Project IST 2001-37652 HRTC

Hard Real-time CORBA

Six Monthly Control Report

HRTC-042

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Project Co-ordinator

Organisation: *Universidad Politécnica de Madrid*
Responsible person: *Ricardo Sanz*
Address: *Jose Gutierrez Abascal 2*
28006 Madrid, Spain
Phone: *+34 91 336 30 61*
Fax: *+34 91 336 30 10*
E-mail: *Ricardo.Sanz@etsii.upm.es*

Consortium

	Participant name	*Participant acronym*
1	*Universidad Politécnica de Madrid*	*UPM*
2	*Lund University*	*ULund*
3	*Technical University of Vienna*	*TUVienna*
4	*SCILabs Ingenieros S.L.*	*SCILabs*

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1. OVERVIEW OF PROGRESS DURING PERIOD, STATUS, ACHIEVEMENTS, DELAYS, MILESTONES, PROBLEMS (IF ANY) AND CORRECTIVE ACTIONS

The project has reached **six months**, i.e. the planned date of the **first milestone**. This milestone is described in the HRTC technical annex as:

> **Milestone MS1 (month 6):** *Domain Analysis of CORBA control systems and real-time protocols completed; Specification and Design of testbeds available.*

We have achieved most of the contents of the milestone (more details later) with the exception of the domain analysis that is still in draft status.

The official starting date of the project was 1 July 2002. Due to summer vacations the *de facto* starting point was 1 September 2002. As a result of this problem the entire project was delayed approx two months; after this initial delay the work has been progressing at a good pace and we have been able to catch up part of this delay during Sep-Dec putting some more effort than originally planned.

Some deliverables were rescheduled during this six month period due to this delay (See previous periodic report M3).

In the present status, the main achievements are as follows:

- All the partners share a common vision of the problem and have a clear understanding of the purpose and challenges of the testbeds.
- The testbeds' requirements have been specified and the design done.
- The equipment for the testbeds is almost procured and installed. Construction of the software has started.
- The contact with the OMG has been done with good results. They have approved the creation of the Control Systems Working Group in the scope of RTESS[1].

[1] Real-time, Embedded and Specialised Systems Platform Task Force.

2. MAIN ACTIVITIES AND ACHIEVEMENTS – SCIENTIFIC AND TECHNICAL PERFORMANCE

2.1 WP1 – WP leader: ULund (Karl-Erik Årzén)

The activities in WP1 have been concentrated on networked control loops. In a networked control loop, the control loop is closed over a communication network. The sensing, control calculations, and actuation are located at separate nodes connected by a network. Measurement signals are sent from the sensors to the controller over the network and control signals are sent from the controller to the actuator over the network. The network generates communication delays. Depending on which protocol is used the delays are more or less deterministic. A survey has been performed where different approaches for handling network delays have been identified. This includes stability and control performance issues. The material was presented as a tutorial at the Vienna meeting.

The domain analysis work within WP1 has been focused on the domain analysis of CORBA-based Control Systems. The work has been focused on collection of information and material necessary for the writing of deliverable D1.1 where the requirements for CORBA-based control systems will be identified.

Discussions have been held with ABB Automation Technology Products concerning the use of component techniques in ABB Control IT and which role hard real-time-enabled CORBA technology could play in industrial control systems, and also in the scope of systems being addressed by the OMG RTESS.

The second activity that currently is being performed in WP1 is the analysis and development of simulation tools to simulate networked control loops closed over CORBA, RT-CORBA, and Hard Real-Time CORBA. The co-simulation toolbox TrueTime[2] has been extended and can now simulate parts of TCP and a thin IIOP layer on top of Ethernet. The simulator currently supports simulation of a range of MAC protocols, including TDMA, Ethernet and CAN. In the near future the system will also be able to simulate the priority handling of RT-CORBA ORB as well as CORBA with deterministic transports based on both TDMA (TTP) and switched Ethernet. The simulator will be used within the virtual testbed version of the RCT testbed developed within WP3.

