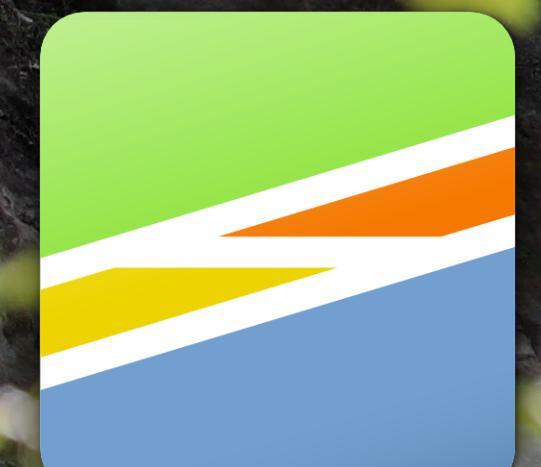
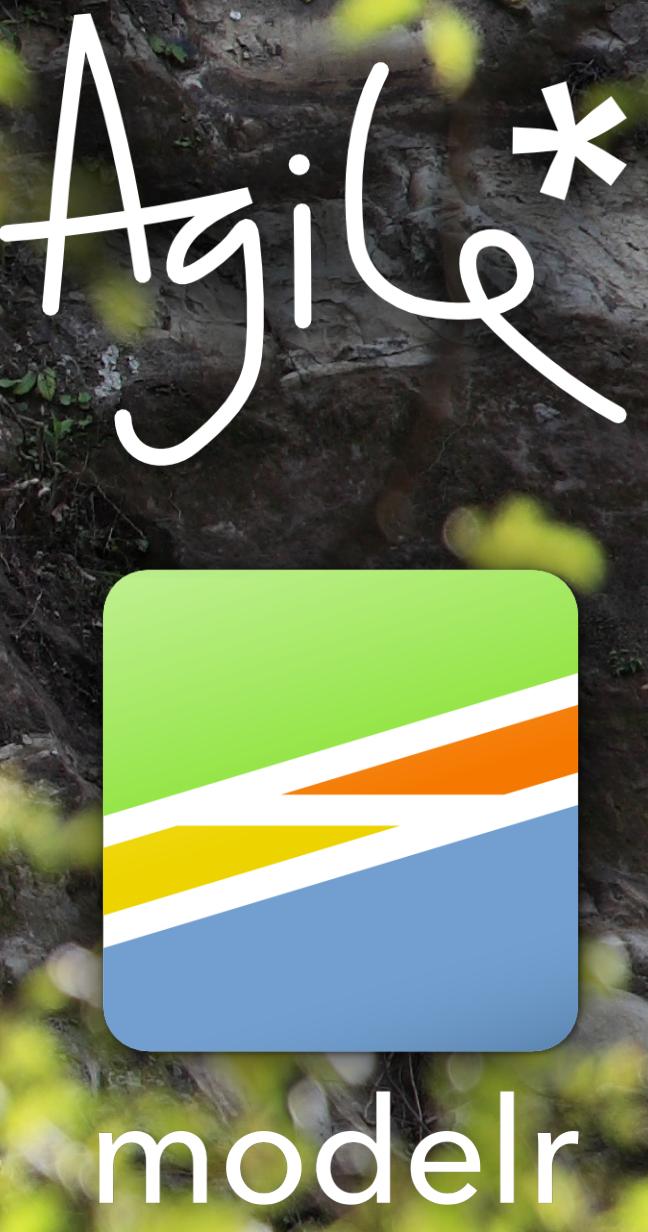


# The road to Modelr building a commercial web application on an open source foundation

Matt Hall

matt@agilegeoscience.com  
Agile Geoscience, Canada



## Motivation

In the reflection seismic interpretation workflow, forward modeling the seismic response is the most important thing that nobody does. We want to change that.



