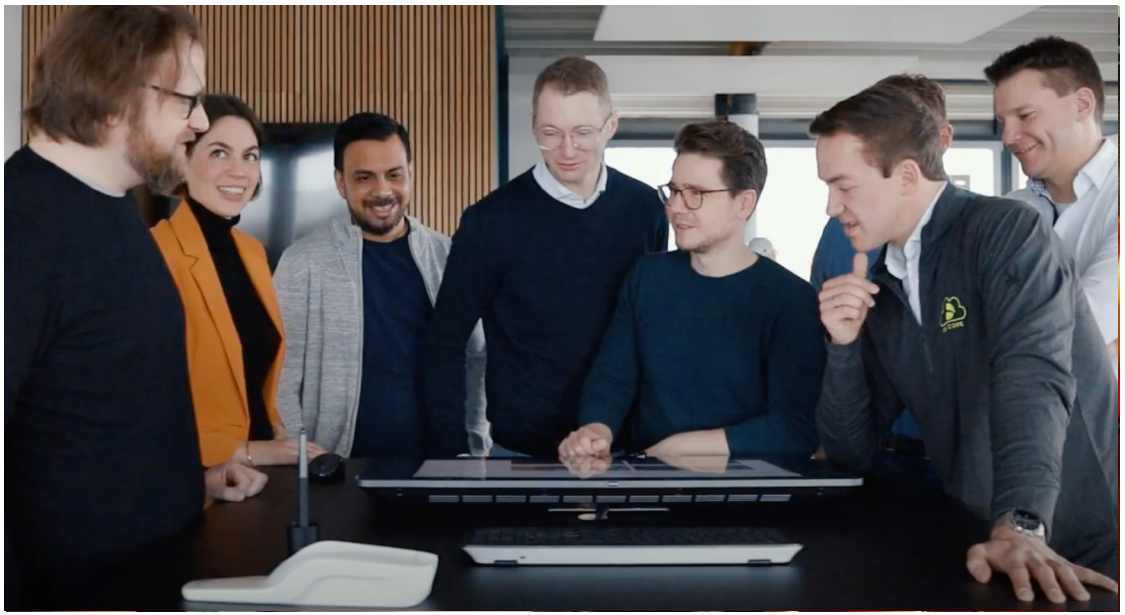
Revolutionizing the dental industry

Dentsply Sirona and freiheit.com move 100.000 dentists into the cloud



freiheit.com
the software engineering company

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All the devices, applications and workflows that we are building will be connected to DS Core, even some back-end processes.
It's the centerpiece that we have, it's what digital dentistry is all about.

Manfred Müller - VP Software Engineering & UX - Dentsply Sirona

Building a revolutionary software solution for dentistry

Dentsply Sirona had a vision. To make the workflow of dental practices around the world efficient, fast and seamless. To give dentists time to focus on what's really important, the well-being of the patient.

Available worldwide. For 100.000+ dentists. With millions of dental procedures every day.
To make this vision come to life, Dentsply Sirona was looking for a strong partner to help them build a solution that would bring all the dental applications safely into the cloud. This cloud platform, called DS Core, would allow dentists and laboratories to collaborate seamlessly with each other, making the workflow more efficient and the treatment span shorter for the patients.

> *At Dentsply Sirona we've been providing solutions for the dental industry for over three decades. These softwares grew continuously, piling many lines of code that demanded a lot of maintenance. We realized that it was time for a change and that we had to improve efficiency and unify the process to create a better workflow for dentists and laboratories. We needed a solution that moved everything natively into the cloud. This is where freiheit.com came in.*
>
> Manfred Müller - VP Software Engineering & UX - Dentsply Sirona

In collaboration with Dentsply Sirona, one of the world's largest manufacturers of professional dental products and technologies, the software engineering company freiheit.com built an **all-in-one platform** that enables dentists and laboratories to upload, visualize, share and store patient data directly in the cloud. This platform does what was unthinkable before, it gives professionals in the dental sector the opportunity to handle almost all of their work in one place.

