



The Business Case for a Common Data Distribution Platform:

A Look at UGS' JT

A Cyon Research White Paper
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Executive Summary

In this white paper, Cyon Research discusses the use of the JT data format as a standard for design, analysis, and manufacturing interoperability throughout the PLM industry, and as a basis for increasing the use of design data in areas beyond traditional engineering departments.

What is the nature of the problem?

Significant progress has been made in recent years in the development and implementation of software solutions targeting the design and manufacturing of complex products. This has been driven by the need to create highly marketable products quickly and cheaply. One of the most impactful solutions is 3D data generated by CAD systems.

The problem discussed in this paper is: Design data in manufacturing firms is typically created and stored in a format that can only be read by the CAD program that created it. It is therefore not accessible to many members of the organization who could benefit from it. How does a manufacturing organization facilitate getting design data to downstream activities and other current non-users of design data?

How has this challenge been addressed in the past?

One way this challenge has been met in the past is to require that users of design data have a seat of CAD software available, typically the same software as that used to create the data.

For years, CAD software vendors and users have worked to establish interoperability standards and the tools to implement data translation. Translators that use the IGES and STEP formats are imperfect for most downstream applications. Direct translation from one system to another has proven problematic.

Solutions in use today

In addition to industry-standard formats for translating data from one system to another, a new generation of "lightweight" (that is, a less verbose subset of the source) 3D data formats are being applied to this problem. A lightweight format typically only includes the design data that is required by downstream applications, removing top-level content such as features and constraints, protecting the originators' intellectual property. This often includes more than just graphic information, but less than full feature definitions and design history.

What is UGS' solution to the problem?

UGS has incorporated JT as the interoperability foundation for its 3D CAx applications and as the visualization platform throughout its PLM solution. UGS has added substantial capabilities to this format and offers a full suite of applications to enable downstream users to leverage 3D without a CAD seat. UGS has also offered JT to the industry, establishing an organization—the JT Open Program—to provide guidance for its future development.

What is Cyon Research's opinion of JT in this context?

Cyon Research believes that the use of JT enables previous non-consumers of design data to effectively use 3D with a minimum amount of difficulty. Users who would have needed a seat of CAD software can now accomplish many tasks with lower-cost applications, through the use of JT.

Cyon Research also believes that the JT Open organization will guide the evolution of the standard to meet the needs of both users and software developers. We are pleased to see JT become a published standard, making it easier for companies to generate and use JT information. But the existence of JT does not obviate the need for other currently available formats that may fit other needs.

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What is the nature of the problem?

Consumers today want new, high-quality, innovative products at affordable prices. This holds true for both low-priced consumer products and expensive capital goods that are expected to last for decades.

The competitive nature of today's market has motivated all manufacturers to be more diligent than ever in reducing expenses while responding to rapidly changing market requirements. But progressive firms realize that, to succeed, they must also invest in the latest product lifecycle management (PLM) technology.

Current technology allows companies to design and support products globally—but to do this, they need efficient tools for exchanging design data among disparate software solutions. Many large manufacturers deal with this issue by insisting that their suppliers use the same design systems they do. Unfortunately, this limits the suppliers' ability to use the tools that are most applicable for their businesses and may limit their ability to adopt new technology. Using different systems for each customer potentially increases the cost for all parties.

Today, the trend is toward using information-exchange standards that enable companies to control all aspects of lifecycle processes, irrespective of the software solutions used by those involved in these activities.

Companies are experiencing increasing competitive pressure. The Internet enables potential buyers to learn about new products, review other buyers' reactions, and compare one product to another faster than ever before. Retailers push manufacturers to reduce prices more and more aggressively, and manufacturers are requiring suppliers to assume an increasing portion of the design process, as well as warranty liability.

Product manufacturers are reacting to this changing business environment by radically modifying the way they do business. In the past, producers of complex products, such as automobiles, trucks, and airplanes, designed the entire product down to the smallest bracket, and then contracted with suppliers to produce parts and assemblies based on their designs. Today, those manufacturers provide a functional specification of what is needed and hire an outside firm to design and produce that part or sub-assembly. In the automotive industry, suppliers produce entire braking systems, and even complete interiors.

