ProSTEP iViP/VDA JT Translator Benchmark

JT TRANSLATOR BENCHMARK

SHORT REPORT

Edition 1

ProSTEP iViP

Contents

1 Introduction

The publication of the JT specification as an ISO Publicly Available Specification (PAS 14306) has laid the foundation for giving consideration to JT when designing efficient PLM processes.

The challenges this entails are many. It is up to the users and the responsible management at the companies in question to decide which of the options that JT offers is to be used for which use case. How well JT then actually supports the individual process steps will depend first and foremost on the quality of the data generated.

In order to achieve a greater degree of clarity here, the ProSTEP iViP Association and the Arbeitskreis PLM of the German Association of the Automotive Industry (VDA) have joined forces and conducted a systematic benchmark.

The test criteria for the benchmark were derived from use cases defined by representatives of leading OEMs and suppliers from the automotive and aerospace industries in the ProSTEP iViP / VDA JT Workflow Forum. In addition to the core topics related to the application of JT – visualization and the use of JT in downstream processes – data exchange processes, were, of course also described.

Since those involved saw the greatest need for clarification in classic data exchange scenarios and wanted to test the extent to which they could rely on the systems and translators already in use at their companies to implement the defined use cases, a pragmatic approach was selected for this first benchmark. This document will provide you with a summary of the results of the first ProSTEP iViP / VDA JT Translator Benchmark.

2 ProSTEP iViP / VDA JT Translator Benchmark

The JT translator benchmark provides an overview of the capabilities of selected JT translators for the export and import of JT files in CAD systems. The type of downstream process involved will result in different requirements with regard the data used. The results may provide help when selecting suitable translators.

The testing described here does not examine the quality of the JT files themselves in more depth. The objective of the testing performed was to determine how much of the information from the generating CAD system can be reproduced in the receiving system.

2.1 JT translators for downstream processes

There are already numerous JT translators available on the market today, and JT is being used by many companies as a lightweight visualization format in day-to-day business.

In addition to using JT merely as a visualization format, many companies are currently checking to see whether JT can be used in other downstream processes. In which case, additional requirements are placed on the JT format. For example, there is a need to exchange exact geometries, product data information and additional attributes.

Of interest is, therefore, not only how well JT data can be generated from CAD models but also how well CAD models can be generated from JT data.

2.2 Procedure

The benchmark involved testing the transfer from CAD to CAD via JT using a combination of different translators and CAD systems. The information to be transferred and the requirements were defined by users in the ProSTEP iViP / VDA JT Workflow Forum.

2.3 CAD systems and translators

Seven translators for four CAD systems participated. Only versions available on the market at the time the benchmark was started were used. The versions of the CAD systems used were determined by the participants in the ProSTEP iViP / VDA JT Workflow Forum. The translators and CAD systems involved in the benchmark are listed in Table 1 and Table 2.

All testing was performed on PCs with Microsoft Windows XP installed as the operating system.

These translators result in the test case matrix shown in Figure 1. The sending systems are listed in the column on the left and the receiving systems in the top row. The translators used to export the JT files are listed to the right of the sending systems, and the translators used to import the JT files are listed under the receiving systems. The abbreviations listed in Table 1 and Table 2 were used to make the matrix and result tables easier to read.

Vendor	Translator	Supported CAD Systems	Abbreviation in Tables
Bentley Systems	MicroStation V8 XM	MicroStation V8 XM	Bentley
CT CoreTechnologie	3D_Evolution 2009 Sp3	CATIA V5 R19, NX 5, Pro/ENGINEER Wildfire 4	CoreTech
Siemens PLM	JT Bi-directional Translator	CATIA V5 R19 for CATIA V5 V 6.0	Siemens
Siemens PLM	Direct import in NX 5	NX 5	Siemens
Theorem Solutions	CADverter (Version 11.0.002)	CATIA V5 R19, Pro/ENGINEER Wildfire 4	Theorem
T-Systems	COM/FOX V4.2.4	CATIA V5 R19	T-Systems