People at the OMG (inside the RTESS) recognized the need of enhancing the available real-time specifications to serve the purpose of building distributed systems where tight timing is crucial. Work has started in the preparation of a white paper to focus OMG activities (preparation of a RFI on control systems).

The work within WP1 suffers the delay due to the bad start of the project.

2.2 WP2 – WP leader: TUWien (Thomas Losert)

In this workpackage we have prepared seminars on real-time CORBA, pluggable protocols for CORBA and time-triggered protocols which are the basis for our hard real-time protocols. From these seminars the key issue for hard real-time protocols (the notion of time) and its absence from the real-time CORBA specifications is being discussed in the consortium and that will be shown in the final specifications for the pluggable protocols. Although out of the scope of the project, also the need of fault tolerance in the broker appeared as a fundamental issue if it is to be used for critical systems.

We have produced the deliverable D2.1 “Analysis of Protocols for Real-Time Control” which is a literature study regarding the available standards of communication protocols and their suitability for our purposes.

[2] A Matlab/Simulink-based toolbox that allow co-simulation of control systems with real-time kernels and communication networks.

Intensive email discussions have been held between the partners concerning how different real-time protocols could be used within CORBA and how real-time properties should be specified. We have started drafting the IDL for a transport layer that provides hard real-time capabilities. Lund is working on using scheduled switched Ethernet as a transport layer for HRT-CORBA and Vienna and SCI are working on the use of a time-triggered transport.

In order to be prepared for the development phase regarding hard real-time time protocols an Ethernet test environment has been set up by Lund and a TTP test environment has been installed by TUV and another by SCI and UPM.

A development environment has been set up to port the broker to the PowerPC platform. It is possible for the development environment to be modified depending on the tools and facilities provided by the TTTech equipment.

2.3 WP3 – WP leader: ULund (Klas Nilsson)

The work around the Robot Control Testbed (RCT) has been focused on finding the appropriate (for the purpose of the testbed)

1. network communication techniques considering the performance demands for robot servo control
2. embedded control processor boards
3. runtime platform suitable for execution of Hard RT software and providing integration with soft or non-RT software
4. investigation on how to provide a physically portable (that is virtual, for presentations and experiments at other sites) and executable specification/illustration of HRTC.
5. sensor-based (using external customer sensors) flexible control loops capturing the properties of component-based real-time networked control.

In task 3.1 (RCT Requirements Specification) the work has been focused on finding the appropriate network communication techniques considering the performance demands for robot servo control, and also for sensor-based (using external customer sensors) flexible control loops capturing the properties of component-based real-time networked control. The need for a testbed that is physically portable (i.e. *virtual*, for presentations and experiments at other sites) and executable specification/illustration of HRTC was also documented during the design phase. The final specifications in written form have been delayed, since T3.1 to T3.4 in practice are carried out more interleaved than planned and due to the initial delay of the project.

Task 3.2 (RCT Design) addressed the particular design aspects of the RCT wrt communications. It was found that switched and scheduled RT Ethernet comprises the most suitable communication technique, due to the performance demands from the low-level servo control. As embedded control processor boards, we will use PPC-G4 boards with PMC connections (from Motorola), plus dedicated processor types when motivated by local IO needs. To provide availability of the testbed from a software point of view, some efforts are spent on Java-based IDL and virtual robots using Java3D.

Visual multi-camera servoing of robot motions was identified as the best choice for testing component-based hard real-time control. The possibilities to get HRTC solutions built into a commercially available camera hardware, as well as having ORBs also in the built-in servo control of the robot arm, has been evaluated with promising results.

As CORBA experts SCILabs has contributed to this task defining what should the robot control testbed look like in order to be able to demonstrate the benefits of hard real-time CORBA in environment with hard timing constraints.