Computer systems have been used to improve product-design processes for only a little more than three decades. During that time we have gone from expensive mainframe and minicomputer systems to far more powerful desktop PCs, at far lower costs. The performance/price ratio continues to increase.

Meanwhile, communication between dispersed sites has gone from slow dial-up to high-speed direct and Internet-based connections that are a thousand times as fast. We now work with partners half-way around the world as easily as we worked with someone down the hall a few years ago.

Design software has improved almost as rapidly. During these three decades we have gone from creating 2D drawings of individual parts to designing complex products containing tens of thousands of parts—in “living color.” Design software has come a long way in recent years, but there is still a lot more that can be done.

As design software has matured, its application has also changed. We no longer simply create product designs; we want detailed simulation, looking at large numbers of design alternatives, and adapting basic designs to meet the needs of smaller and smaller groups of customers – “mass customization.” Combined with the globalization of design and manufacturing, this has resulted in a need for better processes to

About JT

JT was developed by Engineering Animation Incorporated (EAI) in the mid-1990s to support the company’s modeling, visualization and mockup applications. EAI was founded in 1988 by a group of visualization specialists from Iowa State University in Ames, Iowa. Initially the company focused on consulting assignments, especially in the field of forensic engineering. This work required the development of visualization software which led EAI to begin offering a series of commercial software packages. These included VisLab, a 3D visualization package that had a reputation for being particularly fast, VisFly, an interactive model viewer that enabled engineers to “fly” around a design concept and view it from any angle in real time, VisModel, a 3D editing and modeling tool and VisMockUp, a package for building digital prototypes using data from multiple CAD systems.

By the late 1990s, EAI had become a vendor of choice for large-scale visualization applications, especially within the automotive sector. In 2000, UGS acquired EAI to complement its PLM applications. EAI’s underlying visualization technology forms the basis of all of UGS’ Teamcenter visualization and mockup applications.

The JT format can represent a complete CAD model without the detail that describes how the model was constructed, such as design history, parametric relationships, and constraints. JT is not intended to serve as a vehicle for translating complete model data from one CAD system to another. Rather, it provides an easy-to-generate 3D representation of the design that can be used for a variety of downstream applications.

JT is a rich data model that contains:

- Facet information
- Lighting models
- Texture maps
- Precise boundary-representation geometry
- Product structure
- Attributes such as color, layer, and font
- Product manufacturing information

A JT source application need only provide the detail of data that a specified downstream application requires. If this is unknown, a broader set of data can be generated and the receiving application then loads only that data that it needs.

manage massive amounts of data. Unfortunately, while CAD data represents the complete design, it often is unavailable to many who need access to it.

Increasingly, the development of a new product is the work of a virtual product-design team. Partners are lined up to design and produce a product but may not use the same tools as their customer. When the project is completed, they disperse to work on other assignments—so investing in the tools of the contractor just for use on the current project may not make good business sense. At the same time, today’s customer is tomorrow’s partner, and vice-versa—so there needs to be a way for them to work together to realize the unique contribution of each, without constraining all to use the same tools.

Requirements placed on data used to support collaboration workflows

Numerous software tools have been developed to facilitate this evolution. These include digital mockup, interference detection, weight management, static and dynamic analysis, visualization, and animation, as well as product data management (PDM) tools to tie it all together. The need is for more than just visual data but for design data as well. We refer to many of these tasks as “downstream operations.” In addition, some upstream tasks, such as simulation, require better access to specific design data.

When all project participants use the same software packages for these tasks, a common data environment is inherent in the arrangement. In the real world, however, this rarely happens, and data created using different software packages needs to be shared.

Data sharing is particularly relevant when one considers that virtual prototypes have the potential to eliminate the need for most physical prototypes. To accomplish this, the transfer of data between different software packages needs to be transparent to the users. A change made to a part or subsystem should update the virtual mockup of the product being designed, with little effort on the part of the designer.

