openEHR

REFERENCE MODEL

The *open*EHR EHR Service Model

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1. Ocean Informatics Australia

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The *open*EHR foundation

is an independent, non-profit community, facilitating the creation and sharing of health records by consumers and clinicians via open-source, standards-based implementations.

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Amendment Record

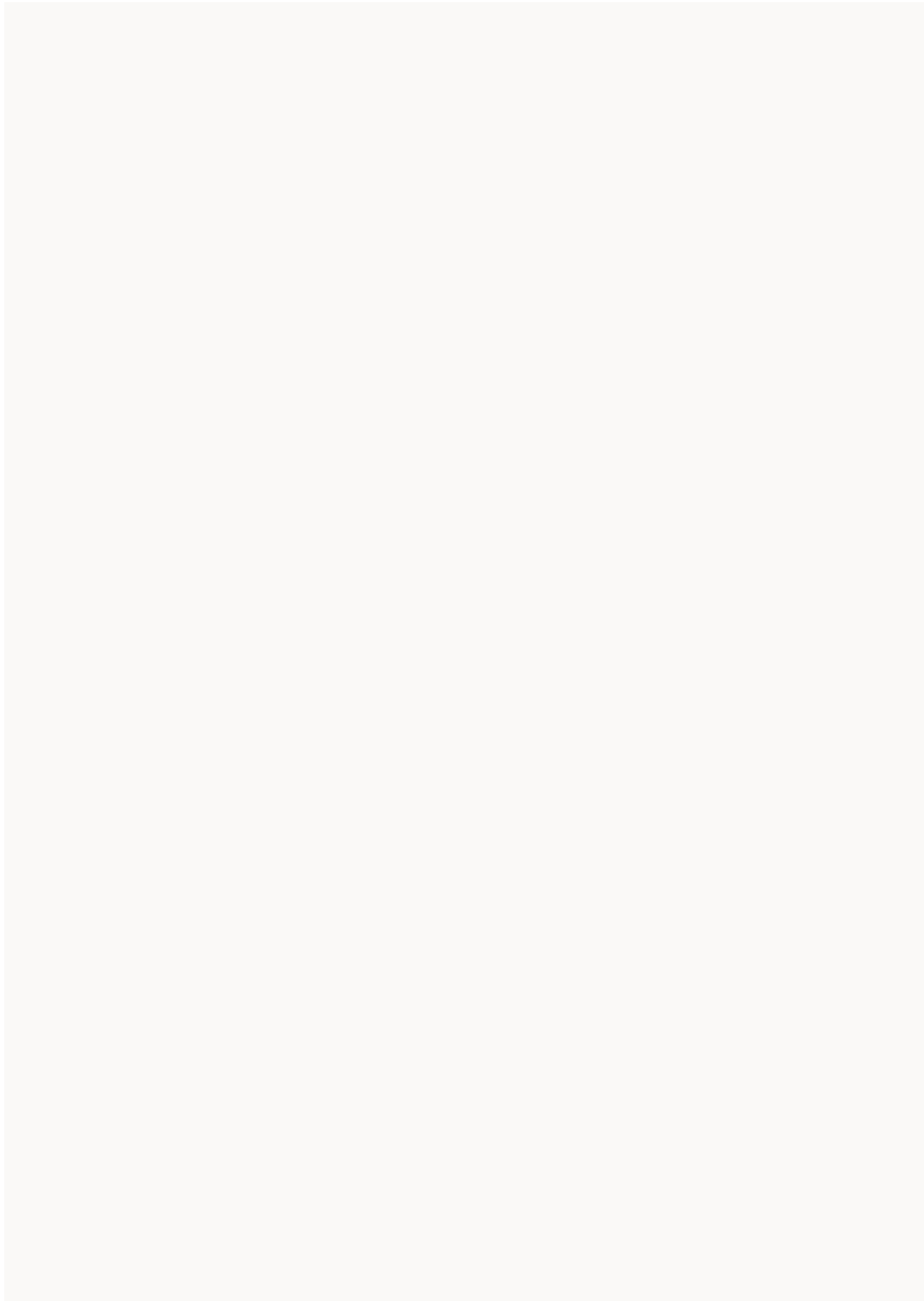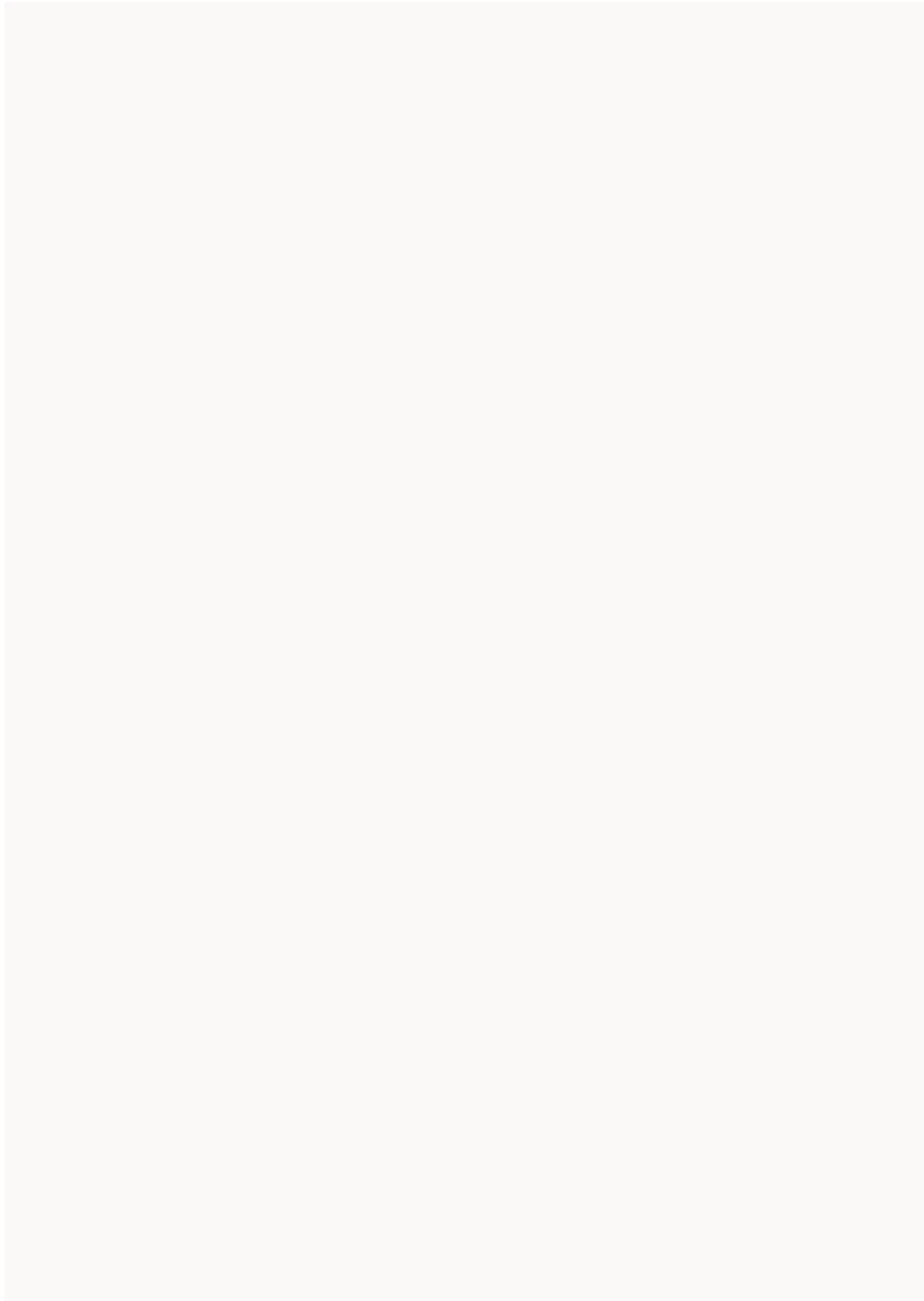| Issue	Details	Who	Date
0.2	Initial phase of rewrite based on various inputs including Prodigy APIs, CEN HISA specifications etc.	T Beale	25 Feb 2003
0.1	Initial Writing	T Beale	8 Jan 2003

Acknowledgements

Thanks to...

