



UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

Escola de Doctorat

INFORME D'ACREDITACIÓ DEL PROGRAMA DE DOCTORAT (IAPD)

ARQUITECTURA DE COMPUTADORS

**Escola de Doctorat
Universitat Politècnica de Catalunya**

Aprovat per Junta d'Escola, el 23 de febrer de 2018

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1. Context

Dades identificadores

Universitat	Universitat Politècnica de Catalunya
Nom del programa de doctorat	Arquitectura de Computadors
Codi RUCT	5600076
Enllaç web	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
Coordinació del programa	Xavier Masip Bruin, PhD Program Coordinator
Dades de contacte	93 8967280, xmasip@ac.upc.edu

Responsables de l'elaboració de l'IAPD	Xavier Masip Bruin. PhD Program Coordinator
Òrgan responsable d'aprovació	PhD Academic Board. Computer Architecture Dpt. Board
Data d'aprovació de l'informe	December 18, 2017

Presentació del Programa de Doctorat

The Computer Architecture PhD program is stemmed from and thus is given and endorsed by the Computer Architecture Program. This program, with a large track record from many years, is intended to train researchers with a high level of international competences in the different thematic areas covered by the program, thus including aspects related to computer architecture, operative systems and computer networks. It is worth highlighting the fact that students are usually supervised by professors linked to the Computer Architecture Department, but the program is enriched with the strong relationship the program (and its professors), has with research centers intensely linked to the Department, such as the Barcelona Supercomputing Center (BSC) or the Equipo de Seguridad para la Coordinación de Emergencias en Redes Telemáticas (esCERT), all playing a very remarkable role in co-advising PhD students.

The Computer Architecture PhD program was awarded with the "Mención de Calidad del Ministerio de Educación, Cultura y Deporte", (BOE, May 28 2003) reference MCD2003-00126 (extended for academic courses 2004/05, 2005/06, 2006/07, 2007/08, 2008/09 and 2009/10), as well as with the "Mención de Excelencia" for academic courses 2011/12, 2012/13 and 2013/14 (MEE2011-0361). In this section we introduce the three conceptual pillars supporting the PhD program:

1) The need for the PhD program and its fit in the context

Computer architecture, in its broader perspective thus including the implicit aspects of the computer architecture itself, but also aspects related to operating systems, execution environments, communications and computer networks, is a widely mentioned research environment in current documents describing the research challenges (R + D + I) delivered by the different administrations, both nationally and internationally. In addition, although the need for the subject matter addressed in this doctoral program is conceptually supported by these R + D + I strategies, it is necessary to mention which is the academic environment both nationally and internationally in which the program of Doctorate is placed, in order to emphasize more, if possible the alignment of the content and objectives of the program with the context to validate the need for such a program.

1.A) Academic context at national/international level:

The thematic area of ICT and specifically the "Computer Sciences" in which the PhD Program is framed, is of relevant importance not only in Spain but beyond our borders. As notable references can be cited:

- The most prestigious universities worldwide in the field are Stanford, Berkeley, Illinois at Urbana-Champaign and Wisconsin-Madison. All these institutions have doctorate programs in "Computer Sciences", being Computer Architecture courses indispensable requisites both for the access to the doctorate program and for obtaining the degree.
- There are several PhD programs in Computer Architecture (also called Computer Engineering) in the Spanish state. To mention some, we can mention the Universities of Seville, Granada, Cordoba, Alicante, Extremadura, Murcia, Malaga, Santander, Zaragoza, Complutense of Madrid and the UAB in Bellaterra. This broad development of programs in the area gives an unequivocal sample of the need for such studies

1.B) Integration with the R+D+I strategies

There are four administrative areas that can be cited to validate the perfect integration and coherence of the objectives of the doctoral program with the defined R + D + I strategies, from highest to lowest level, Europe, Spain, Catalonia and the UPC itself. In a European environment, ICT (Information and Communication Technologies) have a highly notable significance. This relevance has been highlighted in the various updates of the H2020 framework program. Aspects mentioned in the definition of the program objectives, such as "more integration of functionalities on chips", "multi-core architectures", "more intelligent and smart environments" or "Future Internet", are all considered as thematic objectives in the program of doctorate. In a national context, in the document " Plan Estatal de Investigación Científica y Técnica y de Innovación 2017-2020", aspects related to ICT are considered in different sectors, where the doctoral program is perfectly aligned to, such as challenges 4 or 7, with a clear focus on the management, processing, transport and storage of data and services, efficiency of infrastructures and information networks. In an autonomic environment, the doctoral program is aligned with the challenges defined in the research and innovation plan of the Generalitat de Catalunya, in aspects such as telecommunications infrastructures, security or the attraction of creative, scientific and entrepreneurial talent. Finally, the UPC, in its eagerness to pursue a research model aiming at a valorization of the produced knowledge and technologies, defines a series of objectives, organized in strategic axes, clearly affecting the way research is articulated, with the aim of increasing the worldwide positioning of both the doctorate studies and the global research at the UPC. To this end, the UPC reorganized its PhD programs offer into 5 priority areas of expertise, one of which refers to ICT engineering, which includes the information and communication technology area. These technological areas are fed by doctoral programs in each field, being the Computer Architecture PhD Program one of the most relevant.

1.C) Program guarantees

The guarantees on the viability, quality and necessity of the doctoral program is evidenced by the following factors, all of them clearly referenced and contained in the doctoral program object of this document:

- PhD program supported by a department with 8 highly active research groups in research activities (national / international) and with solid interactions with the industrial sector in the thematic areas of the PhD program, which guarantees a complete synergy with the state of the art of the research topics addressed in the reserach

challenges addressed by the different PhD students.

- PhD program supported by a department with clear links and solid relationship with relevant research centers, all of them a reference at an international level.
- Training courses and seminars given by professors external to the PhD program and of very important international relevance (Prof. Ian Akyildiz, Prof. Yale N. Patt, Prof. David Kaeli, Prof. Dimitrios Nikolopoulos, Prof. Rudolf Eigenmann, Prof. Ioannis Tomkos, Prof. Paolo Faraboschi, Prof. Marina Birberstein, Prof. Israel Koren, Prof. Jean C. Walrand, etc.)

2) Training and research capacities of the DAC

The Computer Architecture PhD Program is part of the teaching activities carried out by the professors of the Computer Architecture Department (DAC). However, a doctoral program should not be considered just as a simple training activity in the teaching field, but must provide students with their own scientific skills and closely related to what is known as the ability to investigate. For this reason, doctoral programs must feed on as many research activities carried out in the department endorsing the program, to converge training and research activities in the same educational product for the student. This is the main objective of the doctoral program of the DAC, the training of researchers with an international competence in the areas covered by the program, that is, computer architecture, operating systems, communications and computer networks.

The Computer Architecture PhD program has a long history since its inception. Formally, the current Department of Computer Architecture (DAC) was created in 1987, in application of the LRU, on University departments and the Statutes of the UPC (1985). Since its inception, the department was a multi-center since it taught not only at the Facultat d'Informàtica de Barcelona (FIB), but also at the Escola Tècnica Superior d'Enginyeria de Telecomunicacions de Barcelona (ETSETB). The activity of the DAC was increasing in the next years, including teaching activities in different schools of the UPC. The DAC currently teaches undergraduate degrees offered by the Facultat d'Informàtica de Barcelona (FIB), the Escola Tècnica Superior d'Enginyeria de Telecomunicacions de Barcelona (ETSETB), the Escola d'Enginyeria de Telecomunicació i Aerospace de Castelldefels (EETAC) and the Escola Politècnica Superior d'Enginyeria de Vilanova i la Geltrú (EPSEVG). The DAC also teaches postgraduate teaching in its own doctorate program, in an Erasmus Mundus PhD program (Erasmus Mundus Joint Doctorate in Distributed Computing), in the Computer Architecture Networks and Systems (CANS) Master's degree and in other master's degrees (MTI in the FIB, MINT in the ETSETB, MAST in the EETAC and MUESAI in the EPSEVG).

As mentioned above, the doctoral program of the DAC is supported not only by the students' own training activities but also by the research activities that feed this training. It is for this reason that a high level of quality in the research carried out by the department as well as a good interaction both with the industrial sector and with different research centers facilitate the quality of the PhD degree. The DAC presents a solid activity in this sense with a wide participation in the gestation of pioneering research centers worldwide. In this line it should be taken into account that in October 1991 the activities of the European Center for Parallelism of Barcelona (CEPBA) began. This center integrated the experience in parallel computing of the DAC and the supercomputing needs of other departments of the UPC and the related companies. The CEPBA was the necessary element so that in 2005 several professors of the DAC intervened decisively in the creation and installation of the "Barcelona Supercomputing Center" in Barcelona. DAC professor Mateo Valero was appointed director of the "Barcelona Supercomputing Center - National Center for Supercomputing" (BSC-CNS). The center's facilities house the Marenostrum supercomputer, which became the most powerful in Europe and the fifth most powerful in the world.

The research activity is channeled in the form of 8 active research lines, which show a very significant research activity based on contracts with companies (HP, IBM, Intel, CISCO, ...), competitive national (Plan Nacional, Avanza, ...), and international research projects (several framework programs of the EU) as well as agreements with several institutions.

As shown, the DAC presents a solid and stable research activity, which has been producing better results both in volume and quality over the years, and which guarantees the proximity of doctoral studies towards the needs of society, at the level of training of future doctors, the needs of the industry, as well as the teaching and training capacity of the professors involved in the program.

3) Obtained Results

Although the results obtained in the doctoral program are deeply analyzed later in this document, this section briefly cites the main parameters that justify while ensuring the success and quality of the doctoral program. Thus, taking into account that from 1980 to December 2017, 257 doctoral theses have been read in the DAC, the most significant data of recent years can be summarized as: i) entry offer: 40; theses defended total / half year (last 3 years): 13.5; average duration of the theses: 4 years.