As the time needed to make a design change has been reduced, engineers are being asked to look at a wider range of design alternatives. Gone are the days of “good-enough” products. The tools described in this paper enable product teams to optimize designs in terms of performance, reliability, maintainability, and cost to manufacture, as well as making them more attractive to customers.

A significant consequence of this technological evolution is that design teams now look at hundreds of different product concepts, instead of just a few. Another is that manufacturers can now provide their customers with far more options than ever before. No longer must “one size fit all.” This implies a requirement for a well-designed data management process that ensures ongoing synchronization of the original CAD data with the visual representations employed by non-CAD users.

Many of the individuals who could benefit from interactively viewing and working with product-design data do not currently get it in electronic form, because access is too difficult. They may not need or want CAD or wouldn’t use it often enough to justify even a part-time license. As a

result they continue to work with hard-copy versions of the data that are often incomplete or out-of-date. Many viewing solutions have entered the market; but visualizing the data is only part of the solution. Once they begin to view 3D data, they quickly find the need to interact with it to do their jobs.

CAD translation, rather than downstream application compatibility, has been the major focus of data-exchange efforts. In many cases, this has resulted in users implementing more expensive software than what they needed. A need exists for a mechanism that will enable these individuals to do their job, and not just view 3D images.

In his excellent book, *The Innovator's Dilemma*¹, Clayton Christensen explains how new products create low-end disruption by providing low-cost products that replace the need for existing high-cost products. He goes on to explain how such products can bring non-consumers into the mainstream of the user community.

UGS' JT is part of a class of tools that may prove to be such a disruptive technology. Many downstream users can now access important design and manufacturing data without the need for expensive and hard-to-use software. Consequently many people who had been unable to access this data electronically can now easily do so. They can now catch errors and contribute to the design process early enough for their input to save time and money, and even improve product quality.

How has this challenge been addressed in the past?

There has long been a need for data-exchange formats that could integrate design data created on different systems into a single file that could be used for a variety of applications. A key issue is that many such applications do not require the full richness of the data represented in CAD files, but simply an abstraction of it.

Since the data is used for different purposes, it often must be represented in different forms. As an example, the data needed to visualize the mockup of a complex assembly (extremely large models) is different from the data needed to machine a precise surface (mathematically exact).

There are four ways product data can be moved between applications:

- The simplest solution is to have all the software programs use the same file format—generally that of the authoring application. This works when all the applications come from the same vendor. But many downstream applications do not require this level of detail, and the engineering process is overburdened with superfluous data density.
- The second approach is to use direct translators to move data from one system to another – e.g., convert a Pro/ENGINEER file to a CATIA V5 file. This is problematic at best, and often generates more data than is needed—or worse, fails to translate some elements. The different vendors do not make it easy to translate between competitive applications.

¹ Christensen, Clayton M., *The Innovator's Dilemma*, Harvard Business School Press, Boston, 1997

- The third approach is to use translators into and out of industry-standard formats such as IGES and STEP. This approach does nothing to resolve the inherent differences in geometric entity definition of different systems.
- The fourth approach is to use a flexible format that can accept data from multiple design systems and provide it to downstream applications in a readily consumable format with the content needed for each. This is UGS' approach with JT (and Autodesk's approach with DWF). This approach maintains the CAD file as the master but provides a synchronized representation for the upstream and downstream users.

Software vendors' formats can become standards through popular acceptance. In some cases, these formats are published and can be used without licensing or royalty fees; Autodesk's DWF, and Dassault Systemes' 3DXML are current examples, UGS' JT will soon be another. In other cases, such as Lattice's XVL, the format remains proprietary; to use it, you need to license applicable software or pay a license or royalty fee.

As described above, many large manufacturers, especially in the automotive industry, have addressed the interoperability problem by requiring their suppliers use the same design systems they do. This approach has proved challenging and expensive for suppliers, who must maintain complete systems for each of their customers.

Much effort has been spent in recent years in developing software to translate data from one CAD system to another. The problem with both direct translators and those that use industry standards (IGES and STEP) is that the definition of a particular type of data in one system may not have a direct correlation in the other system. This requires that the translator transform the data from one entity type to an entirely different type. Often, elements (such as surfaces) don't get translated, or get translated incorrectly. Manual intervention is then required to complete the translation process for a particular use.

