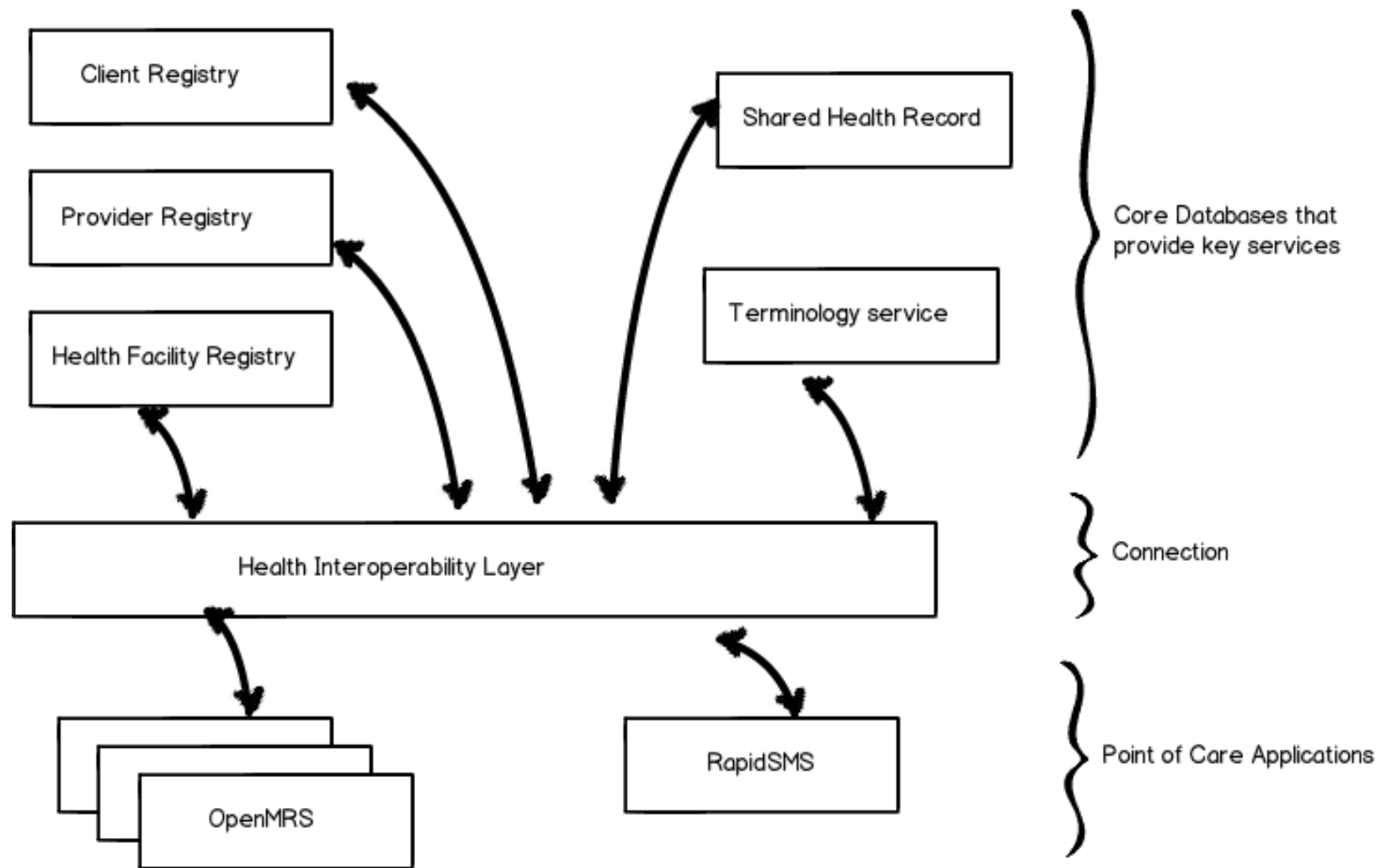


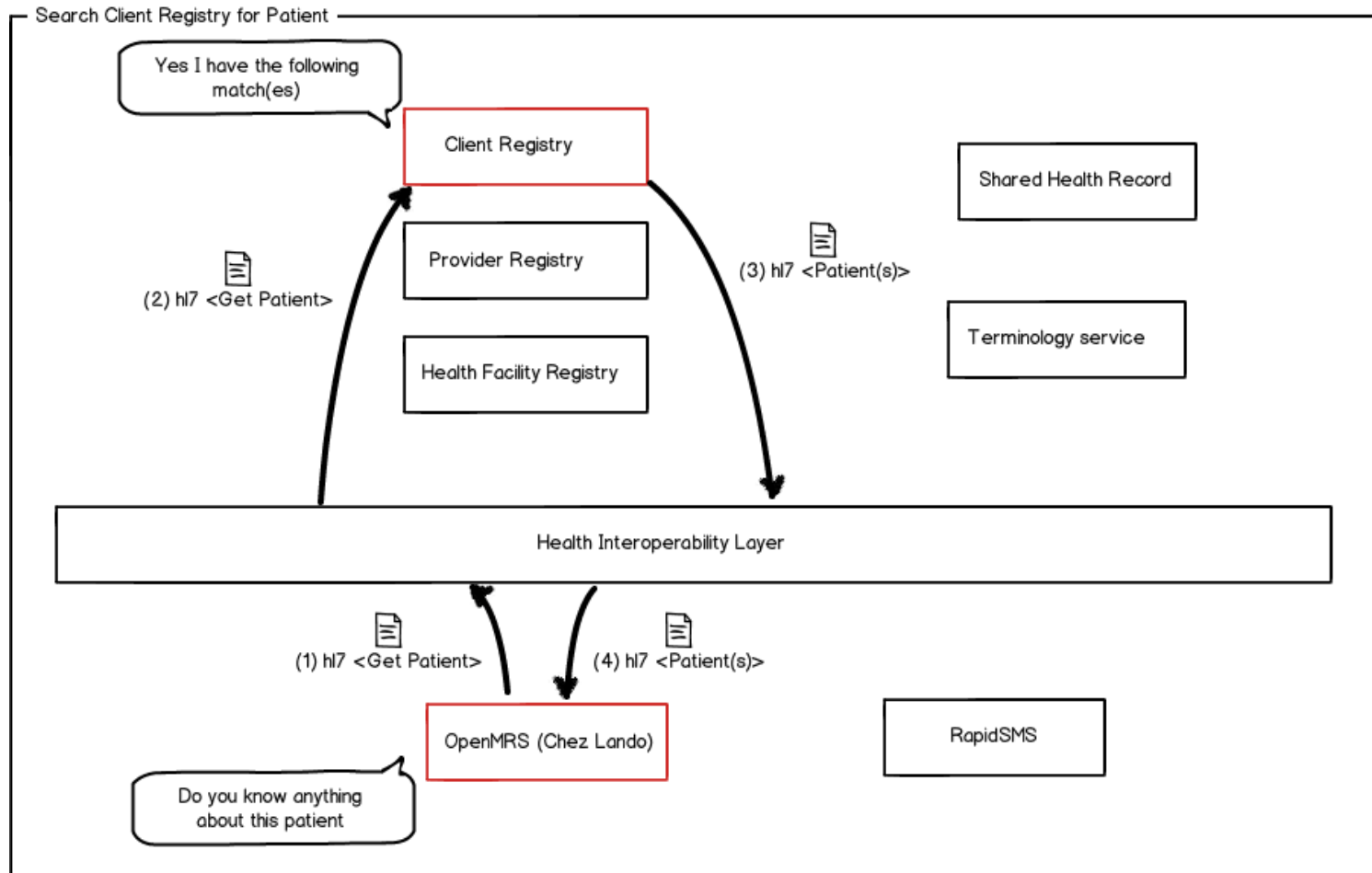
# RHEA HIE Overview

# Sample Scenario

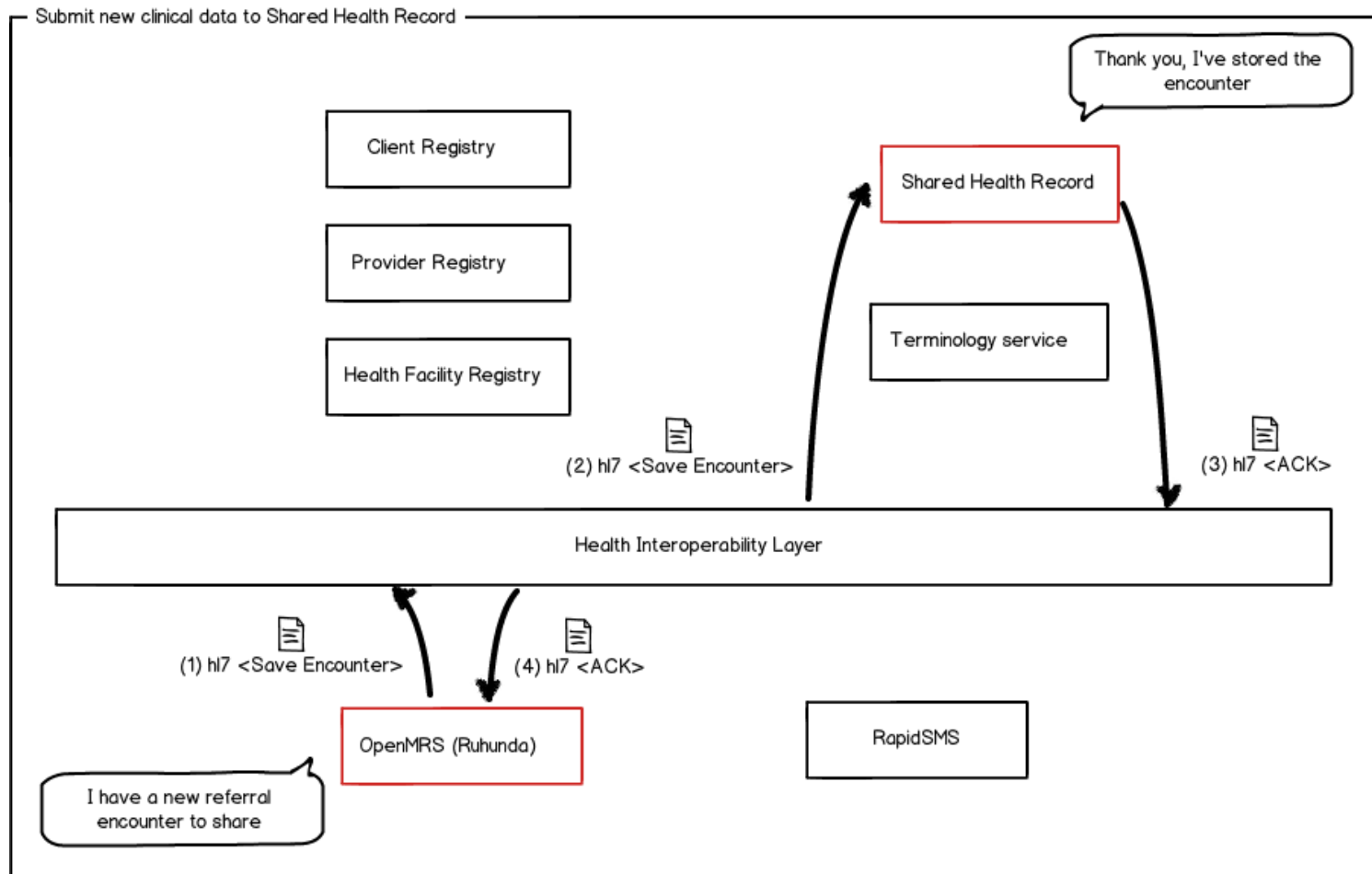
# Health Information Exchange (HIE)



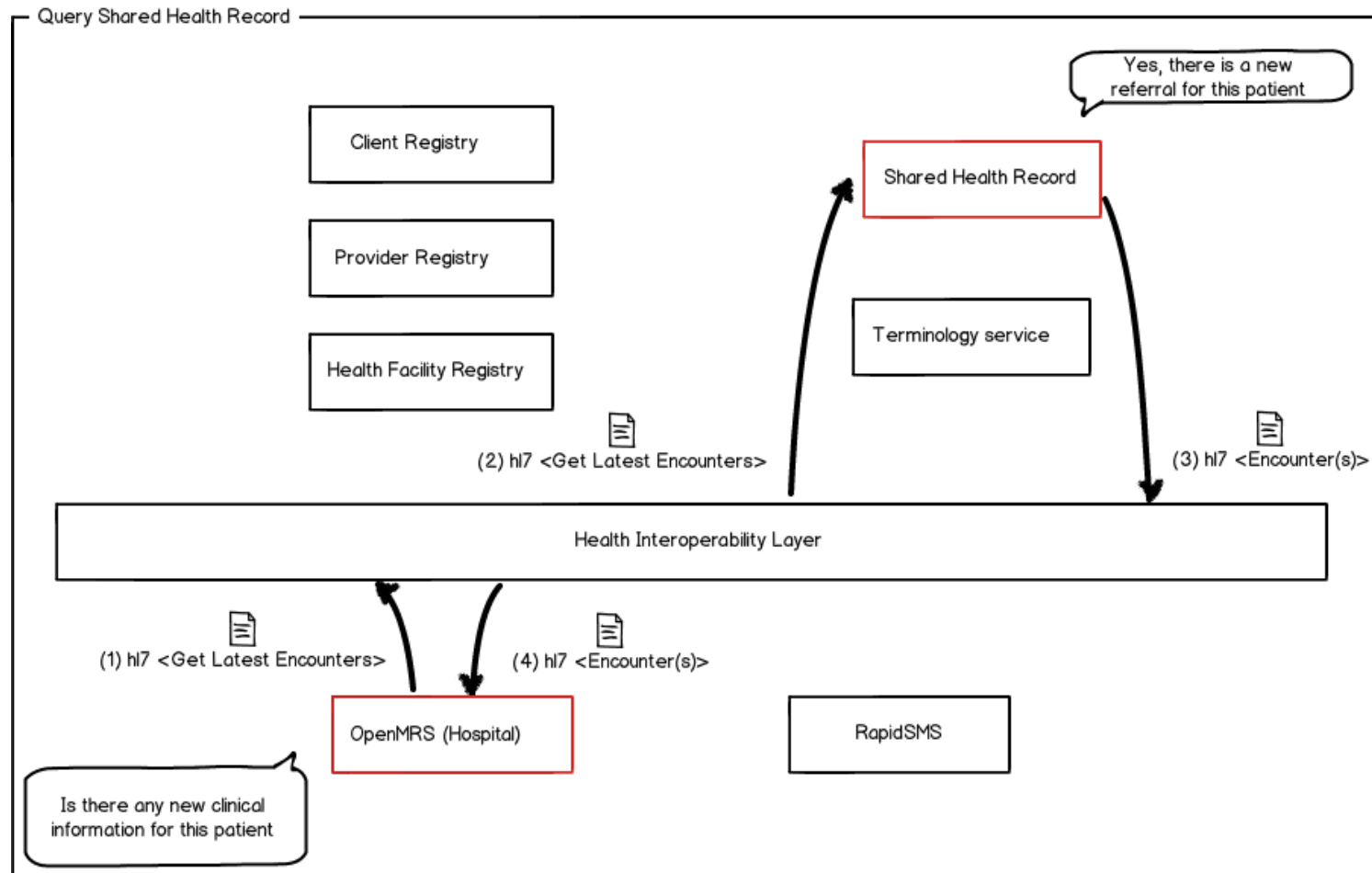
# Patient Search



# Sharing patient data across facilities (Posting new information)



# Sharing patient data across facilities (Retrieving information)



# Referral Guideline

## RHEA Referral Form (v1.0)

**1. Encounter Details**

Date:  (mm/dd/yyyy)  
Location:   
Provider:

**2. Referral Information**

Referral Request Date:  (mm/dd/yyyy)

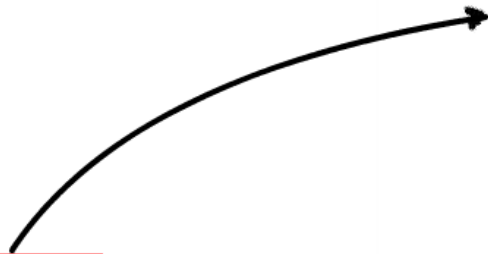
Refer Patient To:

Reason For Referral:

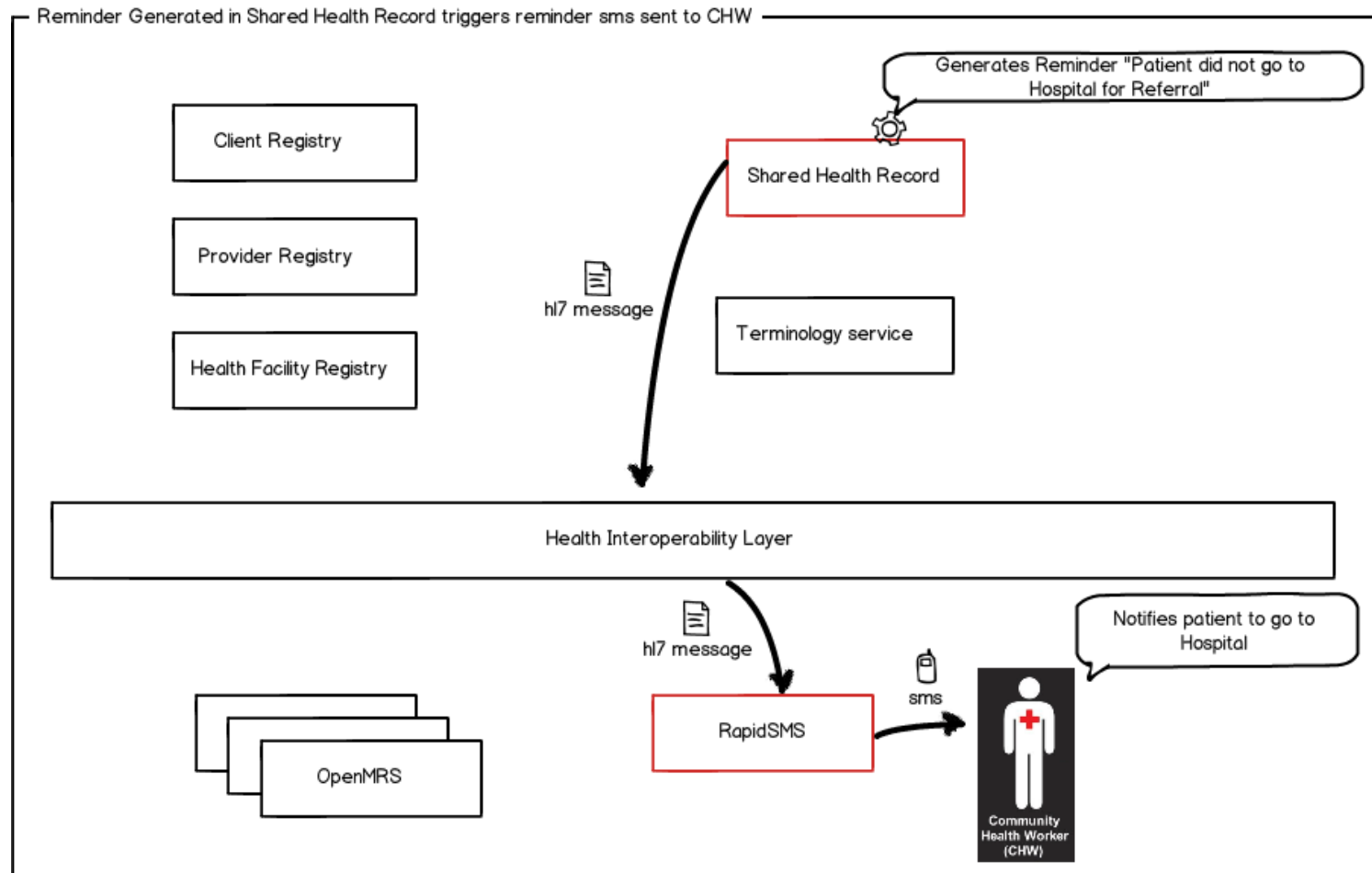
Referral Urgency:  Immediate Referral  Urgent  Routine

Referral Guidelines

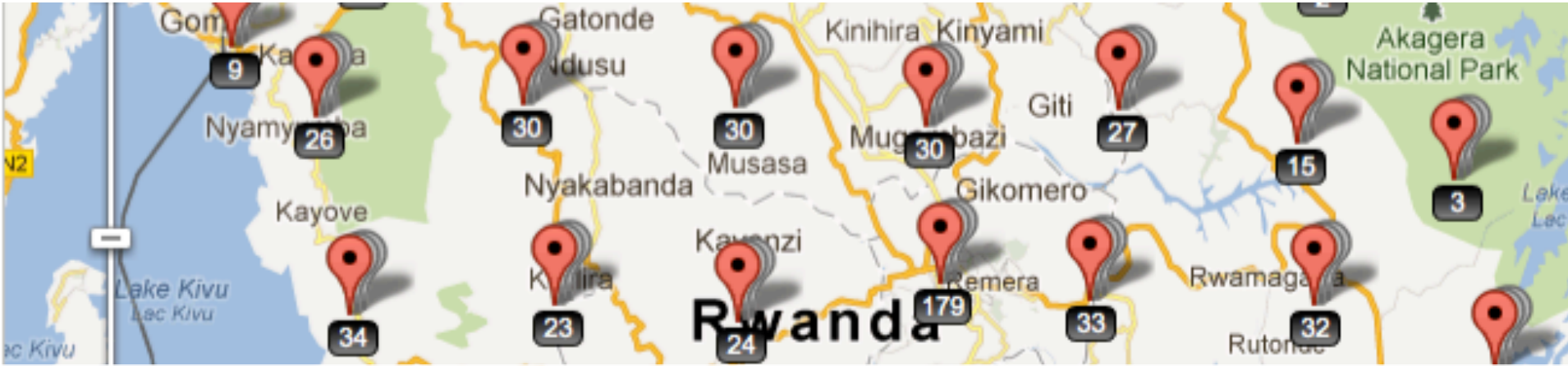
- Immediate = Same day
- Urgent = 3 days from referral date
- Routine = 10 days from referral date



# Automated Reminders via SMS







# Facility Registry



# FR: Facility Registry

- Business function:
  - Registry of facilities, services provided, and other metadata

- Based on:

## Tech

Ruby on Rails,

MySQL,

ElasticSearch

Google Maps & OSM

## Design

Started in Cambodia

2 ys. ago, local devs

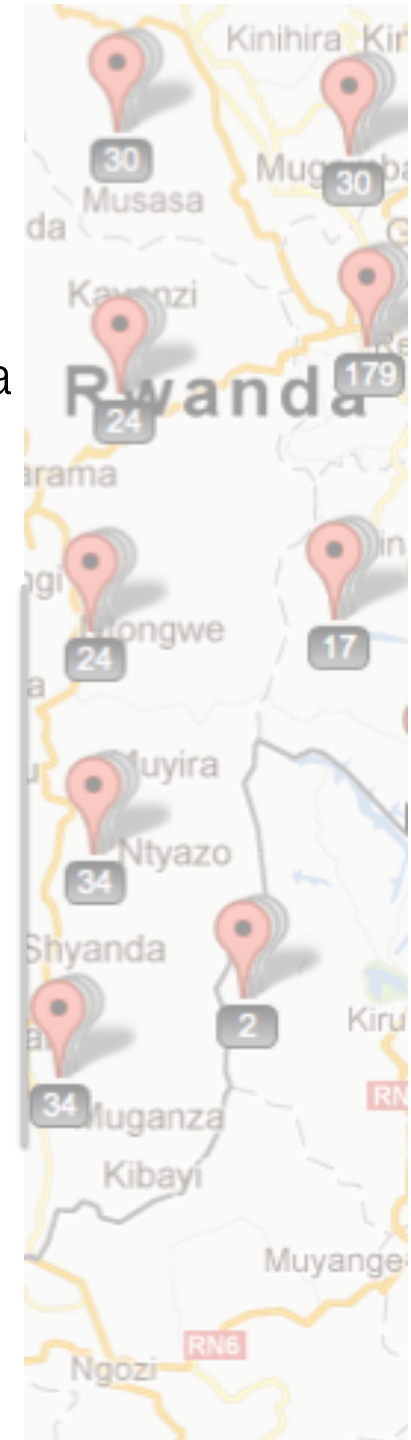
Used by NGOs in national projects

## Integration

REST API

Trigger/Event Streams

- Team: RHEA Team & InSTEDD developers (iLab + Platform)



# Activity

View as [RSS](#)

Collections

- JPaul Facility Registry
- MOH Health facility Registry (Venuste)
- Rwanda Health Facility Registry
- Vale Facility Registry

[check all](#) | [uncheck all](#)

Events

- Collection created
- Site created
- Layer created
- Collection imported
- Site changed
- Layer changed
- Collection CSV imported
- Site deleted
- Layer deleted

[check all](#) | [uncheck all](#)

## Key Functionality

- Browse, query, filter, manage data
- Visualize in maps & lists
- Define facility information schema
- Manage visibility & read/write permissions
- Expose API for data changes and event triggers
- Keep historical version sets (see past data)
- Expose XML, JSON and GeoJSON APIs
- Plugins for Advanced Permissions
- Thresholds, Alerts
- Mobile queries, updates, staff reminders

