IST-2001-37652

Hard Real-time CORBA

Title

HRTC Draft Exploitation and Use Plan

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Reference IST37652/049
Date 2002-31-12
Release 0.1
Status Draft
Clearance Consortium

Partners

Universidad Politécnica de Madrid
Lunds Tekniska Högskola
Technische Universität Wien
SCILabs Ingenieros

Summary Sheet

IST Project 2001-37652
HRTC
Hard Real-time CORBA

HRTC Draft Exploitation and Use Plan

Abstract:

The purpose of this document is to explore into future exploitation of a hard real-time CORBA broker and to analyse possible strategies to get into the hard real-time systems market. This is a draft of the *"HRTC Exploitation and Use Plan"* deliverable which will be available by the end of the HRTC project.

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Release Sheet (1)

Release:	**0.1 Draft**
Date:	2002/31/12
Scope	Initial version
Sheets	All

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1 Introduction

HRTC is a project with a deep scientific-technical orientation dealing with some of the problems of constructing a hard real-time CORBA broker. A tool like a predictable broker is useful in many fields of application and can bring a significant advance in the way real-time systems are built. For this reason, we are taking in HRTC a first step towards the obtention of a hard real-time CORBA product. While building software for hard real-time, we want to do it based on a sound engineering approach. There are several reasons for this, being for the Consortium the most important one that of safety. This type of software artifact is usually embedded in critical systems where life or property maybe at risk in case of failure. With this requirement, it is clear that it is not feasible to build a commercial product in the lifespan of HRTC. Nevertheless, it is the objective of HRTC to show how CORBA is a suitable tool for building distributed-object control systems with hard timing constraints. In doing this, we are providing a hard real-time protocol specification for CORBA which will be used to influence the OMG's specifications for real-time distributed systems and we are also developing a first prototype implementation of a hard real-time transport for the ICa ORB which will be run on the two testbeds of the project.

While the objectives of the above paragraph are good from the scientific point of view, it is also necessary to have an understanding of what the society demands for this type of systems in order to be able to make a real product offering to the market. This objective is covered by this document and the "HRTC Exploitation and Use Plan" available by the end of the project.

1.1. Being in the market

Unfortunately, more important than having a good product is to be able to sell. Sometimes both things happen but this only occurs rarely. In the case of HRTC, the only industrial partner is SCILabs and the company is concerned about selling. Although being a small enterprise, SCILabs has demonstrated its capability to develop high quality products and its

software is running in a great variety of different industrial systems. In this and the final exploitation documents we want also to positively criticize ourselves in order to improve our selling process.

1.2. Reaching to users

We need to make "first things first". For a company, first thing is finding out what the world out there is demanding. This way we can avoid making unnecessary efforts in things that will not fit into the market. In this sense, we have devised a survey in the form of a questionnaire to be delivered to companies with a background in hard / soft real-time applications. We expect to collect answers, opinions and requirements and hopefully that information will be also useful even to modify our protocol specification to be more suitable for distributed control systems. In this task we depend on people of other companies and trying to get questionnaires fulfilled is not a simple task. We will prefer a few questionnaires answered by people interested in supplying us with information. For this reason we are contacting personally possible users to ask them if they would like to collaborate with us in this initiative.

2 Expected Project Results

From *Annex I – "Description of work"* , the following expected results must be reached.

1. An advance in know-how in distributed real-time object-oriented control systems. (Result 1)
2. A prototype implementation of a pluggable real-time protocol for an ORB. (Result 2)
3. A robot control testbed. (Result 3)
4. A process control testbed. (Result 4)
5. Enhancements of OMG CORBA specifications to deal with control systems. (Result 5)

We must ask ourselves how we can exploit those results either to build a commercial product or to be used as valuable information. In the following lines, exploitation hints for those results are given. Some may be self-evident while others are not.

