

# Ignacio Martín Llorente

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*This CV only includes relevant merits of my international research and academic career. For the sake of brevity, I have not included Spanish national grants, publications and professional activities, teaching in extension programs, university and departmental service, non-invited presentations in workshops and conferences, and papers in unpublished workshops and conference proceedings.*

## EDUCATION

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**IE Business School**, Madrid, Spain

- Top-ranked school for Executive MBA programs<sup>1</sup>
- **Executive Master in Business Administration**, 2003 (Grade A)

**Complutense University (UCM)**, Madrid, Spain

- Top University in Spain<sup>2</sup>
- Ph.D. in Physics, **Program in Computer Science**, 1995 (Summa Cum Laude)
- Graduate in Physics, **Concentration in Computer Science**, 1992

## APPOINTMENTS

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**Visiting Professor**, 1/18 – present

- IACS/SEAS, **Harvard University**, Cambridge, MA

**Visiting Scholar**, 8/16 – present

- FAS Research Computing, **Harvard University**, Cambridge, MA

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<sup>1</sup> <http://www.economist.com/whichmba/executive-mba-ranking/2015>

<sup>2</sup> <http://cwur.org/2015/spain.php>

## CURRICULUM VITAE

### **Full Professor** (Catedrático), 3/06 – present

- School of Computer Science, **Complutense University**, Madrid, Spain

### **Head of Research Group**, 6/02 – present

- School of Computer Science, **Complutense University**, Madrid, Spain

### **Visiting Researcher**, 5/14 – 8/14

- Advanced Computing for Science Department, **Lawrence Berkeley National Lab**, Berkeley, CA

### **Senior Researcher**, 6/02 – 6/07

- Advanced Computing Lab, INTA Astrobiology Center, associated **NASA Astrobiology**, Madrid, Spain

### **Visiting Researcher**, 6/97 – 6/02

- Multiple Appointments at ICASE, **NASA Langley Research Center**, Hampton, VA

### **Associate Professor**, 9/97 – 3/06

- School of Computer Science, **Complutense University**, Madrid, Spain

### **Assistant Professor**, 9/94 – 9/97

- School of Computer Science, **Complutense University**, Madrid, Spain

### **Visiting Researcher**, 5/93 – 12/93

- School of Computer Engineering, **Sheffield Hallam University**, Sheffield, UK

### **Teaching Assistant**, 9/92 – 9/94

- School of Computer Science, **Complutense University**, Madrid, Spain

## PROFESSIONAL ACTIVITIES

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### **Consultant Appointments**

- Founder and Chief Scientist, **OpenNebula Systems**, Madrid, Spain, 3/10 – present
- Independent Expert in Distributed Systems and Cloud Computing, **European Commission**, Brussels, Belgium, 6/05 – present
- Consultant in Performance Management, **Sun Microsystems**, Madrid, Spain, 6/98 – 9/03

### **Professional Memberships**

- IEEE Senior Member

### **Expert Groups**

- Member of the **European Commission** Expert Group on Cloud Computing, 2009 – present  
Contribution to reports “The Future of Cloud Computing. Opportunities for European Cloud Computing beyond 2010”, 2010, “Advances in Clouds - Research in Future Cloud Computing”, 2011, and “A Roadmap for Advanced Cloud Technologies under H2020”, 2012
- Invited expert in Future of Cloud Computing Group of **World Economic Forum**, 2010  
Contribution to report “Advancing Cloud Computing: What to Do Now? Priorities for Industry and Governments”, 2011
- Member of the **CloudScape** Expert Group, 2009 – 14  
Contribution to reports “State and Future of Infrastructure Clouds”, 2009, and “Enterprise Usage of Clouds”, 2010

## CURRICULUM VITAE

- Member of the **e-Infrastructure Reflection Group**, 2009. Contribution to report “e-IRG White Paper 2009”, 2009
- Grid Community Coordinator for the Service Oriented Infrastructure Working Group of **NESSI - European Technology Platform on Software and Services**, 2007 – 08
- Coordinator of the Middleware Activity in the **Spanish Initiative in e-Science**, 2007 – 2012
- Coordinator of the Working Group on Service Oriented Infrastructures and Grids of **INES - Spanish Technology Platform on Software and Services**, from 2007 – 12

### Standards Bodies

- Founder and Co-chair of the Working Group on **Open Cloud Computing Interface at Open Grid Forum**, 2009
- Member in several **Open Grid Forum** Working and Research Groups: Distributed Resource Management Application API Working Group (DRMAA-WG), Job Submission Description Language (JSDL-WG), Grid Scheduling Architecture Research Group (GSA-RG), Grid Checkpoint Recovery (GRIDCPR-WG), and Grid and Virtualization (GRIDVIRT-WG), 2002 – 12

### Editorial Board

- IEEE Transactions on Cloud Computing, 2013 – present
- Journal of Grid Computing - From Grids to Cloud Federations, 2013 – present
- Journal of Cloud Computing, 2010 – present

### Journal Refereeing

- Referee for several Journals: IEEE Transactions on Parallel and Distributed Systems, Computing and Informatics, Journal on Parallel and Distributed Computing, Future Generation Computer Systems, The International Journal of Grid Computing: Theory, Methods and Applications, Systems Journal and IEEE Internet Computing.