While productive work is done with IGES and STEP, both standards suffer from the fact that extensions to them must be approved by committees, and key requirements can take years to implement.

Traditionally, CAD vendors have jealously guarded their internal file structures, although most have provided licensed software interfaces that enabled customers and third-party software firms to read their data files. Some vendors have also provided free or low-cost viewing programs that worked only with their data. Eventually, most CAD vendors began to offer the ability to write data in their proprietary formats using licensed software that was tightly controlled. In addition, numerous third-party software firms started offering viewing software for a variety of CAD formats.

Interoperability improved in the mid-1990s, when some CAD vendors licensed geometry kernels from Spatial Technology (ACIS) or UGS (Parasolid). Moving data between ACIS-based or Parasolid-based applications took less effort than earlier approaches, but still typically required licensing the underlying technology.

Because of its huge AutoCAD installed base, Autodesk is a key player in the interoperability story. The company has a history of zealously defending its DWG file format as proprietary and, at least until the release of its RealDWG program, has been very selective in choosing companies to which it licensed access to this data.

This led to the formation of the Open DWG Alliance (now known as the Open Design Alliance), made up of software companies and users. ODA has reverse-engineered the DWG format and makes this information available to its members in the form of a library of software routines.

Solutions being used in the market today

There is a growing realization that CAD file translation is not enough; what is needed are lightweight formats that convey just the data needed for downstream applications such as assembly mockup, visualization, purchasing, technical illustration, and cost-and-weight-rollup, as well as concurrent applications such as structural simulation.

“Lightweight” in this context refers to approaches that range from simply providing an image for a technical manual, to solutions that deliver much of the original data, except for the details of how the part or assembly was constructed.

At one end of the spectrum is Adobe System’s PDF (Portable Document Format), which enables users to create images of text and graphics using Adobe’s Acrobat software and distribute them to anyone who has a free Acrobat Reader. Recently, PDF has been expanded to accommodate 3D model representations, although not at a level of detail required by most engineering uses.

Another “lightweight” format is Autodesk’s DWF (Design Web Format). DWF was initially designed to facilitate the distribution of drawing and model data over the Internet, with capabilities that invited comparison to PDF. DWF has since been expanded to include a variety of different types of data and to facilitate the management of that data.

DWF data can be generated by most Autodesk applications, including Inventor and AutoCAD. The company offers a free DWF viewer and DWF Writer, a free authoring tool.

SolidWorks’ eDrawings is another lightweight, principally graphical file format. It is used to email 2D and 3D models, and the free eDrawings viewer can also open DWG and DXF files.

Originally developed for large-scale model viewing and animation, UGS’ JT has been extended to encompass both faceted and precise data, and can include attribute metadata as well as complete product and manufacturing information (PMI). UGS also provides a free viewer, JT2Go, as well as plug-ins for Microsoft Office that enable users to incorporate 3D JT models in Microsoft Word, Excel, and PowerPoint documents. JT is supported by the JT Open Program, which influenced the creation of JT2Go and has recently successfully pushed for publishing the JT specification.

In late 2004, Dassault Systèmes introduced 3DXML, yet another lightweight format, based on Lattice Technology’s P-XVL. XML (Extensible Markup Language) was developed to facilitate

the sharing of structured data over the Internet. The Dassault Systèmes implementation of 3DXML is a set of XML schemas on top of a modified version of P-XVL solutions for representing complex graphic data.

P-XVL is an extremely compact format. It achieves this compactness by creating a geometric “recipe” of the 3D model. An application that reads the XVL file must then “follow the recipe” and recreate the tessellated geometry at the user side. The trade-off for the compactness is a computation burden on both the creator and user of the XVL model. Lattice Technology recently introduced V-XVL which is slightly less compact, but places a much reduced computational burden on the user of the V-XVL model than the earlier, P-XVL does.