Collection	User	Activity	Time
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Soumission et Approbation' changed: text field 'Approved by (approvedBy)' name changed to '...' <a href="#">show more</a>	2012-09-18T03:50:49-05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Soumission et Approbation' changed: text field 'Préparé par (preparedBy)' name changed to 'Pr...' <a href="#">show more</a>	2012-09-18T03:50:05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Infrastructure' changed: numeric field 'Nombre de pièces (numberRooms)' name changed to 'Numb...' <a href="#">show more</a>	2012-09-18T02:34:42-05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Cordonnés Géographiques' changed: text field 'Nom du Village (villageName)' name changed to '...' <a href="#">show more</a>	2012-09-18T02:51:46-05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Effectif du Personnel' changed: numeric field 'Médecins (numDoctors)' name changed to 'Doctor...' <a href="#">show more</a>	2012-09-18T02:49:58-05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Administrative Information' changed: select_one field 'Catégorie (categoryCode)' name changed to '...' <a href="#">show more</a>	2012-09-18T02:49:11-05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Cordonnés Géographiques' changed: text field 'PO Box' (PO BOX) was added, select_one field 'P...' <a href="#">show more</a>	2012-09-18T02:44:37-05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Administrative Information' changed: text field 'Telephone Titulaire (TEL)' was added	2012-09-18T02:43:23-05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Administrative Information' changed: text field 'NID Titulaire' (NIDT) was added, select_one field 'S...' <a href="#">show more</a>	2012-09-18T02:42:47-05:00
Rwanda Health Facility Registry	tonyglo2002@gmail.com	Layer 'Infrastructure' changed: select_one field 'Internet' (Internet) was added, select_many field 'S...' <a href="#">show more</a>	2012-09-18T02:35:35-05:00
Rwanda Health Facility Registry	wilsonrandy77@gmail.com	Site 'Bungwe (BURERA) MU' changed: location changed from (29.97292, 29.97292) to (-1.503, 29.97292)	2012-09-16T07:11:39-05:00
Rwanda Health Facility Registry	wilsonrandy77@gmail.com	Site 'Bethsaida (Kicukiro)' changed: 'services' changed from (nothing) to ['Consultations curatives ...'] <a href="#">show more</a>	2012-09-16T07:10:14-05:00
Rwanda Health Facility Registry	wilsonrandy77@gmail.com	Site 'Bethsaida (Kicukiro)' changed: 'villageName' changed from (nothing) to 'Kicukiro'	2012-09-16T07:07:54-05:00
Rwanda Health Facility Registry	wilsonrandy77@gmail.com	Site 'Bethsaida (Kicukiro)' changed: 'provinceCode' changed from (nothing) to	2012-09-16T07:07:43-05:00



Group by Admin Hierarchy ▾ Refine results ▶

Search

Rwanda Health Facility Registry

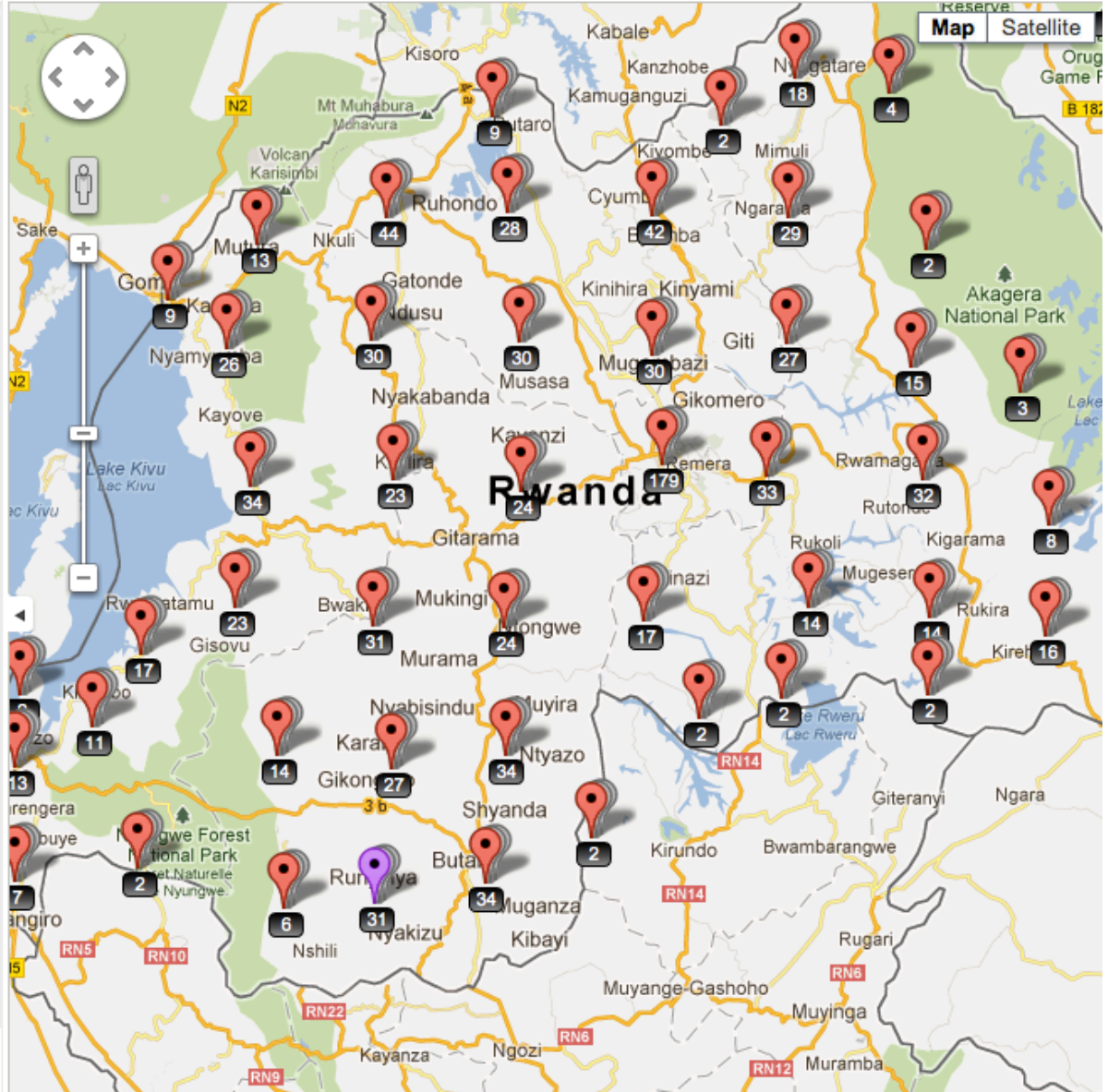


Export this result in [RSS](#), [JSON](#) or [CSV](#) 1039 sites



- VILLE DE KIGALI
- SUD
- NYANZA
- GISAGARA
- NYARUGURU
- HUYE
- Gishamvu**
  - Busoro-Gishamvu
  - Busoro-gishamvu MU
- Huye
- Karama
- Kigoma
- Kinazi
- Maraba
- Mbazi
- Mukura
- Ngoma
- Ruhashya
- Rusatira

Create Site



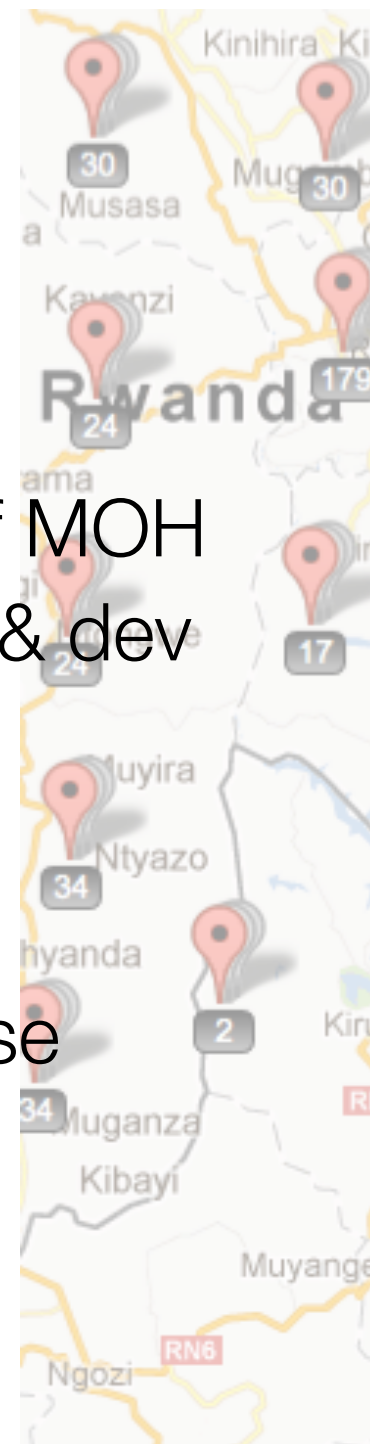
# Next Steps

## RHEA (Suggestions)

- DHIS2 Integration
- Evaluate further use cases and needs of MOH
- Further capacity building in hosting ops & dev on API

## General:

- Continue to evolve from other applied use worldwide
- Continue to work on plug in designs



# SHR: Shared Health Record

- Business function:
  - Maintain a person centric longitudinal health record.
- Technology built on:
  - OpenMRS – custom module
  - HL7 message standards
- Technical Team
  - Jembi Health Systems, OpenMRS community

# What does it do? | Services

- Storage and retrieval of patient data
- Maintains a longitudinal health record
- Business Alerting : Triggers SMS alerts
- Auditable
- Web services
  - λPost patient encounter
  - λGet previous patient encounters
- HL7 Messaging format

# Possible Next Steps | Future feature


- Performance testing and tuning for 11 million people
- Link to Indicator Reporting systems
- Advanced Business alerting



# TS: Terminology Service

## Rwanda Terminology Service

The Rwandan Ministry of Health has published its standard sets of terminologies to be used in the Health Sector. Utilize the Rwandan Terminology Service to locate the standard codes supported by the Rwandan Ministry of Health; choose to view, or export a single or set of terms. Start your search here:

Search 

[Advanced search](#)

### Browse the Standards

The Rwanda Terminology Service houses standardized code sets including ICD-10 and LOINC and also includes a range of codeset extensions specialized to Rwanda.

