



RAPIDSMS-RHEA Integration
Technical Design Document
Version 1.0

Table of Contents

- 1.1 Revision History.....4
- 1.2 Contributors/Reviewers.....4
- 2.1 Scope of this document.....5
- 2.2 Requirements for this document.....5
- 3.4 Technical Structure.....6
- 4.1 Compliance with RHEA transaction specifications.....7
- 4.2 Supported resources.....7
- 4.3 Performance.....8
- 4.4 Security.....8
- 4.5 Message Definitions.....8
- 4.6 Segment Definitions.....8
- 4.7 Standard Code Sets.....12
- 4.8 Message Examples.....14
- 5.1 API design and development.....25
- 5.2 API operations.....26

1 Document Control

1.1 Revision History

| Date | Author | Version | Change Summary |
|------------|-------------------------|---------|-------------------------|
| 28-10-2011 | UWANTWALI ZIGAMA Didier | 0.1 | First version |
| 28-11-2011 | Pivot and RHEA Team | 0.2 | HL7 message definitions |

1.2 Contributors/Reviewers

| Contributor/Reviewer | Comments |
|----------------------|----------|
| MUTESA Christian | |
| NZEYIMANA Antoine | |
| KAGAME Maurice | |

2 Introduction

2.1 Scope of this document

This document describes how the RAPIDSMS system is designed. It describes the structure of RAPIDSMS and how it integrates with the RHEA. After reading the document the reader should be able to understand the system and can maintain or make changes and fix bugs.

2.2 Requirements for this document

This is a technical document that describes the design of the RapidSMS - RWANDA System, and its integration to RHEA. The document refers to various technologies. Readers should be aware of these technologies and terminologies.

- Python
- Django
- Rapidsms
- Web Services
- HL7

2.3 Audience

This document is targeted for developers and technical readers that will integrate RapidSMS - RWANDA with RHEA as well as developing further components and maintaining RapidSMS - RWANDA. It is expected that the reader has some technical background related to the technologies mentioned in the requirements of this document.

2.4 Document References

| Ref #. | Document Name | URL |
|--------|-------------------|---|
| 1 | Python | http://python.org/ |
| 2 | Django | https://www.djangoproject.com/ |
| 3 | Rapidsms | http://www.rapidsms.org http://docs.rapidsms.org http://en.wikibooks.org/wiki/RapidSMS_Developers_Guide |
| 4 | Web Services | http://www.w3schools.com/webservices/ |
| 5 | HL7 | http://www.hl7.com/ |
| 6 | RapidSMS - RWANDA | http://www.rapidsms.moh.gov.rw |

3 Design Overview

3.1 Purpose

This document has the purpose to provide a technical design of RapidSMS interfaces with RHEA's Interoperability Layer (HIE). This document specifies the current RapidSMS – RWANDA design and provides a full explanation of the specifications expected in RHEA transactions, Phase 1, guide for implementation decisions of RapidSMS-SHR integration.

3.2 RapidSMS Overview

RapidSMS (an SMS based system to provide a real time community based surveillance and alert system for maternal and child health in RWANDA) was built on RapidSMS, a free and open-source framework for dynamic data collection, logistics coordination and communication, leveraging basic short message service (SMS) mobile phone technology.

It was customized specifically to support maternal, neonatal and early child health at the community level by introducing tools to help CHWs track pregnant women under their care, monitor antenatal care, identify and refer women at risk, and improve communication with health facility and district level facilities in the case of emergencies.

3.3 Technology

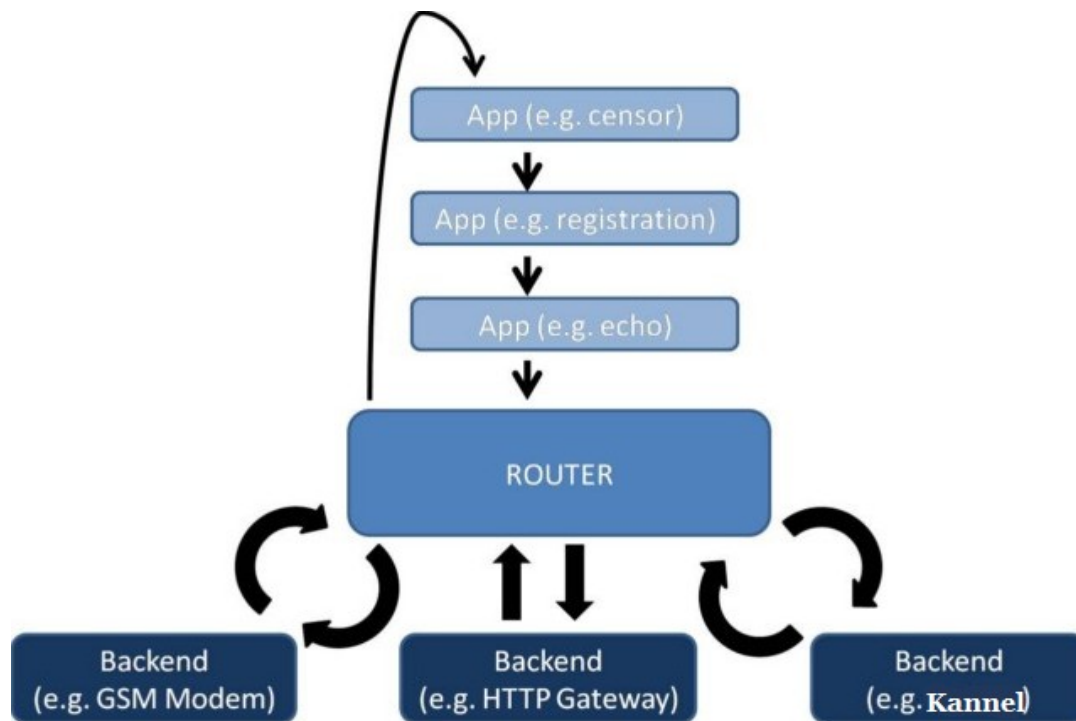
The RapidSMS - RWANDA was designed and implemented using the following technologies:

- OS : GNU/LINUX platform (Ubuntu)
- Python and Required Packages
- Django Web Framework
- Rapidsms Core Library
- Kannel SMS Gateway
- MySQL Database Management System
- Cherokee Web Sever

3.4 Technical Structure

RapidSMS consists of three main components:

- Applications: performs one or more of the following functions; message processing from the Router, Data-model extension, WebUI ... (eg: CHW Registration; Birth report, etc..)
- Backends: receive messages from external sources, and deliver messages from Applications to external sources(GSM Handset or Modem: via the pyGSM backend, SMSC : via Kannel SMS gateway, HTTP clients : via HTTP backend)
- Router: routes messages between Backends and Applications.



