IMS Enterprise Services Conformance Specification

Version 1.0 Final Specification

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Document Name: IMS Enterprise Services Conformance Specification

Date: 11 June 2004

Table of Contents

1. INTRODUCTION 3
1.1 ENTERPRISE SERVICES OVERVIEW 3
1.2 SCOPE AND CONTEXT 3
1.3 STRUCTURE OF THIS DOCUMENT 4
1.4 NOMENCLATURE 4
1.5 REFERENCES 4
2. THE CONTEXT FOR ENTERPRISE SERVICES CONFORMANCE 5
2.1 NATURE OF SYSTEM 5
2.1.1 Service Requester 5
2.1.2 Service Provider 5
2.2 SYSTEM ASSUMPTIONS 5
3. LEVEL OF COMPLIANCE 7
3.1 LEVEL 1 COMPLIANCE 7
3.1.1 Service Requester Compliance 7
3.1.2 Service Provider Compliance 7
3.2 LEVEL 2 COMPLIANCE 7
3.2.1 Service Requester Compliance 7
3.2.2 Service Provider Compliance 7
3.3 LEVEL 3 COMPLIANCE 8
3.3.1 Service Requester Compliance 8
3.3.2 Service Provider Compliance 8
3.4 LEVEL 4 COMPLIANCE 8
3.4.1 Service Requester Compliance 8
3.4.2 Service Provider Compliance 8
3.5 PREFERRED LEVELS OF COMPLIANCE 8
4. INTEROPERABILITY AND CONFORMANCE 9
APPENDIX A – ES CONFORMANCE STATEMENT 11
ABOUT THIS DOCUMENT 13
LIST OF CONTRIBUTORS 13
REVISION HISTORY 14
INDEX 15

1. Introduction

1.1 Enterprise Services Overview

The Enterprise Services specification [EntServices, 04b] is the definition of how systems manage the exchange of information that describes people, group, and memberships within the context of learning. The Enterprise Services specification is constructed following the recommendations documented in the IMS Abstract Framework (IAF) [AbsGloss, 03], [AbsASC, 03], [AbsWhite, 03]. This means that this specification is based upon:

- Interoperability – Enterprise Services focuses on the exchange of information between Enterprise systems. The specification makes no assumptions on how the data is managed within the Enterprise systems;
- Service-oriented – Enterprise Services defines the exchange of information in terms of the services being supplied by the collaboration of the systems. This takes the form of Person Services, Group Services, and Membership Services;
- Component-based – the set of services will be supplied such that they can be combined to form a range of services. The Person Services, Group Services, and Membership Services can be combined to provide other services and the Enterprise Service will have other services added to it in later releases;
- Layering – the Enterprise Service and its constituent services (Person, Group and Membership) are part of the Application Services layer;
- Behaviors and Data Models – the Enterprise Services are defined in terms of their behaviors and data models. The behaviors cause changes in the state of the data model and the state of the data model will only be altered as a result of a clearly defined behavior;
- Multiple Bindings – the Enterprise Services information model is to be defined using the Unified Modelling Language (UML). This enables reliable mapping of the information model into a range of different bindings. The binding of immediate importance is to the Web Services Description Language (WSDL);
- Adoption – the Enterprise Services are based upon the original Enterprise specification data model. While there are significant changes the underlying data model has been maintained and the core Person, Group and Membership structures remain.

1.2 Scope and Context

This document is the IMS Enterprise Services Conformance Specification v1.0 and it is based on the following documents:

a) IMS Enterprise Services Core Use Cases v1.0 [EntServices, 04a] – the set of use-cases that are the basis for the definition of the information model;

b) IMS Enterprise Services Specification v1.0 [EntServices, 04b] – the description of the overall Enterprise Services as created by the combination of the Person Management Services, Group Management Services, and Membership Management Services specifications;

c) IMS Person Management Services Information Model v1.0 [PersonService, 04];

d) IMS Group Management Services Information Model v1.0 [GroupService, 04];

e) IMS Member Management Services Information Model v1.0 [MemberService, 04].