3DXML makes it possible to distribute 3D geometry in a compact format. As with JT, users can drop these images into office applications, as well as incorporate them into technical documentation, marketing brochures, and web sites. Dassault Systèmes plans to use 3DXML in CATIA, DELMIA, and SolidWorks and has made both the specification and a viewer available on its web site; however, portions of the underlying data specification still require Dassault Systèmes’ solutions.

Many other firms and organizations, including Tech Soft America, Informative Graphics, Right Hemisphere, and the 3D Industry Foundation provide solutions to portions of the problem.

The case for common data formats

A common lightweight format allows design data to be created on multiple systems using multiple design processes and then output in a format that allows the different participants in the product lifecycle process to all use the same data. Users of downstream applications need not be concerned with how the source data was created, nor should they be required to process the data before it is useable; they simply must have the assurance that the data they are working with is the same, in its essence, as that being used by everyone else in the process.

Most downstream applications do not require all the information included in a typical CAD file. In addition, most product manufacturers have to deal with components that are sourced from multiple suppliers, each of which has its own design tools and methodologies.

As an example, a component mockup application needs a good approximation of the shape and mass properties of discrete components and subassemblies, but does not need the feature definitions and the history of how the components were designed. On the other hand, if the data is to be used in an application requiring precise measurements, a more-refined representation of the data might be in order; but it still might not need all the details of a full CAD model.

What is UGS’ solution to the problem?

JT is a rich lightweight data model that supports a broad range of geometric entities and related attributes. It was originally developed by Engineering Animation Incorporated (see sidebar: About JT) in the mid-1990s to support that company’s visualization applications. Subsequent to its acquisition of EAI in 2000, UGS began promoting JT as a common format for use wherever

3D is required throughout a product-development enterprise. Ten years after the release of JT, UGS has announced that it will release and document the JT specification and make it available to all at no cost.

JT supports a broad range of data, from compact facets that can be used in mockup applications, to precise geometry and topology that can be used anywhere surface geometry is required such as to generate NC tool paths. Visualization is enhanced with lighting and texture information. UGS has developed a suite of visualization applications called “Teamcenter Visualization” that supports a broad spectrum of product-development use cases, from concept to engineering, and throughout manufacturing. JT can also support CAD and PDM attributes or metadata, which makes it ideal for use in a managed PLM environment. JT can support complete product and manufacturing information, such as GD&T tolerances, weld symbols, and surface finish marks, to replace 2D drawings in downstream use situations. JT can be used in CAM (because it can include precise surfaces) and UGS recently added support for CAE results in JT.

The JT file is structured to support any or all of the data elements above. Not all applications require all of these types of data. The source application can be set up to produce just the data required by a specific downstream application; or multiple forms of data can be generated, and the application will load just those sets that it requires, based on user profiles.

Partnerships and the significance of the JT Open Program

The JT Open Program is a formal group of customers, independent software vendors (ISVs), industry advocates, and even competitors, who promote the use of JT technology and share visualization data using the JT standard. It has about 200 members.

UGS provides JT Open members with the JT Open Toolkit, a C++ library that enables them to create and utilize JT files. The toolkit is available for both UNIX and Windows systems. UGS has taken steps to ensure that as the toolkit is updated, applications built on earlier definitions of JT will not be adversely affected, and existing JT files will still be valid.

Members pay an initial fee upon joining JT Open and an annual maintenance fee based upon the size of the company. Software developers can sell their products to members of JT Open with no royalty fees, while JT-enabled products sold on the open market do incur a royalty fee. Not all corporate members are users of UGS CAD software products, but they do use JT in applications such as Teamcenter Visualization.

JT Open includes companies such as Ford, General Motors, Parametric Technology, Caterpillar, Adobe, and Procter & Gamble. A Management Review Board meets several times a year to go over the overall performance of the JT Open Program and to prioritize program enhancements. A Technical Review Board functions similarly, with regard to technical issues. An individual JT Open member does not have to be on one of these boards to submit an enhancement proposal. Interestingly, UGS competitors, as well as other software vendors, sit on these boards.

