Towards the Bidirectionalization of Spreadsheet Formulas

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Bidirectional Transformations

- Transformations between different data-structures are typical computational problems;
- Changes on either structure should be propagated to the other;
- *Lenses* are one of the most successful *bidirectional* transformation frameworks;
- That have been applied to a variety of areas:

Functional Programming	String Manipulation
Reversible Computation (incl. Arithmetic)	Relational Databases

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Spreadsheet Formulas

- Spreadsheet formulas are *unidirectional*, their output value can not be modified;
- They can be seen as transformations from multiple source cells to a single target cell*;*
- Simple language ⇒ easy to use;
- Their primitives are inspired in various areas:

IF(C;A;B) f (g (A))	RIGHT(A;N) CONCATENATE(A;B)
A + B A * B	VLOOKUP(C;A;N) HLOOKUP(C;A;N)

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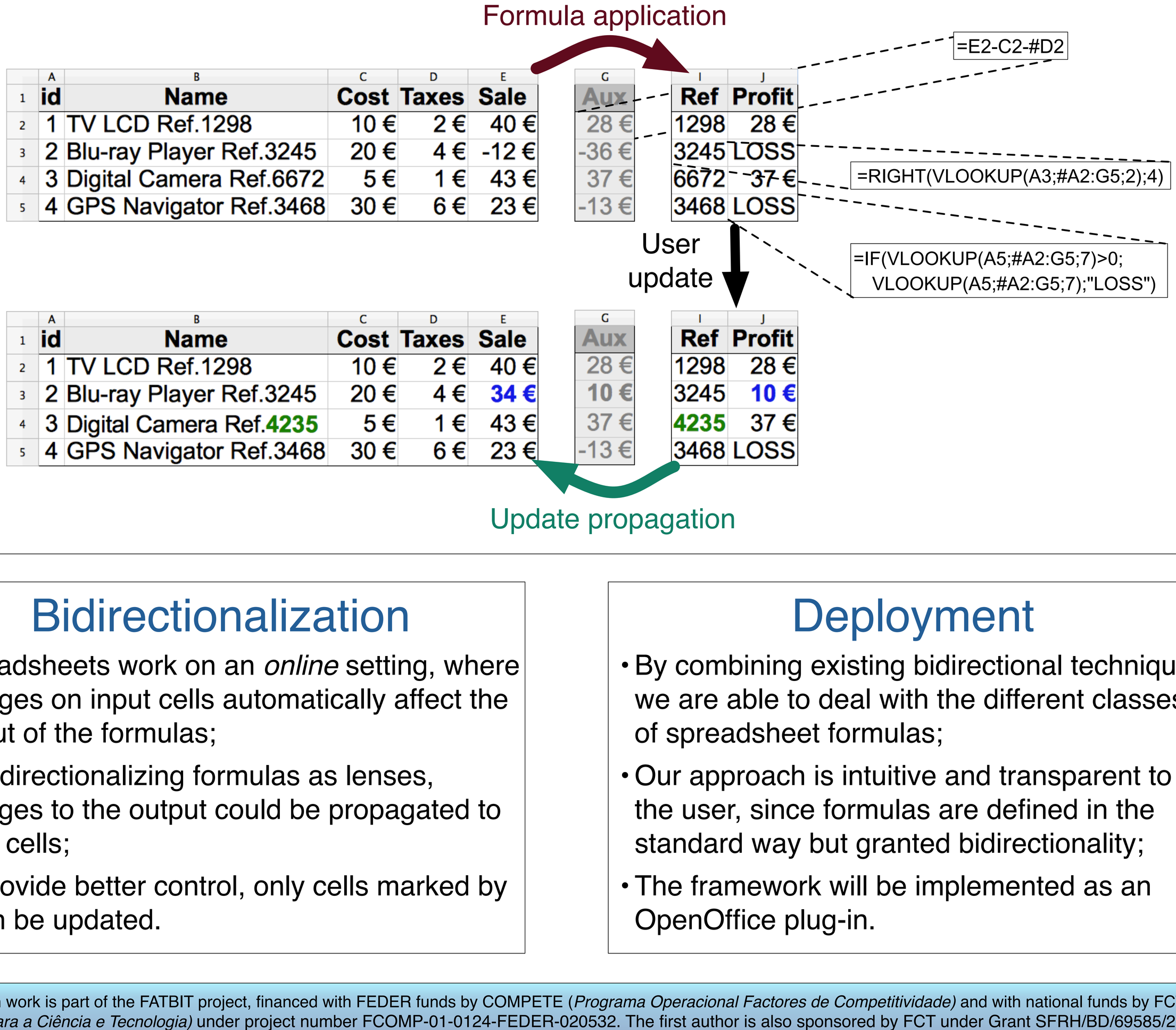
Bidirectional Spreadsheet Formulas



	A	B	C	D	E	G	I	J
1	id	Name	Cost	Taxes	Sale	Aux	Ref	Profit
2	1	TV LCD Ref.1298	10 €	2 €	40 €	28 €	1298	28 €
3	2	Blu-ray Player Ref.3245	20 €	4 €	-12 €	-36 €	3245	LOSS
4	3	Digital Camera Ref.6672	5 €	1 €	43 €	37 €	6672	37 €
5	4	GPS Navigator Ref.3468	30 €	6 €	23 €	-13 €	3468	LOSS

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4	3	Digital Camera Ref.**4235**	5 €	1 €	43 €	37 €	**4235**	37 €
5	4	GPS Navigator Ref.3468	30 €	6 €	23 €	-13 €	3468	LOSS

Bidirectionalization

- Spreadsheets work on an *online* setting, where changes on input cells automatically affect the output of the formulas;
- By bidirectionalizing formulas as lenses, changes to the output could be propagated to input cells;
- To provide better control, only cells marked by # can be updated.

Deployment

- By combining existing bidirectional techniques, we are able to deal with the different classes of spreadsheet formulas;
- Our approach is intuitive and transparent to the user, since formulas are defined in the standard way but granted bidirectionality;
- The framework will be implemented as an OpenOffice plug-in.

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