



Universidad de Oviedo

Planificación y presupuesto del Trabajo Fin de Máster realizado por

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para la obtención del título de

Máster en Ingeniería de Automatización e Informática Industrial

**Upgrade of the UNICOS Time Stamp Push Protocol
(TSPP) broker to include ultra-fast events**

Junio 2017

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1. Introduction

1.1. Project identification

- Title: Upgrade of the UNICOS Time Stamp Push Protocol (TSPP) broker to include ultra-fast events
- Author: Manuel Vázquez Muñiz
- Advisor: Víctor Manuel González Suárez
- Co-advisor: Jerónimo Ortolá Vidal
- Date: June 2017
- Organization: CERN

1.2. Project overview

The current project objective is to solve the issue of the fast interlocks (or ultra-fast events) by improving the Time Stamp Push Protocol (TSPP) used to communicate the control and supervision layers. This protocol is used in the framework UNICOS, and this framework should also be modified as to support this new feature.

With this new feature, the organization will be able to fulfil the requirements of the internal clients who need this capability as to have a proper use of their equipment.

1.3. Document overview

This document explains the schedule of the different tasks needed to deliver this feature and the economical expenses needed for the generation and testing of the code and the documentation of it.

2.Planning

This section describes the tasks developed during the project and the time spent to accomplish them.

The break between the 21st of December 2016 and the 9th of January 2017 is due to the CERN end of year closure of the laboratory [1].

2.1. Task schedule

The project development has been estimated in a lapse of 5 months, with another month of contract dedicated to other tasks in the organization and to test the new feature in case of errors, as well as to complete the documentation of the project for the Master thesis dissertation.

The tasks description and their start and end date are shown in Table 1.

Table 1. Task schedule of the project

Task name	Start date	End date
Analysis of the UNICOS framework	01/09/2016	26/09/2016
Analysis of the TSPP protocol	15/09/2016	26/09/2016
Research for possible solutions	27/09/2016	03/10/2016
Modification of the TSPP protocol	04/10/2016	12/10/2016
Modification of the SCL code	04/10/2016	14/11/2016
Testing and measurement	08/11/2016	14/11/2016
Analysis of the Templates	15/11/2016	21/11/2016
Modification of the Templates	22/11/2016	21/12/2016
Analysis of the Plugin code	09/01/2017	11/01/2017
Modification of the Plugin code	12/01/2017	18/01/2017
Validation	19/01/2017	25/01/2017
Documentation elaboration	26/01/2017	31/01/2017

2.2. Gantt diagram

Fig. 1 shows the time devoted to the different tasks of the project.

ID	Task Name	Start	Finish	Duration	Sep 2016				Oct 2016				Nov 2016				Dec 2016				Jan 2017			
					4/9	11/9	18/9	25/9	2/10	9/10	16/10	23/10	30/10	6/11	13/11	20/11	27/11	4/12	11/12	18/12	25/12	1/1	8/1	15/1
1	Analysis of the UNICOS framework	01/09/2016	26/09/2016	3w 3d	█																			
2	Analysis of the TSPP protocol	15/09/2016	26/09/2016	1w 3d	█																			
3	Research for possible solutions	27/09/2016	03/10/2016	1w					█															
4	Modification of the TSPP protocol	04/10/2016	12/10/2016	1w 2d					█															
5	Modification of the SCL code	04/10/2016	14/11/2016	6w					█															
6	Testing and measurement	08/11/2016	14/11/2016	1w									█											
7	Analysis of the Templates	15/11/2016	21/11/2016	1w									█											
8	Modification of the Templates	22/11/2016	21/12/2016	4w 2d									█											
9	Analysis of the Plugin code	09/01/2017	11/01/2017	3d													█							
10	Modification of the Plugin code	12/01/2017	18/01/2017	1w													█							
11	Validation	19/01/2017	25/01/2017	1w													█							
12	Documentation elaboration	26/01/2017	31/01/2017	4d													█							

Fig. 1. Gantt diagram of the project

3. Budget

This section describes the human, software and hardware resources used in the project, and their prices.

3.1. Unitary Prices

The prices shown are obtained from different currencies (euros, dollars and swiss francs), and changed to the euro currency with the exchange ratio as of 18th January 2017.

Since some of the resources are no longer available, the prices shown may not correspond to the original ones for which the resources were acquired.

3.1.1. Hardware Resources

The hardware resources used for the project, the amount of them and their unitary price are shown in Table 2.

Table 2. Unitary prices of hardware resources

ID	Description	Measurement Units	Amount	Unitary price (euros)
HW01	Personal Computer	Units	1	1,175.64
HW02	Monitor	Units	2	747.88
HW03	CPU 317-2 PN/DP	Units	1	2,649.00
HW04	Memory card	Units	1	340.00
HW05	Rack	Units	1	39.99
HW06	Digital input module	Units	1	498.00
HW07	Digital output module	Units	1	250.00
HW08	Pin connector 20 pin	Units	2	27.80

3.1.2. Software Resources

The software resources used for the project, the amount of them and their unitary prices are shown in Table 3.

