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Request For Proposal

PIM and PSM for Super Distributed Objects

OMG Document: sdo/02-01-04

Submissions due: September 2, 2002

Objective of this Request for Proposal (RFP)

This RFP solicits proposals for a Platform Independent Model (PIM) and at least a CORBA Platform Specific Model (PSM) that:

- describe capabilities and properties of SDOs,
- provide a common interface of SDOs for monitoring, configuration, reservation of these capabilities and properties.

For further details, please see Chapter 6 of this document.

1.0 Introduction

1.1 Goals of OMG

The Object Management Group (OMG) is the world's largest software consortium with a membership of over 800 vendors, developers, and end users. Established in 1989, its mission is to promote the theory and practice of Object Technology (OT) for the development of distributed computing systems.

A key goal of OMG is create a standardized object-oriented architectural framework for distributed applications based on specifications that enable and support distributed objects. Objectives include the *reusability*, *portability*, and *interoperability* of object-oriented software components in heterogeneous environments.To this end, the OMG adopts interface and protocol specifications, based on commercially available object technology, that together define an Object Management Architecture (OMA).

1.2 Organization of this document

The remainder of this document is organized as follows:

Chapter 2 - *Architectural Context* - background information on OMG's Object Management Architecture.

Chapter 3 - *Adoption Process* - background information on the OMG specification adoption process.

Chapter 4 - *Instructions for Submitters* - explanation of how to make a submission to this RFP.

Chapter 5 - *General Requirements on Proposals* - requirements and evaluation criteria that apply to all proposals submitted to OMG.

Chapter 6 - *Specific Requirements on Proposals* - problem statement, scope of proposals sought, mandatory and optional requirements, issues to be discussed, evaluation criteria, and timetable that apply specifically to this RFP.

Additional RFP-specific chapters may also be included following Chapter 6.

1.3 References

The following documents are referenced in this document:

Richard Soley (ed.), *Object Management Architecture Guide*, Third Edition, Wiley, June 1995. OMG Document ab/97-05-05, or successor.

The Common Object Request Broker: Architecture and Specification, Revision 2.1, August 1997. OMG Document formal/97-09-01, or successor.

CORBAservices: Common Object Services Specification, Revised Edition, July 1997. OMG Document formal/97-07-04, or successor.

CORBAfacilities Architecture, Revision 4.0, November 1995.

Business Committee RFP Attachment, OMG Document omg/97-10-01.

Policies and Procedures of the OMG Technical Process, OMG Document pp/97-06-01 or successor.

These documents can be obtained by contacting OMG at document@omg.org. Many OMG documents, including this document, are available electronically from OMG's document server. Send a message containing the single line "help" to server@omg.org for more information, or visit the OMG Web page (URL http://www.omg.org/), which also has more information about OMG in general. If you have general questions about this RFP send email to responses@omg.org.

2.0 Architectural Context

2.1 Object Management Architecture

The *Object Management Architecture Guide* (OMAG) describes OMG's technical objectives and terminology and provides the conceptual infrastructure upon which supporting specifications are based. The guide includes the *OMG Object Model,* which defines common semantics for specifying the externally visible characteristics of objects in a standard implementation-independent way, and the *OMA Reference Model.*

The Reference Model identifies and characterizes the components, interfaces, and protocols that compose the OMA. This includes the Object Request Broker (ORB) component that enables clients and objects to communicate in a distributed environment, and four categories of object interfaces:

- *Object Services* are interfaces for general services that are likely to be used in any program based on distributed objects.
- *Common Facilities* are interfaces for horizontal end-user-oriented facilities applicable to most application domains.
- *Domain Interfaces* are application domain-specific interfaces.
- *Application Interfaces* are non-standardized application-specific interfaces.

A second part of the Reference Model introduces the notion of domain-specific *Object Frameworks.* An Object Framework component is a collection of cooperating objects that provide an integrated solution within an application or technology domain and which is intended for customisation by the developer or user.

Through a series of RFPs, OMG is populating the OMA with detailed specifications for each component and interface category in the Reference Model. Adopted specifications include the Common Object Request Broker Architecture (CORBA), CORBAservices, and CORBAfacilities.

The wide-scale industry adoption of OMG's OMA provides application developers and users with the means to build interoperable software

systems distributed across all major hardware, operating system, and programming language environments.

2.2 CORBA

The *Common Object Request Broker Architecture* defines the programming interfaces to the OMA ORB component. An ORB is the basic mechanism by which objects transparently make requests to - and receive responses from - each other on the same machine or across a network. A client need not be aware of the mechanisms used to communicate with or activate an object, how the object is implemented, nor where the object is located. The ORB thus forms the foundation for building applications constructed from distributed objects and for interoperability between applications in both homogeneous and heterogeneous environments.

The *OMG Interface Definition Language* (IDL) provides a standardized way to define the interfaces to CORBA objects. The IDL definition is the contract between the implementor of an object and the client. IDL is a strongly typed declarative language that is programming language-independent. Language mappings enable objects to be implemented and sent requests in the developer's programming language of choice in a style that is natural to that language.