### Grant Reviewing

- European Commission – DG CONNECT (panelist)
- Ministerio de Ciencia y Tecnología of Spain (panelist)
- Ministerio de Educación, Ciencia y Tecnología of Argentina
- Cyprus Research Promotion Foundation
- French National Research Agency
- French Institute for Research in Computer Science and Automation
- EIT ICT Labs (panelist)

### Program Committees

- Euromicro Workshop on Parallel and Distributed Processing, 1998, 1999, 2000, 2001
- International Workshop on Scientific Applications on Grid Computing, 2004
- International Workshop on Grid Computing and Peer-to-Peer Systems, 2005
- International Workshop On Knowledge and Data Mining Grid, 2005
- International Workshop on Grid Computing and its Application to Data Analysis 2005, 2006, 2007, 2008, 2009
- Workshop on Modern Computer Tools for the Biosciences (IEEE/ACM CCGrid) 2008
- International Symposium on Cloud Computing (IEEE/ACM CCGrid), 2009, 2010
- ACM Compute, 2009
- IEEE International Conference on High Performance Computing and Communications (IWCMC), 2009, 2010
- International Conference on Autonomic Computing and Communications, 2009
- International Workshop On Grids, Clouds and Virtualization, 2009

## CURRICULUM VITAE

- Iberian Grid Infrastructure Conference, 2007, 2008, 2009
- IEEE ChinaCom, 2009
- Workshop on Hot Topics in Cloud Computing (Usenix Annual Technical Conference), 2009
- High Performance Computing and Simulation Conference (IEEE IWCMC), 2009, 2010
- Energy Efficient Grids, Clouds and Clusters Workshop (IEEE Grid), 2009
- Virtualization Technology topic in DATE, 2010
- Workshop on Provisioning and Management of Service Oriented Architecture and Cloud Computing, 2010
- International Workshop on Content Delivery Network (IEEE/ACM CCGrid), 2010
- Workshop on Scientific Cloud Computing (ACM HPDC), Steering Committee, 2010, 2011
- Workshop on Virtualization in High-Performance Cloud Computing (EuroPar), 2010
- International Workshop on Virtualization Technologies in Distributed Computing (ACM HPDC), 2010
- IEEE International Conference on Cloud Computing, 2009, 2010, 2011
- International Advanced Research Workshop on High Performance Computing, Grids and Clouds, 2010
- IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing, 2010
- IEEE International Conference on Software – Science, Technology & Engineering, 2010
- ACM/IEEE International Conference on Grid Computing, 2010
- ISC Cloud, 2010
- ServiceWave, 2010
- International Conference on Utility and Cloud Computing, 2010
- International Workshop on Systems Management Techniques, Processes, and Services, 2011
- Supercomputing, 2011
- Euro-Par, Vice-chair for topic Grid, Cluster and Cloud Computing, 2011
- IEEE International Conference on Cloud Computing 2018

## RESEARCH

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### RESEARCH INTERESTS

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Distributed Systems, Cloud Computing, Big Data, High Performance Computing

## FUNDING

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### **BEACON - Enabling Federated Cloud Networking**

- European Union H2020 Programme Grant Agreement 644048
- 2015-17, 7 partners, €3.4M total grant (€400K UCM grant)
- Role: Scientific Coordinator and UCM Principal Investigator

### **PANACEA - Proactive Autonomic Management of Cloud Resources**

- European Union FP7 Programme Grant Agreement 610764
- 2013-16, 7 partners, €3.2M total grant (€350K UCM grant)
- Role: UCM Principal Investigator

### **CloudCatalyst - Reenergize Productivity and Competitiveness of European economy with Cloud**

- European Union FP7 Programme Grant Agreement 612053
- 2013-2015, 5 partners, €700K total grant (€120K UCM grant)
- Role: UCM Principal Investigator

## **BonFIRE - Building Service Testbeds on FIRE**

- European Union FP7 Programme Grant Agreement 257386
- 2010-13, 14 partners, €8.5M total grant (€230K UCM grant)
- Role: UCM Principal Investigator

## **StratusLab - Enhancing Grid Infrastructures with Cloud Computing**

- European Union FP7 Programme Grant Agreement 261552
- 2010-12, 6 partners, €3.3M total grant (€450K UCM grant)
- Role: UCM Principal Investigator

## **4CaaS - Building the PaaS Cloud of the Future**

- European Union FP7 Programme Grant Agreement 258862
- 2010-13, 17 partners, €15M total grant (€200K UCM grant)
- Role: UCM Principal Investigator

## **IGE - Initiative for Globus in Europe**

- European Union FP7 Programme Grant Agreement 261560
- 2010-13, 11 partners, €3.7M total grant (€200K UCM grant)
- Role: UCM Principal Investigator

## **RESERVOIR - Resources and Services Virtualization without Barriers**

- European Union FP7 Programme Grant Agreement 215605
- 2008-11, 16 partners, €11M total grant (€1M UCM grant)
- Role: Technical Activity Coordinator and UCM Principal Investigator and

## **EGEE - III: Enabling Grids for E-Science**

- European Union FP7 Programme Grant Agreement 222667
- 2008-10, 32 partners, €36M total grant (€250K UCM grant)
- Role: UCM Principal Investigator

## **BEinGRID - Business Experiments in Grid**

- European Union FP6 Programme Grant Agreement IST-2005-034702
- 2006-08, 17 partners, €12M total grant (€135K UCM grant)
- Role: UCM Principal Investigator

## **EGEE-II - Enabling Grids for E-Science**

- European Union FP6 Programme Grant Agreement IST-2005-031688
- 2006-08, 32 partners, €30M total grant (€100K UCM grant)
- Role: UCM Principal Investigator

