# Leeds Patient Oriented IT Benefit Evaluation Project

## Endeavour Data Service - High Level Design

# Document Management

## Revision History

| Version | Date | Summary of Changes |
|---------|------|--------------------|
| 1.0 (Draft) | 28 Sept 2015 | Draft version for internal comment. |
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## Reviewers

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| Endeavour Health Development Team | | | 1.0 (Draft) |
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## Glossary of Terms

| Term | Acronym | Definition |
|---|---|---|
| Care Management System | | IT system supporting the direct care of a patient. In the case of the Adult Cystic Fibrosis unit at Leeds this will be the EMIS Web Clinical System. |
| Prescribing Workflow Application | | A clinician facing application delivered as part of this project, which manages the repeat prescribing workflow within the Cystic Fibrosis unit. |
| Patient Application | | A patient facing mobile application being delivered by this project. Helping to improve decision making for the patient through improved access to relevant clinical information, support for medication adherence and feedback through a suite of questionnaires and surveys.<br><br>This application is being developed as an extension to the VitruCare product provided by Dynamic Health Systems.<br><br>http://www.dynamichealthsystems.co.uk |
| Leeds Teaching Hospitals Data Analytics Service | | A data analysis service provided by Leeds Teaching Hospital. Data provided by the Care Management System (EMIS Web) is included in the analysis service. |
| Clinical System User | | Any clinician/pharmacist in the hospital who uses the Prescribing Workflow Application. |
| RBAC | RBAC | Role Based Access Control. |
| Provider | | A system that exposes an interface mechanism for other systems to use. |
| Consumer | | A system that takes advantage of an interface mechanism exposed by a provider. |
| Interface Mechanism | | Any mechanism by which any two systems exchange data. |
| | | |

# Contents

# 1 Introduction

This document describes the high level design of the Endeavour Data Service in the context of the Leeds Patient Orientated IT Benefit Evaluation Project.

## 1.1 Background

This project is funded and supported by Endeavour Health Charitable Trust, working in partnership with Leeds Teaching Hospital Trust and Leeds University.  Dr Daniel Peckham is project lead and owner responsible for informing the design, functional requirements and project delivery.  Endeavour is responsible for providing development resource to support the successful delivery of the project.

The initial scope of the project is intended as a pilot, using pre-selected patients currently receiving treatment from within the Adult Cystic Fibrosis (CF) unit at Leeds. The patient recruitment process will be managed collaboratively between the Trust and University. Utilising project management resource made available by the University to develop a suite of patient questionnaires and surveys, this resource will also manage the recruitment and communications flows with patients.

Surveys and questionnaires will be developed and distributed within a patient facing application designed to help the patient manage their medication workflow and to provide a direct communication tool with the clinician providing their care. This will require the acquisition of clinical data currently held within the existing Care Management System.  Phase I of the project will require a data feed from EMIS Web which currently holds the full clinical and prescribing record for all CF patients under the care of the Leeds unit.

This project will also provide a digital workflow for the Homecare medication management service currently being piloted at the Trust. Although this is a local pilot it is intended that the Homecare delivery service with be adopted at a national level based on pilot success.  This service provides a medication home delivery service to patients currently prescribed high cost or high risk drugs. Phase 1 will provide the patient, CF pharmacist and the Trust pharmacist access to the patients prescribing record. This will represent a single view of the patient's medication; it is intended that this will join up current medication services within the Trust to provide a single view of the patients prescribing record.

The overall aim of this project is to provide a communication link between the clinician providing care and to digitise the workflow of medication delivered to the patients' home via the Homecare delivery service. This will enable an automated data flow from the CF pharmacist, hospital pharmacist, to the patient, with data flows back to the pharmacist.

Initial scope will be limited to a simple digital workflow between the hospital pharmacists, and the patient. It is expected that future phases will see the inclusion of the Homecare delivery suppliers integrating with the JAC prescribing management solution in use at the Trust, as well as a link to the GP records within primary care.

More information about the Homecare service can be found here: http://www.clinicalhomecare.co.uk/

In addition, data currently held within the Care Management System will extracted on a regular interval and sent to a centrally hosted repository for further analysis by the University.

## 1.2 Scope

Initial scope of this project from the perspective of the Endeavour Data Service is as follows:

1. The integration of the Care Management System through the use of the EMIS Web Patient Access API. Changes made within the EMIS Web system should be made available to the Data Service as close to real time as the implemented solution permits. It is envisaged that an initial bulking phase will be required to seed the remote repositories.

