ELSEVIER

Knowledge-Based Systems 12 (1999) 223–230

Knowledge-Based SYSTEMS

PCONFIG: a Web-based configuration tool for Configure-To-Order products

Paul J.P. Slater*

Principle Engineer, Digital Equipment Scotland Limited (A COMPAQ company), Mosshill Industrial Estate, Ayr KA6 6BE, UK

Received 24 November 1998; accepted 17 March 1999

Abstract

PCONFIG is a modern Web-based constraint system managing the complex configuration requirements of one product range from a specific computer manufacturer. The range spans multiple CPU types, Operating Systems, Option cards and all the diverse multi-way relationships found in the assembly of complex computers.

A principled approach to configuration was adopted from the outset with special attention given to ongoing product enhancement. Computer Parts and Engineering Constraints are separated in this unique configuration engine allowing each to be updated independently; typically by different people. The complex modelling essential in capturing multi-way relationships is dealt with by coding configuration information using a tool boasting a patented pattern-matching algorithm. This highly versatile rules-based, object-orientated development tool encouraged the simplification of a potentially difficult and complex problem into a relatively straightforward and extensible system.

This online configuration system goes live on the Digital customer Web pages early next year. Future enhancements to PCONFIG includes a parts editor, a constraints editor and ordering methods allowing users to place orders not only by part numbers, but also system functions and system benefits.

Keywords: Configuration; Configure To Order; CTO; Constraints: web-based tools; Multiple configuration methods; Pconfig; Modelling

1. Introduction

Build-to-Stock computers can be produced in quantity and stock piled in advance of orders, with both the manufacturer and distributor gaining process and business efficiencies with volume orders. The construction of such computer systems are known and can be planned in advance with meticulous detail. Such systems can be ordered from a menu with delivery times guaranteed.

Configure-To-Order computers cannot be mass produced in advance of orders as their composition is dependent on customer needs. Manufacturing has to be able to respond to many and varied combinations of computer parts in customer orders. This necessitates good vendor and customer relationships as well as manufacturing staffed with sufficient support to ensure systems are properly configured.

When Configure-To-Order volumes are low, a manual process can satisfy configuration needs. This may be accommodated by various support levels. In one scenario the first level of support would be provided by a trained person on each shift dealing with routine problems. The more involved next level of support would be provided by a qualified engineer available on one shift only. A complementary escalation process would ensure problems are dealt with efficiently by the correct level of support.

When product volumes are high, other means must be found to support manufacturing.

2. Problem description

> The need for "right-the-first-time" product configuration has never been greater. […]Companies lose 2–3% of revenue in rework and penalty costs due to errors made in the initial product configuration. PC AI, January–February, 1996

> …customers sometimes received servers without room for the required disk drives, or without connecting cables, or with the wrong kind of preinstalled software. Fixing these mistakes costs […] money, time and customer loyalty. Forbes, June 3, 1996

* *E-mail address:* paul.slater@altavista.net (P.J.P. Slater)

0950-7051/99/$ - see front matter
PII: S0950-7051(99)00016-7

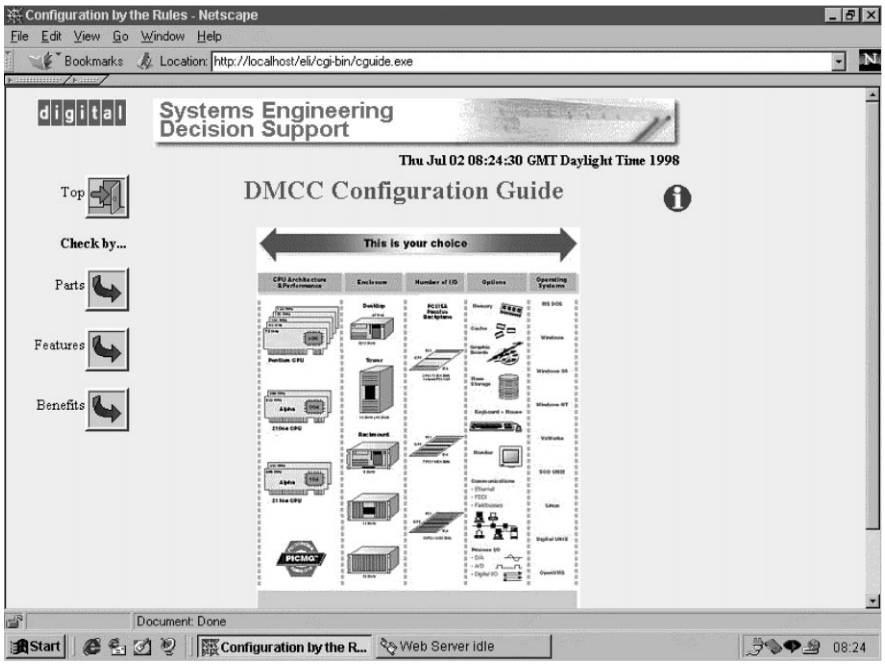

Fig. 1. PCONFIG: DMCC.

Build knowledge for Configure-To-Order products is essential to correctly manufacture such systems in a timely manner. Manufacturing typically use configuration guidelines documented in text manuals supported with qualified staff. These documents are continually updated accommodating parts which are reaching their end of life with new parts being introduced. This is typically a manual process relying heavily on expert knowledge.

The construction of Configure-To-Order computers is complex when these systems vary in many ways such as: enclosure, backplane, Single Board Computers (SBCs), option cards, media devices and operating system. This necessitates the availability of configuration knowledge on-demand within the manufacturing environment. If this configuration knowledge is not available, manufacturing may not be able to complete the build of a configured system. In the example product set, all parts are available for sale as loose piece items. Should an assembly problem occur, a configurable order can be shipped as a collection of loose piece parts. Unfortunately for manufacturing, integrated customer orders shipped loose-piece are considered dirty orders by the customer.

Configure-To-Order systems provide substantial revenue to the manufacturer who can satisfy such orders within reasonable time frames and at attractive prices. This is a lucrative business with increasing volumes in this developing sector of the computer business. Ways must be found to not only configure clean orders on the manufacturing floor but which also ease the task of selling the features and benefits of such systems to customers.

3. Product range

Digital Modular Computing Components (DMCC) [1] is part of the Digital (now COMPAQ) Original Equipment Manufacturer (OEM) business. These systems are designed and built in Ayr, Scotland. The product range offers many enclosures supporting rack mount, desk side and desk top enclosures both with and without power supply units and an extensive range of backplanes with a variety of plug in Alpha and Pentium Single Board Computers. Customers can further choose from an extensive range of option cards supporting 2 popular I/O protocols. The range supports WINTEL platforms as well as Digital UNIX, Open Virtual Memory System (VMS) and some of the less well known embedded operating systems. Both Integrated Drive Electronics (IDE) and Small Computer System Interconnect (SCSI) disk technologies are supported with multiple networking choices available.

Configuration is a challenge because of the complex inter-relationships of the parts. For example, not all option cards can physically fit in all of the available slots. Fitting a card in a slot may also partially occupy adjacent slot space. Also not all operating systems support all the disk technologies.

Example 1. A hard disk is a mandatory requirement for a configured system. Alpha SBC's support only two IDE devices. Part no. SN-KZPBA-CA (UltraWide SCSI adapter) is not compatible with EBM21-AV and EBM23-AV Alpha SBC's.