*instinctools

# E-Health Product — a Revolution for Canadian Cardiac Care

How crafting a virtual healthcare platform for clinics, research centers, and patients empowered a pan-Canadian healthcare association to rewire research and monitoring of high-risk cardiac patients with ICDs (implantable cardiac defibrillators), run **78%** of check-ups remotely, and reduce the number of cardiac-related emergency hospitalizations by **21%**.

**Industry:**
Manufacturing, Energy

SOFTWARE PRODUCT DEVELOPMENT

MOBILE APP DEVELOPMENT

WEB DEVELOPMENT

## Business challenge

Establishing robust, consistent communication has its sway in any industry. However, in healthcare, this becomes a life-and-death matter. The regular collection of patient data enhances scientific knowledge about diseases, and constant health status monitoring of high-risk patients can literally save their lives.

Nevertheless, **even though patients, clinics, and research labs are parts of the healthcare ecosystem, they are still very siloed, and so is their data**. Moreover, healthcare institutions can't keep up with the growth of medical-related data, often failing to process it effectively to get the valuable insights needed for treatment and research.

**Under-digitalization and under-communication** within the Canadian healthcare system were in the spotlight of our client – the **Cardiac Arrhythmia Network of Canada (CANet)**. The association wanted to address the hurdles faced by various parties within the healthcare ecosystem.

### Patients:

- Aren't in control of their personal health data
- Need a budget-friendly remote alternative to costly and time-consuming post-surgery follow-ups at the clinic
- Don't have a credible and easy-to-access source of up-to-date information related to their diseases

### Clinics:

- Lack of systematization in electronic record-sharing when collecting patient data from other healthcare facilities
- Unable to keep up with the current workload without remote monitoring and a specialized digital solution for it

### Research centers:

- Don't have access to a regular source of relevant data
- Waste employees' time processing heterogeneous data to find valuable information

Our client intended to rewire the state of the Canadian healthcare system and decided to test the waters with a **product for a specific patient group, clinics, and research centers (RC)**. It was planned that the project would have these elements:

- **Android and iOS apps** for the patients
- **Web apps** for healthcare providers and research centers

After evaluating several potential tech partners, CANet opted for *instinctools because of our proven expertise, European-based location, and readiness to **set up a 13-person project team in less than three days**.

# Client's goals

Facilitate communication between the patients, clinics, and research centers within a cohesive healthcare platform.

*"We wanted to create a constant feedback loop between the patients, clinics, and research centers."*

**Dr. Anthony Tang, CEO and Scientific Director, CANet**

*"Our platform – VIRTUES® – utilizes state-of-the-art diagnostics with advanced analytics and wireless connectivity to provide cardiac patients access to affordable on-demand virtual care."*

**Dr. Anthony Tang, CEO and Scientific Director, CANet**

Create a trailblazing patient-centered healthcare solution in Canada.

Reduce the number of non-mandatory visits to the clinics by up to **80%**.

Minimize hospitalizations and emergency department visits by up to **20%**.

*"Another milestone we've set for VIRTUES® was **reducing cardiac-related workload on clinics**."*

**Dimitri Popolov, Research Data & Systems Manager, CANet**

# Solution

As time-to-market was critical for the client, we suggested banking on **cross-platform options**. Flutter and React Native were top choices, but as CANet also needed web apps, our team decided to leverage **React Native for mobile apps and React JS for web apps**.

This combo yielded triple wins:

## Budget-friendly cost

As React Native is a React JS-based framework, the client didn't need two separate teams to create mobile and web applications.

## Fast-track development

Core React concepts are the same, which empowers the dedicated team to move through the whole process faster.

## Simplified maintenance of all solutions

Relying on programming languages of the same type, with similar development approaches and code styles, makes software support a walk in the park.

# 01 The tech groundwork of the platform

Before getting into the look and feel of the applications, we had to check all the boxes regarding regulatory compliance to ensure a smooth launch for VIRTUES®.

Every healthcare-related software product targeted at the Canadian market has to comply with the **Personal Health Information Protection Act (PHIPA) and Privacy Impact Assessment (PIA)** regulations.

Moreover, CANet wanted to take into account the **HL7® FHIR® (Fast Healthcare Interoperability Resources) standard** that has become a global best practice for a fast and secure health data exchange between healthcare applications.

