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STEP (Standard for the Exchange of Product Model Data) Development Methods: Specification of Semantics for Information Sharing

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Abstract

This document describes the information sharing requirements and the approaches used to fulfill those requirements in the development of standardized data constructs for STEP (Standard for the Exchange of Product Model Data). It also describes the information architecture that conceptually organizes the standardized constructs and information systems architectures in which these constructs can be used.

Keywords: application interpretation, product data, product data architecture, product data integration, product data modelling, product data specification, product information sharing, resource integration

Contents

1 Introduction

STEP[1] is a standard that provides the basis for information sharing using computer interpretable product model data. Unambiguous information sharing is facilitated by STEP through the use of standardized constructs (data modelling structures that formally define information).

This paper contains a description of information sharing requirements for STEP in section 2. Section 3 contains a description of the information sharing environment in which implementations of STEP will need to operate. Section 4 contains a discussion of the information architecture used to conceptually organize the constructs developed by STEP. Section 5 contains a description of information systems architectures that can be used to implement the standardized constructs of STEP.

1.1 Scope

The material presented in this document is responsive to requirements placed on the major design principles for the development of STEP. This includes functional, compatibility, conceptual, and developmental requirements [1,2]. Functional requirements include data exchange, archiving, sharing, and access completeness as well as extensibility of the standard. Compatibility requirements include upward compatibility in a phased release environment. Conceptual requirements include the use of a minimal set of non-redundant concepts. The development approach requirements include the methods used in the integration of product data resources and the interpretation of the integrated resources in particular application contexts.

1 STEP (Standard for the Exchange of Product Model Data) is the name used to identify ISO (International Organization for Standardization) 10303 developed under Technical Committee 184 / Sub-Committee 4.

1.2 Definitions

Application: Any enterprise process or function that generates or uses data.

Application Activity Model (AAM): A representation of the activities which use product data in a specific application context. It is used to establish an understanding and agreement concerning the technical boundary of the application and for uses of the data (i.e., a clear definition of scope).

Application Interpretation: The development of a conceptual schema, satisfying a set of user requirements, from integrated resource constructs.

Application Interpreted Construct (AIC): A logical grouping of concepts that is shared by two or more application interpreted models.

Application Interpreted Model (AIM): A schema that specifies the STEP product data constructs used for the sharing of information in the application context specified by the application protocol in which it appears.

Application Protocol (AP): Specification of STEP constructs used for the sharing of information in a particular product data application context. It enumerates the conformance requirements and test purposes used in the evaluation of an implementation.

Application Reference Model (ARM): A schema that describes the information requirements and constraints for a product data application. The schema is a consensus user view that employs application-specific terminology and rules familiar to experts from the application domain.

Conceptual Schema: A schema representing the canonical data view in an information system. A conceptual schema supports the requirements of multiple user-application views (i.e., external schemas). It is independent of implementation views (i.e., internal schemas).

Construct: A data modelling structure that represents a semantic abstraction of an idea (a logical grouping of fact types).

Context: A set of related conditions that elucidates a particular meaning. Conditions in STEP include those which limit the relevant products or descriptions of products for which information is shared (e.g., mechanical products described from the point of view of design).

Data: One or more facts used for reasoning, communication, or calculation.

Draft Resource Model: A schema that describes the information requirements and constraints for a product data subject areas (e.g., geometry). The schema is a consensus subject area view that employs specific terminology and rules familiar to experts from that subject area.

External Schema: A schema representing a user-application view in an information system. An external schema has a specified mapping to a conceptual schema in an information system architecture.

Fact: A particular occurrence of a proposition considered to be true (e.g., a value of an attribute for an instance of an entity or a relationship between instances of entities).

Fact Type: A data modelling structure that represents a formal proposition (e.g., an attribute of an entity or a relationship between entities).

Information: An organized collection of related data in an established context for communication.

Information Model: A collection of related constructs, described in a formal data modelling language, that capture the semantics of a chosen domain of discourse.

Integrated Resources: A collection of schemas with controlled interschema references that provides a unification of constructs from multiple product data subject areas and is consistent with an established integration architecture.

Internal Schema: A schema representing an implementation view of an information management system. An internal schema has a specified mapping to a conceptual schema in an information system architecture.

Resource: A construct which is free of a specific product data application context. Its context is that of a specified product data subject area. It is available for interpretation into a product data application context.

Resource Integration: The unification of product data constructs using an explicit architecture that serve as a resource for the development of information sharing standards in specific application contexts.

Schema: A formal data modelling structure used to define a construct.

2 Information Sharing Requirements

STEP contributes to the establishment of product information sharing among computer systems by specifying sufficient semantic content for data to be interpretable directly by application programs. The principal requirement is that STEP be general enough to handle product data for a wide variety of applications and specific enough to meet the needs of particular users.

The development of STEP constructs involves two fundamental aspects. The first aspect emphasizes constructs that are of potential use to any product data application (i.e., an emphasis on requirements from product data subject areas). The second aspect emphasizes product data constructs that are used for particular purposes (i.e., an emphasis on specific product data application requirements). STEP provides data specifications that support both aspects.

