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Carlos E. Cuesta · David Garlan
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Software Architecture

12th European Conference on Software Architecture, ECSA 2018
Madrid, Spain, September 24–28, 2018
Proceedings

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Preface

This volume contains the proceedings of the 12th European Conference on Software Architecture (ECSA 2018), held in Madrid, Spain, during September 24–28, 2018. Specifically, these are the proceedings of the main program, i.e., the conference itself.

This edition had the special meaning of an anniversary. ECSA 2018 was not only the 12th edition of the full-fledged ECSA conference, it was also the 15th installment in the series if we include the three previous meetings held in the original European workshop (EWSA 2004 to 2006, held in St. Andrews, Pisa, and Nantes).

It was also the second time that the conference was held in Spain, and also the second time in Madrid. This was also a commemoration to some extent, as Madrid was also the location of the first ECSA in 2007. Even the current Program Co-chairs shared a close relationship with that edition. Back then, Prof. Cuesta was the Organizing Chair, while Prof. Garlan was one of the keynote speakers — indeed, the first one in the history of ECSA. Since then, the conference has been celebrated in Paphos, Cambridge, Copenhagen, Essen, Helsinki, Montpellier, Vienna, Dubrovnik, Copenhagen again, and Canterbury. This rich tradition will continue next year, when the conference returns to France, for the first time in the historic city of Lille.

ECSA is now the center of a complex ecosystem gathering a number of additional meetings around the main conference. These included three specific tracks, namely the industrial track, the posters, tools and demo track, and the Women in Software Architecture (WSA) track, focusing on diversity. It also included the PhD symposium, along with a full set of eight co-celebrated workshops and the innovator bootcamp — three of these were organized for the first time. The contributions of all these meetings are included in the Companion Proceedings, published in the ACM Digital Library.

This volume, gathering just the papers of the main conference, is published again by Springer, following a tradition which dates back to its origins in 2004. Every edition of the ECSA conference, except for the two joint venues, has been published in the *Lecture Notes in Computer Science* series, creating a timeline which has already become a series itself: LNCS 3047, 3527, and 4344; 4758, 5292, 6258, and 6903; 7957, 8627, 9278, 9839, and 10475; and now this volume, LNCS 11048.

For this reason, and honoring this tradition, Springer provided a 1,000 Euro funding for the 2018 meeting. This was used to bestow the ECSA 2018 Best Paper Award, which was announced during the Gala Dinner. Also for this reason, Springer itself was recognized as a Bronze Sponsor for the ECSA 2018 edition.

The 2018 edition was one of the most successful meetings in ECSA's recent history. Apart from the interest generated by the many co-located events, the main program alone attracted more than a hundred abstracts, which finally solidified in 96 submissions; this was downsized to the final number of 86 submissions after several of them were desk-rejected. Then, each of these was reviewed by our Program Committee (PC); every paper was reviewed by at least three PC members, and several of the papers had additional reviews when necessary.

After a thorough and careful process, the PC selected 17 submissions as full papers and 7 additional ones as short papers. This resulted in a 19,77% acceptance ratio for full papers and an additional 8,14% acceptance ratio for short papers, taking into account just the papers which were considered for review. The global figures added up to a 27,91% ratio, not distinguishing between full and short papers. These calculations reached a 25,00% ratio when all submissions are considered.

ECSA accepted three kinds of submissions: research, industrial, and educational papers, both full and short. After the reviewing process, the majority of accepted papers were still research-oriented: 10 full papers and 3 short ones, encompassing 54,17% of the accepted submissions. The second biggest subset was that of industry-oriented papers: 6 full ones and 2 short ones, comprising one third (33,33%) of the published papers. The remaining 12,50% included 1 full paper and another 2 short ones.

One of the emphases of the ECSA 2018 organization was to stimulate industry participation: the above figures reflect that. Moreover, one third of the accepted papers, belonging to the main program, equaled the submissions sent to the co-located industry track, and were included in the Companion proceedings. These contributions were presented separately but together, during the conference's industry day.

Research, industrial, and educational papers are combined in this volume, as they had exactly the same reviewing process, and the contributions are thematically grouped. So there is not any indication of their nature either in the table of contents or in the papers themselves. As already noted, most of the papers are research-oriented. For information only, the industrial contributions are those beginning with the pages 49, 103, 115, 131, 159, 203, 303, and 336. Again, their aggregation in thematic groups shows how close research is to the actual practice in our field.

The conference also had three outstanding keynote speakers, which honored our community with their presence. These were:

- Rick Kazman from Carnegie Mellon University and the University of Hawaii. His keynote addressed the difficulty of measuring the effects of software architecture, in the context of estimating (and reducing) the architectural debt.
- Michael Keeling from IBM. His keynote outlined the extreme complexity of any real-world architecture problem, and how the definition and use of cognitive landmarks can help to deal with it.
- Siobhán Clarke from the Trinity College at Dublin. Her keynote described how the changing landscape requires the definition of adaptive systems, and how these adaptations are to be affected by the corresponding architectural styles.

