Digitalization Technology 101 – Why Now?

This article is part of the Digitalization Applications 101 learning module, which provides a comprehensive understanding on the basic concepts of digitalization terminologies, technologies and its applications in the steel industry. The course was developed by the Digitalization Applications Technology Committee as an introductory course to educate industry personnel in digitalization

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Most of the technologies that comprise digitalization are not new. In fact, some, such as artificial intelligence and autonomous robotics, have been around for many decades. So, the question is why are companies now embracing and investing in digitalization technologies? These technologies often require vast amounts of data, are computation-intensive and require complex algorithms. Until recent years, this has presented significant cost and long computation times to deliver results from complex algorithms. Much has changed regarding data, computation and advanced algorithms, making it possible to solve complex problems more cost-effectively and in near real time.

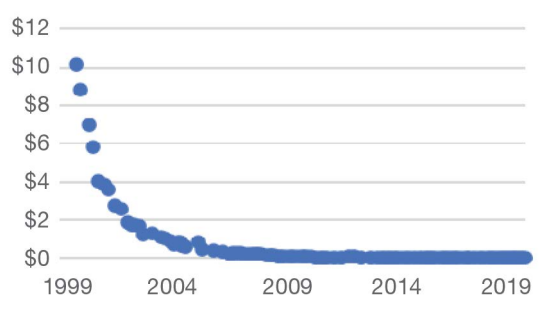
Data

Data is a key component to all digitalization technologies. Whether it be for analytical computations, simulation, additive manufacturing, etc., data is the backbone for these technologies, and the landscape of data has changed in many ways over time. This includes lower cost, faster access, larger volumes, wider range of data types (video, sound, etc.), higher quality and greater accessibility (expanded connectivity). A simple way to state this is that the cost of storing data has gone down, thus allowing for more data to be stored, including more complex data, and being able to retain it for longer periods. Between 1999 and 2019, the cost of 1 GB of data storage went from approximately US$8.00 to US$0.02 (US$0.09 to US$0.02 in the last 10 years).[1] In addition, with cloud storage options, a company can effectively rent storage without having to make an initial infrastructure investment.

Computation

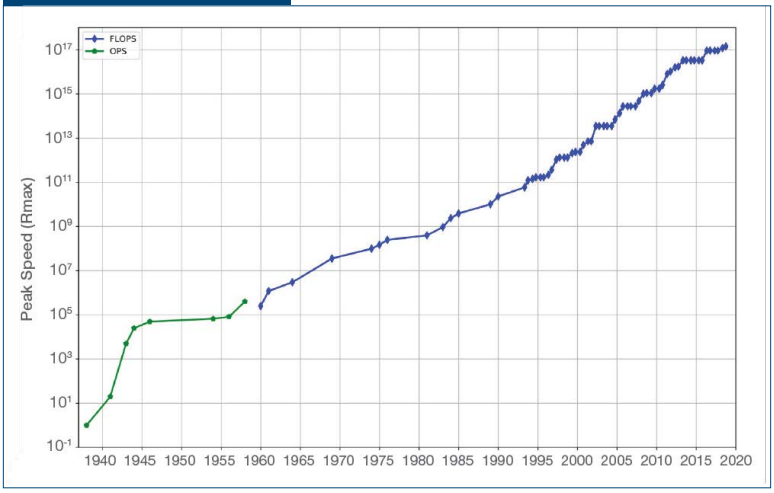
One measurement of a computer processor is instructions per second (IPS). The number of IPS for typical computers has continuously increased over the years. In addition, the number of cores for processors has increased along with the number of processors in a computer, thus increasing the total number of IPS a computer can complete. However, what has really revolutionized high-performance computing is the development of high-performance graphics cards for video processing. These video processors contain graphics processor units (GPUs). These GPUs have many cores and can conduct thousands

Figure 1



Cost of data storage for 1 GB.[1]

Figure 2



Floating point operations per second[2] by year for supercomputers.

of operations at once in parallel. While they were developed for graphics, they are used today to speed up the processing for solving complex problems in shorter times. What once took days or longer can be done in hours, minutes or even seconds. Last, companies can send their data to a cloud service and rent time on a supercomputer to solve complex problems quickly without investing in computing infrastructure. Models can then be developed from the results that can run on-site.

Algorithms

One of the hurdles for running complex analytical algorithms has been the amount of processing time it takes to run the analytics. The combination of increased data capabilities and processing allows for more complex algorithms to be run in a timely manner. Therefore, the algorithms have been allowed to become even more complex, improving machine learning, artificial intelligence, analytics, simulation models, etc.

Summary

The technological advancements and reduced cost in data storage, computer processing, cloud services and more advanced algorithms have greatly enabled digitalization technologies to become a reality for the steel industry. The technology is ready, the costs are feasible and the opportunities to solve more complex problems are abundant.

References

1. J.C. McCallum Jr., https://jcmit.net.
2. Wikipedia, https://en.wikipedia.org/wiki/Supercomputer. ✦

Did You Know?

SKF Bearings Help Mars Rover Collect Rock and Regolith Samples on the Planet's Surface

Enabling the Mars Rover's core operations in the harsh environment on Mars are Kaydon RealiSlim thin-section ball bearings, designed and manufactured by SKF at the company's global thin-section bearing engineering center in Muskegon, Mich., and its recently expanded manufacturing hub in Sumter, S.C., USA.

These highly engineered components contribute to the survival of the rover's main robotic arm, sample collecting turret, tool bit carousel and sample handling assembly during a months-long trip through space, and its function as intended on the Mars surface. SKF also supplied critical bearings for the mission's launch vehicle, which carried the rover and its lander into space.

SKF bearings will play an integral role in the vital process of sample collection on Mars. When the rover is ready to begin collecting samples on the surface, the robotic arm will maneuver into place and the tool bit carousel will whirr into action, deploying tools to drill or abrade material, which will then be collected by the sample collecting turret (a.k.a. "the hand") and transferred to the sample handling assembly for processing onboard the rover, and eventually a potential return to Earth for analysis via a future Mars mission.

"The bearings we designed and built to help the rover perform its core science activities were based on several models of Kaydon thin-section ball bearings customized by our engineers to minimize weight and save space while retaining maximum functionality and reliability for a mission where repair or replacement is simply not an option," said Isidoro Mazzitelli, SKF's director of product development and engineering Americas. Space applications must be a small fraction of the weight of standard bearing assemblies.

Kaydon bearing solutions are often customized from baseline models for specific customers and commonly used in applications that require a careful balance between strength, weight, size, functionality and reliability, including robotic surgical equipment, automated precision manufacturing, detailed painting, aircraft systems and airport security scanners.

In addition to the latest mission, SKF has a decades-long history as a supplier to global space programs, dating all the way back to NASA's Apollo 11 mission. "Our company's bearings, seals and other products have helped enable a wide range of spacecraft and missions for more than 40 years," said John Schmidt, president, SKF USA Inc. "Our parts have flown on the previous space missions, dozens of commercial and government satellites, space-borne telescopes, a wide range of rocket launch vehicles and in astronauts' spacesuits. When conditions become critical and applications demanding, engineering knowledge is the only way to success."