STEP Information Sharing Requirements

- Establish standard data specifications for information sharing among applications involving a wide variety of product types over the entire life cycle of products.
  - Accommodate all data used for product description.
  - Accommodate all product life cycle perspectives that use product data.
  - Accommodate multiple ways of using data.
- Establish standard data specifications for information sharing among specific applications that satisfies the needs of industry and commerce.
  - Share product data precisely and unambiguously.
  - Share product data among specific applications.
  - Share product data without restricting the way an enterprise uses data so industry can adopt improved processes.

The fundamental prerequisite for STEP to be successful is that it satisfies these requirements. To this end, integrated resource constructs are developed for product data subject areas from which application interpreted constructs are developed to meet product data application requirements. The STEP development methods and architecture support both precision of the information shared within product data application contexts and flexibility in sharing information among product data applications.

3 Information Sharing Environment

Information sharing using STEP must accommodate heterogeneous, distributed, and autonomous information system environments. It is heterogeneous in that it involves sharing among dissimilar information systems (e.g., computer-aided design systems). It is distributed in the sense that various pieces of the total information available may exist on a number of systems at different locations with possible replication of data. It is autonomous in that each of the information systems is typically designed to function independently.

Two principal approaches to the integration of information systems in this type of complex environment have been proposed [3,4,5]. The first is a global approach where a single conceptual view is developed through an integration of all local information systems. The second approach is a federated approach where classes of users develop consensus federated views (conceptual in nature) which are then supported by local systems. Global and federated systems are equivalent when a federated system contains only a single federated view. STEP has been developed to provide constructs useful to each of these information system architectures.

STEP Development Approach

The STEP project cannot identify and integrate all information systems that deal with product model data. This would be equivalent to knowing the conceptual view of every information system in every enterprise that will ever use STEP. The STEP project has adopted an approach that uses knowledge of product data subject area requirements to specify a compatible set of integrated constructs that spans the range of current and anticipated systems. Although not a single global schema, these constructs define a standard integrated information structure that serves as a resource for development within STEP. These constructs establish a product data context and are called the STEP Integrated Resources (IRs).

STEP also contains the specification of constructs for information sharing in specific application contexts. Classes of users that cross national and enterprise boundaries define consensus product data application requirements. The Integrated Resources are interpreted for information sharing purposes within a specific context (STEP Application Protocols, APs). Application Interpreted Constructs (AICs) are established to serve as standard information elements that facilitate sharing among multiple APs.

4 Information Modelling

The STEP project has chosen conceptual modelling as its principal technical approach to specify standardized constructs that facilitate information sharing. The development of standardized constructs includes a formal language for the specification of constructs and an explicit data architecture for product data applications.

4.1 Information Model Specification

The formal language for conceptual modelling and data specification in STEP is EXPRESS. The EXPRESS language [6] provides the syntactic mechanism for the specification of data elements and structures in both human-readable and computer-processable form. The particular use of EXPRESS by STEP [7,8,9] provides a pragmatic mechanism for the specification of constructs to satisfy STEP requirements. Integration and interpretation of the constructs within the IRs and APs that satisfy the information architecture of STEP [10] provide the semantic mechanisms by which the standard is specified.

Integration and interpretation are the development methods used by STEP to provide semantically precise information models. The methods are responsive to the dual requirements for generality (i.e., constructs that are useful for a wide variety of product data applications) and specificity (i.e., constructs that are useful for particular product data applications). Integration develops a unified canonical data structure with associated constraints from models developed by experts in product data subject areas. Interpretation derives an application specific specification from that data structure adding necessary constraints based on explicitly defined product data requirements of industry and commerce.

The methods that are used to specify information models in STEP, therefore reflect a specific information architecture.