## **EGEE - Enabling Grids for E-Science**

- European Union FP6 Programme Grant Agreement IST-2003-508833
- 2004-06, 32 partners, €30M total grant
- Role: Researcher

## **iAstro - Computational and Information Infrastructure in the Astronomical Data Grid**

- European Union FP5 Programme Action Cost 283
- 2001-05, 12 partners, €200K total grant
- Role: Researcher

## CURRICULUM VITAE

### Parallel Multigrid Methods and Adaptive Execution on Grid Environments

- NASA Contract NAS1-97046
- 1998-02
- Role: Researcher

### Robust Scalable Solvers in Fluid Dynamics for Multi-block Grids on Parallel Computers

- Fulbright Commission Grant 99003
- 1999-01
- Role: Researcher

### Behavioral Methodologies for Digital System Design

- European Union, *HCM*, CHRX-CT94-0459
- 1994-97
- Role: Researcher

## JOURNAL ARTICLES

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- [1] R. Moreno-Vozmediano, R. S. Montero, E. Huedo, I.M. Llorente, “Orchestrating the Deployment of High Availability Services on Multi-zone and Multi-cloud Scenarios”, **Journal of Grid Computing** 16 (1), 39-53, 2018
- [2] R. S. Montero, E. Rojas, A.A. Carrillo I.M. Llorente, “Extending the Cloud to the Network Edge”, **IEEE Computer** 50 (4), 91-95, 2017
- [3] J. Riley, J. Noss, W. Dillingham, J. Cuff, I. M. Llorente, “A High-Availability Cloud for Research Computing”, **IEEE Computer**, Volume: 50, Issue: 6, 2017.
- [4] L. E. Iacono, J. L. Vázquez Poletti, C. G. García Garino, I. M. Llorente, “A Performance Models for Frost Prediction on Public Cloud Infrastructures”, **Computing and Informatics**, in press, 2017.
- [5] I. M. Llorente. “The Limits to Cloud Price Reduction”, **IEEE Cloud Computing**, Volume: 4, Issue: 3, 2017.
- [6] L. Vazquez, M. P. Velasco, J. L. Vazquez-Poletti, I. M. Llorente, D. Usero, S. Jiménez, Modeling and Simulation of the Atmospheric Dust Dynamic; Fractional Calculus and Cloud Computing, **International Journal of Numerical Analysis and Modeling**, in press, 2017.
- [7] R. Moreno-Vozmediano, R. S. Montero, E. Huedo, I. M. Llorente. “Cross-Site Virtual Network Provisioning in Cloud and Fog Computing”, **IEEE Cloud Computing**, Volume: 4, Issue: 2, March-April 2017
- [8] E. Huedo, R. Moreno-Vozmediano, R. S. Montero, I. M. Llorente, A. Levin, P. Massonet, “Interoperable Federated Cloud Networking”, **IEEE Internet Computing**, 21 (5), 54-59, 2017
- [9] R. S. Montero, E. Rojas, A. A. Carrillo, I. M. Llorente, “Bringing Cloud Computing Capabilities at the Edge of the Network”, **IEEE Computer**, pp: 91-95, Issue No. 04 – April, 2017 vol. 50
- [10] R. Moreno-Vozmediano, R. S. Montero, E. Huedo, I. M. Llorente “Implementation and Provisioning of Federated Networks in Hybrid Clouds”, **Journal of Grid Computing**, June 2017, Volume 15, Issue 2, pp 141–160

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- [11] J. L. Vazquez-Poletti, R. Moreno-Vozmediano, R. Han, W. Wang, I. M. Llorente “SaaS enabled admission control for MCMC simulation in cloud computing infrastructures,” **Computer Physics Communications**, Volume 211, February 2017, Pages 88-97.
- [12] I. M. Carrion, E. Huedo, I. M. Llorente “Interoperating grid infrastructures with the GridWay metascheduler,” **Concurrency and Computation: Practice and Experience**, 27(9), 2015, pp. 2278-2290.
- [13] J. L. Lucas-Simarro, R. Moreno-Vozmediano S. Montero, I. M. Llorente “Cost Optimization of Virtual Infrastructures in Dynamic Multi-Cloud Scenarios,” **Concurrency and Computation: Practice & Experience**, 27(9), 2015, pp. 2260-2277.
- [14] J. L. Vázquez-Poletti, S. Santos-Muñoz, I. M. Llorente, F. Valero. “A Cloud for Clouds: Weather Research and Forecasting on a Public Cloud Infrastructure,” **Cloud Computing and Services Sciences**, Springer, 512, 2015, pp. 3-11.
- [15] J. L. Vázquez-Poletti, R. Moreno-Vozmediano, R. S. Montero, E. Huedo, I. M. Llorente “Solidifying the foundations of the cloud for the next generation Software Engineering,” **Journal of Systems and Software** 86(9) 2013, pp. 2321-2326.
- [16] M. Rodriguez Pascual, R. Mayo Garcia, I. M. Llorente “Montera: A Framework for Efficient Execution of Monte Carlo Codes on Grid Infrastructures,” **Computing and Informatics** 32(1) 2013, pp. 113-144.
- [17] R. Moreno-Vozmediano, R. S. Montero and I. M. Llorente “Key Challenges in Cloud Computing to Enable the Future Internet of Services,” **IEEE Internet Computing** 17(4) 2013, pp. 18-25.
- [18] I. Carrion, E. Huedo and I. M. Llorente “Interoperating grid infrastructures with the GridWay metascheduler,” **Concurrency and Computation: Practice and Experience**, 27 (9), 2013, pp. 2278-2290.
- [19] J. Tordsson, R. S. Montero, R. Moreno-Vozmediano and I. M. Llorente “Cloud brokering mechanisms for optimized placement of virtual machines across multiple providers,” **Future Generation Computer Systems** (28:2), 2012, pp. 358-367.
- [20] R. Moreno-Vozmediano, R. S. Montero and I. M. Llorente “IaaS Cloud Architecture: From Virtualized Data Centers to Federated Cloud Infrastructures,” **IEEE Computer**, 45(12), 2012, pp. 65-72.
- [21] J. Lucas-Simarro, R. Moreno-Vozmediano, R. S. Montero and I. M. Llorente “Scheduling Strategies for Optimal Service Deployment Across Multiple Clouds,” **Future Generation Computer Systems**, 29(6), 2013, pp. 1431-1441.
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- [23] C. Vázquez, E. Huedo, R. S. Montero and I. M. Llorente “On the use of clouds for grid resource provisioning,” **Future Generation Computer Systems** (27:5), 2011, pp. 600-605.
- [24] J. Tordsson, R. S. Montero, R. Moreno-Vozmediano and I. M. Llorente “Cloud brokering mechanisms for optimized placement of virtual machines across multiple providers,” **Future Generation Computer Systems** (28:2), 2011, pp. 358-367.

