# Protection and Monetization of 3D-printed Spare Parts

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# Content



# Introduction

This white paper provides a comprehensive overview of the protection and monetization of 3D-printed spare parts. It highlights the current challenges and opportunities in the field of 3D printing, including intellectual property protection and licensing. Furthermore, the role of Wibu-Systems' CodeMeter technology in integrating into existing business processes is detailed. Through case studies and application examples, the economic potentials and future development possibilities in the 3D printing industry are illustrated.

The initiative "Protection and Monetization of 3D-Printed Spare Parts" by WIBU-SYSTEMS AG, in cooperation with Daimler Buses and Farsoon Technologies, focuses on the IP protection (Intellectual Property) and monetization of 3D-printed spare parts. The innovative business model presents solutions for digital rights and license management for 3D-printed parts, including the integration of CodeMeter technology through-out the entire process chain from ordering to license activation. Additionally, the business processes and potential market for 3D-printed spare parts are discussed, highlighting the need to technically control and monetize intellectual property.

## About the Author

Hans-Joachim Reich is Director Business Development at WIBU-SYSTEMS AG, where he is responsible for the expansion of new market areas since 2022. With a degree in industrial engineering from the University of Karlsruhe, Reich combines technical expertise with astute business acumen. Before joining Wibu-Systems, he gained extensive management experience in the technology sector, where he was a Managing Director for many years. The multiple patents he holds underscore his innovative contributions in this field. Reich's career has been marked by expertise in strategic planning, product management, and sales, underscoring his commitment to driving growth and innovation in the technology industry.

# Market requirements

The current challenges in the 3D printing market are diverse and encompass both technological and economic aspects:

- **Economic and financial challenges:** The industry faces challenges such as inflation concerns, high financing costs, and a potential recession, which can impact customers' investment budgets. Despite the introduction of new technologies, systems, and materials that promote acceptance, the acquisition of capital-intensive 3D printing machines remains a risk as long as macroeconomic headwinds persist.

- **Material development:** The development of materials in the field of 3D printing has significantly accelerated in recent years, leading to a wide variety of available materials. These include various engineering thermoplastics, resins, composites, and metal powders. This diversity opens up new application possibilities beyond traditional industries. For example, special resins enable use in electronics, while composites and metal powders can be used in the production of wearable technologies and transportation. Additionally, biomaterials and organ printing are gaining importance, revolutionizing the capabilities of 3D printing in medicine and biomedical research. These advancements contribute significantly to the flexibility and versatility of 3D printing, allowing the production of parts with specific properties required for certain applications.

- **Software development and automation:** Advances in software are driving important technological steps in 3D printing. Automation is particularly relevant in the industrial context, where speed, quality, and consistency are improved through increased process automation.

- **Quality assurance:** The implementation of secure processes, certified materials, and appropriate technologies is becoming increasingly important. Quality assurance is the foundation for the industrial use of 3D printing, where every part must meet the same quality standards.

- **Sustainability:** The trend toward sustainability in 3D printing will continue to gain importance in the coming years. Additive manufacturing contributes to sustainability goals by significantly reducing the carbon footprint of part production. This is achieved through on-demand manufacturing, which minimizes the need for large inventories and associated transportation. Additionally, 3D printing enables the use of more sustainable materials, such as biodegradable plastics or recycled materials. These approaches reduce environmental impact and promote a more efficient, resource-conserving production method.

- **3D plastic printing:** The future development of 3D plastic printing will be determined by several key factors. Firstly, the development of improved plastic materials that meet specific industrial and technical requirements will advance. At the same time, 3D printing will continue to penetrate more application areas, including medicine, aerospace, and the automotive industry. Technological advancements in printers and software will increase printing speed and accuracy. Finally, 3D plastic printing will become increasingly relevant for mass production, leading to a reduction in manufacturing costs.

- **3D metal printing:** It is expected that the 3D printing of metals will see increasing use, as it allows for the production of complex metal parts with significantly less waste and lower costs. Additionally, 3D-printed metal parts can include safety-critical components as spare parts. In the initial phase of the collaboration between Daimler Buses, Farsoon, and Wibu-Systems, mainly simple, non-safety-critical parts such as armrests, ashtray inserts, and air distributor nozzles were printed. Furthermore, 3D printing enables the production of weight-reduced parts with maximum stability, which would not be possible with injection molding due to geometric constraints, and is already being intensively used in the aerospace industry.

Overall, the 3D printing industry faces the challenge of establishing standardized processes and ensuring quality to achieve true industrial status. In the coming years, digital processes are expected to connect and optimize all steps from selection to storage, ordering, and tracking of 3D-printed parts. Given these developments, it is essential for the industry to increase its profitability. Without a clear increase in profitability, it may be difficult to justify the necessary investments in technology and process optimization and to maintain competitive advantages over conventional manufacturing methods.

