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VILNIUS TECH
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Extraction of Microservices from Monolithic Software Based on the Database Model

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Summary: Software reengineering problem of monolithic systems decomposing into microservices is analyzed applying relational database decomposition technique. The database schema was used to extract the entities and relationships, to build a graph, and calculate the weight coefficient of the relationships. Weight coefficients were obtained by transforming the extracted data into a graph. Candidate microservices were identified based on the clusters of database entities defined by weight coefficients. Validation of microservice extraction was performed using ERP systems by changing resolution and class modularity. It was found that the number of clusters depends on the resolution. Analysis of modularity revealed that higher values of modularity lead to better cluster identification accuracy.

INTRODUCTION

Migration legacy monolithic software to microservice architecture has high cost associated with decomposing of an existing system to microservices. There is no general migration pattern, technique or method to migrate because legacy monolith application can vary in many aspects such as programming languages, database technologies, team size and so on. A key challenge in migration process is the extraction of microservice candidates.

PROPOSED METHOD

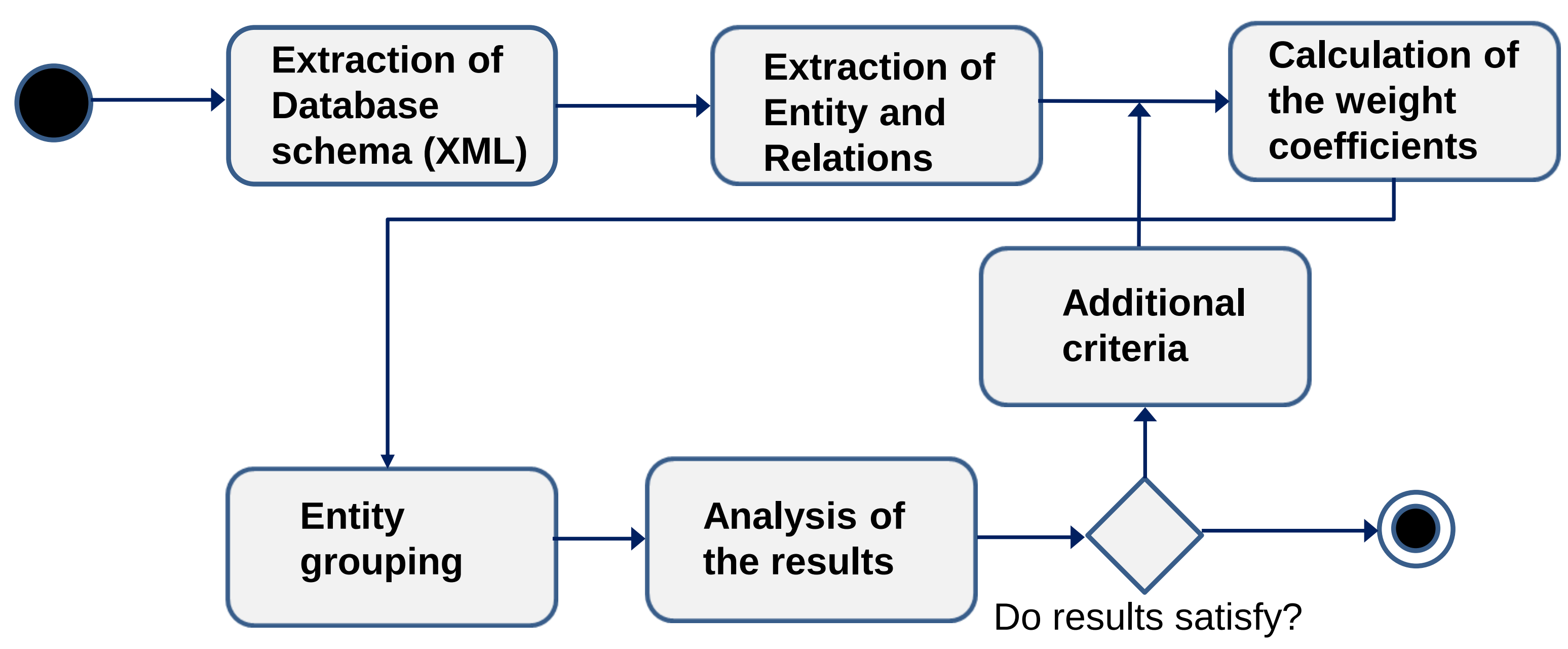

Extraction of Database schema (XML)
Extraction of Entity and Relations
Calculation of the weight coefficients
Additional criteria
Entity grouping
Analysis of the results
Do results satisfy?

