A Logic of Information Flows

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We describe a formalism for combining heterogeneous components – web services, knowledge bases, declarative specifications such as Integer Linear Programs, Constraint Satisfaction Problems, Answer Set Programs etc.. The formalism is a family of logics, where atomic modules – formally, classes of structures – are combined using operations of extended Relational algebra, or, equivalently, first-order logic with a least fixed point construct. Inputs and outputs of atomic modules indicate directionality of the information flows. As a result of this small addition, an interesting modal logic, similar to Dynamic Logic, is obtained. Many binary operations, including those studied in the calculi of binary relations and the standard constructs of imperative programming become definable. We study the properties of this logic and identify an efficient fragment where the main computational task is solvable in deterministic polynomial time.

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