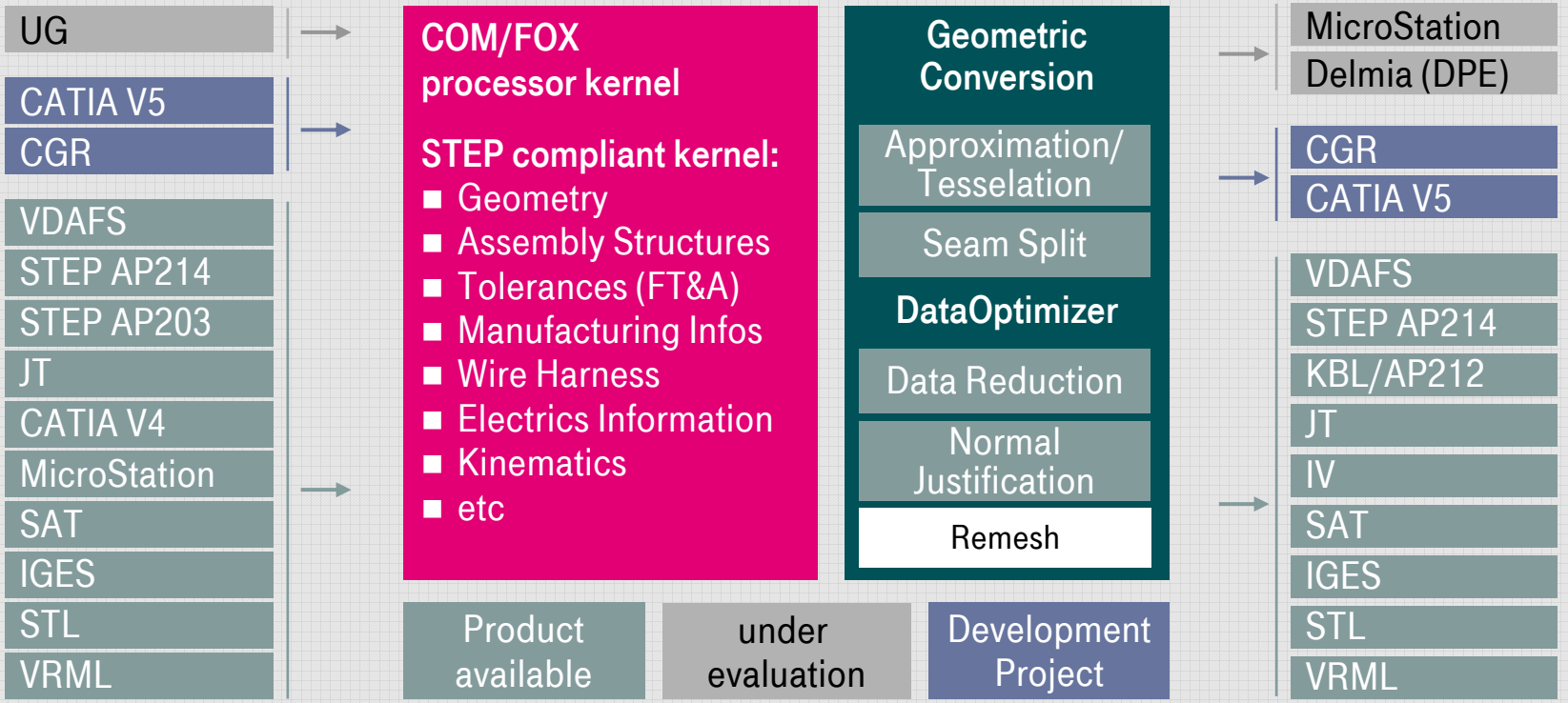
Solution:
- Modular product.
- Project for CATIA V5, CGR.

Functionality:
- Assembly structures.
- Product manufacturing information.
- Electrics – Harness.

DataOptimizer (optional):
- Back face culling (Intellectual property protection!).
- Data reduction.

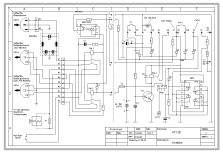
Mechatronics Prototype.
Basic product COM/FOX.