1.3. Result 1

One of the main objectives of HRTC is to deal with the issue of building distributed-object real-time systems with hard timing constraints. In this project, we are confronting a way of building these systems based on a sound engineering approach. By using this approach we intend to build even large systems based in hard real-time CORBA that allow us to *compose* the temporal properties and behavior of the system. This is not a simple task and as an intrinsic result from this project is the fact that the know-how obtained while dealing with these problems will be reused in further systems. This know-how makes it possible to look at present and future developments from a different perspective and not just in the usual ad-hoc way of doing things when engineering real-time systems. The mere shift of technology, let us say from developing an application using TTP to using a real-time CORBA broker over TTP, has enormous consequences

regarding development cycle and associated costs. This is the first form in which project results will be exploited. Through achieved know-how it is possible to tackle future projects with *enterprise knowledge* and tools and not solely relying on the specific knowledge and experience of individuals.

1.4. Result 2

In order to validate the feasibility of the approach we need a software artifact that conforms, at least at the prototype level, with our plans and specifications. We can write very complex specifications regarding QoS control for hard timing constraints but it will be a useless effort if in practice there is not a simple way to provide an implementation. The best form to see if the effort is valid is to develop an implementation (a first prototype system) and make experiments with it. This shall be our *Proof of Concept.* This is also the way for OMG specs.

Developing a prototype implementation in such a reduced time is important in several ways. It is not necessary at the beginning to have a very complex implementation to test basic things and prototypes can get more complex as use cases are tested and errors (architecture, design, analysis and software errors) are corrected. Most important in this step is for us the finding of architecture and design errors. Implementation in this case is of background relevance. Nevertheless, we should consider the prototype implementation in this project as the first step towards building a commerical hard real-time pluggable transport framework for real-time CORBA. So Result 2 will be exploited as the basis for future developments in our pluggable transport architecture.

1.5. Results 3 and 4

These results are the testbed systems used to check the validity of our work. In the worst case it will help us stop following the wrong path and will have given us a unvaluable know-how on distributed control system design and implementation. In the best case they will show we have a significant improvement in the way systems are built (we are not expecting any major scientific break-through). There is a fundamental issue that must be clarified in the testbed applications; an identification of differences and advantages of the HRTC approach against existing methods of building real-time distributed systems must be carried out. In the case of differences or drawbacks we can use the information to

improve future developments whereas in the case of advantages the information can be exploited for instance commercially in a techical data comparison leaflet.

1.6. Result 5

Regarding the exploitation of the enhancements to existing OMG specifications the advantages are threefold. It is easy to understand that influencing the OMG specification process will improve the way other companies and developers look at SCILabs and to the partners of the Consortium. This is *propaganda*. Second is the know-how gained in the specification-writing process that can be exploited also in future developments as explained in Result 1. Third is a collective exploitation of the result. We are at least helping other members of OMG to think about issues of hard real-time and making them collaborate towards an specification which can be exploited by all of us.

3 Strengths, Weaknesses, Opportunities, Threats

In order to enter the market, build customers and position ourselves in an zone of profitable business, some introspection of our own organisation must be carried out. This section is an open section. What this means is that suggestions and counsel from experienced people are welcomed. The objective is to make a list of things to improve in the organisation and to collect guidelines on how to improve them. To carry out this introspection we have decided to follow a simple SWOT analysis. SWOT means Strengths, Weaknesses, Opportunities and Threats. We can use SWOT in two ways. First, it is posibble to carry out swot analysis in order to focus activities into areas where we are strong and where the greatest opportunities lie. The second way to look at SWOT is to find out our weaknesses and threats and to design ways to reduce them. We are more interested in this second form of SWOT analysis.

1.7. Strengths

In this section we should decide on those things that we do well or those things that are an advantage for us.

- **Know-how:** Our knowledge is an advantage over others who simply are mere integrators of the technology. We are also developers/manufacturers. This makes us confront in advance many problems the integrators have not found yet. This is an strength we have over others.
- **Open solutions:** The solution we plan to market is an open solution when compared to other exisiting products of the market. It relies it open well-known specifications and defines an extensible architecture with no scalability limitations. Further, there is no

vendor dependency as interoperability is a must and applications and systems can be migrated from one vendors' real-time CORBA framework to another with a reasonable amount of effort. This is much different that migrating a solution from TTP/C[1] to FlexRay[2] for example.

