**Integrating the Healthcare Enterprise**



# IHE IT Infrastructure
# Technical Framework Supplement

# Mobile Alert Communication Management
# (mACM)

# Trial Implementation

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**Please verify you have the most recent version of this document.** See here for Trial Implementation and Final Text versions and here for Public Comment versions.

## Foreword

This is a supplement to the IHE IT Infrastructure Technical Framework V11.0. Each supplement
30  undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

This supplement is published on August 7, 2015 for trial implementation and may be available for testing at subsequent IHE Connectathons. The supplement may be amended based on the results of testing. Following successful testing it will be incorporated into the IT Infrastructure
35  Technical Framework. Comments are invited and may be submitted at http://www.ihe.net/ITI_Public_Comments.

This supplement describes changes to the existing technical framework documents.

"Boxed" instructions like the sample below indicate to the Volume Editor how to integrate the relevant section(s) into the relevant Technical Framework volume.

40  *Amend Section X.X by the following:*

Where the amendment adds text, make the added text **bold underline**. Where the amendment removes text, make the removed text **bold strikethrough**. When entire new sections are added, introduce with editor's instructions to "add new text" or similar, which for readability are not bolded or underlined.

45

General information about IHE can be found at: http://ihe.net.

Information about the IHE IT Infrastructure domain can be found at: http://ihe.net/IHE_Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the
50  process used to create them can be found at: http://ihe.net/IHE_Process and http://ihe.net/Profiles.

The current version of the IHE IT Infrastructure Technical Framework can be found at: http://ihe.net/Technical_Frameworks/.

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## CONTENTS

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## Introduction to this Supplement

135 ## Open Issues and Questions

*#2) mACM defines FHIR extensions which require profiles in 3.84.41.2.1and 3.85.41.2.1. FHIR requires that these profiles are published. Currently the text states that the profiles are available at, for example:*

    http://www.ihe.net/fake_url_for_trial_implementation/mACM/Profile/flag.recipient

140 these URLs are examples only. Upon publication, a permanent home for any needed extension points should be defined as an IHE resource.

*#6) MEMLS has location notion of physical offset (e.g., within building). How should this be represented for the dissemination event location field? See Appendix A of PCD MEM-LS Supplement.*

145 *#9) A concern brought up by PCD is that the use of flag.patient is limiting scope of the alert. What about location or equipment source=medical device, a use cased highlighted in Vol 1 of PCD? Example of a location would be a cord pull in bathroom in a hallway. A FHIR issue was raised:*
http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=6271&start=0

150 *#11) Open Issue: mACM definition of "alert" is not same as general definition: http://ihe.net/uploadedFiles/Documents/Templates/IHE_TF_GenIntro_AppD_Glossary_Rev1.0_2014-07-01.pdf*

*It is not clear how to resolve: For example, PCD's term could be broadened or we could rewrite* 
155 *this profile to not use the term alert.*

#12) The PCD referenced WCTP standard is not a formally published standard and that maintenance of WCTP is within the PCD Technical Committee.

#13) Would be good to have Group as an allowed recipient for an alert. FHIR issue filed: http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=8466

160 #14) Would be useful to have Period in the core Communication resource rather than as an extension
http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=8467

#15) Figure 3.84.4.1.3.1-1 probably should live in Volume 1.

165 **Closed Issues**

*#0) Should a codeset be defined to capture the priority of an alert in the flag.priority resource. .*

*#1) Would we be prescriptive about the way to set PCD abnormality flags in the flag.characterstics data field?  Table 8.3 is referenced, but no uri or oid is specified.*

*#3) Do not have a way to identity a device which is a non-medical device (e.g., not subject to*
170 *FDA regulation) A clarification issue on FHIR was raised:*

> *http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=6209&start=0*

*#4) Should we have Device as a recipient in transactions 84 and 85. This is not specifically required for the uses cases described in Vol 1, but may be useful for PCD.*

175 *#5) For the flag.author data field, it would be useful to have the author of an alert be an Organization resource (e.g., CDC). A FHIR issue was filed:*

> *http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=6208&start=0*

*If this Issue is not approved, an extension point should be added to the flag resource to allow an*
180 *Organizational author of the alert. For example the following could be added to Table 3.84.4.2.2.1-1:*

| `extension [0..1]` | This data field identifies the originator of the alert. This data field is defined as an extension with URL `flag.author` and with value in `valueReference` and whose value is an organization represented by a reference to an `Organization` resource. This data field should only be populated if a subject of care was not identified. | `Reference( Organization )` |
|---|---|---|

*#7) The use of the flag.category is unclear – it could either be flag/alert content or could be used*
185 *for alert filtering/routing. A FHIR issue was filed:*

http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=6170&start=0

*to clarify its use. A FHIR Skype conversation indicated that the later sense of flag.category is what is intended, and this is the way that is used in this profile.*

190 *#8)  Use Case #1 in Vol 1 requires that an alert be issued without an identified subject of care. The flag resource has a flag.patient field that is [1..1] which would preclude the use of the flag resource for this use case. A FHIR issue has been filed:*

http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=6171&start=0

195   *to change to [0..1]. If this CP is approved, then Section 3.84.4.1.2.1 should be updated.*

*#10) Multiple extension points have been define by this profile on the FHIR flag resource. Some of those may be useful to be part of the core resource. A FHIR issue to this effect was raised here:*

*http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=6272&start=0*

200

*Feb 25, 2015: Should we reference ACM is much as possible (e.g., in Actor and Transaction descriptions), or pull in text as a service to the reader?  Decision: Pull in the text for the ease of the reader. This will also help if there is a potential conflict between ACM and mACM Actor requirements. Any such conflicts should be reviewed and resolved as part of public comment.*

205

Mar 23, 2015:  Various standards were considered for the transaction specification in Vol 2. These standards were assessed according to the matrix: http://wiki.ihe.net/index.php?title=MACM_Volume2_Standards_Assessment Consensus was reached to use FHIR for the two transactions to be specified.

210   Feb 24, 2015: The "Emergent Results" use case will be considered out of scope for the time being. This could be revisited during the public comment period.

Feb 24, 2015:  For dissemination of alerts, it is expected that PCD-06 and PCD-07 transactions will be sufficient. On this assumption, no assessment will be performed on the standards available for the transactions between the Alert Aggregator and Alert Communicator Actors at

215   this time.

Feb 18, 2015: The Query For Alert status is somewhat similar to the PCD-05 transaction in that it is a way to report alert statuses from AM to AR. PCD-05 was cut from final text. However PCD-05 does not meet our requirements for doing analytics on the AR side.

Feb 18, 2015:  It was discussed whether or not the existing PCD-04 Report Alert transaction

220   could be used instead of the new ITI-84 "mACM Report Alert" transaction. PCD-04 is an HL7v2 message for clinical observations. It was decided that using this would be semantically incorrect as we have many uses cases that are not observations.

Nov 20, 2014:

- Consensus: we will narrow to two use cases/healthcare workflows involving notifications
225   (preferably on the next call).

- Recommendation: to have a clinical workflow (about a specific subject of care) and public health/health system management workflow (not about a subject of care).

- Consensus: Critical findings workflow use case is to radiological specific. Derrick E. will draft new one.