Finally, it is important to mention also that several of the graduates in the doctoral program are currently working in research centers, universities and companies of high international relevance, which gives a tangible sample of the quality of the studies carried out and the competence acquired. by the graduates. Thus, for example, we can mention Tokyo Institute of Technology, Rutgers University, Computer Associates (CA), Univ. Of Texas at Austin, BSC, Cisco, Google, Intel, VmWare, nVIDIA, etc.

Agents que han participat en l'elaboració de l'informe d'acreditació (Comitè d'Avaluació Interna)

Nom i Cognoms	Càrrec	Col·lectiu
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Xavi Masip Bruin	PhD Program Coordinator	PDI
M ^a .Jesus Compains	DAC Administration Head	PAS
Joana Munuera	PhD Program Support	PAS
Eduard Ayguadé	Member of the Ad-Hoc Accreditation Board	PDI
José M ^a . Barceló	Member of the Ad-Hoc Accreditation Board	PDI
Agustín Fernández	Member of the Ad-Hoc Accreditation Board	PDI
Enric Morancho	Member of the Ad-Hoc Accreditation Board	PDI
Josep Llosa	Member of the Ad-Hoc Accreditation Board and	PDI
Alejandro Gómez	Member of the Ad-Hoc Accreditation Board	Student
Diego Marron	Member of the Ad-Hoc Accreditation Board	Student

Procés d'elaboració de l'informe d'acreditació

This accreditation report has been made based on an internal review process in order to guarantee not only the veracity of the data provided but also the accuracy and possibility of implementation of the analysis carried out based on the data obtained. It should be noted that the purpose of this report is not only to show data, particularly the most relevant ones related to the doctoral program, but also to provide evidence of the improvements to be made after an arduous analysis of the data collected from the recent years of the program. However, it should also be mentioned that although a large amount of data and internal procedures of the program (regulation, results, etc.) have been analyzed, there are some data that, for various reasons are not as precise as they should be. This is partly due to two facts that deserve to be mentioned. Without emphasizing an established order, the first is a little involvement of graduates in the provision of data to the program, which does not facilitate the ability to analyze results once they have graduated. The second refers to the ability to conduct surveys for undergraduates and professors. These data are obtained through a procedure established by the Doctoral School that is still sensitive to improvements.

The different government boards of the Computer Architecture Department that have participated in the preparation of this report are the Administration of the Department, the Academic Board of the Doctorate Program, the Ad-hoc Accreditation Board, the Board of the Department and the GPAQ (Planning, Assessment and Quality Committee) of the UPC.

The procedure by which this accreditation report has been generated is based on the following actions:

- 1) **Action 1:** Data collection by the administrative staff of the doctoral program with the support of the administrative team of the Department of Computer Architecture and with the timely help of the UPC Doctoral School and when it has been explicitly necessary from the department professors as well.
Date: Up to November 7, 2017
- 2) **Action 2:** The Academic Board of the Doctoral Program delivered a first draft of the accreditation report including all the data provided by the previous procedure, and with a first assessment and quantification thereof
Date: November 8, 2017
- 3) **Action 3:** The first draft of the accreditation report has been delivered to the Ad-hoc Board for the preparation of the report, set on the basis of an extension of the Academic Board of the Program. This Board has deepened in the analysis of the obtained data, mainly in the elaboration of the plan of improvements
Date: November 13, 2017
- 4) **Action 4:** Once the document has been internally agreed on by the Ad-hoc Board, it has been forwarded to the GPAQ of the UPC for a technical and quality analysis.
Date: November 20, 2017
- 5) **Action 5:** The modifications proposed by the GPAQ have been discussed by the Academic Board of the Doctoral Program, making the changes and modifications according to the recommendations received.
Date: December 4, 2017
- 6) **Action 6:** The document resulting from the modifications made by the Academic Board of the Doctoral Program has been submitted to the Ad-hoc Board, which has suggested additional changes in the document.
Date: December 5, 2017 (changes edited in the document by the Program Coordinator in Decenber 7)
- 7) **Action 7:** Document in delivered in public exhibition for the review phase. The public exhibition consisted of the

following actions: i) the document publicly uploaded to the website of the doctoral program; ii) document sent to the heads of the different research groups linked to the doctoral program; iii) document sent to the GPAQ. The result of this public exposure focused on the correction of some data and structure of the document.

Date: From December 11 up to December 14, 2017

- 8) Action 8: Final edition and approval by the Ad-hoc Board

Date: December 15, 2017

- 9) Action 9: Report approved by the Department Board in November 18, 2017

Date: December 18, 2017

- 10) Action 10: Accreditation Report submitted

Date: December 19, 2017

2. Valoració de l'assoliment dels estàndards

ESTÀNDARD 1: QUALITAT DEL PROGRAMA FORMATIU

El disseny del programa (línies de recerca, perfil de competències i activitats formatives) està actualitzat segons els requisits de la disciplina i respon al nivell formatiu requerit en el MECES.

1.1 El programa disposa de mecanismes per garantir que el perfil d'ingrés dels doctorands és adequat i el seu nombre és coherent amb les característiques i la distribució de les línies de recerca del programa i el nombre de places ofertes.

The number of places offered in the program, as it is quantified in the presentation section of this document, is adjusted to the number of students admitted, which shows a correct dimensioning of the program, both in the admission and in the offered students supervision capacity of the program. In fact, the fact that the number of students admitted is noticeably lower than the number of places offered is not observed as a problem, assuming that the intention of admission is presented dynamically in each academic year, and assuming instead that situating this dynamism in the offer of admission is not feasible. In fact, the parameter used to decide the offer of places refers to the ability of the program to absorb students in a satisfactory manner. The correct dimensioning is checked by the absence of problems in the admission and relatively tight offer and demand figures. In addition, in the recent years the volume of admitted is increasingly closer to the offer, which indicates the health of the program. However, and in order to maintain a good relation between offer and demand closer to the real capacity of the program, the continuous monitoring and analysis of both values is proposed as a plan of action to react against any potential deviation as well as to adjust the capacity of students supervision in case of any substantial variation. This action will be carried out by the CAPD annually.

It is also important to mention a change in the distribution of research groups linked to the doctoral program, with respect to the information included in both the verification process and the monitoring process. The change refers to the DMAG research group (<http://dmag.ac.upc.edu/>, which in the information presented in the monitoring report presented a number of doctoral students in the period 2012-2015, equal to zero). This group has not requested the official renewal of the SGR, joining its members the UPC research group IMP (<http://imp.upc.edu/>). It should also be mentioned that the ICARUS research group presents a low number of students due to its high orientation to technology transfer, and therefore less involvement in the recruitment of PhD students.

On the other hand, regarding the admission to the program and the adequacy of the profile of the candidates to the needs of the program for its correct development, it is necessary to highlight the fact that the Computer Architecture program shows a great thematic diversity (computation, systems, networks, etc.), which together with the high involvement of various research centers in the program, motivates an important decision element in the admission process to focus on the recommendation obtained from a professor linked to the program willing to supervise the candidate's thesis work. Thus, in order to guarantee the adequate profile of the candidates in the admission process in a highly heterogeneous academic environment, the program has modified its internal admission procedure, establishing in short, the requirements for admission divided into two sections, formal and conceptual, being the first excluding the second.

Formal Analysis (FA):

Are those requirements linked to present the requirements established in the administrative regulation of the program for any student who requests admission, that focus on both having the necessary level of studies and the accounting of the required credits. Failure to comply with this section is a direct reason for not to be accepted in the PhD program.

Conceptual Analysis (CA):

This section includes the aspects related to the level of knowledge of the candidates, their abilities, as well as the potential interest of a research group in the work to be carried out by the candidate. The requirements in this section are the following:

- TI: Degree in engineering related to the subject of the program, especially in computer science or telecommunications. However, the program also admits, in exceptional cases profiles in other areas, such as Bachelor of Mathematics and Master in Computer Science
- GD: Having a research group linked to the program, as well as a director for the thesis work
- BA: Experience or explicit knowledge in the area, for example, based on the completion of a master's thesis in the thematic area, past collaborations with a group in the work area, etc.
- IN: Extensive knowledge of English, supported by globally accepted tests (TOEFL, etc.)
- FI: Possible financing of the student, either in origin or by the group in which the thesis work would be carried out.

As a result, the admission will be considered based on the result of the following expression:

$$\text{Admission: } FA*(0,1TI+0,4GD+0,1BA+0,2IN+0,2FI)$$

1.2 El programa disposa de mecanismes adequats de supervisió dels doctorands i, si escau, de les activitats formatives.

The doctorate program establishes two different follow-up processes, the first for the monitoring of the student's training activities and the second for the annual monitoring of the student's progress within the program.

The first refers to the scenario in which the student is required to complement their training with training complements. In this case, the doctoral program, through its Academic Board and in complete alignment with the candidate's thesis director, assigns a certain number of credits to the student at the time of admission, being these of inescapable compliance to support his/her future development in the program. These training complements will be selected among the various subjects of the various research Masters linked to the doctoral program. The process of monitoring these training activities is based on two significant points, the formal evaluation by the training complements individually, based on the correct fulfillment of the activities of each subject, and the evaluation of the thesis supervisor, which will monitor the level of knowledge acquired by the student in the particular subject.

The second refers to the student's annual evaluation, which is based on three parallel strategies. The first focuses on the student himself, who is required to update the Research Plan document on an annual basis, with detailed and updated information on objectives, methodology, planning, up to the defense of the thesis and including the results obtained to date. The generation of this document is extremely useful for the student himself given that it gives him a global vision of his/her evolution in the thesis, being him/herself who can detect in the first person an inadequate deviation, and therefore the first one that can take actions in this regard in line with his/her thesis director. The second focuses on the monitoring process by the thesis director. The director himself defines this process, with no explicit indication from the Academic Board (CAPD). The assignment of this task to the director without explicit mandatory support from the CAPD does not attest any additional risk due to the long experience in the thesis direction of most of the professors of the program. In addition, for those professors with less experience and, as indicated in the current doctoral regulation, the director with less experience is assigned a co-director with long experience, who guarantees the correct development of this phase of student supervision. In this process, the thesis supervisor, in addition to the continuous monitoring of the student, must annually generate a report of the student's activity, which is kept in the DAD (Document of Activities of the Doctoral Student). The third strategy focuses on the annual evaluation by the CAPD of the activity of each doctoral student. For this purpose, the CAPD meets physically every July to analyze the information in the DAD (Document of Activities of the Doctoral Student) regarding the progress of the doctorate, gathering any additional information that may be delivered by the thesis director. It should be explicitly mentioned that the three strategies imply and require the participation of all participants involved the elaboration of the thesis, (student, director and CAPD) as well as a diverse set of monitoring and evaluation periods.