As such the Enterprise Services specification supersedes the original Enterprise specifications:

a) IMS Enterprise Information Model Final Specification v1.1 [Enterprise, 02a].

b) IMS Enterprise XML Binding Final Specification v1.1 [Enterprise, 02b];

c) IMS Enterprise Services Best Practice and Implementation Guide Final Specification v1.0 [Enterprise, 02c].

This Conformance Specification defines the formal test specification for the IMS Enterprise Service Information Model. This test specification is used to define the criteria by which an implementation can be evaluated to determine whether or not it complies with the Enterprise Services Information Model.

1.3 Structure of this Document

The structure of this document is:

2. The Context for Enterprise Services Conformance	The definition of the 'Service Provider' and 'Service Requester' perspective for conformance;
3. Levels of Compliance	The definition of the four levels of compliance that a system can claim;
4. Interoperability & Conformance	A discussion of how the reconciliation of conformance statements is produced to make a desk-top determination of interoperability;
Appendix A – ES Conformance Statement	A Conformance Statement that should be use to describe the compliance of a 'Service Consumer' and/or 'Service Provider' to the Enterprise Services Conformance Specification.

1.4 Nomenclature

API	Application Programming Interface
IAF	IMS Abstract Framework
UML	Unified Modelling Language
W3C	World Wide Web Consortium
WSDL	Web Services Description Language
XML	Extensible Mark-up Language

1.5 References

[AbsASCs, 03]	*IMS Abstract Framework: Applications, Services & Components v1.0*, C.Smythe, IMS Global Learning Consortium, Inc., July 2003.
[AbsGloss, 03]	*IMS Abstract Framework: Glossary v1.0*, C.Smythe, IMS Global Learning Consortium, Inc., July 2003.
[AbsWhite, 03]	*IMS Abstract Framework: White Paper v1.0*, C.Smythe, IMS Global Learning Consortium, Inc., July 2003.
[Enterprise, 02a]	*IMS Enterprise Information Model v1.1*, G.Collier, C.Etesse, W.Veres and C.Smythe, IMS Global Learning Consortium, Inc., July 2002.
[Enterprise, 02b]	*IMS Enterprise XML Binding v1.1*, G.Collier, C.Etesse, W.Veres and C.Smythe, IMS Global Learning Consortium, Inc., July 2002.
[Enterprise, 02c]	*IMS Enterprise Best Practice & Implementation Guide v1.1*, G.Collier, C.Etesse, W.Veres and C.Smythe, IMS Global Learning Consortium, Inc., July 2002.
[EntServices, 04a]	*IMS Enterprise Services Core Use Cases v1.0*, C.Smythe and C.Vento, IMS Global Learning Consortium, Inc., June 2004.
[EntServices, 04b]	*IMS Enterprise Services Specification v1.0*, C.Smythe and C.Vento, IMS Global Learning Consortium, Inc., June 2004.
[GroupServices, 04]	*IMS Group Management Services Information Model v1.0*, C.Smythe and C.Vento, IMS Global Learning Consortium, Inc., June 2004.
[MemberServices, 04]	*IMS Member Management Services Information Model v1.0*, C.Smythe and C.Vento, IMS Global Learning Consortium, June 2004.
[PersonServices, 04]	*IMS Person Management Services Information Model v1.0*, C.Smythe and C.Vento, IMS Global Learning Consortium, June 2004.

2. The Context for Enterprise Services Conformance

Conformance is based upon the following considerations:

- Nature of system – whether the system is a consumer, provider or combined supplied of the service;
- Level of compliance – the degree to which the system claims it conforms to the specification.

2.1 Nature of System

It is assumed that the behaviors defined by an abstract API are invoked by the exchange of messages between the 'Service Requester' and 'Service Provider'. The physical construction and manner in which these messages are physically exchanged is outside the scope of the relevant information models and thus this Conformance Specification.

2.1.1 Service Requester

A 'Service Requester' is defined as the system that issues the 'Request' message of a behavior and receives in return the corresponding 'Response' message. The normative responsibilities of a 'Service Requester' are:

a) It must construct the appropriate 'Request' messages as defined by the binding definition being used to support the information model;

b) It must be capable of reliably generating unique 'sourcedIds' that are to be assigned to the data objects;

c) It must be capable of processing the corresponding 'Response' messages as defined by the binding definition to be used to support the information model. It is the binding document that is responsible for detailing how a 'Service Consumer' must maintain the atomic relationship of the Request/Response message sequence. From the perspective of this Conformance Specification it is assumed that the service implementation guarantees that duplicate 'Response' messages do not occur;

d) It must report the returned status codes and comments to the process invoking the behavior.

