

ELECTRONIC BIRTH REGISTRATION
DESIGN DOCUMENT

Version ***1.2***

05/11/2014

Version History

Version Number	Implemented By	Revision Date	Approved By	Approval Date	Description of Change
1.0	C. Kachaje (Baobab Health Trust)	15/07/2014			Initial design.
1.1	C. Kachaje (Baobab Health Trust)	13/10/2014			Incorporated changes suggested by NRB after review of initial design document.
1.2	C. Kachaje (Baobab Health Trust)	05/11/2014			Incorporated changes suggested at joint meeting with NRB, MoH, CDC and Baobab Health representatives.

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1 INTRODUCTION

1.1 PURPOSE OF THE DESIGN SPECIFICATION DOCUMENT

This Design Document seeks to provide a way of documenting an Electronic Birth Registration System(eBRS) that is to be developed for the National Registration Bureau and Ministry of Health by Baobab Health Trust and e-Government on behalf of the Malawi Government with financial support from Centers for Disease Control and Prevention(CDC). eBRS will be a tool that will be used to track births in Malawi as well as provide a way to print birth certificates for babies born in Malawi. The document will also provide a way to track any change requests that may become necessary from time to time in the course of developing the system in a controlled manner.

2 GENERAL OVERVIEW AND DESIGN GUIDELINES/APPROACH

This section will describe the principles and strategies that are going to be used as guidelines when designing and implementing the Electronic Birth Registration System being proposed.

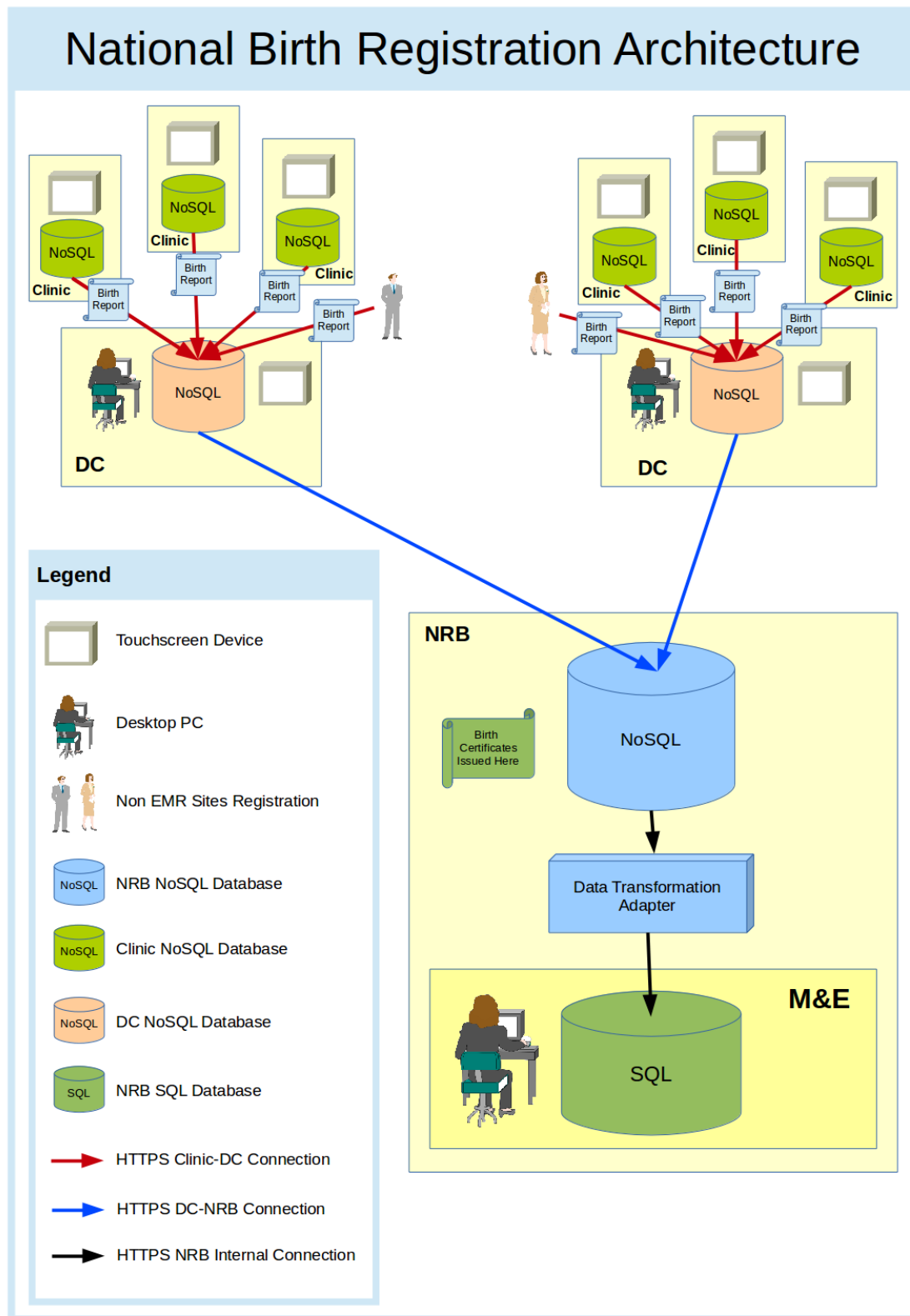
2.1 ASSUMPTIONS / CONSTRAINTS / STANDARDS

The following constraints and assumptions were made in coming up with the requirements for the system:

- a) In this phase of the project, only live births are to be registered in the system.
- b) The system will not capture still-births or any deaths that may occur after a baby has been registered. It is assumed that a link to deaths will be done later through an external system that will be responsible for capturing deaths.
- c) The system is expected to be able to communicate with other external authorized applications that may need to do so from time to time. For cases where there are no such systems, a standalone version of the birth recording component of the system will be provided.
- d) All data is expected to be pushed to the main central office repository within at least a period of less than a week after being captured in any remote client application instance.
- e) Each remote application site location is expected to be able to only access records that belong to that particular site regardless of whether the data is accessed through a standalone instance or the data is accessed through a remote web-based service.
- f) Data that is captured is expected to be encrypted when being stored such that unless it is transformed, it should not be usable outside the application that will be used to generate it.
- g) Access to data is expected to be controlled by levels of privileges with some roles not being allowed to access data that is above their clearance level.

- h) There should be as little as possible data that is kept locally at sites. Periodically, any data that has been processed should be archived and be only accessible from the central repository after archiving.
- i) Each baby is expected to be recorded only once in the system.
- j) The system is expected to be able to support multiple types of user devices.
- k) The system is expected to be able to share data with Ministry of Health in aggregated form.

3 ARCHITECTURE DESIGN



The system is expected to be able to register babies that have just been born alive at health facilities where electronic systems exist that have been linked to applications that will be running at District Commissioners' (DC) offices at the district headquarters of each given district. In such systems, data will be captured alongside regular data capturing that already take place in the facilities to capitalize on the existing human resource at the health facilities in carrying out the registration exercise. This may in turn require capturing of other additional parameters that would normally not be relevant in the national registration exercise. These additional parameters will mainly be used locally at the sites where they are captured and will be ignored at national level in carrying out standard analyses as they will only cover a fraction of the data captured.