4 RapidSMS - RWANDA and RHEA Integration

This paragraph provides an integration design that contains standards and measures that the system must satisfy in order to comply with the RHEA Project. It will be used to validate the design and ensure that it is aligned with RHEA's overall Architecture, Design Principles and Standards.

4.1 Compliance with RHEA transaction specifications

To inter-operate, RapidSMS needs to :

- Consume services exposed by RHEA : RapidSMS should support RHEA Transaction messages as defined in the RHEA transactions specifications document.
- Expose a RESTful API that will avail some of its functionalities to RHEA. RapidSMS has a need to setup and address the connectivity, addressing, security and reliable messaging schema that will allow the communication and the exchange of data with RHEA.

4.2 Supported resources

- ➔ to consume (RapidSMS to RHEA) : Save Patient Encounter : This transaction deals with saving a patients encounter in their medical record
- ➔ to expose (RHEA to RapidSMS) : Post alerts : Receives an alert message and relays it to the appropriate CHW via SMS

4.3 Performance

TODO

4.4 Security

In order to comply with RHEA security regulations, accesses to the patients' health records are provided after authentication. As a result, the RAPIDSMS API will provide authorization function.

4.5 Message Definitions

RapidSMS API will support the Health Level 7 (HL7) Version 2.5 Unsolicited Result Message (ORU^R01). The following are ORU message segments that will be processed, if present:

- ✓ MSH Message Header Segment Provides transactional information for the message.
- ✓ PID Patient Identification Segment includes patient information. PV1 Patient Visit Segment. Used to identify, and provide encounter information.
- ✓ OBR - Observation Request segment serves as a section header for the OBX segments that directly follow.
- ✓ OBX -The Observation Result Segment (OBX) is used to convey observation results as “name/value pairs” that indicates observations.
- ✓ The EVN segment captures basic event information.
- ✓ The STF segment captures relevant information for the health professional.
- ✓ The ORG segment captures organizational affiliation information for the health professional.
- ✓ The LAN segment captures language information

For each of the segments that are processed, please refer to the Segment Definitions section of this document for more details.

4.6 Segment Definitions

The following table shows and describes the segments of the HL7 messages that are sent to SHR or received from SHR by RapidSMS. Many of the segments are either required or optional components of two or more of the messages for patient encounters, or alerts that the RapidSMS API can send or receive. Each segment definition in the table contains several rows and columns of data to define the relevant segment.

| SEGMENT | SEGMENT NAME | FIELD REFERENCE | FIELD NAME | Description note |
|---------|------------------------|-----------------|------------|--|
| MSH | MESSAGE HEADER SEGMENT | | | This segment is required in every transactional message, and it provides all information required to process the Message/transaction |

| | | | | |
|--|--|--------|-----------------------|---|
| | | MSH-1 | Field Separator | It is required to utilize the “ ” field separator in all messages to be sent. |
| | | MSH-2 | Encoding Characters | It is strongly recommended to utilize the encoding characters listed in Special Characters and Encoding section. Literal value: ‘^~\&#’ |
| | | MSH-3 | Sending Application | For each message, the HL7 data exchange partner should value MSH-3.1 with the name of the sending application. e.g: “RapidSMS” |
| | | MSH-4 | Sending Facility | For each message, the HL7 data exchange partner should value MSH-4.1 with the Facility Code that was assigned by the Ministry of Health. e.g: FOSA CODE In RapidSMS |
| | | MSH-5 | Receiving Application | For each message, the target system will be provided. E.g : “SHR” for RapidSMS |
| | | MSH-6 | Receiving Facility | For each message, the target health facility will be provided. E.g : “Rwanda MOH” for RapidSMS |
| | | MSH-7 | Date/Time of Message | Date/time the sending system created the message. The expected format is YYYYMMDDHHMMSS; for example, “20110420105234” represents April 20, 2011 at 10:52 AM and 34 seconds). |
| | | MSH-9 | Message Type | For each message, MSH-9.1 must be valued with message type “ORU”, MSH-9.2 valued with “R01” and MSH-9.3 valued with “ORU^R01^ORU_R01”. |
| | | MSH-10 | Message Control ID | The sender must value this field with a unique identifier. RapidSMS will provide the Report reference number in this field. |
| | | MSH-11 | Processing ID | Use "D" now for Debugging, Production, Training for MSH-11.1, and use “C” for MSH-11.2 the processing mode. |
| | | MSH-12 | Version ID | Use "V2.5" for MSH-12.1, and use “RWA” for MSH-11.2 the internationalization code. |