Task 3.3 (RCT Procurement): The complexity of the application in combination with the initially unknown properties of commercially available devices has implied that specifications of the testbed and interfaces have not been possible to determine without some procurement and initial prototyping. This resulted in the procurement started earlier than planned. Completion of the procurement including its documentation has, however, been delayed for finalization during beginning of Q3. The early testing, on the other hand, means that the implementation phase should proceed well, and the final deadlines are expected to be met.

2.4 WP4 – WP leader: UPM (Manuel Rodríguez)

T4.1 PCT Requirements Specification

The testbed is not only centred in stringent timing constraints but also in scalability and interconnection of heterogeneous plant equipment in a hard/soft real-time environment. The work in this testbed has been focused towards analysing and specifying an environment where an estimation of these benefits can be obtained. This means that the CORBA-based DCS implementation cases have been identified (in conjunction with task 1.1) and the derived requirements have been specified.

T4.2 PCT Design

The PCT Design has been fully completed based on the requirements specifications (deliverable 4.1). The design is such that the PCT mimics a plant control system. Therefore, PCT is essentially a redundant network where components are connected. The hybrid characteristic of current industrial control systems, with distinct networks at different levels, is intentionally eliminated to test the viability of a flat network in control environments.

Work has been focused on devising the set of scenarios to perform on the PCT. The experiments identified for these scenarios are:

1. Single control loop
2. Legacy system integration
3. Simulation components integration
4. Sequence of events generation
5. Traffic capacity test
6. Concurrent access
7. Response to faults

In the tests, the behavior of the system is monitored to judge whether the system complies with the requirements. Notice that in monitoring, testing is used for finding failures or their absence. Debugging (finding the error that cause the failures) is out of the scope of this work.

T4.3 PCT Procurement

A document (D4.3) describing the equipment required to build the Process Control Testbed (PCT) based on its design (D4.2) has been elaborated completing the existing one. Based on the design and the experiments to perform new equipment is required (GPS and analog I/O cards). All the equipment has been received and installed except some components of the cluster and the recently identified needs.

Task 4.4 Non HRTP PCT Implementation.

This task has been initiated. We have been deciding what simple process fits to the needs of the PCT. The process has been built and some CORBA nodes have been developed. Currently the work is focused on the first experiment “Single control loop”.

2.5 WP5 - WP leader: SCILabs (Miguel Segarra)

T5.1 Dissemination Planning: During the first quarter of the project a first release of the dissemination plan document was made. A new release of D5.1 “Dissemination Plan” has been made in this quarter to make small changes into the document. A presentation was made (Dec 13, 2002) at the Chemical Engineering Department of the Massachusetts Institute of Technology (Cambridge, Ma., USA) in order to present the CORBA technology for real-time and to rise the awareness of this type of technology for process control.

T5.2 OMG Standardization: Regarding OMG standardisation work, the Consortium attended during this quarter to the OMG Technical meeting held in Washington DC (USA) from November 18 to November 22, 2002. The objective of the meeting for the consortium was to

foster the work towards specifications that allow us to build controllers based on CORBA technology. To achieve this, the most specific objective of this meeting was to propose the creation of an OMG Working Group to address the topic of Control Systems Engineering. As a result of this work, the Consortium was chartered along with people from Mercury Computer Systems and Lockheed-Martin Aeronautics to write the draft charter for the working group which was presented on 21 November, 2002 to the RTESS plenary meeting. At this moment, there is a group of about 20 people interested in working in this OMG group.

T5.3 Publications: This task is not due yet as there are no project results to be published.

T5.4 HRTC Web site: The HRTC web site is currently running and it is used mostly to exchange private data among the partners. The site will also help to disseminate the project results once publications and public documents are released. For instance, the project flyer designed for the Helsinki OMG meeting can be accessed via the HRTC web site.