230
- Consensus: ~~Triggered Notifications – Integrated Care Plans: The HIE issues reminders to subjects of care and/or care providers regarding pending guideline-informed activities and regarding non-adherence to care plans - both errors of commission and errors of omission.~~ Cut for lack of clarity(from Introductory text)

- Consensus: For each of the use-cases/workflows, the behavior of each actor should be
235     described in high level terms in the relevant "42.4.2.1.2 <simple name> Process Flow" section.

- Question: (Mick T.) Will this include notifications about intrusion detection into the HIE? *Not specifically. If there was no existing system for communicating such notifications in the HIE, the infrastructural components are expected to be reusable to*
240     *communicate the notification. A "notification publisher" Actor would be the system monitoring the HIE (e.g., through queryable-ATNA) and producing the notification for a list of recipients. This type of workflow could be specified in a future work-cycle.*

*December 4, 2014 Call Notes*

- Question (Carl L) What is the retention policy for notification and notification receipts?

245
- Answer (Gila P): retention policies usually left up to jurisdiction.

- Question (Elliott S) Would list of health workers (and/or subjects of care) include contact information:
   Answer (Rob H/Carl L): Yes, can have multiple
   Post-Call Response (Carl L): This needs more discussion as to who should know contact
250     information for recipients. Simplest thing is perhaps the Notification Consumer/Receiver.

- Question (Rob H): who is responsible for prioritization of which contact point to use?
   Answer (Carl L): Envisioned that this is the responsibility of the Notification Consumer/Receiver

- Question (Rob H): What about an existing AP that knows the prioritization of the contact
255     point?

- Answer (Carl L): Example -- The AP would first submit the notification to a primary contact point (e.g., email). If there is no ACK of the notification after a set period of time, the message content can be sent again to a secondary contact point (e.g., cell phone)

- Question (Rob H): In the CAP/Crisis Response use case, what is the nature of the ACK.
260     Answer (Carl L): It is an acknowledgement by the human that they have read the notification. Should require an active confirmation ('click to confirm'), not just a passive "I saw it on the screen."

- Question (Rob H): How notifications in this context different than those in PCD

  Answer (Carl L): There is a feedback option which allows recording of human
  265   interactions.

- Question (Carl L): In two use cases (Critical Findings and Crisis Response) there is an ACK by the human that the alert is received. Are these to be treated differently? Answer (Rob H): Though syntactically they can be the same, they semantically differ. In the Critical Findings use case, the meaning of the ACK in radiology is that the radiologist
  270   reviewed the findings with the patient and there is informed consent. In the Crisis Response use case, it is that the human has read and understood the notification.

- Remark (Lynn F): Should reconsider names of actors to avoid collision with existing actors in other profiles. There is Notification Consumer - in the PCD Notification Communication Mgmt Profile. Notification Message Receiver & Notification Message
  275   Transmitter Actors were used in a HITSP Emergency Msg Distribute Element document. Response (Carl L):  Updated actor names for group feedback.

# General Introduction

280 *Update the following Appendices to the General Introduction as indicated below. Note that these are not appendices to Volume 1.*

## Appendix A - Actor Summary Definitions

*Add the following actors to the IHE Technical Frameworks General Introduction list of Actors:*

| Actor | Definition |
|---|---|
| Alert Reporter | This actor originates the alert (an alarm, either physiological or technical, or an advisory). May also query the Alert Aggregator for the status of the alert. |
| Alert Aggregator | This actor receives alerts from the Alert Reporter and collects status events related to the dissemination of the alert. |
| Alert Manager | This actor receives alert from an Alert Reporter manages them according to business context, and disseminates them to an Alert Communicator. |

## Appendix B - Transaction Summary Definitions

285 *Add the following transactions to the IHE Technical Frameworks General Introduction list of Transactions:*

| Transaction | Code | Definition |
|---|---|---|
| Mobile Report Alert | ITI-84 | This transaction is used by the Alert Reporter to report alerts to the Alert Aggregator. The Alert Reporter sends alerts to the Alert Aggregator in an unsolicited manner. |
| Query for Alert Status | ITI-85 | This transaction is used by the Alert Reporter to query an Alert Aggregator for alert status information as communicated to an Alert Aggregator for a particular alert. |

## Glossary

290 *Add the following glossary terms to the IHE Technical Frameworks General Introduction Glossary:*

No new glossary terms.

# Volume 1 – Profiles

## Copyright Licenses

*Add the following to the IHE Technical Frameworks General Introduction Copyright section:*

295     None

## Domain-specific additions

None

## 42 Mobile Alert Communication Management (mACM) Profile

300 The mACM Profile provides the infrastructural components needed to send short, unstructured text alerts to human recipients and records the outcomes of any human interactions upon receipt of the alert. The mACM Profile additionally allows for a feedback mechanism to determine the status of an alert through the use of alert statuses. Additional characteristics of alerts are discussed in Section 42.1.4.1.

305 Recognizing that there are many health care workflows that could leverage a notification mechanism, it is not the aim of this profile to describe all of these workflows. Instead, this profile will limit considerations to two use cases:

- *Crisis Response,* defined in Section 42.4.2.1, covers the distribution of notifications to health workers defined by the Common Alerting Protocol version 1.2.

310 - *Care Reminders,* defined in Section 42.4.2.2, covers the distribution of notifications to care givers and subjects of care based on upcoming or missed appointments as defined, medication reminders and other similar patient care reminders.

It is the expectation that the infrastructural components of the mACM Profile will be reusable beyond the use cases described here within and will support extensions to support domain specific workflows.

315 The mACM Profile:

- defines a transaction, Mobile Report Alert [ITI-84], which is suitable for mobile devices and non-clinical contexts and provides alternative message semantics for the Report Alert [PCD-04] transaction;

320 - defines a transaction, Query for Alert Status [ITI-85], which allows an originator of an alert to receive all status updates on alert that it reported;

- supports alerting in national deployment and cross-enterprise contexts in addition to a controlled health delivery network;

- supports interaction with the public, such as appointment reminders, on a broad a variety of devices, interaction timings and platforms.

### 42.1 Mobile Alert Communication Management (mACM) Actors, Transactions, and Content Modules

325 Figure 42.1-1 shows the actors directly involved in the ACM and mACM Profiles and the relevant transactions between them.

No content modules are defined by the mACM Profile.

330
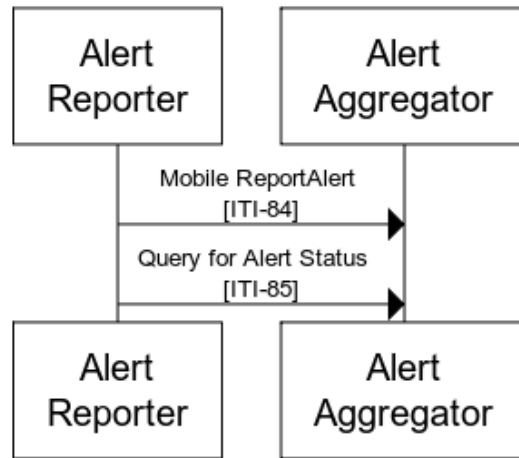
**Figure 42.1-1: mACM Actor and Transaction Diagram**
**(image source: http://bit.ly/1DwulHT)**

335    Table 42.1-1 lists the transactions for each actor directly involved in the mACM Profile. To claim compliance with this Profile, an actor shall support all required transactions (labeled "R") and may support the optional transactions (labeled "O").

