CE Requires a Strong Foundation for Enterprise Collaboration throughout a Product Life-Cycle in the Twentieth Century

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Editorial

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Unigraphics Solutions

For many industries the ability to bring innovative new products to market quickly is becoming more critical to business survival in the twentieth century than fixes like curtailing labor costs. The old paradigm of "design it now and figure out how to make it later" has created more problems than solutions in the long run. Today, the internet-based CAD/CAM, CAE tools and Product data management (PDM) systems are offering more and more collaborative tools to pull the lines separating engineering and manufacturing closer together at cyber speeds and shrink the time-to-market by a very large percentage.

Company requires an advanced framework of collaborative tools to define (create), manage and track their product and process information as products are transformed from virtual concepts to reality [1–3]. Most companies require a strong foundation to manage their enterprise knowledge collaboratively and an open "authoring" architecture that provides cooperative teams with maximum flexibility in capturing knowledge and managing their concurrent tracks and tasks throughout an enterprise.

The "authoring" foundation should provide an active data management framework during the process of "design evolution" versus passive "released data" management capabilities offered by most common PDM systems. This means that concurrent teams should be able to capture and share product knowledge with their cooperative supply-chain partners during the actual product design, development and delivery (PD^3) process. The enterprise collaborative foundation's architecture should allow teams to capture Bill of Processes (BOPs) and Bill of Materials (BOMs) early on—as product is being conceptualized. BOMs and BOPs provide product definition and evolution and are often central to a concurrent PD^3 process [3]. The foundation should support the evolution and multiple views (perspectives) of the BOPs and BOMs as the teams move from "concept" to design, engineering, manufacturing, delivery and servicing. The associated configuration management system should support design evolution and be able to create a single virtual thread of BOPs and BOMs for the most complex line of products. A single point of access to digital product information from all sources (life-cycle functions) is essential. This allows concurrent work-groups to access the virtual product for all purposes—viewing, markup and annotation, digital mockup, measurement, and motion of 2-D and 3-D product information.

The associated (authoring foundation's) architecture should have a "federated" capability supporting a set of independent sites that cooperate with each other. The "federated" capability means that each component has its own resources, its own model, its own set of users and groups, and its own business rules that can be most effectively deployed. When deployed in a federation, each component can be managed and maintained independently or cooperatively while working within the constraints of an organization's current infrastructure. The foundation's architecture should leverage current open industry standards and leading-edge technologies such as Java, HTML, CORBA and ODBC to build a platform for true enterprise collaboration. And because of its (foundation's) rules-based configuration management approach, teams should be able to track the corporate knowledge of their BOPs and BOMs, its variants and the rules to which they are ordered, marketed, designed, manufactured, assembled, shipped and maintained.

A Unified or Single Product, Process and Organization (PPO) Concept

One of the most talked-about application of the "authoring foundation" is a Single-PPO-concept (SPC) [1]. PPO stands for product, process and organization. The concept is based on providing the work-groups with a direct access to leading commercial CAE software (Nastran, Patran, Ansys, etc.), CAD software packages (such as UGS/Unigraphics, CATIA,