# CodeMeter technology

CodeMeter technology from Wibu-Systems offers various features to ensure IP protection in 3D printing and simplify licensing, particularly in the context of integration with an ERP system in conjunction with a web shop.

"Integrate Once – Deliver Many" describes a software licensing and protection concept that aims for efficiency and flexibility. This means that developers only need to integrate their software into Wibu-Systems' protection system once. After this single integration, the software can be delivered across various channels, platforms, and business models.

Technically, this allows the same protected software package to be reused for different distribution models, such as one-time sales, subscription services, or usage-based billing. This not only minimizes development effort but also shortens time-to-market. At the same time, the system ensures a unified security architecture that provides consistent protection mechanisms across all application scenarios.

This strategy optimizes the development process and maximizes the software's reach, as multiple adjustments or integrations for different distribution channels are not required. Developers can focus more on improving and advancing their software, while Wibu-Systems ensures licensing and protection in a scalable and reusable manner.

The philosophy is particularly relevant in the field of 3D spare parts printing. Here, "Integrate Once – Deliver Many" enables spare parts manufacturers to integrate their digital models into the protection system once and then flexibly deliver them to different customers and printing platforms. This allows companies to ensure that their intellectual property rights are preserved while simultaneously enabling the quick and cost-effective provision of spare parts worldwide. This creates a robust and secure supply chain that meets the demands of modern, decentralized production and significantly improves the availability of spare parts.

- **IP protection in 3D printing:** CodeMeter safeguards the integrity and confidentiality of 3D printing files. This is achieved through data encryption and access control to the 3D printing data. With CodeMeter, only authorized users and machines can access the protected 3D printing files, thereby eliminating the risk of IP theft or unauthorized copying.
- **Efficient licensing:** CodeMeter enables flexible and efficient management of licensing rights. Companies can sell licenses for the use of 3D printing designs, which are then managed and monitored by CodeMeter. This provides the opportunity to generate revenue from digital goods while controlling their usage.
- **Integration into ERP systems:** The integration of CodeMeter into ERP systems such as SAP enables the automated management of licenses and customer relationships. This can include the ordering, licensing, and billing of 3D printing designs. By integrating into an ERP system, all relevant information can be centrally managed, making processes more efficient.
- **Integration with a web shop:** By integrating CodeMeter into web shops, companies enable the purchase of usage rights for 3D printing products instead of selling the products themselves. Customers buy licenses through the web shop, granting them the right to use specific 3D printing designs. CodeMeter automatically manages these rights,

