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— Loïc Vaes
CERHIS Project Manager
AEDES

Going digital without reliable power or internet

AEDES revolutionizes healthcare systems in the Democratic Republic of Congo

In many parts of the world, medical healthcare providers are capitalizing on new technologies to improve the quality of care. Patients can refill prescriptions, receive appointment reminders, and check lab test results easily through smartphone apps.

These capabilities are not available everywhere, though. Parts of the developing world are struggling to realize the benefits of modern healthcare technology due to a lack of reliable power, poor internet connectivity, and the sheer costs of going digital.

The public health consulting organization AEDES has come to understand these challenges all too well through its efforts in developing countries to improve health information systems. The organization is currently developing CERHIS – a tactile hospital information system that brings digital services to small and medium-sized hospitals in sub-Saharan Africa, which has some of the most challenging environments for healthcare information management. CERHIS started in the Democratic Republic of Congo (DRC), one of the largest countries in Africa, with nearly 80 million people, 9,000 health centers, and more than 500 medium-sized hospitals.



The Challenge: Go paperless in a difficult environment for digital transformation

Data management affects patient care and treatment in very real and profound ways. In developing countries, where paper records are still commonplace, data is often unreliable, unobtainable, and out of date. Data issues can have negative consequences at every level of healthcare services – from the treatment of individual patients and the operation of hospitals to the tracking and containment of contagious diseases, such as Ebola.

“People immediately understand how medical supplies and equipment make a difference in healthcare, but some of them don’t understand the role of data,” says Loïc Vaes, CERHIS project manager. “But better data makes for better patient care, better hospital management, better healthcare services, and better national health policies.”

Nearly all health centers and hospitals in the DRC are using paper records. “Details such as patient names, addresses, date of birth, and symptoms were all written manually in registers,” says Vaes. “This data needed to be collected in every department, and the



The main challenges facing CERHIS were:

- **Financial restrictions** – DRC hospitals have much smaller budgets than similar sized hospitals in the West. Resources are strictly controlled, which is why cheap paper records have persisted.
- **Unstable power supply** – Power cuts and brownouts are frequent in these countries, and some health structures simply don't have access to the electrical grid.
- **Difficult environmental conditions** – The heat, humidity, and dust in these environments can cause regular technical failures.
- **Poor connectivity** – Cellular and wireless connections are variable in the DRC, making cloud services a risky option for healthcare.
- **Internal skills** – Most doctors, nurses, and other end users in DRC's healthcare services are unfamiliar with desktop technologies such as Microsoft Windows.
- **Low availability of qualified technicians** – A combination of limited resources and skills means that there are not enough qualified technicians in DRC's healthcare system.

process was repeated every time a patient moved from one part of the hospital to another during the course of their treatment. Needless to say, it was a laborious process, and wholly unnecessary when you consider how digital services can help.”

Paper-based processes were time-consuming and inefficient. “Hospitals were reliant on collecting and recording data accurately every time, and afterwards their staff members had to sift through hundreds of records to produce aggregate data for mandatory periodic reports. Accessing patient history was also often not feasible,” says Vaes. “This time could have been better spent treating patients.”

Moreover, using paper-based processes made it difficult to protect information. “Paper records were invariably archived poorly,” says Vaes. “Each facility had dozens of registers, often stored in cardboard boxes that had little protection from heat and humidity. As a result, they were often damaged or destroyed over time.”



The Solution: Implementing an Android-powered medical record system built for rugged environments

The AEDES solution for digitizing DRC records involved deploying rugged Android-based Samsung tablets. These devices are more cost-effective than desktops or laptops and are also easier to navigate for a user base unfamiliar with Microsoft Windows – Android is by far the most common operating system across Africa. A locked metal storage unit connected to solar batteries stores the tablets and covers the charging and security needs of each hospital.

The Couchbase Data Platform powers the Android app used to collect administrative and medical data. With the Couchbase Data Platform, all of a patient's information is stored in one place. The database has been adapted to the CERHIS data model. Each item – such as patient information or exam results – exists as a single document, something that is possible only in a schema-less database model.

Couchbase Server, which runs on Ubuntu, collects information in four buckets: users, data, metadata, and stats. There is also a local database on each tablet device, powered by Couchbase Lite. The local database replicates the first three buckets (users, data, and metadata) so that users can access services offline.

This setup is well-suited to light hardware. Hospitals can scale up, down, and horizontally – quickly and easily – for testing and adding new departments.



The Result: Achieving a digital revolution in healthcare services against all odds

Minimum cost, maximum flexibility

AEDES was able to keep its costs low by pairing Couchbase with commodity hardware. For a reasonable cost, each hospital can receive the CERHIS software, Android tablets,



About AEDES

AEDES, the European Agency for Development and Health, is a private consulting company specializing in public health. AEDES mission is to help improve the quality and access to health care around the world. For this purpose, AEDES promotes the sharing and transfer of knowledge by providing experimented human resources and performing consulting and management services in the areas of health. AEDES operates in developing and intermediate countries, promoting sustainable economic, social, and environmental development. Learn more at www.aedes.be



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a basic x86 server with 8GB of RAM and solid-state drive, batteries, charging docks, and training on the system. Because Couchbase is open source software, AEDES is also able to customize the platform to meet its specific needs – even with a tiny programming team of just two people.

Offline functionality

The intranet was used in a previous iteration of this project, but when connectivity was lost, and the tablet devices could not sync, users reverted to their paper records. AEDES was keen to find a solution with offline functionality. Couchbase was quickly chosen from a list of competitors for its ability to sync with Android tablets offline.

“CERHIS simply would not have been possible without Couchbase,” says Vaes. “We tried other solutions, but without Couchbase’s offline functionality, a feature which might be little more than a bonus in some projects, ours would not have been possible.”

Using the right data model for the job

Because the data changes significantly from year to year and from country to country, AEDES needed the flexibility of a schema-less, document-oriented database model. The team immediately opted for NoSQL. “We knew that the project would have its challenges, and that the data structure was going to change continually,” says Vaes. “For that reason, NoSQL was our first and only choice from the very start.”

NoSQL made training technicians easy. “At the start of the project, we allocated a few days of workshops for teaching the local technicians how to use NoSQL, a type of database they didn’t know,” says Vaes. “It has been very intuitive for them to transition from SQL in order to work on configuration and data querying.”

Couchbase also simplifies management. “The Couchbase installation works even better than expected,” says Vaes. “It’s like magic happening behind the scenes. It is simple to install on the servers and once we boot them we can more or less leave the database alone.”

“Our team is taking a revolutionary approach to care in developing countries and it could be making a real difference for thousands of people in the DRC,” adds Vaes.

About Couchbase

Couchbase’s mission is to be the data platform that revolutionizes digital innovation. To make this possible, Couchbase created the world’s first Engagement Database. Built on the most powerful NoSQL technology, the Couchbase Data Platform offering includes Couchbase Server and Couchbase Mobile and is open source. The platform provides unmatched agility and manageability – as well as unparalleled performance at any scale – to deliver ever-richer and ever more personalized customer experiences.