Cloud Architecture Proposal for Canadian Blood Services

Purpose

This document is a proposal to replace the outdated database system of Canadian Blood Services with a contemporary cloud-based design. The project is motivated by the need to overcome the shortcomings of the current system and take use of cloud computing's advantages, which include increased security, scalability, and disaster recovery.

Objectives

The principal aim is to shift the current RDBMS to a cloud platform, namely Microsoft Azure, in order to attain:

- Enhanced scalability to manage fluctuations in load.
- Enhanced capacities for catastrophe recovery.
- Tightened security protocols to safeguard private information.

Existing Database System

A range of crucial datasets essential to Canadian Blood Services' operations are handled via an on-premises Relational Database Management System (RDBMS). The following are the main elements of the current database system:

Details of Blood Donors	Detailed donor information for monitoring donor history, organizing gift files, and preserving donor contact details for upcoming interactions and alerts.
Blood Inventory	Thorough inventory management to guarantee blood supply safety and availability.
Patients Database	To make it easier to match blood products to recipients, please provide your medical history or other relevant patient data.

Data availability and integrity are given top priority in the current system, which is essential for the healthcare industry. However, this on-premises RDBMS comes with a number of drawbacks:

Problem Statements:

Limited Data Visibility: Real-time visibility is hampered by the current configuration of disjointed systems. This restriction can make it more difficult to efficiently track the availability and distribution of blood across several locations and may delay the timely delivery of blood products to clinics and hospitals.

Scalability Issues: The on-premises infrastructure is not best suited to manage demand variations that occur on a regular basis. Because of this, it finds it difficult to adjust to unanticipated spikes in the demand for blood products or blood donor registrations, which can cause bottlenecks and inefficiencies in the provision of services.

Disaster Vulnerability: In the event of a disaster, there is a higher chance of data loss and service interruptions due to the reliance on localized data storage. In the absence of strong disaster recovery plans, vital information may be lost or stolen, which would have a serious negative effect on business operations and the capacity to save lives.

Vision

The goal is to combine key systems into a single cloud platform, including patient information, inventory management, and appointment scheduling for hospitals and clinics. Azure-hosted advanced analytics, geolocation services, and a strong warning and notification system will all support this connection. A graphic illustrating the project's vision is shown below.

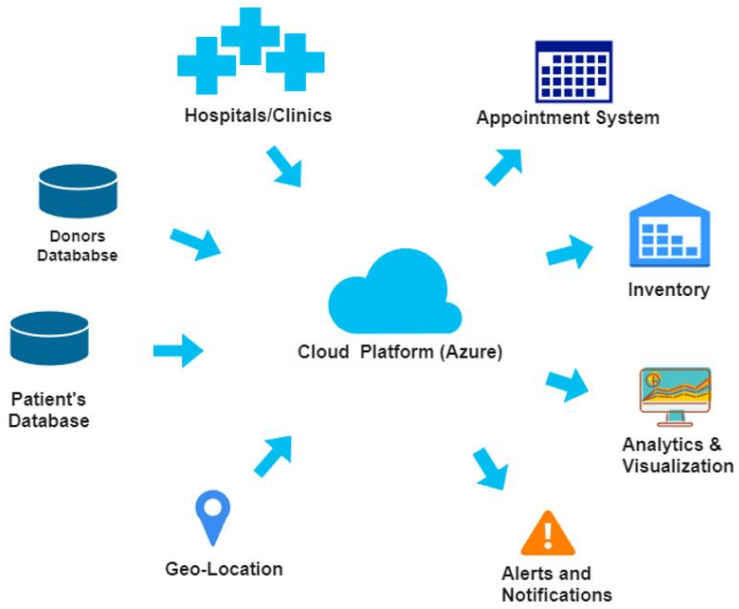

Figure 1: Vision Diagram

Proposed Architecture

Below is the proposed cloud architecture which will utilize Azure services to create a robust and scalable system:

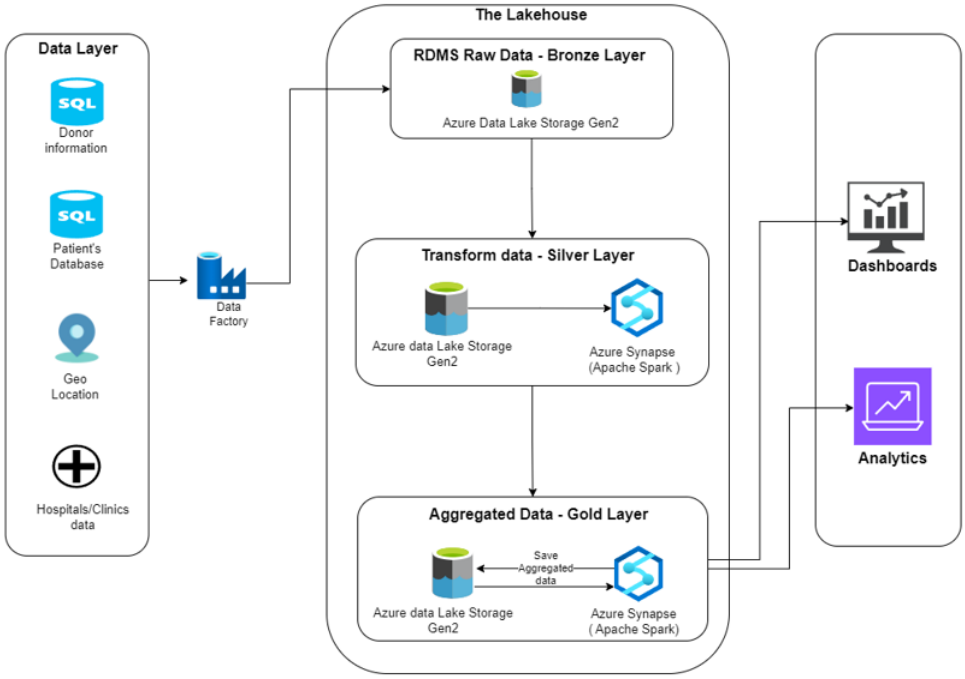

Figure 2: Proposed Cloud Architecture

Using Azure Data Lake Storage and Azure Synapse Analytics (Apache Spark), the architecture will be built around a Lakehouse Data Layer, with Bronze, Silver, and Gold levels to manage raw, converted, and aggregated data, respectively. Three separate zones make up the structure of this layer:

Bronze Layer: The first layer in Azure Data Lake Storage is where raw data from databases belonging to hospitals, patients, donors, and geolocation sources lands. Azure Data Factory will be used to ingest the raw data in batches.

Silver Layer: To refine and organize the data for additional analysis, it will be transformed in this layer using Azure Synapse Analytics (Apache Spark).

Gold Layer: Here is where the most processed and compiled data is kept, ready for end-user applications to use and ana to produce insights.

Data Pipeline Design

Below diagram illustrates the pipeline design utilizing parent-child approach:

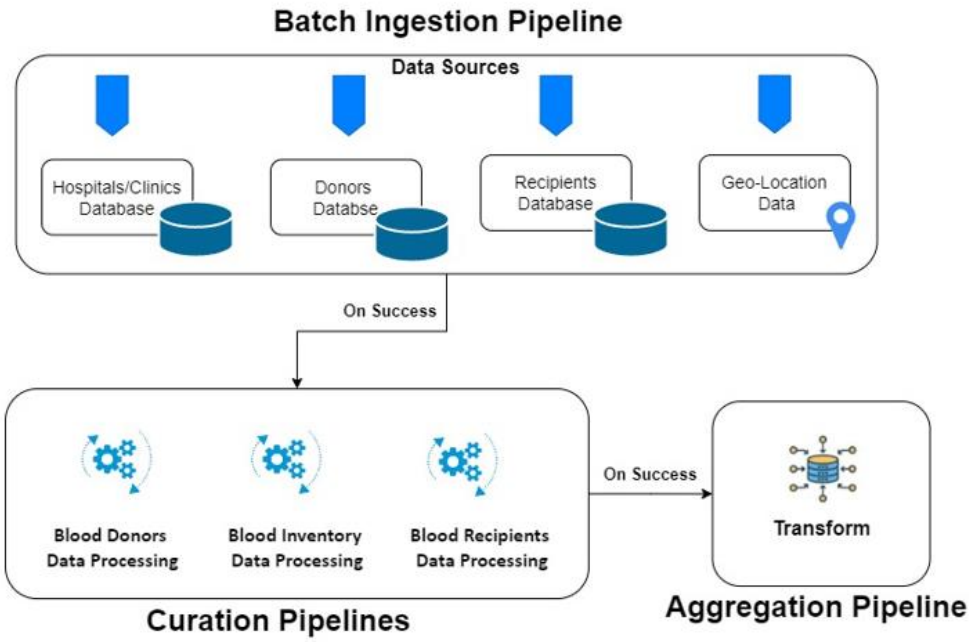

Figure 3: Pipeline design

Deployment & Data access

An API app that shows important blood bank metrics, like blood type availability by region, will be used by end users to obtain the final data.

Safety

The architecture will include the two tools listed below to guarantee safe data access:

1. Role-Based Access Control (RBAC): this system will control who is able to access particular data.
2. API Authentication: Azure Active Directory (AAD) provides security to guarantee that the API application is only accessible by authorized users.

Constraints

The recommended cloud architecture has many benefits, but it's vital to be aware of any possible disadvantages that can arise during the deployment phase. These constraints include things like organizational change management requirements, resource limitations, and technical challenges.

Ensuring the successful implementation of the proposed transformation will depend on taking proactive measures to address these restrictions.

Future Scope

The proposed cloud architecture transition has a wider future scope beyond its initial implementation. It entails ongoing development, expansion, and adaptation to fresh technology and market trends. This potential scope demonstrates Canadian Blood Services' commitment to using data as a key asset in its quest of operational excellence and continuous service improvement.

This proposal serves as a comprehensive road map for Canadian Blood Services' endeavor to leverage cloud computing and update its data architecture in order to adjust to the evolving needs of its company. By placing scalability, performance, and security first, Canadian Blood Services is laying the foundation for a data infrastructure that is ready for the future and compatible with its purpose of innovation and service excellence.

Conclusion

In summary, Canadian Blood Services intends to address the limitations of its present database system by utilizing the scalability, enhanced security, and disaster recovery capabilities of a cloud platform. While the key objectives of the data pipeline design and deployment strategy are efficiency, resource conservation, and reliable deployments, scalability, security, and efficiency are highlighted in the vision of the suggested architecture. The proposed architecture, as it is presented in the presentation, provides Canadian Blood Services with a compelling approach for updating its data infrastructure. It resolves scalability, performance, and security concerns and establishes the foundation for future growth and innovation.