T5.5 Exploitation and Use Planning: The leader for this task is SCILabs. Regarding this task, D5.5 “Draft Exploitation and Use Plan” has been released. The document reviews the expected project results and how they will be exploited by SCILabs. Also, a SWOT analysis is made in order to find better ways to market a product based in HRTC after the project. An interesting contribution of this document is the elaboration of a questionnaire for distributed real-time systems developers. We also contacted people for IST OCERA in order to find out their results regarding real-time systems development. After talking to a participant in this project, we are more convinced that using a personal approach is better to get the questionnaires filled. We have already contacted several companies in order to fill the survey and we expect to have the results available for D5.6 “Exploitation and Use Plan”. Also, D5.5 identifies real-time/control systems developer companies which are being contacted for the survey.

2.6 WP6 – WP leader: UPM (Ricardo Sanz)

The management and coordination work has consisted mainly in the preparation of meetings, elaboration of management documents, coordination of activities, deliverable handling and funds transfer.

As was commented at the very beginning, we have had not a very good start due to summer time but the project is progressing at a fast pace now.

The Kick-off Meeting (only the management committee) was organized in Barcelona in July as the only possible solution due to work and holidays constraints of the people involved (the IFAC World Congress was the context for this meeting).

From September 11th to September 13th the first Plenary Meeting has been held in Vienna. The main topics have been: a) tutorials to align knowledge about the major topics of this project: CORBA, process control, and real-time systems, b) clarification of testbeds and equipment selection and c) organization of standardization and dissemination activities.

3. KEY EVENTS DURING THE REPORTING PERIOD

3.1 Events directly related/funded by HRTC

Event	**Dates/ Duration**	**Location**	**Purpose/Justification/Major Outcome** (this section should be detailed, if appropriate)	**Project Participants**
Kick-off meeting	23/07/2002	Barcelona (Spain)	First meeting of the management committee in order to coordinate the project activities.	SCILabs (Segarra), UPM (Sanz), Lund(Arzen), TUWien (Kopetz)
1st Plenary Meeting	11/09/2002 - 13/09/2002	Vienna (Austria)	First Plenary Meeting. Objectives: technology tutorials, hardware specification, robot and control testbeds definitions and, project procedures. Alignment of knowledge about CORBA, process control, and real-time systems	SCILabs (Segarra, Clavijo), UPM (Sanz, Galán, Rodríguez), Lund(Arzen, Nilsson, Anderson, Blomdell), TUWien (Kopetz, Losert, Obermeister)
OMG Technical Meeting	Sep. 29 - Oct. 4	Helsinki	Initial contacts to establish a "Control Systems Working Group" within the Real-Time, Embedded, and Specialized Systems Platform Task Force (RTESS PTF) of the OMG. The proposal is well received and a major contribution/activity is planned for the next OMG Meeting in Washington.	UPM (Sanz), TUWien (Losert)
Washington OMG Technical Meeting	Nov 18-22, 2002	Washington DC (USA)	OMG Technical meeting/Disseminate HRTC work inside OMG/Promotion of a CORBA Control System Working Group inside OMG	UPM (Ricardo Sanz) TUVienna (Thomas Losert)
Presentation of HRTC at MIT	Dec 13, 2002	Cambridge, Ma. (USA)	Presentation of Hard Real-Time CORBA for Process Control/Introduction of the technology to people from chemical engineering and process control departments/Awareness of CORBA technology for process control and chemical process	UPM (Santos Galán)

3.2 Participation in other events (not funded by HRTC)

Event	**Date**	**Location**	**Purpose/Justification/Major Outcome** (this section should be detailed, if appropriate)	**Project Participants**
IFAC World Congress	July 22-26 2002	Barcelona (Spain)	Activities and contents of strong interest to HRTC. New organization of a working group on computing and control (Chairman Sanz, Co-chairmen Arzen and Pereira)	UPM(Sanz), Lund(Arzen)
RTAS workshop	Sept. 24-27, 2002	San Jose (USA)	Activities and contents of strong interest to HRTC due to the focus of the workshop on real-time systems.	Lund(Arzen)
NEXT TTA	October 4, 2002	Grenoble, France	Workshop on the Integration of Event-Triggered and Time-Triggered Services	TUV(Kopetz), UPM(Sanz)

4. LIST OF DELIVERABLES

The deliverables listed in the following table are the deliverables that appear in the contract and the deliverables that appear as generic collections (5.2.x and 5.3.x) in the contract. In the 5.2 collection, only those documents that are considered OMG documents (i.e. downloadable from the OMG website) are listed here.