CORBA 2.0 is an extension and restructuring of the earlier CORBA 1.2 specification. CORBA 2.0 is a family of specifications consisting of the following components:

- Core (including IDL syntax and semantics)
- Interoperability
- An expanding set of language mappings, including:

  C
  C++
  SmallTalk
  Ada95
  COBOL

Each component is a separate compliance point. The minimum required for a CORBA-compliant implementation is adherence to the core and one language mapping.

2.3 CORBA/Interoperability

Interoperability between CORBA-compliant ORBs is provided by OMG's *Internet Inter-ORB Protocol* (IIOP). Adopted in December 1994 as the mandatory CORBA 2.0 protocol for “out of the box” interoperability, IIOP is the TCP/IP transport mapping of a *General Inter-ORB Protocol* (GIOP). IIOP enables requests to be sent to networked objects managed by other ORBs in other domains.

The OMG interoperability architecture also accommodates communication using optional *Environment-Specific IOPs* (ESIOPs), the first of which is the DCE-CIOP.

2.4 CORBAservices

Object Services are general purpose services that are either fundamental for developing useful CORBA-based applications composed of distributed objects, or that provide a universal - application domain-independent - basis for application interoperability.

Object Services are the basic building blocks for distributed object applications. Compliant objects can be combined in many different ways and put to many different uses in applications. They can be used to construct higher level facilities and object frameworks that can interoperate across multiple platform environments.

Adopted OMG Object Services are collectively called CORBAservices and include Naming, Events, LifeCycle, Persistent Object, Relationships, Externalization, Transactions, Concurrency Control, Licensing, Query, Properties, Security, Time, Collections, and Trading Services.

2.5 CORBAfacilities

Common Facilities are interfaces for horizontal end-user-oriented facilities applicable to most domains. Adopted OMG Common Facilities are collectively called CORBAfacilities and include an OpenDoc-based Distributed Document Component Facility.

A specification of a Common Facility or Object Service typically includes the set of interface definitions - expressed in OMG IDL - that objects in various roles must support in order to *provide*, *use*, or *participate in* the facility or service. As with all specifications adopted by OMG, facilities and services are defined in terms of interfaces and their semantics, and not a particular implementation.

2.6 Object Frameworks and Domain Interfaces

Unlike the interfaces to individual parts of the OMA "plumbing" infrastructure, Object Frameworks are complete higher level components that provide functionality of direct interest to end-users in particular application or technology domains. They are vertical slices down the OMG "interface stack".

Object Frameworks are collections of cooperating objects categorized into *Application, Domain, Facility,* and *Service Objects*. Each object in a framework supports (through interface inheritance) or makes use of (via client requests) some combination of Application, Domain, CORBAfacilities, and CORBAservices *interfaces*.

A specification of an Object Framework defines such things as the structure, interfaces, types, operation sequencing, and qualities of service of the objects that make up the framework. This includes requirements on implementations in order to guarantee application portability and interoperability across different platforms.

Domain Task Force RFPs are likely to focus on Object Framework specifications that include new Domain Interfaces for application domains such as Finance, Healthcare, Manufacturing, Telecom, Electronic Commerce, and Transportation.

3.0 Adoption Process

3.1 Introduction

OMG adopts specifications for interfaces and protocols by explicit vote on a technology-by-technology basis. The specifications selected each fill in a portion of the OMA Reference Model. OMG bases its decisions on both business and technical considerations. Once a specification is adopted by OMG, it is made available for use by both OMG members and non-members.

For more detailed information on the adoption process see the *Policies and Procedures of the OMG Technical Process.*

3.2 Rôle of Board of Directors

The OMG Board of Directors votes to formally adopt specifications on behalf of OMG. The OMG Technology Committees (Domain and Platform TCs) and Architecture Board (AB) provide technical guidance to the Board of Directors. In addition, the Business Committee of the Board provides guidance to ensure that implementations of adopted specifications are made commercially available.

3.3 Rôle of Technology Committees and Architecture Board

Submissions to RFPs are evaluated by the TC Task Force (TF) that initiated the RFP. Selected specifications are recommended to the parent TC after being reviewed by the Architecture Board for consistency with the OMA. The full TC then votes to *recommend adoption* to the OMG Board.

3.4 Rôle of Task Forces

The role of the initiating TF is to technically evaluate submissions and select one or more specifications that satisfy the requirements of the RFP. The process typically takes the following form:

- Voter Registration

  Interested TF members may register to participate in specification selection votes for an RFP. Registration ends on a specified date 6 or more weeks after the announcement of the registration period. The registration closure date is typically around the time of initial

submissions. Companies who have submitted an LOI are automatically registered to vote.

- Initial Submissions

  Initial submissions are due by a specified deadline. Submitters normally present their proposals at the next following meeting of the TF. Initial submissions are expected to be full and complete proposals and working implementations of the proposed specifications are expected to exist at the time of submission.

- Evaluation Phase

  A period of approximately 120 days follows during which the TF evaluates the submissions. During this time submitting companies have the opportunity to revise and / or merge their initial submissions, if they so choose.

- Revised Submissions

  Final revised submissions are due by a specified deadline. Submitters again normally present their proposals at the next following meeting of the TF. Finalists may be requested to demonstrate implementations of their proposal.

