# Press Release

## ProCloud3D: Developing a Cloud-Based Platform for Secure Decentralized Additive Manufacturing

Aachen, March 20, 2024 – In a German-Chinese project consortium, the Chair Digital Additive Production DAP at RWTH Aachen University has developed the architecture for a secure cloud-based platform that enables the encrypted and real-time transmission of production data for laser-based Powder Bed Fusion of metal powder (PBF-LB/M). The project results from the ProCloud3D project, funded by the Federal Ministry of Education and Research (BMBF), lay a foundation for secure decentralized Additive Manufacturing.

Industrial Metaverse, Smart Services, Digitalization: Mega trends in the manufacturing industry into which additive manufacturing seamlessly integrates, transforming digital models into physical components. A key function in efficiently implementing these concepts is the cloud. It offers the essential infrastructure needed for processing, storing, and securely sharing data in real time, irrespective of location. The consortium behind the ProCloud3D project has made this infrastructure securely accessible for Additive Manufacturing.

**Security: The Bottleneck of Decentralized Production**

From the end users' perspective, the additive manufacturing of components is increasingly being outsourced. To manufacture these components, the end user must share their design data with a service provider. Given that a digital design model is all that is needed to produce a physical copy, securing this process is crucial. The solution involves transferring production data layer by layer directly to the service provider's PBF machines during the printing process, a method also known as streaming. However, it is crucial to ensure that this data cannot be intercepted, compromised, or manipulated, and that only the requested number of components is produced. Furthermore, the data for a manufacturing order must be meticulously compiled and prepared for the production process.

**Development Approach of the ProCloud3D Platform**

Against this backdrop, the researchers initially developed a slicer for the real-time generation of machine control code from the construction job information. The architecture of the ProCloud3D platform, for this purpose, is fundamentally based on the Open Vector Format, developed by researchers from the DAP Chair and the Fraunhofer Institute for Laser Technology ILT. The format supports, among other things, the flexible control of lasers with galvanometer scanners, the management of multiple scan field arrays, and the expansion of additional machine axis controls. Building on the OVF, a streaming protocol was developed that ensures efficient real-time transport of PBF-LB production data and relevant metadata for various PBF machines. The protocol includes both secure data transport and data encryption. With a high-performance nester developed by DAP, manufacturing jobs consisting of multiple components can be automatically generated. In a cloud-based user

Editor
**Yvonne Dobrzanski-Esser, B.A. (Kombi)** | PR Manager | RWTH Aachen Chair Digital Additive Production DAP |
yvonne.dobrzanski-esser@dap.rwth-aachen.de | Telephone +49 241 8040 533 | Campus-Boulevard 73, 52074 Aachen, GERMANY

interface, the functionalities are fully integrated and visualized. Part of this solution is digital rights management along the depicted supply and process chain. The data streams are end-to-end encrypted. Hardware-wise, a project-developed machine interface processes the layer-wise control commands from the cloud. The streaming protocol defines who gets access to the data and in what quantity the ordered components are allowed to be manufactured.

**We have a Stream!**

Utilizing this developed cloud solution, the consortium successfully manufactured a demonstrator via the secure stream (refer to Image 1 and 2). The next step involves preparing the cloud-based platform for mass-market adoption in decentralized additive manufacturing. The developed hardware interface will be made compatible with various equipment manufacturers. Furthermore, access to a universally applicable cloud-based software service tailored for manufacturer-specific PBF-LB/M shall be provided.

The developed cloud solution is designed to offer companies across different industries a groundbreaking opportunity: By outsourcing their manufacturing processes to a specially designed secure cloud-based platform, these companies can directly tap into the potential of additive manufacturing. This approach eliminates the need for the high investments in PBF machines and the extensive development of specialized process know-how previously necessary. This solution acts as a catalyst for the adoption of Additive Manufacturing, enabling companies to digitalize and outsource their production in an efficient and secure manner.

The Project Consortium:

- WIBU-Systems AG
- LMI – Laser Melting Innovations GmbH & Co. KG
- RWTH Aachen Lehrstuhl Digital Additive Production DAP
- Beijing University of Technology
- BLT: Xi’an Bright Laser Technologies Co., Ltd.
- Nanjing 1001 automation technology co. LTD.
- Beijing aerospace smart manufacturing technology development Co., Ltd.

This research and development project is funded by the Federal Ministry of Education and Research (BMBF) under the program „Innovationen für die Produktion, Dienstleistung und Arbeit von morgen“ (funding code 02P18X010) and is managed by the Project Management Agency Karlsruhe (PTKA).


**Image 1:**
Logo of the ProCloud3D project manufactured via stream through the developed cloud-based platform.
© RWTH DAP.

**Image 2:**
Directly from the facility: Another logo variant of the ProCloud3D project manufactured via stream using the developed cloud-based platform.
© RWTH DAP.

With the appointment of Prof. Johannes Henrich Schleifenbaum, the Chair Digital Additive Production DAP was established in August 2016 at RWTH Aachen University. Aiming for a sustainable future, over 120 motivated and talented employees within a strong network are now researching and developing the future of digitalization and Additive Manufacturing (AM). Their work spans from the digitalization and networking of production, through materials and manufacturing, to post-processing and quality assurance. The insights from these research efforts lay the foundation for the sustainable implementation of digitalization and Additive Manufacturing into the industrial environment.

www.dap-aachen.de

**Contact**
Moritz Kolter, M. Sc. | Chief Engineer Digital Product & Production | moritz.kolter@dap.rwth-aachen.de |
Telephone +49 241 8040 620 | RWTH Aachen Lehrstuhl Digital Additive Production DAP