Before the platform was built, all communication and collaboration between dentists and laboratories was neither unified nor in one place.

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Unfolding the process

Defining the problem

With an ongoing **global digitalisation** across all industries, Dentsply Sirona was the first to take the next step within their industry. The entire dental sector relied heavily on on-premise IT systems in clinics and laboratories. This made it very difficult to update the software and systems, creating a high hardware dependency and making the interaction and collaboration between parties challenging. To solve these issues in a data secure way, Dentsply Sirona decided to transition its ecosystems into a new cloud architecture using Google Cloud. This would provide an end-to-end digital experience, so that one day, dentists will only need access to a browser.

The challenge

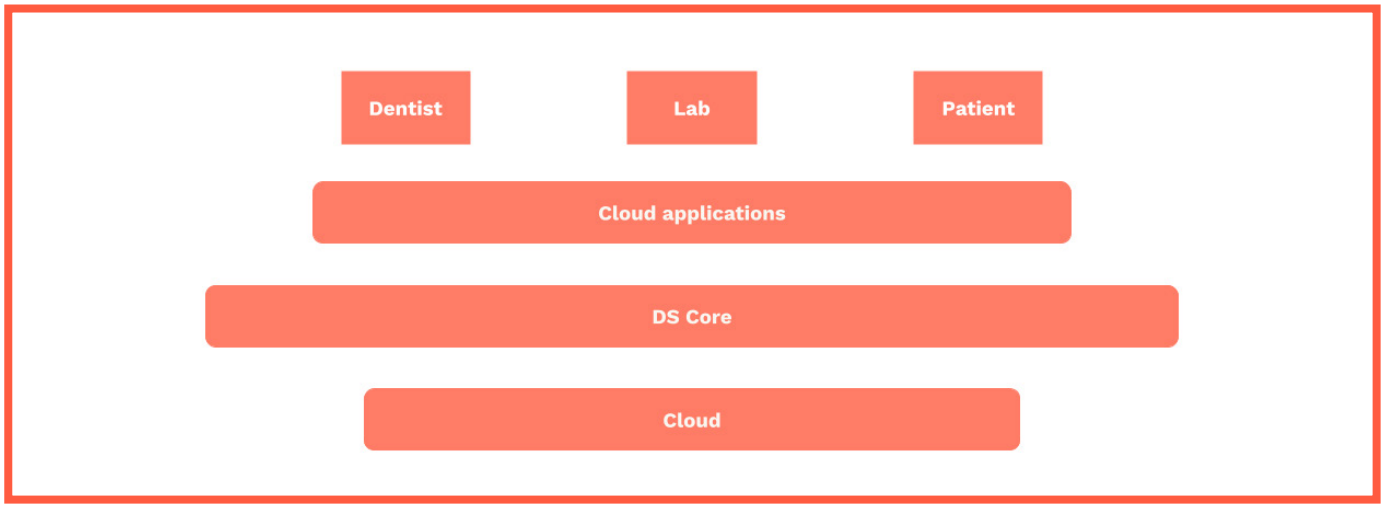
To bring the vision of DS Core to life, Dentsply Sirona and freiheit.com defined the following challenges:

- Secure real-time data sharing between dentists and laboratories.
- Smooth 3D rendering experience of intraoral scans in a cost-effective manner.
- Connection of legacy systems to the cloud to enable seamless workflows as well as a transition phase.
- Integration of all data and systems on a secure clinical cloud sharing platform.
- Building a platform that allows a continuous addition of clinical applications for different devices to DS Core.

Solving the puzzle

- The cloud rendering engine performs the resource intensive computations in the cloud by leveraging Google Cloud's support for high end graphic cards.
- The result is streamed via WebRTC to the browser of the user and allows for real time interaction like in a video game.
- Synchronize on-premise data to Google Cloud storage and the HealthCare API using specialized Windows on-premise connector services.
- Build data sharing on a strong foundation to ensure more applications can be continuously and easily added.

