Senior Citizen Service Management Using WebAging System

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Abstract: The paper presents the WebAging system, designed and developed to provide a single access point to Web services for elderly persons. The system uses semantic technology to organize services in communities. Each community is based on a domain having a collection of generic operations. Understanding the semantics of domains as well as their generic operations, by elderly people, is based on semantic attributes as synonyms, function, purpose etc.

Keywords: semantic attributes, domains taxonomy, communities of services, services registration, customizing access to services, precedence trees.

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1. Introduction

Although the volume of Web services for elderly persons is growing, many online services remain still used at a low degree, due to several factors such as:

- Difficulty or impossibility of finding websites where on-line suppliers post their services;
- Difficulty in understanding the semantics of methods implemented by online services, this factor negatively influencing the user in the selection process of the most suitable methods;
- Difficulty in understanding the input parameters semantics required by computer-implemented methods designed for on-line service, this factor negatively influencing the process of providing fair values of these parameters by users;
- Difficulty in providing execution control of methods implemented in online services;
- Difficulty in customizing services.

WebAging system, designed and developed in the research program PNCD II [7][1][2][3], is relevant to the above challenges. WebAging's main objective is to provide easy and personalized access to online services for elderly persons: services provided by government agencies, non-governmental agencies, foundations, institutions, trade organizations etc.

To achieve this, WebAging system organizes Web services in communities, each community corresponding to a domain of interest for elderly people. Communities in their turn are organized in a hierarchical structure using Domains taxonomy. This organization provides elderly people with an easy access to Web services designed for

them. Elderly people will browse among the nodes of Domains taxonomy and will select generic operations in order to invoke them, without the need to know details about Web services that will be executed as a result of invocating generic operations. Mapping generic operations over the concrete methods of Web services that implement these generic operations is provided by the system. Semantic structure of domains (synonyms, etc) as well as the semantic structure of generic operations (function, synonyms of function, the role of Input/ Output parameters), enable elderly persons to easily make a selection of interest areas and then the generic operations to be invoked.

WebAging provides the following functions:

- Definition and management of Domains taxonomy, including interest areas for services designed for elderly people (social, health, etc.);
- Definition and management of Web services descriptions;
- Services registration in WebAging;
- User profiles management and customizing services access;
- Web Services Execution.

Classic scenario of using WebAging system includes the following steps:

1. An elderly person connects to the system providing connection parameters (Password, user-ID),
2. An elderly person browses the Domains taxonomy to select the interest domain,
3. An elderly person browses the collection of generic operations for domain selected during the previous step and clicks generic interest operation,
4. The system calculates the precedence tree for the operation invoked and displays it on screen; the tree will have as root the operation invoked,
5. The elderly person clicks every generic operation from tree on the screen, in order to invoke these operations. Clicking nodes is starting with terminal nodes and finishing with tree root. If an error occurs while invoking an operation from the generic tree, the system doesn't continue to invoke operations in the remaining tree.

Invoking a generic operation from the precedence tree involves the following steps:

1. WebAging system maps the generic operation invoked in a concrete method of a Web service.
2. WebAging system runs the concrete method of the Web service and returns the result.

The next section will detail WebAging system functions listed above.

2. Domains Taxonomy Definition and Management

Domains taxonomy includes interest domains services tailored to the needs of elderly people. A domain belonging taxonomy is described by [7][3][4][5][6]:

<***Domain-ID, Category, Generic-Operations, Services***>

where:

- *Domain-ID* is the domain identifier.
- *Category* specifies domain synonyms and his father in Domains taxonomy.
- *Operations* are collections of generic operations, each operation including a **syntactic** description, a semantic **static** description and a semantic **dynamic** description.
- *Services* represent the list of services relevant to domain.

Syntactic description of a generic operation includes the attributes:

- operation Id,
- operation name,
- brief description of operation,
- operation type (request, notification),

– operation parameters and their data types.

Semantic description of a generic operation includes attributes:

– scope,

– function,

– synonyms,

– role,

– measurement unit.

services, as well as for services registration component in WebAging system. Services attribute specifies the list of Web services registered in that domain. Web services registration algorithms in the system will compare the syntactic and semantic attributes of generic domains and operations with syntactic and semantic attributes of Web services descriptions.

