Adaptive Controllers in Application Service Management Environment

Knowledge Lab

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Research Aims

Enterprise class system architectures can vary substantially depending on functionality, interconnections to other system and other non-functional requirements. In this work, we consider that there is no model of the enterprise system, and propose a methodology and software framework that could be applied in order to ease work of systems operators and developers working in Application Service Management (ASM). Our proposal combines knowledge engineering, data analytics, neural networks and evolutionary algorithms to design autonomous adaptive controllers for ASM. Currently, one of the most important non-functional requirements is scalability. The most frequently adopted approach to keep a stable level of service (if the system is highly scalable) is adding more and more hardware resources to increase the computational power of a working solution- that is common practice in both on-premises and on the cloud resource provisioning. Adding more computational power just to remove the risk of saturating one of crucial resources may not be always necessary. This project investigates an alternative scenario where short- or mid-term load fluctuations can be managed and mitigated in much cheaper way by intelligent adaptive management applied directly on the software service layer. The thesis discusses this problem and explores possible solutions and profitability aspects of providing services to the enterprise, including energy and hardware costs.

Research Methodology

Adaptive control requires long experimentation so complex scenarios can be executed with the use of queuing models, where neural controllers can be weaved-in. Queuing models provide a widely adopted framework for integration of system run-time, and monitoring and control components in a single environment. This provides a fast and rigorous way for running repetitive experiments and a much more efficient way for observing the operation of intelligent controllers, see Figure 1. Our framework includes a set of algorithms and methods to **decompose signals**, execute tailored **feature selection** using various metaheuristic strategies. To set-up the experiments we developed a test-bed, see Figure 2, that is able to work under different load conditions and search configurations, in order to feed **decision blocks** of tested autonomous controllers.

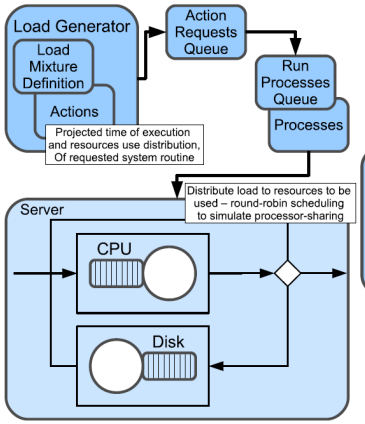

Figure 1. Model Architecture.

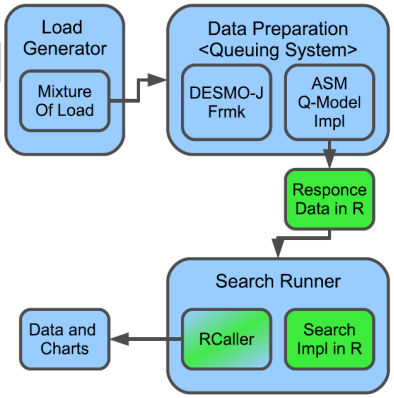

Figure 2. Testbed.

Publications

Sikora TD, Magoulas GD (2013) Neural adaptive control in application service management environment. *Evolving Systems* 4(4) pp 267-287

Sikora TD, Magoulas GD (2014) Finding relevant dimensions in application service management control. In: Intelligent Systems for Science and Information, *Studies in Computational Intelligence*, Springer, pp 335-353

Sikora TD, Magoulas GD (2015) Evolutionary approaches to signal decomposition in an application service management system. *Soft Computing* pp 1-22