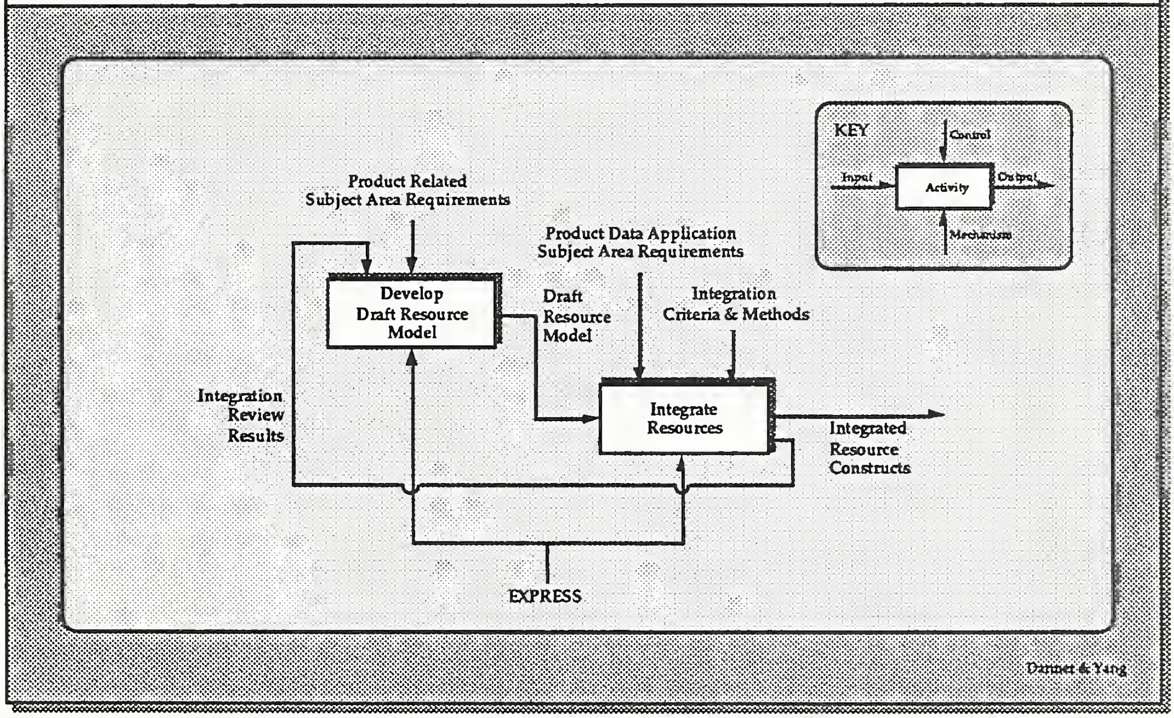
4.2 Information Architecture

The information architecture includes Integrated Resources (IRs) and Application Protocols (APs). The IRs establish an abstract framework containing the definition of information applicable to any product. The Integrated Resources establish the explicit data architecture. APs define information applicable to specific product data applications using the Integrated Resources.

4.2.1 Integrated Resources

The Integrated Resources of STEP are specified as constructs within a logically defined organization that satisfies the STEP resource architecture [11]. The constructs are developed with an emphasis on product data subject area requirements (Fig. 1). Product data application needs are considered primarily in a general sense (i.e., constructs are expected to be useful for a variety of specific product data applications).

Figure 1. STEP Development of Integrated Resources



Integrated Resources contain both generic resources and application resources. Generic resources are constructs applicable to multiple product types, application domains, and life cycle phases that are free of application context constraints. Application resources add to and specialize generic resource constructs to establish specific relationships and constraints which are applicable to one or more applications in a common context. A common context may involve multiple product types, application domains, or life cycle phases. Generic and application resources are further categorized for ease of comprehension.

Generic Resources

Product Description Resources: Resources that specify the conceptual structure of product data in STEP. The product description resources contain four constructs which provide the overall logical structure of the STEP Integrated Resources. They are the result of the development of the Generic Product Data Model [12].

> **Product Definition Context** describes the condition under which product data was established or the conditions for which it is applicable. This information comprises the highest level of conceptualization in STEP.
>
> **Product Definition** identifies a product, the variance in its descriptions, particular context dependent product definitions, and the structure and relationships among product definitions. This information is the foundation of product description upon which other resources build.
>
> **Product Property Definition** describes the characteristics and qualities of a product. This information is extendable as STEP develops.
>
> **Product Property Representation** describes multiple ways in which the properties of a product can be represented.

Math Support Resources: Resources that support the specification of other generic resources using mathematical definitions (e.g., geometry and topology).

Representation Resources: Resources that specify the representation constructs associated with a product.

Presentation Resources: Resources that specify the presentation constructs associated with a product.

Management Resources: Resources that specify the product life cycle management constructs associated with a product.

Application Resources

Drafting Resources: Resources that specify drawing related constructs associated with a product in the context of drafting common to multiple applications.

The number of categories of Integrated Resources (generic and application) is expected to increase as STEP continues to develop. The STEP project expands the scope of the IRs in direct response to the development needs of STEP application protocols.

4.2.2 Application Protocols

The primary purpose of application protocols (APs) is to provide a basis for sharing information within a chosen application context and for standard conformance verification. As such, it includes elements that (1) state explicitly the information requirements of a particular application domain, and (2) specify the meaning of shared information in that application domain.[2]

Based on these objectives, STEP application protocols include five elements [13].

1. Definitions of the application context, scope, and functional requirements which are recommended to include an application activity model (AAM).

2. An application reference model (ARM) that describes the information requirements.

3. An application interpreted model (AIM) that specifies the interpretation of the integrated resource constructs to provide constructs for the required information requirements.

4. Conformance requirements including the definition of test purposes that provide the basis for separately documented abstract test suites.

5. Usage guidelines that provide material on employing the application protocol for sharing of context specific information.