- **Being a local company:** There are not too many vendors of real-time CORBA brokers.In fact there are only two at this moment: OIS & Borland. At the same time, the market niche is not very big so it is not feasible to have very big organisations that span to several countries in a bulky way. This in our case is an advantage, at least in Spain, because we can provide direct support to customers and in their native language. Other companies also offer support but you have to add travel and accomodation expenses and the time it takes to get to the custommer's site.
- **Europe's tradition on sound technologies and development methods:** Advantage should be taken of the *European way of doing things*.

1.8. Weaknessess

The objective of this section is to recognise unpleasant truths as soon as possible, to find our own weaknesses and also to have an external point of view to learn what others perceive in us as weaknesses.

- **Limited resources:** To put this weakness in a plain Information Society language we can define it as as "*A physical agent cannot possess infinite resources. There are bounds on memory and processing capabilities. The limited computation resources available to the agent directly influence the types of processing it can afford to do.*" What this

[1] The *Time-Triggered Protocol (TTP)* is a real-time communication protocol for the inter-connection of electronic modules of distributed fault-tolerant real-time systems. TTP/C was originally intended to meet the requirements of SAE class C automotive applications. The current protocol specification is targeted at distributed real-time systems with strong requirements for safety, availability, and composability in the fields of automotive and aerospace electronics as well as industrial control.

[2] BMW, DaymlerChrysler, Motorola and Philips Semiconductors have joined their expertise to define the FlexRay communications protocol. FlexRay is a communication system that will support the needs of future in-car control application. At the core of the FlexRay system is the FlexRay protocol. The protocol provides flexibility and determinism by combining a scalable static and dynamic message transmission, incorporating the advantages of familiar synchronous and asynchronous protocols. The protocol also supports fault-tolerant clock synchronization via a global time base, collision-free bus access, guaranteed message latency, message oriented addressing via identifiers and scalable system fault-tolerance via the support of either single or dual channels.

means is that to market a product which really is not tangible for many users (a middleware product) you must rely on an organisation that conveys to customers the feeling that they are getting the best solutions for their problems. For that objective, a marketing organisation and everything that surrounds it (propaganda, demonstrations, presentations, etc.) is needed. Being a small SME we currently should seek for some kind of collaboration with other partners to overcome this problem.

- **Development time:** Development time for building a CORBA broker is also an issue. The CORBA specifications are complex and evolving. Just keeping up with the specifications is not an easy task. Further, when changes are made tests have to be performed and being the specification so ample it cannot be done in a short period of time. At the same time, it seems that there are CORBA features (in our opinion) which are of little use in the framework of industrial/embedded/control applications. This is an extra load of work just to say that broker X is fully compliant with the specification even that if in fact a larger amount of running code make the software more complex and then more prone to faults and errors.
- **CORBA is too complex:** From our point of view, building real-time CORBA on top of CORBA is a serious flaw of design. CORBA is a second or third system and it suffers of the "suitable-for everything" illness. Additonally, it has been designed taking in mind developer usability (i.e. the broker handles a lot of things which are transparent to the user/developer). When you build a real-time system usability at the developer's level is not as important as the capability of letting the developer configure the broker. Basically, this is what the real-time and other CORBA specifications offer, capability of configuration. Being CORBA a second system it has grown to a very big piece of software whereas for real-time and embedded applications we are usually close to the controlled process where resources are limited[3]. We have already heard many time embedded and real-time developers ask the question: *how many Kb just to say Hello with a CORBA application?* Undoubtedly, this is a tricky question because a plain CORBA application has far beyond more possibilities than just saying *hello* but the issue is that the people from industrial applications keep

[3] Nowadays, this is becoming less true as more computing power and memory is being delivered in smaller pieces of hardware. Nevertheless, while computing power and memory can be placed close to the process there is still the penalty of the economic cost. Resources are limited at the process level because it also is cheap to do it that way.

asking the question. This is not a simple problem to overcome because there is a conscience CORBA is not suitable for that type of applications.

