

Pinnacles Component Information Standard 1.2 PCIS Tutorial

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National foreword

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Pinnacles Component Information Standard 1.2

PCIS Tutorial

This CENELEC report has been prepared by the technical Committee CENELEC TC 217, Electronic Design Automation (EDA). It was approved by the Technical Committee on 1996-12-09 and endorsed by the CENELEC Technical Board on 1998-08-01.

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CENELEC

European Committee for Electrotechnical Standardization

Comité Européen de Normalisation Electrotechnique

Europäisches Komitee für Elektrotechnische Normung

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Foreword

This CENELEC Report has been produced by The Pinnacles Group (predominantly) and by CENELEC Technical Committee TC 217, Electronic Design Automation (EDA). The text of the draft, which was submitted to the CENELEC members for comments, was approved during the CLC/TC217 meeting on 1996-12-09 and endorsed by the CENELEC Technical Board as R217-015 on 1998-08-01.

The Pinnacles Component Information Standard 1.2 (PCIS 1.2) was developed by members of the Pinnacles Group who collaborated towards internationally agreed standards in the area of electronic data book technology.

The original development of the PCIS standard was accomplished under the coordination of the Pinnacles Group, with members from five electronic component manufacturers who joined together to create a technical information exchange standard for use by the electronics industry. These original member companies have all been active members of the Silicon Integration Initiative, Inc. (Si2) electronic databook working group, and it was in conjunction with Si2 (then the CAD Framework Initiative, Inc.) activities that the original concept of the PCIS was developed. The original work of Hitachi America Limited, Intel, National Semiconductor, Philips Semiconductors, and Texas Instruments was extended when Hewlett-Packard, IBM Microelectronics, and Motorola joined the effort. Representatives of Hewlett-Packard, Hitachi America Limited, IBM Microelectronics, Intel, Motorola, Philips Semiconductors, and Texas Instruments currently serve as members of the Si2 Electronic Component Information Exchange (ECIX) Project Technical Advisory Board.

Additional information regarding tools, customers and related specifications may be found at <http://www.si2.org/ecix/>.

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Contents

General Introduction	4
Scope and object	4
Structure of the Pinnacles Component Information Standard (PCIS)	4
Users of the Pinnacles Component Information Standard	4
Relation to existing standards	5
The Pinnacles Group	5
Informative references	6

General Introduction

Scope and object

The purpose of this European Prestandard is to model electric component data and to define an interchange format for that data (Electronic Data Book -EDB- standard) which is independent of the component supplier or the customers CAD environment.

The Pinnacles Component Information Standard (PCIS) is being developed to serve as a basis for the interchange of technical information about electronic components and to enable electronic component manufacturers to create and distribute a new form of compiled information, Electronic Data Books (EDBs), by electronic component manufacturers. An established, documented interchange standard is a necessary precursor for both of these tasks.

The PCIS principles and methodology may be applied to any kind of electric component, such as semiconductor devices, passive components, display components etc.

An interchange standard will enable companies to provide reusable technical data to customers and vendors. Currently, customers and vendors must rekey this data into their systems. Such rekeying is often an extremely inefficient, inaccurate, time-consuming, and costly process. The interchange standard will define ways to identify information elements so that customers and vendors can receive, process, and extract only the information they need.

In addition, manufacturers themselves will be able to identify, organize, and offer more useful information to customers through the implementation of Electronic Data Books. An EDB is a comprehensive set of information about one or more electronic components, including active and passive components, materials, and connectors. As the PCIS defines an EDB, it could include both the textual and graphic information currently published in databooks and datasheets and other computer-sensible data types such as CAD files, behavioral and functional models, and audio and video recordings. In short, an EDB could include all the data that a company wishes to provide to facilitate the design-in and support of an electronic component.

EDBs will increase the quality of product information by improving its accuracy, accessibility, and timeliness, as well as by enabling CAD integration. Such improvements will help customers realize benefits in product identification and selection, reduce design-in and qualification cycle-times, and improve product life-cycle management, among other benefits.