Table 1: Participating translators

Vendor	CAD System	Abbreviations in Tables
Bentley Systems	MicroStation V8 XM	MicroStation
Dassault Systèmes	CATIA V5 R19	CATIA V5
PTC	Pro/ENGINEER Wildfire 4	Pro/E
Siemens PLM	NX 5	NX

Table 2: Participating CAD systems

WRITE JT with ↓ / READ JT with →		CATIA V5			Pro/E		NX		Micro Station
		CoreTech	Siemens	Theorem	CoreTech	Theorem	CoreTech	Siemens	Bentley
CATIA V5	CoreTech	X	X	X	X	X	X	X	X
	Siemens	X	X	X	X	X	X	X	X
	Theorem	X	X	X	X	X	X	X	X
	T-Systems	X	X	X	X	X	X	X	X
Pro/E	CoreTech	X	X	X	X	X	X	X	X
	Theorem	X	X	X	X	X	X	X	X
NX	CoreTech	X	X	X	X	X	X	X	X
	Siemens	X	X	X	X	X	X	X	X
Micro Station	Bentley	X	X	X	X	X	X	X	X

Figure 1: Test case matrix

2.4 Test criteria

The correct transfer of geometry, auxiliary geometry, PMI annotations, material data, color information, transparency and texture was tested. In the case of assemblies, the correct designation, positioning and structure were tested.

Requirements:

- In the case of the geometry, it was specified that a deviation of no more than 1% of the original values should be allowed for volumes and surfaces and a deviation of no more than 0.1% of the diagonal of the bounding box of the model should be allowed for the position of the center of gravity.

- Auxiliary geometry such as points, axes and surfaces, as well as 3D lines, should also be visible in the receiving system.

- PMI annotations should be displayed graphically as in the sending system and should also be recognized as PMI elements in the receiving system.

- Selected material data should be transferred to the receiving system.

- The RGB values are crucial for evaluating the color information and they should be identical in both the sending system and the receiving system. The same applies to the transparency.

- When naming the assembly elements, the file names must be retained.

- The positioning of the components should not be changed by the conversion.

- The assembly structure is checked to see whether all the elements are located on the same structure level as in the original model and whether or not additional structure elements have been added.

Only test criteria that can be satisfied in accordance with ISO PAS 14306 were considered.

2.5 Test models

Synthetic models were used to ensure that the results could be compared, namely the housing for a torque converter and a tower made of toy building blocks. The torque converter model shown in Figure 2 was derived from the productive model of a truck transmission and was used in the 8th ProSTEP iViP STEP Benchmark. It is a complex solid model. When the 1st ProSTEP iViP/VDA JT Translator Benchmark was started, the model was available in CATIA V5, NX and Pro/ENGINEER. For the purpose of the benchmark, material data, auxiliary geometry, color information and PMI annotations were added to the models so that the required tests could be carried out. Bentley Systems was so kind to create the models for MicroStation V8 XM according to the specifications for the models described above and make them available for use.

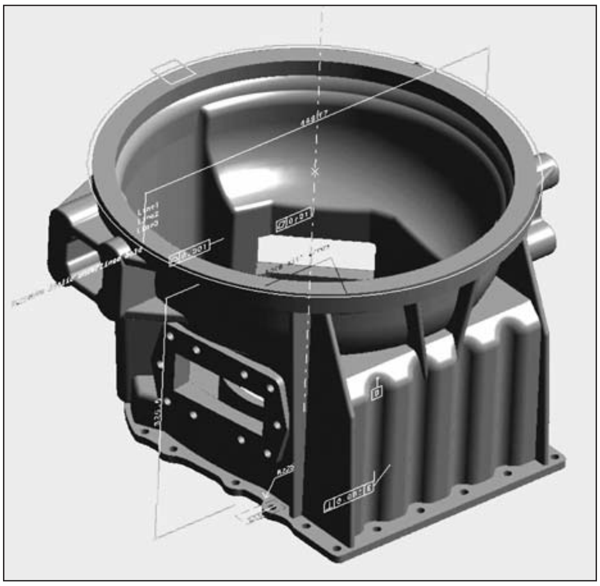

Figure 2: Test model torque converter housing

The test assembly in Figure 3 is an assembly created especially for the JT translator benchmark. It combines the need for a multi-level assembly structure with hierarchical nesting.

