Personal Background & Motivation

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Started career with Fluor Daniel, Inc. 19 years ago as an engineering systems analyst at the company's Irvine, California corporate headquarters.

Responsible for developing and applying solutions to significantly reduce project cost and schedule thereby creating a competitive advantage in project execution. Role spans across Fluor strategic business sectors, including Government, Telecom, Manufacturing, Oil, Gas, Power, Chemicals, and Life Sciences.

Over twenty years of computing experience as a systems analyst and project manager, specializing in systems integration. Have experience in all phases of systems development, support and maintenance. Have taken numerous projects from the needs assessment stage clear through to production support. Have substantial experience with multi-platform system integration projects. This includes integration of databases, CAD, and CAE systems.

The motivation for this project is based on the need to leverage a number of related Internet commerce initiatives that have the potential to significantly improve the engineering, design, and construction of process plants.

Title

Computer Mediated Information Transactions in the AEC Industry

Abstract

The proposed research is to develop an industry framework to automate material information transactions in the AEC industry. This proposal is an extension of research currently being performed by Andrew Arnold under the guidance of Stanford's Center for Integrated Facility Engineering (CIFE) and in conjunction with the National Institute of Standards and Technology (NIST). Research is required to develop a transaction based technical language that would enable automatic processing of information exchanges.

This would extend other Internet commerce initiatives and has the potential of reducing engineering design hours by 20%. It would firm up the conceptual design of a facility. Accurate conceptual design requires information exchange from many suppliers concerning cost, availability, and suitability to service of their products. It is estimated that better optimization of the design in the conceptual phase of a project, based on more reliable and timely technical information, can save up to 30% of the total installed cost of a facility.

Introduction

The AEC industry must change. Factors driving this change include globalization; a push to reduce total installed cost of facilities; acceleration of engineering, procurement, and construction cycle times; and the emergence of the Internet as a mechanism for E-commerce. Much of this change is dependent on the industry changing as a whole so that new solutions can be collectively developed, leveraged, and supported. This is a tremendous challenge for an industry that is extremely fragmented with no dominant market leaders. While the AEC industry produces a significant portion of the US Gross National Product, profit margins are too low to generate substantial internal R&D investment. This has resulted in limited innovation or work process change in the last thirty years.

As a number of studies have noted, the opportunity to make a significant impact on both schedule and cost is early in the project. Schedule reduction is achieved through getting conceptual design done right the first time, while cost reduction is achieved through better design. Better design can be enabled through more accurate, timely, and reliable information. Estimates of cost reduction opportunities during different phases of a project are shown (Figure 1) below.