Structure of the Pinnacles Component Information Standard (PCIS)

This version of the PCIS describes only the SGML component of the developing interchange standard. This Tutorial and the accompanying parts are the first in a series of documents that will be necessary to support the standard. Other documentation, such as a physical packaging standard and graphics standards, will be developed and described in future efforts.

The Pinnacles Component Information Standard 1.2 is organized into four main parts:

- The PCIS Tutorial (document CENELEC R217-015: 1996 E) that describes the SGML architecture, intended use and application of the PCIS standard, and the rationale for the SGML design decisions
- The PCIS Tag Library (document CENELEC ENV 50247-1: 1996 E), that provides definitions of the information elements within electronic component documents;
- The SGML Declaration and SGML Document Type Definitions (document CENELEC ENV 50247-2: 1996 E) that describe the class of electronic components documents; and
- Tagged sample datasheets and datasheet fragments (document CENELEC R217-016: 1996 E).

Users of the Pinnacles Component Information Standard

PCIS will be used by many different types of users, with different benefits accruing to each type.

- Original Information Producers (OIPs) are companies who produce electronic components and materials and who supply information about those components to their customers.
- Value-Added Providers (VAPs) are companies who are in the business of adding value to a manufacturer's information (for example, models, simulations, etc.) and charging customers a fee for the value they add.
- Tool Suppliers supply hardware/software tools, such as CAD/CAE systems, publishing systems, database management systems, etc., to the industry.
- Equipment Producers (EPs) are companies or end users who design electronic products which include the components supplied by OIPs.

Each of these various types of users has a big stake in producing his work as efficiently as possible.

PCIS is designed to provide the most efficient transfer and re-use of component information possible, in both human- and computer-sensible form.

Relation to existing standards

PCIS has been build on existing standards activities where appropriate. PCIS 1.2 was placed in the public domain as an open standard.

The PCIS is an application of the meta-language of Standard Generalized Markup Language (ISO 8879:1986, also known as SGML). It is highly subject/content oriented, with a great deal of structure that can be used to describe the characteristics of electric components.

Clause 2.1 of the PCIS SGML Tutorial (document CENELEC R217-015: 1996 E) describes the reasoning behind this decision and the benefits and drawbacks of SGML usage. SGML is a technical standard, and it is not expected that all readers of this document will necessarily understand the minutiae of its use and syntax. More detailed information about SGML is given at the informative annexes.

Currently there are no analogous standards activities for the electrical component industry that match the PCIS in scope, or applicability to the many phases of the business process and product life-cycle.

It is in no way the intention of the Pinnacles Group to duplicate existing standards, but rather to interoperate with related standards or standards activities such as:

- IEC SC3D; generating the IEC 1360 series of standards "Standards data element types with associated classification scheme for electric components";
- JEDEC;
- ISO 10303 (STEP);
- ESPRIT Project 22124-CIREP "Component Information Representation European Project";

The Pinnacles Group

The development of the Pinnacles Component Information Standard has been accomplished under the coordination of the Pinnacles Group, a non-affiliated standards working group with members from five electronic component manufacturers who joined together to create a technical information exchange standard for use by the electronic components industry. The member companies have all been active participants in the CAD Framework Initiative (CFI) Electronic Databook Working Group (EDB WG), and it was in conjunction with CFI activities that the original concept of the PCIS developed.

In discussion, it became clear to representatives of the various companies that creating such a standard would be difficult and time-consuming in a volunteer setting without expert assistance. As a result, a proposal was made to establish a privately-funded initiative that could address the CFI objectives as well as business issues outside the scope of the CFI. In April of 1993, after a year of preliminary work, Intel, National Semiconductor, Philips Semiconductors, and Texas Instruments signed an agreement to join forces under the working name "Pinnacles Group" to produce a technical information interchange standard to be called the Pinnacles Component Information Standard (PCIS). In July of 1993 Hitachi America Limited joined the Pinnacles Group as a full partner, more recently (1995) Hewlett Packard and IBM Microelectronics joined.

