

Object Management Group

250 First Avenue, Suite 201
Needham, MA 02494
U.S.A.

Telephone: +1-781-444 0404
Facsimile: +1-781-444 0320

Life Sciences Research Gene Expression LSR RFP-7

Request For Proposal

OMG Document: lifesci/00-03-09

Submissions due: August 21, 2000

Objective of this RFP

Life sciences research has experienced rapid growth in the number of gene expression analysis techniques and is faced with explosive growth in the amount of data produced by these experiments. The creation and adoption of standardized programmatic interfaces is a crucial step in support of automated data exchange and interoperability among different gene expression data systems.

This RFP solicits proposals which define interfaces and services in support of array based gene expression data collection, management, retrieval, and analysis.

For further details 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.

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

CORBA facilities 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), CORBA services, and CORBA facilities.

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 CORBA services

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 CORBA services and include Naming, Events, LifeCycle, Persistent Object, Relationships, Externalization, Transactions, Concurrency Control, Licensing, Query, Properties, Security, Time, Collections, and Trading Services.

2.5 CORBA facilities

Common Facilities are interfaces for horizontal end-user-oriented facilities applicable to most domains. Adopted OMG Common Facilities are collectively called CORBA facilities 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 *CORBA services 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.

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.

In addition, submitters are responsible for making available 100 paper copies to attendees of the TF meeting immediately following a submission deadline. There are normally two such presentation meetings, one for the initial and one for the revised submissions.

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 than 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, CORBA services, and CORBA facilities 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 CORBA security 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.

6.0 Specific Requirements on Proposals

6.1 Problem Statement

The development of many new and evolving gene expression platforms and technologies (by both existing and emerging vendors and research organizations), combined with the immense volume of expression data produced by these processes, has resulted in a number of interoperability problems.

While the process and data handled by different systems is fundamentally the same, attempting to integrate gene expression data from multiple platforms and technologies is difficult at best.

In an effort to address this problem, a request is made for proposals defining a set of interfaces, data structures, and services which will allow gene expression systems to more readily exchange data. These standards are intended to form a common basis (framework) upon which more advanced services related to gene expression data can be built.

Specific problem areas related to gene expression data management which would benefit from interface standardization are: array design, experimental conditions, and data representation and retrieval. Object models supporting these and other related problem domains are needed which characterize salient attributes of each.

6.2 Scope of Proposals Sought

The scope of this RFP is limited to the definition of interfaces, data structures and object models in support of storage, retrieval and modification of gene expression information. The scope of this RFP does not extend to user interface or visualization services. Additionally, proposals should offer an appropriate level of granularity of design detail. Focus should be placed on interface definition rather than on implementation details. Discussion of internal data representation, for example, specific relational database schemas, is not appropriate. By contrast, discussion of an XMI compliant DTD intended for use as a portable datastructure is entirely appropriate.

6.3 Relationship to Existing OMG Specifications

In addition to the common CORBA Services (formal/98-12-09), submitters may wish to consider the applicability of newer OMG specifications:

- CORBA Components
- OMG Meta Object Facility
- OMG XML Metadata Interchange

Proposals should take into account current work, in particular LSR proposals for Biomolecular Sequence Analysis and Bibliographic Query Services, which may be approved by the time of submission.

6.4 Related Documents and Standards

Drug Target Validation and Identification of Secondary Drug Target Effects Using DNA Microarrays. *Nature Medicine* 4:1293-1301 (1998).

Gene Expression Informatics--It's All in Your Mine. *Nature Genetics* 21 (supplement):51-55 (1999).

Synthetic DNA Arrays. *Genetic Engineering (N Y)* 20:111-123 (1998).

6.5 Mandatory Requirements

6.5.1 The proposed interfaces shall provide retrieval functionality for array patterns and gene expression data independent of underlying implementation or storage format.

6.5.2 Interfaces shall specifically focus on array based hybridization events. (See 6.7.3)

6.5.3 At a minimum, the interfaces shall provide information about:

- Array patterns, including position and content of features
- Identities of reporters associated with a given feature, and the gene which that reporter is designed to report on
- Probe information and conditions (mobile phase)
- Hybridization conditions
- Expression levels for specific genes in a specific hybridization
- Normalization
- Gene expression clusters
- Array technology/design (focusing on immobile phase, not experimental protocol)

- Detection technology
- Replicate hybridizations
- Experimental paradigm (e.g., collection of hybridization events and relevant associations, such as time-series ordering)
- Experimental annotations

6.5.5 The interfaces shall also provide the ability to add links from expression data to other relevant data.

6.5.6 The proposal must include a glossary defining important terms and concepts used in the response. Names of interfaces, data structures, attributes, and methods should have precise meanings that have been generally agreed upon within the scientific research community. Where such general agreement does not exist, the proposal should clearly define these names in terms of the scientific concepts they represent.

6.6 Optional Requirements

6.6.1 The proposal may include UML diagrams as appropriate for “illustrative” purposes.

6.6.2 Where practical the proposed interface may supply additional information such as:

- Raw experimental data
- Data collection and processing parameters
- Pointers to external references / annotation
- Image data and intensity information
- Statistical summaries of experiments

6.6.3 Definition of one or more XMI compliant Document Type Definitions (DTD's) intended for use as self-describing data structures for encapsulation of hybridization, expression, and cluster data.

6.6.4 Where applicable, portions of the analysis machinery from LSR Biomolecular Sequence Analysis (lifesci/99-12-01) may be used.

6.7 Issues to be discussed

- 6.7.1 The proposal should discuss design decisions relating to the overall performance and efficiency of the interface.
- 6.7.2 As appropriate, the proposal should discuss any interface design decisions that would significantly affect a distributed system implementation.
- 6.7.3 Submitters should discuss applicability of their proposed approach to other expression technologies (proteomics/2D gels, SAGE).

6.8 Evaluation Criteria

In addition to the criteria listed in Section 5.2, the following criteria will be used in the evaluation of proposals:

- 6.8.1 Overall consistency of the design.
- 6.8.2 Completeness and ability to address the mandatory requirements.
- 6.8.3 Degree to which the optional requirements are addressed.
- 6.8.4 Scalability in terms of being able to support both a growing number of users and a growing number of data sets.
- 6.8.5 Flexible interface structure that can be integrated into various types of system architectures.
- 6.8.6 Granularity in the ability to access only the data of interest.
- 6.8.7 Extensibility in terms of the future specification of additional data categories.

6.9 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 step. The latest timetable can always be found in the Member Services section of OMG's Web page (URL <http://www.omg.org/>)

Event or Activity	Date
<i>Preparation of RFP by TF</i>	
<i>Approval of RFP by Architecture Board Review by TC ("Three week rule")</i>	
<i>TC votes to issue RFP</i>	<i>March 10, 2000</i>
<i>LOI to submit to RFP due</i>	<i>June 30, 2000</i>
<i>Initial submissions due</i>	<i>August 21, 2000</i>
<i>Voter registration closes</i>	<i>September 5, 2000</i>
<i>Initial submission presentations</i>	<i>September 11, 2000</i>
<i>Preliminary evaluation by TF</i>	
<i>Revised submissions due</i>	<i>February, 2001</i>
<i>Revised submission presentations</i>	<i>March, 2001</i>
<i>Final evaluation and selection by TF Recommendation to AB and TC</i>	
<i>Approval by Architecture Board Review by TC ("Three week rule")</i>	
<i>TC votes to recommend specifications</i>	<i>May, 2001</i>
<i>BOD votes to adopt specifications</i>	<i>June, 2001</i>