1.9. Opportunities

Here we identify opportunities of business. We can find business opportunities by analysing technology trends we are aware of, changes in technology or market, social behaviour, changes in government policy, etc.

- **Demand of integration software:** In the following years the challenge for integration at all levels of business will continue. There are several reasons for this, globalization of business, mergers and acquisitions are some of them. We are in a time where ROI is exacted from software and the services they provide. The integration concept pervades all the business layers from bottom (sensor layer) to top (management layer). Hence, demand of integration is an opportunity if it ends up with economic benefit and easier to install and maintain systems.
- **Market niche:** It will not be possible to sell our products if we do not find a market niche were we can confront competition. The number of players in the real-time CORBA market is not very large but they are highly specialised. Fortunately, in the areas of application of real-time CORBA brokers there are niches where most companies do not enter. Application of real-time CORBA systems is specially interesting in five big areas:
  - Military and aerospace.
  - Telecommunications.
  - Consumer electronics.
  - Transportation.
  - Automation and process control.

  In some of them, it is easy to understand the reasons why CORBA has some success. The military business runs with public money and is one that fosters research and development (at least in the U.S.). This means that it is avid to try new solutions. We do not believe that CORBA has so much acceptance in the aerospace sector at least for critical systems. The telecommunications sector is one where almost every real-time CORBA player is present. The reason for this is that telecomm has been a very active area in the last years, lots of money have been invested in the business and the

huge demand of telecomm services has arisen also lots of problems to cope with the demand. In this position and with enough resources to try new solutions, the telecomm companies have found in real-time CORBA an innovative solution to some of their problems that at least deserves a try. At the same time, the real-time CORBA market players have found in these companies a place to prove their solutions work. In this sense, an important point to notice is that telecomm CORBA-based solutions may be economically critical but for sure they are not life or property critical. Regarding consumer electronics, CORBA has not had a deep impact. For the automation and process control market there are few CORBA solutions. The reasons for this are the economic impact failure may have in this environment as well as the danger for life and / or property in which failure might result. As CORBA matures (for instance, by being able to plug a deterministic protocol), this market niche becomes a possible choice for CORBA solutions. For us, this would an interesting niche to deploy our systems as it is a rather unexplored market by other competitors.

- **Partnership:** We should look at establishing long-term relationships with other industrial companies in order to provide integrated products, where the broker can be used for an specific task and also to benefit of the market presence and brand recognition of other companies. As a result for customers, they will be getting better products due to the improvement that results from mixing the knowledge of the partners. For us, an improvement of our business opportunities will be made. In order to select partners for strategic alliances, we should try to build them on our strengths, look for weakneness in other partners which are our strengths and viceversa.
- **Attention from competitors:** Currently, we are not bringing up attention from competitors. This can give us the opportunity to enter the market unnoticed and to gain market share before competitors react against us. The problem to turn this into an advantage is that a true technology advance must be made in order to compete with the players of the market. If we just offer real-time CORBA (even hard real-time) there is probably not a good chance to enter the market. This is so because *even if our systems are better,* the established companies *announce* they offer hard real-time (truth or not), their marketing and sales organisations are bigger than ours and their number of running systems is far greater than ours. As a consequence, to consider having small attention from competitors

an advantage we must offer something else, something that is not an easy objective for other competitors.

- **European competitors:** There are no companies selling real-time brokers from Europe and hence, there is an opportinity for a company selling a predictable brokering product that is not coming from the U.S.A. (this is a serious drawback of other brokers if we consider the critical role of these products in the applications).

1.10. Threats

It is necessary to gather the obstacles in front of us. What are the competitors doing? Are there any changes in the technology that might endanger our products? Are the requirements for our products changing?