For some health facilities where there are no supported electronic medical systems, a standalone component of eBRS will be provided to capture and encrypt data.

Data captured at the health facilities will then be transferred electronically to the application that will be running at the District Commissioner's office.

For cases where data originates from health facilities that do not have electronic systems or standalone eBRS components, as well as data for cases of babies born outside health facilities, the data will be captured at the DC's office.

As little data as is practical is expected to be kept at the DC's offices for as long as it has not been processed after which it will be expected to be archived with permanent copies kept at the central repository. Data at the DC's offices will also be pushed to the main central repository as soon as connectivity is available while striving to submit any collected data not later than 7 days of capture. However, DC's offices will still be able to have access to data relevant to their districts remotely from the NRB central repository when the data is archived.

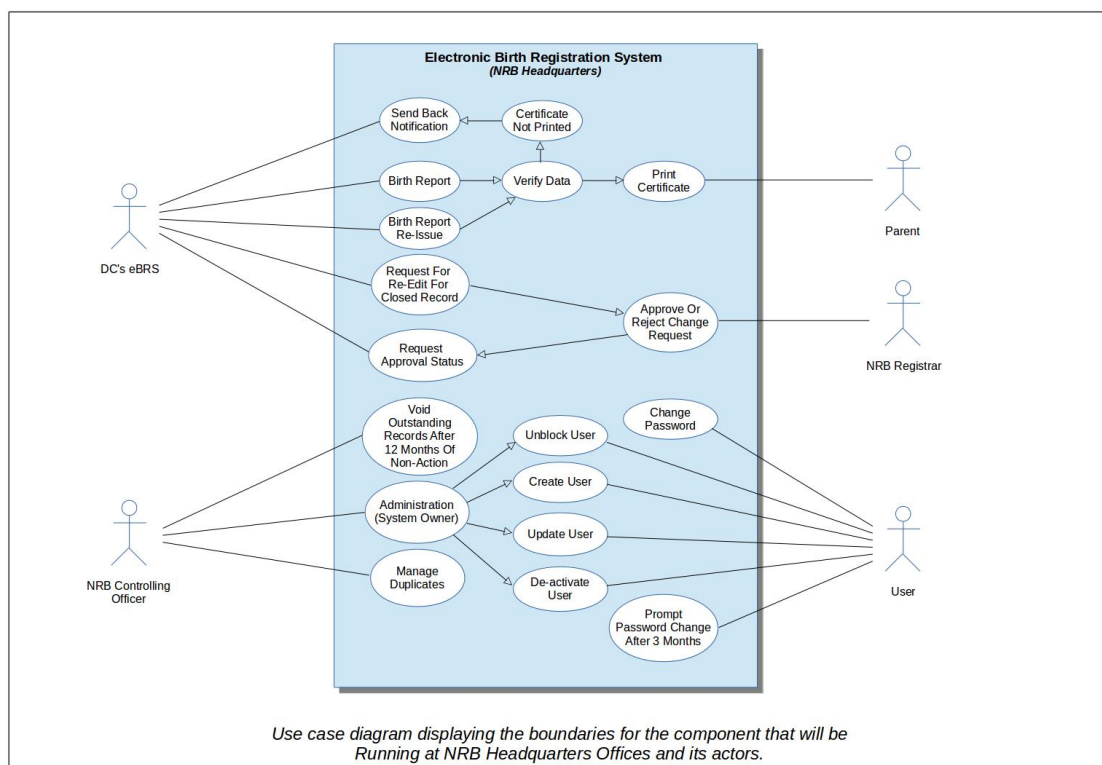
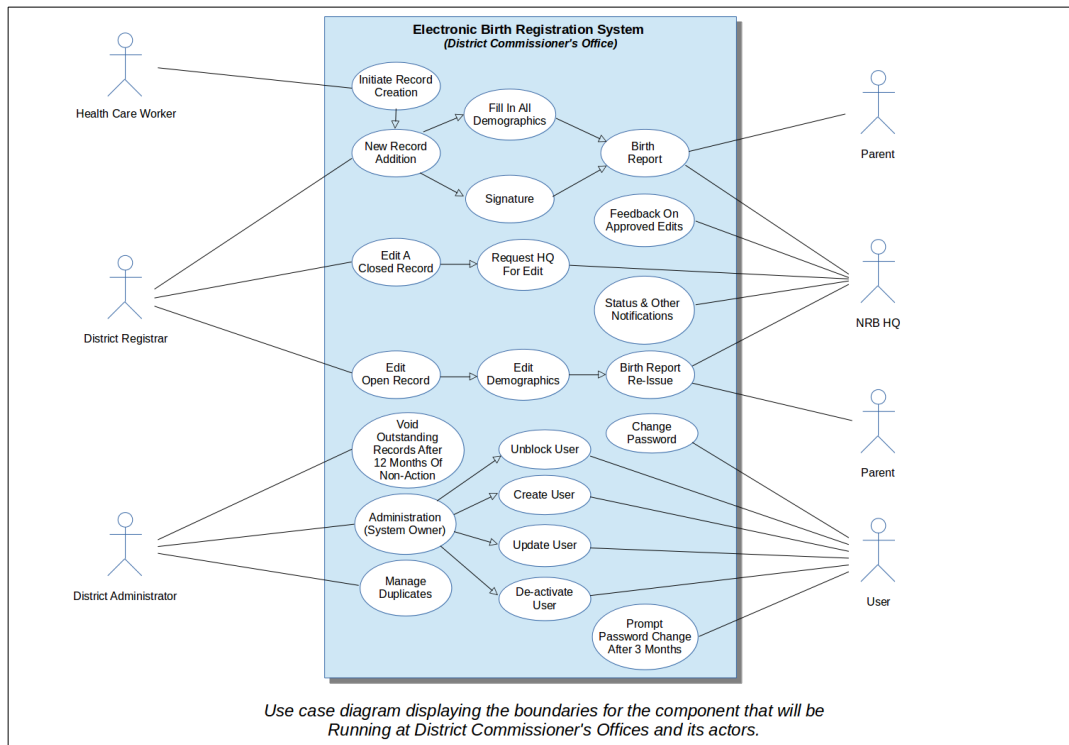
The national repository is expected to keep a permanent copy of all data captured from all districts.

All sites are expected to run NoSQL (CouchDB) databases which are optimized for fast data retrieval and syncing. The main database at the central office will also be a NoSQL database. A data transformation interface will be created to transform the data captured in the NoSQL database to an SQL (MySQL) database format incrementally to allow for easier querying off-line for further data analysis as well as printing of birth certificates. Birth certificates will only be printed at the NRB headquarters office.