| | | | | |
|-----|--------------------------------|--------|----------------------------|--|
| | | MSH-21 | Message Profile Identifier | Defines the kind of functional data carried within this message. Value values: "PRE", "RISK", "BIR", "MAT", and "ALERT". |
| PID | PATIENT IDENTIFICATION SEGMENT | | | This segment is required and is used for identifying the patient and communicating the patient's information |
| | | PID-3 | Patient Identifier List | Patient identifier is included (PID-3.1) and the identifier type value (PID-3.5 , use "NID" from RapidSMS) |
| | | PID-5 | Patient Name | The Patient Last/Family Name (PID-5.1.1) and Patient First/Given Names (PID-5.2) are required. The Patient Middle Name (PID-5.3) should be included, if available. RapidSMS doesn't have names for patient. |
| | | PID-29 | Death Date and Time | The date and time the patient was dead. |
| PV1 | PATIENT VISIT SEGMENT | | | Used to identify, and provide encounter information. |
| | | PV1-1 | Set ID | Use "1" |
| | | PV1-2 | Patient Class | Use "Community Health" |
| | | PV1-3 | Assigned Patient Location | The location where the patient is located. RapidSMS assumes the patient is in the same location as the The community Health Worker (CHW). |
| | | PV1-7 | Attended Doctor | The assigned practitioner ID (from the Provider Registry). RapidSMS use the NID of a CHW. |
| | | PV1-44 | Admit Date/Time | The date and time. RapidSMS use date and time in the collected report by a CHW |
| OBR | OBSERVATION REQUEST SEGMENT | | | The Observation Result Segment (OBX) is used to convey observation results as "name/value pairs" |
| | | OBR-1 | Set ID | Sequence number of one of multiple OBRs that may be in a message. use "1" for first order, "2" for second order , etc. |
| | | OBR-4 | Universal | Code that indicates the type of data |

| | | | | |
|-----|------------------------------|-------|------------------------|---|
| | | | Service Identifier | carried in this Notification segment. use “Maternal Health Reporting” for OBR-4.2 |
| OBX | OBSERVATION RESULT SEGMENT | | | The Observation Result Segment (OBX) is used to convey observation results as “name/value pairs.” |
| | | OBX-1 | Set ID | Sequence number of the OBX, which increments up by one for each observation segment in the group. |
| | | OBX-2 | Value Type | Indicates the type for the observation value. |
| | | OBX-3 | Observation Identifier | Unique identifier of the specific observation being passed in this segment. OBX-3.1 for ID, OBX-3.2 for description, and OBX-3.3 for the coding system. |
| | | OBX-5 | Observation Value | Actual result value or observation. The observation value will always be one of these values: <ul style="list-style-type: none"> ➔ Date of Last Menstrual Period ➔ Mother's Weight ➔ Estimated Date of Delivery ➔ Child Number ➔ Baby weight ➔ Risk Code ➔ Maternal Code ➔ Trigger Name |
| EVN | EVENT SEGMENT | | | The EVN segment captures basic event information. |
| | | EVN-2 | Recorded Date/Time | EVN-2.1 for Date and Time the information has been recorded. |
| STF | STAFF IDENTIFICATION SEGMENT | | | The STF segment captures relevant information for the health professional. |
| | | STF-2 | Staff Identifier List | NID |
| | | STF-4 | Staff Type | CHW, SUP |
| | | STF-8 | Department | The village the CH |

| | | | | |
|-----|--|-------|---|--|
| ORG | PRACTITIONER ORGANIZATION UNIT SEGMENT | | | The ORG segment captures organizational affiliation information for the health professional. |
| | | ORG-1 | Set ID | Use "1" |
| | | ORG-5 | Practitioner Organization Unit Identifier | RapidSMS uses FOSA CODE of the health facility for ORG-5.6.1 |
| LAN | LANGUAGE SEGMENT | | | The LAN segment captures language information |
| | | LAN-1 | Set ID | Use "1" |
| | | LAN-2 | Language Code | LAN-2.1 for Language code, RapidSMS uses "RW", "EN", and "FR" |

4.7 Standard Code Sets

The following table illustrates the code sets, some are taken from RapidSMS, the RHEA transaction specifications document, the SHR_RapidSMS_HL7 mapping document, and others will be added from RHEA DATA CODEBOOK, if any. This means that this table can be modified in any version of this document, where some code sets could be added, removed or modified.

| Source | Category | Code | Description |
|----------|-------------|------|-------------------------------|
| RapidSMS | Vaccination | V1 | BCG, PO |
| | | V2 | P1, Penta1, PCV1 |
| | | V3 | P2, Penta2, PCV2 |
| | | V4 | P3, Penta3, PCV3 |
| | | V5 | Measles |
| RapidSMS | Birth | NA | Never received antenatal care |
| | | | |

| | | | |
|-----------------|-------------|----|--------------------------------|
| | | | |
| | Risk | | |
| | | TW | Twins |
| | | TR | Triplet |
| | | BO | Male Child |
| | | GI | Female Child |
| | | TE | Mother at term |
| | | LA | Mother in labor |
| | | NP | No problem |
| RapidSMS | | | |
| | | SC | Serious condition, but unknown |
| | | CI | Cord infection |
| | | DI | Diarrhea |
| | | MA | Malaria |
| | | FE | Fever |
| | | HY | Hypothermia |
| | | RB | Rapid breathing |
| | | PN | Pneumonia |
| | | HE | Hemorrhaging/ bleeding |
| | | VO | Vomiting |
| | | CO | Convulsion |
| | | SA | Severe anemia |
| | | SB | |
| | | CH | Coughing |
| | | UN | Unconscious |
| | | OE | Oedema |
| | | FP | Flaccid paralysis |
| | | NS | Neck stiffness |
| | | CM | Congenital malformation |
| | | JA | Jaundice |
| | | AF | Abnormal fontanel |

| | | | |
|--|--|----|------------------------------------|
| | | PC | Premature contraction |
| | | SL | Stock labor |
| | | DS | Chronic disease |
| | | PS | Labor on previous cesarean section |
| | | DP | Departure |
| | | RF | Refusal |

4.8 Message Examples

The following examples illustrate the HL7 messages that are sent to SHR or received from SHR by RapidSMS. We have five different examples of messages according to these five different message profile identifiers; PRE, RISK, BIR, MAT and ALERT.

Each example provides the following:

- ✓ Sample Message: provides the entire message string
- ✓ Message Narrative: tells the story of the message.
- ✓ Segment Details: lists each message segment, such as the Message Header (MSH) segment, contained in the sample message, the fields contained in that segment and the data (from the sample message) provided in each field.