2.1.2 Service Provider

A 'Service Provider' is defined as the system that receives the 'Request' message for a behavior and issues in return the corresponding 'Response' message. The 'Service Provider' is responsible for maintaining the persistence of the data throughout its lifetime. The normative responsibilities of a 'Service Provider' are:

a) It must be capable of processing the set of 'Request' messages that can be received as defined by the binding definition being used to support the information model. Invalid data received within a 'Request message should not cause a failure of the 'Service Provider' and should not result in incorrect information being stored;

b) It must accurately implement the processing behavior invoked by the request. The completion of this processing must result in the reporting of the appropriate status information;

c) It must construct the appropriate 'Response' messages as defined by the binding definition being used to support the information model. It is the binding document that is responsible for detailing how a 'Service Requester' must maintain the atomic relationship of the Request/Response message sequence;

d) It must be capable of reliably generating unique 'sourcedIds' that are to be assigned to the data objects;

e) It must maintain the persistence of the data objects once they have been created until they are deleted. This persistence must ensure that the data object can be accessed using the unique 'sourcedId' allocated to it.

2.2 System Assumptions

From a system perspective the following points must be noted:

a) The underlying communications system is reliable. This mans that there is no loss, duplication or corruption of messages;

b) The underlying detailed message choreography for the binding is such that a logical ‘Request/Response’ model is supported. The conformance statements are define with respect to this logical ‘Request/Response’ model. For example, the detailed message choreography for the asynchronous/polled bindings is not address in the conformance statement. Instead only the invoking ‘Request’ and data containing ‘Response’ messages are considered because it is only these that are responsible for maintaining the corresponding system behavior;

c) Mechanisms such as security, service discovery, etc. are outside the scope of the conformance specification. Interoperability of real systems will also have to address these issues.

3. Level of Compliance

3.1 Level 1 Compliance

3.1.1 Service Requester Compliance

This level of compliance means that the service cannot be invoked by the 'Service Requester', i.e., the corresponding API call is not available.

3.1.2 Service Provider Compliance

This level denotes that the service is not supported by the 'Service Provider'. However, the 'Service Provider' must be capable of responding to a service request that the service is unavailable. Upon receipt of the 'Request' message the 'Service Provider' must:

- Transmit the corresponding 'Response' message with a status code of 'Unsupported'. No other form of status information is supplied by the 'Provider';
- Return no data within the message body;
- Make no change to the internal record database.

3.2 Level 2 Compliance

3.2.1 Service Requester Compliance

This level denotes that the 'Service Requester' can invoke the defined behavior, using the 'Request' message and can process the corresponding 'Response' message from the 'Service Provider'. Upon receipt of the appropriate trigger the consumer must issue the 'Request' message such that:

- The 'Request' message is constructed such that it contains all of the required parameters, arranged appropriately in the message;
- The 'Request' message will only contain the data model elements that are mandatory.

Upon receipt of the corresponding 'Response' message the 'Service Requester' must:

- Process the corresponding 'Response' messages as defined by the binding definition to be used to support the information model;
- Be capable of parsing the received XML data against the corresponding XSD. Only the mandated elements are supported at this level;
- Pass the returned status codes back to the process responsible for invoking the behavior.

3.2.2 Service Provider Compliance

Upon receipt of the 'Request' message the 'Service Provider' must:

- Be capable of processing the set of 'Request' messages that can be received as defined by the binding definition to be used to support the information model;
- Accurately implement the processing behavior invoked by the request. The completion of this processing must result in the reporting of the appropriate status information;
- Construct the appropriate 'Response' messages as defined by the binding definition to be used to support the information model;
- Return the appropriate status code. The status code 'Unsupported' must not be returned;
- Maintain the persistence of the data objects once they have been created until they are deleted. Only those elements that are mandatory, as defined by the appropriate data model XSD, are supported at this level.