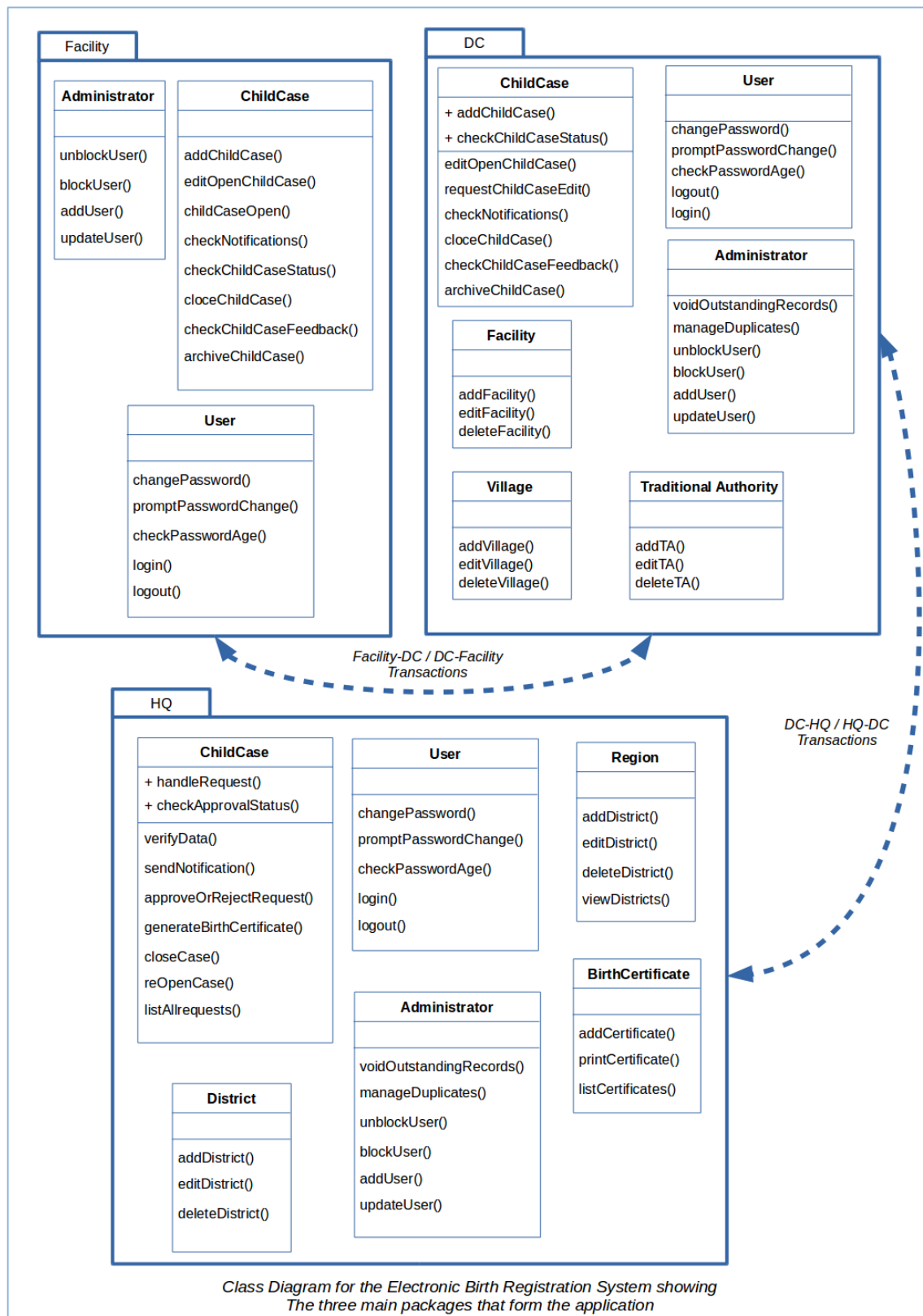
Data is expected to be backed-up continuously to an off-site backup repository at the main central repository.

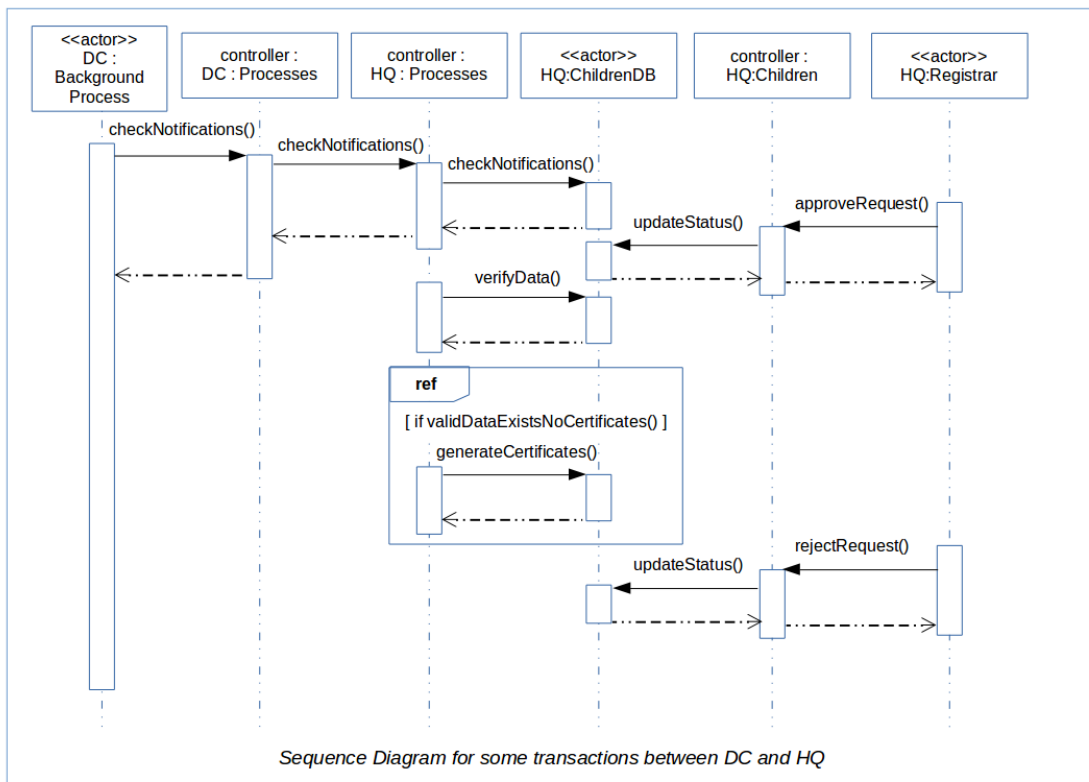
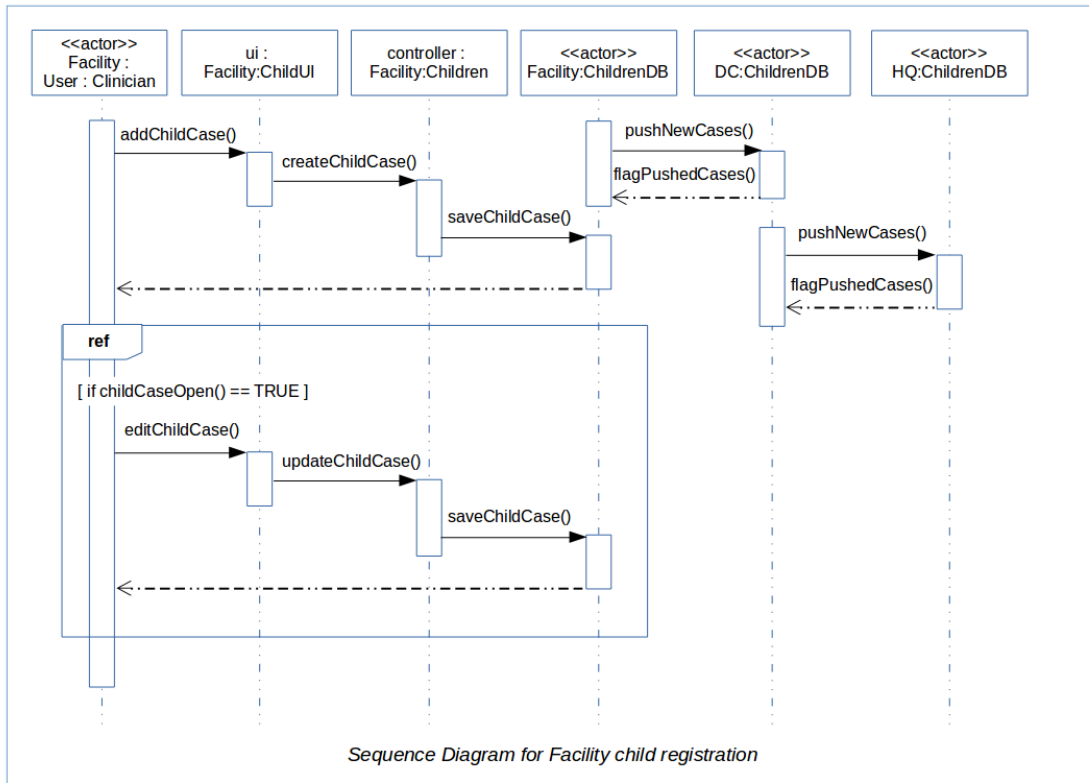
3.1 LOGICAL VIEW