Example 1: PRE message

This message shows the detailed sample HL7 message that is sent to SHR for a new encounter notifying a new pregnancy registration from RapidSMS.

✓ Sample Message

```
MSH|^~\&#|RapidSMS|F316|SHR|RwandaMOH|20111109065718||ORU^R01^ORU_R01|68060|D^C|
V2.5^RWA|||||PR
PID|||1198270120343040^^^NID||
PV1|1|Community Health|316|||1197370056233083|||||20111109065718
OBR|1||^Maternal Health Reporting
OBX|1|TS|^Date of Last Menstrual Period^|20110704||||F
OBX|2|NM|^Mother's Weight^|57k||||
OBX|3|TS|^Estimated Date of Delivery^|20120406||||F
```

✓ Message Narrative

In this example, above, the Message Header (MSH) segment, identifies the message as being sent to SHR, Rwanda MOH facility, from RapidSMS, from the facility registered with code “F316”, which is the facility code associated with MUHOZA Health Centre in RapidSMS. The MSH segment also lets know that the message will contain the standard separator of “|” and encoding characters of “^~\ &#”. This message was created on 09/10/2011 at approximately 6:57 AM (06:57:18 to be exact), and is an ORU R01 (i.e., unsolicited result) message. RapidSMS has assigned the unique message ID of “68060” to this ORU message; the SHR will perhaps echo this unique ID back in the response message. The “D” that follows the unique message ID indicates that this may be a production, training or a debugging message and the “C” the processing mode. The Version field, the next to last field in this segment, identifies that RapidSMS is using HL7 version 2.5. This is a version of HL7 that the RapidSMS API and SHR officially support and the internationalization code is RWA from ISO 3166. In the message profile ID field, the last field shown in this segment, RapidSMS has sent a “PRE” meaning that is a pregnancy notification message.

The next segment of the message is the Patient Identification (PID) segment. This ORU message is for a patient registered in RapidSMS with a national identity number [1198270120343040](#).

The Patient Visit (PV1) segment shows that the visit is a Community Health based program. The set ID is 1 and the patient is located at a location identified by 316, Muhoza health centre; the patient met a CHW with national ID [1197370056233083](#) on 9th November 2011.

The next segments, the observations (OBR and OBX), contains observation data for Maternal Health Reporting. The date of last menstrual period, for the identified patient, is 04/07/2011, her weight is 57kg, and she’s expected to deliver on 6th April.

✓ Segment Details

MSH: MSH-1 Field Separator: |
MSH-2 Encoding Characters: ^~\&#
MSH-3.1 Sending Application – Namespace ID: RapidSMS
MSH-4.1 Sending Facility – Namespace ID: F316
MSH-3.1 Receiving Application – Namespace ID: SHR
MSH-4.1 Receiving Facility – Namespace ID: Rwanda MOH
MSH-7.1 Date Time of Message: 20111109065718 (11/09/2011 at 06:57:18)
MSH-9 Message Type
MSH-9.1 Message Type: ORU
MSH-9.2 Trigger Event: R01
MSH-9.3 Message structure: ORU^R01^ORU_R01
MSH-10 Message Control ID: 68060
MSH-11.1 Processing ID: D

MSH-11.2 Processing Mode: C
MSH-12.1 Version ID: V2.5
MSH-12.2 Internationalization Code: RWA
MSH-21.1 Message Profile: PRE

PID: PID-3.1 Patient Identifier ID: [1198270120343040](#)
PID-3.5 Patient Identifier Type Code: NID

PV1: PV1-1 Set ID: 1
PV1-2 Patient Class: Community Health
PV1-3 Assigned Patient Location: 316
PV1-7 Attending Doctor: [1197370056233083](#)
PV1-44 Admit Date/Time: 20111109065718 (11/09/2011 at 06:57:18)

OBR: OBR-1 Set ID: 1
OBR-4 Universal Service Identifier
OBR-4.2 Text: Maternal Health Reporting

OBX: OBX-1 Set ID: {1, 2, 3}
OBX-2 Value Type: {TS, NM, TS}
OBX-3 Observation Identifier
OBX-3.2 Text :{ Date of Last Menstrual Period, Mother's Weight, Estimated Date of Delivery}
OBX-5 Observation Value :{ 07/04/2011, 57, 04/06/2012}
OBX-6.1 Unit Identifier: {, k,}
OBX-11 Observation Result Status: {F, F, F}

Example 2: RISK message

This message shows the detailed sample HL7 message that is sent to SHR for a new encounter notifying a new risk report from RapidSMS.

✓ Sample Message

```
MSH|^~\&#|RapidSMS|F316|SHR|RwandaMOH|20111109075738||ORU^R01^ORU_R01|68061|D^C|
V2.5^RWA|||||RISK
PID||1198270120343040^^^NID||
PV1|1|Community Health|316||1197370056233083|||||20111109075738
OBR|1||^Maternal Health Reporting
OBX|1|NM|^Mother's Weight^|57|k|||F
OBX|2|CE|^Risk Code^|HE||||F
```


✓ Message Narrative

In this example, above, the Message Header (MSH) segment, identifies the message as being sent to SHR, Rwanda MOH facility, from RapidSMS, from the facility registered with code “F316”, which is the facility code associated with MUHOZA Health Centre in RapidSMS. The MSH segment also lets know that the message will contain the standard separator of “|” and encoding characters of “^~\ &#”. This message was created on 09/10/2011 at approximately 6:57 AM (07:57:38 to be exact), and is an ORU R01 (i.e., unsolicited result) message. RapidSMS has assigned the unique message ID of “68061” to this ORU message; the SHR will perhaps echo this unique ID back in the response message. The “D” that follows the unique message ID indicates that this may be a production, training or a debugging message and the “C” the processing mode. The Version field, the next to last field in this segment, identifies that RapidSMS is using HL7 version 2.5. This is a version of HL7 that the RapidSMS API and SHR officially support and the internationalization code is RWA from ISO 3166. In the message profile ID field, the last field shown in this segment, RapidSMS has sent a “RISK” meaning that is a risk notification message.

