

# ECHELON

CASE STUDY // PERMIAN BASIN

SEPTEMBER 1, 2015

ECHELON'S ACCURACY AND SPEED PLAY A CRITICAL ROLE IN THE CHARACTERIZATION OF THE PERMIAN BASIN UNCONVENTIONAL RESERVOIR.

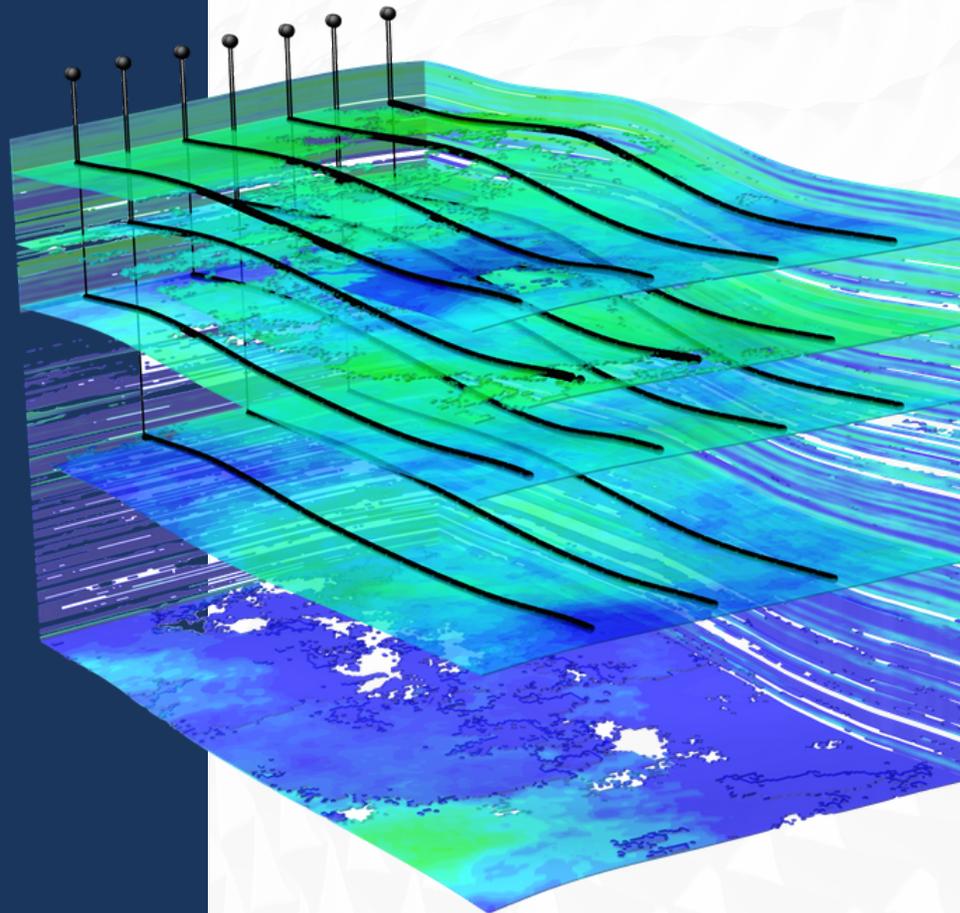
"ECHELON IS ONE OF THE MOST DISRUPTIVE TECHNOLOGIES I'VE SEEN IN MY CAREER DOING SIMULATION. IT HAS PROVEN ABILITY TO RAPIDLY RUN VERY LARGE, MULTI-MILLION CELL, FULL-PHYSICS MODELS USING MASSIVE PARALLELISM. FOR IRESERVOIR, THIS HAS LED TO IMPROVED UNDERSTANDING OF COMPLEX SYSTEMS BY ALLOWING FOR BROAD RANGING SENSITIVITY ANALYSIS IN VASTLY REDUCED TIME FRAMES."

- DR. JIM GILMAN, IRESERVOIR INC.

