Explaining Description Logic Reasoning

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The increasing reliance on automated reasoning needs not just the availability of fast reasoners, but also mechanisms to explain their, often surprising, results to human users, so that they can understand the consequences in their application domain. As one of the significant applications of machine reasoning is the Semantic Web, where reasoning on Description Logic(DL) plays a critical role, it is worth looking into explanation of DL reasoning.

There are three aspects in explanation that we are interested in:

Understandability and conciseness of explanation
Explanation means to bring understanding to the human being. Therefore generated explanation has to be easy to understand and reader friendly. It must not be clumsy and lengthened; otherwise it would be very difficult to consume it. Unfortunately, the tableaux algorithm and its optimizations implemented by DL reasoners are complicated in nature, difficult to be understood. Special explanation methodology is needed to generate understandable explanations for DL reasoning.

Extension of explanation for expressive DLs
Today tableau-based reasoners like FaCT and RACER are capable of reasoning with the very expressive DL ($\mathcal{SHIQ}$). However, explanation methodologies proposed so far can only handle basic DLs like $\mathcal{ALC}$. Growth of explanation power is far behind that of the reasoning capability. Extending explanation power is therefore one of the goals of our research.

Integration of explanation facility to DL reasoners
An explanation engine can not work alone, it must work closely with a DL reasoner. However, current DL reasoners do not support explanation. Modifying an existing DL reasoner to incorporate explanation capability is difficult and costly. A Dual-Reasoner architecture is being investigated to bring reasoning and explanation together.