Defined by regulation, the first evaluation of the Research Plan will be carried out by a Committee constituted by three members as defined in the internal regulation of the Doctorate Program, which in public defense will evaluate the capacity and quality of the proposed Research Plan. Subsequent annual evaluations of the Research Plan will not require a public defense and will be analyzed by a procedure defined internally by the doctoral program. Thus, although the first evaluation is completely regulated in terms and procedure by the existing doctoral regulation, subsequent evaluations referring to its procedure are attributable to the doctoral program and its own evaluation mechanisms. The doctoral program focuses the evaluation on the Academic Board of the Doctorate Program (CAPD) and establishes a clear and determined process for the evaluation of the doctorate's annual activity based on the following points:

- Verification of the monitoring report by the thesis supervisor (may result in either a positive or negative report) and sent to the CAPD
- Analysis of the actual progress shown by the student according to the presented update of the Research Plan, in terms of contribution to the state of the art in the form of publications, patents, mobilities, attendance to courses or seminars or participation in projects. Each of these terms is evaluated in a binary (non-quantitative) manner, with the CAPD estimating a positive report in the case of meeting with one of the terms considered..

The CAPD will issue the decision supported with a report that can be used by the student to facilitate their training within the doctorate program.

In the case of negative evaluation, two actions are carried out, a report justifying the progress delivered by the doctoral student and a meeting with the thesis director to obtain information about the student's progress. At said meeting, and with the student's report, the CAPD will analyze the justifications and make a decision based on the arguments presented and the expected progress by the doctoral student in the following academic year. In the case that the CAPD issues a positive report, the initial negative report, does not condition subsequent evaluations. In the case of a negative final evaluation by the CAPD, the doctoral student will be given 3 months to revert the situation and present a new progress report according to the thesis supervisor. After three months, the CAPD will evaluate the progress again. In the event of a negative report, the doctoral student will not be allowed to continue in the doctoral program.

It is also necessary to mention that according to the recommendations made in the verification report, and in order to improve the quality of the program, the competencies of the graduates, the suitability of the candidates to the program, and ultimately a greater attraction of talent to the program, the program, through the different research groups, fosters the generation of training contracts for local master students, to first encourage their interest in research, strengthen their knowledge in a specific thematic area and finally facilitate the integration within the research group in which the student would carry out the doctoral thesis. In this way, it is granted that the doctoral candidate when he/she decides to do his/her doctoral studies, is already integrated into the group in which he/she will work, knowing the dynamics and projects in which the group works, will have a thesis director, and In short, will minimize the adaptation period, which will undoubtedly translate into an optimization of time that will allow an immediate dedication to the research activities.

1.3 El programa recull les modificacions que s'han introduït en el títol.

The doctoral program in the recent years has made a series of important improvements in order to optimize the available resources, guaranteeing a high quality of training for its PhD students. The improvements made, described in the corresponding sections of this document, focus on the following aspects:

- Modifications in the supervision of students: A strategy has been defined for monitoring students from their beginnings in the program up to obtaining their doctorate, based on a specific annual monitoring of the evolution of the work carried out and an objective plan for encouraging the use of the work done. To this end, both the evaluation parameters and the department responsible for their implementation have been specified, in order to favor the objectivity of the overall evaluation. The updated procedure is described in detail in section 1.2 of this document
- Modifications in the admission: The admission procedure has been defined clearly and concisely, both qualitatively and quantitatively, with a detailed definition of the overall procedure from its formal aspects to the technical ones. In this way, admission becomes a transparent process, the result of which is highly methodical and therefore objective. The updated procedure is described in detail in section 1.1 of this document.
- Regulation update: All processes related to the doctorate program have been described in a clear and objective way to adopt the changes in the regulation. All information is public on the doctoral program page. The status of the modifications made are described in detail in the Improvement Plan of this document
- Modifications aimed at better administrative support: From the Computer Architecture Department, all the necessary support to the program has been provided, both at the technical level (assistance to training courses, implementation of new tools generated by the UPC for the management of the doctorate , etc.), as at a personal level, assigning 1 full-time person and one part-time person to manage the program. The status of the modifications made are described in detail in the Improvement Plan of this document.

ESTÀNDARD 2: PERTINÈNCIA DE LA INFORMACIÓ PÚBLICA

S'informa de manera adequada tots els grups d'interès sobre les característiques del programa de doctorat i sobre els processos de gestió que en garanteixen la qualitat.

2.1 Es publica informació veraç, completa i actualitzada sobre les característiques del programa de doctorat, el seu desenvolupament operatiu i els resultats assolits.

We detail below, in a synthetic way, each of the contents of our doctoral program that are made public on some of the official websites of the UPC. We attach for each of them the link (URL) where the relevant information can be found. Whether it is in-progress or in an elaboration stage, this is indicated as a point to improve and, therefore, it is an improvement action to be taken into account.

TABLE 1.1. Content of public information on the operational development of doctoral programs

DIMENSION	CONTENT	PUBLIC LOCATION
Access to the PhD program	Program objectives	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Admission profile	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Graduate profile	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Places offered	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Registration period and process	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Requisites and admission criteria	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Director and tutor assignment process	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Training complements	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Grants	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
Organization	Research groups	https://www.ac.upc.edu/ca/recerca/grups-de-recerca
	Training activities	http://www.ac.upc.edu/ca/docencia/doctorat/ActualizacioinfowebDACatala.pdf
	Process for elaborating and defending the Research Plan	http://www.ac.upc.edu/ca/docencia/doctorat/ActualizacioinfowebDACatala.pdf
Operative planning	Academic regulation	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Duration of studies and permanence	http://www.ac.upc.edu/ca/docencia/doctorat/programa-de-doctorat-arquitectura-de-computadors
	Academic calendar	http://doctorat.upc.edu/en/registration/academic-calendar
	Training resources: labs, library, other	Although this content is not public, the Intranet of the Computer Architecture Department includes the necessary information about the resources available to doctoral students. Information on global resources can also be obtained on the Doctoral School website.
	Internal quality guarantees system	https://qpaq.upc.edu/ldades/indicador.asp?index=doctorat
Professors	Program professors	The list of professors of the program, explicitly and jointly, is not made public anywhere. Although this fact is proposed as an action of the improvement plan resulting from this accreditation process, it should be taken into account the fact that since the doctoral program is closely linked to the research groups of the department, a simple consultation of these lines will give information about the set of professors of the program. The research groups can be found in the link attached within the organizational dimension.
	Academic and research profile	The academic and research profile of the professors linked the program can be obtained through the FUTUR portal, where information related to the researchers of all the UPC can be found. https://futur.upc.edu/investigadors
	Contact information	https://futur.upc.edu/investigadors
Mobility program	Objectives	In this specific case, we have added to the doctorate website of the department, sub-sections that contain the mobility information that both the international relations service and the academic management service disseminate and make available to all students of the UPC, both undergraduate, master's and doctorate in last term. For this purpose we indicate the URLs that lead to the aforementioned information.
	General regulation	https://www.upc.edu/sri/ca/estudiantat/mobilitat-estudiants/mobilitat-destudiantat-de-la-upc https://www.upc.edu/sqa/ca/Mobilitat
	Grants	https://doctorat.upc.edu/ca/beques https://www.ctt.upc.edu/Inici_117_121_ca.html
Doctoral thesis	Regulation and general framework Thesis presented in the recent academic courses	http://www.ac.upc.edu/ca/docencia/doctorat/arxiu-doctorat/normativa_doctorat_dac_last_en.pdf http://www.ac.upc.edu/ca/docencia/doctorat/llicitat-de-tesis/defensa-de-tesis

Work development	Main work opportunities	A GPAQ campaign is exploiting and analyzing some satisfaction data and insertion indicators. At the time these data are available they will be made public on the website of the PhD program
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TABLE 1.2. Minimum indicators that should be public

DIMENSION	CONTENT	PUBLIC LOCATION
Program Quality		This dimension and all its contents are publicized on our doctorate page, with a direct link to the GPAQ (Planning, Evaluation and Quality Office) that we detail below
	Offer	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Demand	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Students registered for the first time	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Total number of registered students	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Percentage of foreign students registered	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Percentage of students coming from Master studies from other universities	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Percentage of part-time students registered Percentage of granted students with scholarship	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
Adequacy of the professors staff		This dimension and all its contents are publicized on our doctorate page, with a direct link to the GPAQ (Planning, Evaluation and Quality Office) that we detail below
	Number of presented thesis directors	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Percentage of directors of presented thesis with active six-years research periods research	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
Efficacy of learning support systems	Satisfaction of the doctoral students with the studies	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Satisfaction of the thesis directors with the studies	With respect to the thesis directors, the GPAQ is analyzing the opportunity to issue a brief survey to the directors to obtain some information for this edition. If the result is positive, it will be communicated shortly. In any case, it is necessary to mention that the UPC itself is in a design phase of instruments and procedures for collecting information to be incorporated into subsequent monitoring / accreditation reports.
Results quality (see section 6.2 for additional data)	Number of presented full-time thesis	http://www.ac.upc.edu/ca/docencia/doctorat/llistat-de-tesis
	Number of presented part-time thesis	http://www.ac.upc.edu/ca/docencia/doctorat/llistat-de-tesis
	Average duration of the doctorate program at full-time	Average duration for the PhD studies is 4 years.
	Average duration of the doctorate program at part-time	There are few part-time doctoral students in our doctoral program. The majority are students who enjoy some type of link with the UPC, under the framework of a predoctoral scholarship, supported by either the Ministry, the Generalitat or the UPC itself
	Percentage of program abandonment	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Percentage of thesis with honors (Cum Laude)	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Percentage of graduates with the International Mention	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Scientific results of the thesis	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
	Percentage of students doing a research mobility	This information is not collected nor published. It is proposed as an action in the improvement plan detected in this accreditation process
	Occupancy rate	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat
Rate of adaptation of work to studies	https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat	

At the internal level of the department, and beyond the actions carried out by the Doctoral School in a transversal manner, it has been guaranteed that all the information that appears in the various links and pages related to the

program provide the same information in a coherent manner. To do this, we have linked the information on the website of the doctoral program of the department so that the information that appears both in the department and in the Doctoral School is the same and can be accessed through the same link.

