Coalgebraic update lenses

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I will discuss bialgebraic/coalgebraic structures relevant for bidirectional programming.

Ordinary (asymmetric) *lenses* à la Foster et al. are a structure abstracting databases manipulable by means of operations of viewing (projecting the database into a view) and updating (merging a replacement view into the database). *Update lenses* are our refinement where updates are decoupled from views and the operation of merging a view is replaced with an operation of applying an update. The separately given set of updates must carry a monoid structure and act on the set of views.

Update lenses for a given set of views and monoid and action of updates are exactly bialgebras of a suitable functor and monad. But thanks to standard facts about distributive laws and liftings, they can also be described as matching pairs of coalgebras of two comonads, coalgebras of a single composite comonad etc.

Update lenses comodel the same (generally large) Lawvere theory that is modelled by algebras of what we have elsewhere called update monads, a refinement of state monads.

A dependently typed variation of update lenses has every view coming with its own set of updates.

This is joint work with Danel Ahman (University of Edinburgh, United Kingdom).