Architecting the Future IoT Applications through Microservices Architecture Principles

Gibeon Aquino, Geoff Merrett, and Bashir Al-Hashimi

Introduction

The Internet of Things (IoT) is fast becoming a disruptive technology and attractive business opportunity with broad applicability in several areas (e.g., health, industry, transportation, agriculture, energy, and homes). It has made technology more pervasive, personal, and intimate in our daily lives. Therefore, the dependability requirement has become particularly crucial in many contexts involving IoT applications. In addition, there is an increasing trend towards the collaboration between these “things”. It has been fueling the emergence of new applications with colossal power but also with high complexity. Furthermore, extraordinary inflation in the complexity of the upcoming IoT systems is expected. Therefore, this research project aims at investigating how the principles of a Microservices Architecture can be adapted to Complex IoT applications. The focus of this project is on the strategies related to the dependability requirement, particularly those associated with the availability and reliability attributes.

Complex IoT applications

A Complex IoT (CIoT) application inherits the characteristics of complex systems (i.e., emergence, nonlinearity, spontaneous order, and adaptation). In particular, we characterised CIoT based on the fusion of the following statements:

- It involves several systems acting collaboratively, and at least one of them is an IoT component (i.e., a physical device and its corresponding system).
- There are multiple interactions between many of its components.
- It exhibits nontrivial emergent and self-organising behaviours.

Examples

Complexity Drivers

The emergence of complex systems in IoT has been encouraged by some noticeable drivers, such as:

- Demand for Collaboration
- Nano-technology Advent
- Energy supply Challenge

Our Claim

“Architecting the future IoT applications will surely be an even more complex activity. However, the microservices architecture principles can smooth this challenge.”

A Smart Home Case Study

Promising Strategies

- Handshaking
- Throttling
- Circuit Breaker
- Leader Election
- Retry
- Bulkhead
- Saga

References