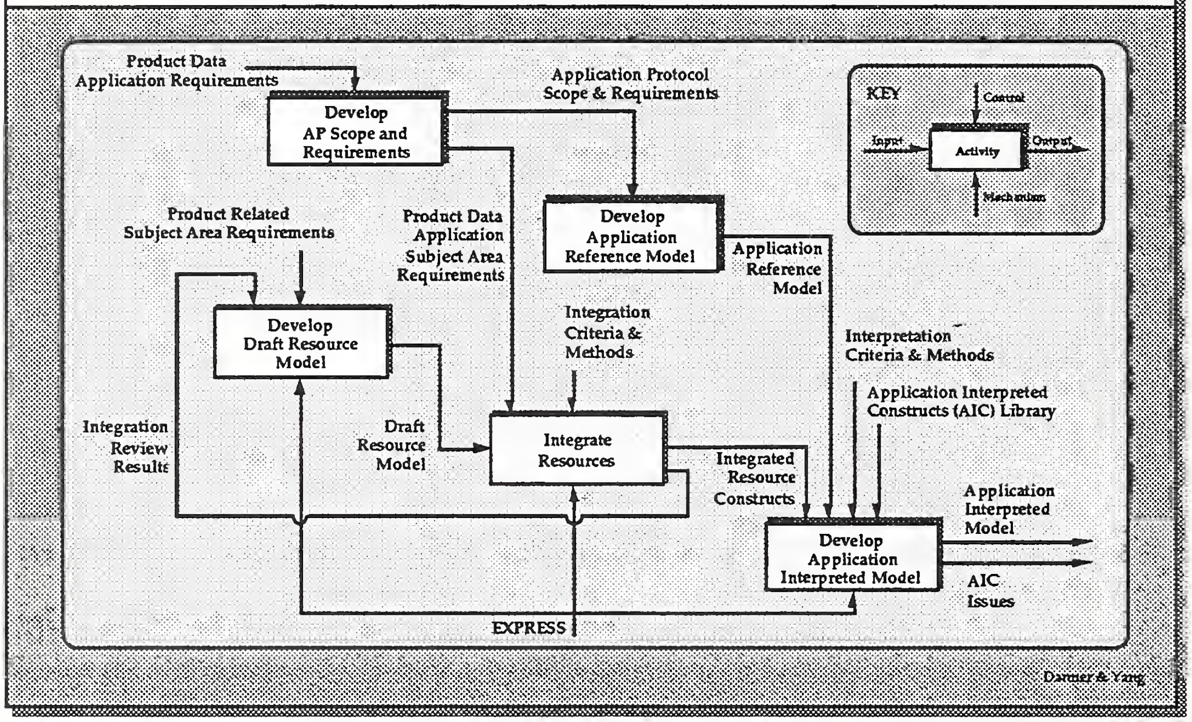
The application protocols, therefore, have two classes of information models: application reference models and application interpreted models. Application reference models capture the information requirements of the identified application domain using domain specific terminology, data structures, and constraints.

The application interpreted models adapt appropriate Integrated Resources for use in the specific application context. The AIMs employ the STEP product data structure specified within the Integrated Resources. Mappings are established from the ARMs and Integrated Resources to the AIMs that document their derivation.

2 Each application protocol is self-sufficient for the communication of information in a given context. This does not mean that STEP is a collection of independent and unrelated context specific models. Information sharing among applications using different application protocols is accommodated through the use of a common data architecture established by the integrated resources and through AP integration (see 4.2 Global System Architecture).

The AIMs collect required resource constructs and adapt the semantics of the resources as appropriate for the identified application context (Fig. 2). Since an application interpreted model is neutral to all applications within its defined context, it is conceptual in nature with regard to that context.

Figure 2. STEP Development of Application Interpreted Models



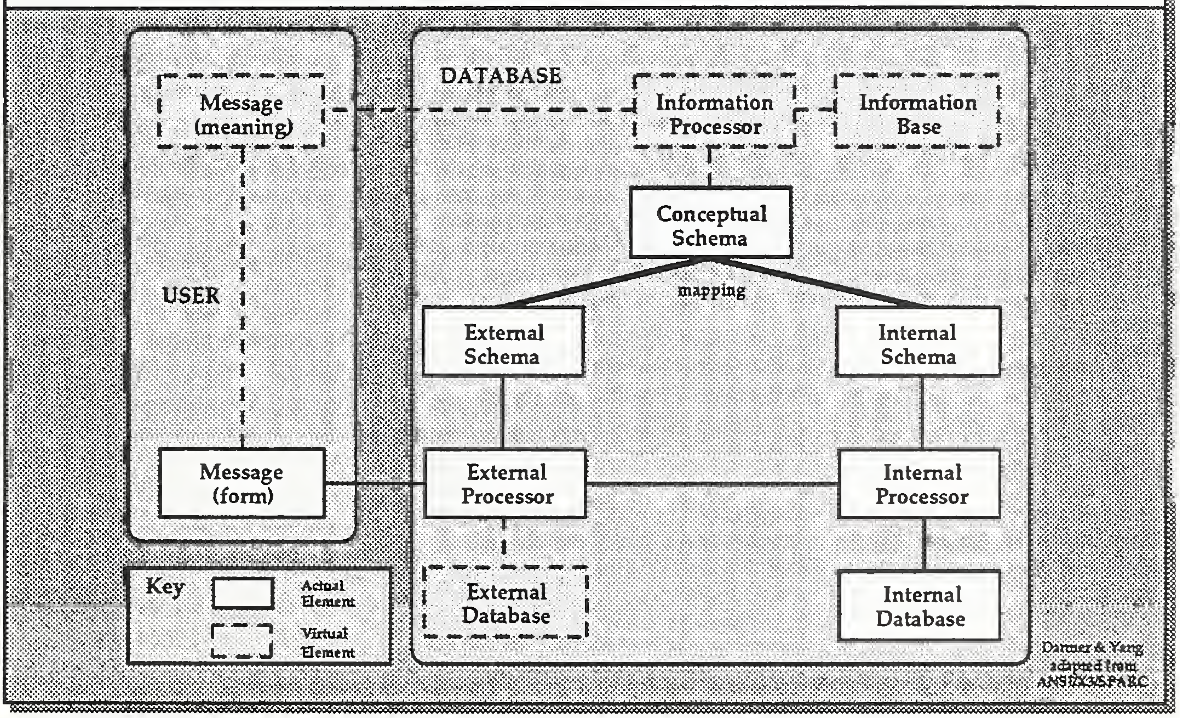
4.3 Specification of Context Specific Information