**Table 42.1-1: mACM Profile - Actors and Transactions**

| Actors | Transactions | Optionality | Reference |
|---|---|---|---|
| Alert Reporter | Mobile Report Alert | R | ITI TF-2c:3.84 |
| | Query for Alert Status | O | ITI TF-2c:3.85 |
| Alert Aggregator | Mobile Report Alert | R | ITI TF-2c:3.84 |
| | Query for Alert Status | R | ITI TF-2c:3.85 |

340

### 42.1.1 Actor Descriptions and Actor Profile Requirements

Most requirements are documented in Transactions (Volume 2) and Content Modules (Volume 3). This section documents any additional requirements on profile's actors.

### 42.1.1.1 Alert Reporter

345    An Alert Reporter shall originate or relay alerts (an alarm, either physiological or technical, or an advisory) to the Alert Aggregator using the Mobile Report Alert [ITI-84] transaction.

Under the Query for Alert Status Option, this actor can query an Alert Aggregator Actor for statistics related to the dissemination of this alert to the intended recipient(s).

The Alert Reporter may receive alerts from multiple sources and translate these alerts as needed
350    to make them interoperable with the Alert Aggregator. It does not need to be the original source
of the alert data. The means by which an Alert Reporter may receive alerts from other sources is
out of scope of this profile.

The Response message of the Mobile Report Alert [ITI-84] and Query for Alert Status [ITI-85]
transactions may reference FHIR resources. An Alert Aggregator's response in these transactions
355    may include URL references to FHIR resources. Such referenced resources could include, but
are not limited to `practitioner`, `patient`, `group`, `organization device` and `location`. In
such an instance, an Alert Reporter may need to resolve the URL reference to obtain any needed
data.

### 42.1.1.2 Alert Aggregator

360    The Alert Aggregator receives alerts from the Alert Reporter via the Mobile Report Alert [ITI-
84] transaction. The Alert Aggregator may then manage these alerts according to the required
jurisdiction defined business context, for example dispatching them onto a communications
platform for delivery to an intended recipient.

The Alert Aggregator may optionally collect statistics related to the dissemination of the alert,
365    for example under the Disseminate and Report Alert Status Option. The Alert Aggregator makes
queries against these dissemination statistics available via the Query for Alert Status [ITI-85]
transaction.

The Response message of the Mobile Report Alert  [ITI-84] and Query for Alert Status [ITI-85]
transactions may utilize FHIR resources. An Alert Aggregator shall either:

370        • include a FHIR resource as a contained resource in the Response

        • or include a FHIR resource as a URL reference in the Response

If the Alert Aggregator includes a URL reference, then the Alert Aggregator shall ensure that the
URL reference resolves to the intended FHIR resource. Such referenced resources could include,
but are not limited to `practitioner`, `patient`, `group`, `organization device` and `location`.

375    # 42.2 mACM Actor Options

Options that may be selected for each actor in this profile, if any, are listed in the Table 42.2-1.
Dependencies between options when applicable are specified in notes.

**Table 42.2-1: mACM - Actors and Options**

| Actor | Option Name | Reference |
|---|---|---|
| Alert Reporter | Query for Alert Status | ITI TF-1: 42.2.1 |

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| Actor | Option Name | Reference |
|---|---|---|
| Alert Aggregator | Disseminate and Report Alert Status | ITI TF-1: 42.2.2 |

### 42.2.1 Query for Alert Status Option

The Query for Alert Status Option enables an Alert Reporter to receive feedback on the current status of the alert. This option supports analytics on the delivery status and provides feedback capabilities for other business processes that an Alert Reporter implements.

An Alert Aggregator may collect and make available for querying the information related to the dissemination of an alert, either through the Disseminate and Report Alert Status Option, or through other means which are out of scope of this profile.

An Alert Reporter that supports the Query for Alert Status Option shall initiate the Query for Alert Status [ITI-85] transaction.

### 42.2.2 Disseminate and Report Alert Status Option

This option enables mACM actors to operate in an environment that is also using the IHE PCD Alert Communication Management (ACM) Profile.

An Alert Aggregator that claims the Disseminate and Report Alert Status Option shall be grouped with an ACM Alert Manager. This grouping enables the mACM Alert Aggregator to collect feedback on the current status of an alert disseminated in an ACM environment.

- When the mACM Alert Aggregator receives a valid Mobile Report Alert [ITI-84] transaction, the grouped ACM Alert Manager initiates the Disseminate Alert [PCD-06] transaction to an ACM Alert Communicator, using the translation tables in ITI TF-2c: 3.84.5.2

- When the ACM Alert Manager receives a response to Report Dissemination Alert Status [PCD-07] about the corresponding alert, then the grouped mACM Alert Aggregator shall represent the dissemination data in a Query for Alert Status [ITI-85] response, using the translation tables in ITI TF-2c: 3.84.5.2.

See Section ITI TF-2c: 3.84.4.1.3.1 "Expected Actions - Disseminate and Report Alert Status Option".

## 42.3 mACM Required Actor Groupings

An Actor from this profile (Column 1) shall implement all of the required transactions and/or content modules in this profile *in addition to* all of the transactions required for the grouped actor (Column 2).

**Table 42.3-1: mACM - Required Actor Groupings**

| mACM Actor | Actor to be grouped with | Reference | Content Bindings Reference |
|---|---|---|---|
| Alert Aggregator with the Disseminate Status and Report Alert Option | PCD ACM Alert Manager | PCD TF-1: 6.1 | -- |

## 42.4 mACM Overview

The mACM Profile supports the delivery of a variety of alert to both Health Workers and Clients (Subjects of Care) with a feedback mechanism to record delivery status and human responses.

### 42.4.1 Concepts

In Figure 42.4.1-1 the sequencing of the transactions in Figure 42.1-1 is illustrated.
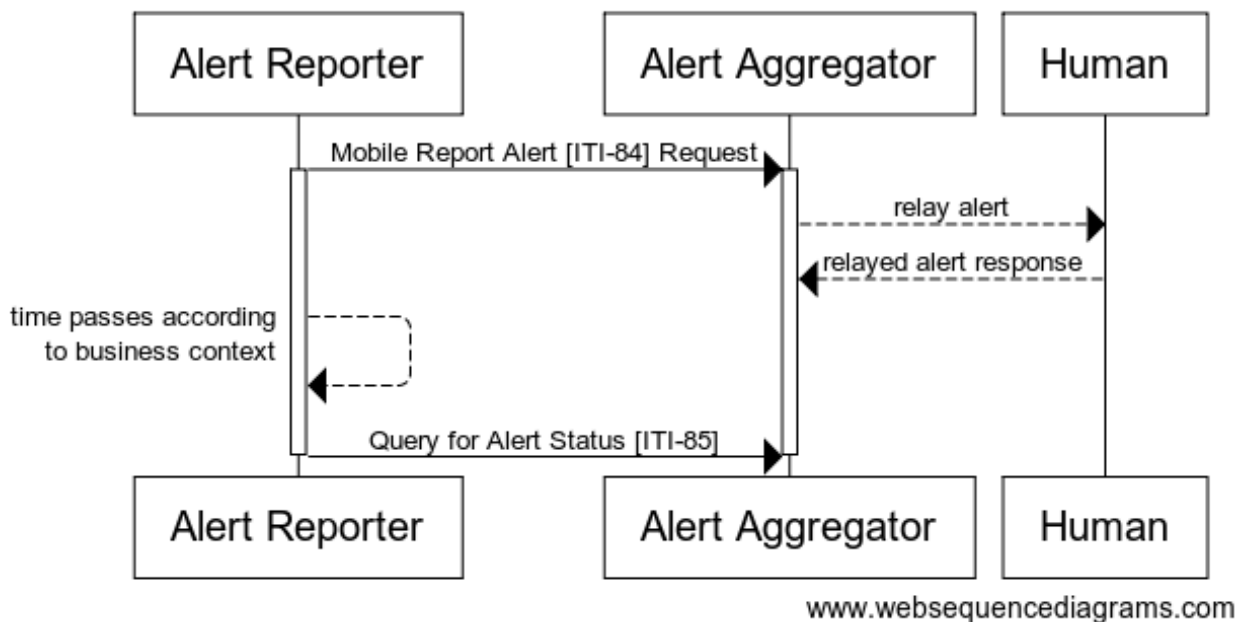