In addition and taking into account the quality standards, we have linked on our website (quality section) the address of the GPAQ where relevant data also appear (<https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat>)

2.2 Es garanteix un fàcil accés a la informació rellevant del programa de doctorat a tots els grups d'interès, que inclou els resultats del seguiment i, si escau, de la seva acreditació.

As mentioned above, a stable effort has been made and is being made from the doctoral program to guarantee public access to all information related to the doctoral program. Thus, public information is available on the various web pages linked to the program, especially that of the program itself on the Computer Architecture department page and that of the Doctoral School. In particular, the Doctoral School shows information on administrative and academic mechanisms. The link to this page is the following:

(<http://www.ac.upc.edu/es/docencia/doctorado/programa-de-doctorado-arquitectura-de-computadores>)

On the other hand, from the main page of the program one can access to the most relevant information for our main users, doctoral students. This information is collected in tables 1.1 and 1.2 that were just described in the previous point of this standard.

Finally, and additionally, the Gabinet de Planificació, Avaluació i Qualitat (GPAQ) offers information on the main indicators of the program. Following the recommendation of the assessment of the monitoring report, a link to this information has been added from the program's website at

<https://gpaq.upc.edu/lldades/indicador.asp?index=doctorat>

2.3 Es publica el SGIQ en què s'emmarca el programa de doctorat.

Look at the Informe de Seguiment d'Universitat issued by the Doctoral School.

ESTÀNDARD 3: EFICÀCIA DEL SISTEMA DE GARANTIA INTERNA DE LA QUALITAT

Es disposa d'un sistema de garantia interna de la qualitat formalment establert i implementat que assegura, de manera eficient, la qualitat i la millora contínua del programa de doctorat.

3.1 El SGIQ implementat facilita els processos de disseny i aprovació del programa de doctorat, el seu seguiment i la seva acreditació.

Look at the Informe de Seguiment d'Universitat issued by the Doctoral School.

3.2 El SGIQ implementat garanteix la recollida d'informació i dels resultats rellevants per a la gestió eficient dels programa de doctorat, en especial la satisfacció amb els grups d'interès.

Look at the Informe de Seguiment d'Universitat issued by the Doctoral School.

3.3 El SGIQ implementat es revisa periòdicament per analitzar-ne l'adequació i, si escau, es proposa un pla de millora per optimitzar-lo.

Look at the Informe de Seguiment d'Universitat issued by the Doctoral School.

ESTÀNDARD 4: ADEQUACIÓ DEL PROFESSORAT

El professorat és suficient i adequat, d'acord amb les característiques del programa de doctorat, l'àmbit científic i el nombre d'estudiants.

4.1 El professorat té una activitat de recerca acreditada.

Taking into account the recommendations of the the monitoring report, we present schematically the research activity of the faculty staff linked to the doctoral program. The following table shows this activity separated by research groups, in the form of several key aspects to quantify the quality and quantity of the research carried out. The table shows the activity in the period January 2013 to December 2017. From the simple observation of the table we can observe a high research capacity within the set of research lines that support the doctoral program.

	ARCO	CAP	CBA	CNDS	CRAAX	DAMA	DMAG	GCO	ICARUS
Faculty (PDI)	4	26	7	7	7	2	4	1	8
Active six-years research periods	1	18	7	7	4	2	4	1	4
Journal papers	11	142	66	34	16	13	7	42	15
Conference papers	35	360	-	-	31	-	-	-	32
Thesis supervised	7	37	12	13	5	3	1	4	1
Projects	7	4	14	8	8	14	1	6	18
Awards	8	0	0	0	2	0	0	2	0

More global information for each one of the professors linked to the doctoral program, regarding the set of quality indicators of the program as well as information related to academic development, can be consulted globally for the entire UPC in the following link, <https://futur.upc.edu/>. In this link all the scientific production of the UPC researchers and their adaptation to the research activity may be found.

It should be mentioned that the GPAQ reflects the values of active six-years research periods at the global level of the entire department. But this information is not detailed at faculty level for privacy aspects. The next link reflects how UPC details this information, https://gpaq.upc.edu/ldades/indicador.asp?index=1_4_10

Finally, it is also necessary to highlight the diversity of the research groups linked to the program, both in terms of number of members and topic, to which the faculty staff belongs, which in fact is a factor of added value to the program. Although disparity and distribution can often be seen as a way of losing value, in this particular case it is shown as a component of added value that is evidenced by both the high collaborations established by the different groups and by the large thematic disparity covered by the program, centered as mentioned earlier in this report, on three basic pillars, architecture, systems and networks.

The department is structured in a group of research groups whose dimensioning adjusts dynamically both to the active members of the group and to the economic disposition of each group. It is for this reason that some groups have few members, and therefore also few doctors in it (see DAMA (2), GCO (1)). However, the quality of the contributions made significantly compensates the volume of members in the groups, and not being an administrative problem, it does not have any effect on the development of the doctoral program. It should also be mentioned that the GCO group is not a research group formally associated with the Computer Architecture Department, although one of the members of this group is a professor of the department, and therefore, given its thematic adequacy, it associates the theses doctorates he directs to the Computer Architecture program. As can be seen in the analysis of the descriptive data of the GCO group, this group presents a high volume of activity, so that no negative effect is estimated to the program, but on the contrary a positive effect due to the quality of the research done. On the other hand, it is also necessary to point out that the DMAG group has not participated in the SGR call for the year 2017, given that its members have requested inclusion in another larger research group, although their doctorate and research activities will continue to be linked to the Department of Computer Architecture and thus to its doctorate.

4.2 El professorat és suficient i té la dedicació adequada per desenvolupar les seves funcions.

According to the data obtained for the last 10 years, 94 researchers have been PhD thesis directors (already defended or in progress). Analyzing this data, with respect to the members of the existing research groups in the department linked to the program (66 PDIs to date), it turns out that 28 thesis supervisors are either external to the program or are members that are no longer part of the current research groups. From these data it is inferred that the PDI group has sufficient capacity to manage the thesis supervision duties associated with the doctoral program, being the PDI group the one that, as is logical, assumes most of the thesis supervision tasks. It is important to mention that in the group of possible thesis directors, personnel from research centers linked to the doctorate program is also included, which increases the capacity of the group as well as the quality of the program. Emphasize the fact that except for outstanding exceptions, all the theses supervised in the program must include a PDI of the DAC as the thesis director. In those cases in which due to the high relevance of the thesis supervisors and given the current limitation to two possible directors, the thesis does not include a PDI of the DAC, this one is included as tutor.

Also note that according to the internal program regulations the admission process requires each student to have a thesis director, so that the figure of the tutor is relegated to those cases, as mentioned above, in which two directors are

not DAC faculties, being therefore the thesis supervisor who, from the beginning of the activity of the student until the end, carries out the tasks of guidance and supervision of the work to be carried out in the thesis.

With regard to the satisfaction of the doctoral students with the doctoral program, we would like to emphasize that the satisfaction surveys indicated in the monitoring report correspond to the 2011/12 academic year. To draw more current conclusions and therefore, in principle more valid data, we must mention that recently the results have been updated to include the academic year 2015/16 (information available at <https://www.upc.edu/portaldades/ca/enquestes/estudiantat/enquestes-a-lestudiantat-de-doctorat>). Next, we analyze the answers given by the 63 doctoral students who answered the survey within the scope of ICT in the UPC, out of which 11 students were registered to the Computer Architecture program. The first set of conclusions to be observed are the following:

- The vast majority of doctoral students begin their activities in the doctoral program with predoctoral grants of various kinds. In some cases, some have a contract and/or link with the UPC itself through these scholarship that formally materialize making them PDI in predoctoral training.
- For the immense majority of these students, their fundamental task is research and this is the reason why they pursue these studies. Some of them answer that within this way they want to achieve an academic career within the institution.
- They have acceded to the doctorate considering the information obtained from the information systems that the UPC website makes available to the whole community, through the Doctoral School, the Departments themselves, but also considering the interaction some of them keep with whom may be their tutors and/or with the coordinator of the doctorate program.
- To the question of why they have chosen this particular University to carry out their doctoral studies, a very high percentage responds that the main reason is twofold the prestige of the UPC as well as the specific theme of our program, and also, in some cases by the contacts between his/her origin University and the UPC
- It should be noted that in the field of ICT, doctoral students are mostly full-time doing doctoral studies and 60% dedicate 40 or more hours a week to carry them out.
- At the same time, when asked about training courses or seminars held within the ICT field, they find them quite interesting.
- Regarding the development of the thesis, many doctoral candidates consider the Research Plan and the changes that are carried out to achieve the thesis objectives useful for the preparation of the thesis.
- To the question of whether the doctoral students have made a stay outside the UPC (mobility), 71.43% answered no. However, these data are for the ICT field as a whole and it is estimated that the volume of responses linked to the Computer Architecture program, that is 11, are not sufficiently representative to make an assessment. In fact, the collection of this information is proposed in the improvement plan of this document.
- In a very high percentage, doctoral students have answered that the average time to develop the doctoral thesis is about 4 years full-time, but if the dedication is part-time, the range will shoot from 5 to 7 years. In this case, we must assess the fact that in order to nurture the society of doctoral students, we must look for mechanisms that allow these students to be fully dedicated to their studies, which is based on a higher availability of predoctoral scholarships.
- With respect to the thesis supervisor, the answers shown in the ICT field show, in a very high percentage, that students already have one designated at the time of registration. In the particular case of the Computer Architecture program, the assignment of a thesis director is done at the enrollment phase.
- The survey shows that most students hold meetings with their director on a weekly or biweekly basis, and that the director is the one supervises their progress in doctoral studies
- On the other hand, it is also reflected in the survey that to a very high degree, the thesis directors propose thesis projects with clear objectives. At the same time it is indicated that the availability of the directors, their knowledge of the subject, as well as the fact that the students consider them good thesis directors, is very high.
- Regarding the tutor of the doctoral students, and beyond the answers reflected in the survey, we would like to emphasize that in our particular case, the director and tutor are the same person in almost 100% of the cases.
- In the line of administrative support and organization, doctoral students perceive it as very good. Both at the level of information at the registration time, admission and other procedures involved in the program, as well as other transversal services, that are not only the administration of the department, but the Doctoral School of the UPC, the support for the obtaining of documentation and the USRL (support unit for labor research) with respect to obtaining information on scholarships and predoctoral grants.
- We want to highlight the fact that in the monitoring report presented in 2016, we already indicated a proposal for improvement of the administrative support internal to the department (918.M.2.2016) where we emphasized certain improvement actions that we have managed to obtain. This point is described in the improvement plan section of this document.

