ADU form

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| **REPORT ON THE QUALITY OF THE THESIS AND AUTHORISATION BY THE ACADEMIC COMMITTEE FOR THE PROGRAMME FOR ITS SUBMISSION** |
| Details of the coordinator of the academic committee for the doctoral programme |
| Full name  Xasip Masip bruin |
| Structural unit  Arquitectura de Computadors |
| Doctoral programme  Department d’Arquitectura de Computadors |

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| Details of the doctoral candidate defending the thesis |
| Full name  Rajiv Nishtala |
| Title of the thesis Energy Optimising Methodologies on Heterogeneous Data Centres |

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| Indicate the reasons for the quality of the thesis |
| Originality of the research  Mr. Rajiv Nishtala has a twofold objective. First, he has developed a novel performance and power modelling technique that can predict across numerous P-States, Cl-States and with core consolidation. This has resulted in three peer-reviewed publications (ICPPW’15, SBAC-PAD’16, IGSC’16). Next, he introduced a scheduling algorithm that allocates latency-critical workloads the best resources possible to minimise energy consumption, or maximise utilisation by collocating latency-critical workloads with batch workloads. The results have been compared with prior state-of-the-art and beat them by up to 18% in reducing energy. This has results in a peer-reviewed publication (HPCA’17) and a journal under review (ACM TOCS 2017). |
| Aims fulfilled in view of the initial aims of the thesis proposal/research plan   - This PhD fulfils the objectives set in the thesis proposal. |
| Methodology  The approaches developed in this PhD thesis have carried out research in the energy-efficiency area, specifically:   * A performance and power modelling and prediction approach * A scheduling policy to allocate latency-critical and batch workloads across server systems.   The results of Mr. Nishtala’s thesis have been implemented on platforms that support them and demonstrate the usefulness of the approaches by evaluating a set of benchmarks on three different types of architectures. |
| Thesis with protection process and/or confidentiality agreements: □Yes □ No  ((If the answer is 'yes', attach the authorisation of the Academic Committee of the doctoral programme)  NO  Results (publications, articles, books or book chapters stemming from the research done for the thesis)  *First author publications of R. Nishtala:*   * “A Hipster approach for Improving Cloud System Efficiency” (Under review in ACM TOCS 2017) * “Hipster: Hybrid Task Manager for Latency-Critical Cloud Workloads” (HPCA 2017) * “REPP-H: Runtime Estimation of Performance-Power on Heterogeneous Data Centers” (SBAC-PAD 2016) * “REPP-C: Runtime Estimation of Performance-Power with Workload Consolidation in CMPs” (IGSC 2016) * “A Methodology to Build Models and Predict Performance and Power in CMPs” (ICPPW 2015) |
| Was the thesis written in the framework of a research project or agreement with specific funding? □**Yes** □**No**  (If the answer is 'yes', please specify.)  Yes, Mont-Blanc-2 (FP7-ICT-610402) project, by the Ministerio de Economia y Competitividad under contract Computación de Altas Prestaciones VII (TIN2015-65316-P) and the Departament de Innovació, Universitats i Empresa de la Generalitat de Catalunya, under project MPEXPAR: Models de Programació i Entorns d Execució Paral·lels (2014-SGR-1051). |
| Analysis of the impact of the thesis results and methods on the socioeconomic environment  This work has targeted improving the life and energy efficiency of data centres.  Energy efficiency – directly or indirectly – implies lower green house gas emissions. |
| Evaluation of the thesis in relation to other projects and links to the structural unit's research lines  Mr. Nishtala’s thesis has been developed in the context of Mont-Blanc-2 (FP7-ICT-610402) project, by the Ministerio de Economia y Competitividad under contract Computación de Altas Prestaciones VII (TIN2015-65316-P) and the Departament de Innovació, Universitats i Empresa de la Generalitat de Catalunya, under project MPEXPAR: Models de Programació i Entorns d Execució Paral·lels (2014-SGR-1051).  His thesis has generated significant improvements to prior work [RAMON PhD Thesis] by generating performance and power prediction models for multicore server systems. In addition, the thesis also generated a novel scheduling policy for latency-critical cloud workloads using hybrid reinforcement learning approach.  Structural Unit: High Performance Computing Group  Link: hpc.ac.upc.edu |
| Evaluation by peer reviewers |
| State the final assessment of the doctoral candidate's progress as shown in the doctoral student activity report (DAD):  □Satisfactory  □Unsatisfactory |

**For the reasons mentioned above, having seen the favourable reports by the external experts consulted, the academic committee for the doctoral programme approves the submission of the thesis.**

Barcelona

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| Place and date |
| Signature of the coordinator of the academic committee |