Fig. 1. Method for microservice extraction based on database schema

```
procedure
  ApplyLeafChildTableReward(child parents count, child children count)
    reward := 0
    if child parents count = 1 and child children count = 0 then
        reward := 5
    end if
    return reward
end procedure
```

```
procedure
  ParentIsAHubPenalty(relationship type, parent children count)
    reward := 0
    if relationship type = many to many and parent children count > 1 then
        reward := reward - parent children count * coefficient
    end if
    return reward
end procedure
```

```
procedure
  ParentOnlyChildReward(relationship type, parent children count)
    reward := 0
    if relationship type != many to many and parent children count = 1 then
        reward := 5
    end if
    return reward
end procedure
```

```
procedure
  RelationshipPresenceReward(relationship type, parent children count)
    reward := 10
    return reward
end procedure
```

Fig. 2. Rules used for weight coefficient detemination

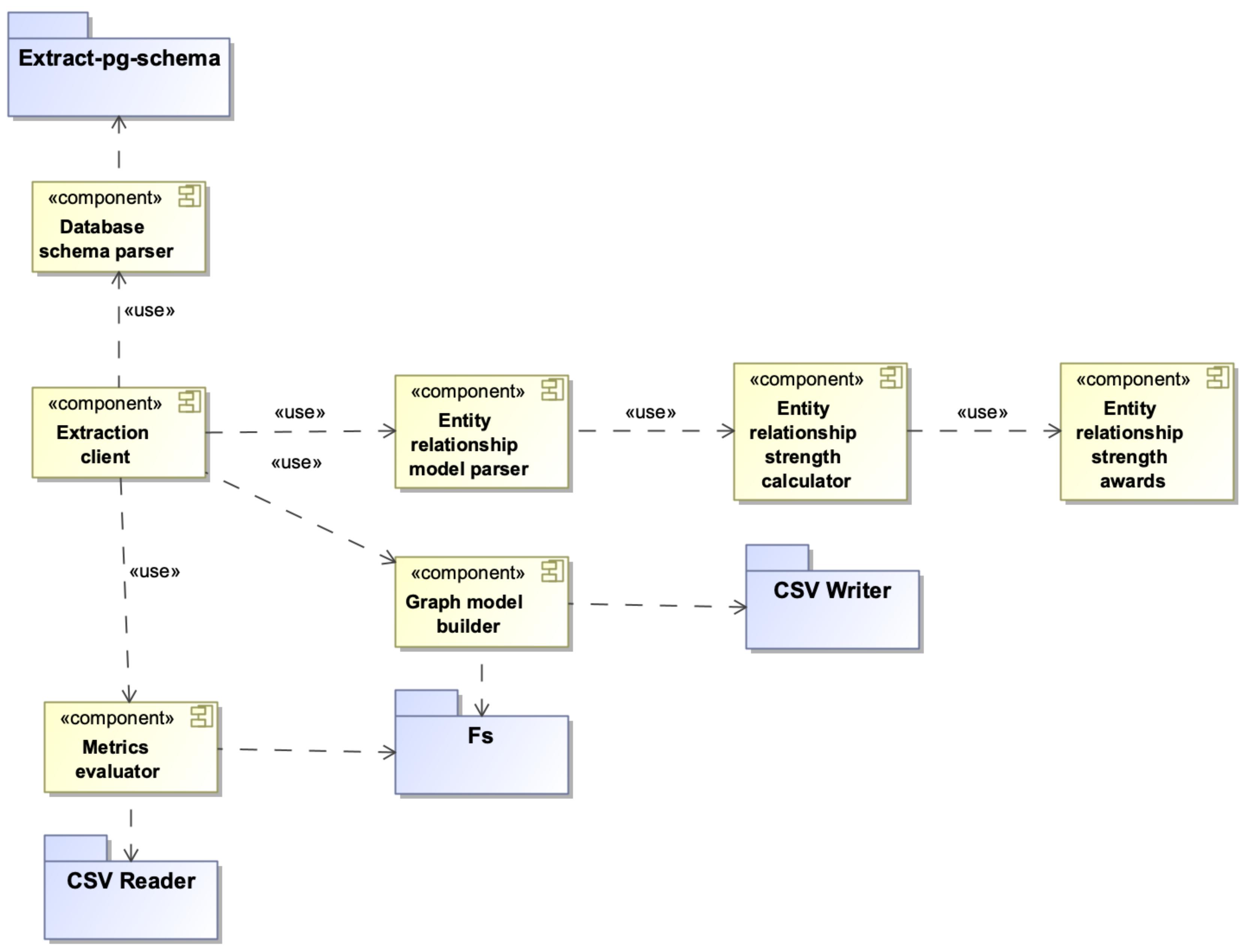

Extract-pg-schema
«component» Database schema parser
«use»
«component» Extraction client
«use»
«component» Entity relationship model parser
«use»
«component» Entity relationship strength calculator
«use»
«component» Entity relationship strength awards
«use»
«use»
«component» Graph model builder
CSV Writer
«component» Metrics evaluator
Fs
CSV Reader

Fig. 3 Component diagram of the prototype

RESULTS OF EXPERIMENT

Five open-source ERP systems were tested to validate the proposed method: Northwind (sales), Auction (auction), Chinook (digital trade), Pagila (rent of the movies), Adventureworks (international trade).
Extracted data from the database schema was used to build a graph applying the ForceAtlas2 layout algorithm. Investigation of microservice extraction was performed by changing resolution while class modularity was used for comparison of the results.