A software solution for the conversion and optimization of the CAD data for an optimal collaboration in the product development disciplines.



Mechatronics Prototype.
Basic product Morpheus – Electrics & Harness.

Solution for the data-, function- and business process-integration in harness development.

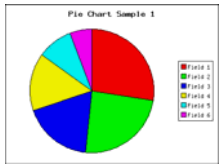


Harness structure view

Search

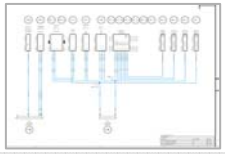
MORPHEUS:

The integrated approach supports the data conversion in various formats for an optimal integration in harness development.



Analysis

Reports:
BoMs
net lists



Graphical representation of the content (SVG)

Software:

- Integration of harness data.
- Central data availability, no data redundancies.

Support:

- Installation and support.
- Individual customizing.

Customers:

- Volkswagen Germany and international.

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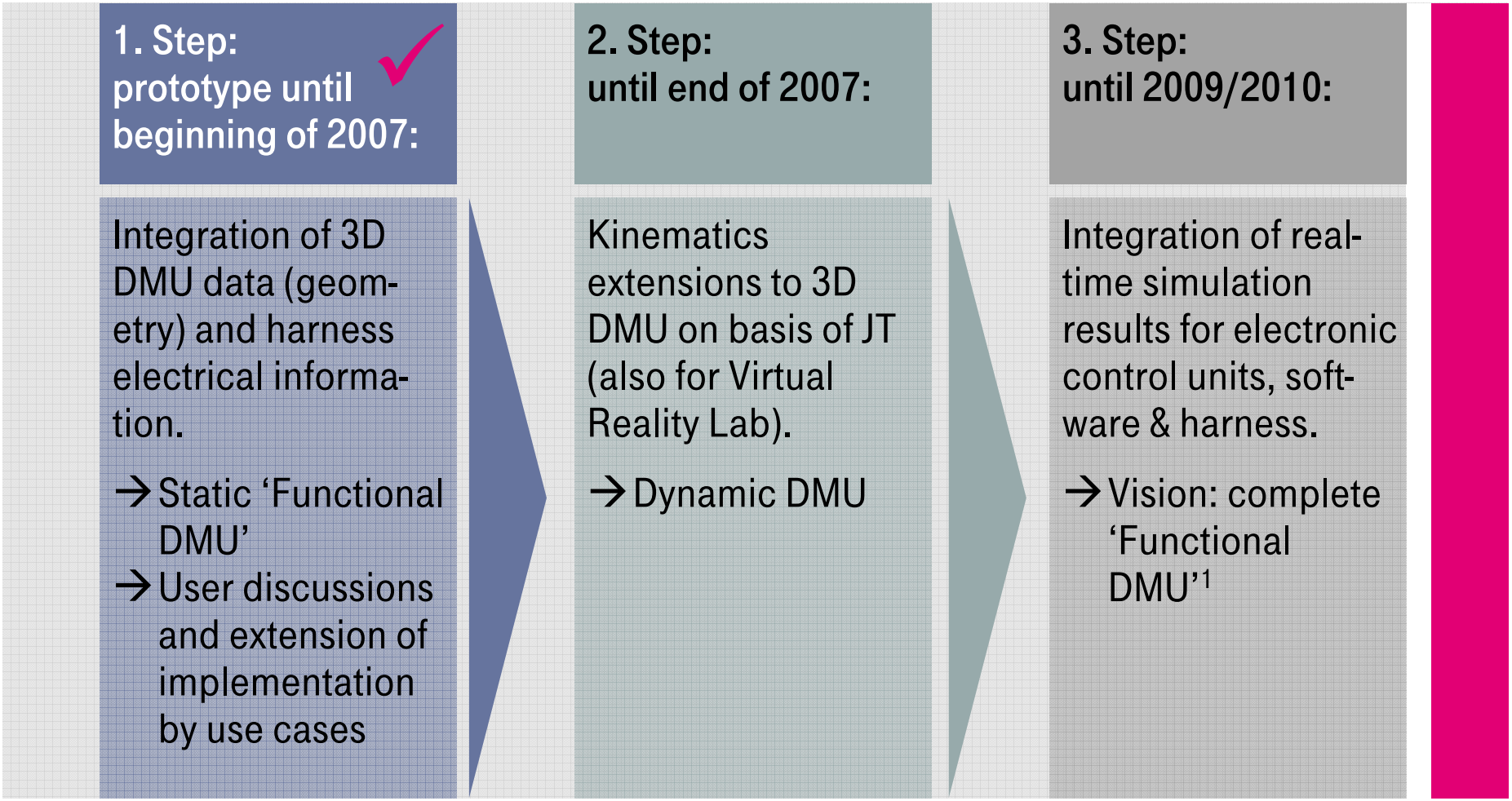
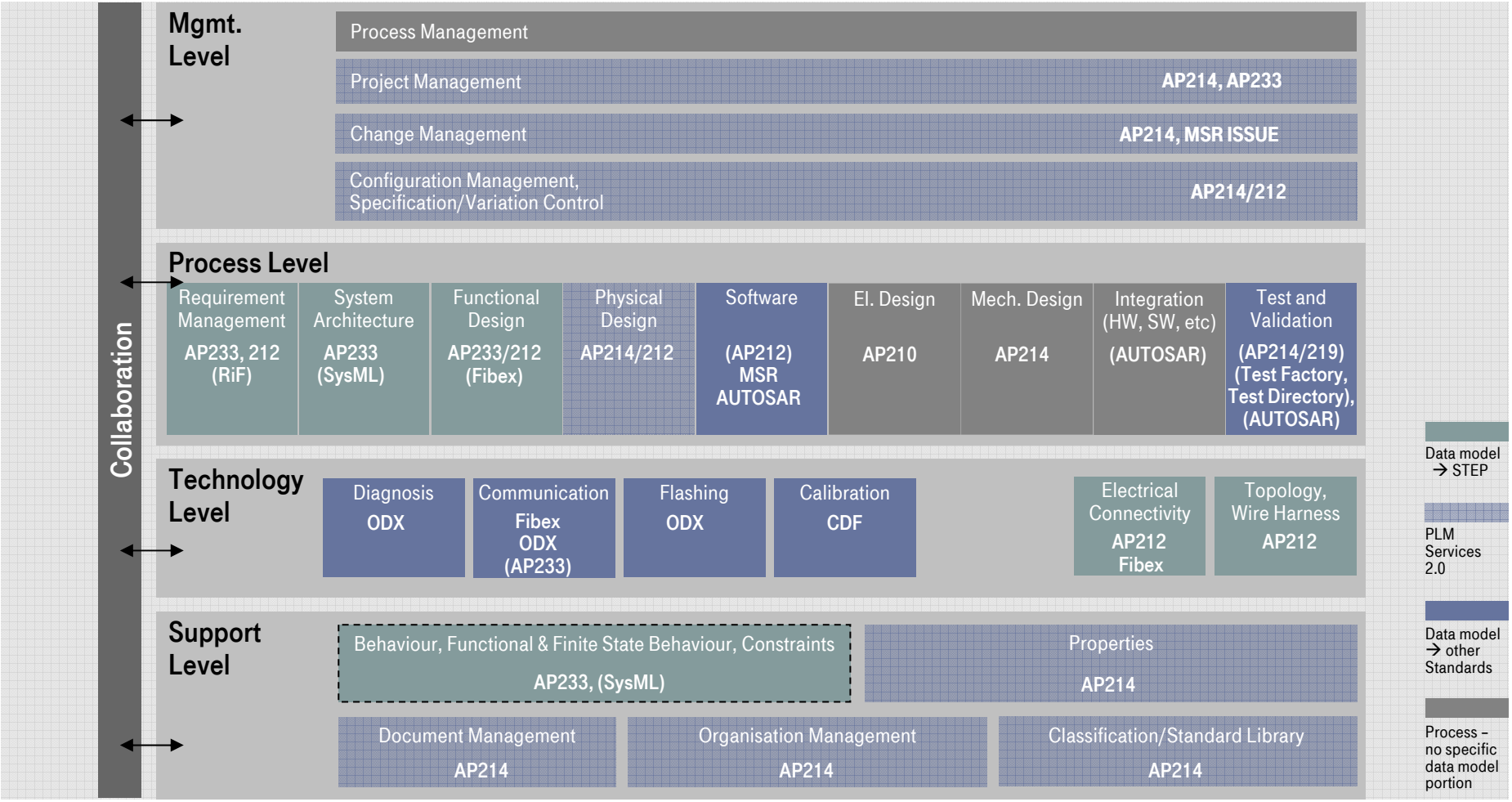
Mechatronics Prototype incl. EE and SW Development.
Further Planning of the Mechatronics Prototype.