Soon after its inception in 1993, the European contribution to the development of PCIS became a part of CENELEC TC 217 WG 4, itself a part of the ESPRIT Project ESIP, ultimately resulting in the current documents as referenced in clause 1.2.

Informative references

The Pinnacles Electronic Data Book Project; The Pinnacles Group, <http://www.cfi.org/pinnacles/>

The SGML Handbook; Charles Goldfarb New York, Oxford University Press, 1990

Developing SGML DTDs; Eve Maler & Jeanne Andalousi, Prentice Hall, 1996

The SGML Primer, SoftQuad, Inc. Toronto, SoftQuad, Inc. 1991

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The SGML Implementation Guide, Travis, Brian & Waldt, Dale, Springer-Verlag, 1995

IEC 1360-1 Standard data element types with associated classification scheme for electric components
- part 1: Definitions - Principles and methods

IEC/48/FDIS Standard data element types with associated classification scheme for electric components - IEC reference collection of standard data element types, component classes and terms -
(to become IEC 1360-4)

Contents

Introduction	11
Background	12
The Decision to Use SGML for Document Interchange	12
PCIS: An SGML Application Standard	12
SGML Application Standards	12
Selection of SGML Features and Capacities	13
Standard Tag Set	13
Standard Documentation and Definitions	13
The PCIS Application Standard	14
Goals of the Pinnacles Group	14
Stated Non-Goals of the PCIS	15
Information to be Included within the PCIS	15
Metadata	16
Computer-sensible Models	16
Document Types Not Included within the PCIS	16
The Pinnacles Document Analysis Process	17
General SGML Architectural Principles of the PCIS	18
Required Document Elements and Element Sequence	18
Generated Text	18
Information Classes (the DIV.CLASS attribute)	19
The Ice Cream Model	19
The purpose of the DIV.CLASS attribute	20
Use of DIV.CLASS in Search and Retrieval	21
Implications for PCIS Authoring Sets	21
DIV.CLASS in Legacy Data	21
Division Type: Product Summary Information	22
Division Type: Detailed Product Specification Information	22
Division Type: Application Information	22
Division Type: Safety and Environmental Compatibility Information	22
Division Type: Information Concerning Support Tools	22
Division Type: Reliability Data	22
How the Pinnacles Component Information Standard may be Used	23
The PCIS SGML Architecture	24
Modularity	24
SGML Parameter Entities	25
Collections of Document Elements	25
Recurring Content Models	27
Monastic DTDs	27
Mixed Content versus Inclusions	28
Architectural Forms and Meta-DTDs	29
Processing Instructions	29
SGML Declaration and Feature Use	30

SGML Features	30
Quantities and Capacities	31
Character Sets	31
Marked Sections	31
Markup Consistency	32
Use of Existing SGML Application Standards	32
Selection of an SGML Application Standard	32
Structural Tables	33
Document and Element Identification	35
Document Identification	35
Element Identification	35
ID Stability	35
Cross-references and Hypertext Links	36
Product Identification	37
Product Identification Elements	37
Product Identification Segments	38
Product Identification in the Title of a Document	38
Structured Data	40
Source and Reflection	40
Source	40
Reflections	40
Where can the reflections occur?	42
What should Reflections contain?	42
Characteristics	42
Structure of a Characteristic	42
Values of Characteristics	44
Aspects of Characteristics (for Search and Retrieval)	45
Additional Information about each Characteristic	46
Conditions	46
Groupings of Characteristics and Conditions	46
Connection and Terminus Information	47
Support Tools	48
Models and Modeling Information	48
Noteworthy Structures	50
Revision History	50
Trademarks	50
Index Structures	51
Other Information Types (Structural Elements)	51
Graphics: Audio/Visual Objects	52
Audio/Visual Object Notation	52