3.3 Level 3 Compliance

3.3.1 Service Requester Compliance

As per level 2 compliance plus:

- 'Request' and 'Response' messages can be composed from the mandatory and a predefined sub-set of the optional elements, as defined by the appropriate data model XSD.

3.3.2 Service Provider Compliance

As per level 2 compliance plus:

- It must maintain the persistence of the data objects once they have been created until they are deleted. All mandatory and a predefined sub-set of the optional elements, as defined by the appropriate data model XSD.

3.4 Level 4 Compliance

3.4.1 Service Requester Compliance

As per level 2 compliance plus:

- 'Request' and 'Response' messages can be composed from any of the elements (mandatory and all optional), as defined by the appropriate data model XSD.

3.4.2 Service Provider Compliance

As per level 2 compliance plus:

- It must maintain the persistence of the data objects once they have been created until they are deleted. All elements (mandatory and all optional), as defined by the appropriate data model XSD.

3.5 Preferred Levels of Compliance

The preferred level of compliance is (in decreasing order of preference):

- Level 4 – extending 'Level 2' by supporting all of the optional elements;
- Level 3 – extending 'Level 2' by supporting some of the optional elements;
- Level 2 – only the mandatory data model elements are supported;
- Level 1 – this states that the service is unsupported.

Interoperability is determined by the system that supports the compliance highest in the order of preference. If a system supports only Level 2 compliance, then it will reject any data contained within an optional element. The rejection of the data will result in a behavior failure status code.

4. Interoperability and Conformance

An implementation of an Enterprise Service is expected to accurately complete a Conformance Statement – see Appendix A for the format of the Conformance Statement. The Conformance Statement lists the level of compliance claimed for each of the behaviors defined within the Enterprise Service specification. Interoperability between two systems is then identified by comparing their Conformance Statements, i.e., a comparison of the 'Service Requester' and 'Service Provider' statements.

Table 4.1 Comparison matrix for the service requester/service provider compliance.

Service Requester	Service Provider			
	Level 1	**Level 2**	**Level 3**	**Level 4**
Level 1	No interoperability. The Requester cannot issue the operation and the Provider does not support the operation.	No interoperability. The Requester cannot issue the operation.	No interoperability. The Requester cannot issue the operation.	No interoperability. The Requester cannot issue the operation.
Level 2	No interoperability. The Provider does not support the requested operation.	Constrained Interoperability. The Requester and Provider will exchange only the mandatory data structures.	Requester Constrained Interoperability. The Provider will supply some optional data structure but the Provider can only process the mandatory ones.	Requester Constrained Interoperability. The Provider can supply all of the optional data structure whereas the Requester can only process the mandatory ones.
Level 3	No interoperability. The Provider does not support the requested operation.	Provider Constrained Interoperability. The Provider will only store the mandatory data structures and will reject any optional ones supplied by the Provider.	Limited Interoperability. Only the mandatory data structures are exchanged under guarantee. Some commonly supported optional data structures may also be exchanged.	Requester Constrained Interoperability. The Provider can support any of the data structures sent by the Requester but it can supply optional data that the Requester may reject.
Level 4	No interoperability. The Provider does not support the requested operation.	Provider Constrained Interoperability. The Service Provider will only store the mandatory data structures and will reject any optional ones supplied by the Service Provider.	Provider Constrained Interoperability. The Requester can handle any of the data supplied by the Provider but the Provider may reject some of the optional data supplied by the Requester.	Full Interoperability. The Requester and Service Provider can exchange all of the data structures.

Table 4.1 lists the interoperability implications for each possible combination of the service requester and service provider compliance claims. The key points from Table 4.1 with regard to interoperability are (all matrix points are denoted as {i,j} with 'i' referring to the level of conformance of the Service Provider – this gives rise to sixteen possible interoperability states):

- Seven states result in **no** interoperability – {1,1}, {1,2}, {1,3}, {1,4}, (2,1}, {3,1} and {4,1};
- Two states result in symmetric but limited interoperability – {2,2} and {3,3};

- Three states results in 'Provider Constrained' interoperability i.e. the capabilities of the Service Provider determine the extent of interoperability – {2,2}, {2,3} and {3,4};
- Three states results in 'Requester Constrained' interoperability i.e. the capabilities of the Service Requester determine the extent of interoperability – {3,2}, {4,2} and {4,3};
- One state provides full interoperability – {4,4}.