## Why a web app?

Industrial software is usually expensive (\$20–100k per seat) and therefore purchased centrally: a gatekeeper or small group evaluates software, and recommends purchases. As a result, purchases take years, and the customer is not an end-user of the software. This means a startup must hire an expensive sales team, and a lawyer to write contracts.

In contrast, we can deliver **modelr** directly and inexpensively to end-users, for a much lower price. Instead of selling a few hundred licenses of a \$20k package, we aim to sell tens of thousands of \$100/year subscriptions.

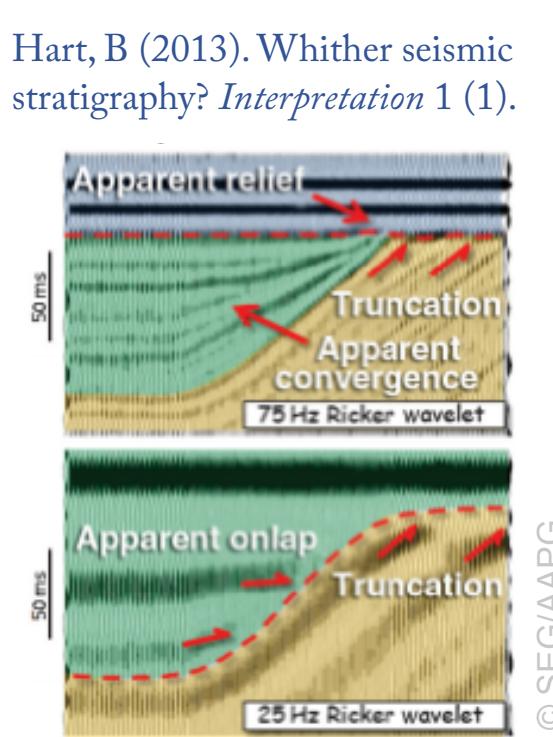
- Cross-platform
- Mobile-friendly
- Easy to demo
- Daily updates
- Teraflops ready
- Social ready
- Greater reach