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- [25] P. Romero, G. Barderas, J. L. Vázquez-Poletti and I. M. Llorente “Spatial Chronogram to detect Phobos Eclipses on Mars with the MetNet Precursor Lander,” *Planetary and Space Science* (59:13), 2011, pp. 1542-1550.
- [26] R. Moreno-Vozmediano, R. S. Montero and I. M. Llorente “Elastic management of web server clusters on distributed virtual infrastructures,” **Concurrency and Computation: Practice and Experience** (23:13), 2011, pp. 1474-1490.
- [27] R. Moreno-Vozmediano, R. S. Montero and I. M. Llorente “Multi-Cloud Deployment of Computing Clusters for Loosely-Coupled MTC Applications,” **IEEE Transactions on Parallel and Distributed Systems**. Special Issue on Many Task Computing (22:6), 2011, pp. 924-930.
- [28] D. Milojevic, I. M. Llorente and R. S. Montero “OpenNebula: A Cloud Management Tool,” **IEEE Internet Computing** (15:2), 2011, pp. 11-14.
- [29] A. Lorca, E. Huedo and I. M. Llorente “The Grid[Way] Job Template Manager, a tool for parameter sweeping,” **Computational Physics Communications** (182:4), 2011, pp. 1047-1060.
- [30] C. Vázquez, E. Huedo, R. S. Montero and I. M. Llorente “Federation of TeraGrid, EGEE and OSG infrastructures through a metascheduler,” **Future Generation Computer Systems** (26:7), 2010, pp. 979-985.
- [31] B. Sotomayor, R. S. Montero, I. M. Llorente and I. Foster “Virtual Infrastructure Management in Private and Hybrid Clouds,” **IEEE Internet Computing** (13:5), 2010, pp. 14-22.
- [32] L. Rodero-Merino, L. Vaquero, V. Gil, F. Galan, J. Fontán, R. S. Montero and I. M. Llorente “From infrastructure delivery to service management in clouds,” **Future Generation Computer Systems** (26), 2010, pp. 1226-1240.
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- [35] I. M. Llorente and R. S. Montero “OpenNebula: Leading Innovation in Cloud Computing Management,” **ERCIM News** (:83), 2010, pp. 14-15.
- [36] K. Leal, E. Huedo and I. M. Llorente “Performance-based scheduling strategies for HTC applications in complex federated grids,” **Concurrency and Computation: Practice and Experience** (22:11), 2010, pp. 1416-1432.
- [37] E. Huedo, R. S. Montero and I. M. Llorente “Grid Architecture from a Metascheduling Perspective,” **Computer** (43:7), 2010, pp. 51-56.
- [38] J. Garzón, E. Huedo, R. S. Montero, I. M. Llorente and P. Chacón “End-to-End Cache System for Grid Computing: Design and Efficiency Analysis of a High-Throughput Bioinformatic Docking Application,” **International Journal of High Performance Computing Applications** (24:3), 2010, pp. 243-264.



