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Research interests

As of my incorporation into the Department of Computer Architecture and Operating Systems of the UAB as a postgraduate student, it is possible to divide my scientific-technical career into the following stages:

Simulation of Parallel Applications (1992-99): Focused on the design and development of simulators of parallel applications. This research main objective was the definition of abstractions for parallel programs, based on characterizing tasks and their dependences. Two main abstractions were developed, at first a simpler one, which was easier to parametrize, and, next, a more complex and accurate one. Using these characterizations, several simulation tools were programmed and used in the context of national and European projects. As part of my Master's thesis, I was involved in the design and development of some of these simulation applications.

National projects: 4, European: 2

Research work (1995)

International congresses: 3, National: 1, Journal papers: 3

Security in Distributed Systems (2007-12): Focused on the design and development of the FPVA (First Principles Vulnerability Assessment) methodology for the evaluation of vulnerabilities in Grid applications. This methodology clearly defined a set of steps for the assessment of Grid applications vulnerabilities, most of these steps could be automatized or at least supported by specific tools. Jointly with other professors of our group and from the University of Wisconsin, I was involved in the original definition and application of this methodology.

International projects: 2

Master Thesis: 1, Ph.D. Thesis: 1

International congresses: 2, National: 1, Journal papers: 2

Parallel Application Modeling (1999-present): This is my main line of research, aimed at defining high-level performance models for parallel applications. Initially, models were defined for MPI applications with a master-worker and pipeline structure, but later this line has been expanded with the definition of models for memory-intensive OpenMP applications, composed (mix of several structures) applications, applications based on mathematical libraries, distributed data-intensive applications and, finally, applications based on the simulation of agents (ABS) with SPMD structure.

As a result of the work on modeling the performance of ABS parallel systems, we have opened a new line for the definition and implementation of a benchmark for assessing the performance of the parallel simulators generated by well-known platforms, such as FLAME, Repast-HPC or D-Mason. In addition, the knowledge we have gained on this topic has opened new ways of collaboration for optimizing real parallel ABS in the health sciences area (tumor growth and infection spread).

National projects: 12, European: 1

Doctoral Thesis (2006)

Master Thesis: 7, Ph.D. Thesis: 3

International congresses: 17, National: 4, Journal papers: 11

International Presentations: 4

Parallel Applications Tuning Tools (2010-present): Focused on the design and development of tools for automatic tuning and, in some cases, also dynamic tuning of parallel applications. These tools allow the integration of performance models in the form of external components provided by the analyst. For this reason, this research line is tightly coupled with the Parallel Application Modeling one. The two main tools developed totally or partially by our group are Monitoring Analysis and Tuning Environment-MATE (and its highly scalable evolution ELASTIC) and Periscope Tuning Framework-PTF.

National projects: 2, European: 1

Master Thesis: 2

International congresses: 11, Journal papers: 2

Tools: MATE, ELASTIC, PTF

International Presentations: 5

Future goals:

In the *Parallel Applications Modeling* research line, the main objective is to define performance models for applications developed for large-scale platforms, which are generally also heterogeneous (multiple nodes with multiple processors with

multiple cores, plus accelerators). Said models could be aimed at reducing execution time and/or energy consumption and incorporate cognitive computing techniques (machine learning) to face the complexity inherent in heterogeneity. This objective is closely related to the main objective of the *Parallel Applications Tuning Tools* research line, which consists of the design and development of tools for large-scale applications that support the integration of the aforementioned models. The development of these research lines has been favored by participation in the European Autotune project, which is why it is considered important to maintain and extend the collaboration established with other research centers.

Finally, based on the work carried out in the modeling of agent-based simulation applications, the objective is to develop real applications in different fields of knowledge (sociology: simulation of pre-Columbian societies, medicine: simulation of growth and tumor treatment). To this end, collaboration agreements have been established with other departments of the UAB itself, private companies and international centers.