However, we must point out that due to the low participation in these surveys, results disaggregated by programs are not available, only by areas. It is an action considered by the UPC to try to increase participation in future editions. This action would be carried out jointly by the doctoral program itself and the UPC Doctoral School.

In addition to the satisfaction of doctoral students and graduates (doctors), the GPAQ is evaluating the possibility of doing a short survey to the thesis directors. For this reason, we want to show that UPC is in a phase of designing instruments and procedures for collecting information to be incorporated in further monitoring/accreditation reports.

4.3 El programa de doctorat compta amb les accions adients per fomentar la direcció de tesis.

As mentioned in the report of the Verification of the Doctoral Program, the program has two activities that promote the direction of doctoral theses. The first one falls in the administrative environment and focuses on the teaching load associated with the thesis direction. The second, and indeed the one that really encourages the participation in the thesis direction by professors of the department focuses on the research related to the research groups that makes it necessary to include doctoral students for the thesis work execution.

From the experience of recent years, it is observed that the teaching load is not sufficient justification to promote the thesis direction, with a higher motivation in the own research load the professors have within their research groups. Internally, each research group has defined its own rules to undertake new supervision tasks, according to the faculties availability and the existing funding.

It has been proven the fact that the participation of doctoral students in the various research projects in which the research groups of the doctoral program participate is an effective measure to promote thesis supervision. In fact, more than 95% of the doctoral students of the program actively participate in research projects, either nationally or internationally, forming part of the research groups and being these doctoral students, in a very high percentage, linked to the UPC with a predoctoral scholarship. That is, professors in training, with predoctoral grants (scholarships from the Ministry, Generalitat and UPC itself). Thus during this training as future PDIs, they are also preparing their theses and form an integral part of the research groups.

On the other hand, it is necessary to mention that the doctoral program does not perform any specific action to promote the thesis defense. Given the long experience in thesis supervision, and the high quality of the research carried out by the professors linked to the program, the program considers that it is the decision of these professors when the thesis work is ready and meets the sufficient quality requirements defined in the program to be defended successfully and according to the high quality standards of the program. In fact, the program is not as concerned with the volume of theses defended as with the quality of them. That said, it is obviously not disputable that the program adjusts the defense of theses to the legally established times. It should also be mentioned that at the beginning of the new regulatory framework, adaptation, mainly in the times of execution of work, have driven a delay in the defense of the theses, which in the last academic years is reduced as shown by the volume of theses defended in these last courses.

Finally, it should be mentioned that although the data added in the monitoring report reflected a low number of theses defended under the framework of Royal Decree 99/2011, as of the date of this report, a total of 19 doctoral theses have been successfully defended.

4.4 El grau de participació de professorat estranger i doctors internacionals en les comissions de seguiment i tribunals de tesi és adequat a l'àmbit científic del programa.

During the academic years 2012-13, 2013-14, 2014-15 and 2015-16 a total of 163 doctoral theses were presented (20 from the new regulatory plan), out of which 50 have obtained the International Mention.

A large number of training activities have been carried out, including seminars and various courses in the different areas of knowledge involved in the doctoral program. Although for reasons of space in this document we can not include the diversity of seminars organized by the program, as an example we mention that only the CAP research line has carried out a total of 47 seminars from January 2013 to December 2015, all of them given by leading members of the international scientific and industrial community (none of the cited courses has been given by an internal professor to the doctoral program)

Following the recommendation of the evaluation of the monitoring report, we detail, in the attached table, the data related to the participation of foreign professors in the thesis committees, linked to the theses defended since 2014 under the new regulatory plan 99/2011.

From the analysis of the presented data two conclusions are observed. First, it can be seen from the table presented that, of the total of doctoral theses presented in the new curriculum, a high percentage includes foreign professors as members of the evaluation tribunal. Second, it is estimated that the participation of international members in the thesis committees is adapted to the needs of the program to guarantee a correct evaluation of the theses presented. It must be taken into account, and it is therefore necessary to mention that, budgetary limitations affect in some way the participation of international members in the thesis committee, given the cost associated with their trip.

Finally, it should be noted that both the predefense committees and the experts selected to carry out the mandatory external reports, both inescapable requirement for the thesis deposit also include, in large part, foreign members.

	Cognoms i nom	Títol	Data qualificació	Membre tribunal	Rol	Entitat i país vinculació
2014-1	CASTRO CASALES, ALBERTO ANDRÉS	Off-Line and In-Operation Optical Core Networks Planning	10/10/2014	ZOTKIEWICZ, MATEUSZ	Vocal	Warsaw University of Technology (Polònia)
2016-1	PRAT PÉREZ, ARNAU	Scalable Community Detection for Social Networks	03/03/2016	BONCZ, PETER	President	Vrije Universiteit Amsterdam (Holanda)
				IOSUP, ALEXANDRU	Vocal	Delft University of Technology (Holanda)
2016-2	GIFRE RENOM, LLUÍS	In-Operation Planning in Flexgrid Optical Core Networks	03/06/2016	MANOLOVA FAGERTUN, ANNA	Vocal	Technical University of Denmark (Dinamarca)
2016-3	ASENSIO GARCÍA, ADRIÁN	Orchestrating Datacenters and Networks to Facilitate the Telecom Cloud	10/06/2016	ZOTKIEWICZ, MATEUSZ	Vocal	Politechnika Warszawska (Polònia)
2016-4	RODRÍGUEZ NATAL, ALBERTO	Decoupling State from Control in Software-Defined Networking	04/07/2016	IANNONE, LUIGI	Vocal	Telecom ParisTech (França)
2016-5	RANA, MANISH	Statistical Analysis and Design of Subthreshold Operation Memories	18/10/2016	GIZOPOULOS, DIMITRIS	President	University of Athens (Grecia)
				DI CARLO, STEFANO	Vocal	Politecnico di Torino (Italia)
2016-6	JIMÉNEZ PÉREZ, VÍCTOR JAVIER	Improving the Efficiency of Multicore Systems Through Software and Hardware Cooperation	20/10/2016	DÓZSA, GÁBOR JÁNOS	Vocal	ARM Ltd. Cambridgeshire (Regne Unit)
2016-7	SUBASI, OMER	Reliability for Exascale Computing: System Modelling and Error Mitigation for Task-parallel HPC Applications	27/10/2016	FELBER, PASCAL	President	Université de Neuchâtel (Suïssa)
				Fetzer, Christof	Vocal	TU Dresden (Alemanya)
2017-1	MARTÍ FRAIZ, JONATHAN	DataClay: Next Generation Object Storage	31/03/2017	ANTONIU, GABRIEL	President	INRIA (França)
2017-2	NISHTALA, RAJIV	Energy Optimising Methodologies on Heterogeneous Data Centres	10/07/2017	PERICAS GLEIM, MIQUEL	President	Chalmers University of Technology (Suïssa)
				Nikolopoulos, Dimitrios	Vocal	Queen's University Belfast (Irlanda del Nord)
2017-3	GARCÍA FLORES, VÍCTOR	Memory Hierarchies for Future HPC Architectures	02/10/2017	KAELI, DAVID	President	Northeastern University (USA)
2017-4	GRASS, THOMAS DIETER	Simulation Methodologies for Future Large-Scale Parallel Systems	09/10/2017	HAGERSTEN, ERIK	President	University of Uppsala (Suècia)
				GABRIELLI, GIACOMO	Vocal	ARM Ltd. Cambridgeshire (Regne Unit)
2017-5	CASTILLO REYES, OCTAVIO	Edge-Elements Formulation of 3D CSEM in Geophysics: A Parallel Approach	23/10/2017	DIAZ, JULIEN	Vocal	UFR Sciences (França)
2017-6	NEMIROVSKY, DANIEL ALEXANDER	Improving Heterogeneous System Efficiency: Architecture, Scheduling, and Machine Learning	30/10/2017	KARAKOSTAS, VASILEIOS	President	National Technical University of Athens (Grecia)
				PALOMAR PÉREZ, OSCAR	Vocal	The University of Manchester (Regne Unit)

ESTÀNDARD 5: EFICÀCIA DELS SISTEMES DE SUPORT A L'APRENENTATGE

Els recursos materials i serveis necessaris per al desenvolupament de les activitats previstes en el programa de doctorat i per a la formació del doctorand són suficients i adequats al nombre de doctorands i a les característiques del programa.

5.1 Els recursos materials disponibles són adequats al nombre de doctorands i a les característiques del programa de doctorat.