The diagram below illustrates graphically the attributes of nodes in Domains taxonomy:

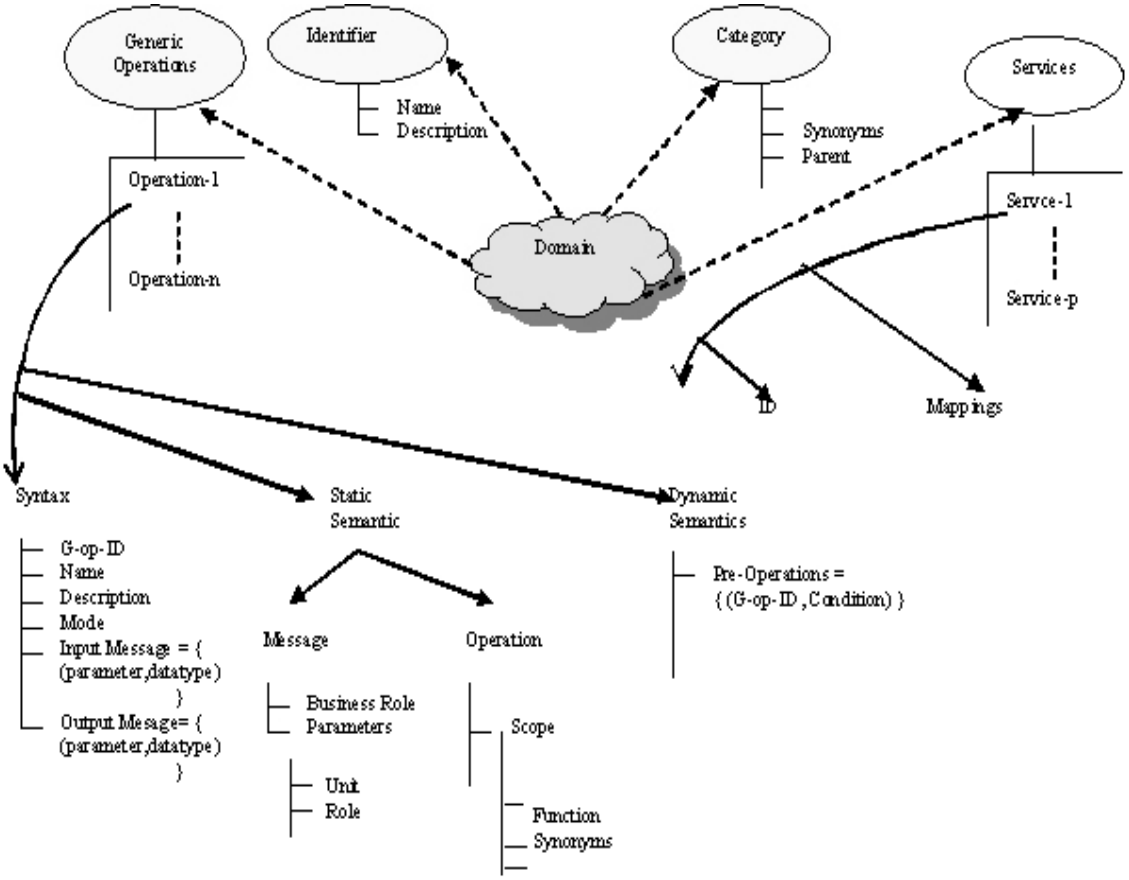

Figure 1. Domain Structure

Dynamic semantic description of an operation specifies the precedence relationships between the operation and the other generic operations of the domain. The specification includes attributes:

– Precedence operation's IDs of the current operation,

– Optionally, personalizing and termination conditions of precedence operations.

Semantic attributes (static, dynamic) are required for users to easily access Web

Using the Domain structure defined above were coded and loaded in Domains taxonomy over 50 domains of interest for elder persons, the process of updating taxonomy will continue Taxonomy root is WebAging node. The diagram below illustrates the current taxonomy of domains [7][4][5][6][8].