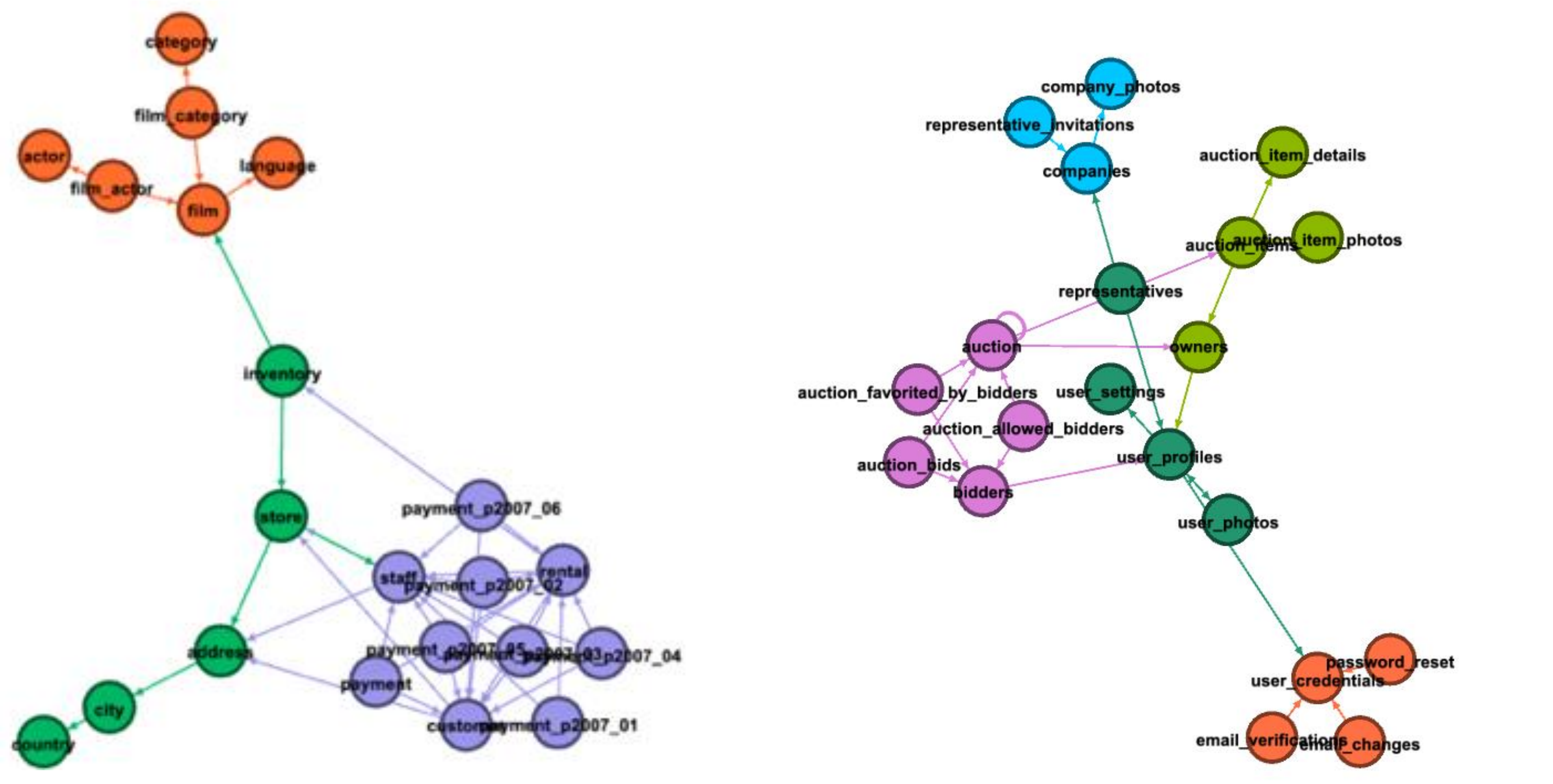
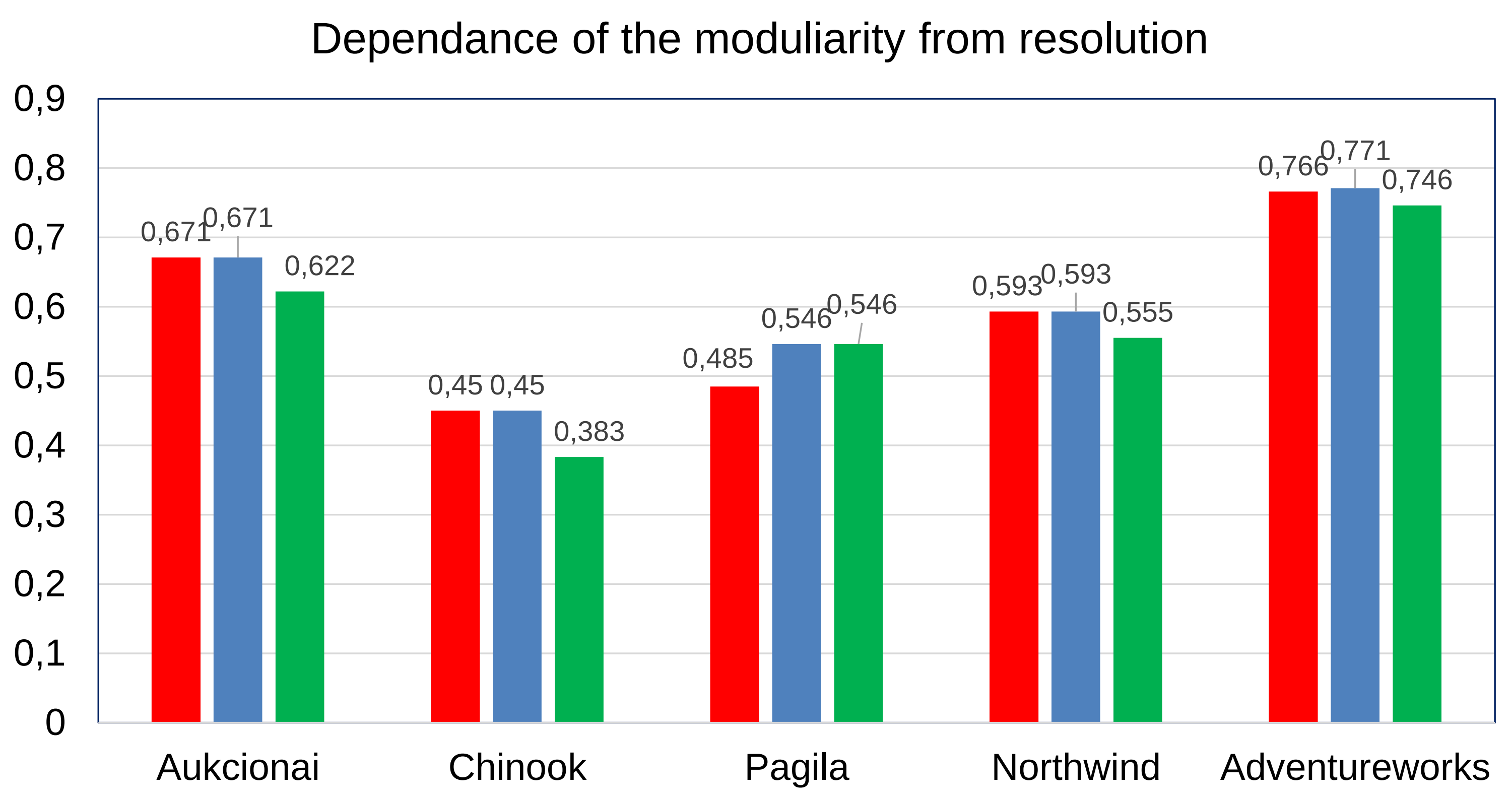
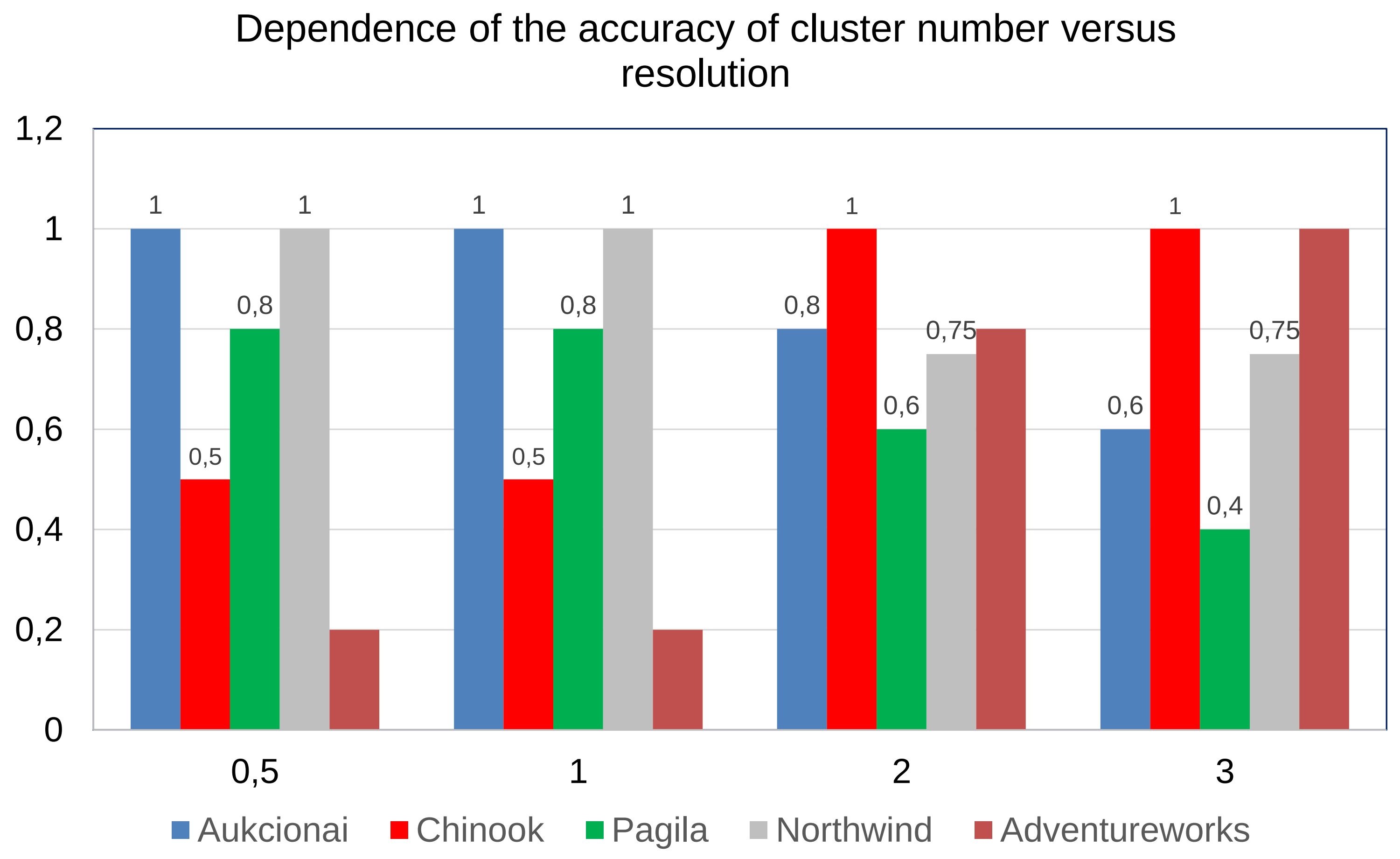