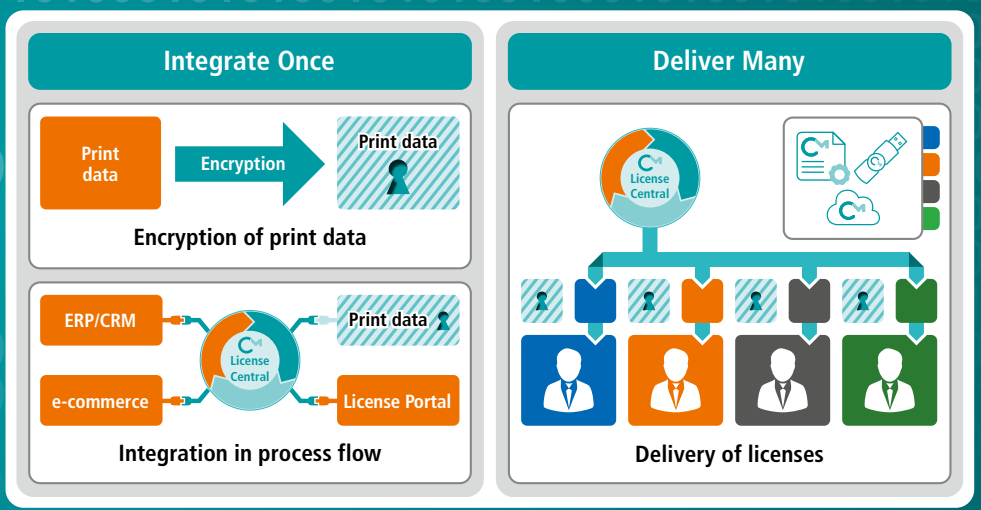


Image 1:
**CodeMeter technology at a glance (Source: Wibu-Systems)**

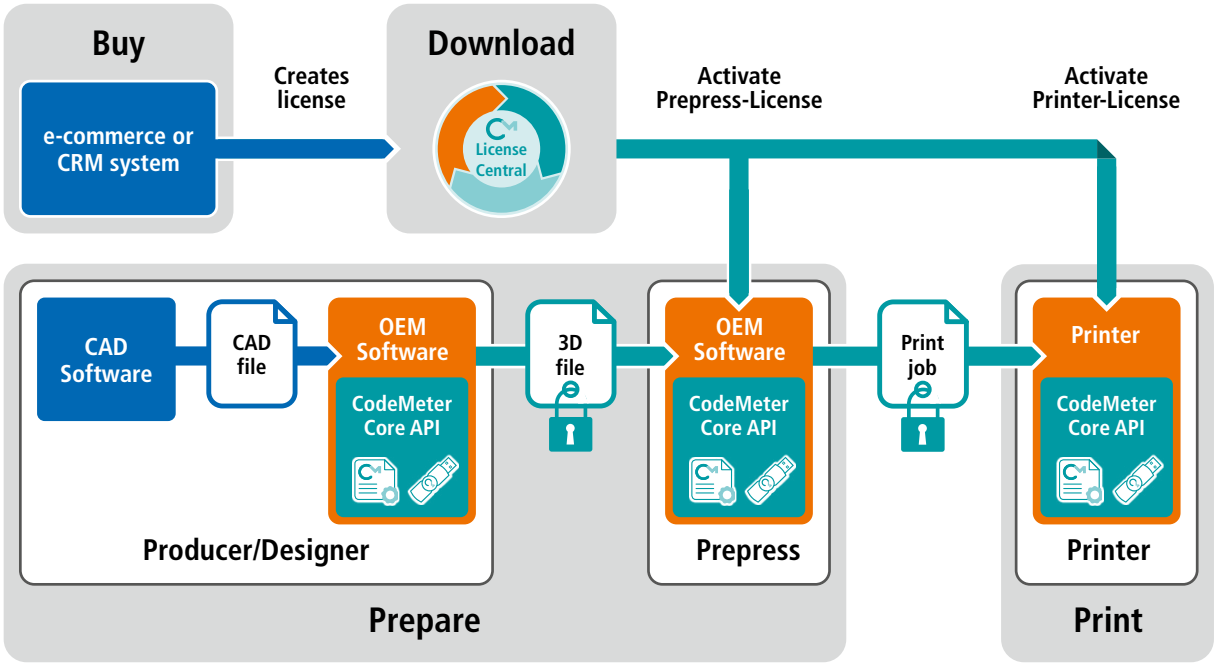


Image 2: The complete process flow (Source: Wibu-Systems)

ensuring a seamless process from product selection to license purchase, thereby enhancing customer loyalty. This strategy simplifies the process for both the provider and the end user.

CodeMeter technology thus offers a comprehensive solution for intellectual property protection and efficient licensing in the field of 3D printing. It becomes particularly valuable when integrated with other enterprise systems such as ERP and web shops.

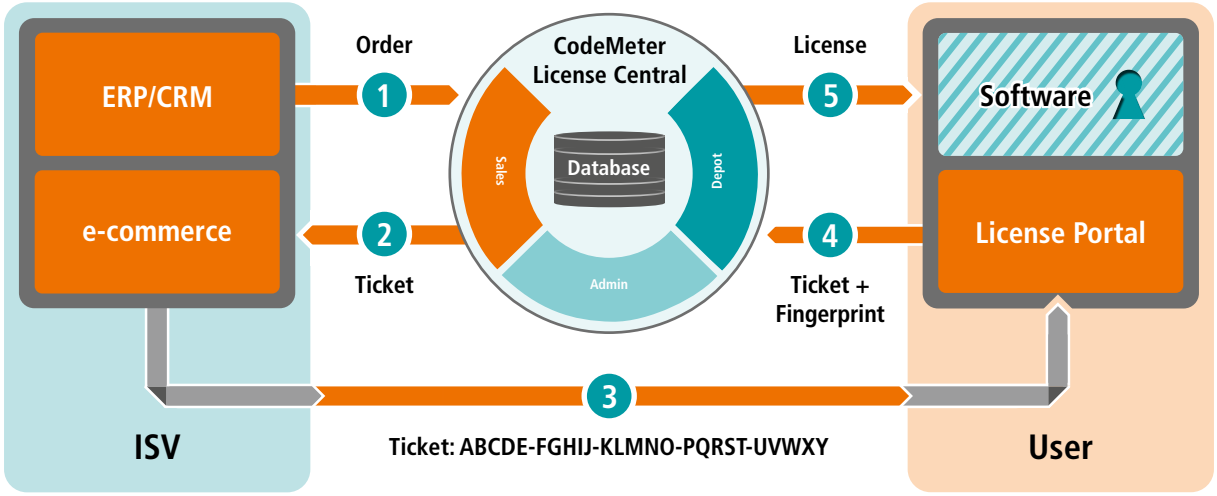


Image 3: Delivery and activation of licenses (Source: Wibu-Systems)

