Joshua Dawes

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Education

2017-present **CERN, CMS Experiment & University of Manchester**
PhD Computer Science - Automated Performance Analysis of Python Programs using Runtime Verification

Expected graduation - September 2020

Supervised by Dr Giles Reger (Manchester), Dr Giovanni Franzoni (CERN) and Dr Andreas Pfeiffer (CERN)

Developed theory and first implementation of what is, to the best of our knowledge, the first application of Runtime Verification in High Energy Physics.

Fulfilled publication quota (recommended by Manchester) of 4 papers 1 year and 10 months after beginning my PhD.

2013-2017 **University of Manchester**
BSc (Hons) Computer Science and Mathematics with Industrial Experience at CERN

First Class Honours (80%) - top 10% of all Computer Science students

Employment and Experience

at CERN

2015-2016 **13 Month Technical Studentship, CMS Experiment**
Designed and implemented multiple systems (see *Projects and Research Output*). Work during this time led to my doctoral appointment at CERN.

at Manchester

2014 **Summer Student**
Proposed a project, conducted research sessions and worked with another student to implement a game-based workshop to introduce primary school pupils to Computer Science.

Projects and Research Output

VyPR
A framework for automated performance analysis of Python programs, the main implementation output of my PhD. http://cern.ch/vypr**.**

Track record includes identification of performance bottlenecks in a critical service used at the CMS Experiment; preliminary applications to multiple other services; and inclusion in a Continuous Integration process to combine functional testing with performance analysis.

For theoretical contributions, see publications, talks and collaboration.

For this project, I coordinate work done by a Masters student (funded by CERN) and a PhD student (funded by CMS) to extend my PhD research.

CMS Alignment and Calibrations Consumption Framework
An object-oriented framework in Python to facilitate consumption of CMS non-event data used during physics reconstruction. Includes an optimised version of a key service used by CMS, due for deployment during LHC Run 3 in 2021.

CMS Alignment and Calibrations Browser
The prototype version of the application that is now used as the entry-point for management of non-event data at the CMS Experiment.

Profiling Tool for CMS Web Services
A tool for profiling, efficient caching and subsequent plotting of performance data from CMS Web Services. This project led to my Doctoral appointment.

Collaboration

Università della Svizzera italiana (USI)
USI PhD student hosted at CERN to perform research for VyPR. First instance of long-term funding from the CMS Collaboration for work on VyPR and surrounding program analysis research.

Awards

2017 **University of Manchester - Head of School of Computer Science Award**
Outstanding contribution to life in the School of Computer Science

2017 **University of Manchester - Certificate of Excellence**
Graduated in top 10% of Computer Science students

Students Supervised

Marta Han (Masters student) - University of Zagreb
CERN Technical Student 2020 - Development of a Web-based Analysis Tool for the VyPR Performance Analysis Framework
CERN Summer Student 2019 - Development of Analysis Tools for the VyPR Performance Analysis Framework

Jurgis Rancevas (Bachelors student) - University of Vilnius
Erasmus Student 2019 - Development of Automated Release Validation Infrastructure for the CMS Alignment and Calibrations Constants Release Service

Per Sunde (post-Bachelors student) - University of Oslo
CERN Summer Student 2018 - Timed Pushdown Automata for Offline Runtime Verification of Web Services

Technical Competences

Python - used for the last 5 years for multiple projects at CERN and personal projects, and in the last 3 years for development of the VyPR framework core.

Relational Databases - used consistently for the last 10 years at CERN and for personal projects.

Javascript (jQuery, Vue.js) - used for personal projects for the last 10 years and for some parts of the VyPR eco-system.

PHP - used for personal projects until 5 years ago.

Java, C and C++ - learned in classes during Bachelors.

Languages

English - Mother Tongue, French - Conversational

Publications

During PhD

2020 J H Dawes, M Han, O Javed, G Reger, G Franzoni, A Pfeiffer, **Analysing the Performance of Python-based Web Services with the VyPR Framework - Tutorial**, International Conference on Runtime Verification, Los Angeles, USA

2020 O Javed, J H Dawes, M Han, G Franzoni, A Pfeiffer, G Reger, W Binder, **PerfCI: A Toolchain for Automated Performance Testing during Continuous Integration of Python Projects - Tool Demo**, International Conference on Automated Software Engineering, Melbourne, Australia

2019 J H Dawes, G Reger, **Explaining Violations of Properties in Control-Flow Temporal Logic**, International Conference on Runtime Verification, Porto, Portugal

2019 J H Dawes, G Reger, G Franzoni, A Pfeiffer, G Govi, **VyPR2: A Framework for Runtime Verification of Python Web Services**, International Conference on Tools and Algorithms for the Construction and Analysis of Systems, Prague, Czech Republic

2019 J H Dawes, G Reger, **Specification of Temporal Properties of Functions for Runtime Verification,** ACM/SIGAPP Symposium on Applied Computing, Limassol, Cyprus

2019 J H Dawes, M Han, G Reger, G Franzoni, A Pfeiffer, **Analysis Tools for the VyPR Performance Analysis Framework for Python**, International Conference on Computing in High Energy and Nuclear Physics, Adelaide, Australia

2018 J H Dawes, G Reger, **Specification of State and Time Constraints for Runtime Verification of Functions**, arXiv

Before PhD

2016 J H Dawes, on behalf of the CMS Collaboration, **A Python object-oriented framework for the CMS alignment and calibration data**, International Conference on Computing in High Energy and Nuclear Physics, San Francisco, USA

Talks

October 2020 **RV 2020**, Los Angeles, USA
Analysing the Performance of Python-based Web Services with the VyPR Framework - Tutorial

November 2019 **CHEP 2019**, Adelaide, Australia
Analysis Tools for the VyPR Framework for Python
http://jdawes.web.cern.ch/jdawes/talks/chep-2019.pdf

October 2019 **CMS Offline Software and Computing Week** - Fermilab, USA - video call, invited
Automated Performance Analysis for Python with VyPR
http://jdawes.web.cern.ch/jdawes/talks/fermilab-2019.pdf

October 2019 **RV 2019**, Porto, Portugal
Explaining Violations of Properties in Control-Flow Temporal Logic
http://jdawes.web.cern.ch/jdawes/talks/rv-2019.pdf

May 2019 **CERN Computing Seminar**, Geneva, Switzerland
Part of the official CERN seminar series
VyPR2: A Framework for Automated Performance Analysis of Python Programs
https://indico.cern.ch/event/805991/

April 2019 **TACAS 2019**, Prague, Czech Republic
VyPR2: A Framework for Runtime Verification of Python Web Services
http://jdawes.web.cern.ch/jdawes/talks/tacas.pdf

April 2019 **University of Manchester Formal Methods Seminar**, Manchester, UK
VyPR2: A Framework for Automated Performance Analysis of Python Web Services
http://cern.ch/jdawes/talks/Manchester-2019.pdf