PCIS Glossary	53
Element Naming Conventions	58
Initial Pinnacles Guidelines	60
PCIS Formal Public Identifiers	62
Introduction	62
Owner Identifier	62
Text Identifier	63
Public Text Classes	64
Sample Full Formal Public Identifiers	64
Formal Public Identifiers for PCIS DTDs	64
DTDs	64
DTD Modules	64
Bibliography	66
Other Standards Cited	66

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1 Introduction

This document, the PCIS SGML Tutorial, is intended to explain the principles behind the PCIS SGML application and to highlight the more unusual and most important aspects of that application. Parts of this tutorial will be of interest to anyone interested in the PCIS, while others are quite technical, and will be of interest only to the creators and managers of SGML applications.

This tutorial begins with a description of the background of the project and the Pinnacles application standard. This is followed by a discussion of the general architectural principles on which the standard is based, and a description of the SGML architecture. The next sections concern important information constructs within PCIS: Document and Element Identification; Product Identification; and Parametric Data. Each of these sections describes the approach to a particularly important type of component information. The tutorial then discusses some further Document Content Considerations, and handling of External Files. Appendices to this tutorial include:

- PCIS Glossary (which should help readers new to either SGML or electric component information);
- Element Naming Conventions (which were used in constructing the SGML tags);
- The Initial Pinnacles Guidelines (which were written at the beginning of the project to guide development); and
- An explanation of the PCIS Formal Public Identifiers (which are used to identify every document and every part of the SGML application such as the DTDs and DTD modules).

2 Background

2.1 The Decision to Use SGML for Document Interchange

From the initial investigations, the Pinnacles Group has been looking for a document modeling and interchange format that:

- Was platform and vendor non-specific;
- Allowed the inclusion and referencing of other applicable standards;
- Was supported by commercially available tools and services;
- Would ensure longevity of the electronic component data; and
- Could support the current publishing processes (such as paper and CD-ROM).

Standard Generalized Markup Language (SGML) met these specifications. SGML, which is defined in international standard ISO 8879, is a widely accepted and supported standard for the encoding of structured information. SGML provides a vendor and platform independent way of identifying information structures.

SGML has been adopted by many organizations and industries whose needs for information exchange are similar to that of the electronic component industry, e.g., the airline, telecommunication, and automotive industries, the Department of Defense, and many major and minor publishers. These organizations have also chosen SGML because SGML can provide:

- A method of describing the structure of information and the relationships between data elements; and
- Content-driven document architectures which are focused on the purpose of the information rather than the physical (printed or displayed) appearance of information.

SGML works through the use of "tags" which are inserted in text to identify the beginning and end of each element (or type of information) in the text.

2.2 PCIS: An SGML Application Standard

Calling for the use of SGML is not enough to provide the electronic components industry with a viable interchange standard. Consistent encoding of the information set forth in databooks, whether existing or future, requires the creation of an SGML Application Standard.

2.2.1 SGML Application Standards

An application standard is a specific subset of the standard. For example, a general standard might say:

- Standard spoons may be 6, 7, 8, or 10 inches long;
- Standard spoons shall be made of a non-toxic wood, or of a food-safe non-reactive metal such as stainless-steel or sterling silver; and
- The length of the standard spoon may be indicated either on the back of the handle of the spoon or on a removable sticky label attached to the inside bowl of the spoon.

An application specification for our spoons might say:

- We will make all spoons out of pewter;
- Our teaspoons will be 6 inches long;
- Our serving-spoons will be 10 inches long; and

- Raised lettering on the back of the handle of the spoon will indicate the date of manufacture, the length of the spoon, and the bowl capacity in fluid ounces.

The application standard establishes strict guidelines within the context of a general specification and selects among the options made available in the general standard.

An SGML application standard specifies how a group, organization, or industry will implement SGML. An SGML application standard conforms to ISO 8879, the international standard for SGML, but is far more specific. An SGML application standard typically includes:

- Selection of SGML features;
- A standard tag set;
- Standard documentation and definitions;
- A standard approach to structure; and
- Standard table coding.