Table 3. Unitary prices of software resources

ID	Description	Measurement Units	Amount	Unitary price (euros)
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SW01	Microsoft Windows 7 Professional	Units	1	160.80
SW02	Siemens Step 7 V5.5	Units	1	337.31
SW03	Siemens WinCC OA V3.11	Units	1	385.00
SW04	Microsoft Visio Professional 2013	Units	1	425.99
SW05	Microsoft Office 2013	Units	1	344.99

3.1.3. Human Resources

The human resources needed for the project, the amount of hours and the price per hour are shown in Table 4.

Table 4. Unitary prices of human resources

ID	Description	Measurement Units	Amount	Unitary price (euros)
HU01	Automation Engineer	Hours	800	21.30
HU02	Director/Supervisor	Hours	40	63.30

3.2. Partial budget

Due to the possible reutilization of the hardware and software resources, its value has been reduced considering the expected resources life time and the use time in the project.

3.2.1. Hardware resources

Table 5. Partial budget for hardware resources

ID	Description	Price (euros)	Cost (euros)	Life time	Use time
HW01	Personal Computer	1,175.64	122.47	4 years	5 months
HW02	Monitor	1,495.76	155.81	4 years	5 months
HW03	CPU 317-2 PN/DP	2,649.00	110.38	10 years	5 months
HW04	Memory card	340.00	35.42	4 years	5 months
HW05	Rack	39.99	0.84	20 years	5 months
HW06	Digital input module	498.00	20.75	10 years	5 months
HW07	Digital output module	250.00	10.42	10 years	5 months
HW08	Pin connector 20 pin	55.60	1.16	20 years	5 months

3.2.2. Software resources

Table 6. Partial budget for software resources

ID	Description	Price (euros)	Cost (euros)	Life time	Use time
SW01	Microsoft Windows 7	160.80	16.75	4 years	5 months
SW02	Siemens Step 7 V5.5	337.31	35.14	4 years	5 months
SW03	Siemens WinCC OA V3.11	385.00	53.48	3 years	5 months
SW04	Microsoft Visio Professional 2013	425.99	44.38	4 years	5 months
SW05	Microsoft Office 2013	344.99	35.94	4 years	5 months

3.2.3. Human resources

Table 7. Partial budget for human resources

ID	Description	Cost (euros)
HU01	Automation Engineer	17,040
HU02	Director/Supervisor	2,532

3.3. Final budget

A resume of the previous chapters and the sum of the partial prices is shown in Table 8.

Table 8. Final budget

Chapter	Price (euros)
Hardware Resources	457.25
Software Resources	185.69
Human Resources	19,572.00
Total	20,214.94

	Euros
Material execution budget	20,214.94
Industrial benefit (0%)	0.00
Overhead (15%)	3,032.25
VAT (0%)	0.00
Total budget	23,247.19

Since the current project is executed by a non-profit international organization, the industrial benefit and the value added taxes (VAT) included in the budget are considered as 0%. The final budget is estimated in twenty three thousand, two hundred and forty seven euros and nineteen cents.

Geneva, 19th January 2017



Signed by: Manuel Vázquez Muñiz (NIF 53558324-H)

4.Acronyms

CERN	European Organization for Nuclear Research
UNICOS	Unified Industrial Control Systems
UAB	UNICOS Application Builder
CPC	Continuous Process Control
BE-ICS-PCS	Beams department, Industrial Controls and Safety group, Process Control Systems Section
FI	Fast Interlock
TSPP	Time Stamp Push Protocol
PLC	Programmable Logic Controller
ST	Structured Text
SCL	Structured Control Language
OB	Organization Block
FB	Function Block
FC	Function
SFB	Standard Function Block
SFC	Standard Function
PII	Peripheral Image of Inputs
PIO/PIQ	Peripheral Image of Outputs
IEC	International Electrotechnical Commission
SCADA	Supervisory Control And Data Acquisition
WINCC OA	WinCC Open Architecture
DI	Digital Input
DA	Digital Alarm
DO	Digital Output
PCO	Process Control Object

5. Documents of the project

The current project has been elaborated in multiple documents that describe a certain part of the project.

1. Report: General description of the project. Objectives and conditions for its test. Conclusion from the realization of the project and future works.
2. Planning and budget: Schedule of the different tasks that compound the project and price of the resources used.
3. Step 7 programmer manual: Modifications to the code of the UNICOS applications to support the fast interlock capability. Results obtained from these modifications.
4. Templates programmer manual: Modifications to the code of the templates and of the plugin used to generate the SCL files used in the PLC.
5. User manual: Steps to create a fast interlock UNICOS application.
6. Templates code: Modified template files inside the resources folder of an application and of the UAB plugin.
7. Datasheets: Datasheets of the devices used to research and test the solution for the fast interlocks issue.

Attachments.

1. Attachment 1: Fast interlock application example.

6. Bibliography

- [1] CERN, “CERN official holidays 2016,” 30 November 2015. [Online]. Available: <https://home.cern/cern-people/cern-official-holidays-2016>. [Accessed 19 January 2017].