

# Demystifying Digital Continuity in 3DEXPERIENCE Manufacturing

One of the mysteries in the PLM world for me - coming from more of a graphics / CAD-centric background - has been manufacturing. During my ten years of working with DS products, I had friends in DELMIA without every fully understanding all that it did and thus it got little coverage in Demystifying 3DEXPERIENCE and my 3DEXPERIENCE video. This post aims to correct that.

First off, what I have gleaned from the various presentations that I have sit through and read is that the overall vision for Dassault Systèmes is to take core activities that were done in ERP like routing, MBOM, and work instructions and move them up into PLM including management of factory resources and consumables. This, in effect, moves the line between PLM and ERP further towards manufacturing execution (much of which is covered partially by current DELMIA Apriso, DELMIA Ortems and QUINTIQ products that are currently not directly on the **3D**EXPERIENCE platform). In fact, we can now speak of "Virtual Build" – where you define a sequence of steps in a manufacturing process and the system automatically creates the 3D required for visualizing it on the fly with dedicated graphical indicators highlighting manufacturing process steps and also supports integrated simulation studies such as for ergonomics or robotics

- this represents potentially a radical reduction in time for moving from physical to virtual world in PLM!

There are two easy to understand scenarios where this vision becomes reality:

## **Body in White for Automotive**

• 3D CATIA modeling of fasteners representing weld points directly on the Assembly Structure of the body frame

• Direct consumption of CAD-based fasteners within the MBOM

• Direct and intelligent consumption of Fasteners w/in MBOM into Process Planning (PP), enabling optimizations such as line-balancing for weld operations as well as intelligent selection of weld guns

• Direct use of Fasteners organized by PP "Operations" to automatically program and simulate Robots and generate controller specific executables per robot

• Feeding robot programs in their native format into robot controllers on the shop floor

and

## **Fully Digital 3D Master**

• CATIA modeling of all aspects of engineering specifications which reflect requirements to manufacturing (tolerance, finish, torque values, etc.) via FTA (3D Annotations)

• Publishing of these specifications as PLM requirements in **3D**EXPERIENCE platform maintaining links to original product definition

• Direct consumption of specification-based "Requirements" into MBOM and PP

 $\bullet$  Direct use of Requirements within auto-generation of 3D Work Instructions to be performed by humans on shop floor – OR

• Direct use of Requirements within auto-generation of machine operations leading to NC Program generation and post-processing

• Results of either of the above are fed via MBOM to people or machines performing the work in the context of a scheduled production order

We can see that this enables the PLM system to simulate and directly feed both people and machines on the shop floor resulting in massive gains in precision, time and cost.

## **A Brief History**

In 1997, Dassault Systèmes acquired DENEB Robotics (Manufacturing Simulation) and in 2000 they acquired both SAFEWORKS (Ergonomics) and DELTA (Process Planning). The result of these acquisitions was the birth of the DELMIA brand in 2000 aimed initially at virtual manufacturing. The new apps used a data model derived from the same one used by CATIA at the time. Since then, many other acquisitions such as, more recently, DELMIA Apriso, DELMIA Ortems, and QUINTIQ have fleshed out a broad manufacturing footprint for the DELMIA brand pushing the envelope to include manufacturing execution, scheduling, supply chain optimization, and many other areas that were traditionally ERP vendor domains.

During the V6 era, as described in my Demystifying Digital Thread and Digital Twin article as well as Demystifying **3D**EXPERIENCE Customization, there were two data models inside the platform - one for the rich clients (CATIA, SIMULIA, and DELMIA) and one for the web-based clients (ENOVIA based on MatrixOne). In the rich client world, the waterfall process including Requirements-Functional-Logical-Physical (RFLP) for CATIA, Model-Simulation-Result (MSR) for SIMULIA, and Product-Process-Resource (PPR) for DELMIA were (and are still) all based on the same basic data model. For the BOM however, this actually presented some significant pain for customers because the Engineering BOM (EBOM) was owned by ENOVIA who also had their own Manufacturing BOM (MBOM) the data model for both of which of which were incompatible with the Product Structure in CATIA and the PPR model in DELMIA. This meant that there was a massive gap between the engineering world and the manufacturing world and customers had multiple issues trying to span their enterprise from design through engineering to manufacturing using a pure-DS stack where the MBOM was concerned.

## **3DEXPERIENCE R2017x and R2018x Improvements**

With the changes in Enterprise Change Management (ECM) and POWER'BY that were rolled out starting in 3DEXPERIENCE R2017x and R2018x, there is a CATIA/DELMIA compatible EBOM called "Unified Product Structure" which is consistent and compatible with the DELMIA Manufactured Item (or MBOM) making true digital continuity a reality as was never before possible. Change Management under ECM is also unified across all business and engineering domains. Now, the digital continuity is maintained from design, through engineering and simulation onto manufacturing enabling true cost and time savings.

There have also been many improvements around 3D Printing support and therefore processes around Additive Manufacturing have not been ignored. The big advantage of Dassault Systèmes in this domain is their ability to cover the chemical & material aspects with BIOVIA, the design and post-processing with CATIA, the in-depth simulation with SIMULIA and the machine simulation, process planning, and slicing output and/or scanned path output for the physical printer with DELMIA, change management and project management with ENOVIA - each of which has dedicated features to support additive manufacturing, such as new virtual 3D Printing Machines which can be simulated and programmed within DELMIA and ultimately used to feed the actual machines on the shop-floor with executable code.

## The Crystal Ball

Going forward, it would seem that the Dassault Systèmes' goal is to maintain full digital continuity from Requirements to Manufacturing/Production (RLFP-MSR-PPR) for ALL Engineering Design domains directly on the **3D**EXPERIENCE platform::

- Engineering Design, Analysis, & Simulation
- System Modeling & Simulation
- Manufacturing Operations Management tighter integration with DELMIA Apriso
- Supply Chain & Scheduling **integration** with DELMIA Ortems and QUINTIQ

These last two, while mature, industry-proven solutions, are new pillars of the overall DS **3D**EXPERIENCE Manufacturing strategy thanks to acquisitions and ongoing integration to the platform alongside the traditional **PPR-based** Digital Manufacturing domain which is intrinsically tied to the Design Engineering domain. While certain business scenarios may only demand a silo-ed use of something like MES or Scheduling, the publicly stated vision and strategy of Dassault Systèmes around Manufacturing and Production embraces such domains as part of an end-end business experience.

The end result will be a nearly impregnable and consistent footprint from design and engineering through simulation to manufacturing execution delegating financials, human resources and payroll to the ERP systems. It is a compelling story that will accelerate bringing the most innovative products to market with the latest and most efficient manufacturing methods. DS has significantly broken down more traditional silos with the net result being even further reduced time to market and reduced cost of reaching quality thanks to all the simulation validation happening earlier in the process, and also thanks to the heightened level of collaboration across the enterprise.

Michael Finocchiaro is an independent **3D**EXPERIENCE consultant