Qualifications

Postgraduate, Doctor en Informàtica, Universitat Autònoma de Barcelona (UAB)
Award Date: 1 Apr 2006

Degree, Licenciado en Informàtica (homologación de título extranjero), Ministerio de Educación y Ciencia (MEC)
Award Date: 1 Oct 1993

Engineer, Ingeniero en Computación, Universidad Simón Bolívar (Venezuela)
Award Date: 5 Feb 1991

Employment

Professor

Department of Computer Architecture and Operating Systems
Bellaterra (Cerdanyola del Vallès), Spain
1 Jan 2015 → present

High Performance Computing Applications for Science and Engineering

Bellaterra (Cerdanyola del Vallès), Spain
1 May 2014 → present

Profesor Asociado

Universidad Nueva Esparta
Venezuela, Bolivarian Republic of
15 Jan 1992 → 30 Jun 1992

Analista I+D

SPG Software House
1 Apr 1991 → 31 Jul 1992

Ayudante de prácticas de laboratorio

Universidad Simón Bolívar (Venezuela)
Caracas, Venezuela, Bolivarian Republic of
1 Sept 1987 → 31 Jul 1990

Research outputs

A methodology for selecting a performance-convenient ABMS development framework on HPC platforms

Moreno, A., Jorba, J., Peralta, C., César, E., Sikora, A. & Hanzich, M., Nov 2023, In: *Simulation Modelling Practice and Theory*. 128, 20 p., 102812.

Performance Optimization using Multimodal Modeling and Heterogeneous GNN

Dutta, A., Alcaraz, J., Tehranijamsaz, A., Cesar, E., Sikora, A. & Jannesari, A., Jul 2023, *HPDC 2023 - Proceedings of the 32nd International Symposium on High-Performance Parallel and Distributed Computing*. p. 45-57 13 p. (HPDC 2023 - Proceedings of the 32nd International Symposium on High-Performance Parallel and Distributed Computing).

Predicting number of threads using balanced datasets for openMP regions

Alcaraz, J., TehraniJamsaz, A., Dutta, A., Sikora, A., Jannesari, A., Sorribes, J. & Cesar, E., 1 May 2023, In: *Computing (Vienna/New York)*. 105, 5, p. 999-1017 19 p.

Pattern-based Autotuning of OpenMP Loops using Graph Neural Networks

Dutta, A., Alcaraz, J., TehraniJamsaz, A., Sikora, A., Cesar, E. & Jannesari, A., 2022, *Proceedings of AI4S 2022: Artificial Intelligence and Machine Learning for Scientific Applications, Held in conjunction with SC 2022: The International Conference for High Performance Computing, Networking, Storage and Analysis*. Institute of Electrical and Electronics Engineers Inc., p. 26-31 6 p. (Proceedings of AI4S 2022: Artificial Intelligence and Machine Learning for Scientific Applications, Held in conjunction with SC 2022: The International Conference for High Performance Computing, Networking, Storage and Analysis).

Building representative and balanced datasets of OpenMP parallel regions

Sorribes Gomis, J., Cesar Galobardes, E., Sikora, A. B., Alcaraz, J., Sleder, S., Tehrani, A. & Janesari, A., 1 Mar 2021, *Proceedings - 29th Euromicro International Conference on Parallel, Distributed and Network-Based Processing, PDP 2021*. Institute of Electrical and Electronics Engineers Inc., p. 67-74 8 p. 9407037. (Proceedings - 29th Euromicro International Conference on Parallel, Distributed and Network-Based Processing, PDP 2021).

CosmoHub: Interactive exploration and distribution of astronomical data on Hadoop

Tallada, P., Carretero, J., Casals, J., Acosta-Silva, C., Serrano, S., Caubet, M., Castander, F. J., Cesar, E., Croce, M., Delfino, M., Eriksen, M., Fosalba, P., Gaztanaga, E., Merino, G., Neissner, C. & Tonello, N., 1 Jul 2020, In: *Astronomy and Computing*. 32, 19 p., 100391.

Designing a benchmark for the performance evaluation of agent-based simulation applications on HPC

Moreno, A., Rodríguez, J. J., Beltrán, D., Sikora, A., Jorba, J. & César, E., 17 Mar 2019, In: *Journal of Supercomputing*. 75, 3, p. 1524-1550 27 p.