Id	Deliverable Name	Lead	Original Due	Revised Due	Actual Date	Status of EC Review
D5.1	Dissemination Plan	UPM	M1/MS1	M3/MS1	M3	Pending
D6.1	Project Management Manual	UPM	M1/MS1	M3/MS1	M3	Pending
D3.1	RCT Requirements specification	ULUND	M2/MS1	M4/MS1	M6	Pending
D4.1	PCT Requirements specification	UPM	M2/MS1	M4/MS1	M6	Pending
D6.2	Evaluation Plan	UPM	M2/MS1	M5/MS1	M5	Pending
D2.1	Protocols for Real-time Control	TUWien	M3/MS1	M5/MS1	M6	Pending
D3.2	RCT Design	ULUND	M3/MS1	M5/MS1	M6	Pending
D4.2	PCT Design	UPM	M3/MS1	M5/MS1	MC	Pending
D6.3	Quarterly Report M3	UPM	M3/MS1	M5/MS1	M5	Pending
D3.3	RCT Procurement	ULUND	M5/MS1	M7/MS1	Draft	Pending
D4.3	PCT Procurement	UPM	M5/MS1	M7/MS1	M6	Pending
D1.1	CCS Domain Analysis	ULUND	M6/MS1	M8/MS1	Draft	Pending
D2.2	HRT Protocol Specification	SCILabs	M6/MS1	M8/MS1	Draft	Pending
D5.5	Draft Exploitation and Use Plan	SCILabs	M6/MS1	M6/MS1	M6	Pending
D6.4	Periodic Report M6	UPM	M6/MS1	M6/MS1	M6	Pending
D1.2	CCS Domain Architectures	UPM	M9/MS1	M9/MS2		Pending
D2.3	HRT Protocol	SCILabs	M9/MS2	M9/MS2		Pending
D3.4	Non HRTP RCT Implementation	ULUND	M9/MS2	M9/MS2		Pending
D4.4	Non HRTP PCT Implementation	UPM	M9/MS2	M9/MS2		Pending
D6.5	Quarterly Report M9	UPM	M9/MS2	M9/MS2		Pending
D3.5	HRTP RCT implementation	ULUND	M11/MS3	M11/MS3		Pending
D4.5	HRTP PCT implementation	UPM	M11/MS3	M11/MS3		Pending
D1.3	CCS Engineering Handbook	UPM	M12/MS3	M12/MS3		Pending
D3.6	RCT Testing	ULUND	M12/MS3	M12/MS3		Pending
D3.7	RCT Documentation	ULUND	M12/MS3	M12/MS3		Pending
D4.6	PCT Testing	UPM	M12/MS3	M12/MS3		Pending
D3.7	PCT Documentation	UPM	M12/MS3	M12/MS3		Pending
D5.4	HRTC Project Web Page	SCILabs	M12/MS3	M12/MS3		Pending
D5.6	Exploitation and Use Plan	SCILabs	M12/MS3	M12/MS3		Pending
D6.6	Periodic Report M12	UPM	M12/MS3	M12/MS3		Pending
D6.7	Project Evaluation Report	UPM	M12/MS3	M12/MS3		Pending
D6.8	Final Report	UPM	M12/MS3	M12/MS3		Pending
Deliverables not specified in the contract						
D5.2.1	HRTC Overview OMG realtime/02-10-02	UPM	-	-	M3	Pending
D5.2.2	Hard Real Time CORBA OMG realtime/02-10-04	TUV	-	-	M3	Pending

