

Universitat Rovira i Virgili

URV

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Summary

URV has coordinated the project and we have collaborated with most partners in the consortium. URV and IBM Israel started the collaboration in IBM PyWren (that evolved to Lithops) from the beginning of the project. URV was responsible for many components of Lithops like the multi-cloud backends and the multiprocessing API among others. URV also collaborated in the development of both serverless genomics pipelines (with Hutton) and serverless geospatial pipelines (with Matrix and ANSWARE).

Publications (Total: 20)

Daniel Barcelona, Marc Sánchez-Artigas, Gerard París, Pierre Sutra, Pedro García-López
On the FaaS Track: Building Stateful Distributed Applications with Serverless Architectures
Middleware '19: 20th International Middleware Conference
[link](#)

Daniel Barcelona-Pons, Pedro García-López, Álvaro Ruiz, Amanda Gómez-Gómez, Gerard París, Marc Sánchez-Artigas
FaaS Orchestration of Parallel Workloads
WOSC '19: 5th International Workshop on Serverless Computing

[link](#)

Pedro Garcia Lopez, Alberto Montresor, Anwitaman Datta

Please, do not Decentralize the Internet with (Permissionless) Blockchains!

IEEE 39th International Conference on Distributed Computing Systems (ICDCS)

[link](#), [link](#)

Pedro García-López

Decentralize the feedback infrastructure!

CoRR abs/2010.03356

[link](#)

Pedro García-López, Aleksander Slominski, Simon Shillaker, Michael Behrendt, Barnard Metzler

Serverless End Game: Disaggregation enabling Transparency

CoRR abs/2006.01251

[link](#)

Mariano Ezequiel Mirabelli, Pedro García-López, Gil Vernik

Bringing scaling transparency to Proteomics applications with serverless computing

WoSC '20: 6th International Workshop on Serverless Computing

[link](#)

Marc Sánchez-Artigas, Germán T. Eizaguirre, Gil Vernik, Lachlan Stuart, Pedro García-López

Primula: a Practical Shuffle/Sort Operator for Serverless Computing

Middleware '20: 21st International Middleware Conference Industrial Track

[link](#)

Pedro García-López, Aitor Arjona, Josep Sampe, Aleksander Slominski, Lionel Villard

Triggerflow: Trigger-based orchestration of serverless workflows (Conference Paper)

DEBS 2020: 14th ACM International Conference on Distributed and Event-based Systems

[link](#)

Gerard París; Pedro García-López; Marc Sánchez-Artigas

Serverless Elastic Exploration of Unbalanced Algorithms

13th IEEE CLOUD 2020

[link](#), [link](#)

Pedro García López, Aleksander Slominski, Michael Behrendt, Bernard Metzler

Serverless Predictions: 2021-2030

CoRR abs/2104.03075

[link](#)

Germán T. Eizaguirre, Marc Sánchez-Artigas, Pedro García-López

A milestone for FaaS pipelines; object storage-vs VM-driven data exchange

Middleware '21: 22nd International Middleware Conference

[link](#)

Josep Sampe; Pedro Garcia-Lopez; Marc Sanchez-Artigas; Gil Vernik; Pol Roca-Llaberia; Aitor Arjona

Toward Multicloud Access Transparency in Serverless Computing

IEEE Software, Vol. 38

[link](#)

Daniel Barcelona-Pons, Pedro García-López

Benchmarking parallelism in FaaS platforms

Future Generation Computer Systems, Vol. 124

[link](#)

Aitor Arjona, Pedro García-López, Josep Sampé, Aleksander Slominski, Lionel Villard

Triggerflow: Trigger-based orchestration of serverless workflows (Journal)

Future Generation Computer Systems, Vol. 124

[link](#)

Pablo Gimeno Sarroca, Marc Sánchez-Artigas

MLLess: Achieving Cost Efficiency in Serverless Machine Learning Training

CoRR abs/2206.05786

[link](#)

Josep Sampe, Marc Sánchez-Artigas, Gil Vernik, Ido Yehekezel, Pedro García-López

Outsourcing Data Processing Jobs with Lithops

2018 IEEE/ACM 4th International Workshop on Extreme Scale Programming Models and Middleware (ESPM2)

[link](#), [link](#)

Aitor Arjona, Gerard Finol, Pedro Garcia-Lopez

Transparent Serverless execution of Python multiprocessing applications

CoRR abs/2205.08818

[link](#)

Pedro García-López, Marc Sánchez-Artigas, Simon Shillaker, Peter Pietzuch, David Breitgand, Gil Vernik, Pierre Sutra, Tristan Tarrant, Ana Juan-Ferrer, Gerard París

Trade-Offs and Challenges of Serverless Data Analytics

Technologies and Applications for Big Data Value

[link](#)

Daniel Barcelona-Pons, Pierre Sutra, Marc Sánchez-Artigas, Gerard París, Pedro García-López

Stateful Serverless Computing with Crucial

ACM Transactions on Software Engineering and Methodology, Vol. 31

[link](#)