2.2.2 Selection of SGML Features and Capacities

ISO 8879, the International Standard for SGML, defines a basic set of capabilities that all SGML applications must have. In addition it defines several optional features. The optional features include several ways to reduce the number of tags in documents and to process complex documents. In general, the more features used, the more computer resources required to support an application.

In SGML each application must specify the maximum length of several SGML components, including tags, attribute values, and the entities which hold standard text. These "capacities" can be used to estimate how much computer memory will be needed to process documents. The larger the number assigned to the capacities, the more computing power needed to process documents. Small capacities may be selected if it is more important that documents be processable on small computers, while larger capacities allow more user-friendly tags, larger boiler-plate text blocks, and larger, more complex documents.

An application standard should specify what SGML features and capacities must be supported by all systems, sub-systems, hardware, and software that support the standard. For example, while many SGML applications have a maximum tag length of eight characters, the US Department of Defense's application standard specifies thirty-two characters. This allows them to use tags with long, mnemonic names (such as SHORTTITLE, which identifies a smaller version of the document title to be used in running heads and indexes). Similarly, PCIS 1.2 specifies a maximum tag length of thirty-two characters.

2.2.3 Standard Tag Set

The international standard for SGML provides the means to name tags and specify their relationships to each other. However, the SGML standard does not provide any tag names nor does it recommend any. There is nothing in the SGML standard that prohibits users from making up different tags for each document. For example, the title of a research paper could be tagged <TITLE>, the title of a bibliography could be <TI>, and the title of a Memorandum <TTL>. An SGML application specifies a set of tags to be used by a group of people and provides definitions of those tags so they can be used consistently.

2.2.4 Standard Documentation and Definitions

An SGML application, like any other computer application, must be documented in order to be useful. It is essential that users be taught to use a new system, and that they have appropriate reference materials at hand to maximize their use of the system. One part of that SGML application documen-

tation is the tag library: documentation including the name of each element, the tag used to represent it, a definition of it, an example, and usage instructions. Each of the tags in the standard tag set must be defined clearly, with samples familiar to the users who will be working with the tags.

2.2.5 The PCIS Application Standard

The PCIS SGML Application Standard includes:

- An electronic-component-specific set of elements and tags - The PCIS elements identify pieces of information concerning electronic components, such as Bus Modes and Pinout Diagrams and symbols. The tags are shortened forms of the element names to be used within the text to mark information.
- Document Type Definitions (DTDs) for common document types - An SGML DTD is a representation of an information structure or database design that is readable by machines and humans, defines hierarchical relationships, allows recursion and complex models, and can be validated for ambiguity and completeness. The PCIS DTDs provide information models for electronic component documents.
- A standard method for constructing formal public identifiers - SGML formal public identifiers provide a mechanism for giving a unique name to every Pinnacles document, such as a datasheet or databook.
- An SGML Declaration - The PCIS SGML Declaration names which features of SGML can be used in Pinnacles documents.

2.3 Goals of the Pinnacles Group

The primary goals of the Pinnacles Group, as formulated during an initial planning meeting during the spring of 1993, are and have been:

- To develop an SGML document architecture and Document Type Definitions (DTDs) for databooks and their subparts and to develop associated documentation to describe the document architecture and DTDs;
- To be able to publish existing paper products and to create electronic documents (using commercial-off-the-shelf publishing tools customized to the application) from data tagged according to these DTDs; and
- To create an information interchange standard, not an authoring standard or an electronic presentation standard.

At the initial meeting, the Pinnacles Group also designated secondary goals:

- The standard should handle all parts of the existing databooks including text, graphics, and tabular data.
- The standard should be hardware, software, platform, vendor, format, and media non-specific.
- The data structures should identify the information necessary to support parametric searching.
- The data structures should support extractive processes (for example, the ability to create a catalogue from a database of datasheets).
- The data structures should be practical and usable in the near future, not just ideal for the far term.
- The architecture should be as extensible as possible.
- Data structures should minimize both future conversions and the severity of conversions.