Material resources are important to guarantee quality in any teaching and research activity. In this aspect, we want to describe the facilities that the Computer Architecture Department makes available to doctoral students to support their doctoral tasks in an appropriate way. The infrastructure that the Department Computation Lab (LCAC) puts at the disposal of the users is focused on 2 high-performance clusters for carrying out tasks in the research and teaching fields as described below:

1) Research Cluster: Including components with the following characteristics:

5 nodes Xeon E5-2630L v3 Dual year 2016: Motherboard Intel S2600WT2R, 2 processors Intel Xeon E5-2630L v3 @ 1.80GHz, 128 GB RAM, 1 HD 1TB SATA-3, 2 network cards Intel I350 Gigabit Ethernet

40 nodes Xeon E5-2630L v2 Dual year 2014: Motherboard Intel S2600GZ, 2 processors Intel Xeon E5-2630L v2 @ 2.40GHz, 128 GB RAM, 1 HD 1TB SATA-2, 4 network cards Intel I350 Gigabit Ethernet

22 nodes Xeon E5-2630L Dual year 2012: Motherboard Intel S2600GZ, 2 processors Intel Xeon E5-2630L @ 2GHz, 64 GB RAM, HD de 1TB SATA-2, 4 network cards Intel I350 Gigabit Ethernet

20 Nodes Xeon L5630 Dual year 2010: Motherboard Intel S5520URR 6 DDR3, Intel SR1600, Chipset Intel 5520 with I/O Controller Hub ICH10R, 2 processors Intel Xeon Quad-Core L5630 @ 2.13GHz, 24 GB RAM Split into 6 x 4GB, 2 HD 320 GB SATA-2, 2 network cards Intel Pro/1000 Gigabit Ethernet

33 Nodes Xeon Dual-Core 5148 year 2006: Motherboard Intel S5000VCL, Intel SR1530, Chipset Intel 5000V, 2 Processors Intel Xeon Dual-Core 2,333GHz, FSB 1333MHz, 4MB Cache, 12 GB RAM in 6x 2 GB, HD SEAGATE Barracuda 320 GB S-ATA-2, 2 network cards Intel Pro/1000 Gigabit Ethernet

Additionally the cluster includes: Disc NAS common for all nodes of 3.5 TB, queue integration with user servers, Hadoop integration with Grid Engine, openMPI integration with Grid Engine, Virtual Machine execution.

2) Teaching Cluster: Including components with the following characteristics:

4 Nodes DUAL 6-core XEON E5645: Motherboard Intel S5500WB12VR, Intel SR1690WBR, Chipset Intel 5000V, 2 processors Intel Xeon E5645 2,40GHz, 6 cores 5,86GT/s QPI 12MB L3, 24 GB DDR3 1333 ECC Registered, 2 HD 2TB SATA, 2 network cards Intel Pro/1000 Gigabit Ethernet

1 Node Quad 6-core Xeon E5-2620: Motherboard Intel Workstation Board W2600CR2, Intel Workstation System P4304CR2LFKN, Chipset Intel BD82C602 PCH, 2 Processors Intel Xeon E5-2620 v2 2.10GHz 6 cores, 64 GB, 2 HD 1TB SATA, 4 GPUs Nvidia Tesla K40c.

In addition to the previous infrastructure, the LCAC makes the following services available to all users: centralized disk, work stations; hardware; software; web publication; network/connectivity; email; servers; printers/resources; Information Systems Development; software development and teaching support. On the other hand, the department has the following spaces to locate doctoral students: 6 rooms with a capacity each of 10-12 students per room and 2 rooms with a capacity of 18 students. These rooms and their reservation are easily managed from the Intranet of the department. In the Intranet these spaces are correlated with the database of department personnel. Once a new doctoral student is registered, he is assigned a space and the resources he needs to develop his activity (table, computer, access to laboratory machines, access to the modules, etc.).

Regarding the documentary collections, the evaluation of the surveys with respect to two specific questions made to the students stands out the following:

- Do you consider adequate the resources, such as furniture, laboratory equipment, computer equipment, etc ... that you have at your disposal? On a scale where 5 is the maximum score, the response obtained was 4.0.
- Do you consider the spaces you have at your disposal adequate? On a scale where 5 is the maximum score, the



response obtained was 4.1.

We want to highlight the global opinion and satisfaction of the doctoral students with respect to the documentary support, i.e., documentary collections related to the doctoral program. For this purpose, the support obtained from the UPC libraries to get documentation is very good, with more than 66% being good or very good at the doctoral level. PhD students usually consult funds such as: journals, conference proceedings, published doctoral theses, standards and legislative texts (ISO, UNE-official legislation, etc.), books, patents and Internet resources in general.

It should be noted that on the Campus Nord where the headquarters of the Computer Architecture Department is located, there is the Gabriel Ferrate-BRGF Rector Library (more information at <http://biblioteca.upc.edu/biblioteca/biblioteca-rector-gabriel-ferrate>). Just as an example, during 2015, the BRGF had around 300,000 visitors, 27,000 on weekends and a total of 66,000 documents loan. The aforementioned library provides services to the centers, departments and research centers located at the Campus Nord. Its service is mainly focused on technology, therefore it is specialized in documentation and information resources in the field of telecommunications, electronic, civil, computer and physical engineering as well as in the environment and ICT in general. All its available resources are in its catalog, databases and also at UPCCommons. Additionally, it offers to users loan material such as laptops, headphones, Ipad, etc., as well as work rooms for teamwork. The library services may be also accessed from the mobile phone or any mobile device.

Based on the resources offered to students, it is considered that these are more than sufficient for the correct development of the activities related to the doctoral program.

5.2 Els serveis a l'abast dels doctorands suporten adequadament el procés d'aprenentatge i faciliten la incorporació al mercat laboral.

Broadly speaking, the University offers different support services for doctoral students. Among them, students can access the Mobility Office that depends on the International Relations and Company Service.

Generally, and in a very high percentage, our PhD students are foreigners, either from the EU or outside. When they begin their activities at the UPC, in addition to the administrative support of the department itself, there are other transversal units that support them. Thus, for example, we can mention the aforementioned Mobility Office, which advises on various needs such as: logistical support to find residence, support for any documentation related to student permission, mobility, etc. (<http://www.upc.edu/sri>)

As for the academic orientation, there is the Doctoral School, which is the academic unit in charge of organizing all the activities that lead to obtaining the degree of doctor (see <http://doctorat.upc.edu/>). In this sense, and looking at the surveys, a 53.3% of the responses are satisfied and very satisfied with the technical and administrative services of the aforementioned Doctoral School.

Regarding scholarships, projects, etc., the Unitat d'Assessorament i Suport Laboral a la Recerca (USRL) manages all types of pre- and post-doctoral scholarships (FPI, FPU, FI and UPC-Recerca scholarships). This type of grants frames the insertion of our PhD students in the university world. In the last year there have been a total of 32 scholarships: 6 FPI-MINECO, 7 FI-AGAUR, 8 FPI-UPC, 5 FPU-MINECO, 5 Erasmus Mundus, 1 Fundació La Caixa.

In this sense and looking at the surveys, a 48% of the responses are satisfied and very satisfied with the information and attention received by the USLR.

The Academic Management service also broadcasts mobility opportunities for PhD students (<https://www.upc.edu/sga/ca/Mobilitat>).

ESTÀNDARD 6: QUALITAT DELS RESULTATS

Les tesis doctorals, les activitats formatives i l'avaluació són coherents amb el perfil de formació. Els resultats quantitatius dels indicadors acadèmics i d'inserció laboral són adequats.

6.1 Les tesis doctorals, les activitats de formació i la seva avaluació són coherents amb el perfil formatiu pretès.

The training inherent to doctoral studies covers many aspects that include not only theoretical knowledge in the thematic work areas, but also the acquisition of certain additional skills that give an additional value to the doctoral student, such as the ability to team up or the ability to express the work done clearly and fluently, both orally and in writing. Although the level of knowledge acquired is relatively easy to assess, after a qualitative analysis of the work carried out, the publications resulting from the work, as well as the novel contributions made as the thesis work, or the assessment of the level of compliance with the additional competences, is not so simple

However, the program adds tools specifically dedicated to the evaluation of this function, in particular for the assessment of the capacity for expression. To that end, the program fixes two key points. The first is the public defense of the Research Plan in the first year of the doctorate, with the aim of allowing the student: to observe objectively the problems associated with generating public documentation on the subject in which the student will work on his doctorate, exposing ideas, methodology and expected results; the oral presentation of that work. Both exercises performed at that early date allow the student (and the director) to detect possible limitations in the forms of oral or written expression that may limit the dissemination of the work to be performed. The second is the predefense of the thesis work, as an unavoidable previous step to the final defense, in a three-person committee. That presentation just before the final defense is a good tool to evaluate the status of the work and facilitate, with the possible feedback from the committee, to improve the document and the presentation of the work done. The result of the predefense is evaluated in terms of apt/not apt, being the first option the only one that allows the student to continue with the thesis defense process.

In relation to the evaluation system, it is worth mentioning the two procedures applied, particularly those related to the training activities and those specific to the research activities carried out by the doctoral student. In the first case, the evaluation of the training activities is managed by a system of rubrics determined by the training activities themselves (for example, the courses to which attendance is recommended). However, the research activity of the doctoral student is not evaluated by a system of rubrics, instead, as described in section 1.2 of this document, the evaluation is handled first through the annual evaluation of the Research Plan, and in the pre-deposit phase of the thesis, through the predefense (also described in this section) together with the external review process. The two external reviewers are selected by the Academic Board of the Doctorate Program, from experts in the thematic area, outside the doctoral program faculty staff. The doctoral student will only be able to complete the thesis deposit (formal process prior to the defense) in the case of both successfully passing the predefense and having two positive external reports.