Mechatronics Prototype incl. EE and SW Development.
Mechatronics data model – Overview.



Common Solutions Strategy.
T-Systems Service Offering Car-ICT.

Embedded Complete
- Systems Integration
- Requirements Management
- Test House/Test Shop

Embedded Control
- CarICT ECU Software
- Seamless Connected Car

Embedded Life
- Systems Lifecycle Management
- Software PlayOut Center
- Business Process Management

Embedded Telematics
- Online-Navigation
- Traffic Information
- Tolling, Tracking & Tracing
- eCall

Embedded Check
- Diagnosis platforms
- Testing in production
- Diagnosis in service

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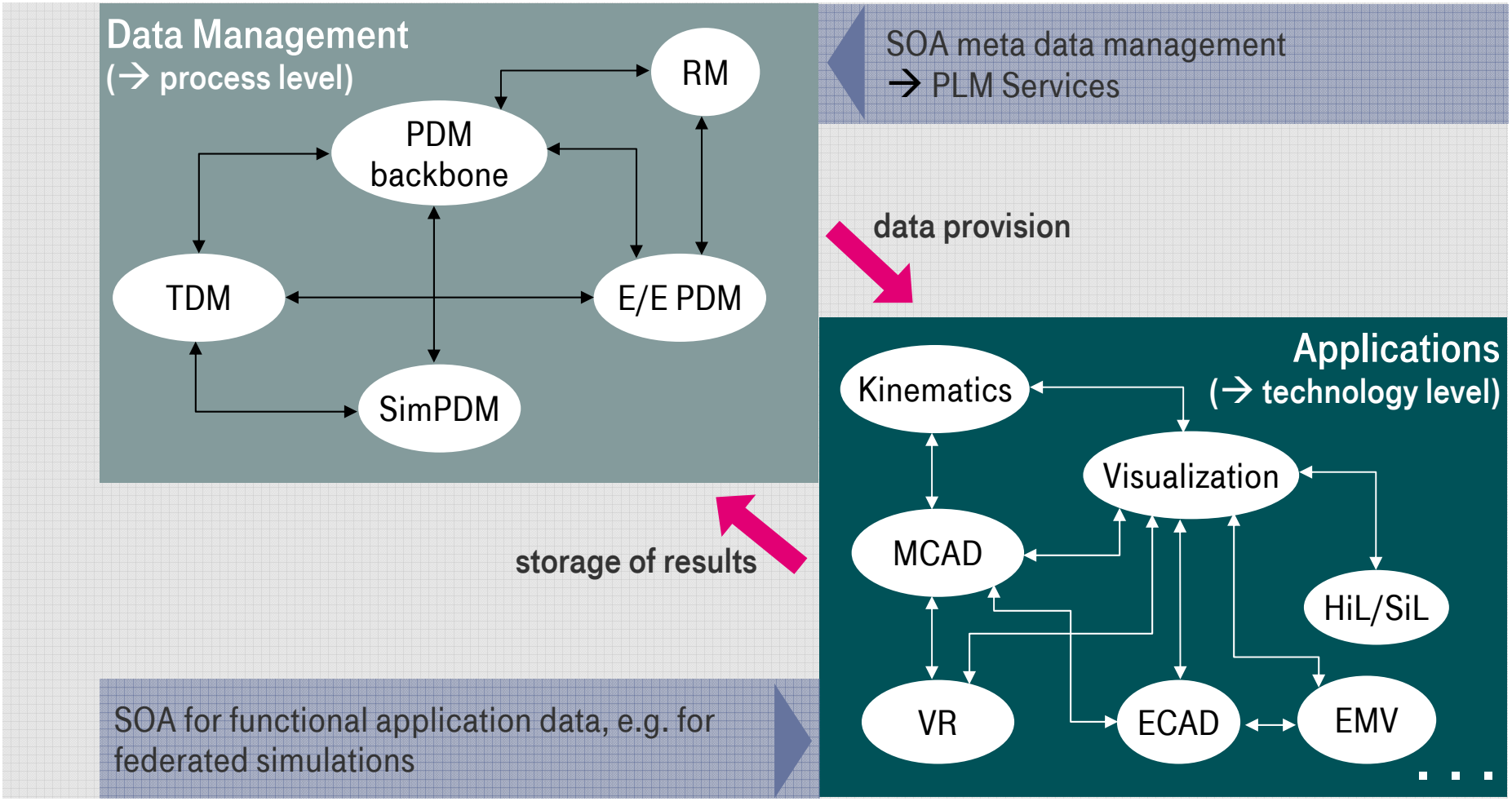
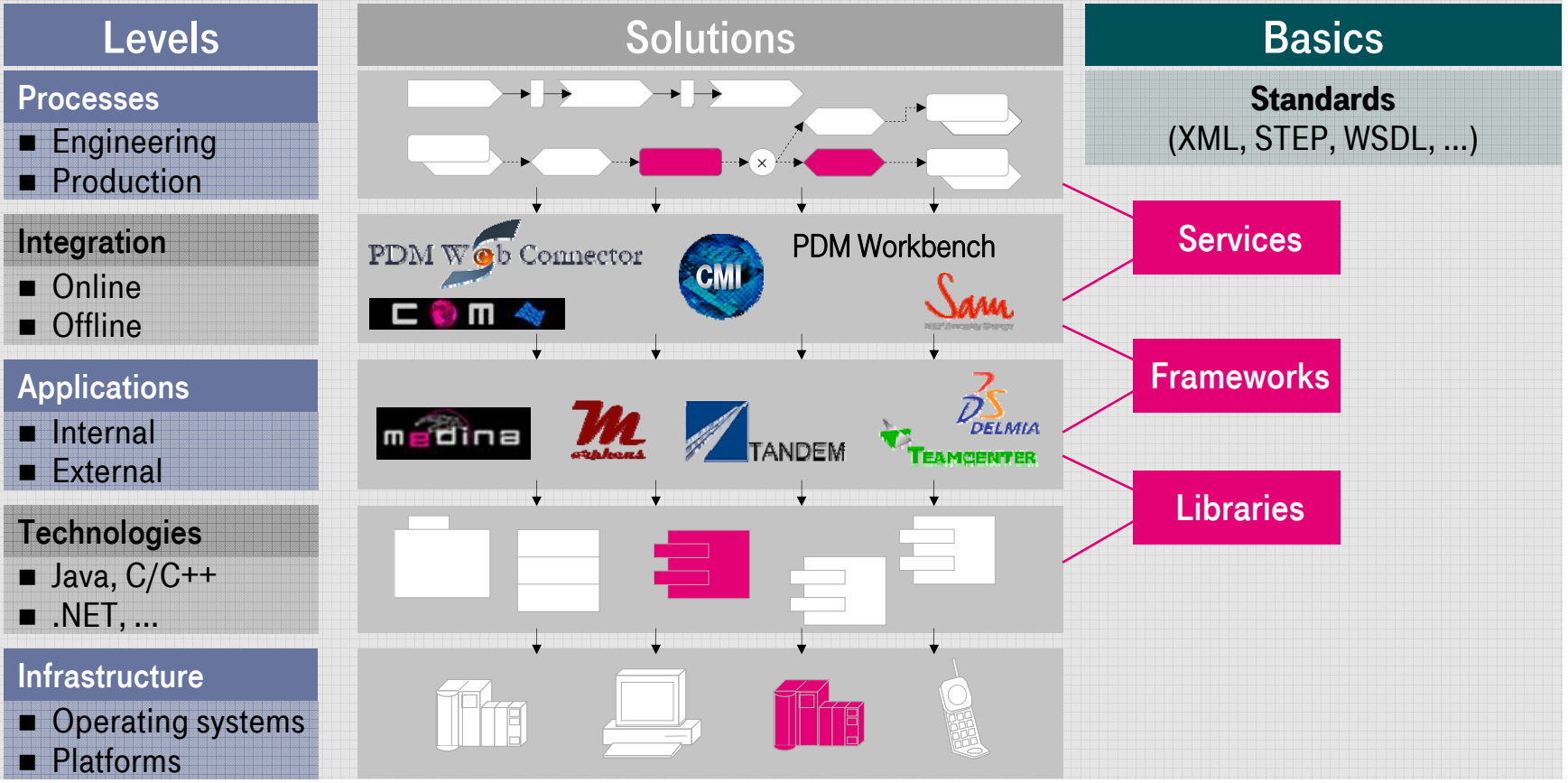
Common Solutions Strategy.
Strategy: SOA Architecture for common solutions.



