Extended Resource Using Mechanism for Resource Space Model

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Abstract
This paper extends resource using mechanism (RUM) for the Resource Space Model (RSM) based application. Resource operation and query language has been implemented in Dunhuang culture application. Besides, operation analyst, resources auto-classifier, and RSM linker are designed and implemented.

1. Introduction
Resource Space Model (RSM) is a semantic data model that uses orthogonal classification semantics for organizing and locating heterogeneous resources [1-12]. Recently, it extends to decentralized model [9, 10, 13].

We extend Resource Operation Language (ROL) and build its interpreter to support resource queries and operations. Operation feasibility analyst is designed to determine whether an operation is legal and secure. Based on operation feasibility analysis, the RSM based application architecture is proposed, and an RSM based resource management system has been implemented in the Dunhuang culture application.

2. Extended RUM and ROL
RUM focuses on using and managing resources with the RSM Model. A resource space browser, a resource management engine and an application development environment are necessary parts of RUM [4]. ROL is an interactive language for users to perform standard operations on RSM [4, 5, 6]. RSM has four primitive operations: join, disjoin, merge and split [4]. ROQL includes two kinds of data processing description language: ROL and RQL. ROL deals with data operation, while RQL deals with the data query. Operation feasibility analyst (OFA) accepts query and determines whether an RSM operation command can be executed.

(1) split operation:
\[ R(x_1, x_2, L, x_3, L, x_4) \xrightarrow{\text{split}} R(x_1, x_2, L, x_3, x_4) + R(x_1, x_2, L, x_4, L, x_5) \]
if \( \text{values}(x_3) \cup \text{values}(x_5) = \text{values}(x_4) \)
AND \( \text{values}(x_3) \cap \text{values}(x_5) = \emptyset \)

(2) disjoin operation:
\[ R(x_1, x_2, L, x_3, L, x_4) \xrightarrow{\text{disjoin}} R(x_1, x_2, L, x_3, x_4, L, x_5) \]
\[ R(x_1, x_2, L, x_3, x_4, L, x_5) + R(x_1, x_2, L, x_4, L, x_5) \]
\[ \text{values}(x_3) \cup \text{values}(x_5) = \text{values}(x_4) \]
AND \( \text{values}(x_3) \cap \text{values}(x_5) = \emptyset \)

(3) merge operation:
\[ \text{values}(x_3) \cup \text{values}(x_4) = \text{values}(x_5) \]
AND \( \text{values}(x_3) \cap \text{values}(x_4) = \emptyset \)

(4) join operation:
\[ \text{values}(x_3) \cup \text{values}(x_4) = \text{values}(x_5) \]
AND \( \text{values}(x_3) \cap \text{values}(x_4) = \emptyset \)

3. Prototype System
Fig. 1 shows the architecture of RSM application system based on the extended RUM. Arrows in the figure represent the directions of data flow.

Fig. 1. RSM based Application Architecture

Fig. 2 shows a three dimensional resource space, and 3D technology is adopted to provide better using experience. The system provides the user interfaces to submit and execute ROQL. Users can manage resources in the resource spaces in the system. The operations include resource insertion, modification and deletion. Besides, the prototype system supports join, disjoin, merge and split operations.
If the user still wants to merge the resource spaces, OFA will give the merge warnings and execute the merge operation forcibly.

4. Conclusions

This paper extends RUM to match the requirements of RSM applications. The architecture of RSM application is proposed, and a prototype system in Dunhuang culture application has been implemented. Operation feasibility analyst is realized to execute the operation commands written in resource operation and query language. The 3D resource browser provides better user experiences for resource management.

References