Hardware Counters' Space Reduction for Code Region Characterization

Alcaraz, J., Sikora, A. & César, E., 2019, *Euro-Par 2019: Parallel Processing - 25th International Conference on Parallel and Distributed Computing, Proceedings*. Yahyapour, R. (ed.). Vol. 11725. p. 74-86 13 p. (Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics); vol. 11725 LNCS).

A multi-aspect online tuning framework for HPC applications

Gerndt, M., Benkner, S., César, E., Navarrete, C., Bajrovic, E., Dokulil, J., Guillén, C., Mijakovic, R. & Sikora, A., 1 Sept 2018, In: *Software Quality Journal*. 26, 3, p. 1063-1096

Evaluating a formal methodology for dynamic tuning of large-scale parallel applications

Martínez, A., Sikora, A., César, E. & Sorribes, J., 25 Feb 2018, In: *Concurrency Computation*. 30, 4, p. - e4340.

Dynamic Tuning of OpenMP Memory Bound Applications in Multisocket Systems using MATE

Alcaraz, J., Sikora, A., César, E. & ACM, (ed.), 1 Jan 2018, *Proceedings of the 47th International Conference on Parallel Processing Companion*. 1 ed. Nova York (US), Vol. 37. p. 1-10 9 p.

HeDPM: load balancing of linear pipeline applications on heterogeneous systems

Moreno, A., Sikora, A., César, E., Sorribes, J. & Margalef, T., 1 Sept 2017, In: *Journal of Supercomputing*. 73, 9, p. 3738-3760

Introducing computational thinking, parallel programming and performance engineering in interdisciplinary studies

Cesar, E., Cortés, A., Espinosa, A., Margalef, T., Sikora, A., Suppi, R. & Moure Lopez, J. C., 1 Jul 2017, In: *Journal of Parallel and Distributed Computing*. 105, p. 116-126

Colorectal tumour simulation using agent based modelling and high performance computing

Kang, G., Márquez, C., Barat, A., Byrne, A. T., Prehn, J. H. M., Sorribes, J. & César, E., 1 Feb 2017, In: *Future Generation Computer Systems*. 67, p. 397-408

Autotuning of MPI Applications Using PTF

Sikora, A., César, E., Ureña, I. A. C., Gerndt, M., Kumar, A. & et al., 1 Jan 2016, *Proceedings of the ACM Workshop on Software Engineering Methods for Parallel and High Performance Applications, Kyoto, Japan, May 31 - June 04, 2016*. 1 ed. (US), p. 31-38 7 p.

Performance model based on memory footprint for OpenMP memory bound applications

Allande, C., Jorba, J., Sikora, A., César, E., Joubert, G. R. (ed.) & et al., (ed.), 1 Jan 2016, *Parallel Computing: On the Road to Exascale, Proceedings of the International Conference on Parallel Computing, ParCo 2015*. 1 ed. Amsterdam (NL), Vol. 27. p. 73-82 9 p. (Advances in Parallel Computing).

Automatic Tuning of HPC Applications. The Periscope Tuning Framework

Cesar Galobardes, E., 1 Jan 2015, 1 ed. Aachen (DE). 216 p.

Graph-Based Automatic Dynamic Load Balancing for {HPC} Agent-Based Simulations

Márquez, C., César, E., Sorribes, J. & et al., 1 Jan 2015, *Euro-Par 2015: Parallel Processing Workshops - Euro-Par 2015 International Workshops, Vienna, Austria, August 24-25, 2015, Revised Selected Papers*. Hunold, S. (ed.). 1 ed. (DE), Vol. 9523. p. 405-416 11 p. (Theoretical Computer Science and General Issues).

Master-Worker Plugin

César, E., Saveta, G., Sikora, A., Margalef, T., Sorribes, J. & Michael Gerndt, E. C. (ed.), 1 Jan 2015, *Automatic Tuning of HPC Applications. The Periscope Tuning Framework*. 1 ed. Aachen (DE), Vol. 1. p. 125-146 21 p.