[Start Browsing »](#)

### Links

Links to various terminology standards.

[Links »](#)

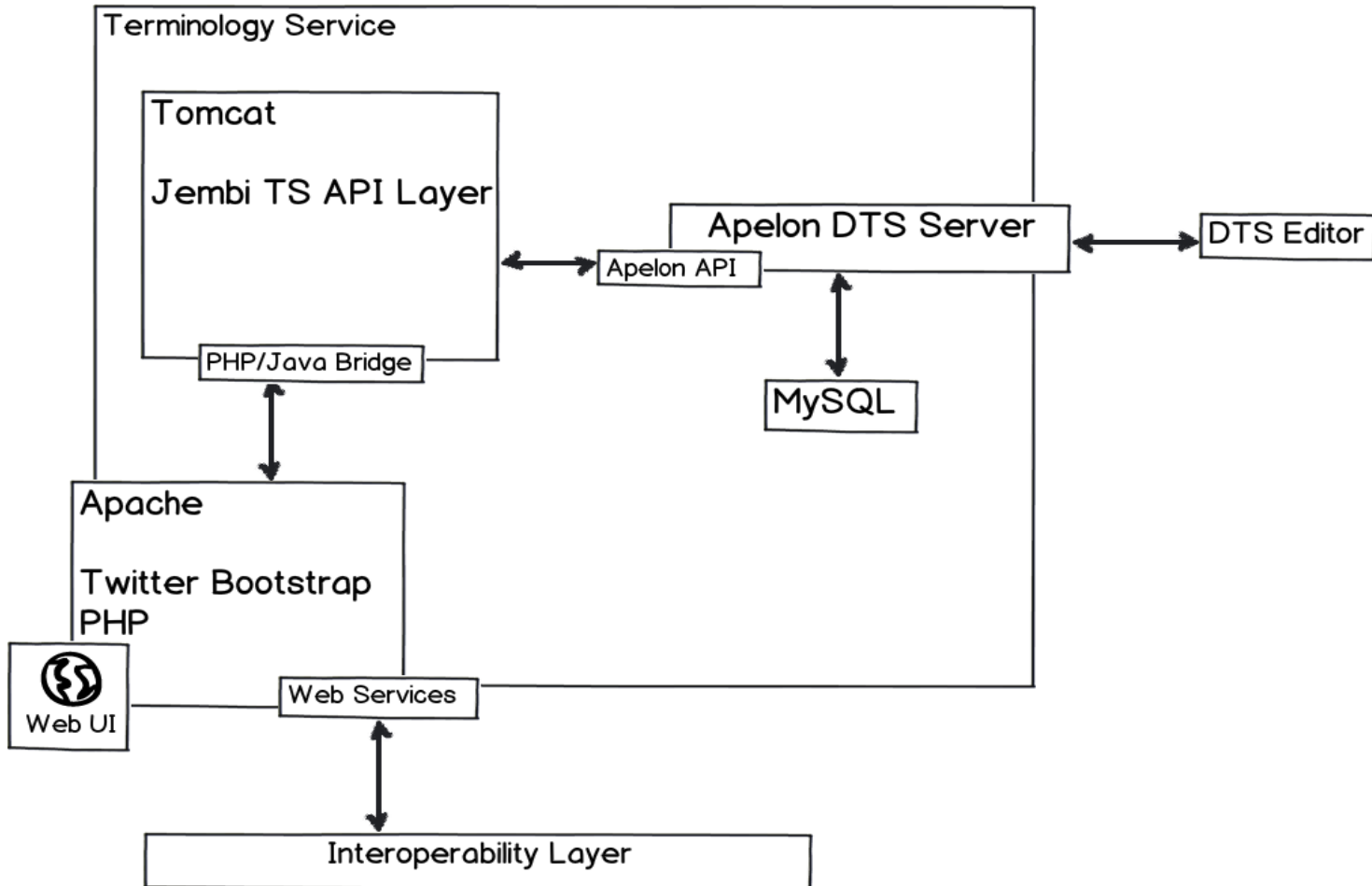
# TS: Terminology Service

- Business function:
  - Promote semantic interoperability between systems/components by providing terminologies for common reference
- Technology built on:
  - Apelon DTS
  - HTML/PHP/Javascript/Java/Twitter bootstrap
- Technical Team
  - Jembi Health Systems

# What does it do? | Services

- Storage of terminology sets
- ICD10, LOINC, Rwanda Extension to LOINC, and lots more
- Interfaces:
  - DTS Editor
  - Website
  - Web service interface

# Structure



# Client Registry (CR)

- Business function: the CR identifies the same patient across different health settings so that clinical data from separate sources can be integrated to provide a comprehensive portrait of care.
- The technology is built on OpenEMPI, the Open Source Enterprise Master Patient Index, which uses Java, Postgres, IHE PIX/PDQ standards (<http://openempi.kenai.com>)
- Technical Team: Includes leadership by SYSNET International, Regenstrief Institute

# What does it do? | Services

- Stores and retrieves de-duplicated patient demographic data
- Uses sophisticated methods to identify duplicate records
- OpenEMPI was designed using an extensible, Service Oriented Architecture approach.
- Interfaces include:
  - IHE PIX/PDQ Interface
  - REST-based Web service interface
  - Java & EJB APIs

# What does it look like

First Name:  Last Name:   
Date of Birth:  Gender:

Fuzzy Match:

First Name	Last Name	Date of Birth	Gender	Address	City	State	Zip Code	Country
<input type="checkbox"/> Rhea	Testpatient1	1987-01-01	Female					Rwanda
<b>Person Identifiers:</b>								
<b>Identifier</b>		<b>Domain Name</b>		<b>Namespace Identifier</b>		<b>Universal Identifier</b>		<b>Universal Identifier Type</b>
56d9d740-03e4-11e2-b1f6-441ea13899d8		ECID		ECID		ECID		ECID
5654454653756721		NID		NID		NID		NID
<b>Linked Patients:</b>								
<b>Name</b>		<b>Identifier</b>						
<input type="checkbox"/> Rhea	Testpatient2	1985-01-01	Female					Rwanda
<input type="checkbox"/> Rhea	Testpatient3	1982-01-01	Female					Rwanda
<input type="checkbox"/> Rhea	Testpatient4	1984-01-01	Female					Rwanda

# Possible Next Steps | Future features


- Scalability: Ensuring the system response exceeds expectations as it scales to 9 million people
- Customization: Supporting tailored data elements across varying clinical environments
- Match Intelligence: Augmenting the matching engine with additional algorithms and methods
- Workflow: Enhancing end-user workflows for algorithm tuning and match-management.




# Rwanda Provider Registry

Utilize the Rwanda Provider Registry to add, update and track health care providers within Rwanda. This data can be used for analysis and to create custom reports. Search for a specific provider here:

Search by Anglo/French Name

Search by National ID

[Advanced search](#)

## Add a Provider

In order to track a provider in the database, add a record for that provider. Certain information is required to start a new record. Once the record is generated, additional options for adding data about the provider will become available.

## View Reports

Reports enable analysis of the provider registry data in various ways. Customize, display and print provider lists, statistical charts and other standard reports.

# RHEA PR: Provider Registry

- **Business function:**
  - Register providers from multiple sources and validate provider data from PoC applications before they enter the shared health record.
- **Technology built on:**
  - **LDAP** – data store (provider and posts for web services)
  - **MySQL** – database (lists (e.g. jobs) & search for user interface)
  - **Twitter Bootstrap** – User Interface
  - **iHRIS** – PHP middleware (provides HRH business & interface logic)
  - **Moodle** – *eLearning system*
- **Technical Team**
  - IntraHealth International, Inc + Capacity*Plus* partnership (TRG, LATH, IMA)
  - RHEA collaborative
  - More to be added in next phase

# What does it do? | Services

- **Storage and retrieval of provider data**
  - Consolidates key information from multiple sources
- **Allows addition and edits by**
  - User interface
  - Updates from national HRHIS (for paid/public sector)
- **Additional interfaces**
  - LDAP
  - Web services for HIM
- **Multiple roles supported e.g...**
  - Administrator
  - Provider Manager
- **Powerful reporting capability**

## Search Provider

Use search fields to locate a specific provider and related postings.