The specification of information requires adequate consideration of both product data subject area and product data application requirements. Standardized constructs for information sharing are developed in STEP from both of these perspectives. The Integrated Resources define data constructs emphasizing product data subject areas. The application protocols define the semantics of consensus user views for specific application contexts (i.e., product data application requirements). The AIM defines the specific constructs required for the sharing of meaningful information based upon both sets of data requirements.

5 Information System Architectures

Elements of the STEP information architecture can be related to the classic three schema database system architecture [14,15]. Figure 3 illustrates this architecture used in a centralized database design. It includes external, conceptual, and internal schemas that represent the points of view of user applications, a common underlying semantic data structure, and physical data-storage structures of implementations. The architecture also includes external and internal processors that manage the operations of a system. The architecture optionally includes a logical schema and associated processor between the external and internal elements. Logical schemas are derived from the conceptual schema adapting it to particular implementation approaches (e.g., relational or object oriented databases).

Figure 3. Centralized Database System



In STEP, the Integrated Resources (generic and application) and the application interpreted models are conceptual in nature [16]. They represent shared neutral points of view from which multiple user applications and implementations could be mapped.[3]

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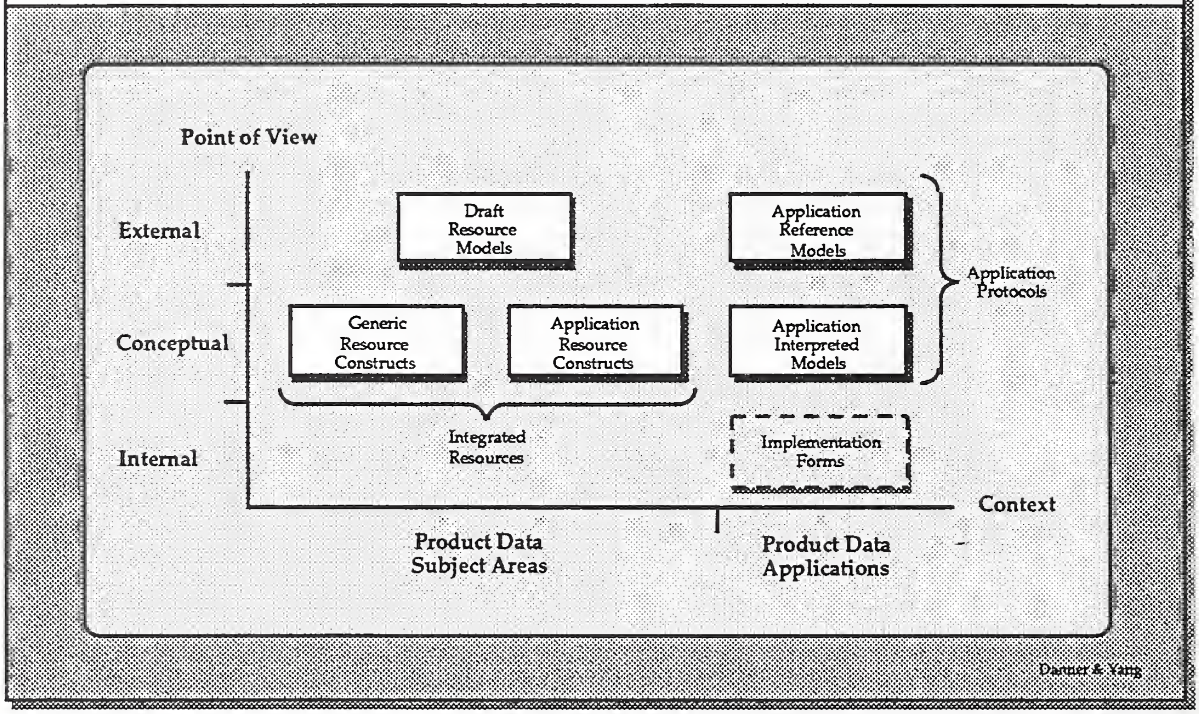
3 STEP does not currently address the development of logical schemas [15] that adapt the conceptual schema for particular implementation types (e.g., relational or object oriented).