# Business process integration

The integration of CodeMeter into production and distribution processes to enhance security and efficiency in the 3D printing of spare parts can be achieved in various ways:

- **Protection of design data:** CodeMeter secures the 3D printing files through encryption. This prevents unauthorized access, use, or modification of the files. This is particularly important for spare parts, whose design often constitutes the intellectual property of the manufacturer.
- **License management:** CodeMeter enables efficient license management for the use of 3D printing files. This allows companies to control who can use the files and how often. This is particularly useful when spare parts are sold to various locations or customers.
- **Integration in ERP systems:** By connecting to an ERP system such as SAP, the entire process from ordering to delivery of 3D-printed spare parts can be efficiently managed and monitored. This includes license management, inventory control, invoicing, and the management of order and customer data.
- **Automation of the sales process:** Customers can directly purchase licenses for 3D printing spare parts through integration with a web shop. The issuance and management of these licenses are automated, making the process more efficient and secure.
- **Quality control:** CodeMeter can also be used to ensure the quality of printed spare parts by enforcing the use of authorized and correct printing parameters. This helps avoid misprints and quality issues.
- **Traceability and compliance:** The technology can be used to track the usage of 3D printing files, which is important for compliance with regulations and for reporting purposes.

Through these integrations, CodeMeter can help increase efficiency while ensuring a high level of security for the 3D printing of spare parts.

# Case studies and application examples

The 3D printing of spare parts in the automotive industry, especially for trucks and buses, offers numerous advantages and innovative application possibilities:

- **Rapid availability of spare parts:** One of the greatest advantages of 3D printing in the automotive industry is the ability to quickly and on-demand manufacture spare parts. This is particularly useful for older models or specialized vehicles, for which spare parts are no longer conventionally produced or physically stocked.
- **Cost efficiency:** Traditional methods of manufacturing spare parts can be expensive, especially for small quantities. 3D printing allows for the production of parts without the need for expensive tools or molds, thereby reducing production costs.
- **Customization and optimization:** 3D printing allows for rapid adjustments of parts to meet specific requirements. This can enhance performance or reduce weight. This is especially important for trucks and buses to increase fuel efficiency and reduce emissions.
- **Complex geometries:** Spare parts often have complex geometries that are difficult to produce with traditional manufacturing methods. 3D printing allows for the creation of complex designs without additional costs.
- **Lower storage costs:** Since parts can be printed on demand, the need for large inventories is reduced. This saves storage costs and reduces the risk of obsolete stock. Parts can be produced wherever a 3D printer is available.
- **Application example:** A concrete example from practice is the use of 3D printing technologies at Daimler Buses. Daimler Buses uses 3D printing to manufacture spare parts for its buses, reducing delivery times and minimizing inventory. The parts range from simple covers to complex components. This approach allows Daimler Buses to quickly respond to customer requests while simultaneously increasing efficiency in production and logistics. As a result, Daimler Buses has significantly advanced spare parts sales, being the first company in the industry to do so. Many spare parts are now available in digital form for 3D printing in the OMNIplus 3D printing license shop, the largest service net-

work in Europe for Mercedes-Benz and Setra buses. These parts can be purchased and directly printed on-site by bus companies and service partners worldwide. This is made possible by the CodeMeter encryption and licensing solution from Wibu-Systems and specially certified printers.

- **Integration into ERP for high efficiency:** The 3D printing files for the spare parts are initially provided for download in encrypted form on the web shop. The customer fills their shopping cart with the desired spare parts and receives both a pre-press license for preparing the encrypted objects for printing with Farsoon Technologies' software and a printing license for the number of purchased objects, which can be printed using another software from the company on a certified 3D printer from Farsoon Technologies. It is possible to position both encrypted and unencrypted objects in one build area to minimize printing costs per order. The entire order processing is managed through the integration of CodeMeter License Central with the SAP system of Daimler Buses. This ensures not only the protection of the object data but also the complete automation of order processing.

- **Secure process chain:** The CodeMeter solution from Wibu-Systems forms the technological basis for both data encryption and the creation and secure delivery of licenses. The 35 years of experience in know-how protection and monetization, along with the ease of adapting the overall solution to the requirements of Daimler Buses, were decisive for choosing Wibu-Systems. Farsoon Technologies has integrated this technology into its software products, ensuring a secure process chain from the web shop to the printer. Farsoon Technologies thus assumes a pioneering role in the 3D printer market. The list of certified 3D printers is constantly being expanded. This, in turn, guarantees the success of the technology and its market penetration.