- Online only
- Security
- Lower value
- Less depth

## Forward modeling

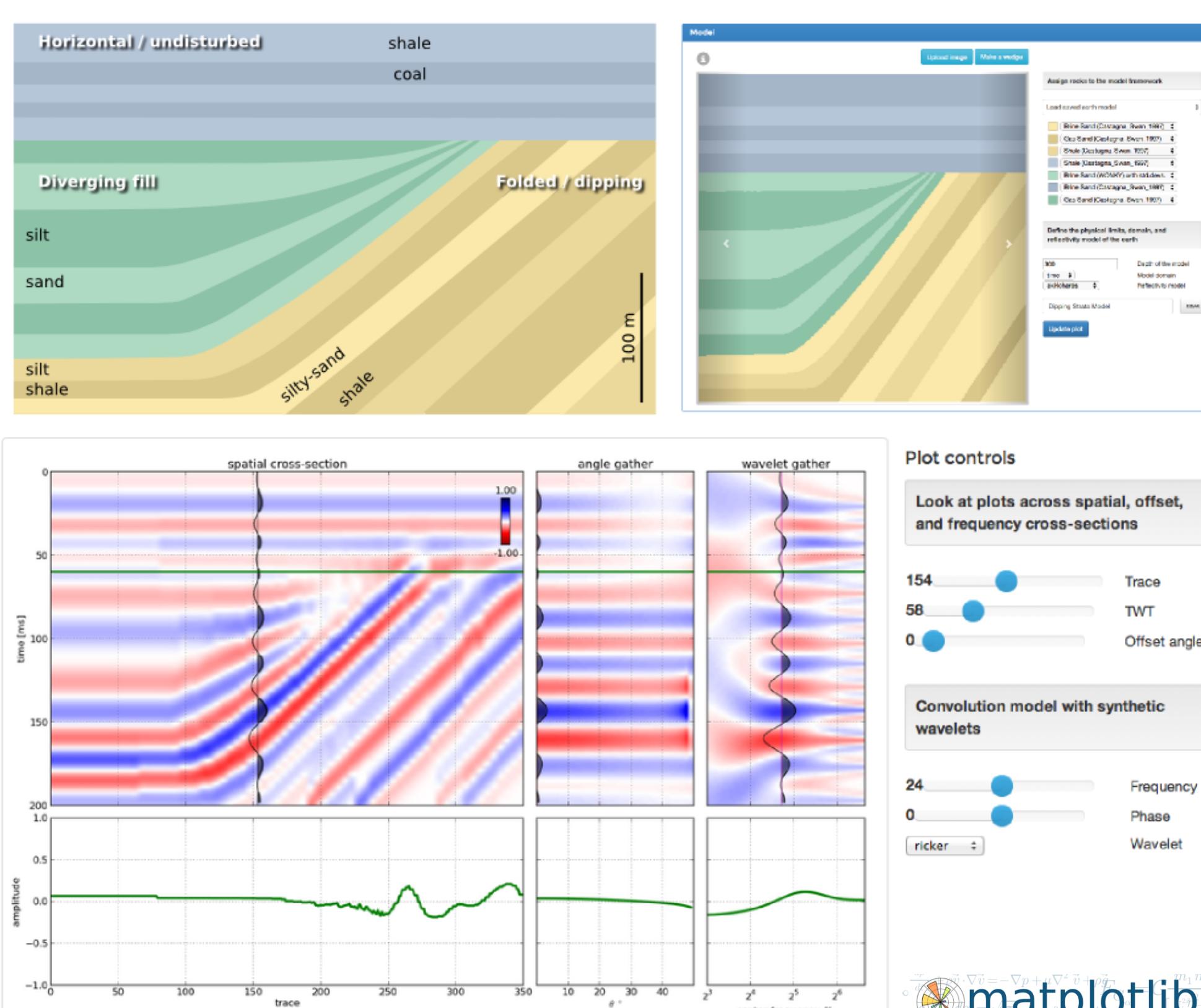
Seismic interpretation is an inverse problem: to find the 4D geologic model that best explains the 2D or 3D seismic reflection data.

Building simple earth models and predicting the seismic response is a good way to tune one's intuition, and to constrain and calibrate our geologic models. This example (right) shows how bandwidth affects the image.