Insufficient references: In order to be able to enter the market it is necessary to have references. A typical problem is that of deploying the first systems. In business, being young and not having references is sinonymous of being bad. This can be overcome by being led into the business by partners of more experience and recognition in the field. In any case, finding a competent and respected partner in the field is a major hurdle to any starting business.
Brand recognition: It is not possible to build brand recognition without references. What this means, is that it is not possible to do it without a certain amount of money for marketing purposes. Brand recognition is a matter of experience and of delivering good products and care for the customers. Marketing is crucial to build brand recognition and can be useful in the lifetime of the company but it will be a waste if there are not good products to back-up the impression marketing delivers.
Economic decline of the market: We must take into account economic decline of the market. Is the technology or products we offer mature? Is there a technology shift actually ocurring? The problem of integration will be a long standing problem partially due to the lack of widely accepted and used specifications and standards. Supporting this, there are also the economic stakes of different vendors (let's cite Microsoft® who is member of OMG, and we can imagine that only to twist OMG's work into its own benefit). Being the situation like this, decline of the market may not be a very big threat for the coming years.

4 User Survey

The User Survey is a *possible-user* research of hard real-time CORBA tools for the development of time critical distributed-object applications. It tries to identify present and future trends in hard real-time application development and how it will influence the technology evolution. It also tries to identify the state-of-the-art as well as the industry requirements to improve system construction and to define HRTC positioning with respect to actual and emerging industry needs. To carry out the User Survey several steps must be taken.

1. Design of a questionnaire.
2. Identification of companies to be interviewed.
3. Interviews
4. Interviews analysis.
5. Drafting of the final report.

It is not easy to get people fill a long questionnaire so we devised two types of questionnaires: a short version and a long version. We will try to fill the long questionnaire but if it not possible we will provide the short one which should take just five minutes to complete and offer the results of our enquiry to the interviewees if they fill out the long version questionnaire. The questionnaires can be found in Appendix A and B at the end of the document.

5 Companies to survey

It is important for us to know what the users demand. To learn what are the needs of real-time developers we have focused mainly in Spanish companies. The reason for this is that, if possible, interviews will be maintained personally (this makes geographic proximity important). Companies business and type of applications varies from automation and control, telecommunications, aerospace, etc. so it will be possible to address a wide range of real-time systems developers.

Telefónica: This is a privatedly owned company and the leading telecommunications company in the spanish and portuguese language markets. It is also one of the telecommunications leading companies of the world. Telefónica has more that 82 million customers and develops its main activity in 16 countries although the company has stakes in more than 50 countries. One datum that gives an idea of the size of the company is that it has more than 161,500 employees around the world.

Eliop: Founded in 1979, ELIOP is a Spanish medium size industrial enterprise with subsidiary companies in Turkey and Argentina. With 140 employees, 80 of them having a University degree, and a turnover of 12 million ECUs, ELIOP is very active in the domain of Information Technologies. ELIOP is a Hardware and Software Factory. Its products, entirely developed within the company, include Remote Terminal Units, for Telemeasurement and Telecontrol applications, large distributed Supervisory Control and Data Acquisition systems (SCADA) and also Computer Vision systems. These products are integrated in turn-key systems that the company sells in national and international Electricity, Transport, Gas, Petrol, Water, and Environment markets. ELIOP is offering innovative solutions for these markets not only in Spain, Europe and Mediterranean countries but competing with the most important international companies in the transportation and energy sectors (mainly from the USA). ELIOP is developing relevant projects in many Latin

America countries: Brasil, Colombia, Ecuador, Perú, Argentina, Paraguay, etc.

Alcatel Espacio: Alcatel Espacio is a subsidiary in Spain of Alcatel Space Industries. Since 1998, the company is developing subsystems and communications equipment for the platform and useful payload of satellites. For the year 2001 its income was of 26M€ with an international business of 63,3%. Alcatel Espacio employs 170 people of which 70% are university graduates.