Figure 4. Categorization of Elements of the STEP Architecture



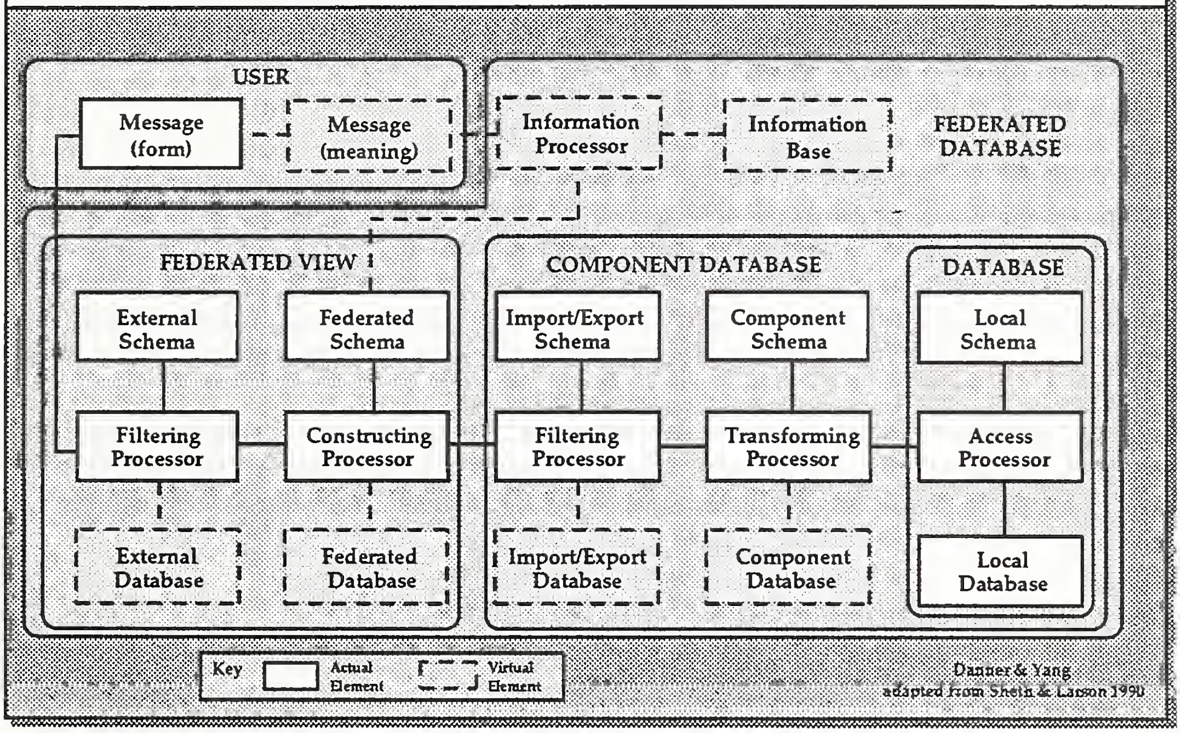
A high degree of context specificity is necessary to provide data constructs with adequate semantic completeness for information sharing in STEP (Fig. 4). The Integrated Resources are not adequately specified to serve as the conceptual schema for STEP implementations. The context of each resource is the product data subject area defined by its scope. The Integrated Resources unify these scopes. The Integrated Resources do not contain the context-specific semantics that establish utility (i.e., they are incomplete). Application protocols are established to supply the specificity required for meaningful information sharing for product data applications using STEP.

Each application protocol contains one or more application interpreted model. Each AIM is the conceptual schema for the specified application context and provides a standardized set of constructs for information sharing. AIMs are designed to support multiple external user application views and implementations within the complex information sharing environment in which STEP must function. Both federated and global system architectures are accommodated by the STEP development approach.

5.1 Federated System Architecture

A federated database system architecture involves more layers than the classical three schema architecture. A five schema architecture has been proposed [5] which includes local, component, import/export, federated, and external schemas (Fig. 5).

Figure 5. Federated Database System



Local Schema: The schema of a local database system specified in a locally chosen modelling language (e.g., SQL for a relational database).

Component Schema: A local schema in a common modelling language (e.g., C++) used by the federated system. A component schema may contain semantics missing in the local schema but required by the federated system.

Import/Export Schema: A subset of the component schema that contains information used to control access to an autonomous component database.

Federated Schema: A conceptual schema that supports a group of users or applications performing a related set of activities. It may include distribution information or be used with a distribution schema.

External Schema: Provides a user application view.

In a federated system architecture, STEP application protocols provide data specifications relevant at the external and federated levels.

An ARM represents the consensus external view that specifies the detailed information requirements of an application protocol. Few users, however, have requirements to manage all data elements in the ARM. Additional external views are expected to provide data in forms appropriate for particular users and activities, emphasizing functionality within the application context.

An AIM contains standardized constructs that are the basis for the sharing of information among a group of users or applications performing a related set of activities. To conform to an application protocol means a system must be capable of information sharing based on entities and attributes within an AIM of that AP. Functionally, an AIM is a federated conceptual schema. The constructing processor provides data access to multiple component databases.

In a product data exchange environment, processors that can translate local databases into a STEP exchange format require the functional equivalent of component and import/export schemas. The component schema allows for retrieval of data from the local database providing data elements suitable for STEP exchange. The import/export schema controls which federation users have access to specific information.

Finally, it should be noted that in those situations where the local database is a computer-aided system (e.g., computer-aided design, CAD) additional local external views are typically used as the basis for local user interfaces.

The use of a federated information system architecture is a viable solution to the problem of sharing information in a heterogeneous, distributed, and autonomous environment. It is particularly well suited to capturing context specific information requirements within conceptual schemas that are derived from the common set of STEP Integrated Resources. The Integrated Resources provide a single architecture for product data. Another approach to information sharing in this complex environment is the global system architecture.

