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Implementation and development of network application

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Abstract
A new discipline at the intersection of the development and operation of software systems known as DevOps has seen significant growth recently. Among the wide range of tasks of DevOps professionals, we focus on that of selecting appropriate cloud deployments for distributed applications. Despite the advent of iautomated software deployment and management frameworks, reasoning about good deployments still requires interaction with experts, often through discussions on online technical forums and social networks. Current social networking technologies offer basic ways to communicate. Within the DevOps community, communication on application structure and cloud deployment tradeoffs could become more effective by using knowledge present in global community-sourced information repositories. In this paper we argue for the benefits of tapping into such knowledge and for seamlessly feeding it back into the social networking platform. The social networking platform presented in this paper integrates social networking with automated deployment of applications on multi-clouds and with knowledge drawn from community-sourced information repositories. The implementation leverages two such repositories, the PaaSage repository and Chef Supermarket. Our user evaluation experiments demonstrate the value created for DevOps professionals.

Keywords: Implementation, Network Application, software

1. Introduction
In an information technology (IT) world that requires shorter development cycles, excellent software reliability and delivery, and a service-oriented perspective on all aspects of software, the fields of software development and IT operations are drawn closer together in a new field called DevOps [1] (short for "development and operations"). DevOps encompasses a rapidly growing class of IT professionals whose interests span the fields of software development and deployment, infrastructur management, system administration, cloud computing operations, and IT optimization In recent years there have been several efforts to provide DevOps professionals with the tools that they need to address challenges in developing, deploying, and managing large-scale applications. To bridge across different development and deployment environments, especially in the cloud computing space, configuration management systems such as Chef [2] and Puppet [3] have emerged as solutions to codifying and executing management procedures (installation, deployment, etc.) around software components. DevOps tools aiming to simplify application management increasingly express application structure, requirements, and application deployments in a cross-platform manner using models1.

Increased adoption of these frameworks by DevOps professionals has spawned active communities of users with an interest in exchanging know-how and in better understanding the DevOps field. A recent trend in DevOps communities is the creation of repositories of nformation where users can jointly contribute knowledge-via crowdsourcing [8] creating shared value.

Among the range of possible DevOps tasks, in this paper we focus on selecting the most appropriate deployment configuration for an application. This task is especially challenging in a multi-cloud setting due to the large diversity of deployment possibilities and tradeoffs.

It is of particular interest to cloud deployment specialists, DevOps engineers whose main role is to perform distributed software deployment to various testing andproduction environments. Since DevOps engineers usually form well-integrated teams, we believe that the theme of this paper is more broadly relevant to the entire DevOps community.

Currently DevOps engineers work with a small set of well-understood deployment options, missing opportunities for improving performance, reliability and/or lower cost. Investigating new options involves time-consuming testing over new infrastructures. Discussing with the community in online social or technical forums may provide insight over deployment options; however the answer to a hard question often needs to be backed by experimental data that is not readily available.

In this paper we argue that the state of things can be improved by providing DevOps engineers with analyses of execution data from a large set of cloud applications over a variety of cloud infrastructures. To store such execution data, we use a new repository of information developed by the PaaSage EU project [14] based on the CAMEL modeling language. In CAMEL, application models are associated with execution histories collected from application deployments over different cloud infrastructures. Analysis of data (collected in a crowdsourced manner) can reveal important knowledge about application deployments, such as performance and availability tradeoffs, cost-effectiveness, etc.

2. Methode

A key aspect of the PaaSage professional network is its support for deployment of applications. CAMEL (through CloudML) is able to express deployable models of applications that specify the infrastructure upon which middleware and application logic will be deployed and run on.n. An important feature of our system is its support for the creation of CAMEL applications through composition of components imported from Chef Supermarket (Fig. 15). We orchestrate the deployment of all application components starting from a CloudML/CAMEL model of the application using the Chef configuration management tool. In what follows we briefly describe our methodology (called CAMEL-to-Chef or C2C for short). The reader is referred to [77] for a complete exposition. C2C comprises three major modules: i) A model parser that analyzes an application model and extracts a list of application components and the nodes (VMs) that the components will be deployed on; iii) the VM manager module responsible for the provisioning of the VMs (using third-party libraries such as JClouds [78] or provider-specific APIs such as Azure SDK [79] and installs the Chef client in each one; and iiii) the Chef iinstructor, a wrapper around the Chef runtime.

3. Result and Discussion

The architecture of the PaaSage social networking platform is shown in Fig. 1, highlighting the integration of a collaborative social platform (left) with the repositories of information (right). It shares certain principles with standard question-and-answer (Q&A) sites where users can create sub-communities relative to specific topics of interest (groups) and use features such as following other users or news feeds, facilitating stronger interaction between users.

The PaaSage social networking platform advances the state of the art in several ways. First, it encompasses the ability to represent applications and infrastructure as models, and to use them in automating deployment on cloud platforms. Second, it incorporates two crowd-sourced repositories: a repository of application models, including software components and configuration properties, along with a collection of their execution histories (denoted "CAMEL repository" in Fig. 1); and a repository of management processes of individual software components (denoted "Chef irepository" [13] in Fig. 1). Another distinctive feature of our system is the mining of information (such as application behavior under different cloud environments in the former repository, and component information and inter-relationships in the latter) and its use in providing users with suggestions and hints while browsing or in Q&A. Our contributions in this paper are:

- The design and implementation of the PaaSage social networking platform (user interface and back-end infrastructure) for the DevOps community, ntegrated with two information repositories.
- Use of advanced features such as pointers to structured descriptions of applications, components, executions, etc., and mined knowledge (statistics, cost-benefit analyses) to improve the level of technical discussion between DevOps users
- Three user evaluation studies and a demonstration of offering users with cost-benefit analyses of application deployments on multi-cloud setups.