Soluziona: Soluziona is a group of companies in which two of them are relevant for our interests: Soluziona Ingeniería and Soluziona Telecommuniactions. Soluziona Ingeniería was founded in 1989 as an engineering, services and consultancy company for Union Fenosa[4]. In recent years, Soluziona Ingeniería has expanded its activity to several areas. The most relevant are the following:

- Energy engineering.
- Civil engineering.
- Technology consultancy.
- Operation and maintenance.

Soluziona Ingeniería is interesting for us because they develop innovative cutting-edge solutions for the industry and it is a receptive company for new solutions to problems. The other company in the group is Soluziona Telecommunications. It is a company with 800 employees specialised in turn-key telecommunications projects. Its areas of activity range from pure communications systems to systems for security assurance to system operation and maintenance.

Indra: Indra is one of the information technology leading companies in Spain. It obtained 782,2M€ of net income in the year 2001. Indra develops its activity in three main lines of business: information technology (78% of business), simulation and automatic maintenance of systems and, military electronics equipment (22% of business). Thirty four per cent of Indra's activity comes from abroad Spain (for the year 2001) being present in more than forty countries.

[4] Union Fenosa is one the major electricity generators and distributors in Spain.

GMV: GMV is a technology developer for the aeropace and defense industries. Its activity is focused towards projects and systems with a high degree of research and development. GMV S.A. was founded in 1992 and has 267 workers. It is a privatedly owned company with a yearly revenue of 20M €.

CASA: Construcciones Aeronáuticas S.A. was the first spanish company in the aerospace industry. It was founded in 1923. In 1999 it joined EADS and its denomination is from then on EADS CASA. CASA develops its main activity in four areas: military transportation, Airbus, aeronautics and space industry. Around 80% of CASA business comes from other countries and 15% of its income is devoted to research and development. It currently employs more than 7000 people which in its main part are highly qualified technicians and engineers. The company has developed its activity in more than 50 different countries.

Espelsa: This is an spanish company member of the industrial division of GRUCYCSA (from the FCC holding). One of their divisions is that of Telecommunications Systems and Control. This division is specialised in high-tech turn-key projects. Among the areas of business of this division we can cite the following: Flight-mission plan systems, command and control systems, simulation and real-time simulation, training systems and consultancy.

Appendix A: User Questionnaire (Reduced)

I. GENERAL INFORMATION

Identification of Responder	
Name of Responder:	
Position of Responder:	
Email:	
Phone:	
Fax:	
Postal Address:	
Company Name:	
Organization Name:	
Number of employees:	

II. Real-Time Distributed Systems Information

1. Please, mark below which of the following situations are present or will be necessary on your developments

	Yes	No
Applications need to use distributed object infrastructures		
Applications use distributed data		
CPU charge is distributed among different hardware		
Users are distributed over different workstations		
Do you use any distributed software architecture?		
Do you know about CORBA?		
Do you use CORBA on any of your applications?		

2. In case you are not using CORBA, what are you using to implement the distributed application?

HRTC

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_____

3. Detail the types of distributed systems you are developing

	Yes	No
Soft Real-Time		
Hard Real-Time		
Workstation		
Embedded		

4. Answer the following questions:

	Yes	No
Does your system have only non critical real-time tasks?		
Does your system have only critical real-time tasks?		
Does your system have both critical (control, guidance, etc.) and not critical (communications, user interface, etc.) real-time task running in the same machine?		
Does your system use TCP/IP transport?		
Do/will you use any transport protocol(s) different from TCP/IP?		
Do you think it's interesting for an ORB to implement means to integrate multiple transport protocols between the different system agents?		
Will you need to be able to add your own user-provided transport protocol to the ORB transport protocols?		
Are you using / have you used Inter-ORB Interoperability Protocol (IIOP) to communicate between different ORBs?		
If you are not using real-time CORBA because IIOP is not a suitable protocol for your application, would you buy a real-time ORB if you could replace the transport layer for a deterministic one?		