The next segment of the message is the Patient Identification (PID) segment. This ORU message is for a patient registered in RapidSMS with a national identity number [1198270120343040](#).

The Patient Visit (PV1) segment shows that the visit is a Community Health based program. The set ID is 1 and the patient is located at a location identified by 316, Muhoza health centre; the patient met a CHW with national ID [1197370056233083](#) on 9th November 2011.

The next segments, the observations (OBR and OBX), contains observation data for Maternal Health Reporting. The weight, for the identified patient, is 57kg, and she’s risky bleeding.

✓ Segment Details

MSH: MSH-1 Field Separator: |
MSH-2 Encoding Characters: ^~\&#
MSH-3.1 Sending Application – Namespace ID: RapidSMS
MSH-4.1 Sending Facility – Namespace ID: F316
MSH-3.1 Receiving Application – Namespace ID: SHR
MSH-4.1 Receiving Facility – Namespace ID: Rwanda MOH
MSH-7.1 Date Time of Message: 20111109065738 (11/09/2011 at 07:57:38)
MSH-9 Message Type
MSH-9.1 Message Type: ORU
MSH-9.2 Trigger Event: R01
MSH-9.3 Message structure: ORU^R01^ORU_R01
MSH-10 Message Control ID: 68060
MSH-11.1 Processing ID: D
MSH-11.2 Processing Mode: C
MSH-12.1 Version ID: V2.5
MSH-12.2 Internationalization Code: RWA
MSH-21.1 Message Profile: PRE

PID: PID-3.1 Patient Identifier ID: [1198270120343040](#)
PID-3.5 Patient Identifier Type Code: NID

PV1: PV1-1 Set ID: 1
PV1-2 Patient Class: Community Health
PV1-3 Assigned Patient Location: 316
PV1-7 Attending Doctor: [1197370056233083](#)
PV1-44 Admit Date/Time: 20111109065718 (11/09/2011 at 07:57:38)

OBR: OBR-1 Set ID: 1
OBR-4 Universal Service Identifier
OBR-4.2 Text: Maternal Health Reporting

OBX: OBX-1 Set ID: {1, 2}
OBX-2 Value Type: {NM, CE}
OBX-3 Observation Identifier
OBX-3.2 Text : { Mother's Weight, Risk Code}
OBX-5 Observation Value : { 57, HE}
OBX-6.1 Unit Identifier: {k,}
OBX-11 Observation Result Status: {F, F}

Example 3: BIR message

This message shows the detailed sample HL7 message that is sent to SHR for a new encounter notifying a new birth registration from RapidSMS.

✓ Sample Message

```
MSH|^~\&#|RapidSMS|F316|SHR|RwandaMOH|20111108065718||ORU^R01^ORU_R01|68080|D^C|
V2.5^RWA|||||BIR
PID||1198270120343041^^^NID|
PV1|1|Community Health|316||1197370056233083|||||20111108065718
OBR|1||^Maternal Health Reporting
OBX|1|CE|^Risk Code^|NP||||F
```

OBX|2|TS|^Birth Date^||20111108|||||F
OBX|3|NM|^Baby Weight^||3.3|k|||||F
OBX|4|CE|^Birth Code^||GI|||||F
OBX|5|NM|^Child Number^||01|||||F

✓ Message Narrative

In this example, above, the Message Header (MSH) segment, identifies the message as being sent to SHR, Rwanda MOH facility, from RapidSMS, from the facility registered with code “F316”, which is the facility code associated with MUHOZA Health Centre in RapidSMS. The MSH segment also lets know that the message will contain the standard separator of “|” and encoding characters of “^~\ &#”. This message was created on 08/11/2011 at approximately 6:57 AM (06:57:18 to be exact), and is an ORU R01 (i.e., unsolicited result) message. RapidSMS has assigned the unique message ID of “68080” to this ORU message; the SHR will perhaps echo this unique ID back in the response message. The “D” that follows the unique message ID indicates that this may be a production, training or a debugging message and the “C” the processing mode. The Version field, the next to last field in this segment, identifies that RapidSMS is using HL7 version 2.5. This is a version of HL7 that the RapidSMS API and SHR officially support and the internationalization code is RWA from ISO 3166. In the message profile ID field, the last field shown in this segment, RapidSMS has sent a “BIR” meaning that is a birth notification message.

The next segment of the message is the Patient Identification (PID) segment. This ORU message is for a patient registered in RapidSMS with a national identity number [1198270120343041](#).

The Patient Visit (PV1) segment shows that the visit is a Community Health based program. The set ID is 1 and the patient is located at a location identified by 316, Muhoza health centre; the patient met a CHW with national ID [1197370056233083](#) on 8th November 2011.

The next segments, the observations (OBR and OBX), contains observation data for Maternal Health Reporting. The identified patient has no problem, she comes to deliver on 8th November 2011, the baby’s weight is 3.3kg, the baby is a girl, and she’s the first born.