**Figure 42.4-1: Process Flow Diagram**

**image source: http://bit.ly/1fnoDCx)**

### 42.4.2 Use Cases

The mACM Profile takes into consideration uses cases that span clinical, health systems management and public health domains.

A critical requirement of the mACM Profile is the ability to provide basic alerting services within resource-constrained environments with a low barrier to entry. Such communities may exist at national context for Low and Middle Income Countries (LMICs[1]), as well as underserved communities in high-income countries (e.g., the population targeted by Detroit's Beacon Project[2]). A proliferation of alerting services exists in national health networks of resource-constrained countries (see Figure 42.4.2-1 for an illustrative example) and the mACM Profile fulfills an important need of the ministries of health to provide a central messaging infrastructure. Such a centralized infrastructure provides the ministry the ability to:

425

430
- Assert and enforce governance policies on the utilization of alerting services on mobile platforms

- Define and enforce cost control measures across various mobile alerting platforms

[1] http://data.worldbank.org/about/country-and-lending-groups

[2] http://www.healthit.gov/sites/default/files/beacon-factsheet-semi.pdf
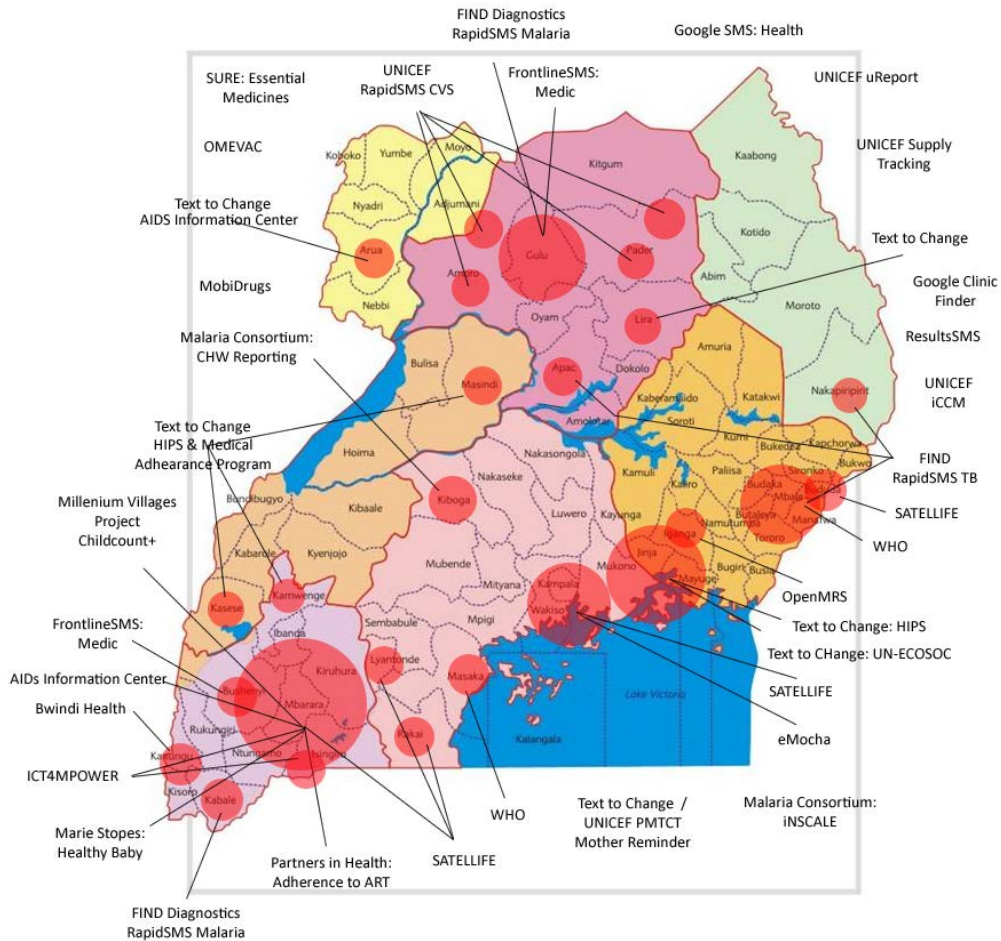
**Figure 42.4.2-1 Extant mobile based mHealth Services in Uganda**

435                                   (Courtesy UNICEF/Blaschke/2011)


### 42.4.2.1 Use Case #1: Crisis Response

In response to a crisis or emergency situation, such as the 2014 and 2015 outbreaks of Ebola in western Africa, it is critical to communicate to health workers across organizational and national
440    boundaries, and to verify receipt of such alerts. Such alerts are commonly issued in the OASIS Common Alerting Protocol (CAP) format:

- http://docs.oasis-open.org/emergency/cap/v1.2/CAP-v1.2-os.html

There is a desire to assure human acknowledgment of receipt of these CAP messages.

### 42.4.2.1.1 Crisis Response Use Case Description

445   The Crisis Response use case describes the mechanism for delivering alerts in the CAP format to health workers within a particular health care network. The nature of this network is not prescribed in this profile and may consist, for example, of a network of hospitals or a national health care network.

The manner of production and publication of the CAP message is not prescribed in this profile.

450   There are several existing profiles and specifications related to CAP messages that detail values of and requirements on particular data fields. Such specifications include:

- OASIS Integrated Public Alert and Warning System (IPAWS)
- HiTSP T 63 - Emergency Message Distribution Element Transaction
- NIEM Emergency Management

455   This profile can be used to relay CAP messages issued by an appropriate authority to an appropriate set of health workers on last-mile devices. In addition, this profile describes a mechanism for recording human acknowledgment of receipt of information contained in the CAP messages. These response can it turn be used for analytical and monitoring purposes.[3]