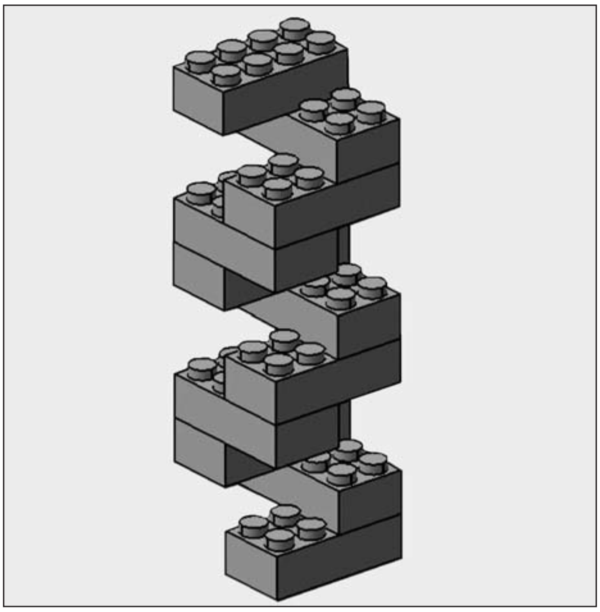

Figure 3: Test assembly

2.6 Test execution

The models generated were then used to play through all the test cases. If possible, the translators were used in batch mode.

For evaluation purposes, the values for

- volume
- surface
- center of gravity

calculated by the sending and receiving were compared. The existence of the above-mentioned additional elements was checked in the receiving system.

The current JT specification includes two different options for exchanging precise BREP data. Because XT-BREP, unlike JT-BREP, is gaining in importance, the users selected XT-BREP as the format to be used for transferring precise geometry.

The assembly was exported using both the structure option "monolithic" and "per part". The former means that the complete structure and geometry is stored in a single JT file. The latter means that the structure hierarchy is stored in a single JT file and each node in the hierarchy, i.e. each individual part, is stored in a separate JT file together with the geometry.

The generated JT files were examined using the JT Inspector from Siemens PLM.

2.7 Documentation

The results are documented in detail in a detailed report which provides an overview of the possibilities offered by the translator/CAD combinations. It contains information on

- the completeness of geometry transfer involving solids
- the transfer of PMI annotations and colors
- the transfer of material data
- the correct transfer of auxiliary geometry
- and, in the case of assemblies, the positioning of the components, designation of the parts, retention of the structure and
- the data quality of the JT files

3 Results

The models used for testing do not claim to represent the entire application spectrum for CAD technology. Therefore the results of the benchmark cannot be applied directly to the whole range of practical applications (neither positive nor negative aspects). The 1st ProSTEP iViP/VDA JT Translator Benchmark indicates the current status of implementation with regard to specific focal points defined by the users and thus gives an impression of the current quality of the translators with regard to the test criteria.

In the result diagrams below, the sending systems are listed in the column on the left and the receiving systems in the top row. The translators used to export the JT files are listed to the right of the sending systems, and the translators used to import the JT files are listed under the receiving systems.

A green circle indicates that the evaluated requirements were satisfied. A red circle indicates that the requirements were not satisfied or that the conversion was not successful.

3.1 Geometry

The quality of the geometry exchange with XT-BREP is very good for most of the system combinations, as can be seen in Figure 4. As a rule, the solids were exchanged as such. As indicated by the evaluation of volumes, surfaces and center of gravity for individual parts, the deviations are minimal and well below the defined tolerances. MicroStation is a special case since the JT translator in the tested version does not support XT-BREP. Therefore the corresponding test cases have a circle in Figure 4.