✓ Segment Details

MSH: MSH-1 Field Separator: |
MSH-2 Encoding Characters: ^~\&#
MSH-3.1 Sending Application – Namespace ID: RapidSMS
MSH-4.1 Sending Facility – Namespace ID: F316
MSH-3.1 Receiving Application – Namespace ID: SHR
MSH-4.1 Receiving Facility – Namespace ID: Rwanda MOH
MSH-7.1 Date Time of Message: 20111108065718 (11/08/2011 at 06:57:18)
MSH-9 Message Type
MSH-9.1 Message Type: ORU
MSH-9.2 Trigger Event: R01
MSH-9.3 Message structure: ORU^R01^ORU_R01
MSH-10 Message Control ID: 68080
MSH-11.1 Processing ID: D
MSH-11.2 Processing Mode: C
MSH-12.1 Version ID: V2.5

MSH-12.2 Internationalization Code: RWA
MSH-21.1 Message Profile: BIR

PID: PID-3.1 Patient Identifier ID: [1198270120343041](#)
PID-3.5 Patient Identifier Type Code: NID

PV1: PV1-1 Set ID: 1
PV1-2 Patient Class: Community Health
PV1-3 Assigned Patient Location: 316
PV1-7 Attending Doctor: [1197370056233083](#)
PV1-44 Admit Date/Time: 20111108065718 (11/08/2011 at 06:57:18)

OBR: OBR-1 Set ID: 1
OBR-4 Universal Service Identifier
OBR-4.2 Text: Maternal Health Reporting

OBX: OBX-1 Set ID: {1, 2, 3, 4, 5}
OBX-2 Value Type: {CE, TS, NM, CE, NM}
OBX-3 Observation Identifier
OBX-3.2 Text : { Risk Code, Birth Date, Baby Weight, Birth Code, Child Number}
OBX-5 Observation Value : { NP, 11/08/2011, 3.3, GI, 01}
OBX-6.1 Unit Identifier: {k}
OBX-11 Observation Result Status: F

Example 3: MAT message

This message shows the detailed sample HL7 message that is sent to SHR for a new encounter notifying a death report from RapidSMS.

✓ Sample Message

```
MSH|^~\&#|RapidSMS|F316|SHR|RwandaMOH|20111108075718||ORU^R01^ORU_R01|68081|D^C|
V2.5^RWA|||||MAT
PID||1198270120343041^^^NID|||||||20111108
PV1|1|Community Health|316||1197370056233083|||||||20111108
OBR|1||^Maternal Health Reporting
```

OBX|1|CE|^Maternal Death Code^|ND|||||F

✓ **Message Narrative**

In this example, above, the Message Header (MSH) segment, identifies the message as being sent to SHR, Rwanda MOH facility, from RapidSMS, from the facility registered with code “F316”, which is the facility code associated with MUHOZA Health Centre in RapidSMS. The MSH segment also lets know that the message will contain the standard separator of “|” and encoding characters of “^~\ &#”. This message was created on 08/11/2011 at approximately 6:57 AM (07:57:18 to be exact), and is an ORU R01 (i.e., unsolicited result) message. RapidSMS has assigned the unique message ID of “68081” to this ORU message; the SHR will perhaps echo this unique ID back in the response message. The “D” that follows the unique message ID indicates that this may be a production, training or a debugging message and the “C” the processing mode. The Version field, the next to last field in this segment, identifies that RapidSMS is using HL7 version 2.5. This is a version of HL7 that the RapidSMS API and SHR officially support and the internationalization code is RWA from ISO 3166. In the message profile ID field, the last field shown in this segment, RapidSMS has sent a “MAT” meaning that is a death notification message.

The next segment of the message is the Patient Identification (PID) segment. This ORU message is for a patient registered in RapidSMS with a national identity number [1198270120343041](#), and the Death Date is 11/08/2011.

The Patient Visit (PV1) segment shows that the visit is a Community Health based program. The set ID is 1 and the patient is located at a location identified by 316, Muhoza health centre; the patient met a CHW with national ID [1197370056233083](#) on 8th November 2011.

The next segments, the observations (OBR and OBX), contains observation data for Maternal Health Reporting. The new born comes to die.

✓ **Segment Details**

MSH: MSH-1 Field Separator: |
MSH-2 Encoding Characters: ^~\&#
MSH-3.1 Sending Application – Namespace ID: RapidSMS
MSH-4.1 Sending Facility – Namespace ID: F316
MSH-3.1 Receiving Application – Namespace ID: SHR
MSH-4.1 Receiving Facility – Namespace ID: Rwanda MOH
MSH-7.1 Date Time of Message: 20111108075718 (11/08/2011 at 07:57:18)
MSH-9 Message Type
 MSH-9.1 Message Type: ORU
 MSH-9.2 Trigger Event: R01
 MSH-9.3 Message structure: ORU^R01^ORU_R01
MSH-10 Message Control ID: 68080
MSH-11.1 Processing ID: D
MSH-11.2 Processing Mode: C
MSH-12.1 Version ID: V2.5
MSH-12.2 Internationalization Code: RWA
MSH-21.1 Message Profile: MAT

PID: PID-3.1 Patient Identifier ID: [1198270120343041](#)
 PID-3.5 Patient Identifier Type Code: NID
 PID-29.1 Death Date: 20111108

PV1: PV1-1 Set ID: 1
 PV1-2 Patient Class: Community Health
 PV1-3 Assigned Patient Location: 316
 PV1-7 Attending Doctor: [1197370056233083](#)
 PV1-44 Admit Date/Time: 20111108065718 (11/08/2011 at 06:57:18)

OBR: OBR-1 Set ID: 1
 OBR-4 Universal Service Identifier
 OBR-4.2 Text: Maternal Health Reporting

OBX: OBX-1 Set ID: 1
 OBX-2 Value Type: CE
 OBX-3 Observation Identifier
 OBX-3.2 Text: Maternal Death Code
 OBX-5 Observation Value ND
 OBX-11 Observation Result Status: F

Example 1: REG message

This message shows the detailed sample HL7 message that is sent to SHR notifying a new CHW registration from RapidSMS.

