Veracity Technology Spearhead

Enabling end-to-end veracity within value exchange ecosystems

A logic for veracity: capturing the essence of veracity

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In supply chains of all sorts, there are concerns around trust, truth, demonstrability and authenticity. These arise because different people taking part in the chain, the actors, may not know each other or directly communicate, may have to use third parties (certainly for the software systems that they probably rely on), may have to take people or documents "at their word" when they would actually like some more tangible evidence to go on, and so on. Such supply chains may be for physical goods, or may be for software in some distributed development environment.

There is a set of rules for certifying organic wine and these can be viewed as business rules, perhaps, but certainly the veracity of their application is an issue. Two questions with such sets of rules arise: are the rules sound?; and how do we check that someone has followed the rules?

Our way of at least providing a basis for answering these questions is to develop a logic for veracity, and subsequently to mechanise it and make it useable "under the hood" for legislators and producers.

Use-case Example

1. **Penelope prepares a specification sheet to describe the ingredients of her fertiliser. *(Claim 1, "x")***
2. **Penelope creates a spreadsheet to describe the ingredients of her fertilizer. *(Claim 2A, "y")***
3. **Penelope lists all non-organic ingredients and their full compositions in a tab of her spreadsheet. *(Claim 2B, "y")***
4. **Penelope lists all organic ingredients in another tab of her spreadsheet. *(Claim 2C, "y")***
5. Penelope prints both tabs of her spreadsheet.
6. Penelope attaches copies of documents regarding the non-organic ingredients to the prints of her spreadsheet. Penelope attaches a Genetically Modified Organism (GMO) declarations and the list of suppliers for each ingredient listed in her spreadsheet.
7. **Penelope attaches copies of valid organic certificates for all organic ingredients listed in her spreadsheet. *(Claim 3, "z")***
8. Penelope puts the prints of her spreadsheet and the attached copies of documents in an envelope.
9. Penelope writes her contact information on the envelope.
10. Penelope sends her envelope to OrgCert.
11. Charlotte at OrgCert receives Penelope's envelope.
12. Charlotte checks that the sheet outlining ingredients is complete and the necessary documents are attached.

Source Code

Working Paper

Use-case Example Snippet in Natural Language

- Assuming the spreadsheet describes the ingredients of the fertilizer is supported by y which Penelope uses, and the ingredients are all certified is supported by z which Penelope uses then **(the fertilizer has these ingredients implies ((the fertilizer has these ingredients and the spreadsheet describes the ingredients of the fertilizer) and the ingredients are all certified))** is supported by λ(x)(((x, y), z)) which Penelope uses, because
  - Assuming the fertilizer has these ingredients is supported by x which Penelope uses, the spreadsheet describes the ingredients of the fertilizer is supported by y which Penelope uses, and the ingredients are all certified is supported by z which Penelope uses then ((the fertilizer has these ingredients and the spreadsheet describes the ingredients of the fertilizer) and the ingredients are all certified) is supported by ((x, y), z) which Penelope uses, because
    - Assuming the fertilizer has these ingredients is supported by x which Penelope uses, and the spreadsheet describes the ingredients of the fertilizer is supported by y which Penelope uses then (the fertilizer has these ingredients and the spreadsheet describes the ingredients of the fertilizer) is supported by (x, y) which Penelope uses, because
      - Assuming the fertilizer has these ingredients is supported by x which Penelope uses then the fertilizer has these ingredients is supported by x which Penelope uses, because
        - **the fertilizer has these ingredients is a veracity claim.**
      - by assumption.
      - Assuming the spreadsheet describes the ingredients of the fertilizer is supported by y which Penelope uses then the spreadsheet describes the ingredients of the fertilizer is supported by y which Penelope uses, because
        - **the spreadsheet describes the ingredients of the fertilizer is a veracity claim.**
      - by assumption.
    - by a logical rule for 'and'.
    - Assuming the ingredients are all certified is supported by z which Penelope uses then the ingredients are all certified is supported by z which Penelope uses, because
      - **the ingredients are all certified is a veracity claim.**
    - by assumption.
  - by a logical rule for 'and'.
- by a logical rule for implication.

Use-case Example in the Logic for Veracity

$$\dfrac{\dfrac{\dfrac{\dfrac{\dfrac{C_1 \text{ is a veracity claim}}{x^P \in C_1 \vdash x^P \in C_1}\,assume \quad \dfrac{C_2 \text{ is a veracity claim}}{y^P \in C_2 \vdash y^P \in C_2}\,assume}{x^P \in C_1, y^P \in C_2 \vdash (x,y)^P \in (C_1 \wedge C_2)}\,\wedge^+ \quad \dfrac{C_3 \text{ is a veracity claim}}{z^P \in C_3 \vdash z^P \in C_3}\,assume}{x^P \in C_1, y^P \in C_2, z^P \in C_3 \vdash ((x,y),z)^P \in ((C_1 \wedge C_2) \wedge C_3)}\,\wedge^+}{y^P \in C_2, z^P \in C_3 \vdash \lambda(x)(((x,y),z))^P \in (C_1 \to ((C_1 \wedge C_2) \wedge C_3))}\,\to^+}{z^P \in C_3 \vdash \lambda(y)(\lambda(x)(((x,y),z)))^P \in (C_2 \to (C_1 \to ((C_1 \wedge C_2) \wedge C_3)))}\,\to^+}{\lambda(z)(\lambda(y)(\lambda(x)(((x,y),z))))^P \in (C_3 \to (C_2 \to (C_1 \to ((C_1 \wedge C_2) \wedge C_3))))}\,\to^+$$

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