2. Data entered in either the patient or pharmacy facing systems that is deemed significant to the ongoing care of the patient will be transferred and written back into the EMIS Web clinical system via the Patient Access API in the form of patient notes.

3. Initial population and ongoing maintenance of a central data repository within the Data Service.

4. The management of data publications and subscriptions in the form of Data Distribution Protocols.

5. The integration of VitruCare clinical system including bi-directional message flows.

6. The integration of the Prescribing Workflow Application including bi-directional message flows.

7. The initial population and ongoing maintenance of a data repository within the Leeds Teaching Hospitals Data Analytics Service.

Out of Scope for the initial phase:

1. Communications between the Prescribing Workflow Application and the Hospital JAC Pharmacy system.

# 2 High Level Design

The Endeavour Data Service implementation routes healthcare messages securely and reliably from the data publisher to the appropriate subscribers.

Publisher and Subscriber contracts are configured using Data Distribution Protocols which underpins the patient consent and data sharing rules within the Data Service.

The Data Service is also responsible for message validation, message transformation and acknowledgement management.

Data received by the Data Service will be persisted in a data repository in internal format.

The service has been designed with scalability and resilience at its core, eliminating any single points of failure and encompassing automatic failover. It is built using the following open source technologies:

- Java – Core language
- Apache Cassandra - Database
- RabbitMQ – Message Broker
- Redis – Caching Framework

A comprehensive service dashboard is available to configure and monitor the health status of the Data Service.

The following diagram *(Figure 1)* shows a high level architectural overview.
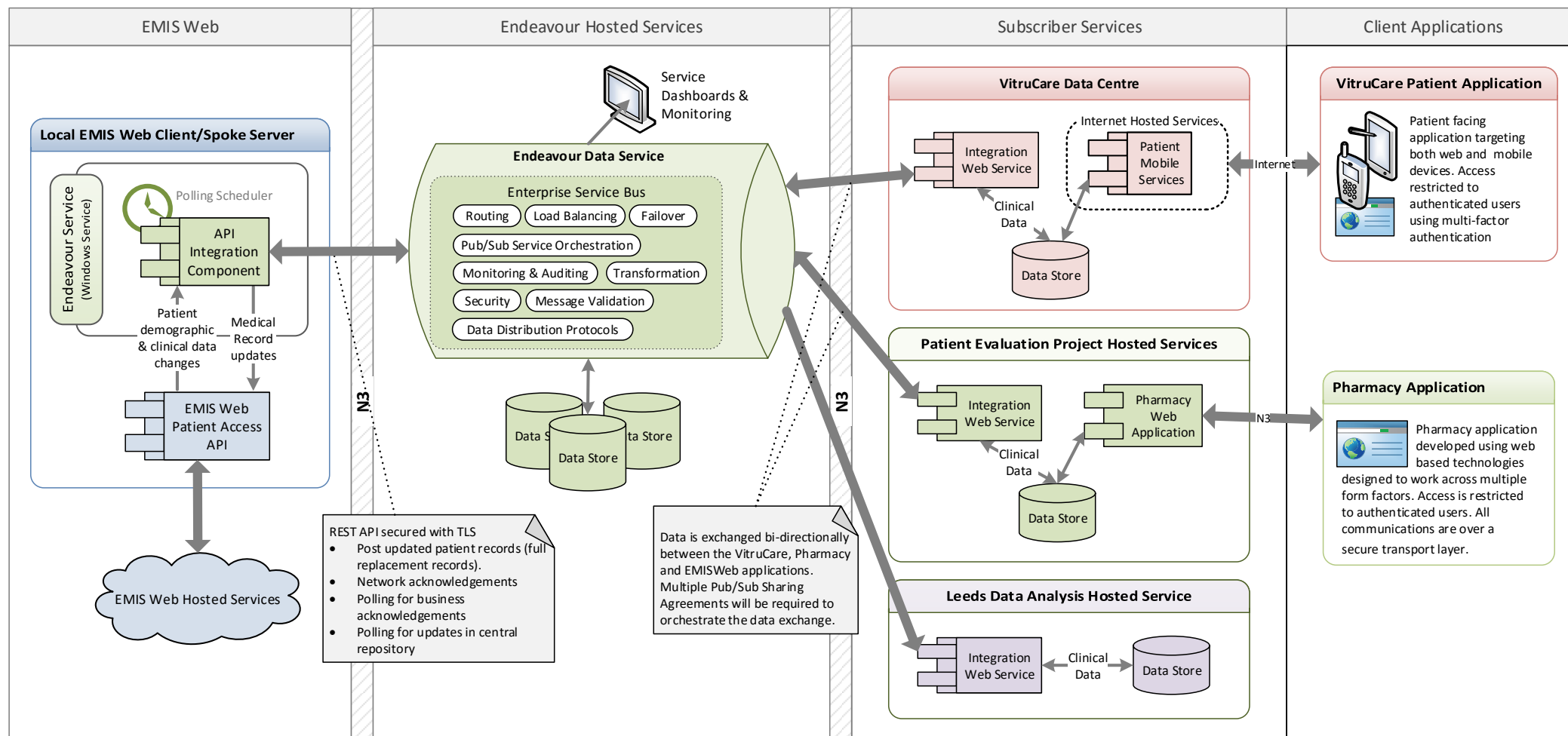
Figure 1 – Architecture Overview