D5.2.3	IST HRTC Toward HRT CORBA OMG realtime/02-11-09	UPM	-	-	M5	Pending
D5.2.4	OMG CSWG Charter OMG realtime/02-11-23	UPM	-	-	M5	Pending
D5.3.1	HRTC Flyer	All	-	-	M3	Pending
D5.3.2	ADCHEM Paper	UPM	-	-	M6	Pending

5. MANAGEMENT, CO-ORDINATION , RESOURCES

5.1 Project Co-ordination and management activities/issues

As this is a small project (in size and in time) the management committee has decided not to overload people with excessive management and coordination activities. During this period we have had two meetings and all the activity is coordinated by means of e-mail through two mail lists: management (only management committee) and general (both management and development).

The collaboration between partners is quite good and we have had no major problem during this period.

5.2 Project Workplan and proposed changes

5.2.1 Deviations from original plans

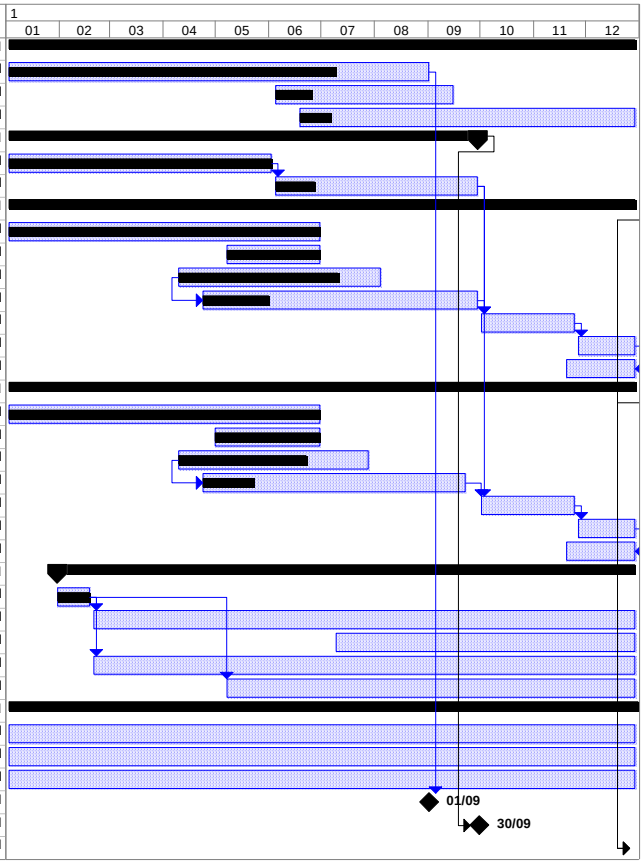
The main deviation came from the delay due to summer holidays. We have coped with some of the delay but not completely.

As mentioned in the first quarterly report, the requirement specification and the design of the testbeds had to be carried out more in parallel than planned, and also in parallel with the procurement. The main reason was that technical limitations of state-of-the-art hardware, needed for modular and open high performance manipulator or process control, were unclear. Some hardware has therefore been borrowed for testing in the case of the RCT, to avoid specifying something that is not possible to accomplish, and the procurement therefore has been delayed.

5.2.2 New workplan

This is the modified Gantt chart that reflects the delay due to the commented problem. The proposed changes do affect partially MS1 milestone content (mainly content related with WP1, i.e. D1.1).