Common Solutions Strategy.
Vision: SOA architecture – vertical integration.

Change has many implications.



Common Solutions Strategy.
Strategy and Vision for common solutions.

Solutions for the integrated development of components including Electrics, Electronics, Software and Mechanics.

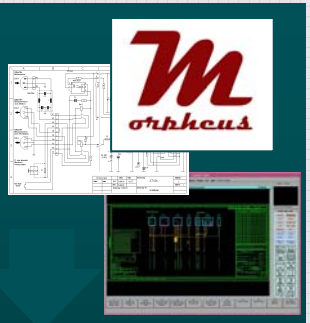
Electronics/Software

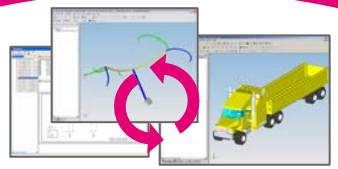
In cooperation with T-Systems 'Car ICT' solutions.

Electrics/Harness

LCABLE

Complete schematics (in 2D)





Complete interconnection between 3D geometry & 2D schematics (available as prototype)

Mechanics

CATIA V5 CGR

COM/FOX

JT

3D DMU with geometry & harness

E/E PDM

PDM

Thank you for your attention!

DaimlerChrysler EDM | CAE Forum 2007.

18./19. July 2007 Congress Center B, Messe Stuttgart

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What is a Functional DMU?
Motivation.

Excerpt of a Functional DMU Workshop @ PS-iViP Symposium 2006:

Stand der Einführung/des Einsatzes von DMU mit Navigationstechniken und räumlichen Anfragen, **z.B. ist es wenig hilfreich, ein komplettes Flugzeug darzustellen, aber keine Möglichkeit zu haben, Kabelbäume räumlich zu selektieren.**	**Complete 3D vehicle representation is available, but e.g. identification/selection of harness in 3D is missing.**
DMU: leichtgewichtiges Format vs. funktionale Überfrachtung Die Algorithmen zu Interpretation/Simulation der Funktion können kaum in einem monolithischen System realisiert werden – zu diesem Zweck ist eine **service-orientierte Architektur** vorzuziehen. Das Visualisierungs-Frontend muss allerdings in der Lage sein, **funktionales Verhalten darzustellen.**	**Service oriented architecture (SOA) preferred for presentation of functional behavior.**
System- und Schnittstellenproblematik Im Geometriebereich konnten Schnittstellenprobleme weitgehend überwunden werden. Bei einer Perspektive für Functional DMU von 5 – 10 Jahren (oder länger) kann es bei hinreichender Nachfrage sicher gelingen, auch im Bereich CAE, ECAD, etc. die **heute bestehende Schnittstellenproblematik** zu reduzieren.	**Interface problems exist today.**