It must be stressed that the matrix in Table 4.1 reflects the level of interoperability for a single behavior. The same matrix comparison needs to be supplied for each of the behaviors. An example of this comparison based upon the Conformance Statement given in Appendix A is shown in Table 4.2.

Table 4.2 Example Person Management Services conformance statement.

Behavior	Service Requester Conformance	Service Provider Conformance	Interoperability Capability
createPerson	3	4	Requester Constrained
createByProxyPerson	3	1	No
deletePerson	4	4	Full
readPerson	3	4	Requester Constrained
updatePerson	3	4	Requester Constrained
replacePerson	3	4	Requester Constrained
changePersonIdentifier	1	1	No
createPersons	3	4	Requester Constrained
createByProxyPersons	3	1	No
deletePersons	4	4	Full
readPersons	3	4	Requester Constrained
readPersonsForGroup	1	4	No
updatePersons	3	4	Requester Constrained
replacePersons	3	4	Requester Constrained
changePersonsIdentifier	1	1	No

In the example in Table 4.2 the Service Provider is defined as a full service (Level 4 conformance) for many behaviors, i.e., it can support all of the mandatory and optional data structures. The Service Requester provides Level 3 conformance for many behaviors. This results in many behaviors being 'Requester Constrained'. The notable differences are the 'deletePerson' and 'deletePersons' behaviors for which no Person data information is required.

Appendix A – ES Conformance Statement

A typical Conformance Statement for the Enterprise Services is shown in Tables A.1, A.2, and A.3. A full Enterprise Services Conformance Statement would entail all three tables being combined.

For each of these tables the 'Service Requester Conformance' and 'Service Provider Conformance' columns need to be completed. The 'Service Requester Conformance' column is used to denote the level of conformance supported by a system that issues Request messages and receives response messages, whereas, the 'Service Provider Conformance' column is used to denote the level of conformance supported by a system that receives Request messages and issues response messages. The possible values in the 'Service Requester Conformance' column are:

- N/A – the system cannot act as a Service Requester;
- 1 – not available i.e. this behavior cannot be requested;
- 2-4 – conformance levels one to three.

The possible values in the 'Service Provider Conformance' column are:

- N/A – the system cannot act as a Service Provider;
- 1 – the service is not supported by the System Provider;
- 2-4 – conformance levels two to three.

Every Service Provider must provide at least level 1 conformance for each behavior. If a system cannot act as a Service Provider then **every** row must have the entry 'N/A'. Similarly, if a system cannot act as a Service Requester then **every** row must have the entry 'N/A'.

Table A.1 Person Management Services conformance statement.

Person Management Service		
Behavior	Service Requester Conformance	Service Provider Conformance
createPerson		
createByProxyPerson		
deletePerson		
readPerson		
updatePerson		
replacePerson		
changePersonIdentifier		
createPersons		
createByProxyPersons		
deletePersons		
readPersons		
readPersonsForGroup		
updatePersons		
replacePersons		
changePersonsIdentifier		

Table A.2 Group Management Services conformance statement.

Group Management Service		
Behavior	Service Requester Conformance	Service Provider Conformance
createGroup		
createByProxyGroup		
deleteGroup		
deleteGroupRelationship		
readGroup		
updateGroup		
replaceGroup		
changeGroupIdentifier		
createGroups		
createByProxyGroups		
deleteGroups		
deleteGroupsRelationship		
readGroups		
readGroupsForPerson		
updateGroups		
replaceGroups		
changeGroupsIdentifier		

Table A.3 Membership Management Services conformance statement.