- Selection Vote

  When the registered voters of the TF believe that they sufficiently understand the relative merits of the revised submissions, a specification selection vote is taken.

3.5 Goals of the evaluation

The primary goals of the TF evaluation process are to:

- Provide a fair and open process
- Force a critical review of the submissions and discussion by all members of the TF
- Give feedback to allow submitters to address concerns in their revised submissions
- Build consensus on acceptable solutions
- Enable voting members to make an informed selection decision

Submitters are expected actively to contribute to the evaluation process.

4.0 Instructions for Submitters

4.1 OMG Membership

Submissions to this RFP may only be made by Platform, Domain or Contributing members of the OMG. To submit to an RFP issued by the Platform Technology Committee an organisation must be a Platform or Contributing member at the date of the submission deadline, while for Domain Technology RFPs the submitter or submitters must be either Contributing or Domain members. Submitters sometimes choose to name other organisations that support a submission in some way; however, this has no formal status within the OMG process, and for OMG's purposes confers neither duties nor privileges on the organisations concerned.

4.2 Submission Effort

Unlike a submission to an OMG Request For Information (RFI), an RFP submission may require significant effort in terms of document preparation, presentations to the initiating TF, and participation in the TF evaluation process. Several staff months of effort might be necessary. OMG is unable to reimburse submitters for any costs in conjunction with their submissions to this RFP.

4.3 Letter of Intent

A Letter of Intent (LOI) must be submitted to the OMG Business Committee signed by an officer of your organization signifying your intent to respond to the RFP and confirming your organization's willingness to comply with OMG's terms and conditions, and commercial availability requirements. These terms, conditions, and requirements are defined in the *Business Committee RFP Attachment* and are reproduced verbatim in section 4.4 below.

The LOI should designate a single contact point within your organization for receipt of all subsequent information regarding this RFP and your submission. The name of this contact will be made available to all OMG members. The LOI is typically due 60 days before the deadline for initial submissions. LOIs must be sent by fax or paper mail to the "RFP Submissions Desk" at the main OMG address shown on the first page of this RFP.

Here is a suggested template for the Letter of Intent:

This letter confirms the intent of <___organisation required___> (the organisation) to submit a response to the OMG <___RFP name required___> RFP. We will grant OMG and its members the right to copy our response for review purposes as specified in section 4.7 of the RFP. Should our response be adopted by OMG we will comply with the OMG Business Committee terms set out in section 4.4 of the RFP and in document omg/98-03-01.

<____contact name and details required____> will be responsible for liaison with OMG regarding this RFP response.

The signatory below is an officer of the organisation and has the approval and authority to make this commitment on behalf of the organisation.

<___signature required____>

4.4 Business Committee RFP Attachment

This section contains the text of the Business Committee RFP attachment concerning commercial availability requirements placed on submissions. This attachment, available separately as document omg/98-03-01, was approved by the OMG Board in February 1998.

Commercial considerations in OMG technology adoption

A1 Introduction

OMG wishes to encourage rapid commercial adoption of the specifications it publishes. To this end, there must be neither technical, legal nor commercial obstacles to their implementation. Freedom from the first is largely judged through technical review by the relevant OMG Technology Committee; the second two are the responsibility of the OMG Business Committee. The BC also looks for evidence of a commitment by a submitter to the commercial success of products based on the submission.

A2 Business Committee evaluation criteria

A2.1 Viable to implement across platforms

While it is understood that final candidate OMG submissions often combine technologies before they have all been implemented in one system, the Business Committee nevertheless wishes to see evidence that each major feature has been

implemented, preferably more than once, and by separate organisations. Pre-product implementations are acceptable. Since use of OMG specifications should not be dependant on any one platform, cross-platform availability and interoperability of implementations should be also be demonstrated.

A2.2 Commercial availability

In addition to demonstrating the existence of implementations of the specification, the submitter must also show that products based on the specification are commercially available, or will be within 12 months of the date when the specification was recommended for adoption by the appropriate Task Force. Proof of intent to ship product within 12 months might include:

- *A public product announcement with a shipping date within the time limit.*
- *Demonstration of a prototype implementation and accompanying draft user documentation.*

Alternatively, and at the Business Committee's discretion, submissions may be adopted where the submitter is not a commercial software provider, and therefore will not make implementations commercially available. However, in this case the BC will require concrete evidence of two or more independent implementations of the specification being used by end-user organisations as part of their businesses.

Regardless of which requirement is in use, the submitter must inform the OMG of completion of the implementations when commercially available.

A2.3 Access to Intellectual Property Rights

OMG will not adopt a specification if OMG is aware of any submitter, member or third party which holds a patent, copyright or other intellectual property right (collectively referred to in this policy statement as "IPR") which might be infringed by implementation of such specification, unless OMG believes that such IPR owner will grant a license to implementers (whether OMG members or not) on non-discriminatory and commercially reasonable terms which wish to implement the specification. Accordingly, the submitter must certify that it is not aware of any claim that the specification infringes any IPR of a third party or that it is aware and believes that an appropriate non-discriminatory license is available from that third party. Except for this certification, the submitter will not be required to make any other warranty, and specifications will be offered by OMG for implementation "as is". If the submitter owns IPR to which an implementation of a specification based upon its submission would necessarily be subject, it must certify to the Business Committee that it will make a suitable license available to any implementer on non-discriminatory and commercially

reasonable terms, to permit development and commercialisation of an implementation that includes such IPR.