2.4 Stated Non-Goals of the PCIS

The PCIS is not intended to be all things to all people. The following list includes some tasks that are closely related to the goals of the initial project, but which are specifically excluded from the current scope. It is likely that many of these will be addressed by the individual companies. Some of these tasks are likely to become part of future Pinnacles efforts.

- The Pinnacles Group will not develop an on-line information system. The PCIS lays the groundwork for individual companies to build such systems efficiently.
- The Pinnacles Group will not mandate or specify any software packages; nor will the PCIS be optimized for any particular software package. Instead, the Pinnacles Group expects organizations to use this SGML Application Standard with a wide variety of application packages.
- The Pinnacles Group will not design, alter, or mandate a presentation format or appearance for this data. However, a major reason for this project is to make information presentation-independent by separating format from content. The intent of the standard is that users will be able to create many different presentation formats without rekeying or human intervention.
- The Pinnacles Group will not develop an authoring environment. Each company will make use of the standard in its own authoring environment and will develop authoring tools independently.
- The Pinnacles Group will not create ongoing team structures in the member companies to continue this work. However, each company may, as a separate effort, create such teams.
- The Pinnacles Group will not decide what will be published concerning any particular component or what information must be in a particular document. However, the standard will provide a way for the various companies to identify what they have chosen to publish. Each company may make different decisions on what they choose to publish and in what sequence, **but all will identify the same information in the same way!**
- The Pinnacles Group will not redefine device parameters such as electrical characteristics and test conditions. The standard will refer to the existing and emerging standards and the work of other groups (such as the CFI EDB Data Dictionary Working Group) instead of replicating their efforts.
- The Pinnacles Group will not develop an Application Programming Interface (API) or an Electronic Databook application.
- The Pinnacles Group will not develop a final standard; the PCIS developed by the Group will still be a draft standard.
- The Pinnacles Group will not customize any of the applications that may be needed to actually create, manage, or receive data that conforms to this standard. Specifically, the standards effort will not include writing output specifications, style sheets, FOSIs, or DSSSL specifications. The Pinnacles Group will not customize any SGML authoring systems; for example, the Group will not develop FrameBuilder EDDs, AuthorEditor Style Files, or ArborText menu systems. The PCIS will provide the structure on which such customization can be based.

2.5 Information to be Included within the PCIS

The scope of the Pinnacles Component Information Standard effort was set before the first document analysis workshops began. Information that was analyzed included:

- Everything in component databooks (this includes datasheets, application notes, front and back matter such as design consideration sections and waveforms, the Table of Contents, indexes, package outlines, instruction sets, packaging, etc.); and
- Anything in stand-alone parts of databooks (such as datasheets or application notes) that is not included when such stand-alones were collected into databooks.

Initially, Component Datasheets were viewed as very different from other types of datasheets. During the course of the analysis, the decision was made that all types of datasheets, such as Family Datasheets, Process Datasheets, and Software Datasheets, are so similar that it is often difficult to determine which

category a particular document fits. All datasheets contain two basic types of information; data concerning a product and application material concerning the use of the product. The two types of information may be intermixed in different ways within a single databook volume.

2.5.1 Metadata

There are two types of metadata associated with databooks: general metadata and company-specific metadata. General metadata comprises information about the databook or datasheet and includes such data as document title, publication date, and what parts of the information have been changed. Company-specific metadata may include information on who wrote or changed portions of the information, what has been reviewed and by whom, and which process, machine, or corporate division produced various pieces of information. General metadata was declared to be within the PCIS scope, company-specific metadata to be outside the scope.

2.5.2 Computer-sensible Models

In the electronic component industry, computer-sensible models (such as SPICE models) are rarely included in print datasheets but often supplied as an associated information product. Such a model might replicate information in a datasheet or supplement it. Modeling information is most appropriately supplied in electronic form; when it is supplied in print form it must be rekeyed to be used. In an electronic environment, the user may want to view the raw data for a model, feed the model to another application, or launch a modeling application directly.