3.1.1 USE CASE DIAGRAMS

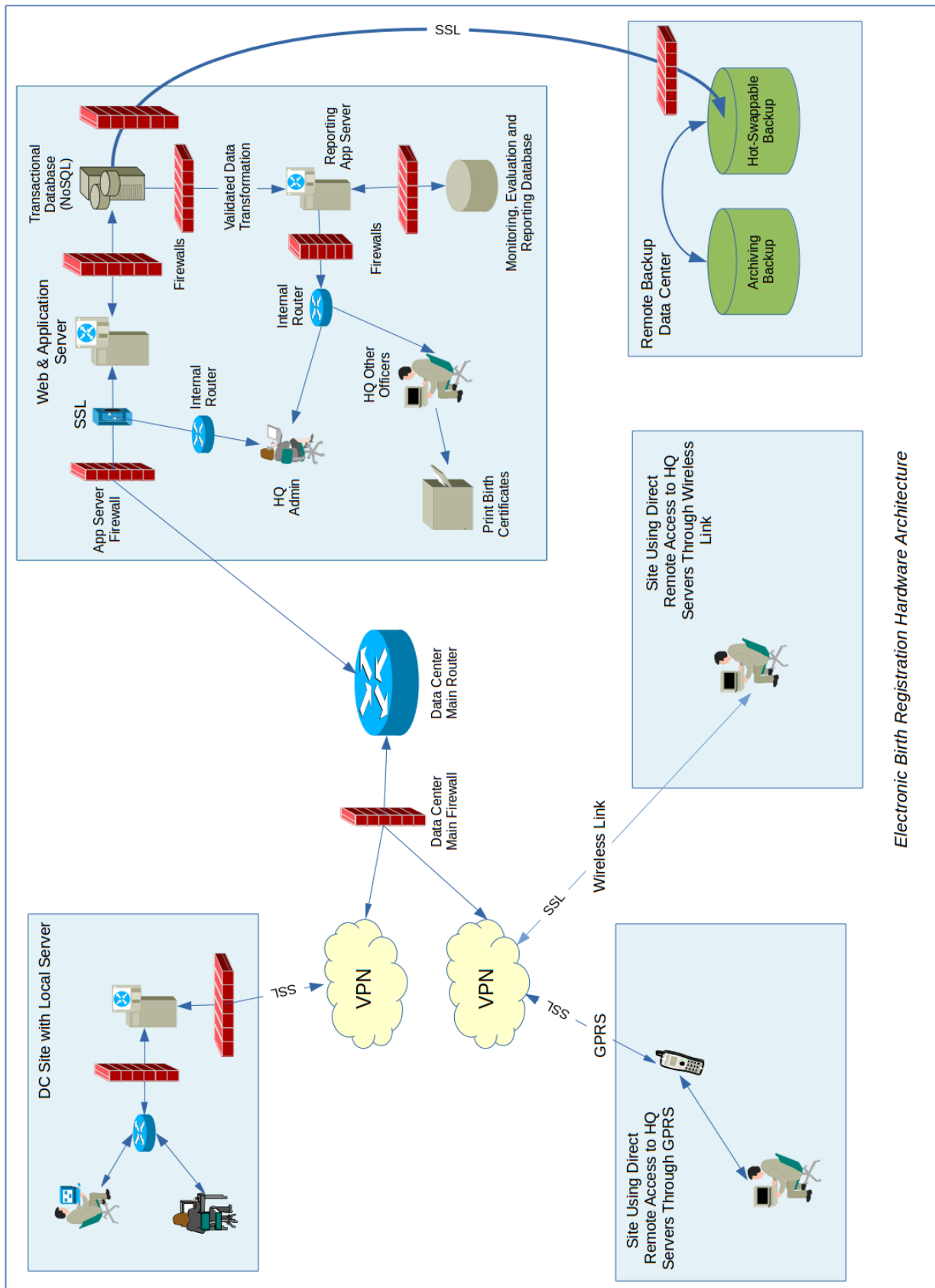


3.1.2 CLASS AND SEQUENCE DIAGRAMS



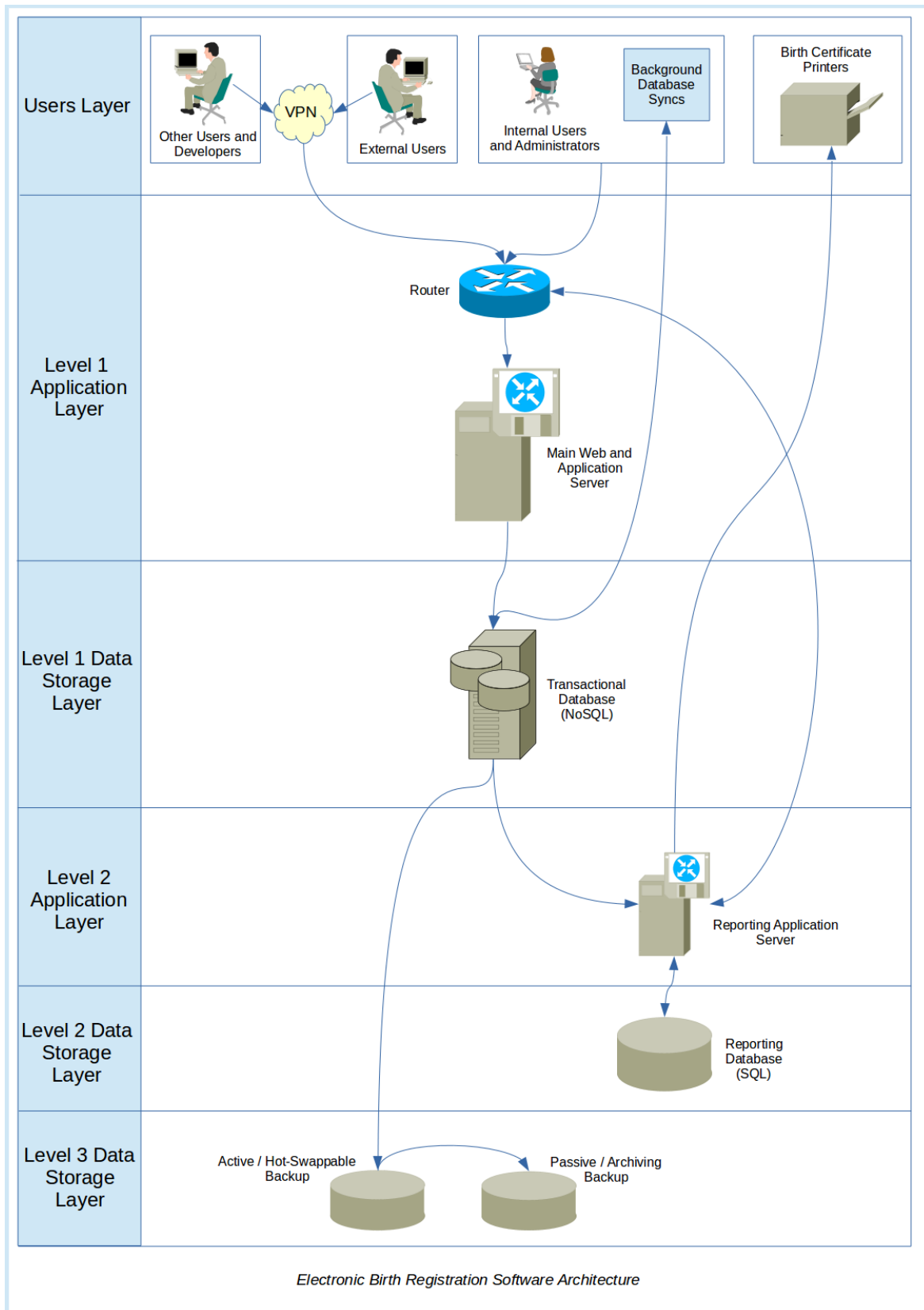


3.2 HARDWARE ARCHITECTURE

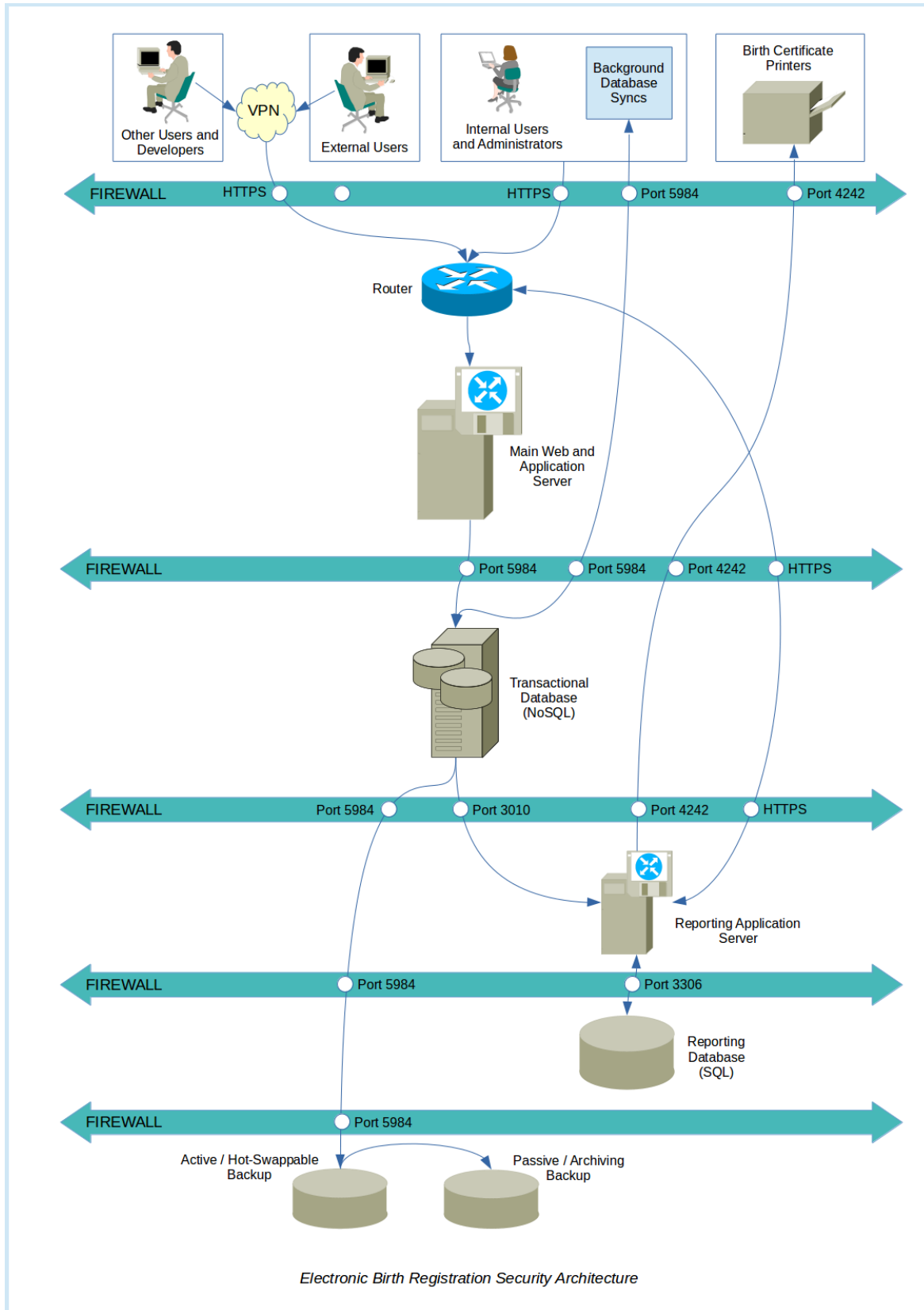


Electronic Birth Registration Hardware Architecture

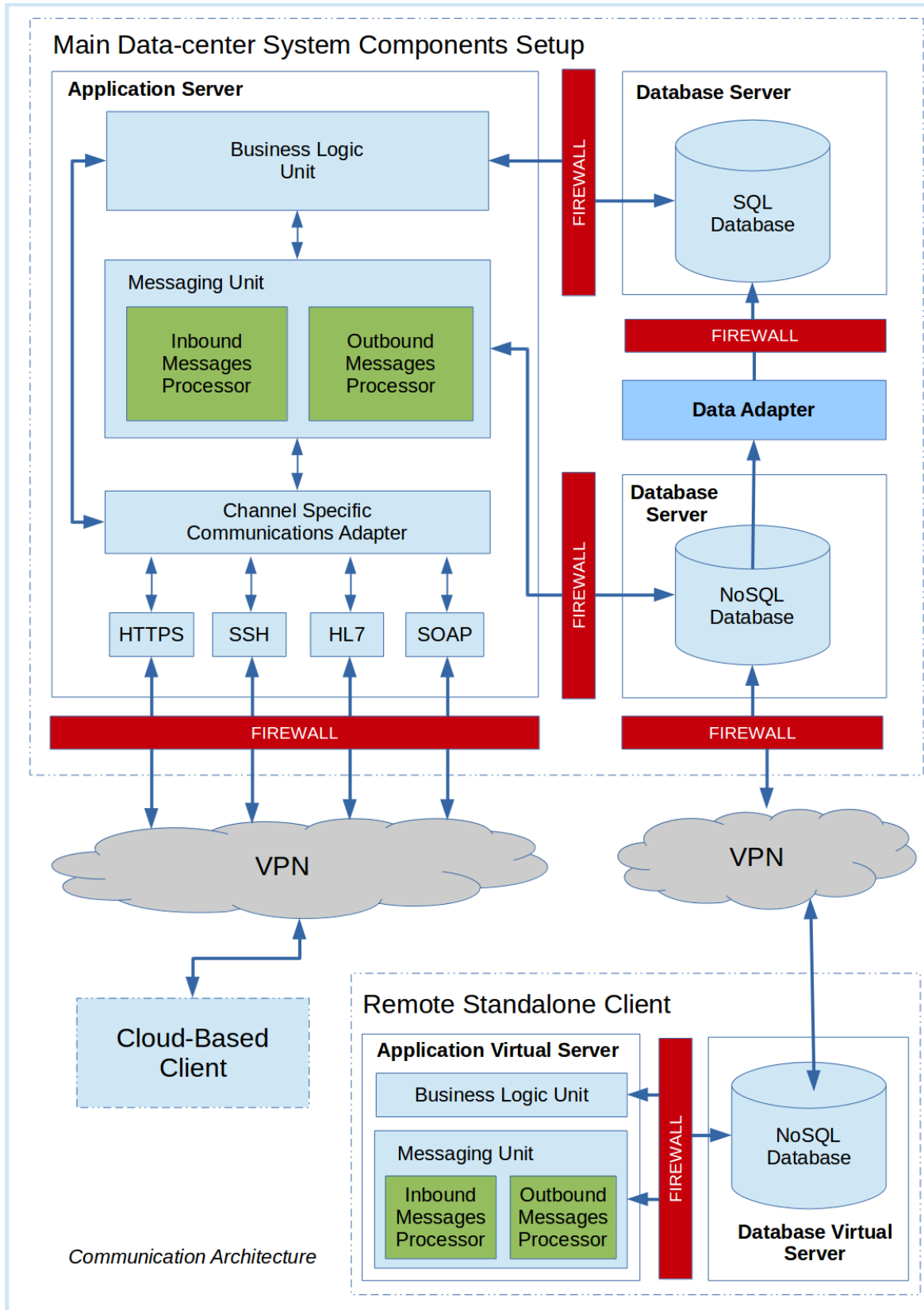
3.3 SOFTWARE ARCHITECTURE



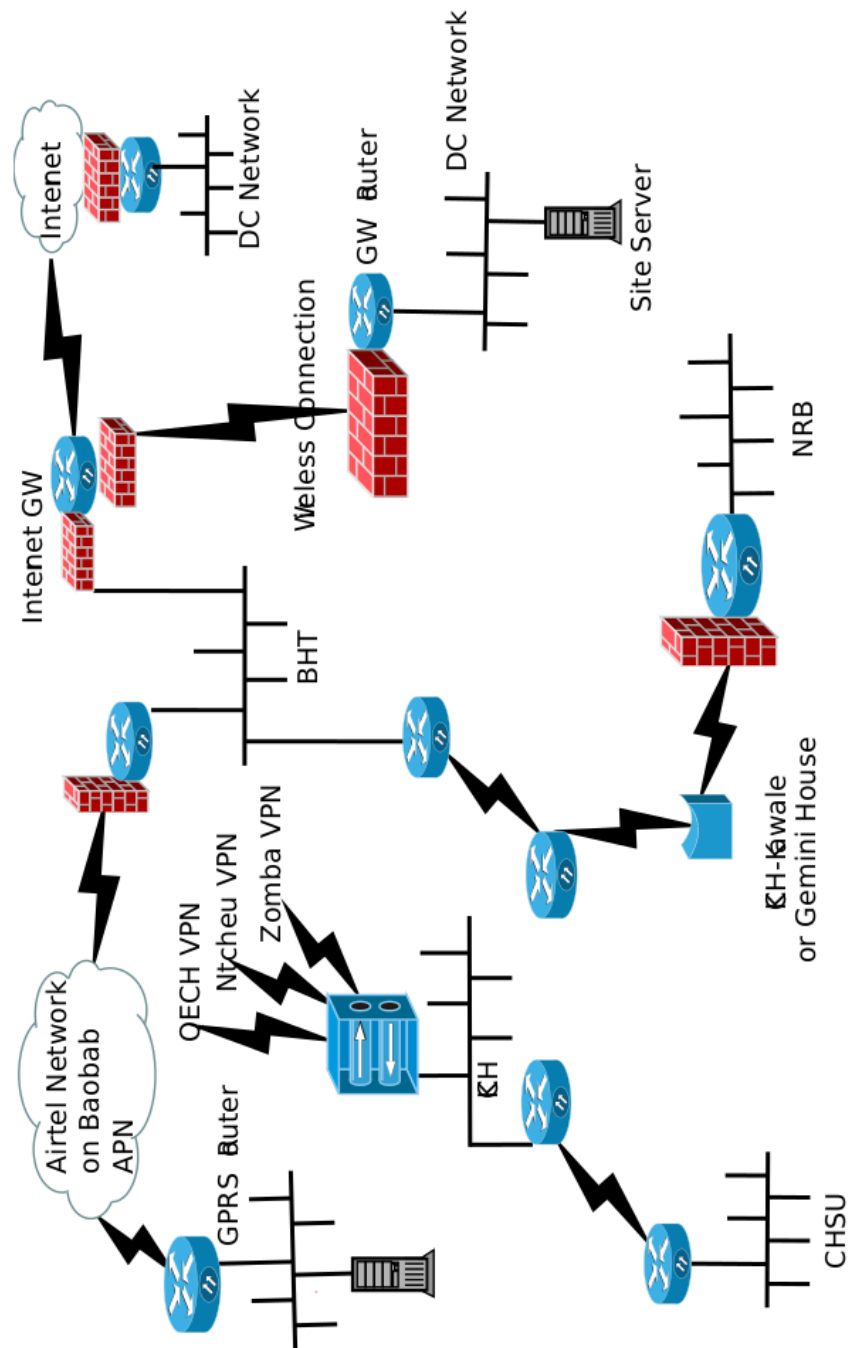
3.4 SECURITY ARCHITECTURE



3.5 COMMUNICATION ARCHITECTURE



3.6 NETWORK CONNECTIVITY DIAGRAM



3.7 PERFORMANCE

System Checklist	Measure