Items To Be Determined

1 Introduction

1.1 Purpose

This document describes the *open*EHR EHR Service Model, which defines both the application programmer interface (API) to the EHR for applications developers, and the interface for other services.

The intended audience includes:

- Standards bodies producing health informatics standards
- Software development groups using *open*EHR
- Academic groups using *open*EHR
- The open source healthcare community

1.2 Related Documents

Prerequisite documents for reading this document include:

- The *open*EHR Roadmap
- The *open*EHR Data Types Reference Model
- The other *open*EHR Reference Models

1.3 Status

This document is under development, and will be published as a proposal for input to standards processes and implementation works.

Future changes will include:

- Currently the UML diagrams are hand-produced. In the next version, the Rational Rose representation will replace these.
- Specific design principles will be referred to throughout the model text, so that readers can easily find the theoretical discussion on which any part of the model is based.

The latest version of this document can be found in PDF and HTML formats at http://www.openEHR.org/Doc_html/Model/Reference/ehr_svc.htm. New versions are announced on openehr-announce@openehr.org.

1.4 Peer review

Known omissions or questions are indicated in the text with a "to be determined" paragraph, as follows:

TBD_1:   (example To Be Determined paragraph)

Areas where more analysis or explanation is required are indicated with "to be continued" paragraphs like the following:

To Be Continued: more work required

Reviewers are encouraged to comment on and/or advise on these paragraphs as well as the main content. Please send requests for information to info@openEHR.org. Feedback should preferably be

discussed on one of the appropriate mailing lists, openehr-technical@openehr.org or openehr-clinical@openehr.org.

1.5   Document Structure

2   Background

This section describes the inputs to the modelling process which created the *open*EHR Reference Model.

2.1   Requirements

There are various sets of requirements which inform this model, which may be categorised as follows:

- archetype retrieval and template creation
- EHR creation, modification and committal
- EHR retrieval
- EHR querying
- Secure login and access control
- Session management
- Pseudonymisation - de-identification

To Be Continued:

Requirements relate to the following categories of users:

- primary users, i.e. clinical carers or the patient themselves. The mode of access is "single EHR per session";
- secondary users, i.e. users who interrogate populations of EHRs to find trends or generate lists of patients. These users may be inside and HCF, and determining lists of patients for recalls or other kinds of contacts, or they may be external researchers who are only allowed de-identified access. The mode of access here is "multiple EHRs per session";
- software agents and applications, such as decision support systems, recall managers, research applications.

2.2   Design Experience

A number of projects contributed to the design approach used here, as documented in the following sections.

2.2.1   Australian GEHR GPCG Project Experience

The Australian Good Electronic Health Record (GEHR) project (2000 - mid 2001; see http://www.gehr.org) funded by the Royal Australian College of GPs (RACGP) General Practice Computing Group (GPCG) was the first project in which an archetype-based EHR server was built. The back-end included an EHR server, an archetype server, an archetype initialiser, a demographic server, and a simple text-file terminology server. These were all built in Eiffel with Java being used in the Archetype Initialiser. The front end consisted of a VB6 application which created and retrieved EHRs, using archetypes actively. The "kernel" - the core part of the EHR server was the first implementation of an "archetype inference engine", i.e. a component whose job is to use archetypes (knowledge artifacts) to create and validate information.

This project led to an interface being built to each server, including the EHR and archetype servers. This interface allowed the creation, modification, and retrieval of EHRs, Transactions and smaller parts of the EHR. The API developed during this experience provided a valuable insight into what the

interface to the EHR of the future might look like, and in particular influenced the following areas of the service model defined in this document:

- archetype server interface;
- EHR modification interface, including
    - archetype retrieval & template building;
    - session control
- the application view of the EHR server.