The preliminary PCIS decision was that modeling information could be encapsulated in an SGML file or stored as an external file which was referenced from within the SGML file. In either case, the model would be stored in its native format, not in SGML. Therefore, models were declared to be within PCIS scope. For the purposes of PCIS 1.2, a model was defined as a model supplied by the provider of the PCIS document. Potential models that third parties, customers, or users of the document may develop from the data provided were not included in the scope.

2.5.3 Document Types Not Included within the PCIS

The electronic component industry produces many other types of documents. Those listed below were specifically excluded from the analysis effort at this time:

- Publicity materials, leaflets, advertisements, and promotional materials such as Product Briefs;
- Journal articles;
- Catalogues;
- Master selection guides;
- Manuals, including user manuals, programmer reference manuals, software manuals, and hardware reference manuals;
- Training manuals, tutorials, and other training materials; and
- Manufacturing instructions such as Build Sheets and Process Descriptions (recipes).

The initial PCIS is being developed for datasheets and data books only, but could be extensible to other electronic component information forms in the future. The initial PCIS is being developed for English language documents only. Facilities for handling other natural languages will not be included in PCIS 1.2 but the design does not prohibit their inclusion in future versions.

2.6 The Pinnacles Document Analysis Process

The Pinnacles Group used a variant of Joint Application Development (JAD) methodology to gather the information necessary to produce the PCIS 1.2. In JAD, the traditional "serial interview" approach to gathering requirements is replaced by one-time, one-place facilitated decision-making, with all interested parties represented. Facilitated JAD workshops are often used in software and hardware development projects and in the initial stages of TQM (Total Quality Management) implementations for the rapid and accurate specification of requirements. The PCIS document analysis was accomplished during a series of JAD-like Rapid DTD Development (RDD) workshops. (RDD is a proprietary methodology of the ATLAS Consulting Group). JAD and RDD are "team design" techniques, in which systems professionals and users cooperate in a highly structured environment to reach consensus on requirements.

Intel, National Semiconductor, Philips Semiconductors, and Texas Instruments each hosted a week-long RDD analysis workshop. During each of these intense, facilitated sessions, the engineers and publications experts from one company determined the structure, content and relationship of data elements contained in component documents, concentrating on that company's product literature. The workshops were cumulative as each successive company started with and built upon the work of prior analysis sessions. This progression of discovery and consensus-building culminated in a reconciliation workshop, attended by representatives from each member company.

This PCIS 1.2 documentation describes the analysis results from that reconciliation workshop as well as the decisions made during architecture and planning sessions held by representatives from all five companies. A formal Review Session was held in April 1994, with input solicited from organizations outside the Pinnacles Group. Comments and suggestions from the April review were incorporated into PCIS. 1.1. Early implementations in 1995 detected some errors and obvious inadequacies of PCIS 1.1. Corrections of these bugs, and changes to make Pinnacles data more compatible with the World Wide Web have been incorporated in PCIS 1.2.

3 General SGML Architectural Principles of the PCIS

The Pinnacles Component Information Standard (PCIS) defines an interchange format, which is neither a document development format nor a presentation format. Thus, some of the capabilities and functionality that may be desired for authoring or presentation are not included in the PCIS by design. However, enough information has been included in the interchange format to create the form(s) of those documents desired for development and/or presentation. The PCIS standard design has been driven primarily by the nature of the component information; such considerations as data volume and ease of implementation have been considered only secondarily.

An SGML Document Type Definition (DTD) is a set of rules that can be used to ensure that all documents within a class governed by that DTD are constructed in the same way. A class of documents is the set of documents that is defined as having the same rules for markup, including the same elements and element relationships. In general, a class of documents can be considered to be documents that are similar in structure and content. DTDs in general range from completely enforcing (where a specific and highly detailed set of rules is enforced throughout the document structure) to enabling (where as many existing documents as possible are legal under the rules of the DTD). The PCIS 1.2 DTDs are, by design, enabling DTDs. Each relevant information element has been named and given an identifier, but very little is strictly enforced.