### 42.4.2.1.2 Crisis Response Process Flow

460   The workflow for delivery and acknowledgment of a CAP message is illustrated in Figure 42.4.2.1.2-1.
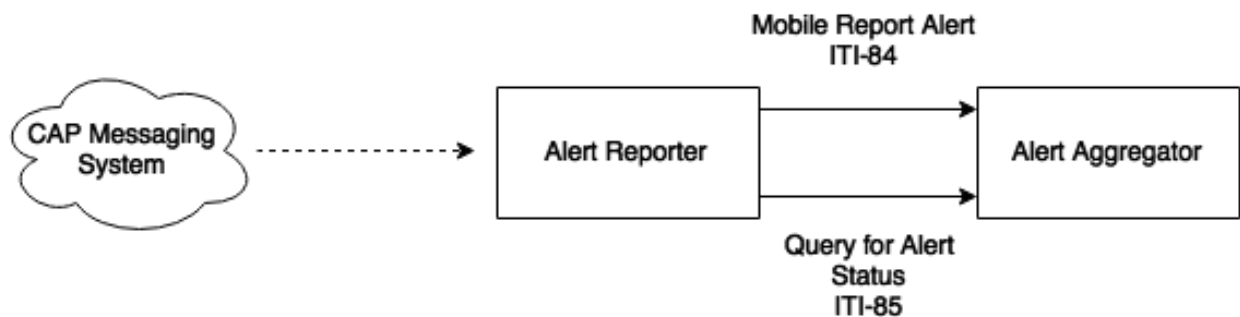


**Figure 42.4.2.1.2-1: CAP Delivery and Acknowledge**

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[3] Waidyanatha, Nuwan and Gow, Gordon and Anderson, Peter, Common Alerting Protocol Message Broker for Last-Mile Hazard Warning System in Sri Lanka: An Essential Component (May 2007). Available at SSRN: http://ssrn.com/abstract=1568001 or http://dx.doi.org/10.2139/ssrn.1568001

465    Figure 42.4.2.1.2-1 illustrates the distribution of CAP message from an external system to an Alert Reporter. Though the method for receiving a CAP message is not specified by the profile, the Alert Reporter should:

- Identify a cohort of health workers for the receiving the text of the CAP message

- Translate the CAP message into the message semantics defined in 3.84 and transmit to
470      the Alert Aggregator

The Alert Aggregator distributes the alert and collects alert dissemination statuses from Alert Communicators and makes status information available to the Alert Reporter via the Query for Alert Status.

## 42.4.2.2 Use Case #2: Care Reminders

475    A subject of care may receive care from multiple providers across multiple health care networks, and coordination of care across providers and networks is difficult. If an Electronic Medical Record or Longitudinal/Shared Health Record is present, Care Reminder alerts can be triggered through the examination of clinical records about the subject of care. Care Reminder alerts are sent either to the subject of care or a designated health worker.

480    ### 42.4.2.2.1 Care Reminder Use Case Description

The following are illustrative examples of Care Reminder alerts:

- (Rwanda)  When patients are referred to the district hospital by a Community Health Worker (CHW), the CHW can choose an immediate, urgent or routine referral. In urgent cases they must visit the hospital within three days and for routine referrals they must
485      visit the hospital within seven days. The Health Information Exchange (HIE) is able to detect if the patient has missed their referral by checking if an encounter has been received at the Longitudinal Health Record within the time frame. If an encounter has not been received the HIE sends out an out an alert of the missed appointment to inform the CHW that originally interfaced with that patient.

490    - (Tanzania) An examination of an Electronic Medical or Health Record indicates that a child has missed a vaccination according to an established protocol of care. An SMS reminder is generated and sent to the mother or other designated guardian. In the case when a mother does not have access to a cell-phone or other electronic device, an alert should be generated and sent to the child's caregiver. This caregiver could be a
495      Community Health Worker, a village elder, or a sub-village chairman.
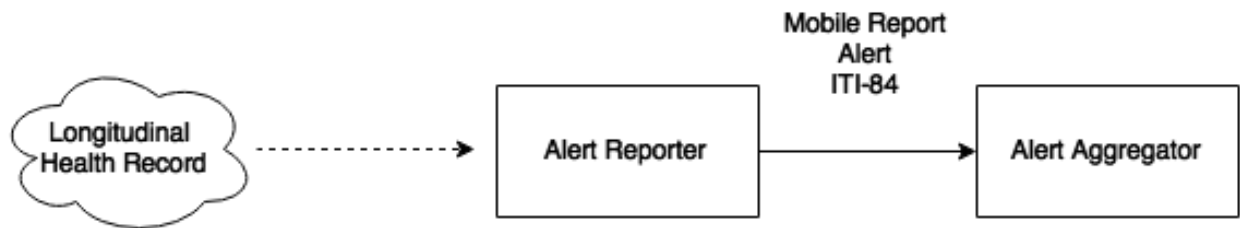
### 42.4.2.2.2 Care Reminder Process Flow



**Figure 42.4.2.2.2-1: Care Reminders**

## 42.5 mACM Security Considerations

The implementer of this profile is advised that many risks cannot be mitigated by the IHE profile and instead the responsibility for mitigation is transferred to the vendor, and occasionally to the operational environment.

For security considerations on transactions between the Alert Manager and Alert Communicator Actors, implementers should adopt those identified in PCD TF-2:3.7.4.2.5 and PCD TF-2:3.6.4.1.6.

To address identified security risks for the transactions defined in this profile, implementers should ensure that:

- All actors in mACM should be grouped with a Consistent Time (CT) Profile - Time Client Actor. This grouping will assure that all systems have a consistent time clock to assure a consistent timestamp for audit logging and alert dissemination.

- All actors in mACM could be grouped with an Audit Trail and Node Authentication (ATNA) Profile - Secure Node Actor or ATNA Secure Application Actor. This grouping will assure that only highly trusted systems can communicate and that all changes are recorded in the audit log.

- The Alert Reporter should be grouped with an Authorization Client Actor in the Internet User Authorization (IUA) Profile. The Alter Aggregator should be grouped with an IUA Resource Server Actor. This grouping will enable service side access control and more detailed audit logging if ATNA is also used.

- All actors in mACM could be grouped with the appropriate actor from the Enterprise User Authentication (EUA) Profile to enable single sign-on inside an enterprise by facilitating one name per user for participating devices and software.

In particular, appropriate care should be taken when a subject of care is identified in the alert as the content may contain PHI. There are many security and privacy concerns with mobile devices, including lack of physical control. Many common information technology uses of HTTP,

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including REST, are accessing far less sensitive information than health documents. These factors present an especially difficult challenge for the security model. It is recommended that application developers perform a Risk Assessment in the design of the applications, and that operational environment using mACM perform Risk Assessments in the design and deployment
530 of the operational environment.

An Alert Aggregator should not return any patient information in transaction Mobile Report Alert [ITI-84] or Query for Alert Status [ITI-85] unless proper authentication and communications security have been proven.

There are many reasonable methods of securing transactions. These security models can be
535 layered in at the HTTP transport layer and do not modify the interoperability characteristics defined in the mACM Profile.

### 42.5.1 Patient Safety Considerations

If used beyond original use cases, patient safety risks may need to be assessed.