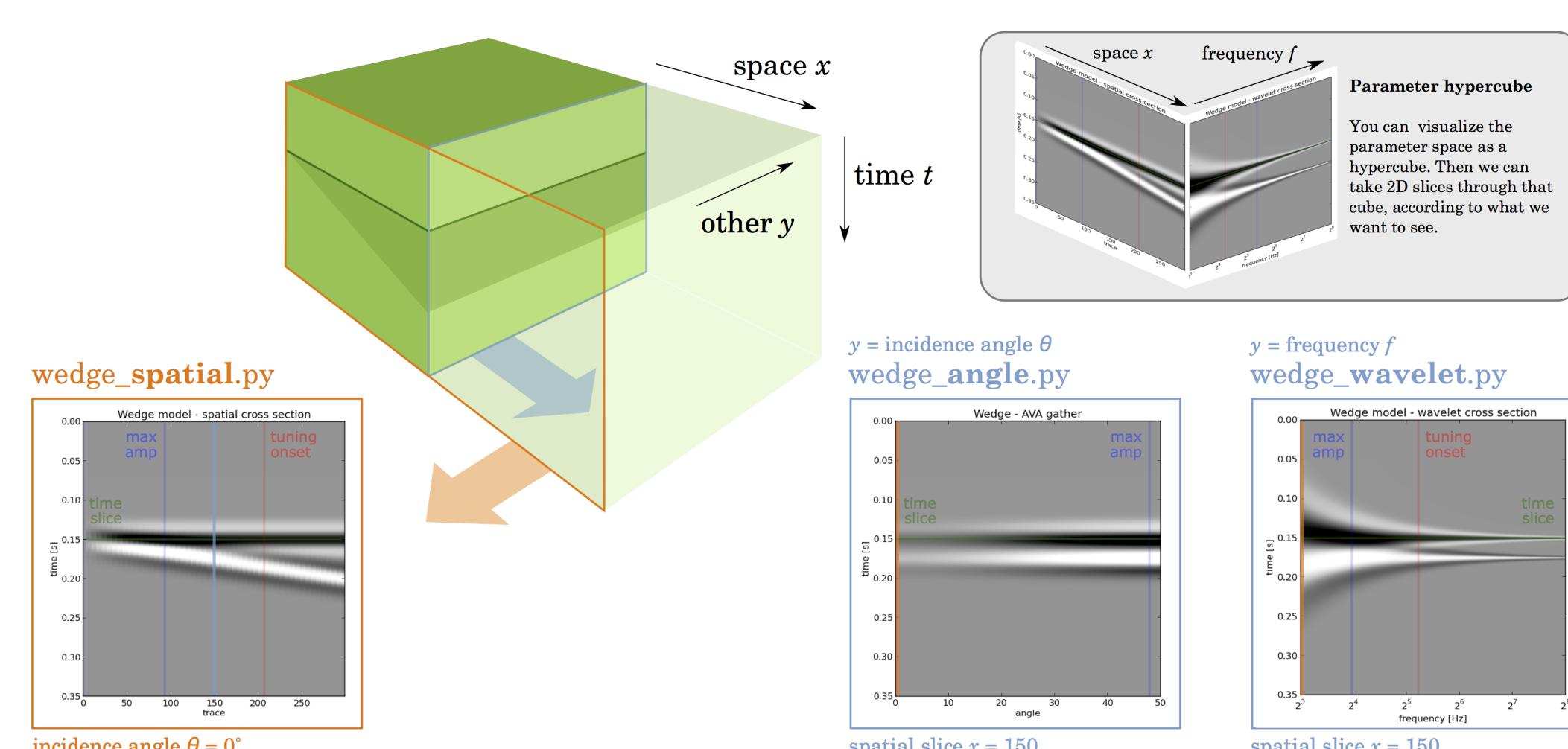


The geologist can use their own artwork, or adapt images from elsewhere. Any image can be used as the model — then rocks are assigned to colours.

The earth model is converted to the time domain, and the reflectivities convolved with a wavelet. The user can explore the result.



**modelr** produces a 4-dimensional synthetic for a 2D slice of the earth. This is saved as an HDF5 volume, and 2D slices are accessed arbitrarily via AJAX.