Estimated Total Number of Concurrent Clients	Up to 2 million+ users
Production Hours of Operation	Normal Business Hours – 08:00 to 17:00 Extended Business Hours – 24 X 7
Production Availability Expectations	Uptime => Downtime/year (i.e. unplanned) 99 (2 Nines) => 003d 15h 36m 00s
Application Backup Requirements	Full Backup: <ul style="list-style-type: none"> • Real time to less than 7days depending on connection health •
Application Recovery Requirements	Recovery Time Objective: <ul style="list-style-type: none"> • On average less than 2 hours
Disaster Recovery Requirements	Recovery Time Objective: <ul style="list-style-type: none"> • Hot Site: Less than 2 hours • Warm Site: Less than 3 days • Cold Site: Less than 2 weeks

4 SYSTEM DESIGN

4.1 BUSINESS REQUIREMENTS

Refer to Business Capabilities and Functionality attachment.

4.2 DATABASE DESIGN

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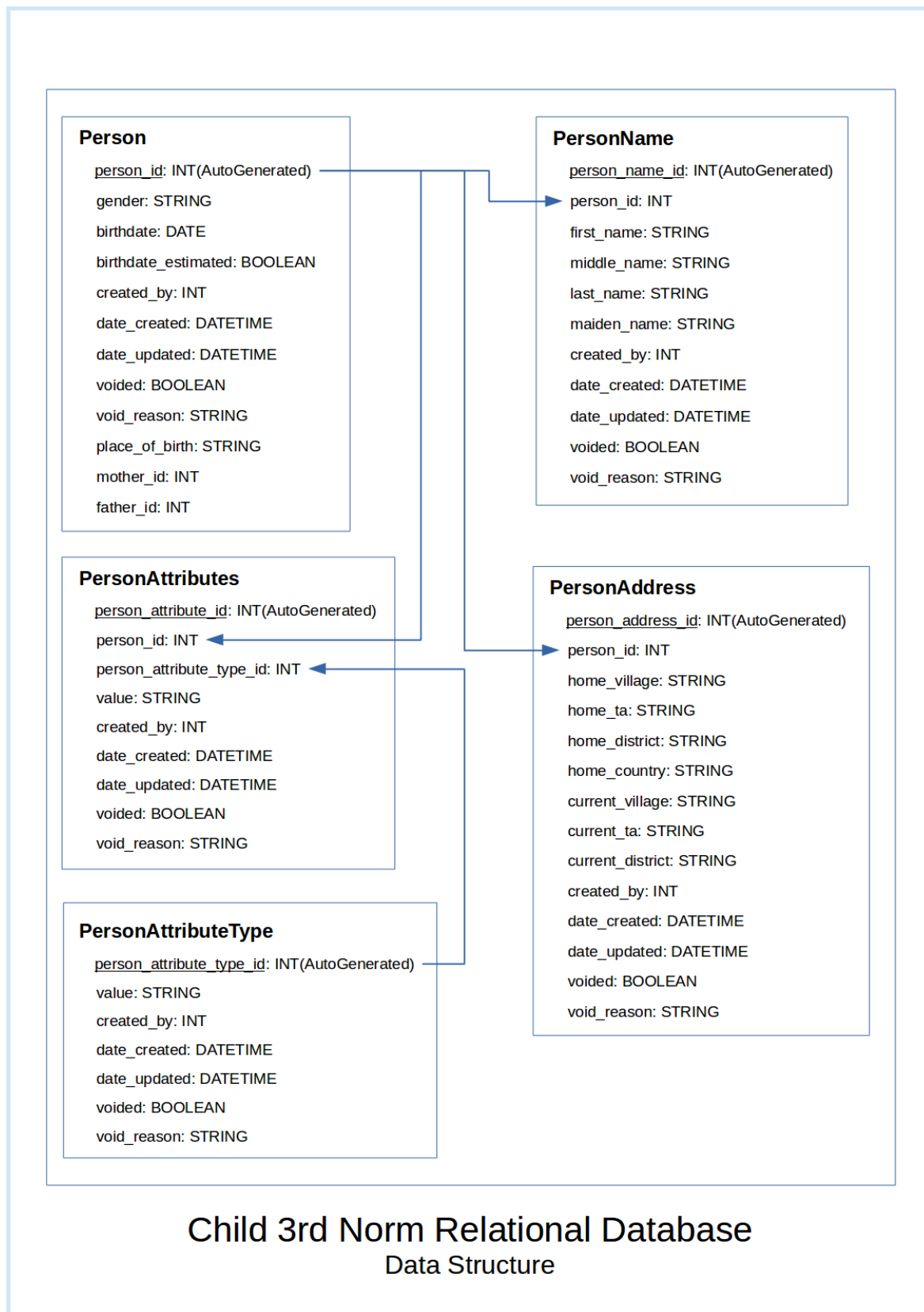
{
  person_id: UUID(Auto-generated),
  first_name: STRING,
  middle_name: STRING,
  last_name: STRING,
  gender: STRING,
  birthdate: DATE,
  birthdate_estimated: BOOLEAN,
  place_of_birth: STRING,
  created_by: STRING,
  date_created: DATETIME,
  record_status: STRING,
  certificate_issued: BOOLEAN,
  date_certificate_issued: DATETIME,

  mother: {
    person_id: UUID,
    first_name: STRING,
    middle_name: STRING,
    last_name: STRING,
    gender: STRING,
    birthdate: DATE,
    birthdate_estimated: BOOLEAN,
    place_of_birth: STRING,
    home_village: STRING,
    home_ta: STRING,
    home_district: STRING,
    home_country: STRING,
    citizenship: STRING
  },