These compliance goals required the selection of a **relevant tech stack for the VIRTUES® data architecture**. As all the components had to be FHIR-compliant by design, CANet ended with this set of software solutions:

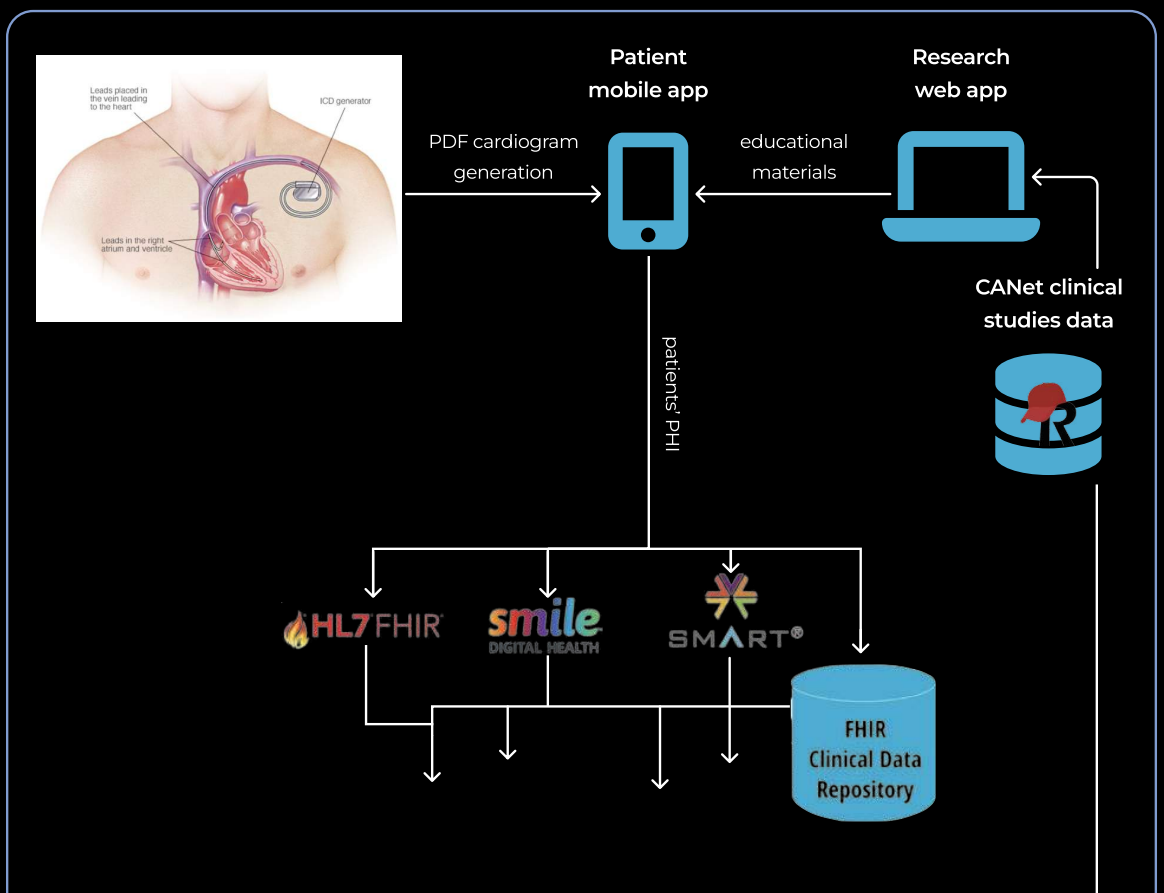
- **SMART on FHIR** as a healthcare-oriented platform with a plethora of open-source tools for crafting robust and secure clinical and patient-facing apps. It helps easily integrate apps with electronic health records (EHRs) and other healthcare software and standardizes data access.
- **Smile Clinical Data Repository (CDR)** as a data repository for managing and maintaining the HAPI-FHIR Library that enables faster development cycles and allows the running of multiple clinical and research studies.