### Results found : 20

#	Rwandan Name	Anglo/French Name	National ID	Category/Cadre	Type	Last Post Facility	Facility	Start Date	End Date	Last Pos/ Locati
1		<a href="#">Gilbert NTAGANDA</a>	<a href="#">1197980035033091</a>		Paid Public Sector					
2		<a href="#">Gilbert E Karonkano Rutayisire</a>	<a href="#">1197980124719077</a>		Paid Public Sector	King Faisal Hospital Provincial Hospital	King Faisal Hospital			
3		<a href="#">Gilbert Munyemana</a>	<a href="#">1198680175218001</a>		Paid Public Sector	Nyamure Health Center	Nyamure			
4		<a href="#">Gilbert Maniriho</a>	<a href="#">1198380019165028</a>		Paid Public Sector	Rutare Health Center	Rutare			
5		<a href="#">Gilbert Musine</a>	<a href="#">1198480187962023</a>		Paid Public Sector	Mwogo Health Center	Mwogo			
6		<a href="#">Gilbert Manishimwe</a>	<a href="#">1198180071771038</a>		Paid Public Sector	Butaro Health Center	Butaro			
7		<a href="#">Gilberte Uwicyeza</a>	<a href="#">119827014990140</a>		Paid Public Sector	Nyamata Health Center	Nyamata			
8		<a href="#">Gilbert Nyandwi</a>	<a href="#">1198680005267025</a>		Paid Public Sector	CHK/CHUK Provincial Hospital	CHK/CHUK			
9		<a href="#">Gilbert Habimana</a>	<a href="#">1198380047661084</a>		Paid Public Sector	Kibillizi HD District Hospital	Kibillizi HD			

### Search Fields

Save as default view

Rwandan Name

Anglo/French Name

National ID

CSR

Mutuelle

Passport

# Add/Update Provider

## Personal Information

Rwandan Name

National ID\*

1197980124719078

Anglo/French Name\*

Carl Leitner

Nationality\*

United States

Other Names

Residence

Gahanga, KICUKIRO, VILLE DE KIG

# Add/Update Post

, Carl Leitner

## Post Information

Facility

Muhima Dispensary

Masaka Health Center

Masaka MU Mutuelle Section Of

Mwendo (NYARUGENGE) Health

Mwendo MU [Nyarungenge] Mu

Muhima Dispensary

Muhima HD District Hospital

Muhima MU Mutuelle Section Of

Muzenga Community Health Po

Mugombwa Health Center

Mugombwa MU Mutuelle Section

Location

► [Select Value](#)

Employee Type

Select One

Category

Select One

Cancel

Confirm

▼ [Select Value](#)

▼ Rwanda

► [GASABO, VILLE DE KIGALI, Rwanda](#)

▼ [KICUKIRO, VILLE DE KIGALI, Rwanda](#)

[Gahanga, KICUKIRO, VILLE DE](#)

[KIGALI, Rwanda](#)

[Gikondo, KICUKIRO, VILLE DE KIGALI,](#)

[Rwanda](#)

[Kanombe, KICUKIRO, VILLE DE](#)

[KIGALI, Rwanda](#)

[Kicukiro, KICUKIRO, VILLE DE KIGALI,](#)

[Rwanda](#)

[Masaka, KICUKIRO, VILLE DE KIGALI,](#)

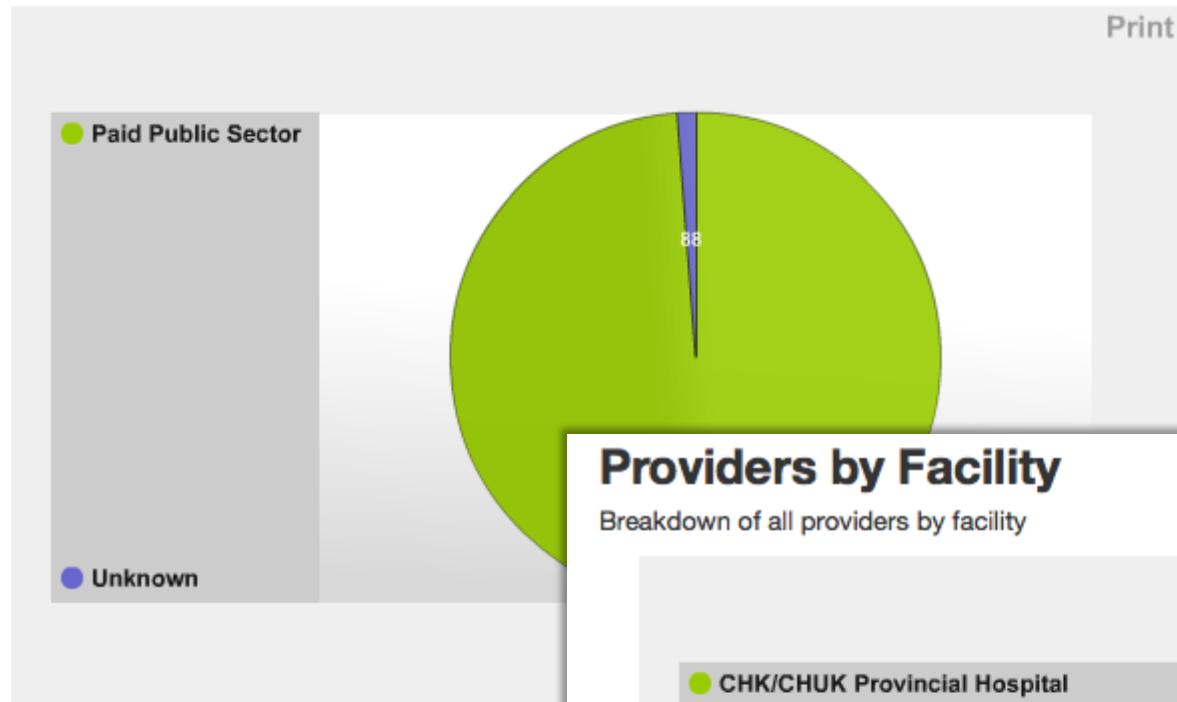
[Rwanda](#)

Cancel

Confirm

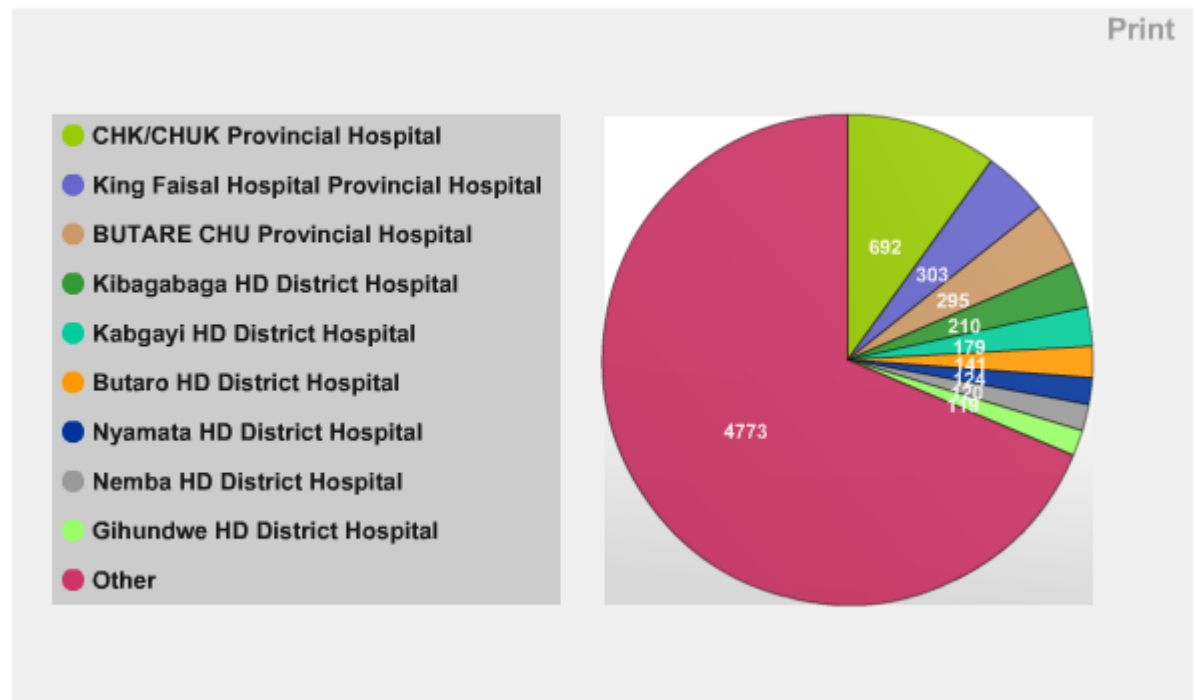
# Providers by Type

Breakdown of all providers by type



# Providers by Facility

Breakdown of all providers by facility



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## Navigation

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- ▼ [My courses](#)
  - ▼ [rhea-pr](#)
    - ▶ [Participants](#)
    - ▶ [General](#)
    - ▶ [Purpose of the Provider Registry](#)
    - ▶ [Using the Provider Registry](#)
    - ▶ [Provider Registry Architecture](#)
    - ▶ [Administration of Provider Registry User Interface](#)
    - ▶ [Introduction to LDAP](#)
    - ▶ [Installation of the Provider Registry](#)
    - ▶ [Provider Registry Software Development](#)
    - ▶ [Customization of the Provider Registry](#)

## Settings

### [News forum](#)

#### Purpose of the Provider Registry

Intended audience: Data managers, system administrators, and software developers

Topics covered:

- Role of the Provider Registry in the RHEA.
- Who is considered a provider?
- What is the scope of the data managed?