DS Core



Visualization of the cloud platform DS Core: The platform is built on the cloud and provides its users, dentists, patients and laboratories with different cloud applications that they can access in real-time through data sharing.

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Meeting the key players

Before going into depth about the roll-out of the collaboration between Dentsply Sirona and freiheit.com, it is of essence to take a look at the two companies that came together to build something revolutionary.

About Dentsply Sirona

Dentsply Sirona is the largest manufacturer of professional dental products and technologies worldwide with over 10.000 employees, a turnover of $3.93B in 2023 and a great variety of dental products. The company provides a large range of solutions that are leading product brands across consumables, equipment, technology and specialty products. It is their overall mission to improve advanced dental patient care around the world.

Dentists are one of the few medical professionals that diagnose their patients and also directly offer procedures within the same facility. The dental industry is also one of the only ones that has successfully digitized its entire process, from diagnosis to finished dental product.

However, before DS Core was brought to life, the collaboration between dentists and laboratories was time consuming and complicated, meaning that each dental practice had its own hardware and software that wasn't connected to each other. To place an order for a dental product, the dentist had to communicate with the laboratories using his own software as there was no platform to combine it all.

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About freiheit.com

freiheit.com has been building large-scale software systems since 1999.
The software engineering company founded in Hamburg, develops large scale software platforms used by millions of users with thousands of requests per seconds.

Failure is not an option. freiheit.com is known for their high reputation on the market, their technical experience and for delivering projects reliably on time, on budget and on target.

For over a quarter of a century, they have been working for the “Who’s Who” of German and European industrial and commercial companies – across all sectors: healthcare, trade, automotive, e-commerce, and more.

Accomplishing Milestones

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Timeline DS Core

From PoC to the 1st clinical application

Roadmap with the most important milestones during the roll-out of DS Core

One PoC, 3 Engineers, 3 Weeks, 3D Rendering in GCP, Seamless Switch Load/Cloud

It all started in 2021 with a small Proof of Concept organized by Dentsply Sirona. The company had embarked on a journey to find the right partner to create a cloud solution for dentists. The collaboration they were looking for would be long-term and in close partnership with the company. Google recommended freiheit.com to Dentsply Sirona during the already ongoing PoC. freiheit.com then submitted their proof of concept within 3 weeks, which included three different challenges:

- Sharing
- Uploading
- 3D Rendering of data in the cloud

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freiheit.com selected the most challenging one, the 3D Rendering.

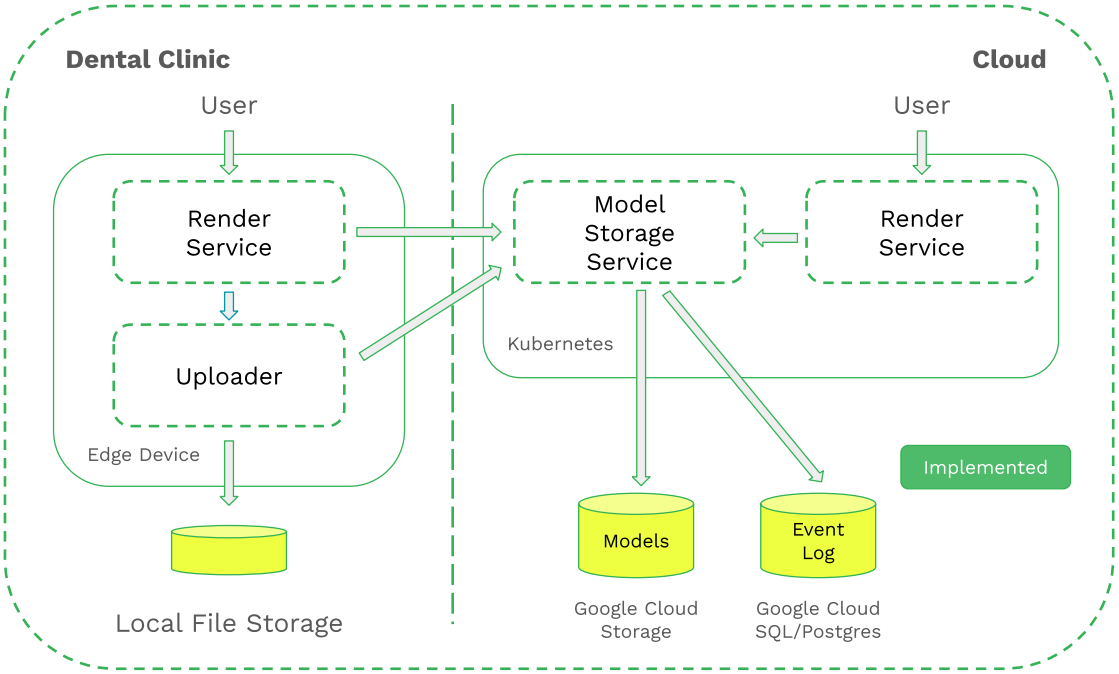
In only 3 weeks and with a small team of 3 engineers, freiheit.com accomplished a Proof of Concept for a software that enables dentists to stream 3D renderings in the cloud and edit them directly in the browser.