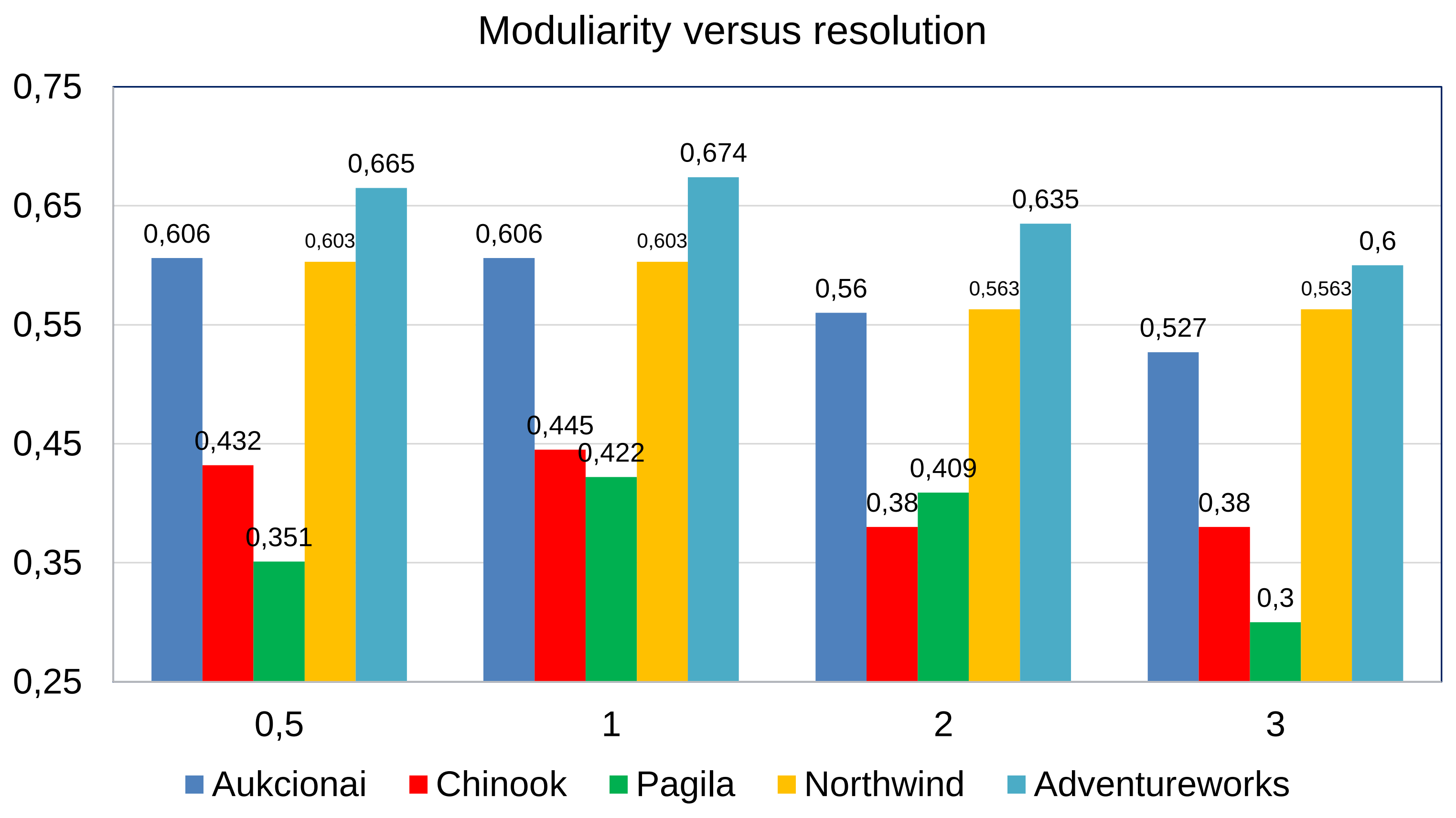


Fig. 4. Results of the graph clustering


Dependance of the moduliarity from resolution
Aukcionai
Chinook
Pagila
Northwind
Adventureworks


Dependence of the accuracy of cluster number versus resolution
Aukcionai
Chinook
Pagila
Northwind
Adventureworks


Moduliarity versus resolution
Aukcionai
Chinook
Pagila
Northwind
Adventureworks