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- [40] K. Leal , E. Huedo and I. M. Llorente “A decentralized model for scheduling independent tasks in Federated Grids,” **Future Generation Computer Systems** (25:8), 2009, pp. 840-852.
- [41] E. Huedo, R. S. Montero and I. M. Llorente “A recursive architecture for hierarchical grid resource management,” **Future Generation Computer Systems** (25:4), 2009, pp. 401-405.
- [42] S. Beco, A. Maraschini, F. Pacini, O. Biran, D. Breitgand, Meth, K., B. Rochwerger , Salant, E., Silvera, E., Tal, S., Y. Wolfsthal, Yehuda, M., Caceres, J., Hierro, J., Emmerich, W., A. Galis, Edblom, L., E. Elmroth, Henriksson, D., Hernandez, F., J. Tordsson, Hohl, A., E. Levy, Sampaio, A., Scheuermann, B., Wusthoff, M., Latanicki, J., Lopez, G., Marin-Frisonroche, J., Dorr, A., Ferstl, F., E. Huedo, I. M. Llorente , R. S. Montero, Massonet, P., Naqvi, S., Dallons, G., Pezz, M., Puliafito, A., Ragusa, C., Scarpa, M. and Muscella, S. “Cloud computing and RESERVOIR project,” **Nuovo Cimento C Geophysics Space Physics C** (32:2), 2009, pp. 99-103.
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- [46] J. L. Vázquez-Poletti, E. Huedo, R. S. Montero and I. M. Llorente “Coordinated Harnessing of the IRISGrid and EGEE Testbeds with GridWay,” **Journal of Parallel and Distributed Computing** (66:5), 2006, pp. 763-771.
- [47] R. S. Montero, E. Huedo and I. M. Llorente “Benchmarking of high throughput computing applications on Grids,” **Parallel Computing** (32:4), 2006, pp. 267-279.
- [48] A. Ibarra, D. Tapiador, E. Huedo, R. S. Montero, C. Gabriel, C. Arviset and I. M. Llorente “On-the-fly XMM-Newton Data Reduction on the Grid,” **Scientific Programming** (14:2), 2006, pp. 141-150.
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- [50] J. Herrera, E. Huedo, R. S. Montero and I. M. Llorente “Benchmarking of a Joint IRISGrid/EGEE Testbed with a Bioinformatics Application,” **Scalable Computing: Practice and Experience** (7:2), 2006, pp. 25-32.
- [51] I. M. Llorente, R. S. Montero and E. Huedo “A loosely coupled vision for computational grids,” **Distributed Systems Online**, IEEE (6:5), 2005.
- [52] E. Huedo, R. S. Montero and I. M. Llorente “The GridWay Framework for Adaptive Scheduling and Execution on Grids,” **Scalable Computing: Practice and Experience** (6:3), 2005, pp. 1-8.

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- [53] E. Huedo, A. Lepinette, R. S. Montero, I. M. Llorente and L. Vázquez “Development and execution of an impact cratering application on a computational Grid,” **Scientific Programming** (13:1), 2005, pp. 19-30.
- [54] E. Huedo, U. Bastolla, R. S. Montero and I. M. Llorente “A Framework for Protein Structure Prediction on the Grid,” **New Generation Computing** (23:4), 2005, pp. 277-290.
- [55] J. Herrera, E. Huedo, R. S. Montero and I. M. Llorente “Porting of scientific applications to Grid Computing on GridWay,” **Scientific Programming** (13:4), 2005, pp. 317-331.
- [56] E. Huedo, R. S. Montero and I. M. Llorente “A framework for adaptive execution in grids,” **Software: Practice and Experience** (34:7), 2004, pp. 631--651.
- [57] E. Huedo, U. Bastolla, R. S. Montero and I. M. Llorente “Computational Proteomics on the Grid,” **Journal of New Generation Computing**, special issue on Grid Systems for Life Sciences (22:2), 2004, pp. 191-192.
- [58] M. Prieto., R. S. Montero, I. M. Llorente and F. Tirado “A Parallel Multigrid Solver for Viscous Flows on Anisotropic Structured Grids,” **Parallel Computing** (29:7), 2003, pp. 907-923.
- [59] R. S. Montero, I. M. Llorente and M. D. Salas “Semicoarsening Smoothers for the Simulation of A Flat-plate at Yaw,” **Computers and Fluids** (32:6), 2003, pp. 873-890.
- [60] V. M. Pérez-García, S. Jiménez, I. M. Llorente and L. Vázquez “A Numerical Scheme for the Simulation of the Blow-up in the Nonlinear Schrödinger Equation,” **Applied Mathematics and Computation** (134), 2002, pp. 271-291.
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- [62] R. S. Montero, I. M. Llorente and M. D. Salas “A Robust Multigrid Algorithm for the Simulation of a Yawed Flat Plate,” **Journal of Scientific Computing** (17:1-4), 2001, pp. 519-528.
- [63] R. S. Montero, I. M. Llorente and M. D. Salas “Robust Multigrid Algorithms for the Navier-Stokes Equations,” **Journal of Computational Physics** (173), 2001, pp. 412-432.
- [64] M. Prieto., I. M. Llorente and F. Tirado “Data Locality Exploitation in the Decomposition of Regular Domain Problems,” **IEEE Transactions on Parallel and Distributed Systems** (11:11), 2000, pp. 1141-1150.
- [65] M. Prieto., I. M. Llorente and F. Tirado “A Revision of Regular Domain Partitioning,” **SIAM News** (33:1), 2000.
- [66] I. M. Llorente, B. Diskin and N.D. Nelson “Alternating Plane Smoothers for Multiblock Grids,” **SIAM Journal on Scientific Computing** (22:1), 2000, pp. 218-242.
- [67] M. Prieto., R. S. Montero, D. Espadas, I. M. Llorente and F. Tirado “Parallel Multigrid for Anisotropic Elliptic Equations,” **Journal of Parallel and Distributed Computing** (61), 2000, pp. 96-114.
- [68] I. M. Llorente and N.D. Nelson “Behavior of Plane Relaxation Methods as Multigrid Smoothers,” **Electronic Transactions on Numerical Analysis** (10), 2000, pp. 92-114.