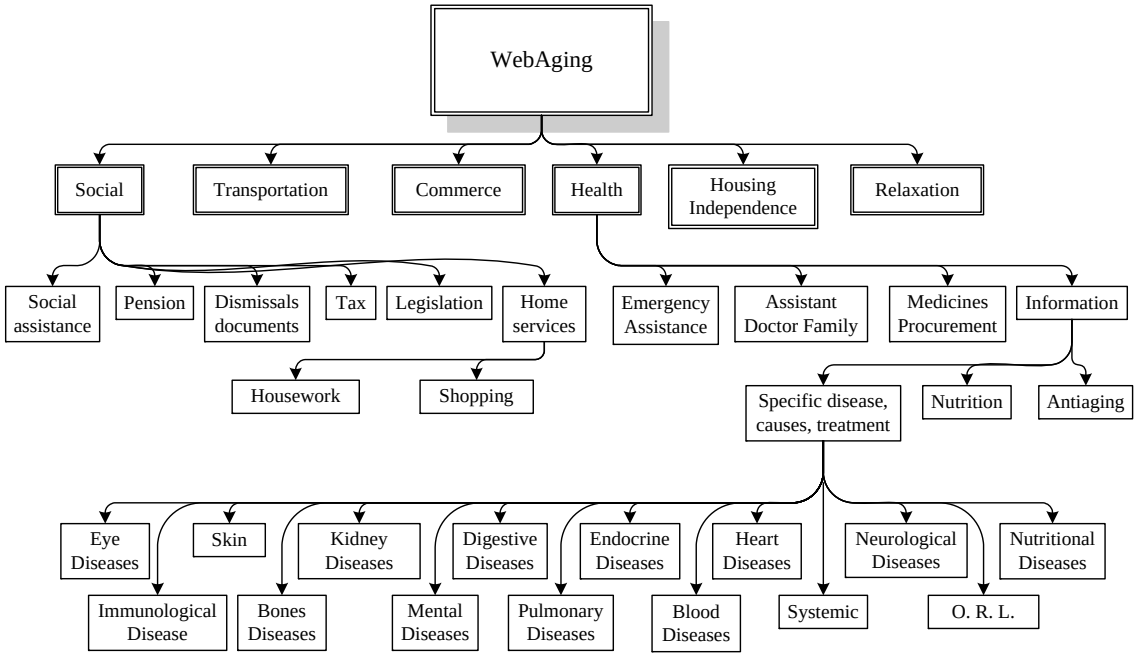

Figure 2. Domains Taxonomy

3. Definition and Management of Web Services Descriptions

Web services posted on various websites by service providers can be used in the WebAging only if they are described using the data structure below [4][5][7][8]. Web service description metadata are stored in the repository system. Web service description structure includes:

- relevant service areas, each area being described using a structure similar to Domain structure defined above,
- methods implemented by service,
- qualitative model of service (response time, cost, reliability, etc.),
- service attributes (name, description, URL).

The diagram below illustrates the WebAging structure used to describe services:

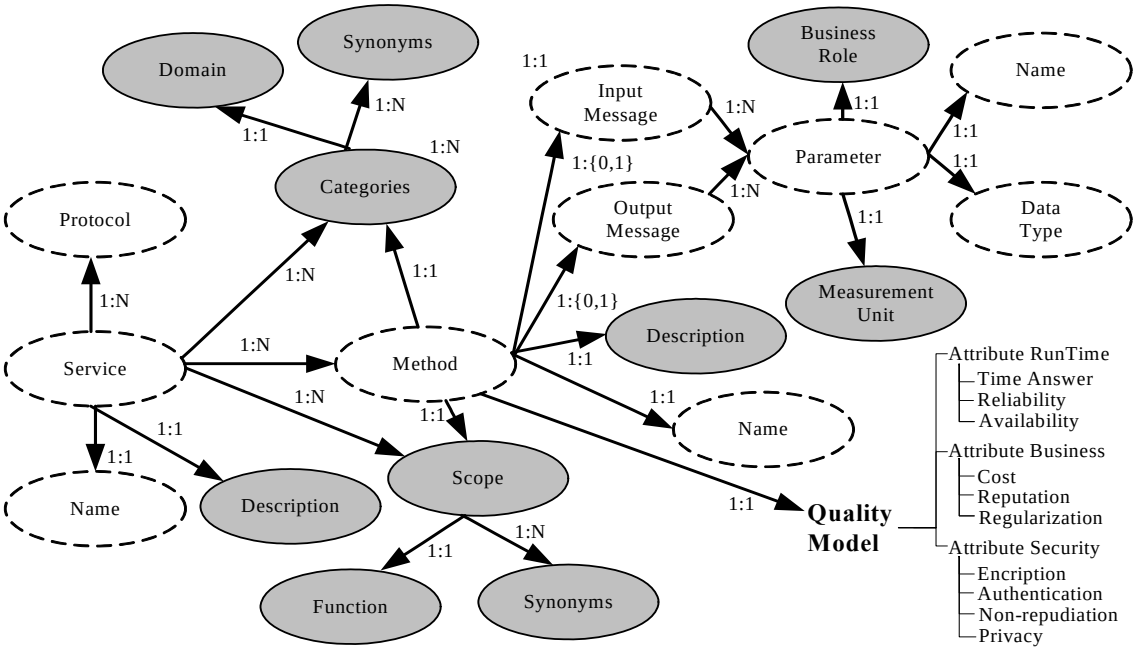

Figure 3. Data structure for services description

4. WebAging Registration Service

The registration process of Web services in the system requires matching methods implemented by services with generic operations defined in Taxonomy Domains. Matching algorithm used in the process includes the following steps:

1. compare domain category of generic operations to domain category of methods implemented by service,
2. compare generic operations purposes with the purposes of services methods,
3. compare the number input/ output arguments of generic operations with the number of input/output arguments for service methods,
4. compare arguments types for both generic operations and service methods.

After the execution of matching algorithm, for each generic operation the system will create a list of concrete methods. During invoking a generic operation by user, the system will enable the selection and execution of a specific Web service method from the attached list.

5. User Profiles Management and Customizing Access to Services

During system registration, users specify personal information that is stored in user profiles. Specifying the precedence relations between generic operations of domains belonging taxonomy Domains contains logical conditions (termination conditions, access personalization conditions, etc) that include variables stored in user profiles. Thus, invoking the same generic operation by elderly people with different user profiles may lead to the calculation of different precedence trees. For example, invoking generic operation "Cross sport register" generally involves the calculation of the precedence tree below:

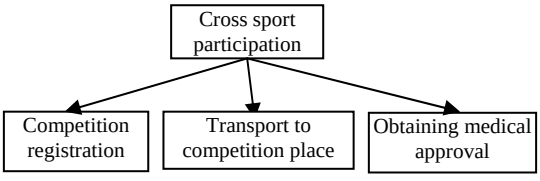

Figure 4. Precedence Tree

However, if the person invoking the operation "Cross sport participation has a good social status, resulting in user profile personal information, then the precedence tree, calculated by the system will stop operation “Transport to competition place”.

6. Service Execution in WebAging System

WebAging system service methods are executed when invoking Domains taxonomy generic operations. The diagram below illustrates the selection of "Digestive-Diseases" field from Domains taxonomy, followed by the selection of generic operation "Biliary-Cirrhosis Information”. Clicking the "Generate PreOperation Tree" button, system calculates and displays the operation’s precedence tree. Invoking tree generic operations can be made by clicking on each node of the tree, starting with terminal nodes.

Figure 5. Generic operations selection

The correspondence between generic invoked operations and concret methods of system registered services, which will effectively execute, is provided by WebAging system.

7. Conclusions

WebAging system was designed and developed to provide a single access point of Web services for elder persons. The services access interface is simple and based on

Domains taxonomy, each domain including a collection of generic operations to be invoked. Understanding the semantics of domains as well as their generic operations, by elder people, is based on semantic attributes as synonyms, function, purpose etc.

Correspondence between generic operations and concrete methods of Web services, to be effectively executed, is provided by the system, this leading to a simplified access of Web services provided by various organizations, by elder people.

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