## 2.1 EMIS Web Integration

### 2.1.1 EMIS Web Integration Option Evaluation

The following table *(Table 1)* shows an evaluation of the two current options for EMIS Web integration:

| Integration Method | Pros | Cons |
|---|---|---|
| **Patient Access API** | • Supports read & write.<br>• Multiple extracts per day. | • Client based – local deployment required.<br>• Full replacement patient record.<br>• Polling required to detect changed records. |
| **Extraction Services** | • Server based.<br>• Transactional updates (deltas). | • Read only.<br>• Restricted to single daily extract. |

**Table 1 Integration Method Evaluation Results**

Based on the project requirements to replicate data as near to real time as possible and the necessity to write data items back into the EMIS clinical system, the Patient Access API method is the most appropriate method of integration.

### 2.1.2 Integration with Patient Access API

All interaction with the Patient Access API is co-ordinated by a locally deployed 'API Integration Component'. This component has been developed as a Windows Service using the .NET framework (target version to be confirmed) and is based on the External Interface Specification provided by EMIS.

This component is responsible for extracting changed patient records from EMIS Web and publishing them to the Endeavour Data Service. In addition, it also subscribes to changes made by the patient/pharmacy facing applications. These changes are pulled from the Data Service and stored in EMIS Web via the API.

The client scheduler polls the Patient Access API at regular intervals, requesting a list of patients that have received record updates since the previous request. A further API call is then made to extract the patient record for each of the identified patients. This record is then subsequently sent to Endeavour Data Service.

*NB*: Reducing the scheduled interval and therefore increasing the polling frequency of the API will also reduce the potential for stale records in the central repositories. However, reducing the polling interval by too much may result in negative performance implications within the EMIS infrastructure. Therefore, the scheduled interval will be configured in line with EMIS guidelines.

There is a requirement for data to be written back to the EMIS System, survey data collected from the patient, clinical and pharmacy teams will be fed back in a structured format.  This will enable a communication layer with primary care to help inform patient adherence and any interactions with new medication regimes and treatments. Due to inbound firewall restrictions it is generally not possible to communicate directly with the client component from the Data Service. The use of a 'WebSockets' style technology should be utilised to enable bi-directional communication between the client and server allowing update notifications to be sent directly to the client.

Sending data to the Endeavour Data Service will result in a synchronous network acknowledgment. In addition, asynchronous business acknowledgments are also produced by the Data Service when a message has been processed. Business acknowledgments are pulled from the Data Service on a scheduled interval as it's unlikely that the local environment is addressable from the central service due to firewall constraints. In the event that an error has occurred, the acknowledgment will indicate a failed state. The type of failure will

determine if a message can be re-tried i.e. communications related issues. For all other error states, the patient with the error will be blocked from all future transmissions until the issue has been resolved.

To assist in the monitoring of the service health a 'Heartbeat' message it sent to the Data Service containing current status information.

All messages are sent to the Data Service over a secure transport layer on the N3 network. The option to configure payload encryption should also be investigated.

The following EMIS Patient Access API methods will be used by the solution:

- Get Patient Sequence (initial bulking).