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### INTERNATIONAL TECHNICAL REPORTS

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### INVITED TALKS

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- [1] “Private Cloud with OpenNebula and Ceph at FAS Research Computing”, Panel Presentation at Seventh Annual Harvard IT Summit, Harvard University, Cambridge, USA, June 8, 2017

## CURRICULUM VITAE

- [2] “An Introduction to OpenNebula – Cloud Federation Features and Use Cases”, **Invited Talk at Harriri Institute for Computing**, Boston University, Boston, USA, April 6, 2017
- [3] “An Introduction to OpenNebula – A Project Perspective”, **Invited Talk at Northeastern University**, Boston, USA, January 31, 2017
- [4] “Cloud as an Enabler for Big Data Analytics”, **Invited Talk at Harvard’s RCC**, Cambridge, USA, November 18, 2016
- [5] “Bringing Private Cloud Computing to HPC and Science: Present and Future”, **Invited Talk at Stanford’s SLAC**, Stanford, USA, June 30, 2014
- [6] “Bringing Private Cloud Computing to HPC and Science: Present and Future”, **Invited Talk at Berkeley Lab**, Berkeley, USA, June 19, 2014
- [7] “OpenNebula - Latest Innovations in Private Cloud Computing”, **Keynote at CLOSER 2014**, Barcelona, Spain, April 3, 2014
- [8] “Enabling Business in Cloud Computing”, **Keynote at Future Internet Assembly 2014**, Athens, Greece, March 19, 2014
- [9] “Cloud Architectures for HPC – Industry Case Studies”, **Invited Talk at ISC Cloud 2013**, Heidelberg, Germany, September 23, 2013
- [10] “Bringing Private Cloud Computing to HPC and Science”, **Keynote at EGI-TF 2013**, Madrid, Spain, September 17, 2013
- [11] “Federated Cloud Computing”, **Keynote at Workshop GARR 2012**, Rome, Italy, November 30th, 2012
- [12] “Cloud Computing Architecture with Open Nebula – HPC Cloud Use Cases”, **Invited Talk at NASA Ames**, Moffett Field, CA, May 24, 2012
- [13] “Open-source and Standards - Unleashing the Potential for Innovation of Cloud Computing”, **Invited Talk at Cloudscape IV Advances in Interoperability and Cloud Computing Standards**, Brussels, Belgium 23-24 February 2012
- [14] “Key Challenges in Cloud Computing to Enable Future Internet of Things”, **Invited Talk at 4th EU-Japan Symposium on New Generation Networks and Future Internet**, Tokyo, Japan, January 19th, 2012
- [15] “Cloud Interoperability and Portability”, **Keynote at 5th International DMTF Academic Alliance Workshop on Systems and Virtualization Management: Standards and the Cloud**, Paris, France, October 24th, 2011
- [16] “HPC Cloud Computing with OpenNebula”, **Keynote at High Performance Cloud Computing Day**, Amsterdam, The Netherlands, October 4
- [17] “OpenNebula Interoperability and Portability” and Panel Discussion about “Resilient Deployments in the Cloud”, **Invited Talks at Open World Forum 2011**, Paris, France, Sept 22-24, 2011
- [18] “Challenges in Federated and Hybrid Cloud Computing”, **Keynote at Cloud Day 2011**, Stockholm, Sweden, Sept 14, 2011

## CURRICULUM VITAE

- [19] “Challenges in Federated and Hybrid Cloud Computing”, **Keynote at 2011 International Conference on Parallel Computing**, Ghent, Belgium, August 30-September 2, 2011
- [20] “Challenges in Federated and Hybrid Cloud Computing”, **Keynote at 2011 International Conference on High Performance Computing & Simulation**, Istanbul, Turkey, Jul 4-8, 2011
- [21] “Unleashing the Potential for Innovation of Cloud Computing”, **Invited Talk at the Workshop Towards a Cloud Computing Strategy for Europe: Matching Supply and Demand at the 1st Digital Assembly**, Brussels, Belgium, June, 2011
- [22] “Leading Innovation in Cloud Computing Management”, **Invited Talk at Canada-EU Future Internet Workshop**, Waterloo, Canada, March, 2011
- [23] “A Reference Open Cloud Stack to Enable Interoperable Enterprise-class Cloud Computing Platforms”, **Invited Talk at CloudScape III**, Brussels, Belgium, March, 2011
- [24] “Enabling Technologies, the OpenNebula Framework”, **Invited Talk at The Future of Cloud Computing, Strategies and Design**, Taormina, Italy, March, 2011
- [25] “Cloud Case Studies for Research and Industry”, **Invited Talk at Des grilles aux Clouds Workshop**, Lyon, France, December, 2010
- [26] “Leading World Innovation in Open-source Cloud Computing”, **Keynote at OW2 Annual Conference 2010**, Paris, France, November 2010
- [27] “Enterprise Usage of OpenNebula”, **Invited Talk at 7th International Cloud Computing Expo**, Santa Clara, U.S.A., November 2010
- [28] “OpenNebula: Leading Innovation in Cloud Computing Management”, **Invited Talk at HP Labs**, Palo Alto, CA, November 2010
- [29] “Your Organization’s Cloud Where to Start What to Do, What to Avoid”, **Invited Panel at ISC Cloud 2010**, Frankfurt, Germany, October 2010
- [30] “Cloud Case Studies”, **Invited Talk at ISC Cloud 2010**, Frankfurt, Germany, October 2010
- [31] “OpenNebula: Leading Innovation in Cloud Computing Management”, **Keynote at OGF30/Grid2010**, Brussels, Belgium, October 2010
- [32] “Leading World Innovation in Open-source Cloud Computing”, **Keynote at CloudComp 2010**, Barcelona, Spain, October 2010
- [33] “Key Research Challenges in Cloud Computing”, **Keynote at 3rd EU-Japan Symposium on Future Internet and New Generation Networks**, Tampere, Finland, October, 2010
- [34] “Innovation in Cloud Computing Architectures”, **Keynote at EuroPar 2010**, Ischia, Naples, Italy, September 2010
- [35] “Innovation in Cloud Computing Architectures”, **Invited Talk at Advanced Workshop 2010 in High Performance Computing, Grids and Clouds**, Cetraro, Italy, June 2010