**16**  
MILLION CELLS

**28x**  
FASTER

**12**  
MINUTES



## CHALLENGE

The Permian Basin located in West Texas and Southeast New Mexico is the largest unconventional onshore oil producing region in the United States. To more accurately predict the performance of the reservoir, engineers at iReservoir needed to determine the sensitivity of the model results to a large number of parameters. These sensitivities were calculated by executing numerical simulations on a large ensemble of model realizations, each with millions to tens of millions of active grid cells. Such multiple realization studies using existing simulators are severely restricted by both software and hardware limitations, take days to weeks to run and require substantial hardware resources.

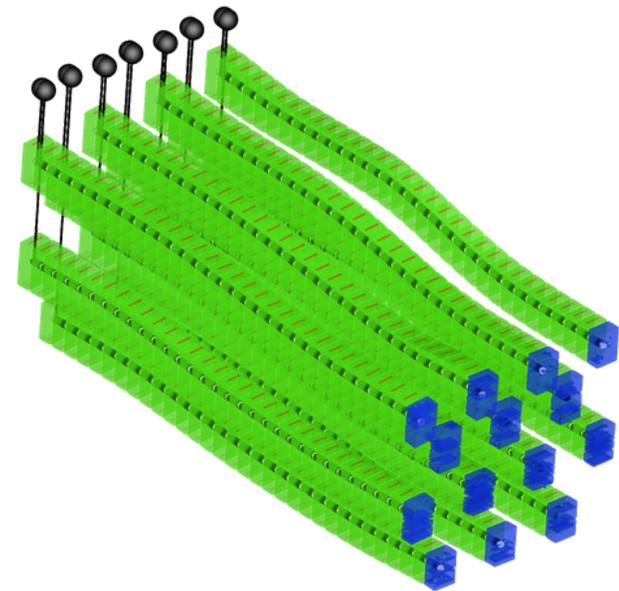


Figure 1. Plot of 14 horizontal multi-staged fractured wells. The fractures and the completions can be seen for all the wells.

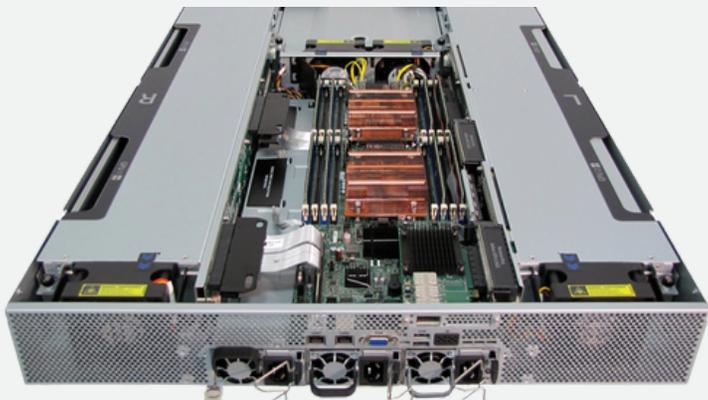


Figure 2. Cray CS-Storm 2U server containing up to 8 NVIDIA Tesla K80 GPUs used for running ECHELON.

## SOLUTION

ECHELON is a massively parallel, fully-implicit, extended black-oil reservoir simulator built from the ground-up for exceptional speed. GPU hardware, modern solver algorithms and careful implementation are combined in ECHELON to allow the simulation of hundreds to thousands of realizations of large complex models in vastly less time than legacy solutions while using fewer hardware resources.

## RESULTS

100 realizations of the 16 million cell model were run on a single Cray CS-Storm 2U node (Fig. 2) with 8 NVIDIA Tesla K80 GPUs. Four realizations could run simultaneously. The run time for both the dual-porosity and dual-permeability descriptions simulating 20 years of production are shown below in Table 1.

Model (16M cells)	Wall time for 100 runs on	Avg. time per job (in mins.)	Speedup per job over standard simulator
Dual Porosity	5.0 hrs	12	28
Dual Permeability	5.7	13.8	48

Table 1. Runtimes for 100 realizations of 16 million cell model using ECHELON on a Cray CS-Storm with 8 NVIDIA Tesla K80 GPUs. The speedup factors compared to an industry-standard simulator run on 16 cores are also shown.



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