Membership in the JT Open Program by software industry leaders like Adobe, PTC, and Microsoft is an reflection of UGS’ effort toward openness. This openness effort has also resulted

in the relationship of UGS and Microsoft working together to extend the 3D into the operating-system environment with support for Microsoft's XAML XML language on the Vista platform.

Members of the JT Open Program are driving for JT to be enhanced to support their product-development processes. Some of the goals currently being discussed are using JT as an interoperability format between different CAD systems; support for lightweight publishing and free viewing; and long-term data archiving. It was discussions of the JT Open Program Management Review Board that led to UGS agreeing to publish the JT format as an open format like DWF or PDF.

UGS' vision for the future

UGS sees JT as the common 3D format for PLM collaboration throughout the supply chain. A generally accepted estimate is that there are perhaps 10 to 20 *users* of product data for every individual who needs a CAD seat to *create* design data. The trend is definitely away from simply creating more data in favor of reusing existing data more efficiently.

Many of these potential users are either still using hard-copy drawings, 2D drawing files, or even CAD to accomplish their tasks, or are performing these tasks without access to all the information they could use. Lightweight data formats greatly increase the number of people who are able to participate in PLM processes.

JT is used most extensively in the automotive, heavy industrial equipment, and defense and aerospace industries. JT is in common use at many of the global automotive OEMs for PLM visualization. DaimlerChrysler in Germany uses thousands of seats of JT-enabled software; Ford and GM each use tens of thousands of seats of JT-enabled software. By publishing the JT specification, UGS expects to see significant expansion of the adoption of JT in all markets it serves.

Similarly, most of the top global tier-one automotive industry suppliers have also adopted JT. Talks are under way that could lead to JT becoming the primary method by which data is exchanged between these suppliers and OEMs. UGS believes that making the JT specification open will have a tremendous impact on this activity.

Caterpillar is an example of a company that uses a non-UGS CAD system—Pro/ENGINEER—but uses UGS Teamcenter for PLM applications, and extensively uses JT as an inter-application communication medium. A similar situation exists at Siemens Power Generation, which employs a variety of different CAD systems at design centers around the world. (See sidebar: Siemens)

Among the ways JT can affect workflow, two are particularly illustrative. In one case, an OEM or prime contractor can provide a major supplier the geometric definition as background information or component requirements in JT, rather than in CAD. The supplier is not required to convert external CAD data to its in-house CAD format; it can just read the JT information. At interim design milestones, component information can be returned to the customer in JT and used for downstream applications such as digital mockup, again without translation. When

changes are made to the component design, these applications are updated by simply transmitting new JT files.

In another situation, manufacturers can reduce or eliminate the need to produce detailed manufacturing and maintenance drawings. Instead, JT files, including exploded assembly views, can be sent directly to users on the factory floor or the maintenance shop. If a change is made to the product, these changes can be distributed to everyone affected nearly immediately, or through a managed PDM workflow.

UGS sees the overall PLM market swinging from being CAD-centered to placing an increased emphasis on applications that use the data in everything from engineering analysis to marketing collateral and sales quotations.

Sale of these downstream applications has been restricted by the difficulty users have had moving data from one proprietary format to another. For decades, the automotive industry has been the driving force behind finding a universal data-exchange format. Neither IGES nor STEP met this need. UGS believes that JT is the enabling technology that does.

In comparing JT to other data-

Siemens Power Generation

Siemens is a 400,000 person global manufacturing company generating over €75 billion in annual revenue. Siemens Power Generation (PGI) is one of two divisions in the company's Power sector. PGI manufactures a wide range of fossil-fuel power-generation systems, small industrial turbines, instrumentation, and controls for the power industry, as well as fuel-cell, nuclear, and hydroelectric systems, some of which is done as part of joint ventures. The company positions itself as a "one-stop shop and system integrator for rotating equipment."

The organization's challenge is that its products are designed, produced, and supported from 83 locations around the world, plus many local service facilities. Most of these locations are only involved with a subset of PGI's products.

What's more, most of PGI's products are engineered to order, although usually consisting of standard subsystems. Compounding the complexity is the fact that the company uses different engineering tools at different sites.