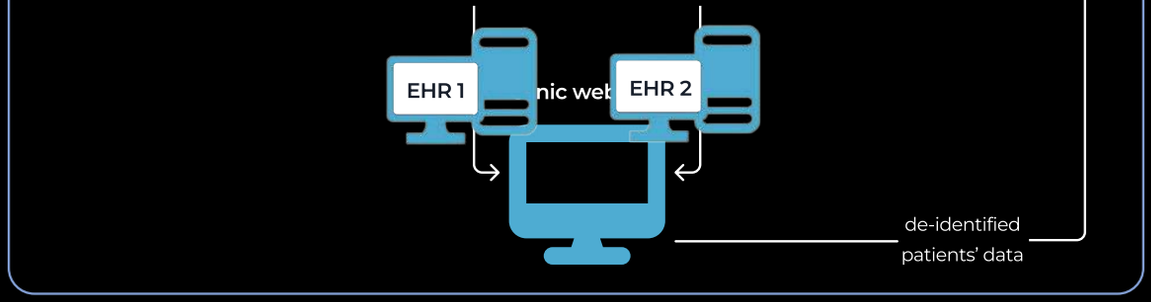
  The system has an **in-built OAuth2/OpenID Connect server**, providing the client with the possibility to hone PHI safety while leveraging ready-made SMART applications instead of building their own solutions from scratch.
- **Research Electronic Data Capture (REDCap)** with the module Clinical Data Interoperability Services (CDIS) as a tool for collecting data from EHRs. It's a standard for healthcare research programs that ensures top-level security of databases with Protected Health Information (PHI).

  CDIS module supports **batch data pulls** from the EHRs and internal CANet clinical studies, providing research centers with data processing speed that was beyond the reach before.

Instinctools' team was in charge of **VIRTUES® integration with REDCap and Smile** on the clients' way to building an all-encompassing healthcare ecosystem with adequate engagement of all the parties:

HL7® FHIR®





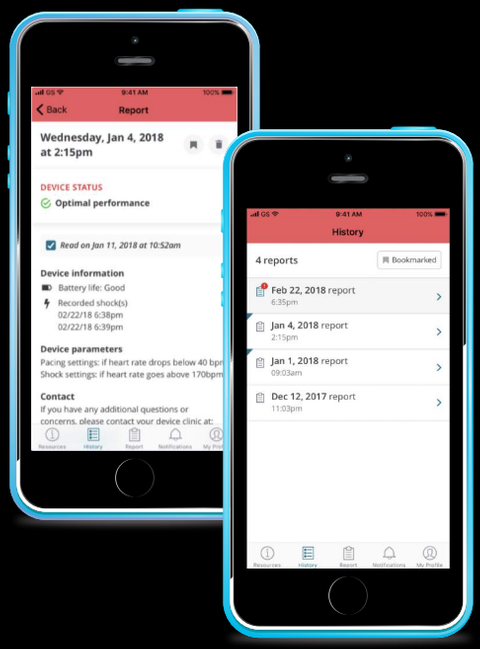

## 02 Mobile applications for patients' monitoring

VIRTUES® is targeted at **patients with an increased risk of sudden cardiac death (SCD)**. All the patients **have cardiac implantable electronic devices (CIED)** that require constant performance monitoring.

However, regular check-ups at the clinic are time-consuming and costly. Offering patients a **solid healthcare digital solution for remote self-monitoring** could have ensured high-level, affordable healthcare services for Canadians. This idea became the foundation for the patient-targeted iOS and Android apps developed by our dedicated team.

### Implantable cardioverter defibrillator (ICD) performance monitoring

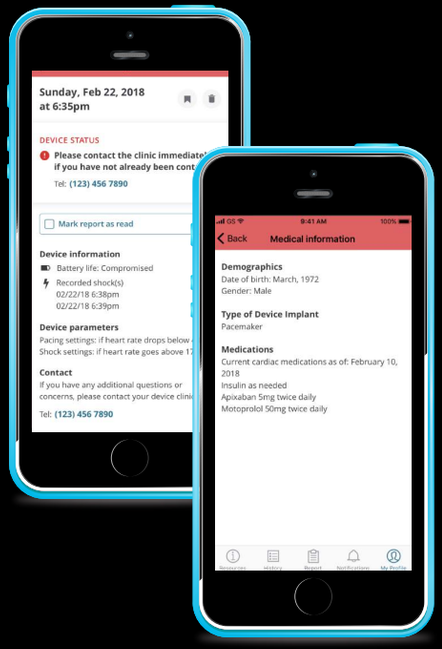
Aside from having Medrtonic's cardioverter defibrillators implanted in their body, patients are given a **specialized device reader to capture the data ICD produces**. Then, the Bluetooth-powered reader transfers data to the mobile and web apps.




To ensure patients were able to take agency over their own healthcare when communicating with their physician, we designed mobile app reports in an easy-to-understand way. They contain:

- Basic ICD information, such as current battery life, pacing and shock settings
- Timesheet of recorded shocks, if any where delivered to a patient

As all the trial patients belong to a high-risk group, we added a **notification function, enabling the patient to contact the clinic immediately,** especially if there are any issues with a person's ICD status. As the clinic receives the same report automatically, they are also able to get in touch with the patient without delay.