Id	Nombre de tarea	Duración
1	**1 CORBA Control Systems**	**260 d**
2	1.1 CCS Domain Analysis	175 d
3	1.2 CCS Domain Architectures	75 d
4	1.3 CCS Engineering Process	140 d
5	**2 HRT Protocols**	**195 d**
6	2.1 Protocols for Real-time Control	110 d
7	2.2 HRT Pluggable CORBA Protocols	85 d
8	**3 Test 1: Robot Control**	**260 d**
9	3.1 RCT Requirements specification	130 d
10	3.2 RCT Design	40 d
11	3.3 RCT Procurement	85 d
12	3.4 Non HRTP RCT Implementation	115 d
13	3.5 HRTP RCT implementation	40 d
14	3.6 RCT Testing	25 d
15	3.7 RCT Documentation	30 d
16	**4 Test 2: Process Control**	**260 d**
17	4.1 PCT Requirements specification	130 d
18	4.2 PCT Design	45 d
19	4.3 PCT Procurement	80 d
20	4.4 Non HRTP PCT Implementation	110 d
21	4.5 HRTP PCT implementation	40 d
22	4.6 PCT Testing	25 d
23	4.7 PCT Documentation	30 d
24	**5 Dissemination**	**240 d**
25	5.1 Dissemination Planning	15 d
26	5.2 OMG Standardization	225 d
27	5.3 Publications	125 d
28	5.4 HRTC Web site	225 d
29	5.5 Exploitation and Use Planning	170 d
30	**6 Management**	**260 d**
31	6.1 Project Coordination and Reporting	260 d
32	6.2 Project Management	260 d
33	6.3 Project Assessment	260 d
34	6.4 Milestone 1: Domain Analysis	0 d
35	6.5 Milestone 2: HRT Protocols	0 d
36	6.6 Milestone 3: Final Results	0 d



5.3 List of items to be amended in Contract incl. Annex 1

5.3.1 Contract

No changes.

5.3.2 Annex 1 17/05/2002

We're using the Annex 1 as included in the HRTC contract: ***Annex 1 (IST-2001-37652) Version V1, 17/05/2002.***

Due to the delay, the due date of some deliverables (end date of some tasks) has changed from what was specified in the contract. The new proposed timing is detailed in the Gantt diagram and the table of deliverables.

5.4 Effort consumption

The first table is included for reference purposes. It refers to the first reporting period (M0-M3). The second table includes the effort spent during the rest (M3-M6) of the six month period reported in this report.

5.4.1 M0-M3

	WP1 (PMs)	WP2 (PMs)	WP3 (PMs)	WP4 (PMs)	WP5 (PMs)	WP6 (PMs)	**Total used in Reporting Period (PMs)**	Planned Reporting Period (PMs)	Number of hours per month/ months per year		**Total used accum. (PMs)**	Total Planned in Annex 1 (PMs)
UPM	1	0	0.2	2	1	1.5	**5.7**	9.5	135/12		**5.7**	46
ULUND	1.5	0.5	2	0	0	0.5	**4.5**	9.25	140/12		**4.5**	37
TU Vienna	0	1.34	0.13	0	0.465	0.645	**2.58**	3.375	133,33/12		**2.58**	13,5
SCILabs	0	1	0.5	0.5	0.75	0.25	**3,00**	4.875	140/12		**3,00**	19
Total Used in Period	2.5	2.84	2.83	2.5	2.215	2.895	**15.78**					
Planned in Period	6	5	5	5	2,5	3,5		27				
	WP1 (PMs)	WP2 (PMs)	WP3 (PMs)	WP4 (PMs)	WP5 (PMs)	WP6 (PMs)						
Total used accumulated	2.5	2.84	2.83	2.5	2.215	2.895					**15.78**	
Total planned (Annex 1)	31	13	20	22	17.5	12						115.5

