HAL
open science

Towards a Decoupled Context-Oriented Programming Language for the Internet of Things

Baptiste Maingret, Frédéric Le Mouël, Julien Ponge, Nicolas Stouls, Jian Cao, Yannick Loiseau

To cite this version:

Baptiste Maingret, Frédéric Le Mouël, Julien Ponge, Nicolas Stouls, Jian Cao, et al.. Towards a Decoupled Context-Oriented Programming Language for the Internet of Things. 7th International Workshop on Context-Oriented Programming (COP'2015) in conjunction with the European Conference on Object-Oriented Programming (ECOOP'2015), Jul 2015, Prague, Czech Republic. pp.6, 10.1145/2786545.2786552 . hal-01180586

HAL Id: hal-01180586

https://inria.hal.science/hal-01180586v1

Submitted on 27 Jul 2015

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Towards a Decoupled Context-Oriented Programming Language for the Internet of Things

Baptiste Maingret
University of Lyon
INSA-Lyon,
Telecommunication Dpt
F-69621, Villeurbanne, France
baptiste.maingret@insa-lyon.fr

Frédéric Le Mouël
University of Lyon
INSA-Lyon, CITI-INRIA Lab
F-69621, Villeurbanne, France
frederic.le-mouel@insa-lyon.fr

Julien Ponge
University of Lyon
INSA-Lyon, CITI-INRIA Lab
F-69621, Villeurbanne, France
julien.ponge@insa-lyon.fr

Nicolas Stouls
University of Lyon
INSA-Lyon, CITI-INRIA Lab
F-69621, Villeurbanne, France
nicolas.stouls@insa-lyon.fr

Jian Cao
Shanghai Jiao Tong University
800 Dongchuan Road
Shanghai, 200240, China
cao-jian@sjtu.edu.cn

Yannick Loiseau
Blaise Pascal University
24 Avenue des Landais
F-63170 Aubière, France
yannick.loiseau@univ-bpclermont.fr

ABSTRACT

Easily programming behaviors is one major issue of a large and reconfigurable deployment in the Internet of Things. Such kind of devices often requires to externalize part of their behavior such as the sensing, the data aggregation or the code offloading. Most existing context-oriented programming languages integrate in the same class or close layers the whole behavior. We propose to abstract and separate the context tracking from the decision process, and to use event-based handlers to interconnect them. We keep a very easy declarative and non-layered programming model. We illustrate by defining an extension to Golo - a JVM-based dynamic language.

Categories and Subject Descriptors

D.3.3 [**Language Constructs and Features**]: procedures, functions, and subroutines; D.2.11 [**Software Architectures**]: languages (e.g., description, interconnection, definition); D.2.8 [**Software Engineering**]: metrics—*complexity measures, performance measures*

General Terms

Language, Performance

Keywords

Programming Language, Context-Oriented Programming, Decoupled Architecture, Event-Based Handling, JVM, Golo

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, to republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.
COP '15 July 05 2015, Prague, Czech Republic
Copyright is held by the owner/author(s). Publication rights licensed to ACM.
ACM 978-1-4503-3654-3/15/07 ...$15.00.
DOI: http://dx.doi.org/10.1145/2786545.2786552.

1. INTRODUCTION

Easily programming behaviors is one major issue of a large and reconfigurable deployment in the Internet of Things. Such kind of devices often requires to externalize part of their behavior such as the sensing, the data aggregation or the code offloading. Most existing context-oriented programming languages integrate in the same class or close layers the whole behavior.

In this article, we propose

- to abstract and separate the context tracking from the decision process. Indeed, most context-oriented languages use event-condition-action rules embedded in the business class or in the context definition. This definition is rather restrictive and would benefit from more complex decision-making mechanism such as neural network or machine learning;
- to externalize these interactions by using API-defined context and decision maker, and interconnecting them with event-based handler mechanisms;
- to demonstrate the feasibility of such externalization by developing Congolo - *Contextual Golo*, an extension to Golo - a JVM-based dynamic language [17]. Preliminary performances are given.

Section 2 details related works. Section 3 introduces Congolo: language enhancements and architecture. Section 4 goes into Congolo implementation, and finally, section 5 gives preliminary results.

2. RELATED WORK

Several COP languages exist based on a variety of programming languages. Most of them implements the context with the use of layers. Layers include context tracker mechanisms and context reaction ones. In order to compare these languages, we can thus focus at first on the way the context are defined, then how they are activated and finally how they are used throughout the code. Table 1 proposes a summary.