5. If you have already replaced TCP/IP please detail what protocol, product and vendor have you replaced TCP/IP with

_____

_____

_____

_____

6. ***In case you are implementing real-time applications which are on your opinion the most critical features (predictability, operation latency, message sizes, etc…)***

7. ***Answer the following questions:***

	Yes	No
Are you using ORB for embedded systems?		
Do you think minimum CORBA is suitable for embedded applications?		
Is Real-Time CORBA is too complex to be used in embedded industrial applications?		
Are you willing to trade features of a CORBA broker for less memory footprint or more broker performance?		

If you answered affirmatively to the previous question, please specify what features will you drop from CORBA in embedded or real-time applications:

Feature	Reason

8. ***Please detail which hardware platforms you already have or you would need the ORB to be embedded in***

9. ***Please specify which attributes (memory footprint, fault tolerance, availability of services, configuration, support, languages, hardware platforms, options…) would influence your selection for a particular ORB for your application.***

Appendix B. User Questionnaire (Full)

I. GENERAL INFORMATION

Identification of Responder	
Company Name:	
Organization Name:	
Name of Responder:	
Position of Responder:	

Contact Info for Responder:	
Email:	
Phone:	
Fax:	
Postal Address:	

Number of employees of your company*			
1-50	51-250	251-500	>500

Market dimension					
Year	1999	2000	2001	2002	2003 (Est.)
Revenues					

Geographical Dimension*			
Regional	National	International	Global

Please specify: _____

_____

_____

* Place a mark over the selected answer

II. DISTRIBUTED SYSTEMS INFORMATION

10. Do you need to use distributed object infrastructures on your applications?

Yes	No

If the answer is affirmative, please describe below which of those situations are present or will be necessary on your developments

	Yes	No
Applications need to use distributed object infrastructures		
Applications use distributed data		
CPU charge is distributed among different hardware		
Users are distributed over different workstations		

11. Did you know there are software frameworks that ensure device and system inter-operability?

Yes	No

12. Do you use any of those software frameworks?

Yes	No

13. What did you know about CORBA?

Please detail the ORB known or used. If possible, please detail different releases and the execution environment (Operating System and CPU).

ORB / release	known	Used	Execution CPU	Execution OS

14. In case you are not using CORBA what are you using to implement the distributed application?

15. In case you are already a CORBA products user, please detail the types of systems where the product has been used

	Yes	No
Soft Real-Time		
Hard Real-Time		
Workstation		
Embedded		

16. Please write down the types of applications where the ORB products have been used:

17. Describe the number of objects connected by the ORB for your most complex application

CPU	Operating System	Number of objects

18. Describe the average number of methods and number of parameters per method for a typical object interface

Number of methods	Number of parameters

19. Are there any services you needed to develop for your application to improve or complement the included CORBA services?

Yes	No

Which are those services?

_____

_____

_____

_____

20. Are there any CORBA services or features you would like to have improved for your future developments?

Yes	No

In case affirmative, describe them below:

_____

_____

_____

_____

21. Do you need to inter-communicate hardware and/or electronics devices from different vendors.

Yes	No

22. Can those different devices be controlled by a non-proprietary protocol?

Yes	No

23. If your system integrates electronic devices or hardware from different vendors please answer the following questions

	Yes	No
Control of devices requires the use of vendor proprietary protocols		
There are devices which can be controlled by non-proprietary protocols		
The introduction of new devices from new manufacturers requires to implement SW to include support for new communications protocols		
The introduction of new devices makes the control system more difficult to manage		
Data is shared among electronic devices no matter the manufacturer		
Data is shared among electronic devices of the same manufacturer only		
Data is not shared among different electronic devices		

24. If you are not yet using CORBA, do you think CORBA products can be a good solution for your application?

Yes	No

If the answer is no, please, specify why:

_____

_____

_____

25. If you are using CORBA, are you satisfied with the way it works for your application?

Yes	No

If the answer is no, please, specify why:

_____

_____

_____

26. Are you using / have you used Inter-ORB Interoperability Protocol (IIOP) to communicate between different ORBs?

Yes	No

List the platforms /ORB used for IIOP communications

ORB(release #)	CPU	OS(release #)	Compiler	Nº of units

III. REAL-TIME

27. In case you are implementing real-time applications which of the following features do you think are most critical. Rate the features from 0-5, where 0 means the less critical and 5 most critical for the application

feature	Rating
Average operation latency	
Predictable operation latency	
ORB operation rates (invocations/sec)	
Typical Message Size	
Total volume of data transferred	

Complexity of interface datatypes	
Others	

Is there any other critical feature (specify):

_____

_____

_____

_____

28. Answer the following questions:

	Yes	No
Do you need a priority based queuing so client requests to the server can be answered accordingly to the priority?		
Do you need to have support for asynchronous message-based system architectures?		
Does your system have both critical (control, guidance, etc.) and not critical (communications, user interface, etc.) real-time task running in the same machine		
Does your system have only non critical real-time tasks?		
Does your system have only critical real-time tasks?		
Do you need your application to have persistent bindings between executions of the application?		
Do you expect objects to move to different locations during system operation?		
Are you satisfied with the real-time features and behavior of the product?		

29. Does your system use TCP/IP transport?

Yes	No

30. Do/will you use any transport protocol(s) different from TCP/IP?

Yes	No

31. What protocol(s) would you like to have TCP/IP replaced with?

_____

_____

HRTC

_____

_____

32. If you have already replaced TCP/IP:
What protocol have you replaced TCP/IP with?

_____

What product and vendor?

_____

Rank from 0 (less)-5 (most) how difficult it was the replacement
☐

33. Do you think it's interesting for an ORB to implement means to integrate multiple transport protocols between the different system agents?

Yes	No

34. Will you need to be able to add your own transport protocol (user-provided transport) to the ORB transport protocols?

Yes	No

35. If you are not using real-time CORBA because IIOP is not a suitable protocol for your application, would you buy a real-time ORB if you could replace the transport layer for a deterministic one?

Yes	No

IV. EMBEDDED SYSTEMS

36. Are you using ORB for embedded systems?

Yes	No

37. In case you are using embedded ORB, answer the next questions in the table below:

Which hardware platforms are ORBs embedded in?
What is the actual memory footprint of the core ORB and services on each platform?
What do you think it should be the desirable memory footprint?

Hardware device	Memory footprint	Desirable footprint

38. In case you are not using embedded ORB answer the next questions in the table below:

Which hardware platforms would you need ORB to be embedded in?
What do you think it should be the desirable memory footprint?
What would be the critical maximum footprint allowable on your system?

Hardware device	Desirable footprint	Maximumfootprint

39. Do you think minimum CORBA is suitable for embedded applications?

Yes	No

40. Are you willing to trade features of a CORBA broker for less memory footprint?

Yes	No

41. If you answered affirmatively to the previous question, please specify what features will you drop from CORBA in embedded or real-time applications?

Feature	Reason

42. Please choose the answers that most accurately describe your opinion about the following statements

	Strongly agree	Agree	Disagree	Strongly disagree	Don't Know
CORBA can reduce the cost of application new releases in the case that changes in the hardware or OS of the systems are needed					
It is critical for embedded systems to reduce as much as possible the memory footprint of the broker and its services.					
It is essential to bypass the marshalling / de-marshalling mechanism when objects are collocated in the same process					

Real-Time CORBA is too complex to be used in embedded industrial applications					
I only need in an ORB the real-time CORBA specification and a way to plug deterministic transports with hard timing constraints. I do not need any of the dynamic aspects of CORBA (dynamic invocation, dynamic any types, etc.)					

43. Please rate the following features from 0 (less) to 5 (most) or detail your necessities to indicate which of them are most relevant for an ORB to be useful for your developments

feature	Rating
Small memory footprint	
Performance (invocations/second)	
Throughput (volume of information/second)	
Reliability	
Fault tolerance	

feature	Specify
Availability of specific services	
Availability of specific configuration options	
Availability for hardware/OS platforms	
Support of specific language bindings	
Support for specific languages/compilers	
Support for specific development environments	

Others	