The paper is structured as follows. In Section 2 we describe related work split into two major areas: professional (social) networks and systems automating configuration management and deployment. In Section 3 we provide background on modeling distributed applications and the Chef configuration management frame work. In Section 4 we describe the requirements and design principles of the social networking platform and in Section 5 we describe our implementation. In Section 6 we describe our user evaluations and experience with our prototype (accessible online) and in Section 7 we present our conclusions.

4. Related work

Does the platform rely on one or more repositories to store the following type of information: software code, software models, configuration information, execution histories; and whether these repositories are community-sourced;

(2) does the social networking platform leverage the repositories to provide users with specific suggestions and hints;

(4) does it support application deployment?

During the last few years social networking has evolved into a fundamental daily activity for many individuals and a new frontier for business marketing. Besides "traditional" social networking, a recent trend is professional and domain-specific networking services focused on interactions and relationships of a business nature around a specific target domain. These online communities have the potential to become a platform for collective intelligence and open innovation [16], a medium for knowledge-centered collaboration [17], and a trustworthy decision-support tool [18].

IT professionals use a variety of online sources as aids in their daily tasks. Developers typically prefer community moderated forums over vendor-moderated sites [19]. Professional networks focusing on software technology in particular provide developers with the opportunity to leverage the knowledge and expertise of their peers. One of the most popular such platforms is GitHub [9],

LinkedIn provides no specific support for software engieering activities and thus more closely resembles traditional social networking platforms such as Facebook. The above systems can be further classified based on whether they use a repository to store software-related information (code, models, configuration, or execution histories) and whether this information is shared and raised through crowdsourcing [8].

Our professional network is the only solution that analyzes information in its software-related repositories to assist users with suggestions and hints. On the other hand, an important concern when designing an online community portal is to stimulate regular contributions and effective collaborations. The willingness to share knowledge with community

members is influenced by social interaction ties, trust, norm of reciprocity, identification, shared vision and shared language [30]. In addition, the willingness of professional community members to continue being engaged with the network was found to be affected by social interaction ties and by their satisfaction in relation to their preusage expectations [31]. Following the above principles, as well as literature reported usability and sociability factors to reading, contributing, collaborating and leading in an online community [32] the PaaSage professional network aims to provide high quality services to software engineers, actively engaging them in collaborative and community-building activities. Next we review related work in the areas of configuration management and application deploymen.

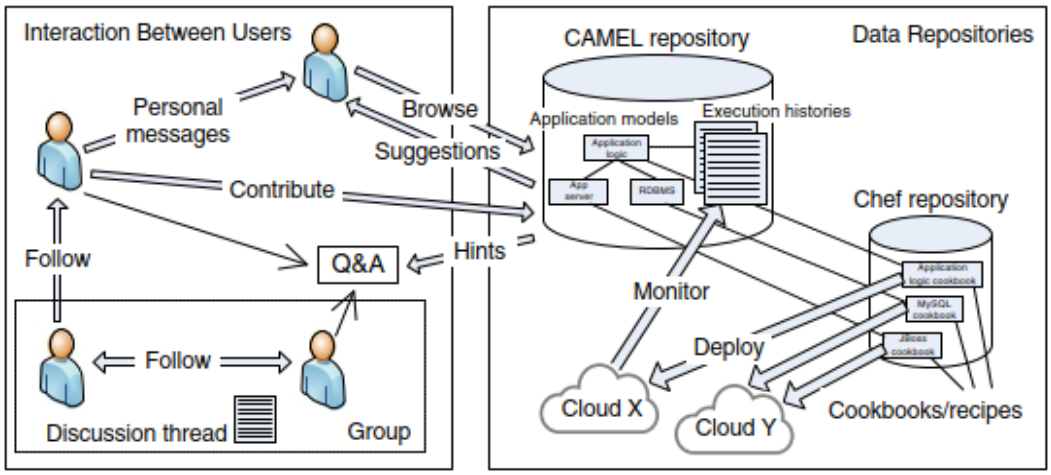

Fig 1: Integration of a collaborative social platform with repositories of information

5. Conclusion

In this paper we presented the design and implementation of the PaaSage social networking platform, a novel platform for professional networking targeting the community of DevOps engineers. The network combines community knowledge with information from two repos-tories, Chef Supermarket and the CAMEL repository of application models and executions, to improve the configuration, deployment, and optimization of distributed multi-cloud applications, tasks of major interest to cloud deployment specialists. The design of our professional network applied best practices aiming to support the creation of a vigorous community, to allow users to retrieve timely and appropriate information and to carry out actions in a small number of steps. Tightly interweaving professional with social content and actions, as well as providing personal information wherever and whenever suitable was one of the main design concerns.

The positive findings of the three user evaluation experiments conducted with domain experts, cloud computing engineers, and representative end-users, highlight the potential of the proposed system since many of its abilities such as model sharing, discussions and networking with users of similar interests were highly appreciated. We therefore believe that our social networking platform is successful in providing DevOps engineers with new value and thus strong incentives to use it. Future work will include full-scale testing with larger communities of users in order to further evaluate the usability of the designed network and validate the design practices that have been applied.

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