Pros and Cons of Running COMSOL Multiphysics® Touch-Sensor Simulations on Amazon Web Services ™

A. Gourevitch[1]

[1]Cypress Semiconductor Corp., San Jose, CA, USA

Abstract

We described an implementation of parallel computing on Amazon Web Services™ (AWS) for touch-sensor modeling. Touch-sensors consist of one or two ITO layers patterned to produce horizontally and vertically connected electrodes that form a grid structure. When a human finger is touching a screen surface it distorts the electrostatic field; the touch is measurable as a change in a mutual capacitance between horizontal and vertical electrodes. COMSOL Multiphysics® was used to simulate an electromagnetic field distribution in a touch-sensor. The computational jobs were deployed on AWS and performance improvement was benchmarked with a premise DELL T5500 desktop.

Sensor design optimization requires running numerous independent simulations with different pattern element shapes and dimensions. These simulations can be considered as a sequence of jobs independently varying one or more model parameters. The jobs can be sequentially executed on a single computing node or can be deployed as an array of jobs that shares the same executable and resource requirements, but have different input parameters, see Figure 1. By running the jobs in parallel, the COMSOL tool generates an accumulated simulation data set in one shot without waiting for a sequential job execution.

AWS provides a collection of remote computing services that together make up a cloud computing platform. The main advantage of AWS is vertically (instance type) and horizontally (cluster) computational resource scalability. COMSOL simulations were tested on a single AWS instance and on a cluster. The cluster solution architecture is shown in Figure 2.

Several test projects were run on AWS instances vs a DELL T5500 desktop. The T5500 machine has 48Gb RAM, Intel® Xeon® CPU X5680 @3.33 GHz (2 processors) total 12 CPU, 64-bit operating system. Significant improvement was observed for a large simulation project with more than 30 million mesh nodes. We were not able to complete this job on the T5500 machine within 2 hours of run time (only several percent of the job was completed) vs 30 minutes required to fully complete the job on AWS cr1.8xlarge instance.

CC2 and CR1 Instances are backed by 2 x Intel Xeon E5-2670 processors, eight-cores with hyperthreading. Instances launched into the same cluster placement group are placed into a non-

blocking 10 Gigabit ethernet network

We also tested single job performance running on distributed resources. A COMSOL touch-sensor model was deployed on a 3-node cluster and on a single instance and simulation time was com-pared. Instance type of cc2.8xlarge was used in the benchmarking experiment. We observed almost 3X simulation time increase for the distributed job vs stand alone one. The simulation time increases due to intercommunications between the shared nodes.

We report an implementation of COMSOL touch-sensor simulations on AWS. The simulated results indicate that parallel computing can significantly reduce computational time. Even though simulation speed is reduced for the distributed job this approach still may be beneficial for extra large simulation models.

Figures used in the abstract

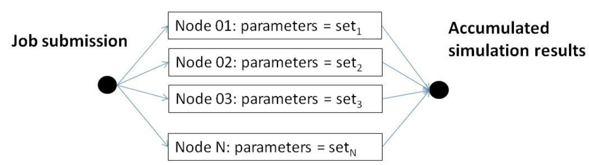

Figure 1: EM simulations as parallel jobs.

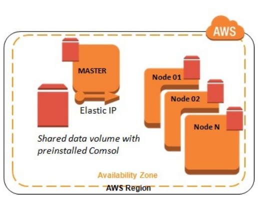

Figure 2: AWS cluster architecture.