The advantages:

- 3D renderings could immediately be accessed by any dentist and collaborating laboratories.
- Rendering in the cloud minimizes the hardware dependency, creating flexibility for the end-user.
- Fast implementation of new dental applications due to the flexibility of updating directly in the cloud.

> *Within 3 weeks, the freiheit.com team showed that a seamless transition between local and cloud rendering was possible. We wanted to show that we could render 3D scans like jawbones in the cloud and stream it in the browser of the user. We wanted to bring video gaming technology to the dental practice.*
>
> Stefan Richter - CTO & Co-Founder - freiheit.com technologies

Overview Proof of Concept



Technical components and construction of the Proof of Concept

> *The initial development was mainly managed by freiheit.com alone until we reached the first Alpha Release of DS Core. We then gradually broadened the teams that worked on that platform.*
>
> Manfred Müller - VP Software Engineering & UX - Dentsply Sirona

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Deep Dive 1

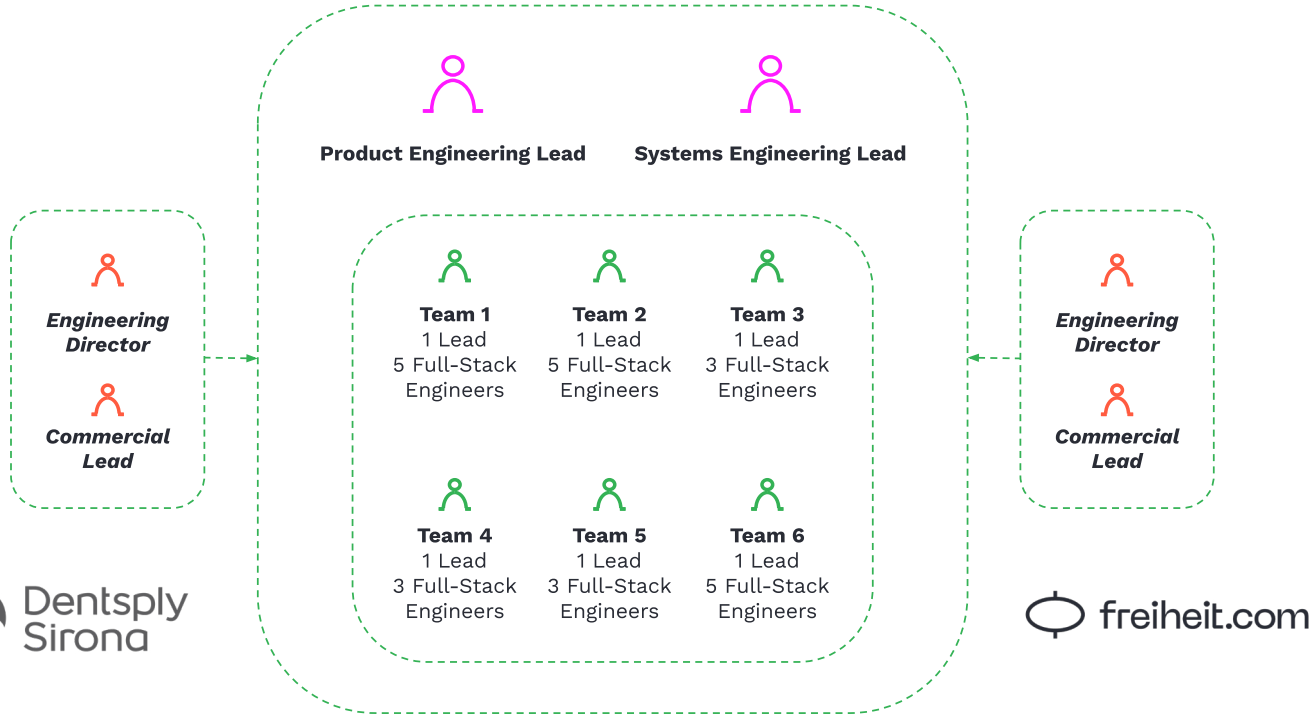
3D Rendering in the cloud

The initial Proof of Concept aimed to demonstrate the technical feasibility of cloud-based 3D rendering in a time- and cost-effective manner.
freiheit.com paired with the experts from Dentsply Sirona to migrate a desktop 3D render engine to the cloud.
The render engine used in the PoC version for DS Core lacked headless rendering support, prompting freiheit.com to devise a solution utilizing the render engine within a background X11 desktop environment. Rendered frames were captured as screenshots, compressed, and transmitted via websockets.

For the production version, the focus shifted to balancing user experience with resource optimization. freiheit.com transitioned from the X11 solution to a render engine version that supported background rendering. Additionally, freiheit.com implemented WebRTC streaming for real-time frame delivery and video codec compression for further data reduction. This minimized data transfer and ensured smooth playback, even for complex scenes.