## CURRICULUM VITAE

- [36] “Innovation in Cloud Computing Architectures”, **Keynote at IEEE International Conference on Software Science, Technology & Engineering**, Herzlia, Israel, June 2010
- [37] “Enabling Technologies for Cloud Computing”, **Invited Talk at 1st European Summit on the Future Internet**, Luxembourg, June 2010
- [38] “Building IaaS Clouds with OpenNebula and its Application to Grid Computing”, **Invited Talk at CERN**, Geneva, Switzerland, June 2010
- [39] Design and Building IaaS Clouds, **Keynote at CloudViews 2010**, Porto, Portugal, May 2010
- [40] Cloud Computing from an Institutional Perspective, **Invited Talk at 1st eInfraNET Information Exchange Workshop**, Lovain, Belgium, April 2010
- [41] OpenNebula Open-Source Toolkit for Cloud Computing, **Invited Talk at Cloud Computing Europe 2010**, March 2010
- [42] “Innovation for Cloud Infrastructure Management in OpenNebula-RESERVOIR”, **Invited Talk at ETSI Workshop on Grids, Clouds & Service Infrastructures**, Sophia Antipolis, France, November 2009
- [43] “Cloud Interoperability with the OpenNebula Cloud Toolkit”, **Microsoft Roundtable on Cloud Computing: Interoperability and Data Portability Issues**, Brussels, Belgium, November 2009
- [44] “The OpenNebula Standard-based Open-source Toolkit to Build Cloud Infrastructures”, **Keynote at Jornadas Técnicas RedIris**, Santiago de Compostela, Spain, November 2009
- [45] “The OpenNebula Open Source Toolkit to Build Cloud Infrastructures”, **Invited Talk at LinuxWold Expo 2009**, Utrecht, The Netherlands, November 2009
- [46] “OpenNebula - An Innovative Open Source Toolkit for Building Cloud Solutions”, **Invited Talk at Cloud Computing and its Applications 2009**, Chicago, U.S.A., October 2009
- [47] “An Introduction to Cloud Computing Infrastructures”, **Invited Talk at Grids and e-Science 2009 Advanced Workshop on the future and sustainability of production Grids**, Santander, Spain, June 2009
- [48] “VM Management for Energy Efficiency with the OpenNebula Virtual Infrastructure Engine”, **Invited Talk at Workshop OGF-EU: Using IT to reduce Carbon Emissions**, Catania, Italy, March 2009
- [49] “Position Paper “State and Future of Infrastructure Clouds”, **Roundtable Panel Discussion at Cloud Computing - Cloudscape Workshop**, Brussels, Belgium, January 2009
- [50] “Cloud and Virtualization to Support Grid Infrastructures”, **Keynote at European Space Agency ESAC GRID Workshop '08**, Villafranca del Castillo, Spain, December 2008
- [51] “Research Challenges in Cloud Infrastructures to Provision Virtualized Resources”, **Panel on “Beyond Amazon: Using and Offering Services in a Cloud”**, **Future Internet Assembly**, Madrid, Spain, December 2008
- [52] “An Introduction to Cloud and Virtualization to Support Grid Computing”, **Invited Talk at Session on Cloud, Virtualization and Grid**, EGEE08, Istanbul, Turkey, September 2008

## CURRICULUM VITAE

- [53] “Cloud Computing for On-demand Resource Provisioning”, **Invited Talk at 7th NRENs and Grids Workshop**, Dublin, Ireland, September 2008
- [54] “Towards a New Model for the Infrastructure Grid”, **Panel “From Grids to Cloud Services” in the International Advanced Research Workshop on High Performance Computing and Grids**, Cetraro, Italy, July 2008
- [55] “Cloud Computing for On-demand Resource Provisioning”, **Invited Talk at International Advanced Research Workshop on High Performance Computing and Grids**, Cetraro, Italy, July 2008
- [56] “Grid Scheduling Architectures with Globus GridWay and Sun Grid Engine”, **Invited Talk at Sun Microsystems**, Regensburg, Germany, September 2007
- [57] “Grid Scheduling Architectures with Globus”, **Invited Talk at International Research Workshop on Scheduling**, Cetraro, Italy, June 2007
- [58] “Grid Scheduling Architectures”, **Invited Talk at IBERGRID, 2007**, Santiago de Compostela, May, 2007
- [59] “Position about Standardization Bodies and Open Source Communities”, **Invited Talk at NESSI Workshop on Relationship with Standardization Bodies and Open Source Communities in the Grid Area**, Brussels, Belgium, July 2006
- [60] “GridWay Scheduling Architecture”, **Invited Talk at GSA-WG**, Global Grid Forum 16, Athens, Greece, February 2006
- [61] “Technologies for Grid Computing”, **Invited Talk at ESAC**, European Space Agency, Madrid, October 2005
- [62] “Robust and Parallel Multigrid Methods on Structured Grids”, **Invited Talk at NASA Langley Research Center**, Hampton, Virginia, USA, July, 2001
- [63] “Robust and Parallel Multigrid Methods on Structured Grids”, **Invited Talk at Lawrence Livermore National Laboratory**, California, USA, July, 2001

## **COURSE DEVELOPMENT AND TEACHING**

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Fully responsible for all aspects of course development, instruction, and assessment.