The decision to design PCIS DTDs as enabling DTDs was motivated by the requirement that the interchange standard must work for a large number of enterprises and users throughout the industry. It is not expected that any company will use the PCIS DTDs, as currently defined, as authoring DTDs, but that more prescriptive authoring-sets will be designed and used for those purposes.

3.1 Required Document Elements and Element Sequence

The Pinnacles Component Information Standard 1.2 provides a mechanism to identify the information currently printed in documents that pertain to electronic components. The PCIS does not require that particular information be present in any given document. Since it is a stated goal of the PCIS that member companies be able to use the standard to describe existing documents such as component datasheets, this standard also cannot require or enforce the sequence in which any current product information is to appear.

Therefore, element sequence has been enforced only in those elements that are not currently printed in the datasheets or that are part of the document metadata, that is, information concerning the document as opposed to information within the document. When possible, such metadata has been positioned as the first element within an element. Element sequence has been imposed within metadata as well as within non-printing supplementary information such as models that have little or no relationship to current printed products.

3.2 Generated Text

Generated text is text such as automatically generated headings and the numbers or bullets that precede list items that could be created from SGML tagging by a formatting or display engine. Although SGML-encoding permits and encourages the use of generated text for standard structures, including numbered elements, this feature will not be used with PCIS conforming documents. Because the PCIS is an interchange and not an authoring standard, it is expected that generated text will be created by the authoring application, and that the text will be included in the PCIS exchange version of the document. Thus, while the authoring set may include elements that are intended to generate text, no elements will be expected to generate text in the PCIS interchange version of the documents. Generated text such as automatically named headings or titles will be included in the title element content. Numbered structures (such as lists, numbered sections, or footnotes) in an interchange document instance will carry their numbering with them. The attribute named "label" has been placed on all numbered

structures to hold this information. Generated text such as bullets on lists will also be carried in PCIS documents as attributes. Such attributes will indicate the preferred rendering of the authoring enterprise, but the attribute values can be overridden by the receiving enterprise.

It is highly probable that the authoring-set DTDs used to author Pinnacles documents will often automatically generate numbers and other text, and their generation will be required before a document is moved to the PCIS interchange format to be exchanged.

3.3 Information Classes (the DIV.CLASS attribute)

Many kinds of information exist within a single document such as a datasheet. The Pinnacles workshops concluded that there are six distinct useful categories (types or classes) of information present in electronic components documents. No single document need have all six classes, although many datasheets do. If the category of each piece of information were clearly identified, the categories could be used to retrieve related groups of information. Such groupings might be used by an engineer to limit data searches to the most specific product information, or by marketing to create spin-off publications, or by a researcher to determine the environmental impact of a process. Use of the information class (in the div.class attribute) is key to the creation of high-quality PCIS documents that will be useful in electronic retrieval, particularly if implementation of some details of PCIS must be postponed or omitted.

The six types/classes of information identified in electronic component documents are:

- Product Summary Information;
- Detailed Product Specification Information;
- Application Information;
- Safety and Environmental Compatibility Information;
- Information Concerning Support Tools; and
- Reliability Data.

There is no requirement that the data in each class be grouped together within a document. In fact, in many documents the information in any given class will be scattered throughout. As long as information can be identified as belonging to a particular class, the physical arrangement does not matter. (The PCIS calls this the "ice cream model" of information arrangement and it is described in the following pages.)

All divisions of a PCIS document may be identified as containing information of a particular class.

3.3.1 *The Ice Cream Model*

It seemed to the developers of the PCIS that component documentation in general, and datasheets in specific, could be usefully compared to ice cream. The ice cream analogy is explained here to demonstrate why the PCIS is so complex and why it enforces so few rules regarding the sequence in which information will be found.

The basic structure of information within a Pinnacles document may be thought of as analogous to the way ice cream is packed into containers.