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## Privacy Issues in Web Services: An Ontology based Solution

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### Abstract

Privacy is the right of a person to specify that when, how and to what amount information about him is disclosed to others. Due to the tremendous use and popularity of web services, the likelihood of intentional and unintentional privacy disclosures is also increasing. The web services users generate a rich amount of information when they browse the websites of the service providers, access social networking sites to post their comments & product reviews, and store their data in the cloud. The data such generated is a voluminous and valuable treasure for the marketers as well as advertisers. The emerging technologies and fast increasing online activities of users are posing new threats to user's privacy and digital life. While accessing the web services, users unknowingly agree to the privacy policy of the service provider through which they authorize the service providers to collect and share their personally identifiable information. Most of the users think that while accepting the privacy policy of the service provider, they are protecting their privacy but actually they are signing the policy which informs them about the privacy rights they are surrendering to the service providers. In this paper, we aim to minimise the privacy related information disclosure of the user through various prevalent semantic web based technologies.

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## 1. Introduction

Due to the integration of web services in our daily life, abundance of privacy sensitive data about people is available in web based databases, which can be easily accessed by persons having malicious intentions. The basic reason behind this is the ease of web availability. The main idea about minimising privacy disclosure is to match the privacy policies of the service provider to the requirements of the service user so that privacy sensitive data of the service users is secured based on both the security policies as well as the privacy policies [1][2][3][4] [5].

This paper proposes a framework which solves client's privacy protection dilemma in the context of web services paradigm. The proposed framework and its practical applicability has been validated through an ontological implementation. The implementation model of our proposed framework uses the web ontology language OWL and semantic web rule language SWRL. We have undertaken a study about online shopping, in order to validate the authenticity of our framework. The organization of the paper is as follows: In the second section, related work in this area is discussed. In section 3, our proposed framework is described in detail. Finally, the paper is concluded with a mention of how automation of selecting the appropriate web service, can lead to the minimal undesired disclosure of user's sensitive personal data.

## 2. Related Work

The rise of the Semantic Web has given birth to a novel structure called ontology defined using Web Ontology Language (OWL) [6] which was used to provide interoperability [7][8][9]. Earlier work presented in [10] [11] [12] followed a similar approach like ours. The difference lies in that we have created ontology for storing privacy policies of the service providers incorporating a number of privacy related parameters.

## 3. Proposed Ontological Framework

First thing in any ontology is the description of its core concepts. Concepts are also known as classes and these classes are the core component of most of the ontologies. A Concept explains a group of different objects which share common characteristics. For example, humans share characteristics, such as a set of specific body parts, the ability to speak a language etc. Most of the ontology languages allow the developer to define classes on the basis of these characteristics. A class may be a subclass of another class; this means that if the classA is a subclass of B, then any individual of type A will also be an individual of type B. An individual represents objects in the real world e.g, RB\_Company, IBM\_Company etc. It is possible within ontology to explicitly state that A is a subclass of B; in some languages, including OWL it is also possible to infer this. Classes may also share associations with each other. These associations or relationships specify the way individuals of one class are associated with the individuals of another class. The Privacy ontology for online shopping scenario has four main classes: Web\_Service\_Entity, User\_PII, Privacy\_Policy, Permission. The Web\_Service\_Entity class has two sub classes named: Service\_Provider and Service\_User. Service providers specify their privacy policies in the Privacy\_Policy class whereas service users specify their privacy preferences in the semantic web rule language based rules. The User\_PII class contains personally identifiable information (PII) of service users:

1. Identification\_Info: Identification information ( name, address, passport number, PAN card number )
2. Contact\_Info: Contact details ( phone number, e-mail id )
3. Health\_Info: Health information ( disease, treatment, medicines )
4. Financial\_Info: Financial information (bank account, locker number, property details)
5. Other\_Info: Other privacy sensitive information (Any such information, which is regarded as sensitive by the user and which he wants to reveal selectively, will come under this class).

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