Our business analyst also suggested adding the category "Medications" to a section with medical information, so that users always have their **current prescriptions** on hand.

### Library with expert-directed materials about cardiac diseases

Additional patients' pain point VIRTUES® addresses is a lack of a credible and easy-to-access source of up-to-date information related to cardiac diseases. The mobile app has a library of educational materials in various formats — images, videos, PDFs — all verified by unbiased CANet experts.

## 03 Web app for clinics

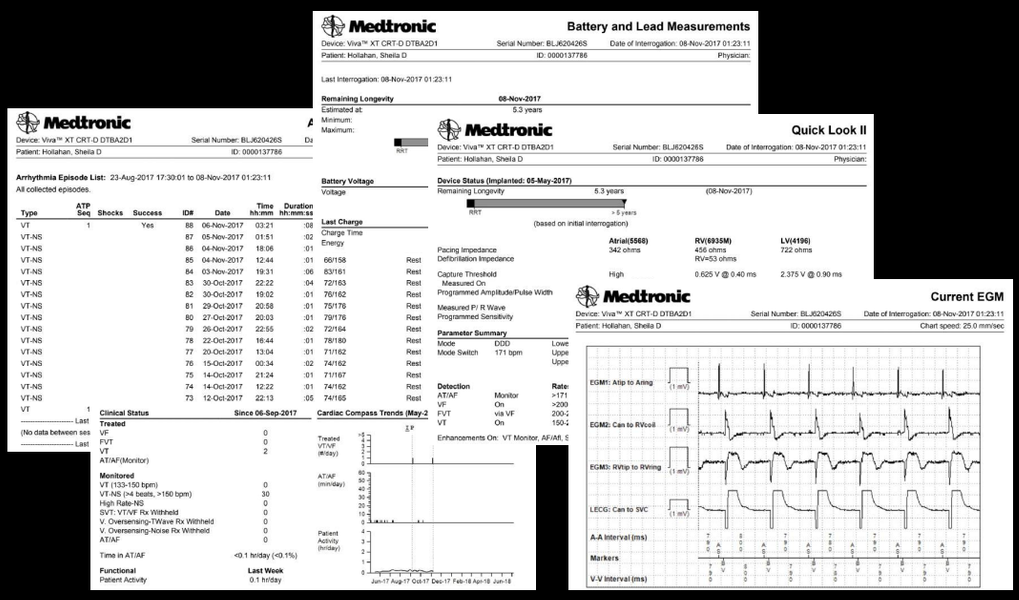
According to CANet, there are **over 97,000 cardiac patients** across Canada. Daily tracking of each individual's overall health status and ensuring their implants work hassle-free was **beyond the reach, given the 1,000+ emergency departments in Canada**. Therefore, they needed a **digital health solution** to ensure adequate care for all the patients.

VIRTUES® web app aimed to cover this gap. The pilot trial involved **1,400 patients across 15 clinical sites** throughout Canada.

As mentioned earlier, healthcare providers automatically receive reports about the patient's ICD status. They include:

- **Patient's personal data**, such as name and date of birth
- **ICD data**, such as its type and model, battery longevity, and patient-specific settings

Unlike summaries in patient-facing mobile apps, these reports are more detailed and contain **cardiograms recorded by the reading device**. Here are several examples:



Moreover, this data is coupled with the patient's **health information from the EMRs**, allowing for a broader picture of the individual's current health condition and enabling doctors to spot the problem areas faster.

On-field tests proved this digital solution is highly scalable. Before VIRTUES®, clinicians spent at least 45 minutes per patient for a standard intracardiac electrogram (EGM). Given the high number of patients, **cardiologists across the 15 trial clinics had a 57-hour workweek on average**.

With the VIRTUES® web app, they don't have to invest their time in the EGM procedure, as data is recorded remotely and automatically. All the doctors need to do is interpret the EGM results and contact the patient in case of abnormal patterns. The **digital platform made it possible to relieve healthcare professionals of excessive workload**.

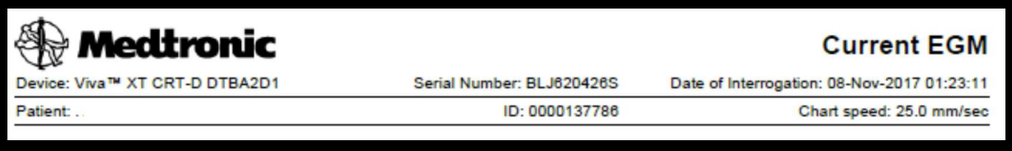
Now, **one cardiologist can easily manage 25+ remote patients daily** without compromising the healthcare quality, while earlier, the maximum per doctor was seven high-risk individuals.