WRITE JT ↓ / READ JT →		CATIA V5			Pro/E		NX		Micro Station
		CoreTech	Siemens	Theorem	CoreTech	Theorem	CoreTech	Siemens	Bentley
CATIA V5	CoreTech	△	△	△	□ 1)	△	△	△	○
	Siemens	△	△	△	□	△	□	△	○
	Theorem	△	△	△	□	△	□	△	○
	T-Systems	△	△	△	△	□	△	□ 2)	○
Pro/E	CoreTech	□	△	△	△	△	△	△	○
	Theorem	□	△	△	□	△	□	△	○
NX	CoreTech	△	□	□	□	△	△	□	○
	Siemens	△	△	△	△	△	△	△	○
Micro Station	Bentley	○	○	○	○	○	○	○	○

Legend: △ Solid was correctly transferred
□ Solid was not correctly transferred
○ No XT-BREP supported

1) Healing mechanism within 3D_Evolution can resolve import problems to Pro/E (Source: CT CoreTechnologie)

2) Import problem within NX 5.0.4.1 Fixed within NX 5.0.6 and following NX versions (Source: Siemens PLM)

Figure 4: Results geometry exchange

3.2 PMI annotations

Many translators also already allow the exchange of PMI to the JT files. It should be noted that the PMI elements were often also recognized as such in the JT files. From JT to the CAD systems, on the other hand, only the geometric representation – if anything – was exchanged. None of the translators tested achieved the aim of also allowing the receiving system to identify the PMIs as such.

3.3 Auxiliary geometry

The transfer of points, axes and surfaces was only successful in very few cases. Only the 3D curves were exchanged in many cases but seldom in their entirety.

3.4 Positioning

With just a few exceptions, the positioning of the assembly is also reproduced correctly as shown in Figure 5 for "monolithic" JT files and in Figure 6 for JT files generated with the option "per part".

WRITE JT ↓ / READ JT →		CATIA V5			Pro/E		NX		Micro Station
		CoreTech	Siemens	Theorem	CoreTech	Theorem	CoreTech	Siemens	Bentley
CATIA V5	CoreTech	△	△	△	△	△	△	△	△
	Siemens	△	△	△	△	△	△	△	△
	Theorem	△	△	△	△	□	△	△	△
	T-Systems	△	△	△	△	△	△	△	△
Pro/E	CoreTech	□	□	□	□	□	□	□	□
	Theorem	△	△	△	△	△	△	△	△
NX	CoreTech	△	△	△	△	△	△	△	△
	Siemens	△	△	△	△	△	△	△	△
Micro Station	Bentley	□	□	□	□	□	□	□	□

Legend: △ correctly converted
□ not correctly converted

Figure 5: Results for positioning "monolithic"

WRITE JT ↓ / READ JT →		CATIA V5			Pro/E		NX		Micro Station
		CoreTech	Siemens	Theorem	CoreTech	Theorem	CoreTech	Siemens	Bentley
CATIA V5	CoreTech	△	△	△	△	△	△	△	△
	Siemens	△	△	△	△	□	△	△	△
	Theorem	△	△	△	△	△	△	△	△
	T-Systems	△	△	△	△	△	△	△	△
Pro/E	CoreTech	□	□	□	□	□	□	□	□
	Theorem	△	△	△	△	△	△	△	△
NX	CoreTech	△	△	△	△	△	△	△	△
	Siemens	△	△	△	△	△	△	△	△
Micro Station	Bentley	□	□	□	□	□	□	□	□

Legend: △ correctly converted
□ not correctly converted

Figure 6: Results for positioning "per part"

3.5 Structure

The assembly structure was not exchanged correctly in every test case. Additional structure levels were often introduced and in some cases, other empty components were also added. In several cases, only one CAD file was generated from the monolithic JT file resulting in the entire assembly structure being lost. In other words, there is a difference between the various structure options for JT conversion. The structure was exchanged correctly in a greater number of cases with the "per part" option than with the "monolithic" option.

4 Publication

Detailed documentation on the 1st ProSTEP iViP/VDA JT Translators Benchmark will be made available to members on the ProSTEP iViP Association website (www.prostep.org).

5 Outlook

The vendors have announced that they will be improving their translators, especially with regard to support for XT-BREP and PMI.

A subsequent benchmark could focus on selected use cases for the JT format. This should involve examining an entire process so that the performance of JT in the individual process steps can be evaluated.

6 Acknowledgements

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