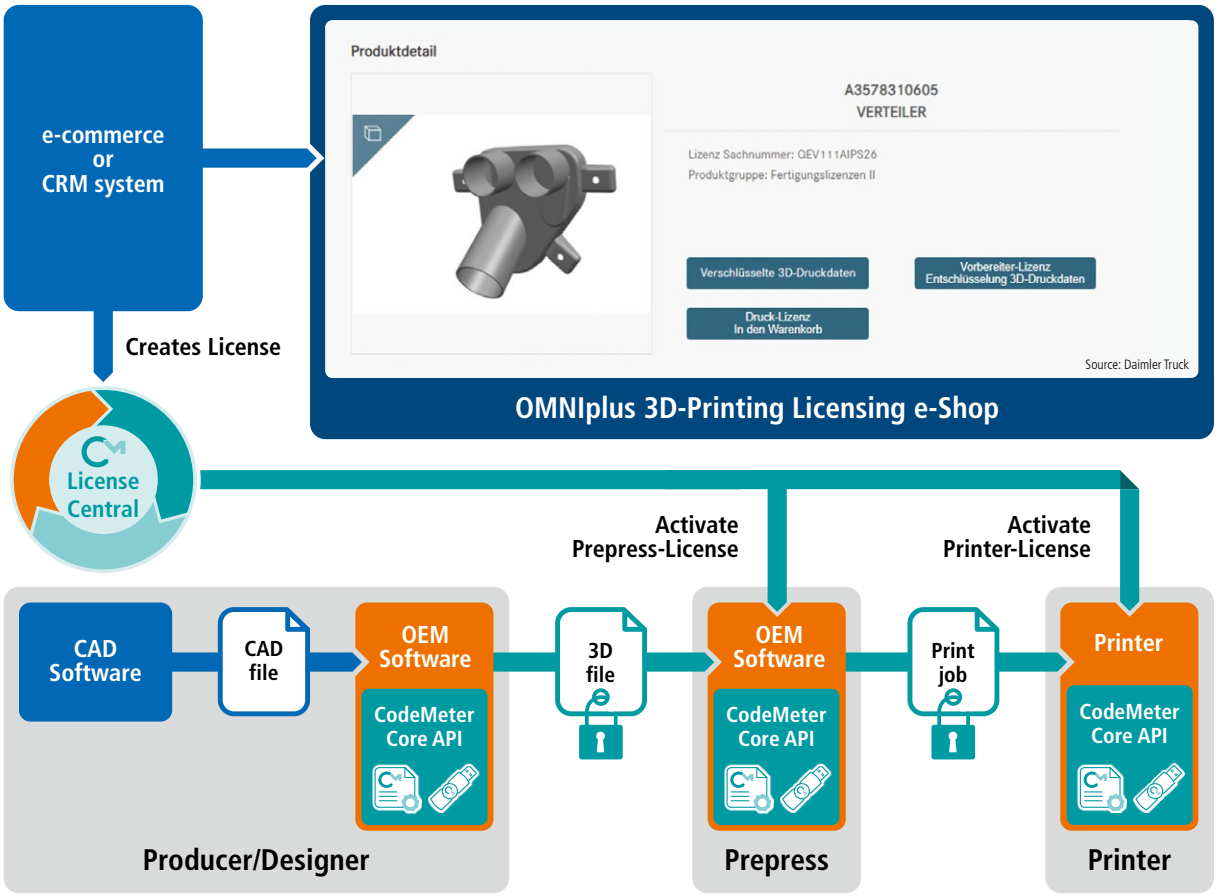


Image 4: Purchase of spare part data
(Source: Daimler at the top and Wibu-Systems at the bottom)