✓ Sample Message

```
MSH|^~\&#|RapidSMS|F316|SHR|RwandaMOH|20111109055718||ORU^R01^ORU_R01|68050|D^C|
V2.5^RWA|||||REG
STF||1197370056233083||Community Health Worker|||^ISANGANO
ORG|1||||^^^316
LAN|1|RW
```

✓ Message Narrative

In this example, above, the Message Header (MSH) segment, identifies the message as being sent to SHR, Rwanda MOH facility, from RapidSMS, from the facility registered with code “F316”, which is the facility code associated with MUHOZA Health Centre in RapidSMS. The MSH segment also lets know that the message will contain the standard separator of “|” and encoding characters of “^~\ &#”. This message was created on 09/10/2011 at approximately 6:57 AM (05:57:18 to be exact), and is an ORU R01 (i.e., unsolicited result) message. RapidSMS has assigned the unique message ID of “68050” to this ORU message; the SHR will perhaps echo this unique ID back in the response message. The “D” that follows the unique message ID indicates that this may be a production, training or a debugging message and the “C” the processing mode. The Version field, the next to last field in this segment, identifies that RapidSMS is using HL7 version 2.5. This is a version of HL7 that the RapidSMS API and SHR officially

support and the internationalization code is RWA from ISO 3166. In the message profile ID field, the last field shown in this segment, RapidSMS has sent a “PRE” meaning that is a CHW registration notification message.

The next segment of the message is the Staff Identification (STF) segment. This ORU message is a registration of a new CHW in RapidSMS with a national identity number [1197370056233083](#), from ISANGANO village.

The Organization (ORG) segment shows that the CHW is registered at a facility with 316 Code, which is Muhoza Health Centre.

The next segment, the Language (LAN), contains language spoken by the CHW, which is Kinyarwanda (RW).

✓ Segment Details

MSH: MSH-1 Field Separator: |
MSH-2 Encoding Characters: ^~\&#
MSH-3.1 Sending Application – Namespace ID: RapidSMS
MSH-4.1 Sending Facility – Namespace ID: F316
MSH-3.1 Receiving Application – Namespace ID: SHR
MSH-4.1 Receiving Facility – Namespace ID: Rwanda MOH
MSH-7.1 Date Time of Message: 20111109055718 (11/09/2011 at 05:57:18)
MSH-9 Message Type
MSH-9.1 Message Type: ORU
MSH-9.2 Trigger Event: R01
MSH-9.3 Message structure: ORU^R01^ORU_R01
MSH-10 Message Control ID: 68050
MSH-11.1 Processing ID: D
MSH-11.2 Processing Mode: C
MSH-12.1 Version ID: V2.5
MSH-12.2 Internationalization Code: RWA
MSH-21.1 Message Profile: REG

STF: STF-2 Staff Identifier: [1197370056233083](#)
STF-4 Staff Type: Community Health Worker
STF-8.2 Staff Department: ISANGANO

ORG: ORG-1 Set ID: 1
ORG- Practitioner Organization Unit Identifier
OBR-5.6 Assigning Facility: 316

LAN: LAN-1 Set ID: 1
LAN-2.1 Language Code - Identifier: RW

Example 2: ALERT message

This message shows the detailed sample HL7 message that is sent to RapidSMS describing a new alert from SHR.

✓ Sample Message

```
MSH|^~\&#|SHR|RwandaMOH|RapidSMS|316|20111109075738||ORU^R01^ORU_R01||D^C|
V2.5^RWA|||||ALERT
PID|||1198270120343040^^^^NID||
OBR|1||^Maternal Health Alert|||||||||||||||||||||||||||||||||CHW
OBX|1|CE|^Alert^|HE|||||F
```

✓ Message Narrative

In this example, above, the Message Header (MSH) segment, identifies the message as being sent to RapidSMS, 316-Muhoza Health Centre, from SHR, from Rwanda MOH facility. The MSH segment also lets know that the message will contain the standard separator of “|” and encoding characters of “^~\ &#”. This message was created on 09/10/2011 at approximately 6:57 AM (07:57:38 to be exact), and is an ORU R01 (i.e., unsolicited result) message. RapidSMS has assigned the unique message ID of “68061” to this ORU message; the SHR will perhaps echo this unique ID back in the response message. The “D” that follows the unique message ID indicates that this may be a production, training or a debugging message and the “C” the processing mode. The Version field, the next to last field in this segment, identifies that RapidSMS is using HL7 version 2.5. This is a version of HL7 that the RapidSMS API and SHR officially support and the internationalization code is RWA from ISO 3166. In the message profile ID field, the last field shown in this segment, SHR has sent an “ALERT” meaning that is a alert message.

The next segment of the message is the Patient Identification (PID) segment. This ORU message is for a patient registered in RapidSMS with a national identity number [1198270120343040](#).

The next segments, the observations (OBR and OBX), contains observation data for Maternal Health Alert to be sent to the CHW by RapidSMS. The patient is bleeding.

✓ Segment Details

MSH: MSH-1 Field Separator: |
MSH-2 Encoding Characters: ^~\&#
MSH-3.1 Sending Application – Namespace ID: SHR
MSH-4.1 Sending Facility – Namespace ID: Rwanda MOH
MSH-3.1 Receiving Application – Namespace ID: RapidSMS
MSH-4.1 Receiving Facility – Namespace ID: 316
MSH-7.1 Date Time of Message: 20111109065738 (11/09/2011 at 07:57:38)
MSH-9 Message Type
 MSH-9.1 Message Type: ORU
 MSH-9.2 Trigger Event: R01
 MSH-9.3 Message structure: ORU^R01^ORU_R01
MSH-11.1 Processing ID: D
MSH-11.2 Processing Mode: C
MSH-12.1 Version ID: V2.5
MSH-12.2 Internationalization Code: RWA
MSH-21.1 Message Profile: Alert

PID: PID-3.1 Patient Identifier ID: [1198270120343040](#)

PID-3.5 Patient Identifier Type Code: NID
OBR: OBR-1 Set ID: 1
OBR-4 Universal Service Identifier
OBR-4.2 Text: Maternal Health Alert
OBR-47.1 Filler Supplemental Service Information: CHW

OBX: OBX-1 Set ID: 1
OBX-2 Value Type: CE
OBX-3 Observation Identifier
OBX-3.2 Text: Alert
OBX-5 Observation Value: HE
OBX-11 Observation Result Status: F