2.2.2 DSTC GEHR Demonstrator

The DSTC Titanium group developed a multi-node virtual EHR system, in which EHRs for a given patient could exist on any number of servers. The client application was capable of viewing the virtual EHR, using filtering and basic security. In this case, XML and Java technology were used. The DSTC also developed the archetype editor used by both the GPCG Eiffel-based project and the DSTC demonstrator.

The demonstrator has provided experience in the following aspects of an EHR system interface:

- retrieval of the virtual EHR from numerous physical nodes;
- querying;
- filtering;
- secure login and access control;
- multiple simultaneous users.

To Be Continued:

2.2.3 Prodigy Decision Support System and the vMR

To Be Continued:

2.3 EHR Service Interface Standards

To Be Continued: relationship to OMG COAS / orders models should be described .

3   Requirements

3.1   Overview

FIGURE 1 illustrates a typical community shared care context. There are two places health record systems might be used: at the community level, that is, inter-provider, and within providers. The first kind of a record - a shared care record (longitudinal, comprehensive, patient-centred) - is classified by ISO (TS 18308) as an "EHR", or Electronic Health Record. Some providers also have intra-provider records (episodic, institution-centred) which are usually known as EMRs (Electronic Medical Records) or EPRs (Electronic Patient Records). Others need to connect directly with the EHR. Within larger health system contexts - provinces and nations - there may also be so-called "summary health records", or "health summaries". The figure shows the shared care EHR as if it is located within a geographical community, but this need not be so: mobile patients such as health workers, entertainers, athletes and the military may well be represented in the same kind of system (from an IT point of view), where the contributing providers are located all over the world. Essentially, the only difference between the two is the network deployment.
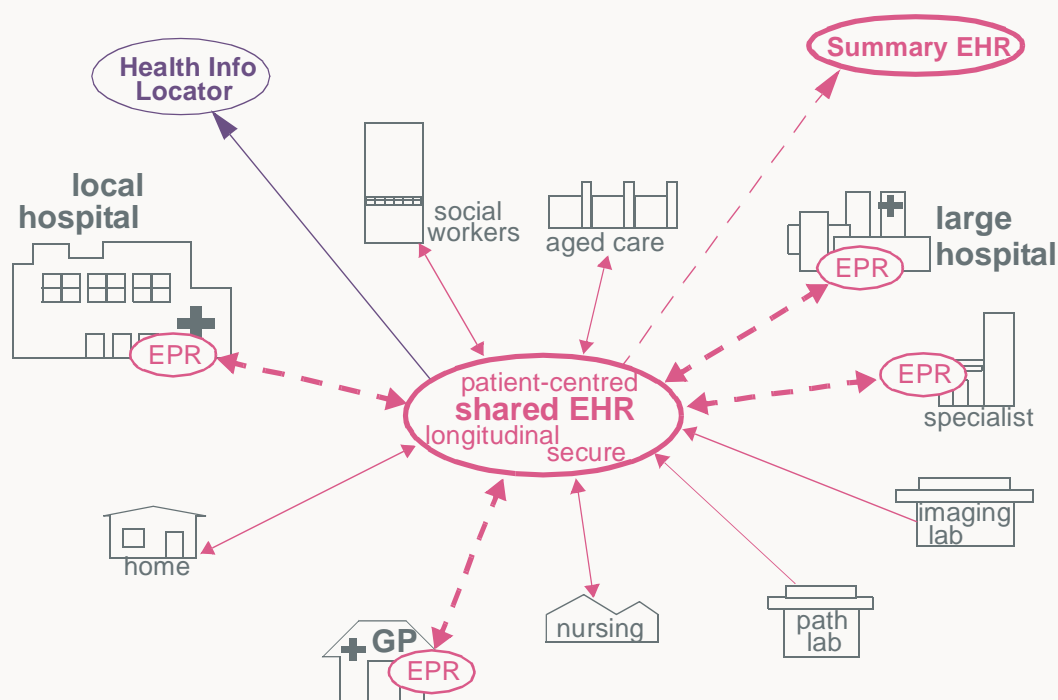

FIGURE 1 Community Shared Care Context

Health record systems built according to *open*EHR and related specifications could be used in any of these three locations; the health record at each level will then be in exactly the same technology and logical data format, and differ only in content, for example as follows.