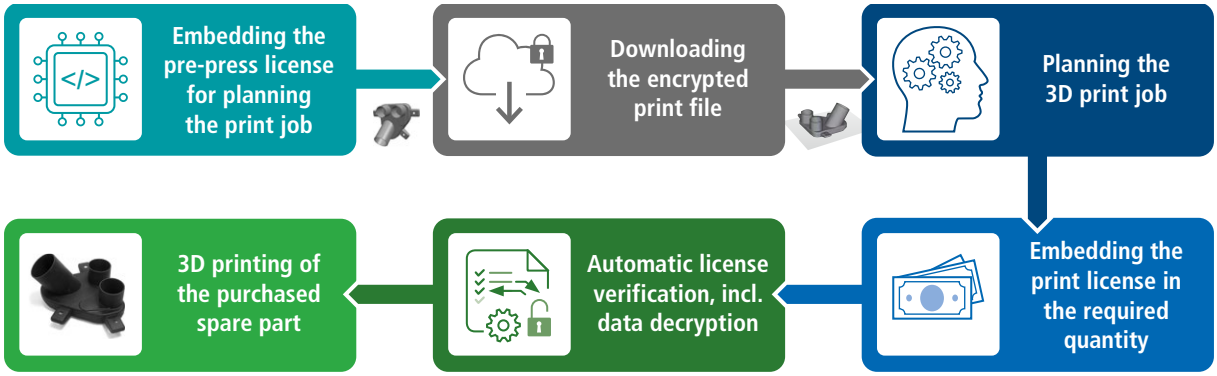


Image 5: The process at the logistics service provider (Source: Seifert Logistics Group)

Companies from other industries are increasingly using 3D printing as part of their manufacturing strategy for spare parts. They often enter into partnerships with specialized service providers to fully leverage technological capabilities while effectively complementing their own production capacities.

## Further industrial application areas

The industrial application areas for 3D printing of spare parts are diverse and extend to other industries. The aerospace industry uses 3D printing for lightweight, high-strength components, where it is less about spare parts and more about the production of individual parts. In medical technology, 3D printing enables the creation of customized replacement parts. In mechanical engineering, special components for machinery and equipment are produced. In the railway and shipping industries, hard-to-source parts can be manufactured, and in the defense sector, customized or urgently needed parts for military equipment are produced. These application areas highlight the diverse possibilities of 3D printing in industrial manufacturing.

## IP protection for decentralized production: ProCloud3D

The "ProCloud3D" project was a German-Chinese cooperation aimed at developing a secure, cloud-based platform for 3D printing and was completed in March 2024. The goal was to automate and encrypt all steps of the 3D printing process, including a user-friendly interface, a technology database, and a security infrastructure to protect the digital models. A central element was the license management, which monitors data transfer and process steps to ensure the protection of intellectual property.

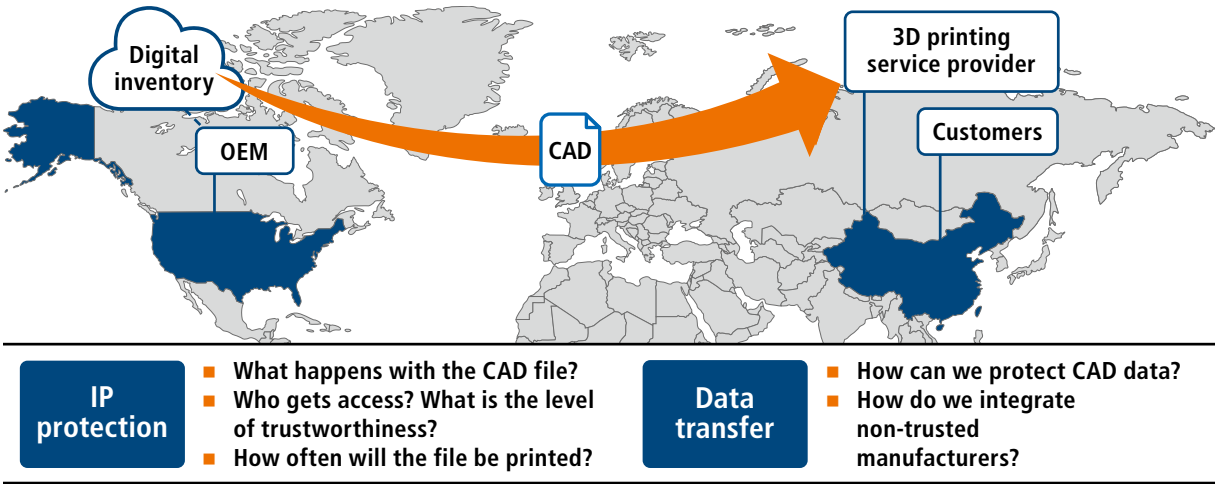


Image 6: Challenges of digitalization for IP protection (Source: RWTH Aachen University, Moritz Kolter, M.Sc.)

The project was coordinated by Wibu-Systems and funded by the German Federal Ministry of Education and Research. It was demonstrated that more efficient and secure manufacturing processes across national borders is possible by facilitating the use of external service providers for industrial 3D printing.

In contrast to the application example from Daimler Trucks, slicing is performed in the cloud and then the protected layer data is sent to the printing service provider layer by layer. The goal here is also to maintain control over the number of printed parts, protect the design data, and enable the manufacturing of parts even with non-trusted service providers.