- Get Changed Patients

- Get Changed Patients Medical Record

- Get Medical Record

- File Record

Further details of the API definitions can be found in the latest version of the EMIS Partner Programme documentation.

The following flow diagrams illustrate the typical API interfaces use within the solution.

*Figure 2* shows the identification of patients with changed records in EMIS Web and the publishing of the updated medical records to the Data Service.
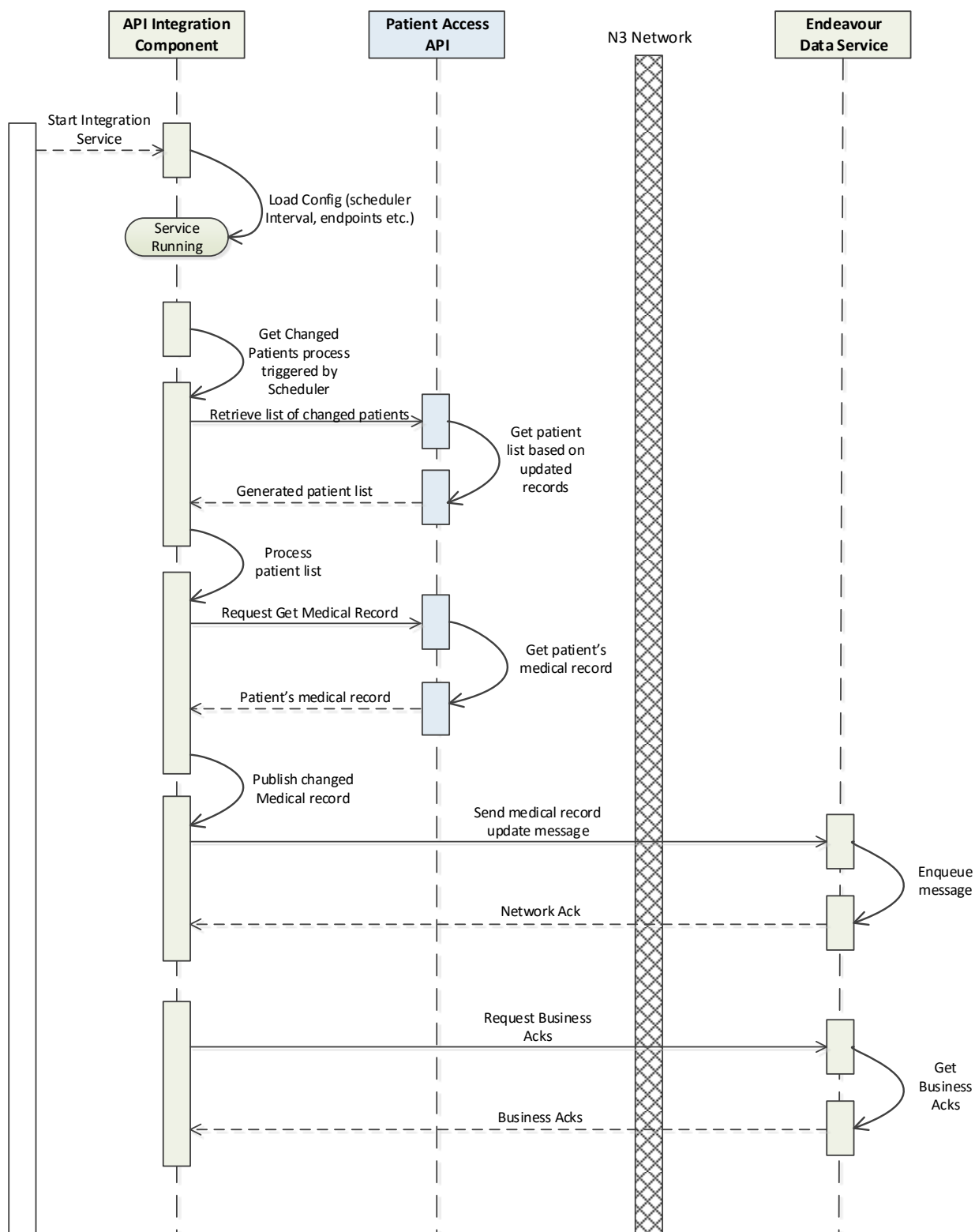
Figure 2 Publish EMIS Web Changes Data Flow

