

MDSheet: A Framework for Model-driven Spreadsheet Engineering

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Why do Spreadsheets matter?

Omnipresent
Easy-to-use
Multi-purpose
Flexible

95% of all U.S. firms

90% of all analysts in industry

50% of all SSSs are the basis for decisions

Still...

BARABOO NEWS REPUBLIC



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W. Baraboo to pay more for borrowed money than believed

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December 09, 2011 8:17 pm • By Brian D. B

Due to a calculating error by their financial advisors, West Baraboo officials learned Thursday they will be paying about \$400,000 more over the lifetime of their most recent 10-year borrowing plan than originally projected.

During its regular December meeting, the West Baraboo Village Board looked back over last month's decision to sell \$1.1 million in general obligation bonds to cover a variety of village projects, said Village Clerk Mary Klingenmeyer. The review was required after the board received a letter from its financial advisory firm, Ehlers of Brookfield.

Ehlers advisor James Mann said "operator error" resulted in a spreadsheet underestimating the total cost of the 10-year bond.

The Salt Lake Tribune | News

Tuesday, April 17, 2012 Last Updated: 01:01 am

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Utah education officials make big mistake

Utah education officials don't likely be hurt by the resignations of two top finance

First Published Apr 11 2012 11:54 am • Last Updated Apr 11 2012 11:22 pm

A miscalculation at the State Office of Education has led to a \$25 million mistake in Utah's education budget for next school year — and the resignation of two top finance officials.

Education leaders, however, say they don't expect the potential shortfall to hurt schools or districts. State leaders are considering solutions ranging from using education money expected to be left over at the end of this school year to calling a special legislative session.



Photos

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"We committed to fund [enrollment] growth and this is an important part of growth," said Senate Budget Chairman Lyle Hillyard on Wednesday. "We would hope to get it fixed, and I think that's going to be our first priority."

The \$25 million represents less than 1 percent of the state's overall \$3 billion-plus education budget.

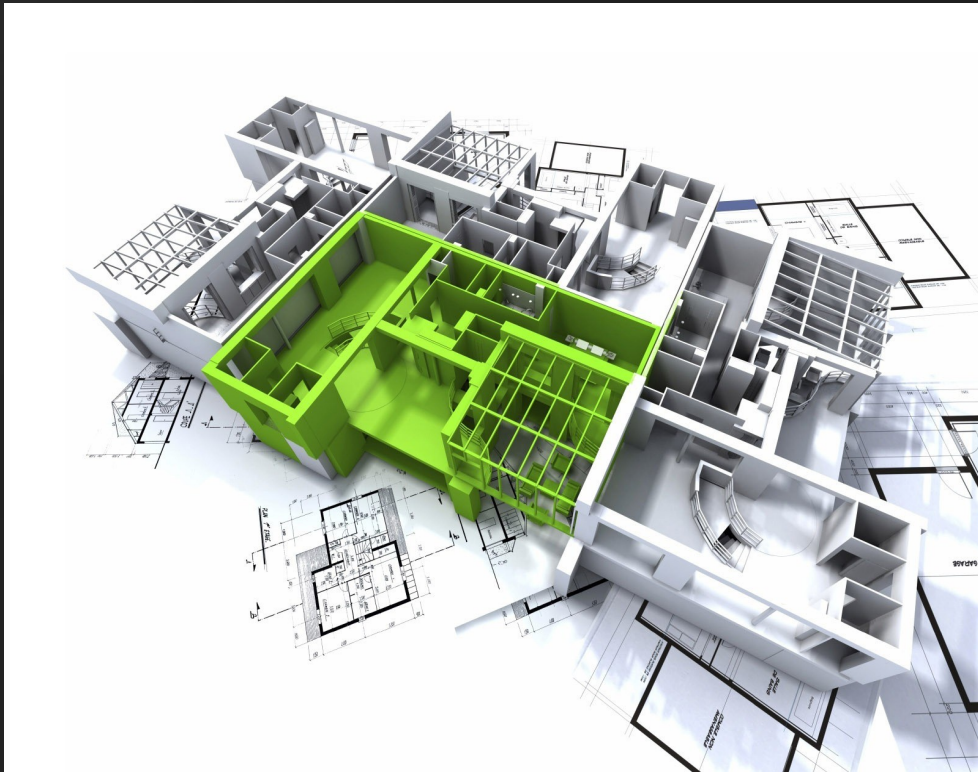
The problem was that the state office essentially underestimated the number of students expected in schools next school year. The correct number will cost the state \$25

million more than anticipated.

State Superintendent Larry Shumway attributed the mistake to "a faulty reference" in a spreadsheet. He emphasized that no money was misappropriated. He called the mistake "significant" but "manageable."

