Summary: The pressure to develop products from multiple locations continues to grow. Computer technology isn't keeping pace with requirements. But there are techniques that managers can use to minimize problems and make the process leaner. This is the first of a three-part series by Contributing Analyst L. Stephen Wolfe, P.E. (July 16, 2009)

Managing Distributed Product Development, Part 1: PDM Systems Still Don't Know How to Play Nice

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July 16, 2009—If John Donne were alive today, he might have written, "No manufacturer is an island, entire of itself; every company depends on others to help design its products or the tools and processes to make them." The job of the original equipment manufacturer (OEM) is to coordinate the activities of its various suppliers so that its end product—be it an airplane or a bulldozer—meets customers' requirements at the lowest possible cost.

Fortunate are companies that can design all their products in a single office using off-the-shelf components. For such firms, the current CAD and product-data-management (PDM) systems work well enough. Even when production tools are made by specialized tool shops, the interaction between the tool maker and its customer remains fairly straightforward. But when an OEM and its suppliers must simultaneously interact in ways that affect a product's functional characteristics, physical design, fabrication, and assembly processes, then current engineering software leaves much to be desired.

PDM Problems

High-priced product-data-management systems are supposed to help companies with remote engineering offices collaborate. But in practice, PDM systems from both Parametric Technology (PTC) and Dassault Systèmes (DS) don't serve remote offices well, according to customers.

Speaking at Longview Advisors' 2009 Collaboration and Interoperability Conference (CIC), Mike Voth of Spirit Aerosystems said that offices that are more than 300 miles from Boeing's Enovia PDM system in the Puget Sound area of

Washington State exhibit unacceptably long delays in retrieving files. For example, a test data set that opened in three seconds at Boeing Commercial Airplane headquarters took 18 minutes to open in Wichita, Kansas, and an hour in Moscow. Delays like these occur even when bulky CAD files are replicated to file servers at remote locations. According to Voth, Dassault Systèmes attributes these delays to excessive communication between the PDM server containing the metadata and remote sites.

Users of Parametric Technology's Pro Intralink 3.X have reported similar problems retrieving data in remote offices. PTC's Intralink 8, which is based on its Windchill technology, is said by some customers to have relieved the delays, but problems still occur. For instance, one Windchill customer told me that his company employs three replicas of its headquarters' Pro/ENGINEER data server at remote plants around the US. Two work perfectly, but a third is sluggish and sometimes fails to update files correctly.

Problems are compounded by the fact that even PDM systems from the same manufacturer employ different data models that make them incompatible. PDM differences sometimes occur among divisions of the same company. When two or more companies collaborate, their product lifecycle-management (PLM) systems are almost certain to not work well together.

Spirit Aerosystems makes major aircraft subassemblies for a variety of airplane makers. Currently, its CAD and PDM software must be matched to the PDM system for each aircraft program. Spirit currently supports 17 versions of CATIA for various customers.

Until 2005, Spirit was part of Boeing, so it could employ whatever PDM systems Boeing was using. Today Spirit must pay for its own PDM infrastructure and provides aircraft substructures to Airbus, Cessna, Gulfstream, and Sikorsky as well as Boeing. To operate efficiently, Spirit needs its own PDM system and data-management processes. It can't employ the PDM and work processes of each of its customers and deliver the manufacturing efficiencies that customers expect.

Parker Aerospace has an even more complex web of customer relationships than Spirit. Bob Deragisch, Parker's manager of enterprise systems, says his company supplies engineered control systems and components for most commercial and military aircraft in operation today. In some cases, Parker acts as a Tier 1 supplier to an OEM; in others it is a Tier 2 supplier. With so many relationships, Parker maintains one of almost every CAD system ever made. But it's impractical to integrate with every PDM system used by its customers.

Impaired View of Reality

Today's PDM software makers have an overly simplified view of the relationships among OEMs and their suppliers. They assume, incorrectly, that all design is done

by the OEM and that all suppliers work exclusively for the OEM. Companies such as Spirit and Parker Aerospace belie these notions. These companies are in turn working with multiple suppliers that provide not only physical parts but design services too.

Because of their parochial viewpoints, PDM suppliers expect an OEM's suppliers to retrieve information through idiosyncratic custom interfaces in proprietary graphics formats. Metadata isn't accessible to other manufacturing software unless suppliers are willing to write costly custom interfaces. Even if the market were to permit one PDM supplier to win monopoly status, differences among systems caused by customization would make each OEM's system appear unique.

Predictably, only the richest Tier 1 suppliers will bother to use an OEM's PDM software. The rest of the companies in the supply chain continue to rely on email or Fed Ex packets for engineering models and documents. When changes occur, these systems require people to remember to send updates. In most cases, suppliers re-key information about release dates and revision levels into their own information systems.

Build to Communicate

If PDM is to realize the vision of its PowerPoint presentations, then software must be designed from the start with exchanging data in mind. OEMs don't know who is going to need data from their PDM systems or which applications those suppliers might use to read that data.

Most of the systems that enable people to communicate cheaply and at low cost —telephones, the Internet, television, and radio—rely on international standards or published protocols. In like fashion, PDM systems should employ international standards where possible to make information available to any software program that can read it.

In its various parts, ISO Standard 10303, "Industrial automation systems and integration - Product data representation and exchange" (also called STEP), contains much of the common information stored in PDM systems:

- Product structures, versions, responsible persons or organizations, and locations
- Approvals and release states, security classifications, authorizations, certifications, and status
- Effective dates for configurations
- Change management
- Non-geometric properties
- Classification

According to Charlie Stirk, chair of PDES Inc. Technical Advisory Committee, these concepts have been expressed in standard modules that are incorporated into the various application protocols (APs) that PDES, Inc. has developed, such as:

- AP203 - Configuration controlled 3D design, TS and 2nd edition (mechanical CAD)
- AP209 - Composite and metallic structural analysis and related design, upcoming 2nd edition (Finite Element Analysis and Computational Fluid Dynamics)
- AP210 - Electronic assembly, interconnect and packaging design, 2nd edition (electronic CAD and design automation)
- AP 233 - Systems engineering
- AP 239 - Product life cycle support

In other words, the information typically stored in PDM systems can be applied to either mechanical, electrical, or system-level products in the development, manufacturing, or maintenance cycles of their lives.

Currently there is scant interest by PDM suppliers in standardizing their data. Testing of CAD software and translators for conformance to ISO 10303 is currently conducted by the CAx Implementor Forum (CAx-IF) with participation by the major vendors. The next round of testing covers Product Manufacturing Information (PMI or GD&T) Presentation and Representation, Validation, and User Defined Attributes. These attributes, along with previously tested attributes, such as Material Name, constitute typical PDM information.

Previous efforts at testing PDM interoperability using STEP did not receive similarly sustained industry support. The Long Term Archiving and Retrieval collaborative effort (LOTAR) is developing recommended practices for PMI representation which will be tested through the CAx-IF. LOTAR also is addressing PDM information interoperability, Stirk wrote in an email.

In Part 2 of this series managing distributed product development, Steve Wolfe examines the continuing problems with transferring 3D model data from one environment to another. The article will appear next week.

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