

INFORMATION OF DOCTORAL DISSERTATION

Research title: **COMBINING DATA MINING AND FORMAL METHODS FOR
WEB SERVICE COMPOSITION AND VERIFICATION**

Major: **COMPUTER SCIENCE**

Major code: **62.48.01.01**

PhD student: **HUYNH TAN KHAI**

Scientific advisors:

1. Assoc. Prof. Dr. QUAN THANH THO

2. Assoc. Prof. Dr. BUI HOAI THANG

University: **HCMC University of Technology, Vietnam**

Dissertation Summary:

Components Reuse is considered a method of the rapid software development approach that has many advantages and is widely used. *Service-Oriented Architecture* (SOA) is a software architecture that helps build information technology systems through components that are packaged as *services*. Thus, it can be said that component-based software development method are reused in SOA. *Web services* are services which operate and communicate using Web protocols. A Web service provides complete functionality. However, a single Web service is unlikely to meet the user requirements. Therefore, *Web Service Composition* is a very important issue in SOA.

Web service composition is a exponential complexity problem. To reduce the complexity, we need to filter the candidate services at each composition step by using *data mining* techniques and applying the *heuristic-based searching* method. In addition, in order to the composition satisfies different kinds of constraints, especially the temporal relationship constraint between services, the *formal methods* should be applied. Because the traditional approaches such as planning can not check these constraints.

The main contributions of the thesis:

- i. The thesis proposes a general framework for software component composition in general and Web service composition in particular.

- ii. The thesis proposes a formal specification for Web services and formalize the Web service repository as an LTS4WS model. Based on this model, the Web service composition and verification is done by using the model checking technique.
- iii. Next, the thesis presents a solution to control the state space explosion problem of composition problem by applying the heuristic-based searching method and the bitwise-based indexing technique.
- iv. The thesis proposes a logic-based Web services clustering method to support the filtering of candidate services needed for the composition process.
- v. Finally, the thesis has built a complete tool called WSCOVER for composing and verifying the Web service composition automatically.

Practical applications of dissertation's result:

With the algorithms have been proposed and experiments have been done, the results of the thesis can be applied widely in practice today. We can point out some practical applications of the thesis, such as combining and providing information in the field of tourism, in medicine as well as in the field of education. In addition, the works in the thesis also create the premise for extended researches in the field of information synthesis, support for intelligent information processing systems.

Further research of the dissertation:

For the future work, this research still has many issues to be considered. Details of the development directions for this study are:

- Dealing with the semantics of Web services based on ontology
- Mining the candidate Web service from the Web service repository with other data mining methods
- Applying the probabilistic and machine learning models in processing Web service repository
- Allowing users to specify the requirement specification in the natural language

Scientific advisors

PhD student

Assoc. Prof. Dr. Quan Thanh Tho Assoc. Prof. Dr. Bui Hoai Thang Huynh Tan Khai