In addition to the competences related to the acquisition of knowledge, the program also considers transversal skills, such as teamwork. Thus, it is important to point out that the students doing the doctorate in the computer architecture program are strongly involved in the different research groups of the department and, therefore, to a large extent they participate in their research projects. This fact, although it is not a requirement, certainly facilitates, among other aspects, the acquisition of teamwork competences by the candidate. In fact, it is considered that the different research activities carried out by the research groups facilitate and undoubtedly allow, the achievement of the necessary skills and abilities that we consider must have a doctoral student having done his doctoral thesis in the program of computer architecture. This fact is clearly shown by the Jobs and work positions of a large number of graduates, forming part of teams of global highly tech companies.

6.2 Els valors dels indicadors acadèmics són adequats per a les característiques del programa de doctorat.

Before analyzing the academic indicators, we want to highlight that the results obtained by the students admitted under the current academic plan, are still not significant enough given the short space of time elapsed since its establishment. In any case, it is the desire of the program to attest as quickly and efficiently as possible its indicators of excellence, for which the results obtained to date are included, shown in the form of an illustrative table below.

Graduates Plan 99/2011	2012-13	2013-14	2104-15	2015-16
Number of presented full-time thesis	0	0	1*	5
Number of presented part-time thesis	0	0	0	0
Average duration of the doctorate program at full-time	0	0	1	3
Average duration of the doctorate program at part-time	0	0	0	0
Percentage of program abandonment	11%	4%	0%	5,74%

Percentage of thesis with honors (Cum Laude)	-	-	100%	80%
Percentage of graduates with the International Mention	-	-	100%	60%
Scientific results of the thesis	12	15	18	6**
Percentage of students doing a research mobility	N/A	N/A	N/A	N/A

* coming from a transfer from a different doctorate program, enrolled at the Computer Architecture Program for 1 year

** only includes data about defended thesis

From the information included in the previous table, it is not considered feasible to carry out an exhaustive analysis that may conduct to binding conclusions about the evolution of the program or even to correct any deviation of the figures defined in the verification report. It is considered that for the subsequent monitoring phase of the program there will be reliable information on the evolution of the program that can be carefully analyzed to detect deviations and propose improvement plans.

6.3 Els valors dels indicadors d'inserció laboral són adequats per a les característiques del programa doctorat.

In 2014, AQU Catalunya issued the third study about the labor insertion of PhD students in the Catalan universities. The presented studies have a three-year periodicity (2008, 2011 and 2014 the last). The study shows the following results:

- Doctors have an advantage in the labor market in front of people with lower educational level, and therefore, access to more qualified jobs in the labor market.
- 93% of doctors have a job and only 5% are unemployed
- 88% of doctors have a full-time contract, but only 46% have a fixed contract.
- 60% of doctors work in higher education and research centers, so the remaining 40% do so in companies.
- 57% of doctors in the different disciplines of Engineering work or develop research functions.
- 14% work abroad.

The Doctoral School will provide information on graduates, already processed and individual for each doctoral program. However, just as for satisfaction surveys, there is no guarantee about the level of participation of the doctors. Nevertheless, it should also be mentioned that a campaign of the GPAQ is exploiting and analyzing some satisfaction data and insertion indicators.

3. Pla de Millora

Fruit de l'anàlisi i reflexió del desenvolupament del programa de doctorat, cal proposar un Pla de Millora.

Valoració global del Pla de Millora

Based on the analysis of the data obtained in this report, as well as after the evolution observed from the verification phase, certain conclusions can be drawn in the form of a global assessment. However, it should be mentioned that the doctoral program, like all existing ones, has been involved in a scenario of significant changes, both due to the entry into force of the new regulation, with an important effect in most related processes related with the thesis activities (admission, evaluation or duration), but also with the management bodies (for example the appearance of the Doctoral School). These effects have been very remarkable in a program like the one described in this document with a high volume of students. The main effects of the assessment are the following:

Program quality: The Computer Architecture program keeps the quality leveraging the volume of admitted students, the quality of the faculty staff linked to the program and its activity, and the high skills of the graduates.

Transparency: The program has made public all the necessary information for its correct development for the student, the director, the manager and the evaluator, making an effort to guarantee coherence in all the information available at the different pages that point to the program.

Regulation: The program has defined in a clear, concise and objective way all the processes followed by the program for its management. Particular mention is made about the definition of both the admission procedure, generating a qualitative and quantitative mechanism, and the evaluation, for the different time windows in which the evaluation of the thesis work progress is required.

Admission: The program maintains admission numbers close to the offer, that is, close to the supervision capacity estimated for the potential thesis directors in the program. This fact turns into both a correct program dimensioning, and considering the high offer, a large demand showing the interest that the program has both nationally and internationally. Nonetheless, continuous monitoring and analysis of both values is proposed to act on any potential deviation as well as to adjust the program's supervision capacity if necessary.

Internationalization: The program has carried out internationalization actions, focused on co-directing theses with international members, the participation of international members in the thesis committees, as well as the various actions carried out by the research groups individually to internationalize the program (such as participation in international networks, joint doctorates, etc.). However, this is a task that will require uninterrupted attention in order to guarantee a correct and sustained internationalization of the program.

Overall, it can be said that the program works excellently and that the aspects of improvement that were considered in the monitoring phase have been carried out properly and within the foreseen date.

In addition, as a result of this accreditation process, two more actions have been added to be considered in the improvement plan, which are considered to have a high impact on the attraction of talent and the visibility of the program:

Information related to the faculty staff of the program: It is considered appropriate to show more clearly, transparently and above all with a single access, all the information related to the professors linked to the program. It is also considered that participation in the program may depend on factors outside of the professors (for example, obtaining scholarships), what conducts to defining two lists, to avoid the exclusion of some professors from the program. At the same time the lists split differentiates between those professors who in recent years have been more active in the program and those that did not, but want to.

Information related to students: Beyond the information that can be obtained through the surveys carried out by the Doctoral School, it is considered appropriate to show more information, for example, related to the activities that doctoral students carry out during their studies, as well as additional information from graduates that facilitate the visibility, relevance, and the benefits obtained by carrying out the doctorate in the Computer Architecture program.

Relació de Propostes de Millora

918.M.1.2016

Clarification of the regulation.

	<p>Càrrec: Program Coordinator</p> <p>Origen: Monitoring</p> <p>Estàndard: Estàndard 3: Eficàcia del sistema de garantia interna de la qualitat de la titulació</p> <p>Diagnòstic: Already included in the monitoring report, it is observed that while the changes in the text of the doctoral regulations are going on, the stabilization of the aspects specific to the doctorate program must be guaranteed, especially in areas such as the evaluation strategy of the Research Plan or the requirements for defending by compendium of articles. The lack of definition associated to continuous changes, often generates doubts in some of the administrative processes related to the doctorate, especially with regard to the evaluation of the doctoral thesis.</p> <p>Implica modificació de la memòria verificada?: No</p> <p>Objectius a assolir: The main objective focuses on stabilizing the different processes and regulations linked to the evolution of the doctorate program, maintaining total synchronization with the existing regulation. Closely linked to the doctoral regulations, currently in the development phase, the program must devote efforts in the definition of the concepts that the regulation leaves to the decision of the doctoral program. To this end, the Academic Board of the Doctoral Program will take the appropriate decisions to establish the internal regulations associated with these processes. Once all the information has been decided, it will be made public in the different webpages on which the program is advertised. The clarification process of the regulations will be carried out by academic courses, in order to guarantee that the information shown in the doctoral program, in any of its information channels, is accurate and in accordance with higher regulations. It is also the objective of the program to maintain all the administrative processes required by the regulations of the program within reasonable limits of dedication and effort.</p> <p>Accions proposades: The following actions were proposed: <ul style="list-style-type: none"> • Monitoring of regulations, regulatory framework and information of the Doctoral School intended to detect updating needs in the internal regulations of the program. • Meetings of the Academic Board of the program to set the internal regulations linked to the required updates. • Internal management of the regulations through approval by the Department Board and the Doctoral School Board, if necessary. • Publishing the changes or the new regulations in the different webpages on which the program is present. </p> <p>Abast: Computer Architecture</p> <p>Prioritat: high</p> <p>Termini: 18/7/2017</p> <p>Estat: Ongoing</p> <p>Actuacions realitzades: Update of several procedures in the program already done according to the instructions suggested by the Doctoral School. Public exhibition on the program website of the current regulations, so that the information of the current academic course is complete.</p>
918.M.2.2016	<p>Improving the administrative support</p> <p>Càrrec: Department Administration Head</p> <p>Origen: Monitoring</p> <p>Estàndard: Estàndard 5: Eficàcia dels sistemes de suport a l'aprenentatge</p> <p>Diagnòstic: The Computer Architecture doctorate program is a decentralized program whose management is carried out efficiently by the administrative staff of the department. Although this fact is considered convenient by the department, it also influences, especially in periods of enrollment and deposit given the large volume of students enrolled into the program, in the workload of the administration staff. The aim is to optimize the mechanisms to improve the management of the program, either with a more dynamic allocation of human resources adapted to real-time needs, or with the use of new platforms for management.</p> <p>Implica modificació de la memòria verificada?: No</p> <p>Objectius a assolir: At the level of internal management, and in anticipation of a continuous scenario of scarcity of resources, the department should establish mechanisms to guarantee an efficient management of the</p>

