R E V I E W

Assoc. Prof. Dr. **Boris Blagovestov Shishkov**
Department of Information Systems and Technologies
University of Library Studies and Information Technologies, Sofia

on a PhD defence procedure
in field of higher education: 4. Natural sciences, mathematics, and informatics,
doctoral program "Computer sciences",
Sofia University „St. Kl. Ohridski" – Faculty of Mathematics and Computer Science (FMCS)

By order № 38-560/26.09.2019 of the Rector of Sofia University "St. Kl. Ohridski" (SU), issued in accordance with decision № 9/16.09.2019 of the FMCS Faculty Council, in accordance with the corresponding laws and regulations, I was appointed a doctoral committee member in the PhD defense procedure featuring the doctoral candidate **Anastasios Georgios Papapostolu**, in field of higher education: 4. Natural sciences, mathematics, and informatics, professional field: 4.6 Informatics and computer science, doctoral program "Computer sciences". I have attended the first jury meeting on 30 September 2019; then I was given the competition materials (paper versions and electronic versions), namely: Doctoral Thesis (in English), Synopsis (in Bulgarian and in English), publications and certificates. The PhD Thesis „*jADL, μσADL – Case Study of New Generation ADLs for Architecturing Advanced Software Architectures*" is of 125 pages, comprising 6 chapters, namely: *Introduction* (1-11), *Related Work* (12-31), *jADL* (32-58), *μσADL* (59-74), *Tool Support / Evaluation* (75-92), and *Conclusion* (93-96); the references list is featuring 87 sources in English language, among which are books of outstanding authors, such as P. Krutchen, M. Fowler, and others. The thesis' contribution is three-fold, proposing: (i) a new architecture description language (characterized by a comparatively simple syntax); (ii) a corresponding language extension featuring the utilization of microservices; (iii) a framework featuring an integration with BPMN (Business Process Model and Notation) notations.

ABOUT THE CANDIDATE

In 2014, Anastasios Georgios Papapostolu has graduated as a Computer Engineer from TU Crete – Greece. Afterwards he was appointed as a PhD Student at SU and he has completed the 3-years doctoral course. Currently, Anastasios Papapostolu works as programmer at the SU Computer Center. Anastasios Papapostolu has published 7 articles; 3 of them are SCOPUS-indexed; his SCOPUS h-index is 1.

ON THE CANDIDATE'S RESEARCH

As it is seen from the thesis and publications of Anastasios Georgios Papapostolu, his research is focused on a key challenge concerning the current software development, namely the *mismatch between models and code*: models are about abstractions that reflect what is desired (by the user) as it concerns the software system-to-be, while code is about the implementation of the system itself and this in turn assumes concrete algorithmizations with regard to the functioning of the system. Unfortunately, due to the fact that models are often inspired by people who are mainly driven by a user perspective (they rarely have adequate software development knowledge) while code is generated by programmers who rarely have deep knowledge as it concerns the corresponding application domain, we often observe programmers and users "speaking in different languages" – this clearly indicates for the abovementioned problem. Within the last 15 years, essentially there are two main approaches to mitigate the problem: (1) Alignment between enterprise modeling (featuring underlying social theories) and software specification (featuring underlying computing paradigms), with counting on well-defined transformations between enterprise models and software specifications. Here one would use (in the software specification) general-purpose languages that are not expected to be specific as it concerns the application domain – the domain specifics are "brought in" via the transformations. (2) The other approach is featuring domain-specific languages, concerning the development of software – those languages are "burdened" by specifics about the application domain. This is what Anastasios Georgios Papapostolu has opted to consider in his research, in general and in his PhD thesis, in particular. Nevertheless, with many currently available domain-specific languages and related research, I argue that it would be challenging to identify innovation „niches" and "room" for new R&D solutions in the area. What Anastasios Papapostolu has done is not to focus on domain-specific languages in general but to address in particular *Architecture Description Languages*" – „*ADL*" for short (ADLs are considered a type of domain-specific languages). In this area, he has identified an actual problem, namely the high degree of formality (as it concerns most current ADLs) – this is claimed to be causing a "mismatch" between built architectures and corresponding follow-up implementations.

