

# CIOReview

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## 20 Most Promising HPC Solution Providers - 2019

The “Big Bang,” or the initial expansion of all energy and matter in the universe, happened more than 13 billion years ago in trillion-degree Celsius temperatures but High Performance Computing simulations make it possible to observe the occurrences during the universe’s birth. HPC systems can handle more complex queries, more variables and faster turnaround requirements.

Seymour Roger Cray, the supercomputer architect who founded Cray Research, considered by many as the father of supercomputers once said, “Anyone can build a fast CPU. The trick is to build a fast system.” Likewise, there is great value in the ability to access large data sets, but there is additional value to the data analyst in the ability to do so with extreme speed.

HPC has also been the topic of discussion amongst corporate circles from sometime. Organizations from a variety of market segments have been leveraging HPC technologies to tackle big data analytics workloads effectively. The Internet of Things (IoT) has ushered in the age of Big Data – large volumes and disparate types of enterprise information that reaches a point where normal computing approaches no longer suffice. Whilst this is the case today, to help companies better understand, leverage and tap into their data, HPC can play a big role.

This magazine is an attempt to get the top players in this space creating a difference. We hope you enjoy this edition as much as we enjoyed putting this together.



**Company:**  
D2S

**Description:**  
Provides GPU-accelerated solutions for semiconductor manufacturing, founding member of the Center for Deep Learning in Electronics Manufacturing (CDLe.ai)

**Key Person:**  
Aki Fujimura  
Chairman & CEO

**Website:**  
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## D2S

# Digital Twins are Essential for Deep Learning in Semiconductor Manufacturing

**A**dvancements in graphics processing units (GPUs) have empowered semiconductor organizations to embrace deep learning (DL) and process a vast amount of manufacturing data using sophisticated pattern-matching techniques. Deep learning has already shown a broad range of applicability in semiconductor design and manufacturing. However, the neural networks used in DL require significant training with a huge amount of design data – more data than is available in most cases. DL networks require training with as broad a data set as possible, but anomalous data (e.g., uncommon errors or extreme conditions that rarely occur) are difficult to find in the real world.

Simulation is crucial for getting enough anomalous data to make DL robust. In this case, the simulations used for DL must mimic the physical, chemical, and environmental operating conditions of the equipment and processes involved in semiconductor manufacturing. This is called a digital twin. To empower semiconductor manufacturing companies to create the data required for DL with their own digital twins, D2S offers a GPU-accelerated solution—TrueMask® DLK—featuring simulation capabilities combined with neural networks pre-trained for semiconductor manufacturing applications.

“GPU-acceleration enables fast full-chip simulation or digital twins of semiconductor manufacturing applications for robust deep learning,” says Aki Fujimura, chairman and CEO of D2S. TrueMask® DLK utilizes a GPU-accelerated Computational Design Platform (CDP) to run native photomask (mask) and wafer lithography simulators that encompass the most advanced curvilinear mask shapes. TrueMask DLK combines these tools with pre-trained neural networks that enable semiconductor manufacturers to accelerate their deep learning R&D initiatives. An initial task is to create a digital twin of every physical product or process.

One of the early adopters of TrueMask DLK is the Center for Deep Learning in Electronics Manufacturing (CDLe)—an alliance of companies who have come together to pool talent and resources to advance the state-of-the-art in deep learning for their unique problem space. CDLe understands the importance



Aki Fujimura

**GPU acceleration enables digital twins of semiconductor manufacturing applications for robust deep learning**

of robust, pre-trained neural networks: “Irrespective of the industry, simulation is essential for generating training data that deep learning solutions need in order to manage unusual circumstances occurring during manufacturing and R&D stages,” states Ajay Baranwal, director of the CDLe. This is true for the autonomous driving space, due to the fact that even a billion miles of driving video does not necessarily provide sufficient anomalous data – very unsafe conditions are actually very rare. Comparably, in semiconductor mask manufacturing, relatively few defects occur in masks in the real world; this would lead to insufficient wafer fabrication data for training deep learning neural networks without simulated data from digital twins.

Over more than a decade, D2S has developed GPU-accelerated engines, models and the CDP to serve multiple applications within the semiconductor manufacturing segment. Today, to help clients perform DL using TrueMask DLK, D2S has introduced the sixth-generation CDP using the NVIDIA Tesla V100 GPU accelerator.

“Deep learning is clearly a critical success factor for any semiconductor manufacturing business, whether a fab, mask shop, equipment or service supplier, or a fabless customer,” says Fujimura. As data is the new currency in the deep learning era, every company must be capable of doing DL with their own data to protect it. “D2S is committed to helping semiconductor manufacturing companies by providing TrueMask DLK as a quick-start kit for accelerating clients’ deep learning initiatives,” concludes Fujimura. 