- EPR/EMR: contents reflect only certain episodes, and possibly particular medical specialties, but in the greatest level of detail (outside of dedicated imaging and other monitoring systems).
- EHR: contents reflect all episodes in all providers in the community, and all medical specialties, but may be somewhat summarised, with certain intermediate details of care during certain episodes not included or greatly summarised. The EHR needed by all providers in

> the community to provide proper care to a patient, since local EMRs will not in general provide comprehensive information.
>
> - Health Summary: contents probably include only core information that is needed for accident/emergency care admissions, such as basic data (blood type, age, sex), major problems, therapeutic precautions (allergies, cultural preferences) and so on.

Care events that happen while a patient is out of his or her usual context (on holiday, at a conference) will most likely initially be recorded in an EMR system not connected to the health information environment containing the principal instance of the patient's EHR. To perform the care, the provider in question will need to be able to obtain an extract from the patient's primary EHR; for the latter to be kept up to date, an extract will need to be sent back containing details of the foreign care event. Such interactions are mediated by a Health Information Location service (of the kind defined by the OMG HILS specification for example).

Of the three kinds of record system, the first two - the EMR and EHR - are care-oriented, and will have user software applications accessing and writing to them. Summary EHR systems will most likely have write access due to uploading of EHR Extracts, and read access.

3.2   Scenarios

The system interfaces covered by this specification include the following:

- user (client) to EHR or EMR server (real-time read/write per patient record)
- query interface to EHR or EMR (real-time or batched access to multiple records, including pseudonymisation capability)
- EMR server to EHR server (publishing with summarisation)
- EHR server to Summary server (publishing with summarisation)
- EHR to EHR Server (synchronisation or move of patient record)
- EMR or EHR to HILS (publishing)

This specification describes formal, functional interfaces between systems which correspond to these scenarios.