Raul Saiz-Laudo, Marc Sanchez-Artigas

EGEON: Software-Defined Data Protection for Object Storage

CoRR abs/2206.13162

[link](#)

Open source repositories (Total: 9)

Lithops <https://github.com/lithops-cloud/lithops>

Lithops Multi-Cloud Benchmark

<https://github.com/lithops-cloud/applications/tree/master/benchmarks>

Triggerflow <https://github.com/triggerflow/triggerflow>

Crucial <https://github.com/crucial-project/crucial>

Primula <https://github.com/cloudbutton/primula>

MLLess <https://github.com/cloudbutton/mlless>

FaaS Parallelism Benchmark <https://github.com/cloudbutton/faas-parallelism-benchmark>

Java Hybrid Serverless Executor and Serverless Elastic Algorithms

<https://github.com/cloudbutton/serverless-elastic-exploration>

Geospatial Workflows <https://github.com/cloudbutton/geospatial-usecase>

Lithops Airflow plugin <https://github.com/lithops-cloud/airflow-plugin>

Dissemination activities (Total: 44)

5 Jul 2022: Articles about the impact of Lithops on many national newspapers and media: [Europa Press](#), [La Vanguardia](#), [InfoCamp](#), [Diari Més](#), [Tarragona Ràdio](#), [Reus Digital](#), [Gente digital](#), [Nació digital](#), [Cope](#), [Cadena Ser](#)

21 Jun 2022: Pedro Garcia presents CloudButton results in the Huawei InnoWave Global Conference

16 Jun 2022: Pedro Garcia Lopez chairs WOSCx1

<https://www.serverlesscomputing.org/woscx1/program.html> (first online Workshop on Serverless Computing). In the panel, CloudButton contributions to the field, including Lithops, are discussed

3 Jun 2022: Pedro Garcia presents CloudButton in the panel "Using Big Data and Data Marketplaces to power Digital Transformation for European Ecosystem and SMEs" in the context of DataWeek'22 <https://www.big-data-value.eu/data-week-2022/>

18 May 2022: Marc Sanchez and Raul Saiz-Laudo speak at CCGrid symposium, and present "Egeon: Software-Defined Data Protection for Object Storage"

<https://fclab.unime.it/ccgrid22/wp-content/uploads/2022/04/CCGRID22-AdvancedProgram.pdf>

12 May 2022: The DATOMA project, a startup on OMICS Data Analytics emerged from CloudButton and YanesLab, is presented in the second round of La Caixa Research Validate

15 Feb 2022: Pedro Garcia presents Cloudbutton in the HIPEAC workshop

Dec 2021: URV presents “Serverless Big Data Analytics with Lithops” in the Serverless Data Analytics in the WOSC7 Workshop (International Workshop on Serverless Computing) in the session for Serverless Data Analytics organized by CloudButton

29 Nov 2021: Pedro Garcia, Josep Sampe, Gil Vernik, Tristan Tarrant present CloudButton in the European Big Data Value Forum 2021

18 Oct 2021: Pedro Garcia presents “Data-driven Serverless Analytics over Cloud Object Storage” in the Huawei Strategy and Technology Workshop 2021 (STW 21)

2-3 Sep 2021: Presentation at JCSD 2021 (Jornadas de Concurrencia y Sistemas Distribuidos): interventions by URV about “Benchmarking parallelism in FaaS platforms”, Primula, and Triggerflow

Jul-Sep 2021:

- Horizon Results Booster (With EMBL).
- Invitation to Huawei STW (Strategy and Technology Workshop) about Data Driven Serverless Analytics.

Apr-Jun 2021:

- Meeting with Albert Tenesa. University of Edinburgh. Cloud and Serverless Genomics. Interested party in the CloudButton project.
- Meeting with Beril Kirci. PMO Partners. Interest from Doğuş Technology in CloudButton results. The company aims to become a Stakeholder of CloudButton.eu.
- Meeting with IBM Spain (Oriol Vilaplana Canal). Cloudbutton dissemination.

14 May 2021: Pedro Garcia is the keynote speaker at the Serverless Computing Seminar at Schloss Dagstuhl <https://www.dagstuhl.de/en/programm/kalender/semhp/?semnr=21201>

25 Nov 2021: CloudButton is present at the European Researchers Night by ComCiència (URV) <http://tarragona.nitdelarecerca.cat/ca/european-corner/>

22 Mar 2021: CloudButton announces its first challenge open to Computer Engineering Students <https://challenge.cloudbutton.eu/> to analyze big datasets using the Lithops toolkit and Cloud distributed systems. URV promotes participation from its students

8 Dec 2020: Participation in International Workshop on Serverless Computing WOSC6, Mariano Mirabelli presents “Bringing scaling transparency to Proteomics applications with serverless computing” by URV <https://www.youtube.com/watch?v=4GSQRNgdFOA>

21 Jan 2020: Pedro Garcia talk: “The next revolution in Distributed Computing” in IBM Watson Research

19 Dec 2019: Daniel Barcelona presents “On the FaaS track: Building Stateful Distributed Applications with Serverless Architectures” at the Middleware 2019 conference, UC Davis, California