5.2 Global System Architecture

A global system architecture has a single conceptual schema. In STEP, the development of a global schema relies upon application protocol integration [18].

The identification of common constructs across multiple AIMs is a critical aspect. When common functionality is identified in multiple application contexts (i.e., different APs), a common data specification is used. Sharing common data specifications among APs enables information sharing.

AP integration identifies common constructs within AIMs and specifies them as Application Interpreted Constructs (AICs). AICs are placed in an AIC library for common use during STEP development. The AIC library, therefore, contains common data specifications for AIM development. AICs are copied to the AIM in each of the APs sharing the construct. AICs differ from the Integrated Resources in that:

1) an AIC is an interpretation of the Integrated Resources that has a specific scope and context based on product data application requirements and is thus semantically complete for the sharing of information; and

2) the use of AICs involves exact copies without any additional interpretation to ensure interoperability among applications using different APs that desire the ability to share information.

AIMs are developed using AICs where possible. Only upon determining that an AIC is not available or cannot be created by using an AP specific construct from an existing AP with common scope are the STEP Integrated Resources used in the development of an AIM.

The AIC library approach to AP integration provides the ability to discover over time which applications actually have requirements for information sharing. It provides appropriate interoperability for computer systems using STEP. It provides for the explicit definition of shared AICs among such systems. It provides a basis for testing and conformance as part of the methodology. The approach is responsive to the complex information requirements of STEP thus ensuring that shared information is of value.

<u>STEP Global Schema</u>

The global schema of STEP is the combination of the constructs of the AIC library and those limited constructs unique to application protocols. The AIMs of application protocols are subsets of this global schema.

The development of the STEP global schema is an integral part of the evolution of the standard. Its foundation is the product data structure developed through the integration of resource constructs. Information sharing capabilities are ensured by the application interpretation of the Integrated Resources to satisfy explicitly stated product data application requirements. Interoperability is based on the actual needs of international industry and commerce. It is achieved through application protocol integration as an inherent aspect of application interpretation.

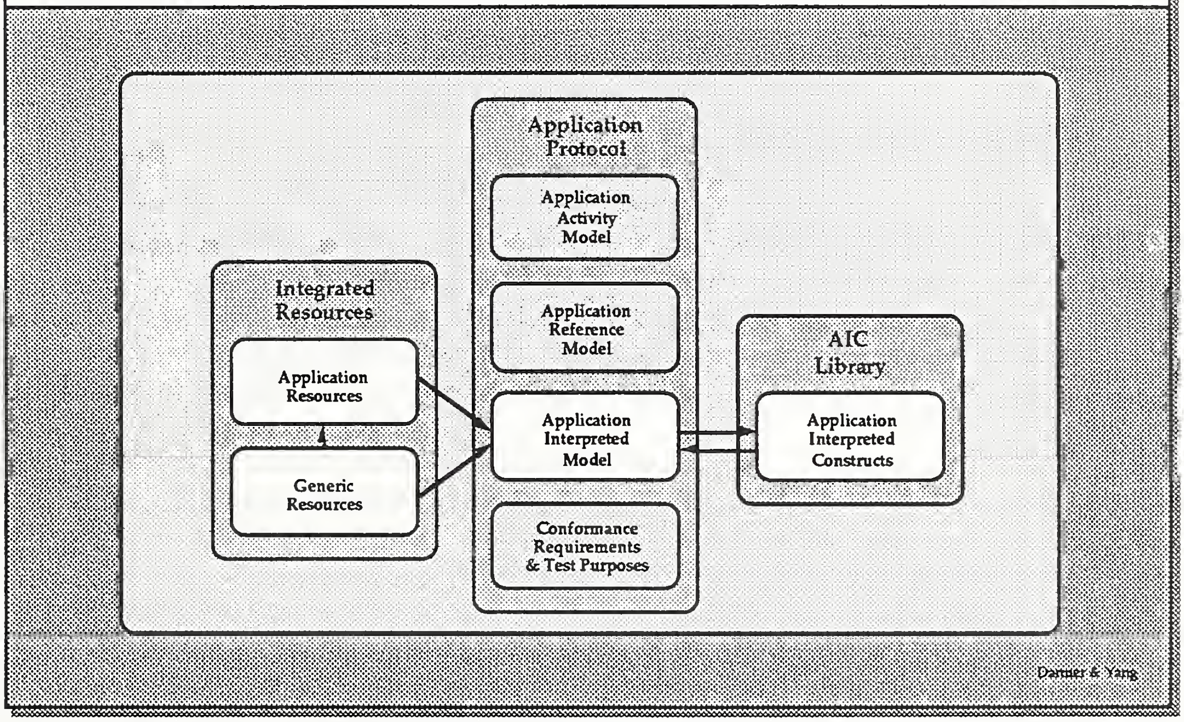
The STEP development process provides an implicit shared global view containing data constructs developed specifically for the sharing of information in the complex information system environment in which STEP must operate.

6 Summary

STEP Integrated Resources and application protocols contain the standardized constructs that facilitate information sharing among computer systems. The Integrated Resources accommodate product data applications through ongoing consideration of product data subject area requirements within the scope of STEP. Application protocols ensure the precision and utility of information sharing for specific product data application contexts while maintaining the flexibility required as data usage undergoes change due to process improvement.