It is the goal of the OMG to make all of its specifications available with as few impediments and disincentives to adoption as possible, and therefore OMG strongly encourages the submission of technology as to which royalty-free licenses will be available. However, in all events, the submitter shall also certify that any necessary license will be made available on commercially reasonable, non-discriminatory terms. The submitter is responsible for disclosing in detail all known restrictions, placed either by the submitter or, if known, others, on technology necessary for implementation of the specification.

A2.4 Publication of the specification

Should the submission be adopted, the submitter must grant OMG (and its sublicensees) a world-wide, royalty-free licence to edit, store, duplicate and distribute both the specification and works derived from it (such as revisions and teaching materials). This requirement applies only to the written specification, not to any implementation of it.

A2.5 Continuing support

The submitter must show a commitment to continue supporting the technology underlying the specification after OMG adoption, for instance by showing the BC development plans for future revisions, enhancement or maintenance.

4.5 Responding to RFP items

4.5.1 Separate proposals

Unless otherwise indicated in Chapter 6, independent proposals are solicited for each separate item in the RFP. Each item is considered a separate architectural entity for which a proposal may be made. A submitter may respond to any or all items. Each item will be evaluated independently by the initiating TF. Submissions that do not present clearly separable proposals for multiple items may therefore be at a disadvantage.

It should be noted that a given technology (e.g. software product) may support two or more RFP items. So long as the interfaces for each item are separable, this is not precluded.

4.5.2 Complete proposals

Proposals for each separate RFP item must be complete. A submission must propose full specifications for each item and address all the relevant general and specific requirements detailed in this RFP.

4.5.3 Additional specifications

Submissions may include additional specifications for items not covered by the RFP which they believe to be necessary and integral to their proposal. Information on these additional items should be clearly distinguished.

Submitters must give a detailed rationale as to why these specifications should also be considered for adoption. However submitters should note that a TF is unlikely to consider additional items that are already on the roadmap of an OMG TF, since this would pre-empt the normal adoption process.

4.5.4 Alternative approaches

Submitters may provide alternative RFP item definitions, categorizations, and groupings so long as the rationale for doing so is clearly stated. Equally, submitters may provide alternative models for how items are provided within the OMA if there are compelling technological reasons for a different approach.

4.6 Confidential and Proprietary Information

The OMG specification adoption process is an open process. Responses to this RFP become public documents of the OMG and are available to members and non-members alike for perusal. No confidentiality or proprietary information of any kind will be accepted in a submission to this RFP.

4.7 Copyright Waiver

If a submitted document is copyrighted, a waiver of copyright for unlimited duplication by the OMG is required to be stated in the document. In addition, a limited waiver of copyright is required that allows each OMG member to make up to fifty (50) copies of the document for review purposes only.

4.8 Proof of Concept

Submissions must include a "proof of concept" statement, explaining how the submitted specifications have been demonstrated to be technically viable. The technical viability has to do with the state of development and maturity of the technology on which a submission is based. This is not the same as commercial availability. Proof of concept statements can contain any information deemed relevant by the submitter, for example:

> "This specification has completed the design phase and is the process of being prototyped."
>
> "An implementation of this specification has been in beta-test for 4 months."
>
> "A named product (with a specified customer base) is a realization of this specification."

It is incumbent upon submitters to demonstrate to the satisfaction of the TF the technical viability of their proposal. OMG will favour proposals based on technology for which sufficient relevant experience has been gained in CORBA-based or comparable environments.

4.9 Format of RFP Submissions

This section provides guidance on how to structure your RFP submission.

4.9.1 General

- Submissions that are concise and easy to read will inevitably receive more consideration.
- Submitted documentation should be confined to that directly relevant to the items requested in the RFP. If this is not practical, submitters must make clear what portion of the documentation pertains directly to the RFP and what portion does not.
- The models and terminology in the *Object Management Architecture Guide* and *CORBA* should be used in your submission. Where you believe this is not appropriate, describe and provide a rationale for the models and terminology you believe OMG should use. Submitters are encouraged to document their object models and designs using OMG UML where appropriate, and to supply an OMG XMI representation of the design (including a machine-readable copy) for

the convenience of those wishing to import the UML model into design tools.

4.9.2 Suggested Outline

A three part structure for submissions is suggested:

PART I

- Copyright Waiver (see 4.5)
- Submission contact point (see 4.2)
- Overview or guide to the material in the submission
- Overall design rationale (if appropriate)
- Statement of proof of concept (see 4.6)
- Resolution of RFP mandatory and optional requirements

  Explain how your proposal satisfies the mandatory and (if applicable) optional requirements stated in Chapter 6. References to supporting material in Part II should be given.