PGI realized it needed a common global collaboration infrastructure. The solution involves wide use of UGS' Teamcenter software along with ERP software from SAP.

Data feeds into this solution from engineering departments using PTC's Pro/ENGINEER, Autodesk's AutoCAD, UGS' NX, and a number of other CAD packages. The use of Teamcenter has made possible real-time conferencing, multi-CAD visualization, PDM integration, and work-in-progress data-sharing involving engineering, manufacturing, and suppliers.

By early 2005, Siemens was using more than 800 licenses of Teamcenter at 180 sites, including 70 strategic suppliers. The result is a multi-site collaboration environment for distributed teams. It uses UGS' PLM XML as its data-transport protocol and JT for data-sharing.

PGI has also joined JT Open as a corporate board member. Siemens' interest in JT extends beyond today's application interoperability, viewing, and collaboration to its eventual use for archiving 3D CAD data.

exchange tools, UGS believes that JT has two significant advantages. On one hand, JT is “battle-hardened” technology; it has been in production use in product development companies of all sizes for many years with nearly four million users worldwide. Sales of JT-enabled applications continue to grow and the JT Open Program is attracting new members at an increasing rate. Any serious flaw in the concept of the JT approach should have shown up by now.

The second factor is the breadth of application data types that JT can handle, and the fact that it is extensible.

UGS’ view of other “lightweight” formats

XML has been used extensively by UGS as a PLM interoperability protocol in its PLM XML format for years. UGS’ view of Dassault Systèmes’ 3DXML is that it is new and has not proven itself in actual use. UGS points to the fact that 3DXML was introduced in 2005, while JT has been in productive use for more than ten years. UGS’ position is that, first EAI and then UGS have had the opportunity to refine JT in response to customer needs over a period of ten years, while Dassault Systèmes has yet to go through this process for 3DXML. To date, there are no commercial engineering applications available that use 3DXML. Also, Dassault Systèmes does not yet have a formal industry organization to provide oversight to the future development of its format, while UGS has JT Open.

UGS’ viewpoint is that, from a technical standpoint, the biggest difference between JT and 3DXML is that JT transmits data sets with different qualities to the user’s desktop, depending on the need. Their view is that, while purportedly more compact than JT, the 3DXML model data must be tessellated by the user’s system, making it inefficient for use with large assemblies.

Autodesk’s DWF is seen by UGS as more of a complementary technology than a direct competitor to JT. In fact, in early 2005, Autodesk and UGS announced an agreement, under which Autodesk will join JT Open and will provide JT support in its software products, while UGS has joined the Autodesk Developer Network and is a DWF Developer partner. DWF is particularly applicable to distributing drawing and model images, while JT carries substantially more detailed design information. Additionally, JT is “tuned” to the needs of manufacturing, while DWF is a more general-purpose format. Open Design Alliance president Evan Yares, noted in his CADwire.net commentary on the Autodesk-UGS agreement:

“It makes sense for Autodesk to join JT Open, because the format is important in the automotive industry -- and Autodesk Inventor is targeted towards the machinery design segment of the automotive industry.

Likewise, it makes sense for UGS to support DWF, because it is the pervasive publishing format for Autodesk products, used in many applications that are ancillary to UGS' core focus. And the cost for supporting it is almost nothing.

The argument about whether JT, DWF, PDF, or even DWG is better is really immaterial here, because the issue is primarily one of supporting customer workflow. And, in this case,

after getting past any politics (Autodesk and UGS are competitors, after all), it was a no-brainer for them to support each other's collaboration format.”

Adobe Systems, which recently added the ability to handle U3D data within its PDF file format, has also become a member of JT Open. UGS sees Adobe's PDF format as also being complementary to JT. As an example, JT is used to collaborate on design data, such as when working on a digital mockup. But often, collaboration is required on a document basis, such as for a request for quote. PDF files meet this need. Adobe recently announced Acrobat 3D, which supports the import of JT. UGS expects significant adoption of the use of JT in conjunction with Acrobat 3D for document-based workflows.

What is Cyon Research's opinion of JT in this context?