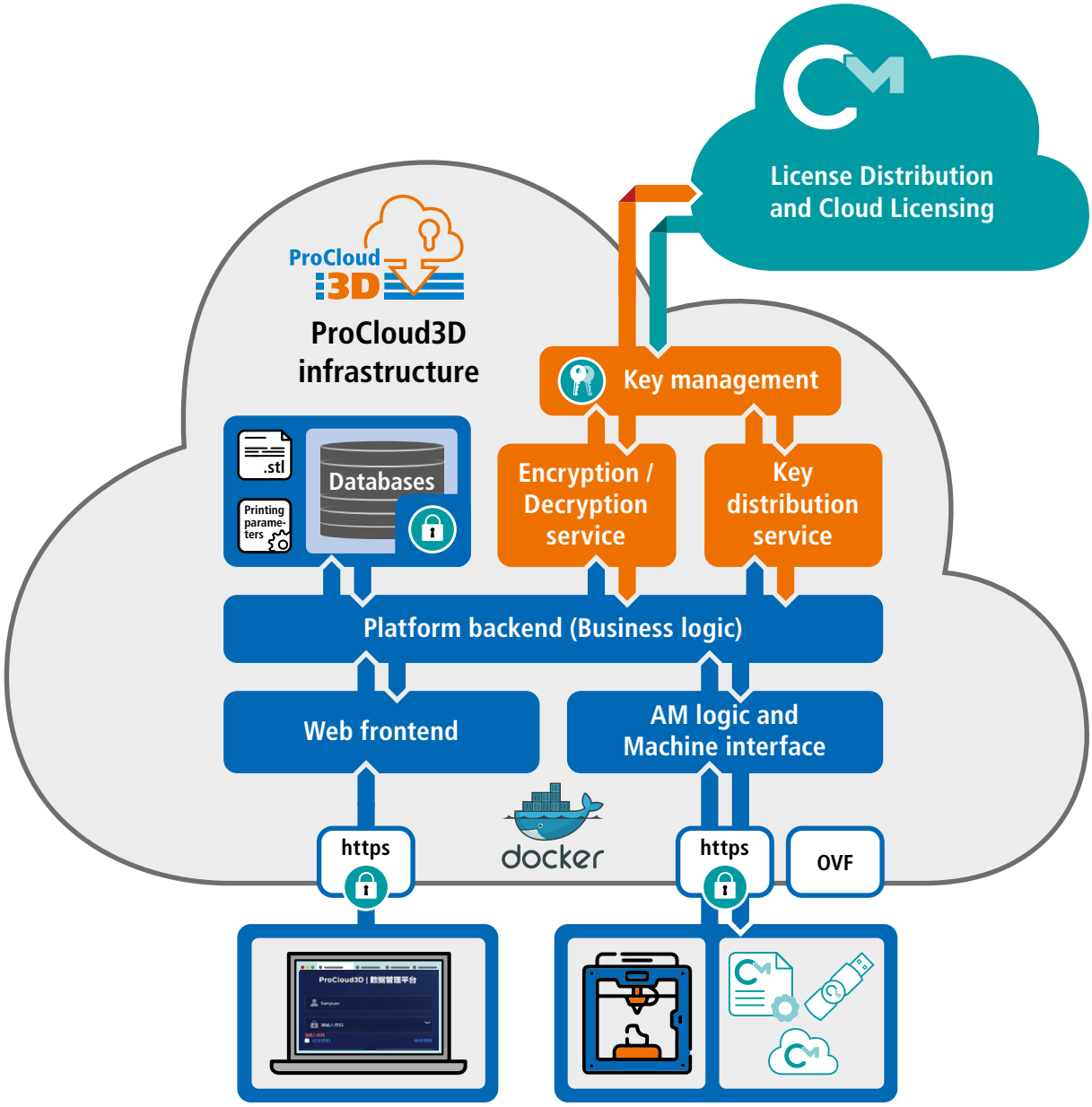


Image 7: Security components and end-to-end encryption
(Source: RWTH Aachen University, Moritz Kolter, M.Sc.)

# Economic perspectives

The securing and licensing of 3D-printed spare parts opens up significant economic opportunities and a large market potential not only for the automotive industry: The global market for industrial 3D printing was estimated at approximately 12.6 billion US dollars in 2022. Forecasts indicate that the 3D printing market will reach a size of about 50 billion US dollars by 2028, representing an annual growth rate of about 22.5%.