  In addition, if your proposal does not satisfy any of the general requirements stated in Chapter 5, provide a detailed rationale.

- Responses to RFP issues to be discussed

  Discuss each of the "Issues To Be Discussed" identified in Chapter 6.

PART II

- Proposed specification

PART III

- Summary of optional versus mandatory interfaces

  Submissions must clearly distinguish interfaces that all implementations must support from those that may be optionally supported.

- Proposed compliance points

  Submissions should propose appropriate compliance points for implementations.

- Changes or extensions required to adopted OMG specifications

Submissions must include a full specification of any changes or extensions required to existing OMG specifications. This should be in a form that enables "mechanical" section-by-section revision of the existing specification.

- Complete IDL definitions

  For reference purposes and to facilitate electronic usage, submissions should reproduce in one place a complete listing in compilable form of the IDL definitions proposed for standardization.

4.10 How to Submit

Submitters should send an electronic version of their submission to the *RFP Submissions Desk* (rfp@omg.org) at OMG by 5:00 PM U.S. Eastern Standard Time (22:00 GMT) on the day of the submission deadline. Acceptable formats are Postscript, ASCII, PDF, FrameMaker, Word, and WordPerfect. However, it should be noted that a successful submission must be supplied to OMG's technical editors in Framemaker source format, using the most recent available OMG submission template (document ab/97-06-02 at the time of writing). The AB will not endorse adoption of any submission for which appropriately-formatted Framemaker sources are not available; it may therefore be convenient to prepare all stages of a submission using this template.

Submitters should make sure they receive electronic or voice confirmation of the successful receipt of their submission. Submitters should also send, within three (3) working days after the submission deadline, a single hardcopy version of their submission to the attention of the "RFP Submissions Desk" at the main OMG address shown on the first page of this RFP.

5.0 General Requirements on Proposals

5.1 Mandatory Requirements

5.1.1 Proposals shall express interfaces in OMG IDL. Proposals should follow accepted OMG IDL and CORBA programming style. The correctness of the IDL shall be verified using at least one IDL compiler (and preferably more then one). In addition to IDL quoted in the text of the submission, all the IDL associated with the proposal shall be supplied to OMG in compiler-readable form.

5.1.2 Proposals shall specify *operation behaviour, sequencing*, and *side-effects* (if any).

5.1.3 Proposals shall be *precise* and *functionally complete*. There should be no implied or hidden interfaces, operations, or functions required to enable an implementation of the proposed specification.

5.1.4 Proposals shall clearly distinguish *mandatory* interfaces and other specification elements that all implementations must support from those that may be *optionally* supported.

5.1.5 Proposals shall *reuse* existing OMG specifications including CORBA, CORBAservices, and CORBAfacilities in preference to defining new interfaces to perform similar functions.

5.1.6 Proposals shall justify and fully specify any *changes or extensions* required to existing OMG specifications. This includes changes and extensions to CORBA inter-ORB protocols necessary to support interoperability. In general, OMG favours *upwards compatible* proposals that minimize changes and extensions to existing OMG specifications.

5.1.7 Proposals shall factor out functions that could be used in different contexts and specify their interfaces separately. Such *minimality* fosters re-use and avoids functional duplication.

5.1.8 Proposals shall use or depend on other interface specifications only where it is actually necessary. While re-use of existing interfaces to avoid duplication will be encouraged, proposals should avoid gratuitous use.

5.1.9 Proposals shall specify interfaces that are *compatible* and can be used with existing OMG specifications. Separate functions doing separate jobs should be capable of being used together where it makes sense for them to do so.

5.1.10 Proposals shall preserve maximum *implementation flexibility*. Implementation descriptions should not be included, however proposals may specify constraints on object behaviour that implementations need to take into account over and above those defined by the interface semantics.

5.1.11 Proposals shall allow *independent implementations* that are *substitutable* and *interoperable*. An implementation should be replaceable by an alternative implementation without requiring changes to any client.

5.1.12 Proposals shall be compatible with the architecture for system distribution defined in ISO / IEC 10746, Reference Model of Open Distributed Processing (ODP). Where such compatibility is not achieved, the response to the RFP must include reasons why compatibility is not appropriate and an outline of any plans to achieve such compatibility in the future.

5.1.13 In order to demonstrate that the service or facility proposed in response to this RFP, can be made secure in environments requiring security, answers to the following questions shall be provided:

- What, if any, are the security sensitive objects that are introduced by the proposal?
- Which accesses to security-sensitive objects must be subject to security policy control?
- Does the proposed service or facility need to be security aware?
- What CORBAsecurity level and options are required to protect an implementation of the proposal? In answer to this question, a reasonably complete description of how the facilities provided by the level and options (e.g. authentication, audit, authorization, message protection etc.) are used to protect access to the sensitive objects introduced by the proposal shall be provided.
- What default policies should be applied to the security sensitive objects introduced by the proposal?
- Of what security considerations must the implementers of your proposal be aware?