*Figure 3* shows the retrieval of changes made to the central repository and subsequent filing into EMIS Web via the API.
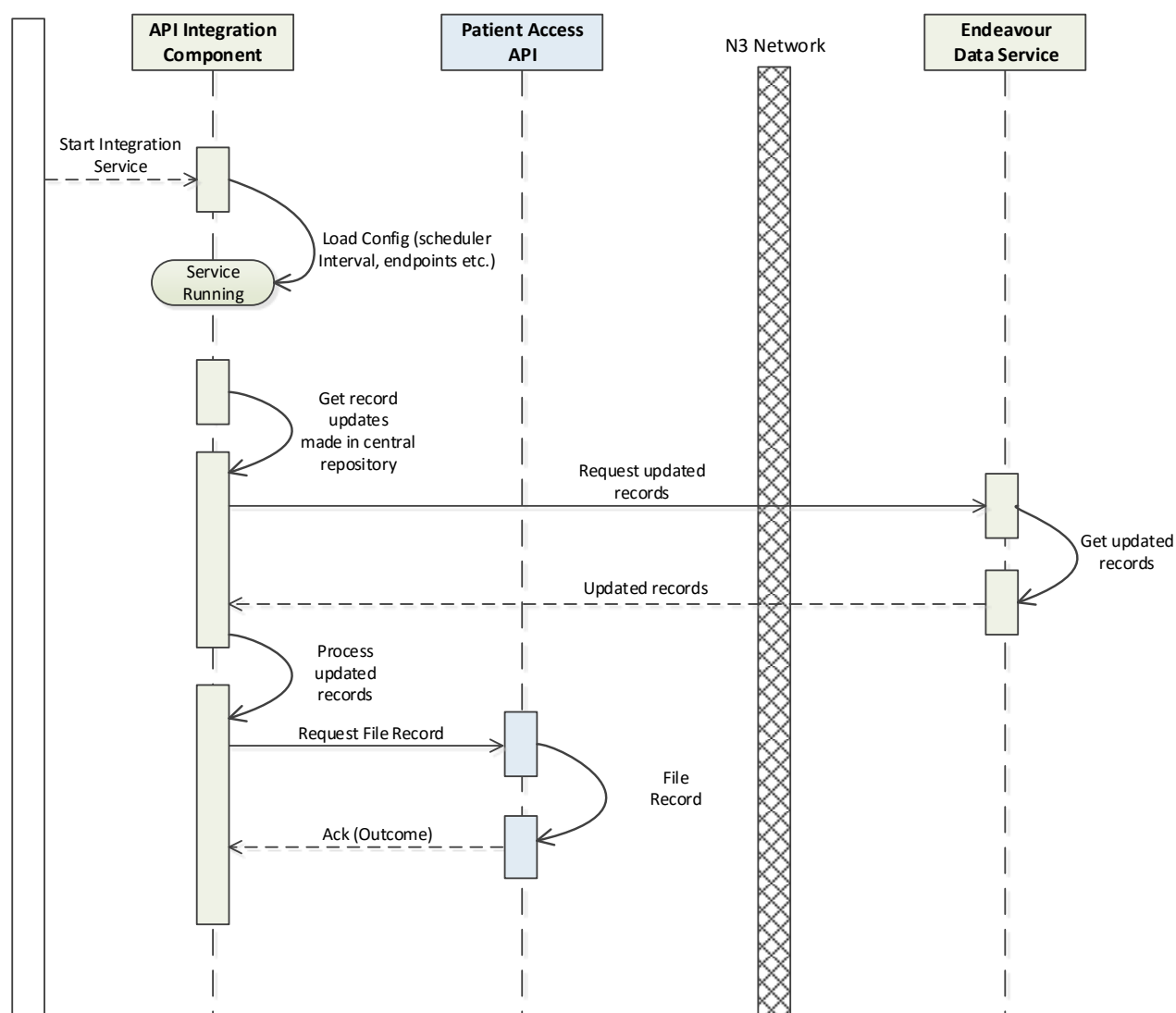


Figure 3 File Central Changes in EMIS Web Data Flow

## 2.2 VitruCare Integration

Details of VitruCare integration can be found in the following document:

'VitruCare clinical system integration specification 2013-10-15.docx'.

## 2.3 Prescribing Workflow Application Integration

TBC.

## 2.4 Data Analytics Service Integration

TBC.