

Enhancing Healthcare Through Integrated Technology

About client

A MedTech company is reshaping pathology practices with an AI-based digital workflow designed for broad compatibility across different systems.

Their core solution is a certified, intuitive platform aimed at streamlining operations in pathology labs. This platform equips pathologists to conduct case reviews and diagnoses swiftly, aided by automated features that reduce manual tasks. By integrating smoothly with other systems, it enhances data sharing, simplifies reporting, and ultimately boosts pathologists' productivity in clinical settings.

Challenge

1. Medical Staff Workflows

Doctors and nurses were struggling with fragmented and time-consuming processes for entering, updating and tracking patient data. This inefficiency reduced the time available for patient care, and it was clear that a more streamlined system was needed to reduce administrative burdens and improve workflow coordination.

2. System Performance and Integration

The existing system had scalability limitations and experienced intermittent latency and reliability issues during peak usage periods. In addition, doctors were required to install special software on their computers, which limited their ability to log in from any device.



About company

A MedTech company in the pathology sector with a platform for the optimization of work processes.

Industry

Healthcare

Team

Backend	4
Frontend	2
DevOps	2
Project Manager	1

Duration

4 years

Technologies

- Node.js
- RabbitMQ
- Nest.js
- React
- React Native
- OpenSeadragon
- Microservices Architecture
- Test-Driven Development (TDD)

3. Data Accessibility and Security

There was room for improvement in terms of data accessibility, particularly to ensure that all authorized personnel could easily access the information they needed at any time. At the same time, security protocols needed to be enhanced to ensure compliance with evolving healthcare regulations without compromising the user experience.



4. User Experience and Training

The system's user interface was overly complex, making it difficult for medical staff to use. In addition, training programmes for staff to adapt to new system updates were time-consuming, and more effective solutions for onboarding and ongoing training were needed to ensure smoother transitions.

Solution

To address the client's challenges, we designed and implemented a comprehensive solution consisting of several key modules. Each module was designed to address specific operational and technical challenges, optimize system performance, improve workflow and ensure compliance with healthcare regulations.

Workflow Automation and Data Entry Optimization

Using the **Enhanced Data Management** module, we restructured the way we handle patient data, centralizing all patient information and enabling real-time updates across multiple departments. This approach ensured data consistency, reduced duplicate entries and provided medical staff with fast, secure access to up-to-date records.

By automating routine tasks such as data entry and report generation, healthcare professionals freed up valuable time to focus on patient care and improve clinical workflows.

Workflow Automation and Data Entry Optimization

To further improve this process, we developed a **Front-end Web Platform** with a customisable interface that allowed medical staff to configure views of patient data, assign cases and use filtering options to optimize daily operations. This platform was built using a micro-frontend architecture, providing a flexible, unified workspace for staff.

The micro-front-end architecture was implemented to create a unified user interface where clinic professionals – doctors, administrators and others – could collaborate efficiently. Now hosted in the cloud (Amazon), the application allows doctors to log in from any device, not just their work computers.

A comprehensive summary table was developed to support real-time interaction and customisation based on individual user needs. Users could also block cases being worked on by others, ensuring smooth collaboration. By transforming a monolithic front-end into a micro-front-end architecture, we enabled seamless integration with third-party systems and tailored user experiences.

System Performance Enhancement and Integration

The **Advanced Integration Layer** addressed system scalability and interoperability issues. By connecting disparate tools and platforms, we facilitated the seamless flow of data between legacy systems and new technologies.

We also implemented an Event-Driven Architecture to ensure real-time data synchronization across the system, improving the speed of decision making and enabling different departments to act on the latest available information.

At the heart of the system's infrastructure, we developed an event-driven, asynchronous **Back-end Data Bus** using a microservices architecture.

The Data Bus module acts as an asynchronous event bus, efficiently managing requests and activities. When a physician takes action, the event is published to the bus and distributed to subscribed services via queues, streamlining communication throughout the system.

This architecture handles high volumes of doctor requests and integrates seamlessly with legacy systems using RabbitMQ. It includes an audit system that logs significant events, ensuring compliance and security, and provides traceability of diagnoses and incidents.

The module supports live updates, allowing users to collaborate without disruption, and implements exclusive locks with Redlock for secure editing. Automated case distribution based on pre-defined criteria reduces the manual workload for administrators, improving overall operational efficiency.

Enhanced Data Accessibility with Upgraded Security

To ensure data accessibility without compromising security, we implemented a **Security and Compliance Framework**. This module integrated encryption protocols, access control and audit logs to protect patient data and ensure compliance with healthcare regulations.

Authorized personnel could securely access patient information from anywhere in the hospital, streamlining workflows while protecting sensitive data.

Improved User Experience and Training Solutions

The user experience was a central focus of our solution, leading us to redesign the system's interface to be more intuitive and user-friendly. For specialist requirements, such as working with high-resolution tissue images, we developed the **Viewer Module** using React and OpenSeadragon.

The Viewer module modernizes medical image handling by digitizing physical slides for online processing. Once uploaded, a digital slide opens in an intuitive interface that allows doctors to zoom, annotate and use measurement tools such as a ruler.

Doctors can highlight areas of interest, take high-quality snapshots and integrate with external APIs for AI-powered image analysis, sending tagged images to services such as MindPeak and DeepBio. This streamlines workflows, reduces reliance on physical copies and improves diagnostic accuracy through the use of advanced technologies.

To support the transition of staff to the new system, we created a **User Training Programme** that included self-guided modules and support materials. This reduced the need for extensive face-to-face training and helped staff quickly adapt to the updates with minimal disruption.

The system architecture was flexible, allowing for future enhancements and compliance with evolving healthcare regulations. In addition, the **Mobile Application**, developed using React Native, provided doctors with remote access to patient data, ensuring flexibility for healthcare professionals working in multiple locations.

Optimized Reporting and Deployment Processes

For reporting, we introduced a multi-threaded **Reporting Module** that allows complex reports to be generated using worker threads. This improved the performance and speed of creating detailed reports directly via the system.

To further streamline development and deployment, we implemented a **Test-Driven Development (TDD)** approach. This included a custom SDK toolkit that enabled automated testing, significantly improving system reliability and reducing time to market for new features.

Results

The implementation of our solution resulted in significant improvements in several areas of the client's operations. By optimizing workflows, improving data management and strengthening system reliability, we were able to help the client achieve its goals while maintaining continuity of service.

- **Improved efficiency:** Consolidated fragmented systems into a unified platform, reducing manual workflows and improving data accessibility for physicians and pathologists.
- **AI Integration:** Successfully integrated AI diagnostics, enabling faster and more accurate disease detection by sending images to third-party AI services and returning accurate, automated analysis.
- **Scalability & Flexibility:** The microservice system based on event-driven architecture enabled the platform to handle higher loads and easily adapt to customer-specific requirements without vendor lock-in.
- **Seamless image handling:** Transitioned from outdated physical imaging methods to an online, high-resolution system, improving accessibility and collaboration in diagnosis.
- **Enhanced reporting:** Automated complex report generation, enabling faster and more accurate clinical documentation.
- **Cross-Platform Accessibility:** Implemented a mobile app and web-based system for streamlined workflows, allowing access from any device.

By providing a fully integrated and flexible solution, the Client can now benefit from a scalable digital platform that improves diagnostic accuracy and operational efficiency in the medical field.



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