-  [Purpose of the Provider Registry](#)
-  [Provider Registry Validation](#)

#### Using the Provider Registry

Intended audience: Data managers and software developers

Topics covered:

- Search for an existing provider
- Create a new provider
- Add deployment information to a new provider
- Edit provider details
- Handling exceptions from the interoperability layer
- Running reports
- Data quality issues

-  [Using the provider registry](#)

## Search forums

[Advanced search](#) 

## Latest news

(No news has been posted yet)

## Upcoming events

There are no upcoming events

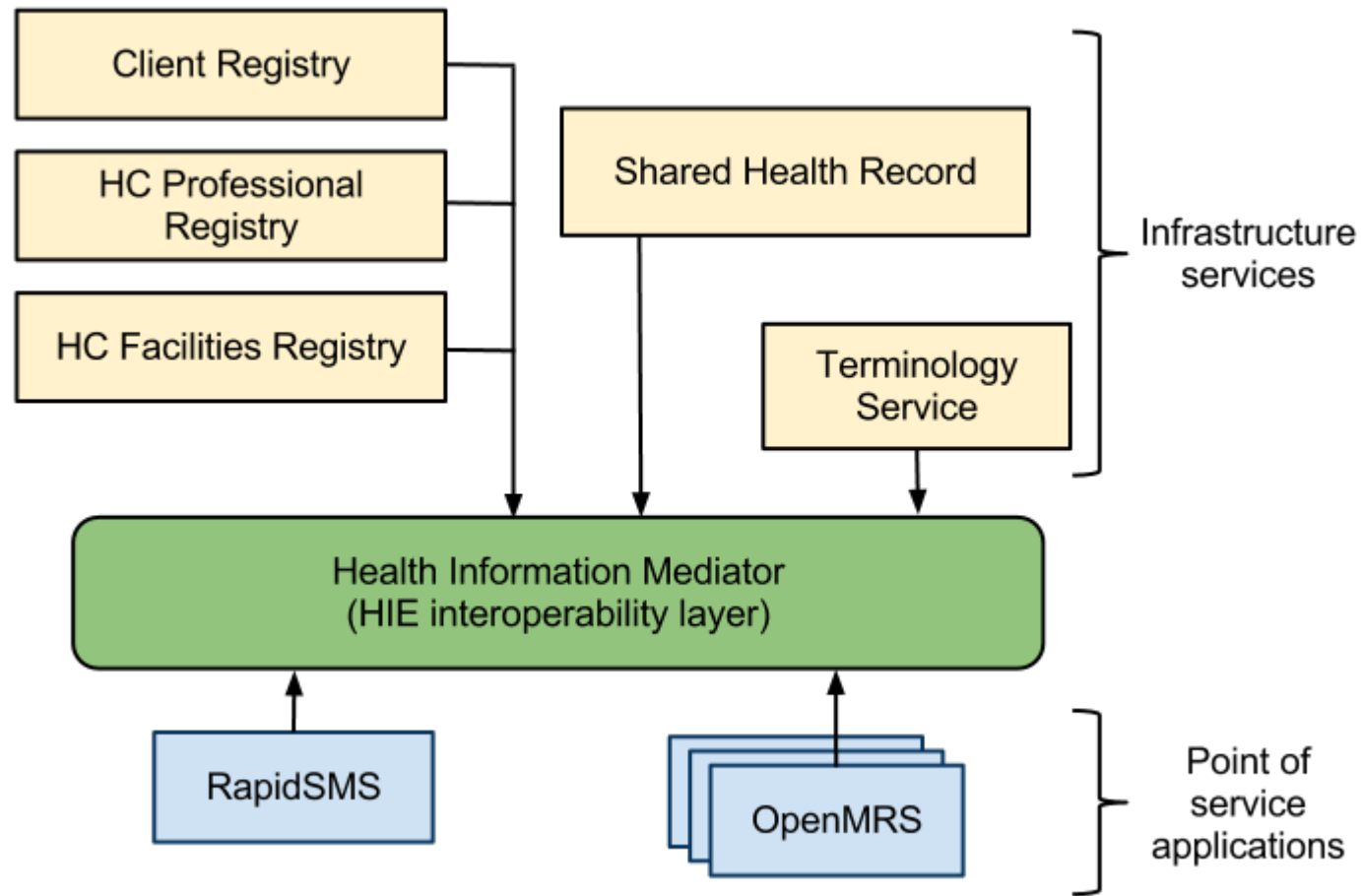
[Go to calendar...](#)  
[New event...](#)

## Recent activity

Activity since Friday, 21  
September 2012, 6:05 PM  
[Full report of recent activity...](#)  
Nothing new since your last login

# Health Information Mediator

What is the Purpose of RHEA? - Information sharing between sites



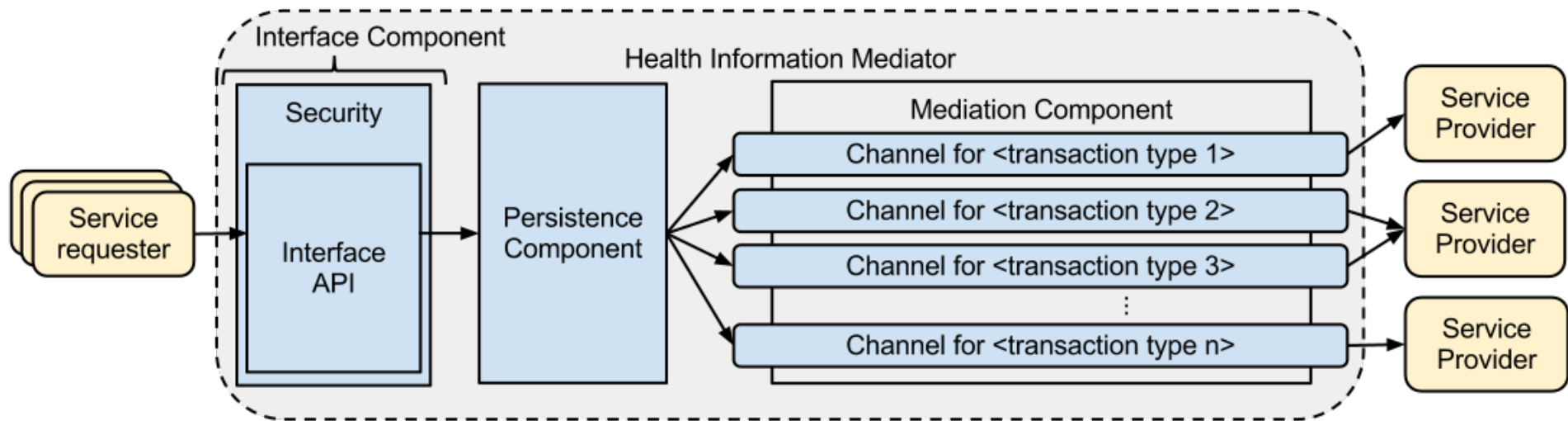


# Requirements and challenges of Interoperability

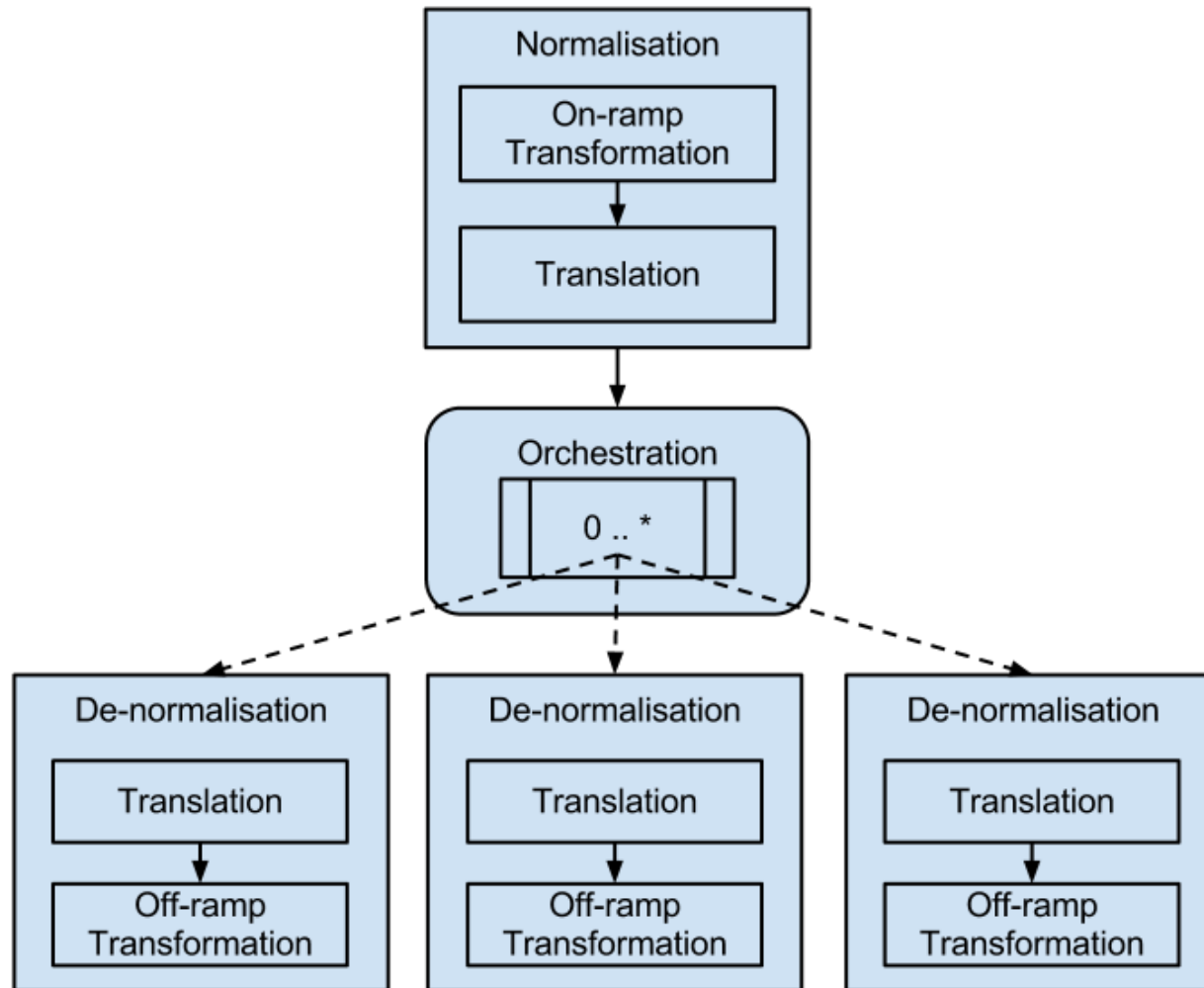
- Facilitate interoperability between disparate and heterogeneous systems, both existing and future.
- Adapt and scale within a changing environment
- Local changes should not propagate through the system
- Provide a low barrier to entry to connect new and legacy systems