## 04 Web application for research centers

As the ongoing research of cardiac diseases helps to hone overall healthcare, CANet invested efforts into developing a solution for the research centers (RC) within the VIRTUES® platform.

Instinctools' team created a web application that receives the data from the patients' app and EMRs' records and transforms this information into reports for research purposes.

RCs get **de-identified files**, where patients only have study IDs. Here's an example of an anonymized report header:




Cardiovascular reports include:

- Patient's date of birth and study ID.
- Individual's type of heart disease, CABG, NYHA class, etc.
- Information about their current cardiac medication, recent cardiovascular investigations, and hospitalizations.

Paired with data from the other studies conducted by the CANet association, this information has become the **backbone of this leading-edge cardiac research in Canada**.

## Before

- Patients, clinics, and research centers are separate entities of the healthcare system
- Inability of the healthcare providers to ensure all the patients get timely and more accessible medical care
- Patients with ICDs have to visit clinics for monthly check-ups
- Scarcity of expert educational materials for patients
- Cardiologists suffer from excessive workload
- Lack of a constant source of relevant data about cardiac patients

## After

- Consistent communication between patients and healthcare providers
- User-friendly platform for remote patient self-monitoring
- Patients need to visit their healthcare provider only when unusual patterns are spotted instead of regular monthly check-ups
- Scientifically credible educational materials about cardiac diseases at the patients' fingertips
- Precautionary approach to managing health status of high-risk cardiac patients
- Decreased workload
- Ever-flowing stream of research-valuable data to the RCs

## Business value

- Remote patient monitoring capabilities for the patients and healthcare providers
- Decrease in the amount of cardiac-related emergency hospitalizations by **21%** thanks to a precautionary approach to health management
- The number of mandatory in-clinic visits reduced by **78%**
- Cardiologists' working week has been shortened **from 57 to 42 hours**
- Increase in the number of patients a cardiologist manages daily **from 7 to 25+** thanks to remote monitoring

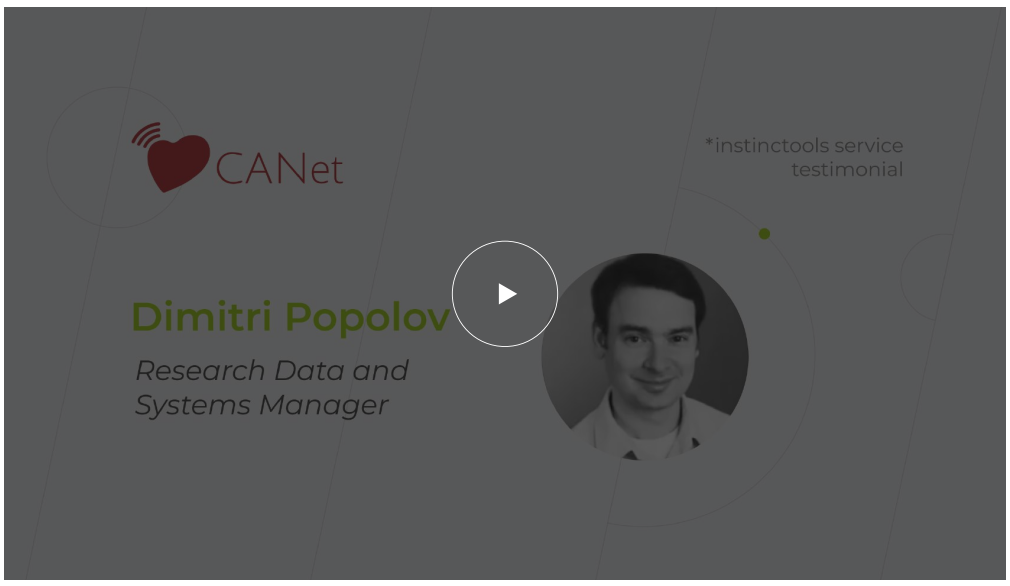
## Client's testimonial

**Hear about the project's result directly from our client:**

*"When the partner is good, things are just getting done. And that was the case with *instinctools. I liked that they were active in learning new things, in suggesting better solutions, like "we can do it like this, or we can do it like that". The first project has been very successful, very good value for money, so we have requests for more."*

**Dimitri Popolov**

Research Data & Systems Manager, CANet

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