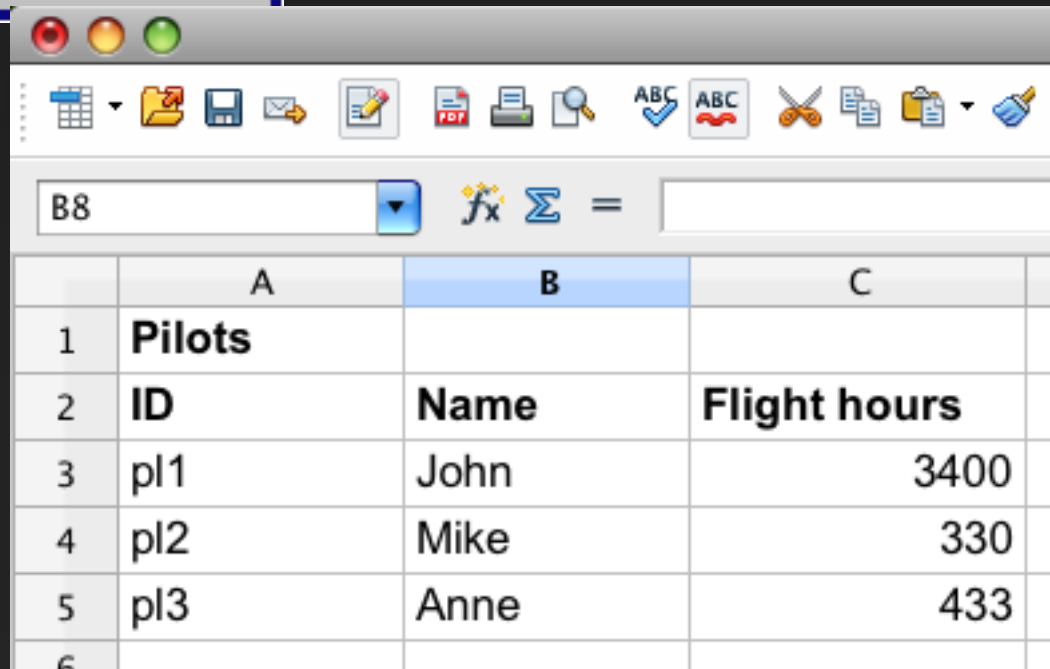
Economy losses of \$10 billion/year!

The Contribution of Models



Models in SpreadSheets

	A	B	C
1	Pilots		
2	ID	Name	Flight hours
3	id=""	name=""	flight_hours=0
⋮			



The screenshot shows a spreadsheet application window with a toolbar and a formula bar. The active cell is B8. The spreadsheet contains the following data:

	A	B	C
1	Pilots		
2	ID	Name	Flight hours
3	pl1	John	3400
4	pl2	Mike	330
5	pl3	Anne	433
6			

ClassSheets: automatic generation of spreadsheet applications from object-oriented specifications, Gregor Engels, Martin Erwig, ASE'05

