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CLOUD NATIVE USP LASER PROCESSING

Task

An ultrashort pulse (USP) laser is a complex system that can ablate any material with micrometer precision. To accomplish this, numerous sensors are used to control the machine and the laser process. The software that controls the components and reads the data from the sensors is correspondingly diverse. In industrial production, many such systems are used in parallel. Fifty systems running side by side is not unusual here. But how can they be installed efficiently and controlled centrally?

Method

Conventional concepts are no longer able to control 50 and more lasers simultaneously, install new software for these systems and evaluate sensor data in real time. For this reason, Fraunhofer ILT redeveloped the entire control and analysis software while taking into account the RAMI4.0 specifications. The institute placed particular emphasis on integrating it in data centers and making the system easy to scale. The software is thus "cloud native" and can be installed very quickly on production computing clusters. "Kubernetes", open source software, operates at the core of the data center. It can automatically install, scale and maintain application programs on distributed computing systems. Kubernetes was originally designed by Google and is supported by leading cloud platforms such as Microsoft Azure, IBM Cloud, Red Hat OpenShift, Amazon EKS, Google Kubernetes Engine and Oracle OCI.

Results

The Chair for Laser Technology LLT at RWTH Aachen University has co-developed cloud native control software that is administered by Kubernetes. The entire management software stack used is open source and allows for extensive customization of the processes. In addition to automation routines, condition monitoring and other analysis algorithms, the control algorithms can now be centrally hosted, administered and updated on the shop floor. This centralized control level creates economies of scale that make software management of hundreds of plants possible in parallel. In addition, by using Kubernetes, developers can provide external computing capacity to the plant algorithms "on demand" at any time. For example, through cloud providers or on-premises data centers, the computing capacity can be individually adapted to the current operational load.

Applications

The control software is primarily designed for use in laser systems. The framework used here scales very well for hundreds of simultaneously operated systems, for example in a job store, as well as for individual systems that need to be continuously adapted. The modularity favors easy adaptation to other processes such as LPBF.

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