5.1.14 Proposals shall specify the degree of internationalization support that they provide. The degrees of support are as follows:

a) Uncategorized: Internationalization has not been considered.

b) Specific to <region name>: The proposal supports the customs of the specified region only, and is not guaranteed to support the customs of any other region. Any fault or error caused by requesting the services outside of a context in which the customs of the specified region are being consistently followed is the responsibility of the requester.

c) Specific to <multiple region names>: The proposal supports the customs of the specified regions only, and is not guaranteed to support the customs of any other regions. Any fault or error caused by requesting the services outside of a context in which the customs of at least one of the specified regions are being consistently followed is the responsibility of the requester.

5.2 Evaluation criteria

Although the OMG adopts interface specifications, the technical viability of implementations will be taken into account during the evaluation process. The following criteria will be used:

5.2.1 Performance

Potential implementation trade-offs for performance will be considered.

5.2.2 Portability

The ease of implementation on a variety of ORB systems and software platforms will be considered.

5.2.3 Securability

The answer to questions in section 5.1.13 shall be taken into consideration to ascertain that an implementation of the proposal is securable in an environment requiring security.

5.2.4 Compliance: Inspectability and Testability

The adequacy of proposed specifications for the purposes of compliance inspection and testing will be considered. Specifications should provide sufficient constraints on interfaces and implementation characteristics to

ensure that compliance can be unambiguously assessed through both manual inspection and automated testing.

5.2.5 Standardised Metadata

Where proposals incorporate metadata specifications, usage of OMG standard XMI metadata representations will be considered, since this allows specifications to be easily interchanged between XMI compliant tools and applications. Since use of XML (including XMI, XML/Value) is evolving rapidly, the use of industry specific XML vocabularies (which may not be XMI compliant) is acceptable where justified.

6.0 Specific Requirements on Proposals

6.1 Problem Statement

The increasing availability of high-performance and low-cost processor technology is enabling computing power to be embedded densely in devices like mobile phones, PDAs, and such facilities as Internet appliances and desktop computers. They are most likely to become ubiquitous at home and in the office, on the street, in cars, in factories, and in various other locations. They will collaborate, and will enable various services and applications. Furthermore, emerging network technologies such as Bluetooth, PowerLine, and IPv6 enable such devices to connect to each other in an easy and ad-hoc manner and to construct a large scale network of such devices.

Besides the devices networking arena, ubiquitous network connectivity allows building global software infrastructures for distributed computing and storage. A goal of these infrastructures is to provide a distributed community of software components that pool their services for solving problems, composing applications and sharing contents. Peer-to-peer, grid computing, and global storage networking systems are good examples of these infrastructures. Such infrastructures host a large number of software components that collaborate with each other in a less centralized manner.

These technical advances and trends will lead to the ubiquitous availability of services – anytime, anywhere, and for anyone – and enable new computing paradigms like mobile computing, ubiquitous computing, community computing, voluntary computing, and pervasive computing. The Super Distributed Objects DSIG has worked for exploring the characteristics in these paradigms and specifying the standards that allow us to implement them in a model-driven and interoperable manner by leveraging existing OMG specifications. In this group, the resources such as hardware devices and software components in the above two technological spectrums are abstracted as *Super Distributed Objects* (SDOs), because both share common assumptions and technical issues such as a large number of distributed resources, ad-hoc application boundary, temporal unavailability of resources, and decentralized organization of resources.

An SDO is a logical representation of a hardware or a software entity that provides well-known functionality and services. Super distribution

means incorporating a massive number of objects, each of which performs its own task autonomously or cooperatively with other objects, without centralized control. Examples include abstractions of devices such as mobile phones, PDAs, and home appliances, but are not limited to hardware abstractions. An SDO may also act as a peer in a peer-to-peer networking system, or a storage node in a global storage network system. SDOs are characterized as follows. They:

- represent hardware devices and software components,
- are highly distributed,
- provide manifold, different functionalities (e.g. TV set, refrigerator, light switch),
- abstract underlying heterogeneous technologies (e.g. PowerLine, EIB, Jini, UPnP, HAVi, JXTA, proprietary technologies)
- have standardized interfaces independent from underlying technologies, hardware and software platforms, and programming languages,
- have a highly dynamic behavior (with temporary unavailability and mobility),
- enable a dynamic discovery of their functionality by services and applications, user interfaces, or other SDOs,
- can be organized in a hierarchical (i.e. resulting in composite SDOs) or decentralized manner,
- may be mobile or stationary.

Due to their inherent features, SDOs need interoperable middleware technology that enables uniform access to them in order to support easy and rapid service creation. The middleware shall provide SDOs the functionalities of access control, general management (e.g. configuration, monitoring, and reservation), discovery with support of mobility, social networking (cooperative processing), and spontaneous networking in an ad-hoc manner. Today, there are several resource[1] interconnection technologies like HAVi, BACnet, OSGi, Jini, and JXTA. However, they are restricted to specific platforms, network protocols, programming languages, or they focus on limited application domains. No common model-based standards exist to handle various resources in a unified

[1] The term “resource” here means both hardware device and software component.

manner independently of underlying technologies and application domains.