4   Design Overview

Although this specification does not seek to describe particular architectures, it is worth considering some generic architectural aspects as a way of understand the interfaces that follow. FIGURE 2 shows some aspects of a 4-tier architecture, fairly typical in large systems today.
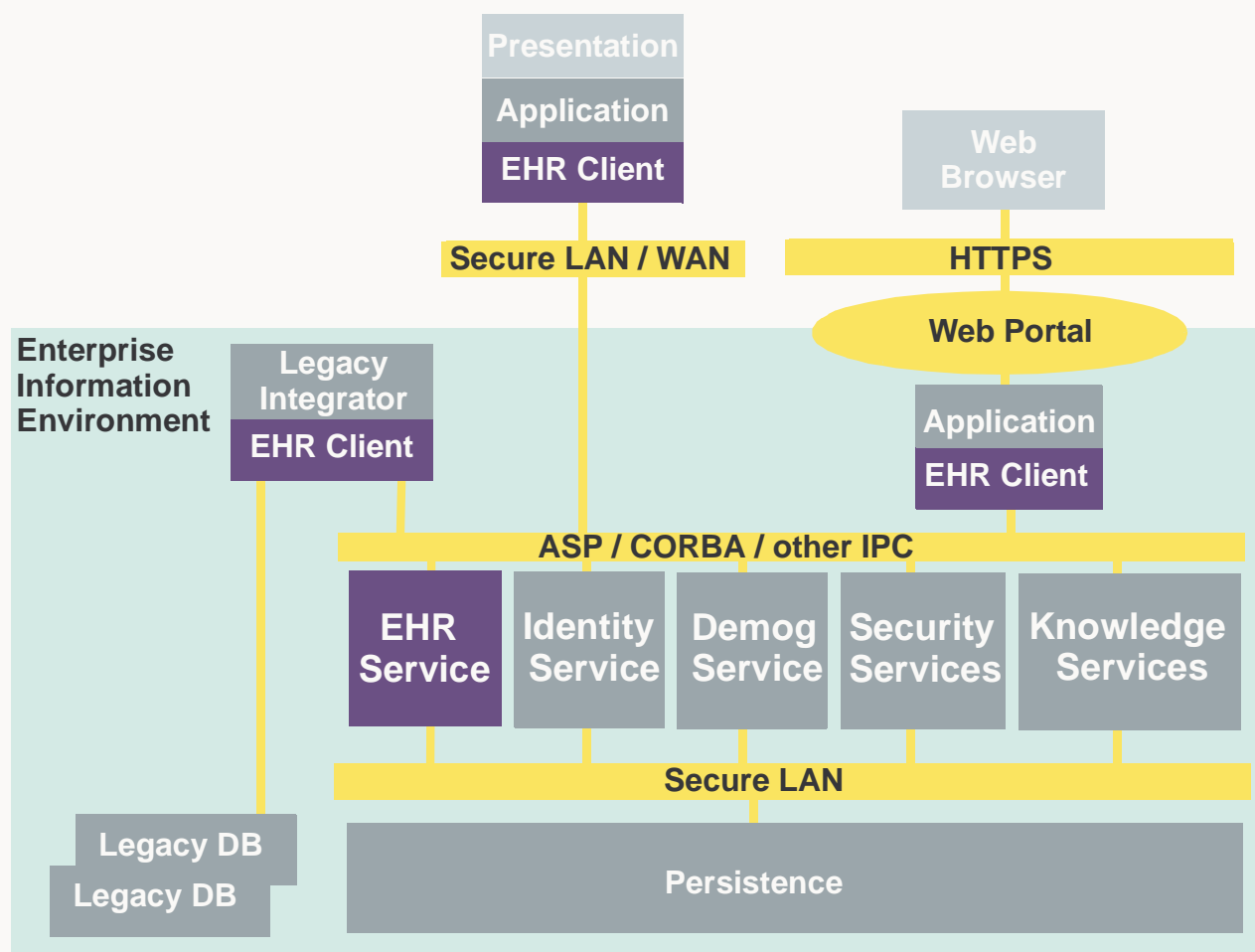

FIGURE 2 Generic EHR System Architecture

The tiers are:

- presentation (light grey 'presentation' box);
- application logic (dark grey 'application' boxes);
- enterprise services (where 'enterprise' means 'data manager'): EHR, identity, demographics, knowledge management, security and others;
- persistence.

In such architectures the last two layers are usually colocated in a secure health information environment. The following possibilities exist for application users:

- local users have both application and presentation layers within the same secure environment as the services;
- some remote users ("thick clients") will have both application and presentation layers on their own computer;

- some remote users ("thin clients") will have presentation layer only on their own computer, with "their" application residing in the server environment.

The blue "EHR Client" boxes in FIGURE 2 provide the interface between applications and the back end services. Using the more precise illustration in FIGURE 3, the interfaces which concern us here are those exposed by the EHR Client component to an application, and those exposed by the EHR service (both interfaces shown in magenta). The following sections describe these in detail.