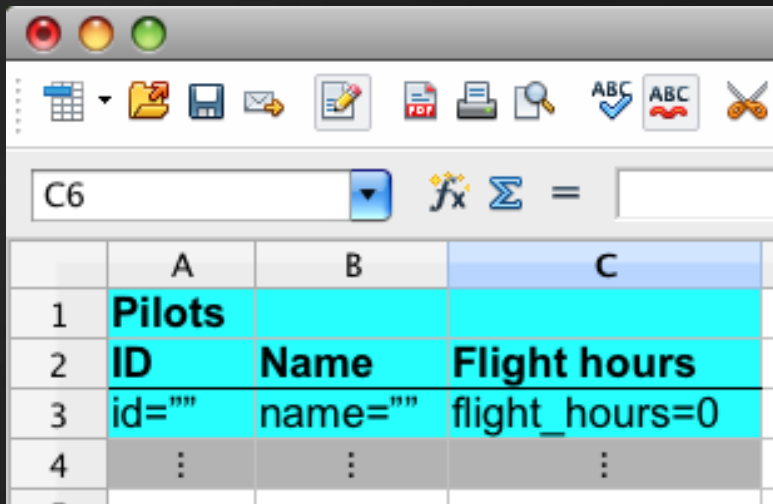
MD SpreadSheet Engineering in MDSheet

I. Embedding ClassSheets in
SpreadSheets

II. Co-evolution of Models and Instances

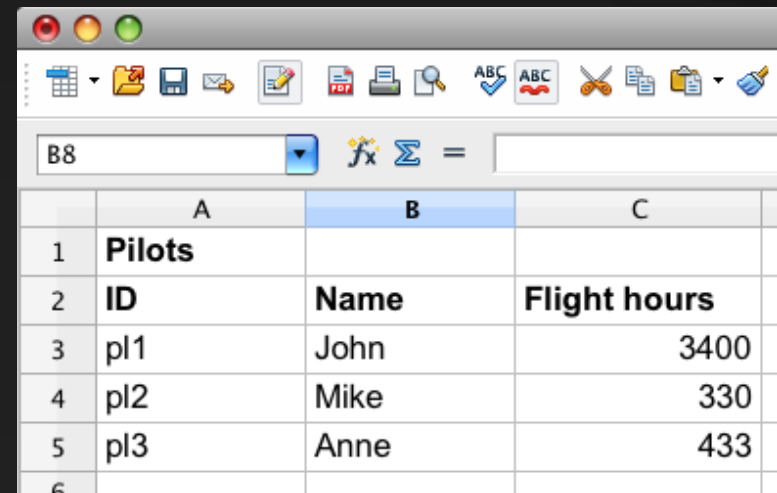
III. ClassSheet Model Inference

I. Embedding ClassSheets in SpreadSheets



A screenshot of a spreadsheet application window. The active cell is C6. The spreadsheet contains a class sheet for 'Pilots' with the following structure:

	A	B	C
1	Pilots		
2	ID	Name	Flight hours
3	id=""	name=""	flight_hours=0
4	:	:	:



A screenshot of a spreadsheet application window showing a data table for 'Pilots' with the following structure:

	A	B	C
1	Pilots		
2	ID	Name	Flight hours
3	pl1	John	3400
4	pl2	Mike	330
5	pl3	Anne	433
6			



Powerful interactive interface
Single Environment for SS evolution
Model-instance synchronization



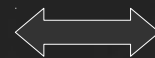
Syntactic restrictions

II. Co-evolution of Models and Instances

Semantic Rules	
$Block \leq Block \mid Block$	Add a block horizontally
$Block \leq Block \wedge Block$	Add a block vertically
$Sheet \leq Sheet \mid Sheet$	Add a sheet
$Class \leq Class \wedge Class$	Add a class
$Sheet \leq Sheet \mid Class$	Add a column
$Block \leq Block \mid Block$	Add a column
$Label : Class \leq Label : Class \downarrow$	Make a block expandable
$Class \leq Class \rightarrow$	Make a class expandable
$Sheet \leq (Sheet \mid Sheet)_{ref}$	Split
$Sheet \leq (Sheet \mid Sheet)_{ref}$	Split functional dependency

Data-refinement theory

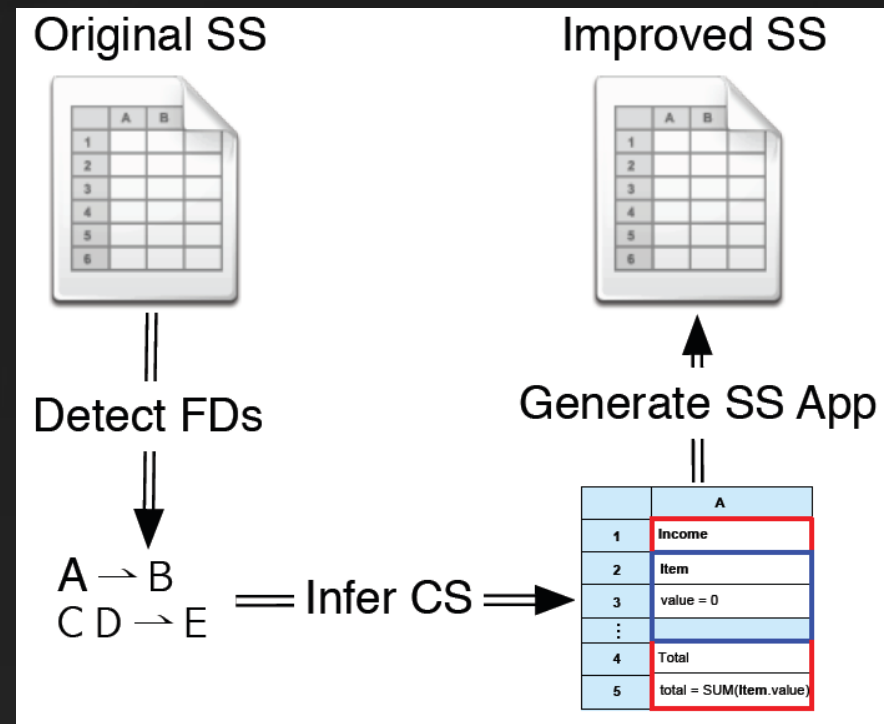
Model transformations
(type-level)



Data transformations
(value-level)

Type-safe Evolution of Spreadsheets, Jácome Cunha, Joost Visser, Tiago Alves, João Saraiva, FASE'11

III. ClassSheet Model Inference



Database Normalization Theory

Automatically Inferring ClassSheet Models from Spreadsheets, Jácome Cunha, Martin Erwig, João Saraiva, VL/HCC'10

MDSheet

- Available at <http://ssaapp.di.uminho.pt>
- Built out of ~7500 LOC:
 - 3695 in Haskell, for the Evolution and Inference
 - 871 in Basic, for the Embedding
 - 2800 in C++, for gluing all components