5.4.2 M3-M6

	WP1 (PMs)	WP2 (PMs)	WP3 (PMs)	WP4 (PMs)	WP5 (PMs)	WP6 (PMs)	**Total used in Reporting Period (PMs)**	Planned Reporting Period (PMs)	Number of hours per month/ months per year		**Total used accum. (PMs)**	Total Planned in Annex 1 (PMs)
UPM	2	0.5	0.0	8	1	1.5	**13**	12	135/12		**18.7**	46
ULUND	5	0.5	3	0	0	0.5	**9**	9.25	140/12		**13.5**	37
TU Vienna	0.5	2.1	0	0.2	0.2	0.5	**3.5**	3.375	133,33/12		**6.08**	13,5
SCILabs	0	1.5	1	1	1.25	0.25	**5**	4.875	140/10		**8**	19
Total Used in Period	7.5	4.6	4	9.2	2.45	2.75	**30.5**					
Planned in Period	10.5	3	4	5	2,5	2.75		28.75				
	WP1 (PMs)	WP2 (PMs)	WP3 (PMs)	WP4 (PMs)	WP5 (PMs)	WP6 (PMs)						
Total used accumulated	10	7.24	6.83	11.7	4.665	5.645					**46.28**	
Total planned (Annex 1)	31	13	20	22	17.5	12						115.5

Deviations from plan

There is no major deviation in relation with the effort planned. Deviations from the plan are due to the problem mentioned of initial reduced dedication due to summer holidays and the need of doing the work in the testbeds in a way more parallel than planned.

5.5 Summary of partner contributions during the reporting period

5.5.1 UPM

The activities of UPM have been focused in four areas: a) Domain analysis of CORBA-based process control systems, where the major issues in distributed process control –related to CORBA- to be addressed in the testbed have been identified; b) Specification, design, procurement and implementation of the PCT c) Dissemination and standardization activities and d) Management and coordination of the project.

5.5.2 ULUND

The main contributions from ULUND have concerned the study of networked control loops, the simulation of CORBA-based control systems, CCS domain analysis, robot testbed specification, and scheduled switched Ethernet as a deterministic plug-in transport layer in HRT-CORBA.

The domain and requirements analysis of CORBA-based control systems is on-going. The simulation tool for CORBA-based networked control systems is under completion. The requirements and the design of the RCT have been written, and the procurement is ongoing. Intensive discussion concerning real-time protocol properties and interfaces has been done.

As was commented before, due to technical reasons, T3.1 to T3.4 in practice are carried out more interleaved than planned.

5.5.3 TUWien

TUWien has done the analysis of communication protocols for real-time control. Based on the results of this analysis drafting the IDL for a real-time transport has been started.

They organized the HRTC September Meeting in Vienna and attended the OMG Technical Meetings in Helsinki and Washington to establish the Control Systems.

5.5.4 SCILabs

Elaboration of two talks on real-time CORBA and pluggable CORBA protocols, the setting-up of a development environment for the broker (to be modified depending on the target hardware).

SCILabs has provided expertise and feedback in the requirements specification of both testbeds and has led the Dissemination and Exploitation workpackage in which a dissemination plan has been produced, the OMG standardization process has begun, an informational flyer of the project has been elaborated in collaboration with UPM and a first version of the project web site has been set up. Regarding the exploitation and use plan, SCILabs has begun to contact companies in the field to gather information.

SCILabs has contributed also in this period to the revision of D2.1 “RT Protocols for Real - Time Control”. We have also written a draft document of the D2.2 “HRT Protocol Specification” in which an analysis of available frameworks for pluggable protocols is made. This document, in draft status, is to be completed with an IDL description of the HRT protocol. Additionally, a port of the ICa broker has been done to the Linux platform in order to be used in the test-beds. We have also led WP5 Dissemination and have completed D5.5 “Exploitation and Use Plan” in which a questionnaire of real-time developer companies has been included. We have also contacted several companies in order to get their help to fill the survey.

5.6 Implementation of the previous Review Recommendations

There are no previous review and therefore no recommendations.

6. EXPLOITATION / TECHNOLOGY IMPLEMENTATION PLAN

SCILabs is contacting several companies in order to find out their interests in tools like a hard real-time broker and their current development practices for hard real-time. A questionnaire will be forwarded to each of these companies to collect the information.

The document corresponding to D5.5 “Draft Exploitation and Use Plan” has been released.