## 42.6 mACM Cross Profile Considerations

540 ### 42.6.1 Health Worker Directory Services

The Alert Reporter Actor would receive great benefit in the context of a health care network that has a health worker registry. These registries can be used to create a list of enterprise IDs for health workers. Such a service for health workers could be provided, for example, by the:

- InfoManager Actor in the Care Services Discovery (CSD) Profile
545 - Provider Information Directory Actor in the Healthcare Provider Directory (HPD) Profile
- Personnel White Pages Directory Actor in the Personnel White Pages (PWP) Profile

The manner in which these, or other similar directory services, are queried is not prescribed by this profile. The utility of such providing such services is illustrated in Figure 42.6.1-1, which shows in interaction diagram, and Figure 42.6.1-2, which shows a sequencing of these
550 interactions.
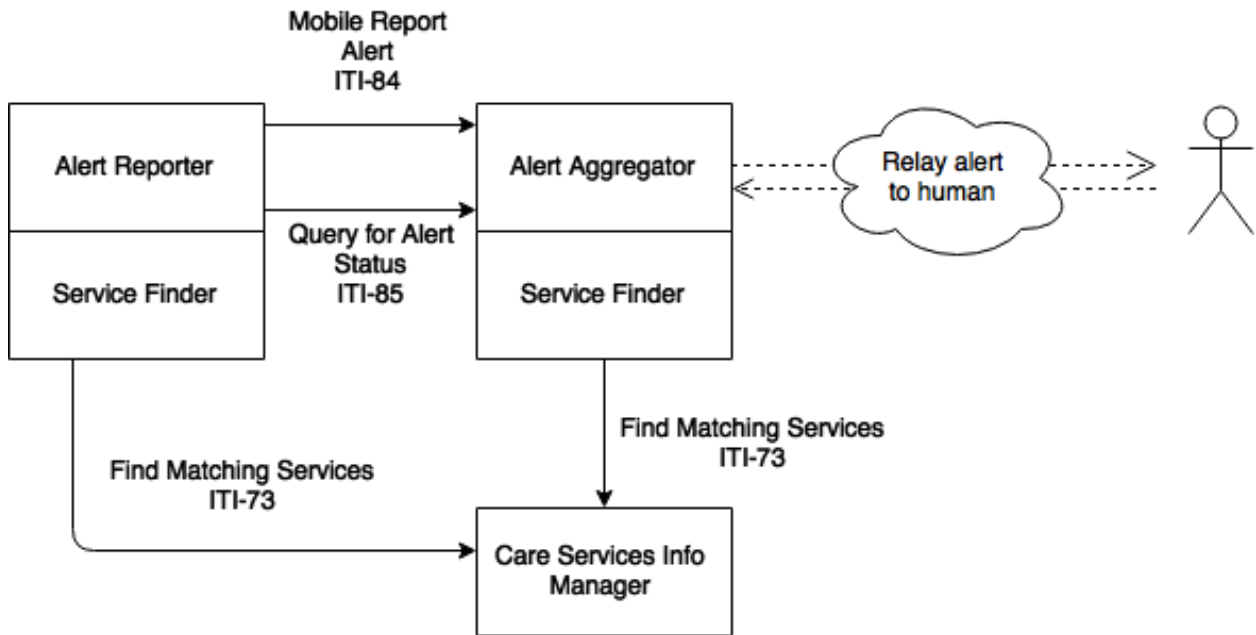
**Figure 42.6.1-1: mACM Actor Interactions with a Health Worker Registry**

555    In Figure 42.6.1-1, the CSD Info Manager Actor acts as a directory of health workers in the health system. The Alert Reporter, grouped with a Service Finder, executes an appropriate Find Matching Services [ITI-73] transaction to determine a list of enterprise IDs for targeted health workers according to internal business requirements. The Alert Reporter then sends the alert on to the Alert Aggregator using the Mobile Report Alert [ITI-84] transaction. The Alert

560    Aggregator, grouped with a Service Finder, may also execute an appropriate Find Matching Services [ITI-73] transaction in order to determine the contact points (e.g., cell phone number) of the referenced health worker.
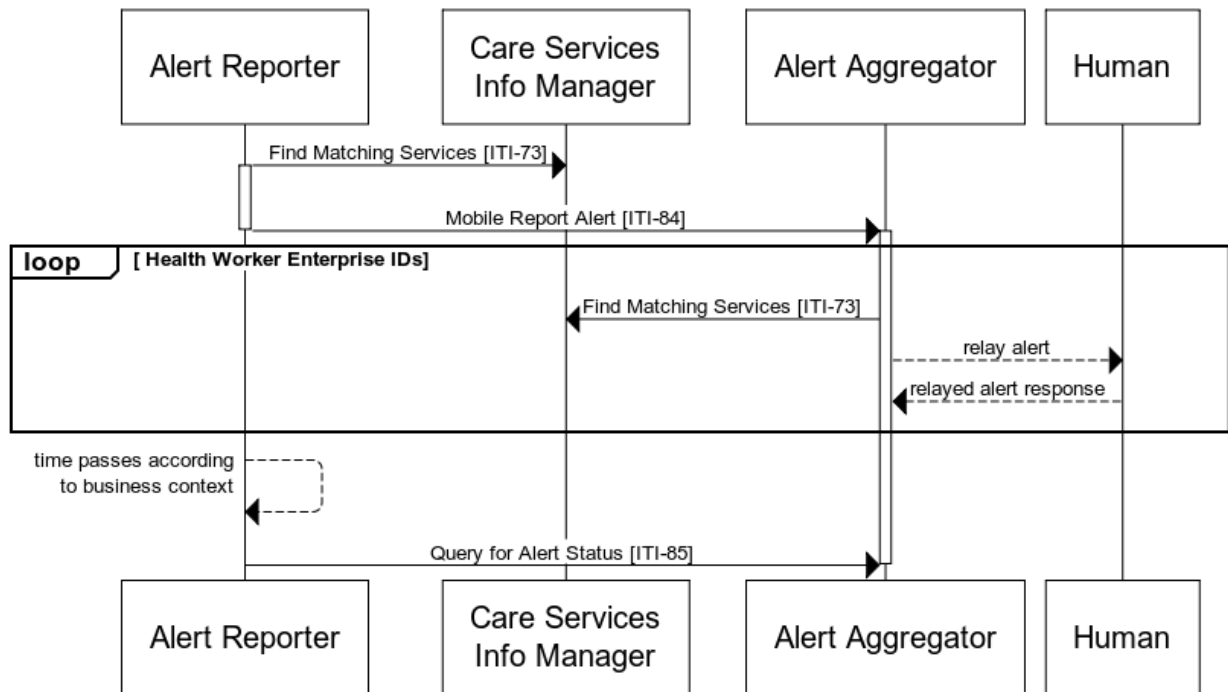
565 **Figure 42.6.1-2: Sequencing of mACM Actor Interactions with a Health Worker Registry**

**(image source: http://bit.ly/1CR8wIA)**

In Figure 42.6.1-2, a potential sequencing of the transactions in Figure 42.6.1-1 is illustrated. These steps may be described as follows:

570    1. The Alert Reporter, grouped with a Care Services Finder, executes the Find Matching Services [ITI-73] transaction against a Care Services Info Manager to determine the enterprise IDs for a list of Health Workers matching a set of criteria. The specific criteria used are dependent on the business context under which the alert is intended to be communicated.

575    2. Using the resultant list of Health Worker enterprise IDs, the Alert Report executes Mobile Report Alert [ITI-84] to report the given alert to an Alert Aggregator.

   3. For each Health Worker identified in the alert, the Alert Aggregator, grouped with a Service Finder, determines available contact points (e.g., telephone number, email address) by executing Find Matching Services [ITI-73] against a Care Services Info 580    Manager.

