Usability of System Configuration Languages

IGS Studentship Proposal

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Proposal

Title: Usability of System Configuration Languages

Supervisor: Joint supervision between Paul Anderson and Kami Vaniea. Current students are:

- Weili Fu, 3rd year (Paul, with James Cheney)
- Sara Albakry, 1st year (Kami)

Institute: CISA or ILCC

Matched Funding: We currently have no matched funding, although our preliminary work on this topic has generated some interest from industry, and we are planning to explore the possibility of closer collaborations in the is area.

Funding Sought: Full

Background & Motivation

System Configuration Languages are now ubiquitous for specifying and deploying the infrastructure for almost all large computing installations. Some of these are embedded in conventional scripting languages, while others are custom languages with a more declarative feel. However, they have significantly different goals from general-purpose programming languages and, in contrast to most modern programming languages, they have usually developed in very ad-hoc ways. This has often led to a complex and confusing semantics (e.g. *Puppet* [1]), and the resulting configuration errors are responsible for a large proportion of system failures. In addition, there is anecdotal evidence that the apparent complexity of languages such as Puppet is turning administrators away from a more declarative approach which we believe is ultimately necessary to create large, correct configurations.

We have been interested for some time in the design of configuration languages with a clearer semantics and features which provide appropriate support for modelling complex configurations. In support of this we (Paul and Kami) co-supervised an MSc project which involved a short survey of real users, in an attempt to understand the difficulties caused by some typical features of declarative languages. This produced over 350 responses (indicating a high level of interest), mostly from professional system administrators. These contained a wealth of interesting data [2], including evidence that professional administrators are often not (experienced) programmers, and that some concepts from programming languages (such as inheritance) are frequently misunderstood and misused in this context – especially when the underlying semantics is not particularly clear.

This leads us to believe that successful new languages (or developments of existing languages), need to take more account of the usability of the language for typical users. As far as we are aware, there is no previous work in this area, although there is some related work on the usability of programming languages (e.g. [4]), and a small amount of work on human factors relating to system administration [3], which should provide a useful starting point.

The Proposed Project

The aim of this project is to study the usability of various features of current configuration languages to identify concepts which are potential sources of misunderstanding and errors for typical system administrators. This will build on the work undertaken for last year's MSc project [2] which provides a "proof of concept". We would expect to propose changes or new features for these languages which would ultimately improve the correctness and reliability of large-scale system configurations. The project may also identify a potential for more intelligent tools to assist in the collaborative development of complex configuration specifications.

The inter-disciplinary nature of this project is particularly interesting, since it involves the application of human factors techniques to systems administration and (programming) language design - hence the proposed joint supervision. Potential candidates would be eligible from any of these backgrounds, although they are unlikely to be experienced initially in all three areas.

References

[1] Weili Fu, James Cheney, and Paul Anderson. *An Operational Semantics for a Fragment of the Puppet Configuration Language*. Edinburgh University, School of Informatics, Technical Note, 2016. http://arxiv.org/abs/1608.04999

[2] Adele Mikoliunaite. *Usability of System Configuration Languages: Confusion Caused by Ordering*. Edinburgh University, School of Informatics, MSc dissertation, 2016.
https://homepages.inf.ed.ac.uk/dcspaul/homepage/live/pdf/msc_20162088.pdf

[3] Eser Kandogan, Paul Maglio, Eben Haber, and John Bailey. *Taming Information Technology: Lessons from Studies of System Administrators*. Oxford University Press, 2012.

[4] J.M. Hoc, T.R.G. Green, R. Samurcay, and D.J. Gilmore. *Psychology of Programming (Computers and People)*. Academic Press Inc, 1990.