EHR client API

Application

EHR Client

Compositions   **Contributions / Transactions**

EHR Service Client API

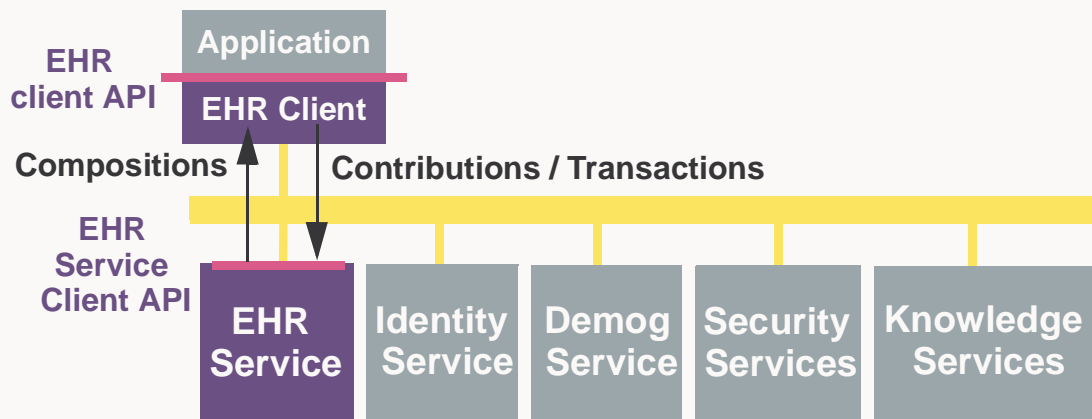| EHR Service | Identity Service | Demog Service | Security Services | Knowledge Services |

FIGURE 3 EHR Client and Service APIs

5 EHR Client API

5.1 Overview

Because the EHR Client is where information is integrated from distinct back-end services such as EHR, identity, demographics, and security, the EHR Client API reflects to some extent the APIs of not only the EHR service, but also these other services.

5.2 Access

5.2.1 Secure Login

5.2.2 Access Control

5.2.3 Session Management
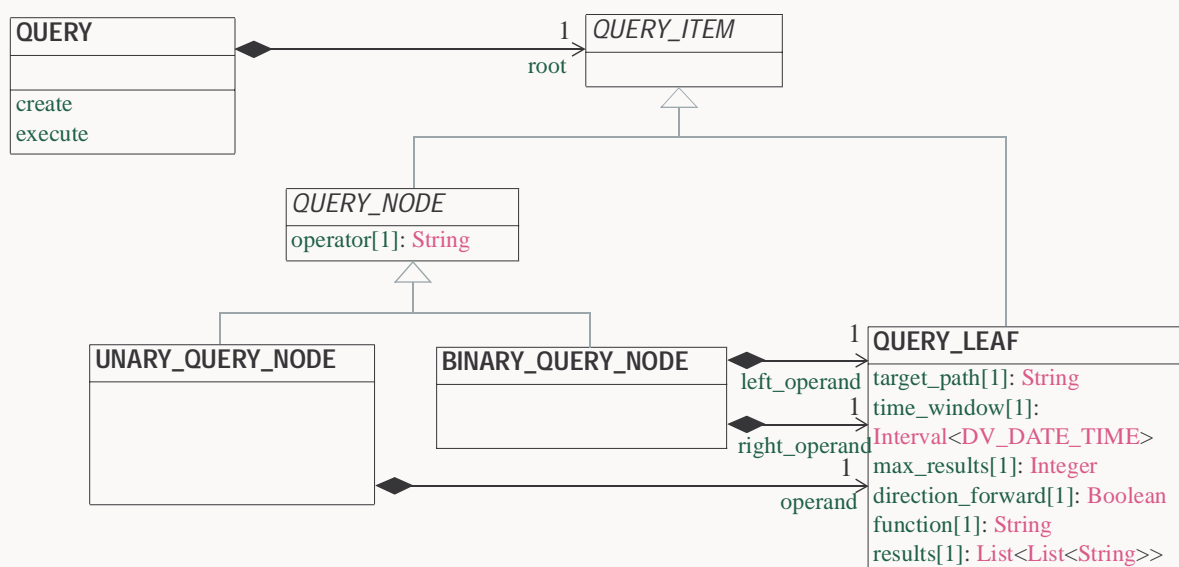
5.3 Data Retrieval

FIGURE 4

5.3.1   EHR Retrieval

5.3.2   EHR Querying

5.4   Data Creation and Modification

5.4.1   Archetype Retrieval

5.4.2   Template Creation

5.4.3   EHR creation, Modification and Committal

5.5   Pseudonymisation

6   EHR Service API

6.1   Overview

6.2   Transactions

6.3   Contributions

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END OF DOCUMENT