The abstracts for their keynote addresses are included later in this volume, specifically after this preface.

In spite of being “European” both in name, location, and inspiration, ECSA has always had an international vocation. Many of the submissions were from Europe, but papers were received from all continents. After the reviewing process, 83,33% of the contributions were European in origin, while 12,50% were from America, and the remaining 4,17% were from Oceania. Contributions were accepted from Germany, Italy, Sweden, France, Austria, Belgium, Brazil, Denmark, Estonia, Ireland, the Netherlands, New Zealand, the United States, and Colombia, in descending order.

The Program Committee itself had an international composition. Again, and as probably expected, it had a majority of Europeans, which composed 69,49% of the members; but also 23,73% of the members were American, and 6,78% were from Oceania. However, the distribution of countries was very different, particularly within Europe; so that countries with an important presence in the PC did not have a significant representation in the final program, and vice versa. This just serves as a testimony of the rigour and independence of the excellent work done by this committee.

This year's program showed the thematical richness which has always been a defining feature of ECSA. To a great extent, the conference dealt with the challenges posed by brand-new technology and the consequence of its presence, as in the case of, e.g., cyber-physical systems or the Internet of Things. It also studied the effects of applying new architectural styles, such as the recent surge on microservices, while still developing the consequences of well-known patterns, such as service-orientation. It elaborated on hard, long-term goals, such as self-adaptation, while also building up on everyday domain-specific issues, as in the case of security and data architectures. And while the classic strategies to deal with knowledge, i.e. design decisions, in the field are still being refined, it is ultimately defined by its actual practice.

Due to the extent and quality of the research presented in this volume, a virtual special issue on the *Journal of Systems and Software* issued an open call for papers, which specifically targeted extended and refined versions of the better qualified papers in the ECSA program. The topic of this *JSS* special issue was defined as "The Next Generation of Software Architecture," and had this edition's Program Co-chairs and General Chair as its guest editors.

ECSA is currently the only meeting on software architecture which is included in the CORE 2018 conference ranking, having achieved an A-rank. Now it is also the eldest research venue in this area, with the current name and acronym; though this is circumstantial, just while the others are undergoing a change of name and orientation. In any case, for more than a decade now, it has been recognized as one of the premier conferences in this branch of software engineering.

Though it has always been present, both in theory and in practice, in the last few years software architecture has recovered a central position in the field, together with a renewed popularity and a considerable interest from the industry. The discipline is now recovering the importance it already had in the first decade of the century – to the extent that even industrial conferences are already happening.

The research and expertise that our conference has been developing for the last 15 years are now more relevant than ever. Our findings and results, both the classic and the more recent ones, are now applied in day-to-day operation and practice. Let's continue building — and defining — the future of this discipline.

July 2018

Carlos E. Cuesta
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Keynote Talks

Measuring and Managing Architecture Debt: Tales from the Trenches

Rick Kazman 

Carnegie Mellon and University of Hawaii, USA

Abstract. In this talk I will present my experiences in transitioning and validating an automated software architecture measurement system in two large multinational corporations. I will describe the measures that we employed and the tool chains that we constructed to automatically calculate these measures. I will also describe how we got the development teams to accept and apply these measures through pilot studies, surveys, and constantly adjusting the measures based on feedback and correlations with productivity measures. This experience shows that it is critical to guide the development teams to focus on the underlying problems behind each measure, rather than on the scores themselves. It is also critical to both quantify architecture debt and prove to development teams and management alike that these measures matter, and that we can calculate the return on investment of paying down the debt.

Finding Our Way in the Software Wilderness


Michael Keeling

IBM, USA

<http://neverletdown.net>

Abstract. Over time, even modestly large or complex software systems can become an untamed wilderness. Anyone who dares venture into one of these wild systems can quickly become entangled in the serpentine vines of past design decisions, sliced by the razor-sharp barbs of hidden assumptions, and lost in a labyrinth of code and documentation. Software architects can help their teams navigate this harsh landscape by creating cognitive landmarks that can be used as reference points and by building trails other designers can follow. In this talk we'll explore techniques for creating architectural landmarks in the code, in documentation, and even in the physical workspace, that your fellow developers can use to navigate the wilds of your software system.

Exploring Different Architecture Styles for Adaptive Systems

Siobhán Clarke 

Trinity College Dublin, Ireland

Abstract. Modern software encompasses a dizzying range of application types operating in changing environments. This inherent complexity requires adaptive execution models operating within a range of architectural styles. Over the last decade, my team has explored the requirements for, and execution of, adaptation in a range of application types. We found that we naturally veered towards different software architecture styles in different circumstances – e.g., decentralised multi-agent systems when autonomous entities were required, or service-oriented computing when large-scale adaptive composition of behaviours was required. In this talk, I share our experiences with different classes of systems, and discuss open challenges for the research community.

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