	<p>program in critical situations, such as the enrollment period and the evaluation periods.</p> <p>The following actions were proposed:</p> <ul style="list-style-type: none"> • Make some people in the administration staff to become polyvalent in order to optimize the support given to the program, with a dynamic management of resources reacting to the real needs. • A global management of the various human resources both in terms of human needs and the different capabilities of the staff. <p>Accions proposades:</p> <p>Abast: Computer Architecture</p> <p>Prioritat: Medium</p> <p>Termini: 10/10/2018</p> <p>Estat: Done</p> <p>Actuacions realitzades:</p> <p>Several actions in the department have been already launched, aimed at offering the best service to the program users (i.e., doctoral students), taking into account that the current UPC lemma is more for less. That is to say, we are in a stage of scarcity of material but also human resources. We are making polyvalent to certain internal personnel of the department to be able to give a more adequate support and not to make a single person to be the only one taking over all the program responsibilities, especially, registration and the whole program management. Furthermore, the UPC is immersed in a reorganizing study of its structures that may end up in future changes that can remarkably influence all the administrative support.</p> <p>The doctoral program has a great acceptance by the students, but evidently this fact makes the management of the paperwork and procedures associated with the program pretty complex. It is important to highlight that (also raised to improve the administrative support to the program), until only a year ago, there was only one person giving administrative support to the program. However, currently an interim person has been trained to be able to support the multiple processes that are carried out associated with the doctoral program and thus satisfying its administrative needs. It is therefore necessary to mention that aspects related to the attention to users have been improved in areas such as:</p> <ol style="list-style-type: none"> 1.- The days and hours of attention to the students who come to register are parameterized to avoid long queues. 2.- Templates for handling the registration, the thesis deposit and the thesis paperwork have been produced. Thus, the new support person (who helps the doctorate responsible) can start as a front-desk for the students gathering the necessary documents so all is ready for the final procedure with the administrative doctorate head. 3.- The new person has been trained in the English Language (received and continues to receive conversation courses in English within the UPC) in order to maintain a more fluid dialogue with doctoral students (mostly English speaking). <p>However, it should be mentioned that the UPC and, specifically, the Campus Nord, where the DAC is located and, therefore, the doctoral program, is immersed in a significant change. This change is a global restructuring of the administrative services of the entire Campus Nord, which will also include the service and support for the doctoral program. This restructuring is scheduled for 2018. It is proposed as an inescapable improvement that said restructuring does not adversely affect the support for the program. In fact, the main change in the support to the doctorate will be based on centralizing the administrative support to all the programs in a single office, created ad-hoc to support the procedures of the doctorate programs, also located in the Campus Nord. Therefore, the improvement plan includes transferring our experience in management and support all doctorate procedures, to the new unit.</p> <p>Resultats obtinguts:</p>
918.M.3.2016	<p>Talented and local students attraction</p> <p>Càrrec: Program coordinator</p> <p>Origen: Monitoring</p> <p>Estàndard: Estàndard 6: Qualitat dels resultats dels programes formatius</p> <p>Diagnòstic:</p> <p>Action already mentioned in the monitoring Report, is considered a primary challenge in any degree and even more so in the doctoral studies. The Computer Architecture program is an international program that attracts highly qualified students from all over the world. However, the attraction of quality is and should always be a constant challenge, so the need to encourage the attraction of talent to the program is undeniable. On the other hand, an important aspect to consider in new students is the percentage of local students. As it is observed in the admission documents of new students or in those who successfully defend their doctoral thesis, the number of local students is reduced. This fact is undoubtedly due to the lack of relevance that doctorate studies have at the country level, which does not encourage students to go for it.</p> <p>Implica modificació de la memòria verificada?: No</p> <p>Objectius a assolir:</p> <p>Objectives focused on two aspects:</p> <ul style="list-style-type: none"> • Attract talented students to the program • Attract local students

	<p>To that end, and beyond the dissemination activities specific to the department (for example those linked to the significant number of awards that the members of the department receive), which export the program excellence, the following actions are proposed:</p> <ul style="list-style-type: none"> • Admit highly skilled students with excellent academic records (75% admitted GPA ≥ 2.0; 25% admitted GPA ≥ 3.0). • Urge department researchers to increase their participation in international networks (for example, networks of excellence, ITN initiatives, etc.), which facilitate interaction with other groups, in other contexts, thus increasing the opportunities for spreading the program on an international level • Through the participation in the various Master's programs in which the professors linked to the program actively contribute, students are asked to share the importance of a doctorate. Its achievement opens the doors to a broader contracting scenario, mainly at the international level • Disseminate participation in networks of excellence among researchers. Most participatory sessions among PhD students • Emphasize the different research activities carried out by the different research groups linked to the program. • Ease the enrollment of local students in the research groups (30% local students) <p>Accions proposades:</p> <p>Abast: Computer Architecture</p> <p>Prioritat: High</p> <p>Termini: 10/10/2017</p> <p>Estat: Done</p> <p>Actuacions realitzades: The different actions proposed for this improvement plan have been applied. However, it should be taken into account that the realization of doctorate studies by a MsC graduated with high chances to get a job is a non-easy decision given the current economic context, where there are no many scholarships available, and evidently being the graduates with the best academic record those who have the best work insertion, even before finishing their studies.</p> <p>Resultats obtinguts: No significant effects of the actions proposed in this improvement plan have yet been observed due to the short time from its implementation. In any case, it is necessary to mention that the program already attracts notable academic records mainly for the quality of the program, the research carried out by its faculty team and the research centers linked to it.</p>
918.M.4.2016	<p>Improving the program public information</p> <p>Càrrec: Program coordinator</p> <p>Origen: Monitoring</p> <p>Estàndard: Estàndard 2: Pertinència de la informació pública</p> <p>Diagnòstic: As mentioned in the monitoring report, it is proposed to improve the external visualization of the doctoral program through both the public dissemination of the indicators related to the quality of the program, as well as the information related to the program whose public visibility is considered necessary. These indicators include aspects related to: offer of places, students enrolled, satisfaction of doctoral students, theses defended, etc.</p> <p>Implica modificació de la memòria verificada?: No</p> <p>Objectius a assolir: The objectives aim to improve the communication with other units of the UPC, Doctoral School, and Academic Management Service, so that the information is global-transversal and accessible to all users of our doctoral program. It is also considered that better public information of the different activities carried out may be highly related to the recruitment of talent, as mentioned in M.3.</p> <p>Accions proposades: The following actions were proposed:</p> <ul style="list-style-type: none"> • Check and review the webpage and Intranet content together with the ICT personal at the department. • Tracking the accuracy of the most relevant information twice per year <p>Abast: Computer Architecture</p> <p>Prioritat: Medium</p> <p>Termini: 10/10/2018</p> <p>Estat: Ongoing</p>

	<p>Actuacions realitzades: This improvement proposal is a never ending action. Thus, the information must be updated to constantly adapt the information of the program, to meet not only the internal changes, but also UPC and external regulations that must be communicated to students and professors. Moreover, the yearly generation of information regarding the student data requires a constant updating.</p>
<p>918.M.5.2017</p>	<p>Improving the information about the faculties linked to the program</p> <p>Càrrec: Program coordinator</p> <p>Origen: Accreditation</p> <p>Estàndard: Estàndard 4: Adequació del professorat al programa formatiu</p> <p>Diagnòstic: It is observed that a clear description of the professors linked to the doctorate, with a clear and simple access, can facilitate the attraction of students, especially those interested in developing high quality research activities and who may be attracted by the excellent research carried out in the Computer Architecture Department.</p> <p>Implica modificació de la memòria verificada?: No</p> <p>Objectius a assolir: Information about active professors in the doctoral program visible and easily accessible in a single link located on the webpage of the Computer Architecture Department</p> <p>Accions proposades: The following actions are proposed: <ul style="list-style-type: none"> • Update the list of faculties linked to the program, including only those that have been active in the last 10 years • Set an additional faculty list, including professors that even though they did not supervise a thesis recently for any reason, they are interested in doing so • List approval by the Academic Board of the Program and the Department Board • Publishing both lists in the department webpage </p> <p>Abast: Computer Architecture</p> <p>Prioritat: Medium</p> <p>Termini: 4/12/2019</p> <p>Estat: Ongoing</p> <p>Actuacions realitzades: At the time of writing this document, the information about the professors active in the program is being collected to update the list. Once this action is done successfully, the criteria to formalize the second list will be established, following the steps defined in the actions proposed for this improvement plan.</p>
<p>918.M.6.2017</p>	<p>Publishing information about the doctoral students' activities</p> <p>Càrrec: Program coordinator</p> <p>Origen: Accreditation</p> <p>Estàndard: Estàndard 6: Qualitat dels resultats dels programes formatius</p> <p>Diagnòstic: It is observed that the fact of including information about doctoral students, always maintaining the necessary privacy, such as the motilities done, the participation in research projects (national, European), contracts, the work insertion, etc., may show the real impact of the program mainly due to its external visibility and therefore may result in additional talent attraction.</p> <p>Implica modificació de la memòria verificada?: No</p> <p>Objectius a assolir: Much better information about the students' activities including current students but also activities graduated did during their thesis work</p> <p>Accions proposades: The following actions are proposed: <ul style="list-style-type: none"> • Collect information about graduate students • Collect information about the activities carried out by students active in the program (all information would be anonymized and made public in the program webpage) </p>

Abast:	Computer Architecture
Prioritat:	medium
Termini:	4/12/2019
Estat:	Ongoing
Actuacions realitzades:	Currently, we are waiting to know what the information to be issued by the Doctoral School based on their own survey processes will be. Once this information is delimited, the Academic Board of the Program will establish the mechanisms to collect the information considered necessary to successfully achieve this objective.

4. Evidències

En aquest apartat cal introduir les evidències que suporten l'informe d'acreditació. Aquestes evidències han d'estar disponibles i accessibles per als membres del Comitè d'Avaluació Externa (CAE).

Nom de l'evidència	Localització (URL)
Survey for students for the academic course 2015/16	https://www.upc.edu/portaldades/ca/enquestes/estudiantat/enquestes-a-lestudiantat-de-doctorat
Information about six-years research periods	https://gpaq.upc.edu/lldades/indicador.asp?index=1_4_10
Information about the Rector Gabriel Ferrate-BRGF library	http://bibliotecna.upc.edu/biblioteca/biblioteca-rector-gabriel-ferrate
Mobility office	http://www.upc.edu/sri
Mobility for students	https://www.upc.edu/sga/ca/Mobilitat
Link to the documents at the program webpage	http://www.ac.upc.edu/es/docencia/doctorado/programa-de-doctorado-arquitectura-de-computadores?set_language=es
Computer Architecture Program webpage	http://www.ac.upc.edu/es/docencia/doctorado/programa-de-doctorado-arquitectura-de-computadores?set_language=es
Accreditation process	https://www.ac.upc.edu/ca/docencia/doctorat/proces-dacreditacio-del-programa-de-doctorat-desembre-2017