_____

### 42.6.2 Client Registry Services

The Alert Reporter Actor would receive great benefit in the context of a health care network that has a health client registry. These registries can be used to create a list of enterprise IDs for subjects of care. Such a service for a client registry could be provided, for example, by the:

585
- The Patient Demographics Supplier Actor in the Patient Demographics Query (PDQ) Profile

- The Patient Demographics Supplier Actor in the Patient Demographics Query for Mobile (PDQm) Profile

The manner in which these, or other similar directory services, are queried is not prescribed by
590 this profile. The utility of such providing such services is illustrated in Figure 42.6.2-1, which shows in interaction diagram, and Figure 42.6.2-2, which shows a sequencing of these interactions.
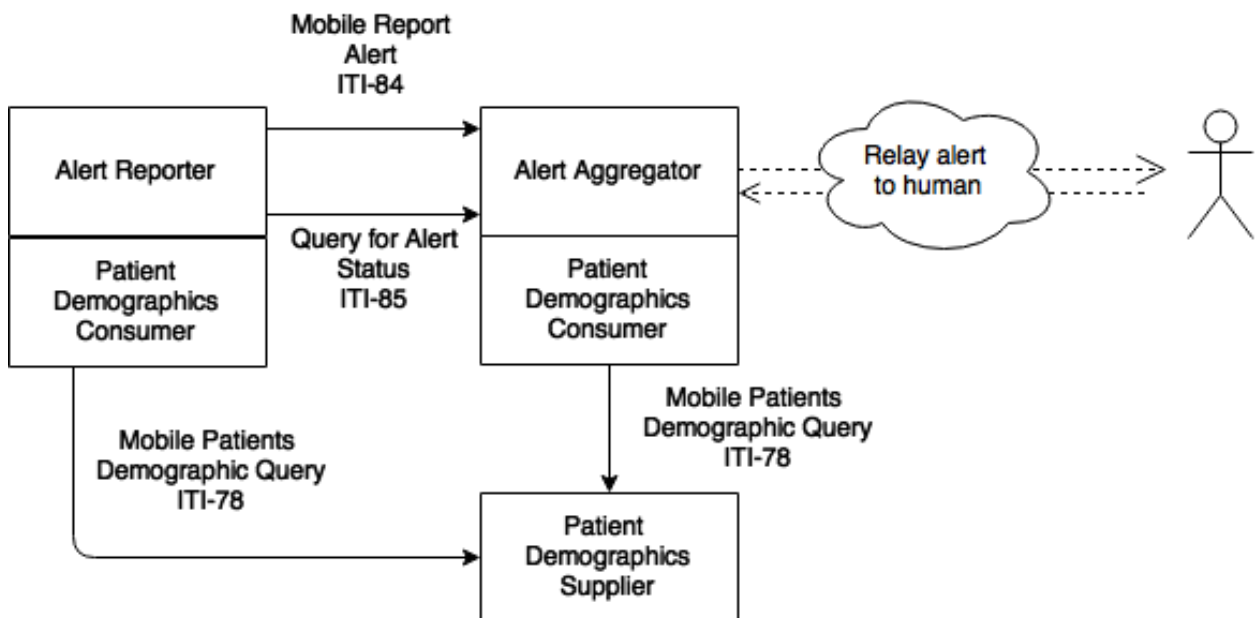


595 **Figure 42.6.2-1: mACM Actor Interactions with a Client Registry**

In Figure 42.6.2-2, the PDQm Patient Demographics Supplier Actor acts as a directory of subjects of care in the health system. The Alert Reporter, grouped with a Patient Demographics Consumer, executes an appropriate Mobile Patients Demographic Query [ITI-78] transaction to
600 determine a list of enterprise IDs for targeted subjects of care according to internal business requirements. The Alert Reporter then sends the alert on to the Alert Aggregator using the

_____

Mobile Report Alert [ITI-84] transaction. The Alert Aggregator, grouped with a Patient Demographics Consumer, may also execute an appropriate Mobile Patients Demographic Query [ITI-78] transaction in order to determine the contact points (e.g., cell phone number) of the referenced subject of care.

605
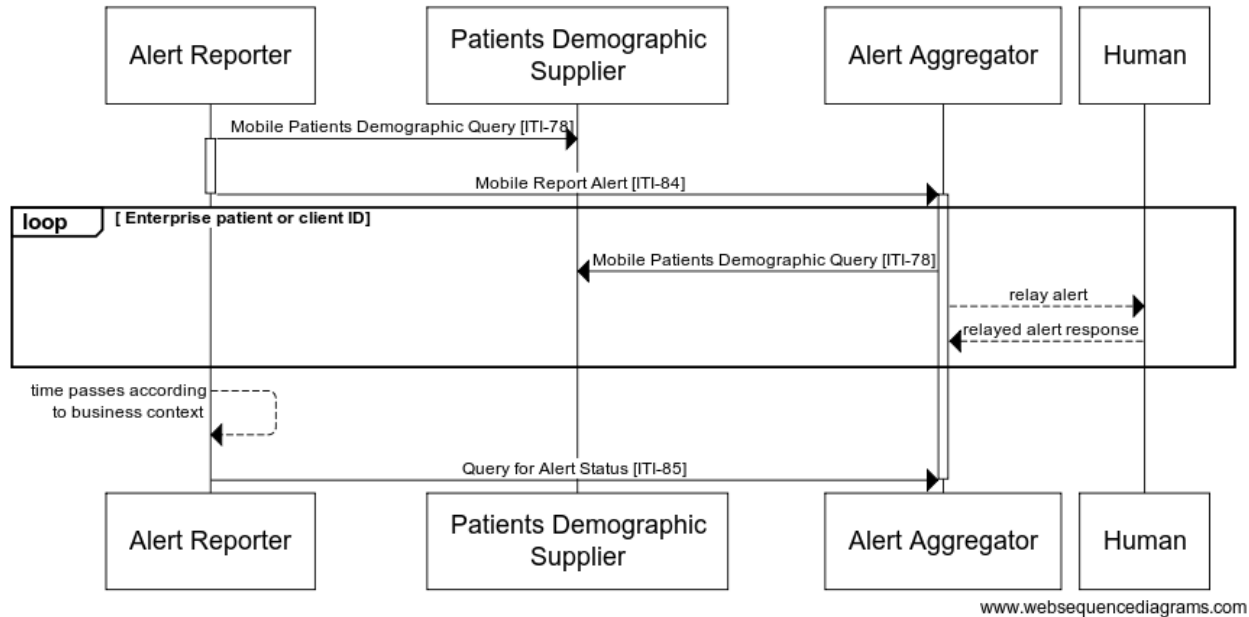


**Figure 42.6.2-2: Sequencing of mACM Actor Interactions with a Client Registry**

**(image source: http://bit.ly/1IjSGGr)**

610

In Figure 42.6.2-2, a potential sequencing of the transactions in Figure 42.6.2-1 is illustrated. These steps may be described as follows:

1. The Alert Reporter, grouped with a Patient Demographics Consumer, executes the Mobile Patient Demographics Query [ITI-78] transaction against a Patient Demographics

615
   Supplier to determine the enterprise IDs for a list of Subjects of Care matching a set of criteria. The specific criteria used are dependent on the business context under which the alert is intended to be communicated.

2. Using the resultant list of Subject of Care enterprise IDs, the Alert Report executes Mobile Report Alert [ITI-84] to report the given alert to an Alert Aggregator.