MPI Parameters Plugin

César, E., Saveta, G., Sikora, A., Margalef, T., Sorribes, J. & Michael Gerndt, E. C. (ed.), 1 Jan 2015, *Automatic Tuning of HPC Applications. The Periscope Tuning Framework*. 1 ed. Aachen (DE), Vol. 1. p. 47-82 35 p.

Teaching Parallel Programming in Interdisciplinary Studies

Cesar, E., Cortés, A., Espinosa, A., Margalef, T., Moure, J. C., Sikora, A. & Suppi, R., 1 Jan 2015, In: *Lecture Notes in Computer Science*. 9523, 1, p. 66-77 11 p.

Graph-based automatic dynamic load balancing for HPC agent-based simulations

Márquez, C., César, E. & Sorribes, J., 2015, In: *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*. p. 405-416 12 p.

Improving performance on data-intensive applications using a load balancing methodology based on divisible load theory

Rosas, C., Sikora, A., Jorba, J., Moreno, A. & César, E., 1 Feb 2014, In: *International Journal of Parallel Programming*. 42, p. 94-118

Agent Migration in HPC Systems Using FLAME

Márquez, C., César, E. & Sorribes, J., 1 Jan 2014, *Euro-Par 2013: Parallel Processing Workshops: Parallel Processing Workshops - BigDataCloud, DIHC, FedICI, HeteroPar, HiBB, LSDVE, MHPC, OMHI, PADABS, PROPER, Resilience, ROME, and UCHPC 2013, Revised Selected Papers*. 1 ed. Berlin (DE), Vol. 8374. p. 523-532 10 p. (Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics); vol. 8374 LNCS).

Automating risk analysis of software design models

Frydman, M., Ruiz, G., Heymann, E., César, E. & Miller, B. P., 1 Jan 2014, In: *Scientific World Journal*. 2014, 805856.

Dynamic tuning of the workload partition factor and the resource utilization in data-intensive applications

Rosas, C., Sikora, A., Jorba, J., Moreno, A., Espinosa, A. & César, E., 1 Jan 2014, In: *Future Generation Computer Systems*. 37, p. 162-177

ELASTIC: A large scale dynamic tuning environment

Martínez, A., Sikora, A., César, E. & Sorribes, J., 1 Jan 2014, In: *Scientific Programming*. 22, p. 261-271

Impact of message filtering on HPC agent-based simulations

Márquez, C., César, E. & Sorribes, J., 2014, In: Modelling and Simulation 2014 - European Simulation and Modelling Conference, ESM 2014. p. 65-72 8 p.

Specification of periscope tuning framework plugins

Mijaković, R., Soto, A. P., Ureña, I. A. C., Gerndt, M., Sikora, A. & César, E., 2014, *Parallel Computing: Accelerating Computational Science and Engineering (CSE)*. IOS Press BV, p. 123-132 10 p. (Advances in Parallel Computing; vol. 25).

AutoTune: A Plugin-Driven Approach to the Automatic Tuning of Parallel Applications

Miceli, R., Civario, G., Sikora, A., César, E., Gerndt, M., Haitof, H., Navarrete, C., Benkner, S., Sandrieser, M., Morin, L., Bodin, F. & Pekka Manninen, P. Ö. (ed.), 1 Jan 2013, *Applied Parallel and Scientific Computing. 11th International Conference, PARA 2012, Helsinki, Finland, June 10-13, 2012, Revised Selected Papers*. 1 ed. Berlin (DE), Vol. 7782. p. 328-342 14 p.

How to Determine the Topology of Hierarchical Tuning Networks for Dynamic Auto-Tuning in Large-Scale Systems

Martínez, A., Sikora, A., César, E. & Sorribes, J., 1 Jan 2013, *International Conference on Computational Science (ICCS 2013)*. 1 ed. Barcelona (ES): Elsevier, Vol. 18. p. 1352-1361 9 p. (Procedia Computer Science).