5 RapidSMS-RWANDA RESTful API

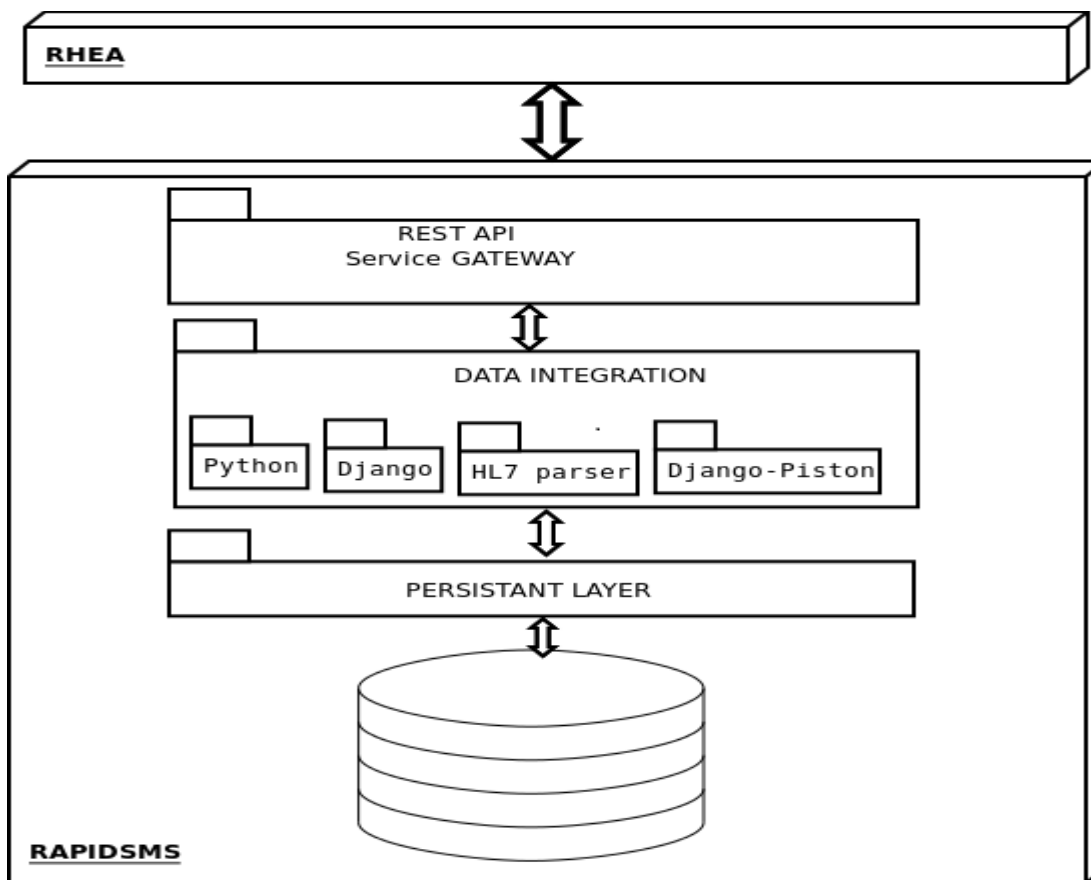
RapidSMS-RWANDA has also chosen the REST architecture for its API, because the separation of concern is clear and all resources are accessible using the same protocol (HTTP).

5.1 API design and development

With REST we will dynamically build unique URLs to represent enriched RAPIDSMS resources as needed using the following standard message formats: HL7 v2.5, JSON or XML.

The HL7 messages back and forth, in the body of requests are parsed, integrated and presented in the correct format that can be understood by the recipient. RapidSMS uses Python-HL7 parser to deal with these messages.

The API will be built using DJANGO-PISTON, a REST library making the definition of the resource mapping easy to do in a very declarative manner. The integration of the API layer with the backend data source, as well as other services such as configuration, will be done using the Python/Django framework.



Throughout the development cycle, we plan to use a continuous integration process with unit tests. The plan to manage the project on RAPIDSMS side is through an agile/SCRUM process, with iterative, incremental development sprints, preferably every two-to-four weeks.

5.2 API operations

The identification of the resources (patient, encounters and/or alerts...) will be back and forth (RHEA to RapidSMS and RapidSMS to RHEA).

The initial feature of RapidSMS-RWANDA RESTful API is to expose one of its functionalities to the RHEA system. Restrictions for certain operations could be required for sensitive information being exchanged by both the system.

RapidSMS-RWANDA will consume :

Resource: PatientEncounters

Save Patient Encounter

URL: POST /ws/rest/v1/patient/\${pat-ID}/encounters

Description: This transaction deals with saving a patients encounter in their medical record.

Request:

HTTP request body will contain the HL7 v2.5 message defined below with a single patient identification parameter in the URL

Parameters: \${pat-ID} : represents the patient ID

HL7 Message Data Elements: From Maternal data mapping.xls and Requirements for RapidSMS_SHR Integration FINAL.docx (PRE, RISK and BIR messages)

HL7v2 message specification and mapping: TODO

Response: HTTP 201 - Created - If the encounter was saved.

Errors:

HTTP 500 - Server Error - If the server encountered an error.

HTTP 400 - Bad Request - If the HL7 v2.5 message is malformed.

and expose :

Resource: Alerts

Post alerts

URL: POST /api/patients/{patient-id}/alerts

Description: Receives an alert message and relays it to the appropriate CHW.

Request:

HTTP request body will contain the HL7 v2.5 message defined below.

HL7 Message Data Elements:

See Requirements for RapidSMS_SHR Integration FINAL.docx (R#4, R#8, R#12)

HL7v2 message specification and mapping: TODO

Response: HTTP 201 - Created - If the encounter was saved.

Errors:

HTTP 500 - Server Error - If the server encountered an error.

HTTP 400 - Bad Request - If the HL7 v2.5 message is malformed.

6 Integration and TESTS

RESTful APIs are very easy to test using HTTP requests from simple command line tools such as cURL or from a web browser. We can create and deploy, in a few days, a full working prototype of the API and produce mock-up resources and interacting application of the API can retrieve sample data in the same way as the final API production version.