Fig. 6.1 shows an example of SDO system structure. There exist a massive number of SDOs in the system which are loosely-coupled and communicate with each other in a less centralized manner (e.g. a peer-to-peer manner). A key feature of an SDO system is that SDOs collaborate with each other to spontaneously form an integrated service such as automatic lighting, universal remote controller, energy-conservation, etc. An integrated service is provided by a composite SDO or a group of SDOs. Another feature is that SDOs dynamically join and leave the system, which causes topology change and temporal unavailability of SDOs.

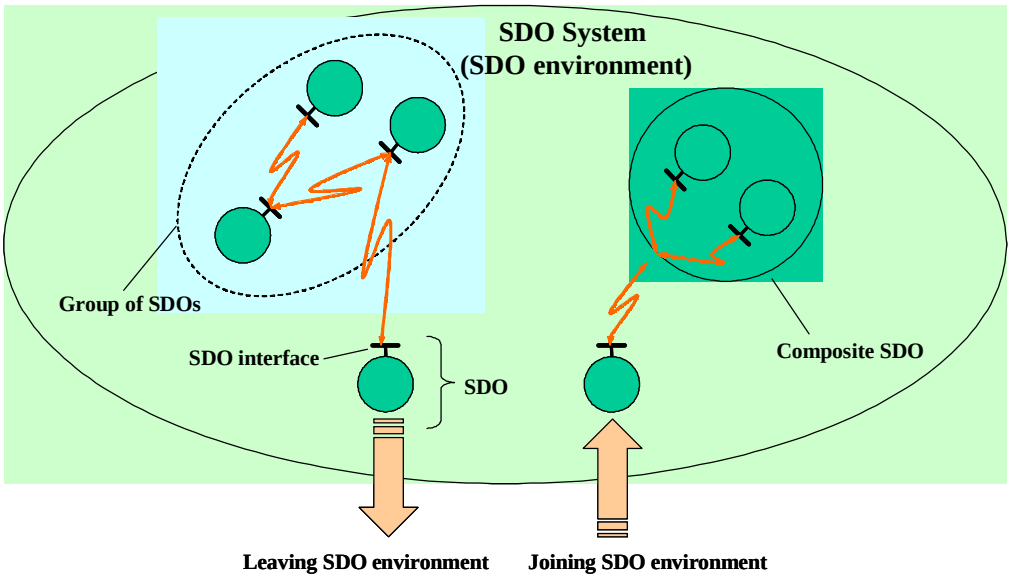

Fig. 6.1: An SDO system structure

For example, an SDO joins an SDO system (i.e. the SDO was switched on / started or, if it is mobile, came in network range). In order to use the services provided by other SDOs in the network, it first has to discover them, which means to obtain references to their interfaces and additional data describing the capabilities and properties of these SDOs. These data could include location, dependencies, and business relationships such as ownership. Then, the SDO knows about the availability, characteristics, and function provided by the other SDOs and how this can be used via their interfaces. These data describing SDO capabilities and function should be specified by the SDO resource data model. The resource data model should be independent from domain specific standards.

The current CORBA specification enables registering and discovering of services with the OMG Trader Service. However, the SDO resource data model shall specify the model for concrete data used in SDO systems. The SDO interface shall provide the necessary common functions to manage these capabilities and properties, which are not yet specified in existing CORBA specifications.

This RFP requests a Platform Independent Model (PIM) and at least one CORBA Platform Specific Model (PSM) that:

- describe capabilities and properties of SDOs,
- provide a common interface of SDOs for monitoring, configuration, and reservation of these capabilities and properties.

A proposed PIM shall be specified with UML, and a CORBA PSM shall specify necessary IDL interfaces and their semantics.

Future RFPs will address additional areas such as social networking, lifecycle management, service unavailability handling, user interaction, and security.

6.2 Scope of Proposals Sought

As described earlier, this RFP solicits proposals for a PIM and corresponding CORBA PSM for SDO that describe the resource data model and the common SDO interface with support for monitoring, configuration, and reservation.

The resource data model shall specify capabilities and properties of SDO, which are used for discovery and usage. In addition to the properties about provided services, the resource data model should describe real-world properties such as SDO service specific data (e.g. type of SDO and provided services), location, dependency on other SDOs, as well as organizational properties (e.g. ownership and usage permissions).

The SDO interface should provide general functions, such as configuration, monitoring, reservation etc. that are identical for all SDOs. These are the common SDO functions whereas SDOs also provide further specific functions (which are specific to SDO's respective functionality).

This RFP first requests only basic necessary functions to be included in the common SDO interface part. Further RFPs can extend these common functions according to certain requirements such as security, load balancing, etc. The functions requested in this RFP comprise:

- Monitoring
  This function shall enable to monitor an SDO's resource data.

- Configuration
  This functions shall enable to configure an SDO's resource data.

- Reservation
  This functions shall enable to reserve an SDO's utilization in order to gain an exclusive access to it.

These functions depict the minimum functionality needed to build an SDO system.

6.3 Relationship to Existing OMG Specifications

Proposals shall identify how existing OMG specifications may be used to support Super Distributed Systems. The following list provides some of the existing OMG specifications that need to be analyzed to examine whether the CORBA PSM for SDO system can benefit from them:

- Naming Service [formal/2001-02-65]:
  The Naming Service enables to bind names to objects. These name bindings are defined relative to a naming context. These mechanisms enable to realize directories of SDOs for different application purposes. For example, several SDOs could be grouped into different naming contexts according to their type or location. This allows the sensible structuring of a huge number of SDO instances and the searching and finding of SDOs in an easy manner.

