And third, automated reasoners can deduce (infer) conclusions from the given knowledge, thus making implicit knowledge explicit. Such reasoners have been studied extensively in AI. Here is an example of an inference. Suppose we know that all professors are faculty members, that all faculty members are staff members, and that Michael is a professor. In predicate logic the information is expressed as follows:

$$prof(X) \rightarrow faculty(X)$$

$$faculty(X) \rightarrow staff(X)$$

$$prof(michael)$$

Then we can deduce the following:

$$faculty(michael)$$

$$staff(michael)$$

$$prof(X) \rightarrow staff(X)$$

Note that this example involves knowledge typically found in ontologies. Thus logic can be used to uncover ontological knowledge that is implicitly given. By doing so, it can also help uncover unexpected relationships and inconsistencies.

But logic is more general than ontologies. It can also be used by intelligent agents for making decisions and selecting courses of action. For example, a shop agent may decide to grant a discount to a customer based on the rule

$$loyalCustomer(X) \rightarrow discount(X, 5\%)$$

where the loyalty of customers is determined from data stored in the corporate database.

Generally there is a trade-off between expressive power and computational efficiency. The more expressive a logic is, the more computationally expensive it becomes to draw conclusions. And drawing certain conclusions may become impossible if non-computability barriers are encountered. Luckily, most knowledge relevant to the Semantic Web seems to be of a relatively restricted form. For example, our previous