How to Scale Dynamic Tuning to Large Parallel Applications

Martinez, A., Sikora, A., Cesar, E. & Sorribes, J., 1 Jan 2013, *Proceedings - IEEE 27th International Parallel and Distributed Processing Symposium Workshops and PhD Forum, IPDPSW 2013*. 1 ed. Piscataway (US), p. 355-364 10 p. (Proceedings - IEEE 27th International Parallel and Distributed Processing Symposium Workshops and PhD Forum, IPDPSW 2013).

Increasing Automated Vulnerability Assessment Accuracy on Cloud and Grid Middleware

Serrano, J., Cesar, E., Miller, B., Deng, R. H. (ed.), Feng, T. (ed.) & Heymann Pignolo, E., 1 Jan 2013, *Information Security Practice and Experience. 9th International Conference, ISPEC 2013, Lanzhou, China, May 12-14, 2013. Proceedings*. 1 ed. Berlin (DE), Vol. 7863. p. 278-294 16 p. (LNCS).

Methodology for MPI applications autotuning

Pimenta, A., César, E., Sikora, A. & Jack Dongarra, J. G. B. (ed.), 1 Jan 2013, *Proceedings of the 20th European MPI Users' Group Meeting*. 1 ed. Nova York (US), Vol. 1. p. 145-146 1 p.

Vulnerability assessment enhancement for middleware for computing and informatics

Serrano, J., Heymann, E., Cesar, E. & Miller, B. P., 25 May 2012, In: Computing and Informatics. 31, 1, p. 103-118

Load balancing in homogeneous pipeline based applications

Moreno, A., Cesar, E., Guevara, A., Sorribes, J. & Margalef, T., 1 Mar 2012, In: Parallel Computing. 38, p. 125-139

A Methodology for Generating Dynamic Tuning Strategies in Multicore Systems

Allande, C., Jorba, J., Sikora, A., César, E., Arabnia, H. R. (ed.), Ishii, H. (ed.), Ito, M. (ed.), Joe, K. (ed.) & Nishikawa, H. (ed.), 1 Jan 2012, *The 2012 International Conference on Parallel and Distributed Processing Techniques and Applications - PDPTA 2012*. 1 ed. (US), Vol. 2. p. 780-786 6 p.

Dynamic tuning of the workload partition factor in data-intensive applications

Rosas, C., Sikora, A., Jorba, J., Moreno, A., Cesar, E. & Geyong Min, J. H. (ed.), 1 Jan 2012, *14th IEEE International Conference on High Performance Computing and Communication & 9th IEEE International Conference on Embedded Software and Systems (HPCC-ICESS 2012)*. 1 ed. (US): IEEE Computer Society, p. 216-223 7 p.

Hierarchical MATE's approach for dynamic performance tuning of large-scale parallel applications

Martinez, A., Sikora, A., Cesar, E. & Sorribes, J., 1 Jan 2012, *Performance Computing and Communications Conference (IPCCC), 2012 IEEE 31st International*. 1 ed. Austin (US), p. 191-192 1 p.

MATE: Toward scalable automated and dynamic performance tuning environment

Morajko, A., Martínez, A., César, E., Margalef, T. & Sorribes, J., 2012, In: Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics). PART 2, p. 430-440 11 p.

Dynamically Tuning Master/Worker Applications with MATE

Martínez, A., Morajko, A., César, E., Sorribes, J. & F. Almeida, V. B. (ed.), 1 Jan 2011, *XXII Jornadas de Paralelismo*. 1 ed. (ES), Vol. 22. p. 613-618 5 p. (978-84-694-1791-1).

Metodología para la sintonización de aplicaciones OpenMP en sistemas multicore

Allande, C., Jorba, J., César, E., Morajko, A. & F. Almeida, V. B. (ed.), 1 Jan 2011, *XXII Jornadas de Paralelismo*. 1 ed. (ES), Vol. 22. p. 649-655 6 p. (978-84-694-1791-1).

Workload Balancing Methodology for Data-Intensive Applications with Divisible Load

Rosas, C., Morajko, A., Jorba, J. & Cesar, E., 1 Jan 2011, *SBAC-PAD '11 Proceedings of the 2011 23rd International Symposium on Computer Architecture and High Performance Computing*. 1 ed. Washington D.C. (US), p. 48-55 7 p.