- Trader Object Service [formal/2000-06-27]:
  Similarly to the Naming Service, the Trader Object Service enables to build directories of objects, but here based on their types and capabilities. SDOs could advertise their capabilities to this directory service and clients can search for SDOs with a certain capability. In an SDO environment, this could be a important function keeping the envisioned high multitude of heterogeneous SDO with very different capabilities in mind.

- Life Cycle Service [formal/2000-06-18]:
  The Life Cycle Service defines services and conventions for creating,

deleting, copying and moving objects. These services could be relevant for managing the lifecycle of SDOs. Because of the high number of SDOs, standardized mechanisms for creating and deleting SDOs will be necessary. These mechanisms should be provided by all kind of SDOs in the same way.

- Relationship Service [formal/2000-06-24]:
  The Relationship Service specifies mechanisms to specify complex relationships among objects in order to model real world scenarios. SDOs of different nature will be in different and complex relationships likewise. Therefore, mechanisms are necessary that provide support for managing such complex relationship.

- Meta-Object Facility (MOF) Specification [formal/2001-11-02]:
  The MOF Specification defines a set of CORBA IDL interfaces that can be used to define and manipulate a set of interoperable metamodels and their corresponding models. These interoperable metamodels include the UML metamodel, the MOF meta-metamodel, as well as future OMG adopted technologies that will be specified using metamodels. The MOF provides the infrastructure for implementing CORBA-based design and reuse repositories. The MOF specifies precise mapping rules that enable the CORBA interfaces for metamodels to be automatically generated, thus encouraging consistency in manipulating metadata in all phases of the distributed application development cycle.

6.4 Related Documents and Standards

Proposals may include existing systems, documents, URLs, and standards that are relevant to the problems discussed in this RFP. They can be used as background information for the proposal.

Examples are:

- Home Network, HAVi, Echonet, etc. (http://www.havi.org, http://www.homerf.org)
- BACnet
- Jini (http://www.sun.com/jini/)
- Universal Plug and Play (http://www.upnp.org)
- OSGi: Open Service Gateway Initiatives (http://www.osgi.org)
- JXTA: (http://www.jxta.org)

- CIM (Common Information model) specified in DMTF (Distributed Management Task Force, http://www.dmtf.org/)

Proposals can clarify the relation between background information and the purpose of SDO.

6.5 Mandatory Requirements

For all the mandatory requirements, proposals shall provide a plat form-independent model and at least one CORBA specific model.

6.5.1 Proposals shall specify a resource data model for SDOs, which describes their capabilities and properties. This model shall identify all the necessary and relevant data to describe them and contain the corresponding data structures and relationships.

6.5.2 Proposals shall specify interfaces that are common to all SDOs to monitor and configure the resource data of SDOs.

6.6 Optional Requirements

6.6.1 Proposals may specify a model and interface for dynamic discovery of SDOs.

6.6.2 Proposals may specify a common interface for reserving an SDO's utilization in order to gain an exclusive access to it.

6.7 Issues to be discussed

Proposals should address how the OMG Trader Object Service is applicable in their CORBA platform specific models and other standard in eash PSM, or at least shall justify precisely why the they are not used and describe their evaluation criteria.

6.8 Evaluation Criteria

The proposed PIMs should be compliant with the OMG UML standard. The proposed CORBA-specific PSMs should be compliant with the CORBA standard. Any metadata described by the proposed model should be compliant with the XMI standard.

Proposals should show an example of SDOs for a specific application domain (Home, Building, Industry, etc.) using specified model and interface.

Proposals will be evaluated in terms of consistency in their specifications, versatility across different application domains, and extensibility.

6.9 Other information unique to this RFP

None.

6.10 RFP Timetable

The timetable for this RFP is given below. Note that the TF may, in certain circumstances, extend deadlines while the RFP is running, or may elect to have more than one revised submission steps. The latest timetable can always be found in the Member Services section of OMG's Web page (URL http://www.omg.org/)

Approx Day	**Event or** *Activity*	**Actual Date**
	Preparation of RFP by TF	
	Approval of RFP by Architecture Board *Review by TC ("Three week rule")*	
0	*TC votes to issue RFP*	*February 1, 2002*
60	*LOI to submit to RFP due*	*April 2, 2002*
210	*Initial submissions due*	*September 2, 2002*
230	*Voter registration closes*	*September 20, 2002*
233	*Initial submission presentations*	*September 23-26, 2002*
	Preliminary evaluation by TF	
330	*Revised submissions due*	*January, 2003*
350	*Revised submission presentations*	*January, 2003*
	Final evaluation and selection by TF *Recommendation to AB and TC*	*January, 2003*
	Approval by Architecture Board *Review by TC ("Three week rule")*	*January, 2003*
330	*TC votes to* recommend specifications	*March, 2003*
360	*BOD votes to adopt specifications*	