Furthermore, to optimize resource utilization, the team employed GPU timesharing, enabling concurrent rendering sessions on a single GPU. freiheit.com also incorporated intelligent scaling mechanisms that dynamically adjust resource allocation based on anticipated usage patterns.

A collaboration in mixed teams

Team Setup DS Core - Dentsply Sirona x freiheit.com



The team that worked on the DS Core was a symbiosis of Fullstack Software Engineers coming together to create something that had not been done before. They started with a team of 3, later becoming up to 30 engineers. Early on, they decided in agreement with Dentsply Sirona, to use Flutter/Dart as their UI technology as it is suitable for adaptable development and could be used for a mobile application if that's needed in the future.

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Deep Dive 2

A detailed look at Flutter/Dart

Flutter is a framework for the language Dart to build smooth and native-compiled apps for mobile, web and desktop.

Unlike Javascript, Flutter/Dart uses Ahead-of-Time compilation which leads to superior performance and faster loading times. Moreover Flutter uses the CanvasKit for native-like rendering that bypasses the DOM, enabling direct manipulation of the canvas for pixel-perfect rendering and smooth animations, achieving a native-like look and feel on the web.

Flutter's mantra "Everything's a Widget", the tooling support, as well as ability to iterate fast, using hot reload make it a very pleasant developer experience as well.

All of these features, but also the benefit of having the possibility to use a single codebase to create the application for all platforms made Flutter/Dart a perfect match for the project.