Automatic Performance Tuning of Parallel Mathematical Libraries

Salawdeh, I., Morajko, A., César, E., Margalef, T. & Luque, E., 1 Jan 2010, In: *Advances in Parallel Computing*. 1, p. 407-414 8 p.

First Principles Vulnerability Assessment

Kupsch, J. A., Miller, B. P., Cesar, E., Radu, S. S. B. U. (ed.) & Heymann Pignolo, E., 1 Jan 2010, *CCSW 2010: The ACM Cloud Computing Security Workshop*. 1 ed. Nova York (US), p. 87-92 5 p.

Manual vs Automated Vulnerability Assessment for Grid Middleware

Serrano, J., Cesar, E., Garcia Polo, E. M. (ed.), Bermudez Marin, A. (ed.), Casado Gonzalez, R. (ed.) & Heymann Pignolo, E., 1 Jan 2010, *XXI Jornadas de Paralelismo*. 1 ed. València (ES), p. 1-1

A performance tuning strategy for complex parallel application

Guevara, A., Sorribes, J., Margalef, T., Luque, E., Moreno, A. & Cesar Galobardes, E., 2010, In: *Proceedings of the 18th Euromicro Conference on Parallel, Distributed and Network-Based Processing, PDP 2010*.

Task distribution using factoring load balancing in Master-Worker applications

Moreno, A., Cesar, E., Sorribes, J., Margalef, T. & Luque, E., 31 Jul 2009, In: *Information Processing Letters*. 109, 16, p. 902-906 5 p.

Euro-Par 2008 Workshops - Parallel Processing: Lecture Notes in Computer Science

Eduardo, C. G. (ed.), 2009

Integración de políticas de distribución de datos para aplicaciones tipo Master/Worker en la librería eSkel

Guevara Quintero, J. A., Cesar, E., Sorribes, J., Luque, E. & Badia Centelles, JM. (ed.), 1 Jan 2008, *XIX Jornadas de Paralelismo*. 1 ed. Castelló de la Plana (ES), p. 1-1 (E-Treballs d'Informàtica i Tecnologia).

Dynamic Pipeline Mapping (DPM)

Moreno, A., César, E., Guevara, A., Sorribes, J., Margalef, T. & Luque, E., 2008, In: *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*. p. 295-304 10 p.

Performance model for parallel mathematical libraries based on historical knowledgebase

Salawdeh, I., César, E., Morajko, A., Margalef, T. & Luque, E., 2008, In: *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*. p. 110-119 10 p.

Modeling Master/Worker applications for automatic performance tuning

Cesar, E., Moreno, A., Sorribes, J. & Luque, E., 1 Sept 2006, In: *Parallel Computing*. 32, p. 568-589

Definition of Framework-based Performance Models for Dynamic Performance Tuning

Cesar Galobardes, E., 1 Jan 2006, 1 ed. Bellaterra (Cerdanyola del Vallès) (ES). 164 p.

Automatic tuning of master/worker applications

Morajko, A., César, E., Caymes-Scutari, P., Margalef, T., Sorribes, J. & Luque Fadon, E., 1 Nov 2005, In: Lecture Notes in Computer Science. 3648, p. 95-103

Development and Tuning Framework of Master/Worker Applications

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César, E., Sorribes, J. & Luque, E., 1 Jan 2005, *Euro-Par 2005 Parallel Processing*. 1 ed. Berlín (DE), Vol. 3648. p. 83-92
9 p.

Modeling Master-Worker applications in POETRIES

Cesar, E., Mesa, J. G., Sorribes, J. & Luque, E., 2004, In: Proceedings - International Parallel and Distributed Processing Symposium, IPDPS 2004 (Abstracts and CD-ROM). p. 2121-2129
9 p.

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Dynamic performance tuning environment

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Un modelo integrado para la especificación e implementación de aplicaciones paralelas/distribuidas

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Simulation in Parallel Software Design: IAASTED 1997

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Simulation in parallel software design

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Parallel systems development in education: a guided method

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PSEE: A tool for parallel systems learning

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