Intelligent Ensembles – a Declarative Group Description Language and Java Framework (Artifact)*

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Abstract

Smart cyber-physical systems (sCPS) is a growing research field focused on scenarios such as smart cities or smart mobility, where autonomous components are deployed in a physical environment, and are expected to cooperate with one another, as well as with humans. As these systems typically operate in a highly uncertain and dynamically changing environment, being able to cooperate and adapt in groups to cope with various (possibly unanticipated) situations becomes a crucial and challenging task. In this artifact, we respond to this challenge by presenting the Intelligent Ensembles framework, consisting of a high-level declarative language for describing dynamic cooperation groups, and a Java runtime library for automatically forming groups that best satisfy the given specification. The framework provides dynamic architecture adaptation (i.e., forming groups of components and exchanging data between them) based on the state of components and situation in their environment. Further, the framework can be used as a first step of a group-wise adaptation (i.e., identifying components that are to negotiate and coordinate in an adaptation). The framework is built on top of the Z3 SMT solver and the Eclipse Modelling Framework.

1998 ACM Subject Classification D.2.11 Software Architectures

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1 Scope

This artifact represents an implementation of the Intelligent Ensembles concepts outlined in the related SEAMS 2017 paper. This implementation consists of Eclipse plugins for supporting the custom Ensemble Definition Language (EDL), as well as a runtime library capable of parsing the specification and forming suitable groups. A demo is also included. The implementation covers all concepts discussed in the paper, including filtering concepts for improving scalability. It is written in Java for Eclipse, and takes advantage of several Java technologies, such as the Xtext and Xpand DSL tools, and Ecore modelling facilities. The ensemble formation strategy in this implementation is realized by translating the DSL specification and the system state into logical formulas and using the Z3 SMT solver to find the best assignment of components to groups.

2 Content

The artifact package includes:

- Compiled plugins for installing the Ensemble Definition Language support into an existing Eclipse instance – located in the *Compiled plugins* folder
- A pre-configured standalone Eclipse instance with all necessary packages installed and loaded with the artifact workspace – located in the *eclipse* folder
- A workspace containing both the Intelligent Ensembles implementation source files, as well as the demo application – located in the *Workspace* folder
- Instructions for working with the artifact – located in the *index.html* file

3 Getting the artifact

The artifact endorsed by the Artifact Evaluation Committee is available free of charge on the Dagstuhl Research Online Publication Server (DROPS). In addition, the artifact is also available at: `http://d3s.mff.cuni.cz/software/deeco/files/seams-2017.zip`.

4 Tested platforms

The artifact was tested on a release version of Windows 10, 64-bit. While older 64-bit versions of the Windows OS may be capable of running the artifact, they have not been tested and thus are not supported by the authors.

5 License

6 MD5 sum of the artifact

b2cb477b115a1be8a9db2a71d96d8ebb

7 Size of the artifact

894.4 MB