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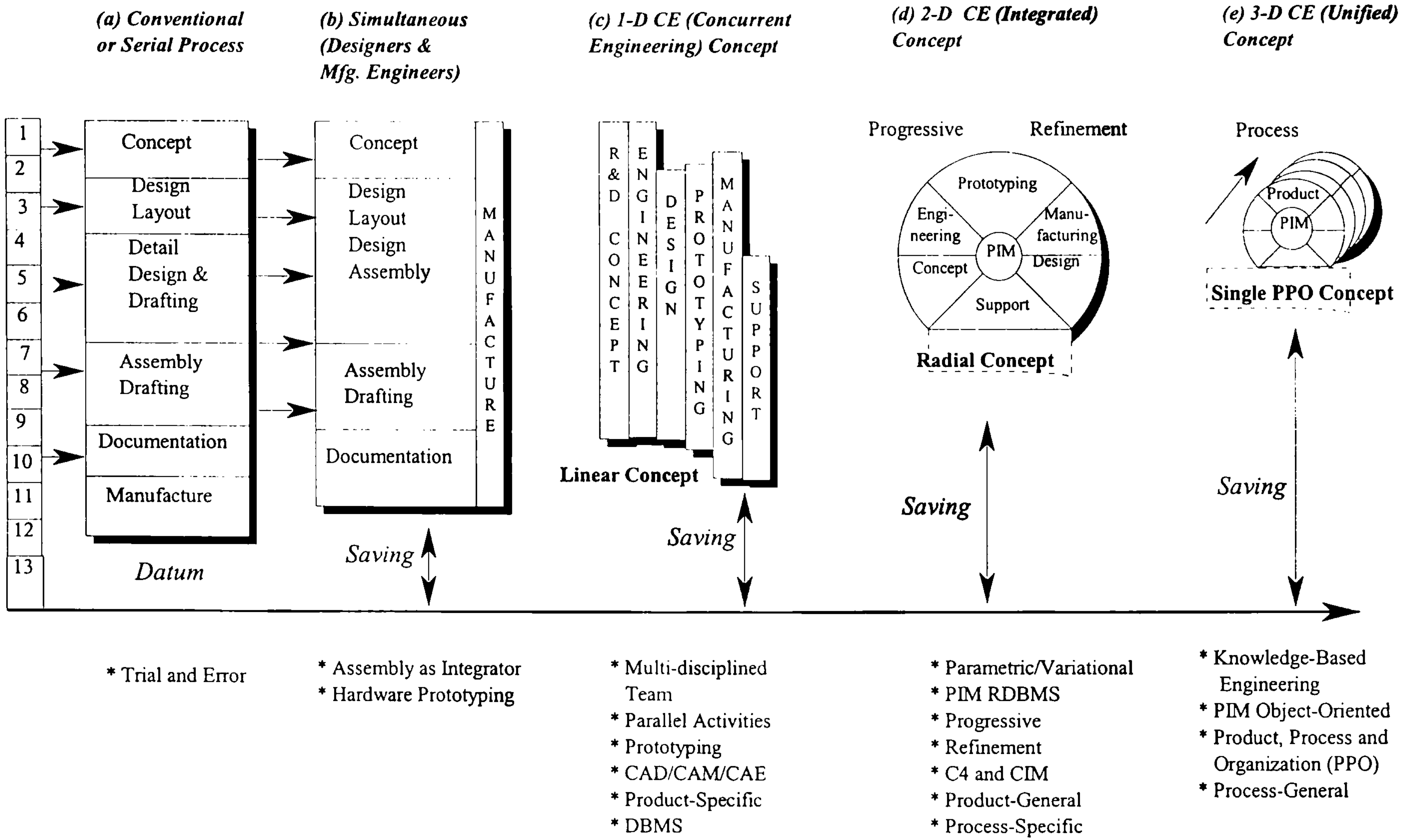

Figure 1. A progression of concepts for product and process realization.

etc.), and CAM software (CAPP, etc.) built on a single consistent PPO representation. Direct access means that CE work-groups can eliminate the transfer, translation, or recreation of product features, when using SPC. Most of the intelligence in SPC relates to the theoretical foundations for the development of mapping between design support technologies, particularly between intelligent CAD, CAE, CAM and product Information Management (PIM) systems. Part functions and possible features are synthesized to align with a desired common product and process mapping (see Figure 7.5 of Volume I [1]). Coupling product, process and organization constraints with one common PPO mapping is critical for SPC. A typical progression of concept from a conventional (serial engineering concept) to a SPC (a 3-D CE concept) is shown in Figure 1. Figure 1(a) shows a conventional process discussed in previous chapters of volume I [1] several times. Figure 1(b) shows an early version of simultaneous engineering concept, when design and manufacturing functions were carried out simultaneously. The next series of three concepts in Figure 1 deals with concurrent engineering (CE). Figure 1 [2] also shows the accompanied savings as a result of using such CE concepts. The most popular of these concepts are: 1-D, 2-D and 3-D CE concepts. A unified or single PPO concept (SPC) is another name for a 3-D CE concept. In 1-D CE concept, the various functional tracks are overlapped linearly as shown in Figure 1(c). In 2-D CE concept, the individual tracks are overlapped radially as shown in Figure 1(d). PIM, which stands for product information management, forms the core of this 2-D CE concept. It serves as a communicating (e.g., 7Cs) block for the radially overlapping tracks. This way, a series of cyclic iterations can take place, design improvement is radially progressive, and product is refined as it moves from one cyclic iteration to another. This way, to come up with a new product design, reasoning based on the constraints from a combined PPO feature library can be employed by the work-groups to search for suitable form features to satisfy a desired part function. Sources of the constraints become immaterial. In 3-D CE concept, the 2-D cyclic process is repeated along a third-axis as shown in Figure 1(e). This axis, in 3-D CE concept, represents a process taxonomy dimension, which is generically captured and is so general that it is applicable across all product lines. The concept of a mapping process—between functional models, attributes, symbols or features—is described in Chapter 6 [2].

References

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Announcement

This is to inform the readers that the phone numbers and address of the Managing Editor, Dr. Prasad, have changed. The new address is Dr. Biren Prasad, CERA Institute, P.O. Box 3882, Tustin, CA 92781, USA.; Tel: (714) 952-5562; Fax: (714) 505 0663. Email address: prasadb@ugsolutions.com