## Uncertainty everywhere

### My rocks

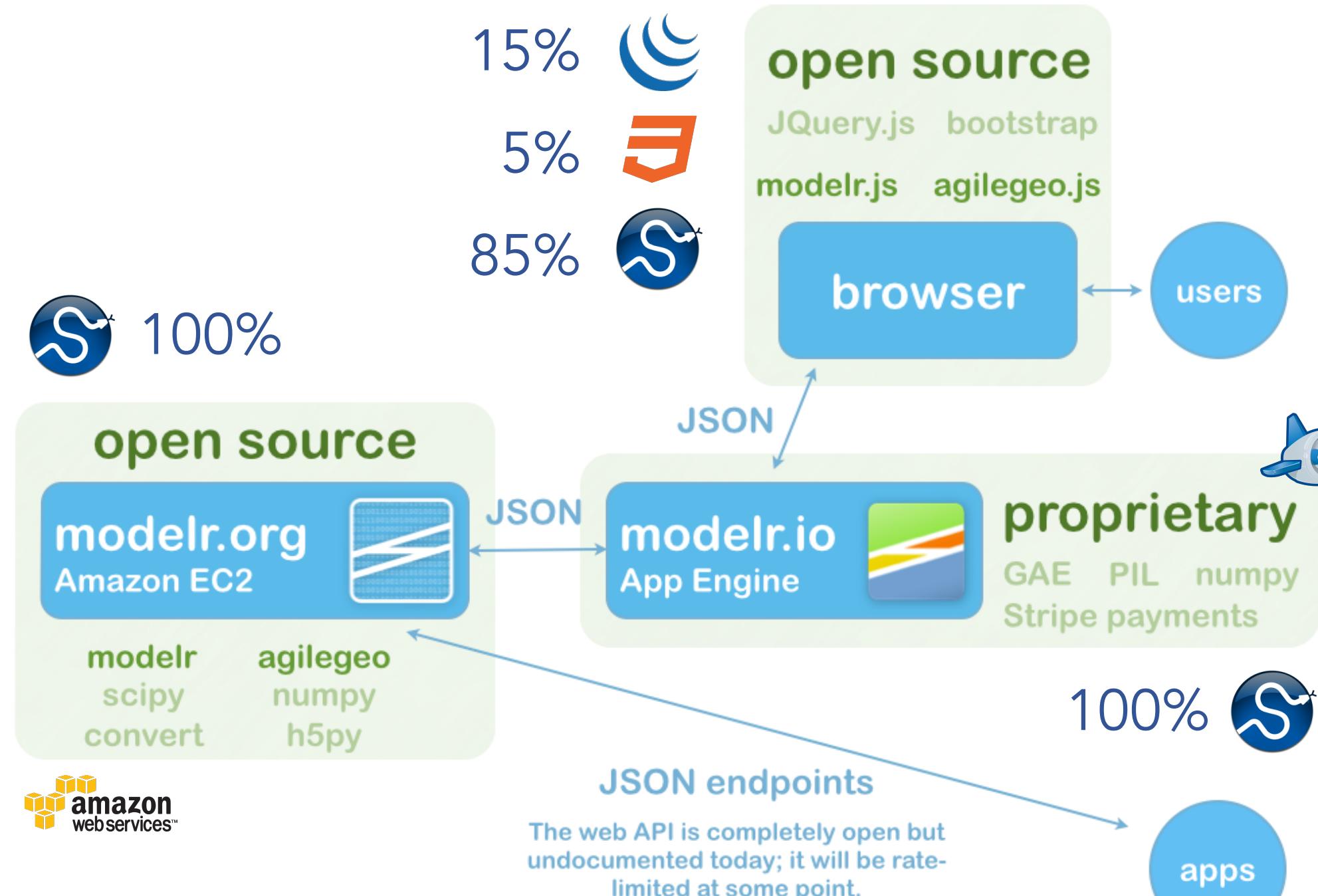
	$V_p$	$V_s$	$\rho$	$V_p$ SD	$V_s$ SD	$\rho$ SD	
Shale	3000.0	1600.0	2500.0	50.0	50.0	50.0	<a href="#">edit</a> <a href="#">remove</a>
Gas sand	2835.0	1762.0	2040.0	200.0	100.0	20.0	<a href="#">edit</a> <a href="#">remove</a>
Brine sand	2835.0	1472.0	2080.0	200.0	100.0	30.0	<a href="#">edit</a> <a href="#">remove</a>

One of the principles at the core of **modelr** is that there should be no deterministic model. Rock properties therefore have standard deviations, and some types of simulations are stochastic. This one (left) predicts the amplitude of a gas-filled sand as a function of offset.