$$\text{HIM} = \{I, P, M\}$$

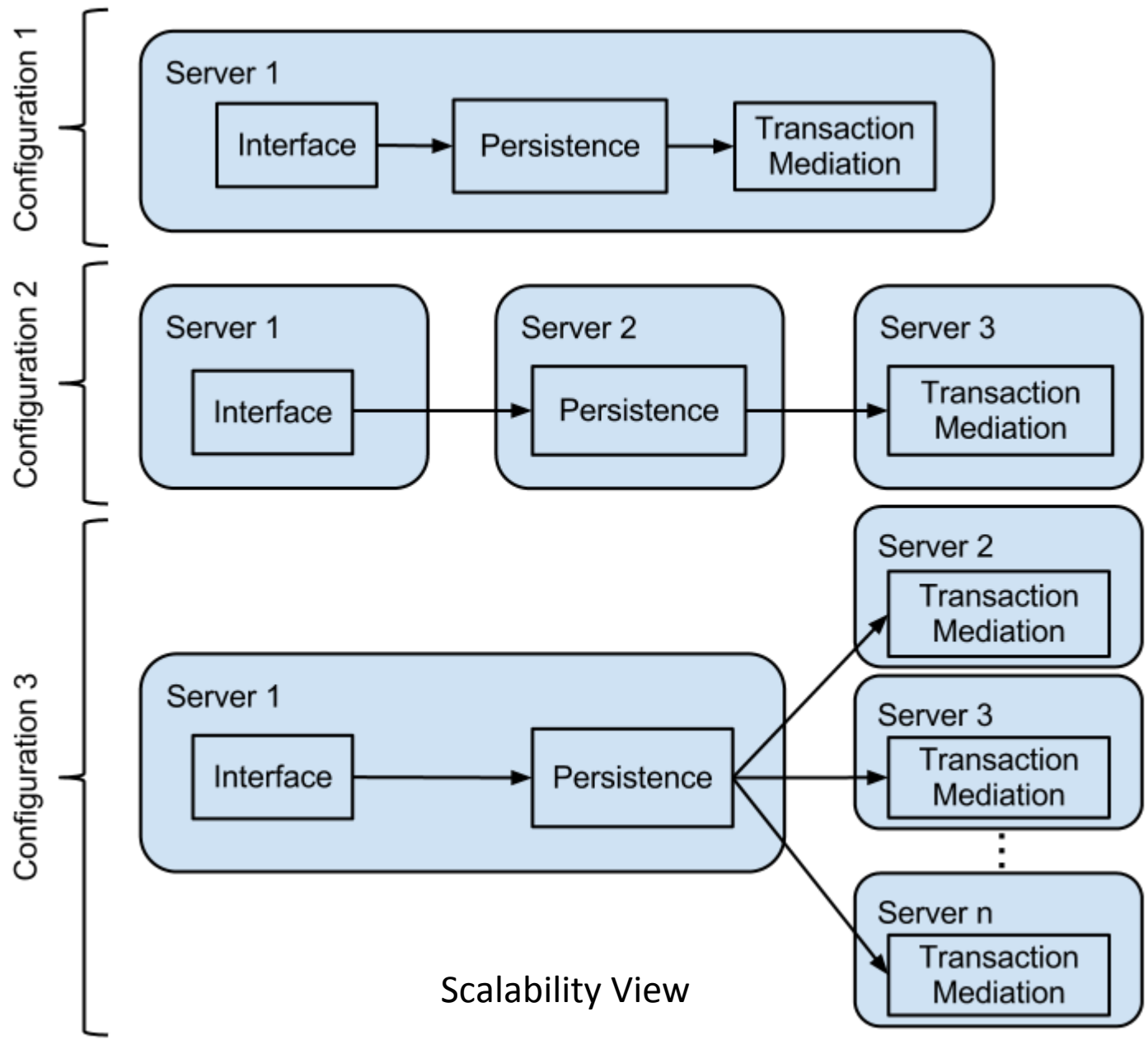
Enterprise Service Bus approach



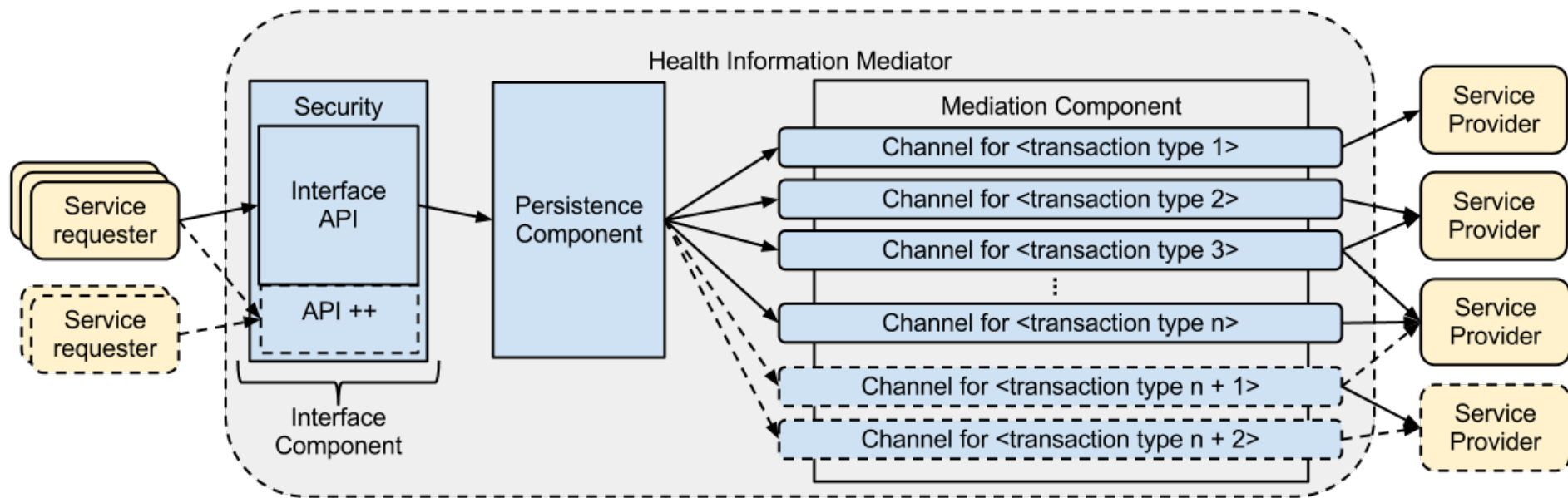
Overview of the HIM Components



Mediation Component



Scalability View



Adaptability View

# Analysis

- Currently being implemented in Rwanda
- API hides complexity of infrastructure
  - facilitates easy interoperability between disparate HISs
- Encourages local autonomy
- The HIM does not prescribe a data exchange format

# Conclusion

- Future Work
  - Developing a more general framework
  - Security architecture
- Proposed architecture proves to
  - facilitate easy interoperability, promote local autonomy
  - scale and adapt
- We currently have a functioning reference implementation of this architecture