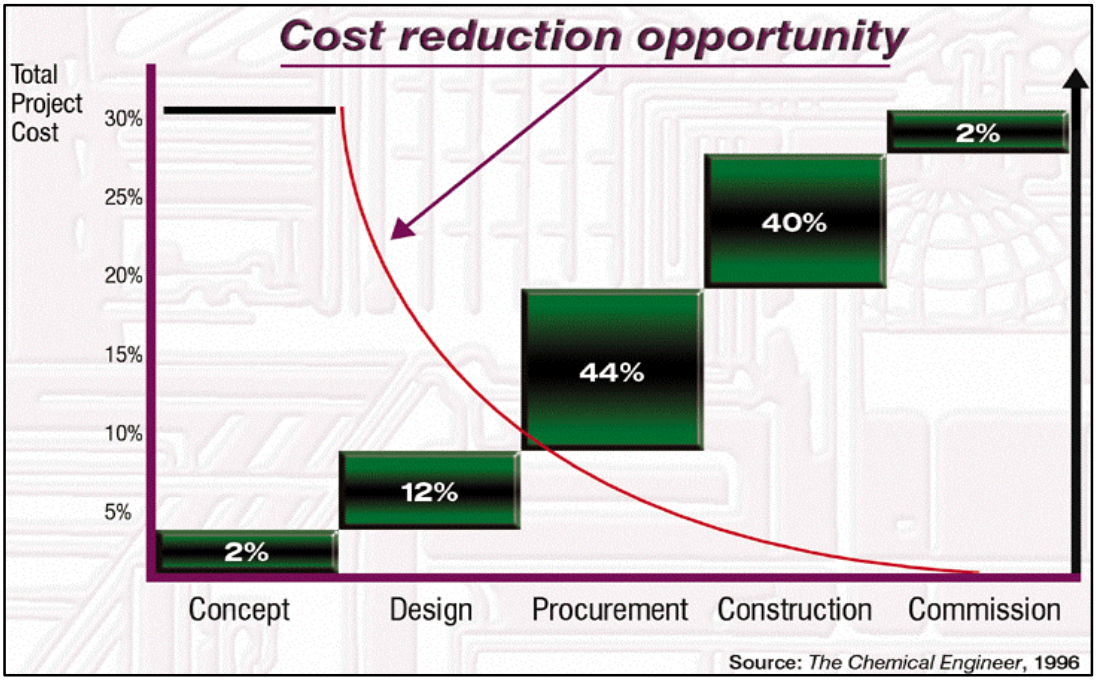

Figure 1.

All process facilities go through conceptual, preliminary and detailed design phases. During conceptual engineering, the general requirements and parameters of the chemical process and facility are developed. In preliminary engineering equipment selection is initiated and requests for information such as weights and dimensional data are issued for later use in the design process. In the detailed design phase all the components are integrated and detailed out. Finally the design is issued to the constructor in the form of drawings, specifications, and 3D models.

Throughout this process the engineering contractor spends a great deal of effort with supplier interfaces writing specifications; anticipating dimensional, weight, and performance data; expediting information; and waiting for the specific informational components which drive related design issues. Data that arrives late often results in significant rework in the home office and in the field. Late data also greatly increases the risk of design errors and costly construction rework. Key components of data value are accuracy, relevance, and timing. Engineering contractors spend an estimated 40% of their efforts dealing with supplier interface related issues. This is a key area where change can reduce schedule, cost, and project risk.

This issue is becoming further extended by the trend of pushing more equipment engineering design to the supplier. The engineering contractor dictates and controls fewer information design elements, yet there are significant related design impacts of a component on the rest of the facility.

Future State Use Case

The process design team is made up of process engineers, piping design engineers, facilities design engineers, construction engineers and representatives from the client. The team begins with the conceptual design package consisting of process flow diagrams, basic site data, and project objectives. One element of the design involves transferring liquid fuel from a storage tank to a fuel preheater. The process engineer determines the delivery specifications from the conceptual process design basis and makes a preliminary pump selection. This selection is made possible by automatic generation of a query from a pump data sheet into a material information request using an XML schema. The information request is sent via the Internet to a neutral hosted message service that can fulfill the request and respond with possible selections or request additional data and constraints from the original requester. An additional information request may be required to expand, or narrow the result set. Once selected by the process engineer additional design details would populate an electronic data sheet and a bid package by parsing the XML schema compliant return message. The transaction could take place in a matter of seconds from the available supplier catalogs for pumps suitable for fuel transfer service. The equipment selection may then be released to the supplier for confirmation of suitability and availability. When the supplier responds, the equipment may then be released for detail design.

Proposed Research

It is proposed that research be done to develop an AEC focused Material Information Transaction Language (MITL). This will enable an accelerated supplier information exchange to reduce both cost and schedule of facilities. Research is needed to extend the value of current research projects in the area of electronic catalogs. MITL will leverage electronic catalogs and move the industry from a slow document exchange process to a real time data exchange process. For example, key information pieces for a pump might be weight; foot print dimensions, and nozzle size and locations. This often can be determined early, however may not be passed back to the contractor until all material types, internals and peripheral equipment are determined. A Material Information Transaction would be able to get the required information based on preliminary process design conditions and specifications. The contractor can move forward with the design while still waiting for the supplier to confirm the information transaction and provide more design details at a later time.

MITL should be developed through analysis of a series of various use case scenarios for different types of components. When new use cases no longer suggest additional extensions of the Material Information Transaction Language the initial framework will be complete. This initiative can leverage components of data schemas already developed in ISO303, also known as STEP (**ST**andard for the **E**xchange of **P**roduct model data). The development of MITL will also leverage other industry consortia initiatives including; The International Alliance for Interoperability, http://iaiweb.lbl.gov ; RossettaNet, http://www.rosettanet.org ; CommerceNet,

http://www.commerce.net ; and Microsoft's sponsored BizTalk Framework, http://www.biztalk.org. In particular, CommerceNet's efforts to develop catalogs for the digital market place will be important for this project to succeed.

Application of the standard in a test environment would be done at a latter date as a second phase of this proposed research.

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