## Architecture

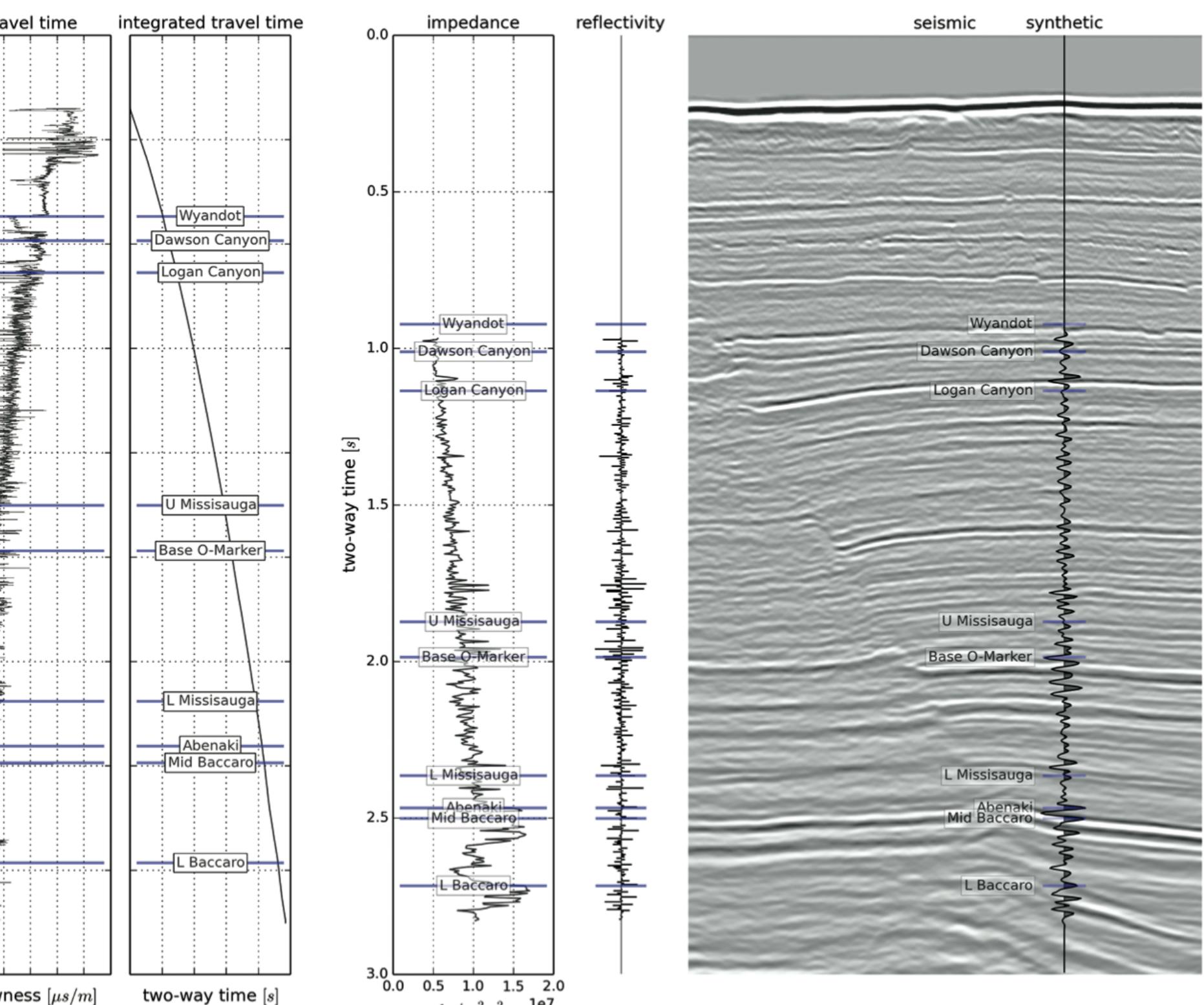
**modelr** has two parts: an open source back end, and a proprietary front end. The back end is running on an Amazon EC2 server; it does the geophysics and the plotting (matplotlib today, Bokeh tomorrow). The front end runs on Google App Engine, and handles user logins, billing, database, and user interaction. We will likely move to Google Cloud Platform, collocating the back and front ends for better performance.



## Future

Some big things we want to do soon:

- 1D models
- Load & save logs
- Export SEG-Y
- Import wavelets
- 3D models
- Ray tracing
- Full waveform
- Exploding reflector
- Finite difference



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**modelr** is crafted by Ben Bougner, Evan Bianco & Matt Hall

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