Release of the first Early-Market version of DS Core

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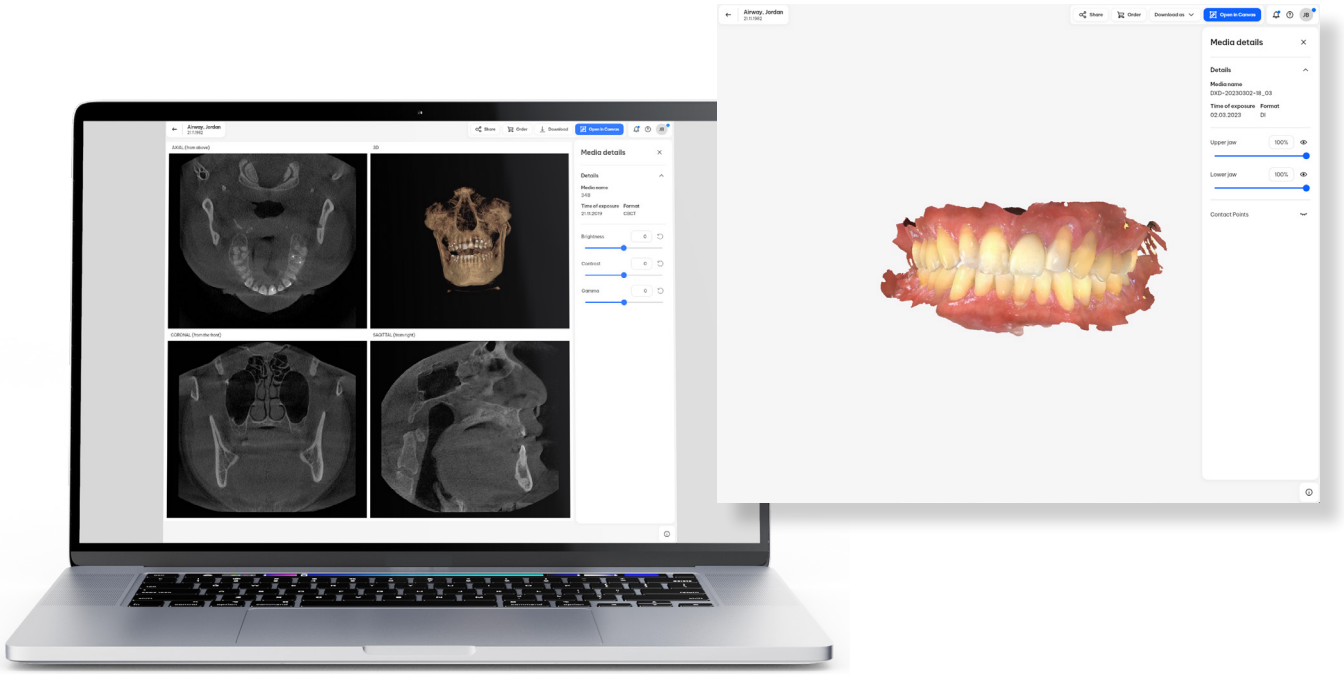
The Closed Alpha, which was already released after **7 months**, is an extension of the results gained from the Proof of Concept. The early market version not only had the capability to visualize 3D data like the Proof of Concept (PoC) version, but it was also integrated into a platform offering various other features. The most important addition was the extension to store and share patient data **directly in the cloud**, allowing access to the data from anywhere. It was now also possible to automatically synchronize on-premise XRay scans from the dental practice into DS Core.

Overview of the platform DS Core



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Release of DS Core as the 1st clinical application at the IDS in cologne

1,788 exhibitors from 60 countries - 120.000 trade visitors from 162 countries - 180.000 m2 gross exhibition space

Dentsply Sirona and freiheit.com officially brought the **first clinical application** to the market and presented it at the International Dentist Show (IDS) in Cologne **6 months later**. This trade fair is of high relevance as it is where both the latest products within the industry are presented and networking with dentists and partners from all over the world takes place.

The features in DS Core:

1. Dentists can upload 2D and 3D X-ray scan files from Dentsply Sirona devices automatically to DS Core. In addition, they can manually upload third-party scans to their library.
2. Digital impressions speed up the scanning process, reducing the chair time by handling scans in under a minute.
3. Each patient data is stored in the cloud in the patient library in accordance with GDPR/HIPAA. All the data can be accessed from anywhere via a web browser, enabling seamless sharing with laboratories and patients.
4. The Communication Canvas connects patients to their dentists and allows for a digital conversation with the experts.
5. The Labflow is the central platform that enables dentists to communicate with the laboratories directly, send out orders with indications and exchange patient records.