5 Sep 2019: Josep Sampe presents CloudButton at the Big Medilytics Event 2019 in Valencia, Spain

16 Jul 2019: Pedro Garcia presents "Please, do not Decentralize the Internet with (Permissionless) Blockchains!" at the 39th IEEE International Conference on Distributed Computing Systems (ICDCS) in Dallas, Texas

11 Jul 2019: Pedro Garcia presents "CloudButton: Serverless Data Analytics" in IBM Watson Research, open by videoconference to all IBM locations

26-28 Jun 2019: URV attendance at Big Data Value PPP Summit, Riga

13-15 Jun 2019: Pedro Garcia attends JSCD 2019 (XXV Jornadas de Concurrencia y Sistemas Distribuidos) in Zaragoza, Spain, to disseminate preliminary results of the CloudButton project

20 May 2019: Marc Sanchez presents "λFlow: Automatic Pushdown of Dataflow Operators Close to the Data" in the 19th IEEE/ACM Cluster, Cloud and Grid Computing (CCGrid) Symposium 2019, Larnaca, Cyprus <http://www.ccgrid2019.org/>

27 Feb 2019: BDVA meeting in Brussels: Pedro Garcia presents CloudButton to BDVA community. Interactions with other H2020 projects

Feb-Mar 2019: CloudButton announcement in Tarragona:

- URV press announces CloudButton
<https://diaridigital.urv.cat/la-urv-coordina-un-proyecto-europeu-per-simplificar-lanalisi-massiva-de-dades-al-nuvol/>
- Pedro Garcia speaks about CloudButton in Onda Cero radio
- Pedro Garcia speaks about CloudButton in Tarragona Radio
- Pedro Garcia speaks about CloudButton and Serverless to the Tarragona Developers community
- Interview at medium.com about Serverless Orchestration Services

29 Sep 2018: CloudButton concept is present at the European Researchers Night in Reus (talk by Pedro Garcia)

Blog posts with collaboration of URV members:

- <https://itnext.io/lithops-a-multi-cloud-serverless-programming-framework-fd97f0d5e9e4>
- <https://itnext.io/speed-up-your-python-applications-using-lithops-and-serverless-cloud-resources-a64beb008bb5>
- <https://www.ibm.com/cloud/blog/serverless-without-constraints>
- <https://www.ibm.com/cloud/blog/decoding-dark-molecular-matter-in-spatial-metabolo-mics-with-ibm-cloud-functions>

Lithops website: <https://lithops-cloud.github.io/>

Videos in the CloudButton Youtube channel:

- CloudButton Project Overview <https://www.youtube.com/watch?v=Ku9AsQIF4d8>
- (Collaboration with Answare) Geospatial Use Case - Part 1 / 2
<https://www.youtube.com/watch?v=TrD2jPA-znk> /
<https://www.youtube.com/watch?v=7K80PuHwPZ8>
- Serverless Big Data Analytics with Lithops - WoSC7
<https://www.youtube.com/watch?v=5ICRuY82OQw>

Exploitation Activities (Total: 2)

URV has two relevant exploitation activities:

- 1) URV CloudLab is collaborating with YanesLab (experts in metabolomics at URV) to create a startup during 2023. We hired two engineers using Next Generation Funds in a Proof of Concept project combining Cloud (URV, CloudButton Lithops results) and Metabolomics algorithms from YanesLab (CIBER ISCIII). This exploitation activity also received different side funding and support grants (Xartec, LaCaixa, IESE) to create the company, and the best patent award in Spain. The company and associated efforts are now called DATOMA CLOUD.
- 2) URV CloudLab has created soundless.app, a Cloud-edge mobile application for detection of acoustic pollution and impact on human health. Soundless builds on top of Lithops in the Cloud and it leverages serverless geospatial technologies developed in Cloudbutton. Soundless has obtained funding from Diputació de Tarragona to deploy a real proof of concept with users in the city of Tarragona. We also requested proof of concept funding to create a startup in the next years.

Collaborations (Total: 6)

URV as coordinator has closely collaborated with most partners in the consortium.

The more relevant collaborations are:

- 1) URV and IBM collaborated closely in the development of IBM PyWren and Lithops during the past years. We also published papers with them.
- 2) URV and Hutton Institute collaborated closely in Serverless Genomics pipelines with Lithops in the last months of the project. The results will be published after CloudButton finishes.
- 3) URV and ANSWARE and MATRIX collaborated in Serverless Geospatial pipelines with Lithops. URV monitored the activity of both partners. ANSWARE abandoned the consortium, and MATRIX has recurring staff issues that precluded their progress.
- 4) URV and IMT collaborated around the Crucial open source project and related publications.

- 5) URV and ATOS collaborated around the ATOS SLA component and testbed integrations with Lithops.
- 6) URV has joint publications with most partners in the consortium (IMT, IMP, IBM, RHT, ATOS).