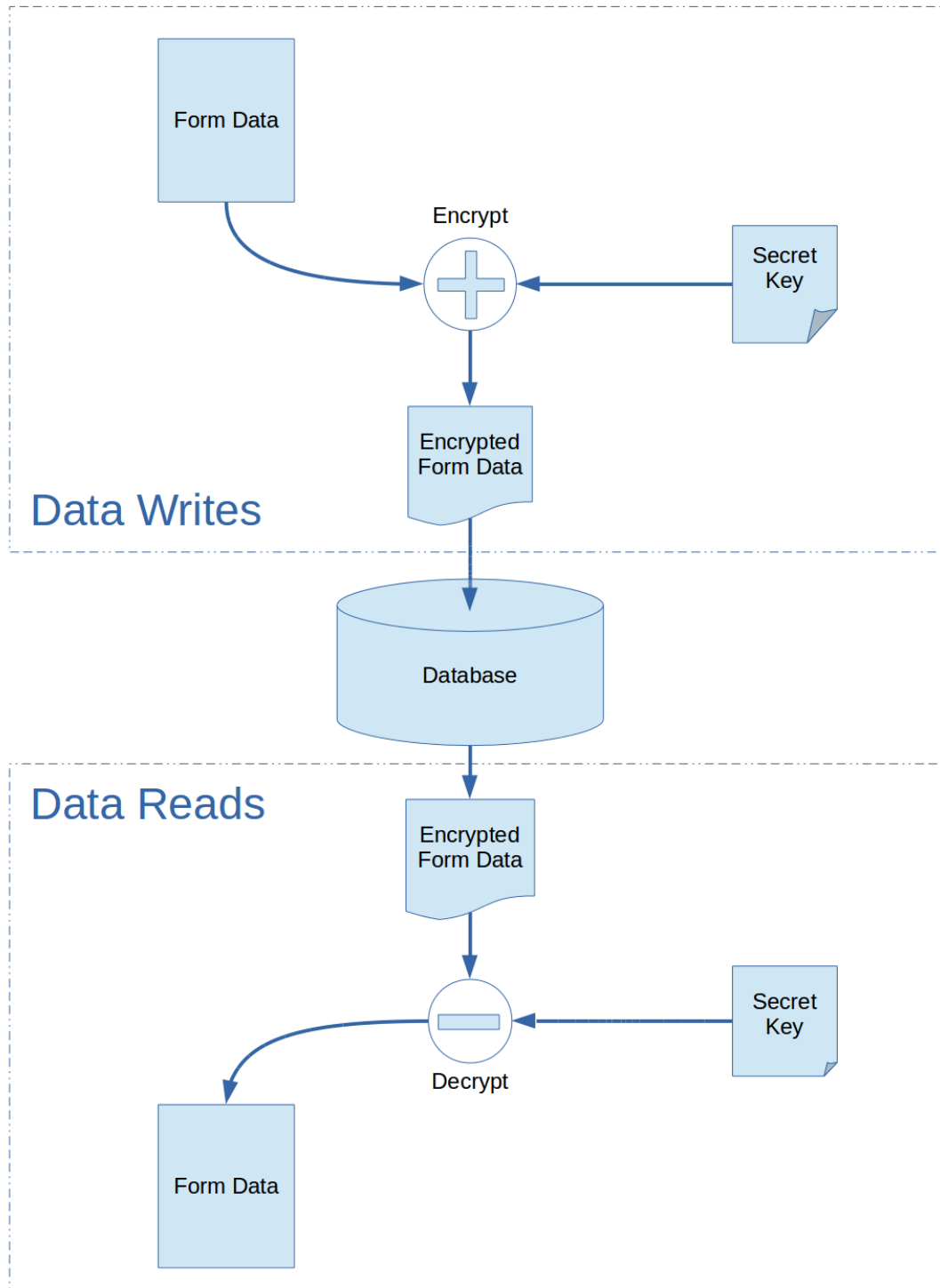
  father: {
    person_id: UUID,
    first_name: STRING,
    middle_name: STRING,
    last_name: STRING,
    gender: STRING,
    birthdate: DATE,
    birthdate_estimated: BOOLEAN,
    place_of_birth: STRING,
    home_village: STRING,
    home_ta: STRING,
    home_district: STRING,
    home_country: STRING,
    citizenship: STRING
  }
}

```

Child NoSQL Document Format Data Structure



4.3 DATA CONVERSION



Data Conversion Design

4.4 APPLICATION PROGRAM INTERFACES

API Standard/Protocol	Description	Version
HL7	Health Level 7: For easier integration with Clinical systems if it becomes necessary. Focuses on the “application layer” which is “level 7” of the Open Systems Interconnection (OSI) model. It will be the primary API interfacing standard for communication with external applications.	2.x
SOAP	Simple Object Access Protocol: To be used as a fall-back protocol in cases where HL7 may not be possible to use.	1.2

4.5 USER INTERFACE DESIGN

Refer to the Application Storyboard Attachment.

Appendix A: Design Specification Approval

The undersigned acknowledge that they have reviewed the **Electronic Birth Registration System Design Specification** and agree with the information presented within this document. Changes to this **Design Specification** will be coordinated with, and approved by, the undersigned, or their designated representatives.

Signature: _____ Date: _____
Print Name: _____
Title: _____
Role: _____

Signature: _____ Date: _____
Print Name: _____
Title: _____
Role: _____

Signature: _____ Date: _____
Print Name: _____
Title: _____
Role: _____

APPENDIX B: REFERENCES

The following table summarizes the documents referenced in this document.

Document Name	Description	Location
Business Capabilities and Functionality		

APPENDIX C: KEY TERMS

The following table provides definitions and explanations for terms and acronyms relevant to the content presented within this document.

Term	Definition
eBRS	Electronic Birth Registration System
SSH	Secure Shell
SSL	Secure Socket Layer
HL7	Health Level 7
SOAP	Simple Object Access Protocol
VPN	Virtual Private Network
Firewall	A part of a computer system or network that is designed to block unauthorized access while permitting outward communication.
SQL	Simple Query Language for interacting with Relational Databases
NoSQL	An umbrella term for a loosely defined class of non-relational data stores that break with a long history of relational databases and ACID guarantees. Data stores that fall under this term may not require fixed table schemas, and usually avoid join operations. The term was first popularised in early 2009.
DC	District Commissioner
HQ	Headquarters
M&E	Monitoring and evaluation
NRB	National Registration Bureau
EMR	Electronic Medical Record

APPENDIX D: STANDARDS TO BE USED

Standard	Type
License	Open-source (GNU Lesser General Public License - Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA)
Databases	CouchDB – http://couchdb.apache.org MySQL – http://www.mysql.com
Data transmission	Hypertext Transfer Protocol Secure (HTTPS) Secure Shell (SSH)
Data exchange protocols	Health Level 7(HL7) – http://www.hl7.org Simple Object Access protocol (SOAP 1.2) - http://www.w3.org/TR/soap/
Software architectural pattern	Model-view-controller(MVC)
Web application framework	Ruby-on-Rails - http://rubyonrails.org/