Membership Management Service		
Behavior	Service Requester Conformance	Service Provider Conformance
createMembership		
createByProxyMembership		
deleteMembership		
readMembership		
updateMembership		
replaceMembership		
changeMembershipIdentifier		
createMemberships		
createByProxyMemberships		
deleteMemberships		
readMemberships		
readMembershipsForPerson		
readMembershipsForGroup		
updateMemberships		
replaceMemberships		
changeMembershipsIdentifier		

About This Document

Title	IMS Enterprise Services Conformance Specification
Editor	Colin Smythe (IMS)
Team Co-Lead	Chris Vento (WebCT Inc.)
Version	1.0
Version Date	11 June 2004
Status	**Final Specification**
Summary	This document presents the IMS Enterprise Services Conformance Specification. The original Enterprise specification was based upon the description of the data model for the information to be exchanged between communicating enterprise systems. The Enterprise Services specification extends this work by adding a series of behavioral models that define how the data models are to be manipulated. The material in this document describes the Conformance Specification as applied to the Enterprise Services Information Model. This version supersedes the IMS Enterprise v1.1 specifications.
Revision Information	11 June 2004
Purpose	This document has been approved by the IMS Technical Board and is made available for adoption.
Document Location	http://www.imsglobal.org/es/esv1p0/imses_confv1p0.html

To register any comments or questions about this specification please visit:
http://www.imsglobal.org/developers/ims/imsforum/categories.cfm?catid=20

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Revision History

Version No.	Release Date	Comments
Public Draft 1.0	12 January 2004	The final approved Public Draft Document for the IMS Common Data Model Definition. In this document the Common Data Models are described in their own stand-alone information model.
Final Specification 1.0	11 June 2004	This is the formal Final version of the IMS Enterprise Services Conformance specification.

Index

A

Abstract Framework 3, 4
API 4, 5, 7
Attributes
  Common
    sourcedId 5
  RecordMetaData
    comments 5
  Result
    result 3, 5, 7, 8, 9
  Role
    status 5, 7, 8
  StatusInfo
    description 3, 13
  TypeValue
    level 7, 8, 9, 10, 11

B

Binding technologies
  WSDL 3

C

Classes
  Group 3, 4, 12
    Description 3, 4
  Member 3
  Membership 3, 12
  Person 3, 4, 10, 11
Conformance 3, 4, 5, 9, 10, 11, 12, 13

E

Enterprise Service 3, 4, 9, 11, 13
Enterprise Service Information Model 3

G

Group Management Service 3, 4, 12

M

Membership Management Service 3, 4, 12

O

Operations
  Group
    changeGroupIdentifier 12
    changeGroupsIdentifier 12
    createByProxyGroup 12
    createByProxyGroups 12
    createGroup 12
    createGroups 12
    deleteGroup 12
    deleteGroupRelationship 12
    deleteGroups 12
    deleteGroupsRelationship 12
    readGroup 12
    readGroups 12
    readGroupsForPerson 12
    replaceGroup 12
    replaceGroups 12
    updateGroup 12
    updateGroups 12
  Membership
    changeMembershipIdentifier 12
    changeMembershipsIdentifier 12
    createByProxyMembership 12
    createByProxyMemberships 12
    createMembership 12
    createMemberships 12
    deleteMembership 12
    deleteMemberships 12
    readMembership 12
    readMemberships 12
    readMembershipsForGroup 12
    readMembershipsForPerson 12
    replaceMembership 12
    replaceMemberships 12
    updateMembership 12
    updateMemberships 12
  Person
    changePersonIdentifier 10, 11
    changePersonsIdentifier 10, 11
    createByProxyPerson 10, 11
    createByProxyPersons 10, 11
    createPerson 10, 11
    createPersons 10, 11
    deletePerson 10, 11
    deletePersons 10, 11
    readPerson 10, 11
    readPersons 10, 11
    readPersonsForGroup 10, 11
    replacePerson 10, 11
    replacePersons 10, 11
    updatePerson 10, 11
    updatePersons 10, 11

P

Person Management Service 3, 4, 10, 11, 12

S

Services
  Group Management 3, 4, 12
  Membership Management 3, 4, 12
  Person Management 3, 4, 10, 11, 12
Specifications
  IMS
    Enterprise Service Information Model 3
Status Codes
  unsupported 8

W

WDSL 3, 4

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Please refer to Document Name: IMS Enterprise Services Conformance Specification

Date: 11 June 2004