Deep Dive 3

Implementing DS Core in 21 countries

DS Core leverages eight geographically distributed environments hosted across two hyperscalers: Google Cloud Platform (GCP) and Alibaba Cloud (Alibaba). These eight clusters strategically placed across the globe, cater to the specific data residency needs of the 21 countries where DS Core operates (spanning Asia, Europe, North America, South America, and Australia).

To manage the infrastructure complexity of these eight clusters and ensure consistency across them, the infrastructure was utilized as code (IaC) and abstracts cloud provider-specifics. Furthermore, GitOps principles are employed to manage the Git repository containing application manifests, enabling full traceability and version control. The CI/CD scan automates the rollout process across all eight environments.

Despite this multi-cloud, multi-regional complexity, DS Core maintains agility through a robust CI/CD pipeline with integration and smoke testing. Proactive monitoring of both infrastructure and application health is achieved through Datadog, while using a feature toggle API, that empowers management of feature rollouts and mitigates risks. This combination of automation, version control, and monitoring allows for frequent deployments while maintaining a stable and secure infrastructure for DS Core.

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Taking a look into the future

DS Core is well on its way to becoming the most important tool for all dentists, laboratories and patients worldwide. New features are continuously added to the cloud platform and it is already available on 5 continents and in 21 countries. Efficient workflows - all in one platform, accessible from everywhere and at any time.

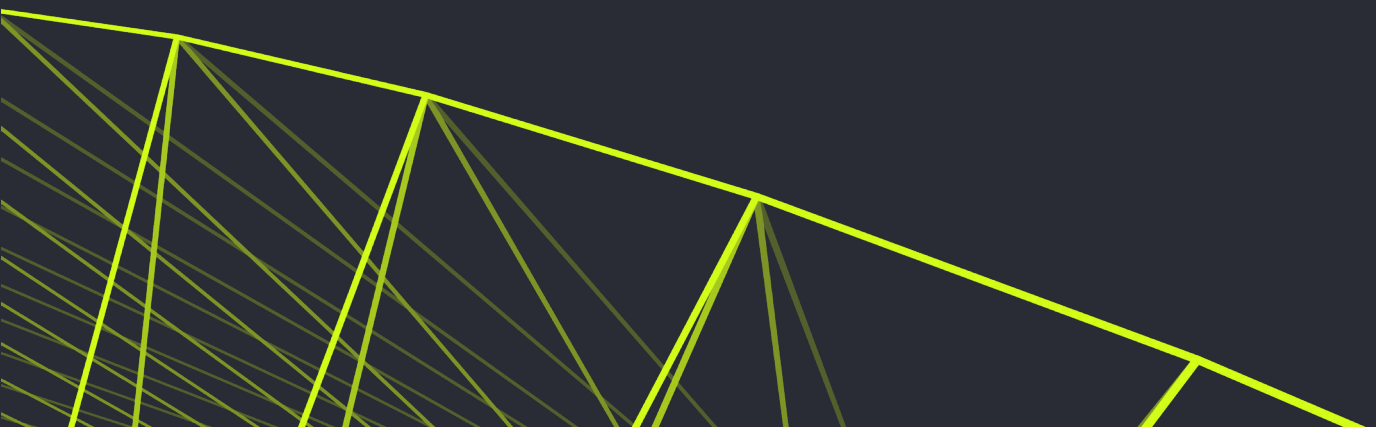
So dentists can focus on what's most important - the well-being of their patients.

> *For thousands of years humans have crafted dentures and dental implants. Today this process is completely digitized and software-aided. As Alan Turing once said: "We can only see a short distance ahead, but we can see plenty there that needs to be done.*
> *This is only the beginning.*
>
> Stefan Richter - CTO & Co-Founder - freiheit.com

Get in touch with us

Do you want to learn more about us and the projects we are working on?
We would love to talk to you:

kontakt@freiheit.com



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