### **HARVARD - DISTRIBUTED COMPUTING, CLOUD COMPUTING AND BIG DATA COURSES**

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#### **CS205: Computing Foundations for Computational Science**

- Web: Harvard-CS205.org
- Graduate Course
- Contents: Cloud computing, high performance computing, and big data

School years: 2017-2018

### **UCM - DISTRIBUTED COMPUTING, CLOUD COMPUTING AND BIG DATA COURSES**

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#### **Distributed Computing and Grid Computing**

- Graduate Course
- Contents: Principles, fault-tolerance, security, scheduling, resource and data management, monitoring
- School years: 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, 2011-12

#### **Cloud Computing and Big Data**

- Graduate Course
- Contents: Cloud models, challenges and migration strategies, and Big Data architecture, management and analytics
- School years: 2014-15, 2015-16, 2017-2018
- Course evaluation (10 scale): 8.3 and 8.3

### **UCM - COMPUTATIONAL SCIENCE AND HIGH PERFORMANCE COMPUTING COURSES**

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#### **Scientific Computing and Programming**

- Undergraduate Course
- Contents: Structured programming, computer arithmetic, and classical numerical methods of scientific computing
- School years: 1995-96, 1996-97, 1997-98

#### **Programming of High Performance Computing Systems**

- Undergraduate Course
- Contents: Applications, architectures, scalability models, benchmarking, parallel programming
- School years: 1995-96, 1996-97, 1997-98

#### **Multiprocessor Programming**

- Graduate Course
- Contents: Shared memory architectures, threads, directives, data distribution, scalability
- School years: 1996-97, 1997-98

#### **Design, Development and Evaluation of Parallel Programs**



## CURRICULUM VITAE

- Graduate Course
- Contents: Applications, architectures, scalability models, benchmarking, parallel programming
- School years: 1998-99, 1999-00, 2000-01, 2001-02, 2002-03

### **Parallel Programming**

- Undergraduate Course
- Contents: Models, optimization, shared memory programming, distributed memory programming
- School years: 2002-03, 2003-04, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, 2011-12, 2012-13, 2013-14

### **High Performance Computing**

- Undergraduate Course
- Contents: Architectures, applications, scalability, shared and distributed memory, resource management
- School years: 2013-14, 2014-15, 2015-16
- Course evaluation (10 scale): 7.9 and 7.5

## **UCM - OPERATING SYSTEMS AND SYSTEMS SECURITY COURSES**

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### **Operating Systems**

- Undergraduate Course
- Contents: Types, structure, processes, synchronization, communication, deadlocks, file system
- School years: 1994-95, 1995-96

### **Operating Systems Programming**

- Undergraduate Course
- Contents: Foundations, development environments, file systems, processes, communication, kernel, security
- School years: 2012-13

### **Systems Security**

- Graduate Course
- Contents: Foundations, server security, network security, auditing, policies, norms
- School years: 2003-04, 2004-05, 2005-06

## **UCM - COMPUTER ARCHITECTURE COURSES**

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### **Computer Architecture Lab**

- Undergraduate Course
- Contents: Basic organization, arithmetic, architecture, assembler, input/output
- School years: 1994-95, 1995-96, 1996-97, 1997-98, 2003-04, 2004-05, 2005-06

### **Introduction to Computer Architecture**

- Undergraduate Course
- Contents: Arithmetic, processor, memory hierarchy, multi-processor
- School years: 1999-00, 2000-01, 2001-02, 2002-03, 2017-18

### **Advanced Computer Architecture (Parallel Architecture)**

- Undergraduate Course
- Contents: Parallel architectures, Coherence, consistency, synchronization, interconnection networks

## CURRICULUM VITAE

- School years: 1996-97, 1997-98, 1998-99, 1999-00, 2000-01, 2001-02, 2004-05, 2005-06, 2006-07, 2007-08, 2008-09, 2009-10, 2010-11, 2011-12

### UCM - ADVISING EXPERIENCE

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#### Ph.D. Dissertations Advised

- “Dynamic Provisioning of Computational Resources in Cloud Infrastructures”, Dr. Constantino Vázquez, 10/12
- “Efficient Execution of Monte Carlo Applications in Grid Infrastructures”, Dr. Manuel Rodríguez, 03/12
- “Optimal Scheduling Strategies in Federated Grid Infrastructures”, Dr. Katia Leal, 12/10
- “Adaptive Loop Scheduling Techniques in Grid Infrastructures”, Dr. José Herrera, 10/08
- “Efficient Execution of Computational Workflows in Grid Infrastructures”, Dr. Jose Luis Vázquez-Poletti, 09/08
- “Adaptive Execution of Jobs in Computational Grid Environments”, Dr. Eduardo Huedo, 12/04
- “Simulation of Navier-Stokes Equations on Parallel Architectures”, Dr. Rubén Santiago, 06/02
- “Parallel Implementation of Robust Multigrid Methods”, Dr. Manuel Prieto, 10/00

#### Undergraduate Research

- Advised Senior Thesis of 30 undergraduate students