- **Expansion of service offerings:** Installing 3D printing services in key distribution centers of automotive manufacturers can create significant added value. This allows manufacturers to respond quickly to customer requests by printing spare parts on-site, leading to higher customer satisfaction and loyalty.
- **Reduction of storage and logistics costs:** By utilizing on-demand 3D printing of spare parts, companies can significantly reduce their storage costs. This is particularly true for rarely needed or obsolete parts.
- **Tapping into new markets:** 3D-printed spare parts offer a unique opportunity to serve markets that are traditionally difficult to access, such as the classic car market. Specific parts, which are often no longer available, can be produced on demand, presenting a significant opportunity for manufacturers.
- **Individual adjustments and improvements:** 3D printing enables the customization of parts to individual specifications, which is particularly attractive for tailored solutions or performance enhancements.
- **Licensing model for 3D printing files:** Manufacturers can tap into new revenue streams by licensing 3D printing files. Customers purchase a license for the design of a replacement part and can then print it on-site or at an authorized facility.
- **Promoting sustainability:** 3D printing supports sustainable production methods by reducing material waste and optimizing logistics processes. This can be an important factor for customers who value environmentally friendly products.

Overall, the integration of 3D printing technologies in the industry not only offers opportunities for cost reduction and efficiency improvement but also chances to tap into new markets and customer segments.

# Future outlook

The anticipated developments in the 3D printing industry and their impacts on intellectual property (IP) protection and licensing are multifaceted and promising:

- **Market growth and geographic trends:** The 3D printing market is growing due to technological advancements, decreasing costs, and an expanded range of applications. North America holds the largest market share, followed by Europe and the Asia-Pacific region.1 The latter shows significant growth potential due to the increasing adoption of 3D printing in various sectors and government initiatives to promote the industry.
- **Metal additive manufacturing and industrial integration:** Metal additive manufacturing is gaining increasing importance as a production technology. Numerous automotive manufacturers and their suppliers have already successfully integrated additive manufacturing (AM) into their production processes. This development underscores the growing role of AM as an integral part of industrial manufacturing processes. This will also impact areas of IP security and licensing.
- **Healthcare and medicine:** The healthcare sector, especially dentistry, is considered a pioneer in the use of 3D printing technologies. The ability to produce highly specialized medical devices and components has led to broader acceptance of this technology. Furthermore, the 3D printing of organs represents a transformative development in medicine. This technique allows the creation of organs with patient-specific properties, which will revolutionize transplantation medicine and significantly reduce the problems of organ shortages and rejection reactions. Additionally, the 3D printing of organs opens new avenues in pharmaceutical research and development by providing realistic models for tests and studies. These advances will significantly improve the efficiency and safety of medical treatments.

[1] https://www.fortunebusinessinsights.com/de/industrie-berichte/markt-f-r-3d-druck-101902

- **Food production:** The use of 3D printing in food production opens up innovative culinary possibilities as well as potential in global food security. By efficiently and precisely manufacturing food, 3D printing can contribute to solving nutritional problems and securing the food supply for the growing world population. This perspective will have far-reaching implications for the development and licensing of new food production technologies.

- **Cybersecurity and IP risks:** In the world of 3D printing and manufacturing facilities, the risk of cybersecurity breaches is increasing due to growing IoT connectivity. IP theft and process sabotage are the biggest threats. While cloud-based data transfer platforms and blockchain technologies that are constantly online carry their own security risks, Wibu-Systems' CodeMeter technology offers a more robust solution. CodeMeter effectively protects intellectual property and production processes, even offline, thus closing the security gaps that can arise with constantly online systems like blockchain.

Overall, these trends show that the 3D printing industry continues to develop dynamically and is increasingly integrated into various industries. All these developments will impact IP and licensing, as custom medical solutions and innovative food products, for example, are usually patented and licensed. This necessitates a stronger focus on IP security and licensing to protect and promote intellectual property and innovative developments in this area.

# Summary

The white paper delves into the topic of protecting and monetizing 3D-printed spare parts, highlighting the challenges and opportunities arising from the use of 3D printing in production, especially regarding IP protection and licensing. The role and significance of Wibu-Systems' CodeMeter technology are discussed in detail, including its integration into ERP systems like SAP and web shops. Concrete use cases and the economic potential of the technology are presented, concluding with an outlook on future developments in the 3D printing industry and their impact on IP security and licensing.

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Wibu-Systems is a global leader in cutting-edge cybersecurity and software license lifecycle management. We are committed to delivering unparalleled, award-winning, and internationally patented security solutions that protect the intellectual property embedded in digital assets and amplify the monetization opportunities of technical know-how. Catering to software publishers and intelligent device manufacturers, the interoperable hardware and software modules of our comprehensive CodeMeter suite safeguard against piracy, reverse engineering, tampering, sabotage, and cyberattacks across mainstream platforms and diverse industries.

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