Even though the *problem statement* could have been made more explicit in the thesis, I reckon that the candidate has identified and addressed an ACTUAL RESEARCH PROBLEM, and this by itself I consider a contribution. Further, the extensive literature review, presented in the second chapter of the thesis is justifying the claims concerning the need for "yet another" ADL, and is also "proving" the actuality of the identified research problem. Actually, the proposed new ADL (labelled "*jADL*"), developed in "response" to the identified problem, is considered to be an essential thesis contribution. Aiming at helping bridge the abovementioned architecture-implementation gap (characterizing most current ADLs and claimed to be caused by the mentioned high degree of formality), Anastasios Papapostolu proposes jADL whose syntax is comparatively simple; next to that, this language allows for utilizing easy-to-integrate modules. Bringing forward such a solution and inspired by service-oriented computing and in particular by SOA – „*Service-Oriented Architectures*", the candidate positions his work in a SOA perspective, supporting the claim that many current software products are delivered to users by means of IT services – such services are realized by different underlying software components, "active" in the "network", and can be dynamically composed and utilized by customers. Moreover, the so called "microservices" offer even a higher degree of flexibility, allowing to be plug-and-play-utilized by the user, in his or her achieving corresponding (business) goals. Hence, another purpose underlying jADL is „covering" microservices – the *μσADL* extension is developed for that purpose. Having stated this, I reckon that the thesis of Anastasios Georgios Papapostolu is clearly featuring RESEARCH CONTRIBUTION that is two-fold: (i) *A new ADL is proposed, characterized by a comparatively simple syntax, which is expected to mitigate the abovementioned architecture-implementation mismatch*; (ii) *Opening the language towards microservices*. And in the end, as it concerns the *practical applicability* and *validation* of the proposed languages (jADL and the extension μσADL), I would like to mention the following: (a) An *integration framework has been proposed, supposed to be aligning jADL and BPMN notations*, allowing for the application of jADL models in combination with BPMN модели; in my opinion, this increases the applicability value as it concerns the contribution of the thesis because BPMN is a *de facto* standard - models featuring BPMN notations would therefore be easy to integrate with models developed in other projects. (b) As it concerns the validation of the proposed language (jADL), this is done by means of a *case study* that focuses on a system representing a gas station – it consists of *three components*, namely: *client*, *cashier* and *pump*. Even though the presented case study looks like a toy example (rather than a full value industrial case), as it concerns scalability, in my opinion this case study represents an adequate validation (proof-of-concept) at a doctoral thesis level, especially in combination with a *prototype*, development that has also been done. Hence, I claim that such an APPLICATION/VALIDATION is also an adequate contribution as it concerns the thesis. In stating my opinion concerning contributions featuring a problem identification, the proposal of a new ADL and its validation, I refer to my experience as Jury member in Bulgaria and The Netherlands; *I am satisfied by the quality of the thesis*; still, I would like to bring forward some *critical comments*, recommending the following: ADL concern architectures and they in turn are about *software modeling*. Re-phrasing *Apostel*: Any subject using a *system A* that is neither directly or indirectly interacting with a *system B*, to obtain information about the *system B* is using *A* as a model for *B*. Therefore, any model (and also any architecture) is somehow *abstract*. We are also aware of the *meta-model* concept – that is related to information concerning the model itself. For example, if we use the notations of UML (the Unified Modeling Language) to model something (a software broker, for instance), we are using UML to model the broker. But if we would model the mere (graphical) elements of UML, through which we have modeled the broker, we would be creating a corresponding meta-model. It is well known that *MOF – Meta-Object Facility* (www.omg.org/mof) is about this, also "covering" transitions to higher meta-levels. Next to that, *MDA – Model-Driven Architecture* (www.omg.org/mda) in turn concerns different abstraction levels: from the highest level –*Computation-Independent Models – CIM*, featuring the software system-to-be, through conceptual models of the system (*Platform-Independent Models – PIM*), to concrete technical specifications (*Platform-Specific Models – PSM*). Let us consider an imaginary 2D coordinate system with two axes, namely MDA (from lower to higher abstraction levels) and MOF (from lower to higher meta-levels). I would recommend that Anastasios Papapostolu tries to "position" *jADL in such a coordinate system*, also answering the question: *How much relevant are MDA and/or MOF with regard to what is presented in the thesis*?

ACQUIRED POINTS

- *Doctoral thesis*: 50 p.
- *3 SCOPUS-indexed articles*: 90 p.

PERSONAL CONTRIBUTION

In my opinion, the personal contribution of the candidate is indisputable, especially as it concerns the thesis. As it concerns the presented articles, most of them were co-authored by the doctoral supervisor of Anastasios Papapostolu, the late Assoc. Prof. Dr. Dimitar Birov; other publications are only authored by the candidate. This indicates for a clear personal contribution of Anastasios Papapostolu in all his works submitted for evaluation.

OTHER

Both Prof. Birov and Anastasios Papapostolu have contributed to a symposium that I have established and currently lead, namely *BMSD – Business Modeling and Software Design* (www.is-bmsd.org): (i) 8 years ago today, I was honored to attend in Sofia the inspiring BMSD'11 presentation of Prof. Birov, touching upon (still then!) model-driven engineering and domain-specific languages; (ii) 7 years later, the PhD student of Prof. Birov, Anastasios Papapostolu, has presented in Vienna his BMSD'18 paper entitled „*Towards a Methodology for Designing*

Micro-service Architectures Using μσADL„ making it to the Springer proceedings where 35 papers were selected for publication, out of 76 submissions. The BMSD'18 presentation of Anastasios Papapostolu was of high quality, as the paper itself that is closely related to the content of the candidate's thesis. That is how I know the candidate and his supervisor.

CONCLUSION

The presented thesis fully corresponds to the set of criteria and indicators for the acquisition of educational and scientific degree "Doctor", according to the Law for the Development of Academic Staff in the Republic of Bulgaria, Rules for its implementation and Rules for the conditions and procedure for acquiring academic degrees and occupying academic positions at SU and its Faculty of Mathematics and Computer Science. **Considering all the above, I give a DEFINITELY POSITIVE assessment of the thesis and the other submitted scientific works, suggesting to the honorable scientific jury to promote the acquisition of the Doctor's degree by the candidate Anastasios Georgios Papapostolu in the field of higher education: 4. Natural sciences, mathematics, and informatics, professional field: 4.6 Informatics and computer science, doctoral program "Computer sciences".**

Sofia
18 October 2019

Signature:
/Assoc. Prof. Dr. Boris Shishkov/