There is little question that extensive use of JT-enabled applications can improve the efficiency of a business enterprise, especially for organizations involved in the design and manufacturing of complex products on a global basis. Historically, companies needed to use the same CAD software for downstream applications as was used to create the data, or go through a costly, time-consuming, and error-prone translation process.

JT enables users to share lightweight representations of product designs without concern for which CAD system was used to create the data, or which applications are going to use the data. From what we have been able to determine, all the data needed by these other applications is readily provided by JT.

By including both users and software developers in the JT Open Program, UGS has taken an important step in ensuring that the JT standard will evolve in a way that meets the needs of both groups. In the past, users often felt that technology enhancements were made on the basis of simply what was most efficient for the vendor to implement. By publishing the JT specification UGS has sent a clear message of support for open exchange of product data.

The JT Open Program is run by its members, not by UGS. Members play a pivotal role in the requirement-generation process, and directly affect the direction of the standard.

Cyon Research does not see either Autodesk's DWF format or Adobe's PDF being a direct alternative to JT. These formats—each developed for different purposes—are intended to handle less-complex and less-precise data. In fact, there are circumstances in which employing both JT and PDF or DWF may be appropriate.

Cyon Research would like to see the JT Open Program continue to take a proactive role in promoting the concept of lightweight data formats for downstream applications, and be even more vocal in advocating that data be shared between suppliers and OEMs in JT, rather than in native or translated CAD formats. We are pleased to see JT become a published standard, making it easier for companies to generate and use JT information.

The agreement with Microsoft is important because, to an increasing extent, users want to incorporate rich 3D JT models into Word, Excel, or PowerPoint documents, and then be able to

manipulate these models directly in the application. Increasingly, 3D is being incorporated directly into the Microsoft operating system using their XAML (eXtensible Application Markup Language).

This white paper has discussed a number of scenarios where the use of formats such as JT can increase productivity and reduce costs, so the enterprise can respond to market demands. In many situations, users do not need expensive CAD seats to perform downstream operations, such as component mockup or creating technical documentation. JT can be very effective in such cases.

While JT is a useful technology for large manufacturing firms and their supplier base, it is not necessarily the universal choice. Smaller manufacturing companies, where all design work is done in-house and few components are purchased from outside suppliers, often are able to work with just their CAD systems and the lightweight data formats described above.

Firms that have effective information-sharing mechanisms in place may not be served by switching to JT-based applications, unless they plan to expand their collaboration base. Other, more compact formats, might be more appropriate than JT for streaming applications such as games and some real-time applications.

Organizations that can make best use of JT will be those that have a need to share data with their extended enterprise—including large manufacturing firms and their supply chains. The latter will typically include many relatively small companies, as well as multi-billion-dollar firms. Using JT will not put an undue burden on the smaller companies. In fact, it should help them reduce their costs, since using JT will require fewer resources and effort than transferring the data into an OEM-required CAD format that is not commonly used by the firm. .

About Cyon Research...

Cyon Research is a consulting firm that provides design, engineering, construction, and manufacturing firms with a strategic outlook on the software tools and processes they rely on to create the world around us. Cyon Research also supports the vendor community with its unbiased insight, vision, and expertise to help them understand the complex nature of their markets and grow, by serving the needs of their customer base.

Cyon Research brings to its clients a unique combination of experience, perspective, and insight, supported by an extensive network of well-established industry relationships. Our close contacts throughout the user, analyst, vendor, and developer communities provide surprising benefits for our clients and add significant value to our services.

Those relationships are enhanced by our publications and events. While consulting is the heart of our activities, our publications and websites—including *CADCAMNet*, *Engineering Automation Report*, and *CADwire.net*—are our voice. Through them, we connect daily and monthly with the user and vendor communities. And COFES: The Congress on the Future of Engineering Software, our annual, invitation-only event, is our face—the place where we can make the types of connections that just aren't possible through any other means than face-to-face.

The focus of our research within the realm of design, engineering, construction, and manufacturing is technologies and markets that are likely to become real within the next two to six years.

The domain of our research is the tools, processes, and procedures used in the design, engineering, management, and production of the built environment and manufactured goods.

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