Viewed from within the STEP development process, STEP contains standardized constructs within the Integrated Resources, AIMs, and AIC library (Fig. 6). Viewed from outside the development process, however, STEP is a set of integrated application protocols. These APs share application interpreted constructs in a mofular fashion. Very limited unique semantics are used.

Figure 6. Integrated Resources, APs, and AIC Library of STEP



Each application protocol provides an application interpreted model. Each AIM is a portion of the STEP standard and the conceptual schema for the defined application context. Each AIM is designed to support multiple external user views and implementations within the complex and expansive scope of STEP.

The use of standardized AIMs that share AICs is analogous to a combined federated and global approach to multidatabase integration in a heterogeneous, distributed, and autonomous environment. Advantages to such a combined approach in STEP include:

- interoperability in sequential file, centralized database, and multidatabase environments
- responsiveness to user needs
- effectiveness with respect to attaining consensus within identified contexts
- flexibility with respect to change
- maintainability of the specification
- accommodation of legacy systems

As a standard to facilitate information sharing, STEP provides standardized AIMs that serve as necessary control mechanisms for the unambiguous sharing of information in specified product data application contexts. The STEP methods and architectures used to develop the AIMs support both precision of the information shared and flexible information sharing among product data applications.

STEP facilitates the establishment of an information sharing capability for applications involving all product types over the entire life cycle of products. It satisfies the product information needs of international industry and commerce by providing the ability to share information precisely and unambiguously, the ability to share information among specific applications, and the ability to change as business processes, and the automated use of information are improved.

REFERENCES

[1] STEP (Standard for the Exchange of Product Model Data) Requirements Document, N9, ISO TC184/SC4/WG1, 1985.

[2] Danner, W.F. and Yang, Y.; Proposed Revision of the Requirement Document of STEP (Standard for the Exchange of Product Model Data), ISO TC184/SC4 Project Management Advisory Group, October 1990.

[3] Breitbart; Multidatabase Interoperability, SIGMOD Record, Vol. 19, No. 3, September 1990.

[4] Litwin, W., Mark, L., and Roussopoulos, N.; Interoperability of Multiple Autonomous Databases, ACM Computing Surveys, Vol. 22, No. 3, September 1990.

[5] Sheth, A.P. and Larson, J.A.; Federated Database Systems for Managing Distributed, Heterogeneous, and Autonomous Databases, ACM Computing Surveys, Vol. 22, No. 3, September 1990.

[6] ISO 10303-11: The EXPRESS Language, Draft International Standard, ISO TC184/SC4, August 1992.

[7] Danner, W.F., Sanford, D.T., and Yang, Y.; STEP (Standard for the Exchange of Product Model Data) Resource Integration: Semantic & Syntactic Rules, (N80, ISO TC184/SC4), NISTIR 4528, National Institute of Standards and Technology, March 1991.

[8] Williams, A. L., "AIM Specification Practices," ISO TC184/SC4/WG5 N23, September 1991.

[9] EXPRESS Usage Guide, S. Brett (ed.), N39, ISO TC184/SC4/WG5, August, 1992.

[10] Danner, W.F. and Yang, Y.; STEP (Standard for the Exchange of Product Model Data) Development Methods: Resource Integration and Application Interpretation, N31, ISO TC184/SC4/WG5, February 1992.

[11] Danner, W.F.; A Proposed Integration Framework for STEP (Standard for the Exchange of Product Model Data, NISTIR 90-4295, National Institute of Standards and Technology, April 1990.

[12] Danner, W.F. and Yang, Y.; Generic Product Data Model (GPDM), N3, ISO TC184/SC4/WG5, January 1991.

[13] Palmer, M., Gilbert, M., and Anderson, J.; Guidelines for the Development and Approval of STEP Application Protocols, NISTIR, National Institute of Standards and Technology, in progress.

[14] ANSI/X3/SPARC Study Group on Data Base Management Systems Interim Report, FDT (ACM SIGMOD Bulletin) 7, No. 2, 1975.

[15] The ANSI/X3/SPARC DBMS Framework, Report of the Study Group on Database Management Systems, Edited by D. Tsichritzis and Anthony Klug, University of Toronto, 1977.

[16] Yang, Y.; Three-Schema Implementation in STEP (Standard for the Exchange of Product Model Data), May 1991.

[17] Reference Model for DBMS Standardization, Database Architecture Framework Task Group (DAFTG) of the ANSI/X3/SPARC Database System Study Group, NBSIR 85-3173, National Bureau of Standards, May 1985.

[18] Danner, W.F. and Yang, Y.; Application Protocol Integration Strategy, N15, ISO TC184/WG5, July 1991.

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This document describes the information sharing requirements and approaches used to fulfill those requirements in the development of standardized data constructs for STEP (Standard for the Exchange of Product Model Data). It also describes the architecture used to conceptually organize the data constructs, and the information sharing architecture in which the standardized constructs are used.

12. KEY WORDS (6 TO 12 ENTRIES; ALPHABETICAL ORDER; CAPITALIZE ONLY PROPER NAMES; AND SEPARATE KEY WORDS BY SEMICOLONS)

application interpretation, product data, product data architecture, product information sharing, product data integration, product data modelling , product data specification, resource integration

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