620
3. For each Subject of Care identified in the alert, the Alert Aggregator, grouped with a Patient Demographics Consumer, determines available contact points (e.g., telephone

number, email address) by executing Mobile Patient Demographics Query [ITI-78] against a Patient Demographics Supplier.

625

# Volume 2 – Transactions

## 3.84 Mobile Report Alert  [ITI-84]

### 3.84.1 Scope

The Mobile Report Alert transaction is used to issue alerts to health workers and subjects of care.

An Alert Reporter initiates a Mobile Report Alert transaction against an Alert Aggregator.

630 **3.84.2 Actor Roles**
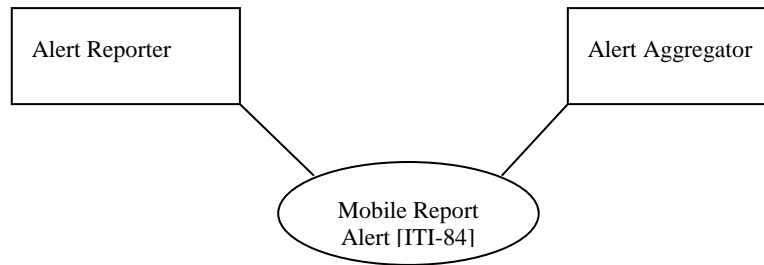


**Figure 3.84.2-1: Use Case Diagram**

**Table 3.84.2-1: Actor Roles**

| | |
|---|---|
| **Actor:** | Alert Reporter |
| **Role:** | Sends an alert to an Alert Aggregator for dissemination to a health worker or subject of care. |
| **Actor:** | Alert Aggregator |
| **Role:** | Accepts an alert from an Alert Reporter for dissemination to subjects of care and health workers |

635

### 3.84.3 Referenced Standards

- FHIR  DSTU2 Ballot http://hl7.org/fhir/2015May/index.html
- HL7 - Health Level 7 Version 2.6 Ch7 Observation Reporting
- ISO/IEEE 11073-10201 Domain Information Model

640 - ISO/IEEE 11073-10101 Nomenclature

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- JSON – IETF RFC 7159

- XML

- HTTP 1.1

- XML Schema 1.1

645 - Tags for Identifying Languages – IETF RFC 5646

### 3.84.4 Interaction Diagram

The following interaction diagram illustrates an Alert Reporter sending a Mobile Report Alert to an Alert Aggregator via the message semantics as defined for a `Communication` resource.

650



**Figure 3.84.4-1: Interaction Diagram**

**(image source: http://bit.ly/1HT3VIC)**

#### 3.84.4.1 Mobile Report Alert Request

655 The Alert Aggregator shall support the message semantics for create and read as defined in Sections 2.1.0.1.8, 2.1.0.10, 2.1.0.13 of FHIR as applicable to a `Communication` resource defined in Section 5.20 of FHIR.

The `Communication` resource is furthered constrained as defined in Section 3.84.4.1.2.1.

#### 3.84.4.1.1 Trigger Events

660 An Alert Reporter triggers a Mobile Report Alert Request according to the business rules for the alert being issued. These business rules are out of scope of this transaction.

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### 3.84.4.1.2 Message Semantics

An Alert Reporter initiates a create request as defined in Section 2.1.0.13 of FHIR on the `Communication` resource in order to report a new alert.

665 An Alert Aggregator shall support receiving a request in both the JSON and the XML messaging formats as defined in FHIR. An Alert Reporter shall use either the XML or the JSON messaging formats as defined in FHIR.

#### 3.84.4.1.2.1 FHIR Communication Resource Constraints

An Alert Aggregator and an Alert Reporter that supports the Mobile Report Alert [ITI-84]
670 transaction shall transaction shall use a FHIR `Communication` resource. The FHIR `Communication` resource shall be further constrained and extended as described Table 3.84.4.1.2.1-1. The Data Field column in Table 3.84.4.1.2.1-1 references the object model defined in Section 5.20.3 of FHIR.

An Alert Aggregator shall provide an extension definition as specified in Section 1.16.1 of
675 FHIR. The extension definition shall include extension points as defined in Table 3.84.4.1.2.1-1 and 3.84.4.1.2.1-2.

For the extension points defined in Table 3.84.4.1.2.1-1 and Table 3.84.4.1.2.1-2, the relative portion of the `url` attribute are qualified with the implied base URL:

> http://www.ihe.net/fake_url_for_trial_implementation/mACM/Profile

680

**Table 3.84.4.1.2.1-1: `Communication` Resource Constraints**

| Data Field & Cardinality | Description & Constraints | FHIR Data Type |
|---|---|---|
| category [1..1] | Signifies that this communication shall be disseminated by the Alert Aggregator according to the expected actions defined in Section 3.84.4.1.3.<br>This data field is defined as an extension which shall be constrained so that:<br>• The `coding.code` attribute value is defined in the "Code" column of Table 3.84.5-1<br>• The value `coding.system` attribute value is defined in the "Code System" column of Table 3.84.5-1 | CodeableConcept |
| _lastUpdated [1..1] | The last time that the `Communication` resource was updated or an associated alert dissemination status was updated. | instant |

_____

| Data Field & Cardinality | Description & Constraints | FHIR Data Type |
|---|---|---|
| payload [1..*] | This data field contains the content of the alert.<br><br>Note that this cardinality differs from the cardinality required in the FHIR base resource in that it requires at least one payload element with the unstructured text content of the alert. Additional payload elements may be used may be used, for example for compliance with jurisdictional accessibility requirements, literacy issues, or translations of the unstructured text content in other languages.<br><br>The payload element shall have at least one contentAttachment element that meets the following requirements:<br>• The payload shall contain the language of the unstructured plain text content in the contentAttachment.language attribute<br>• The payload shall contain the unstructured plain text content of the alert to be communicated in the contentAttachment.title attribute<br>• The payload shall have the value "plain/text" in the contentAttachment.content-type attribute | Attachment |
| extension [0..1] | Signifies that the period during which communication is intended to be disseminated by the Alert Aggregator according to the expected actions defined in Section 3.84.4.1.3.<br>This data field is defined as an extension which shall be constrained so that:<br>• the url attribute has relative value "communication.period"<br>• a valid period code is stored in valuePeriod | extension |

_____

| Data Field & Cardinality | Description & Constraints | FHIR Data Type |
|---|---|---|
| extension [1..1] | Signifies that the priority under which communication is intended to be disseminated by the Alert Aggregator according to the expected actions defined in Section 3.84.4.1.3.<br>This data field is defined as an extension which shall be constrained so that:<br>• the `url` attribute has relative value "`communication.priority`"<br>• a valid priority code is stored in `valueCodeableConcept`<br>• The `coding.code` attribute value is defined in the "Code" column of Table 3.84.5-2<br>• The value `coding.system` attribute value is defined in the "Code System" column of Table 3.84.5-2 | extension |
| extension [0..*] | This data field identifies secondary characteristics of the alert.<br>This data field is defined as an extension which shall be constrained so that:<br>• the `url` attribute has relative value "`communication.characteristic`"<br>• a valid characteristic code is stored in `valueCodeableConcept`<br><br>In the case of an Alert Aggregator which is exercising the Disseminate and Report Alert Status Option, the `valueCodeableConcept` shall further be constrained so that:<br>• The `coding.code` attribute value is defined in the "Code" column of Table 3.84.5-3, as appropriate to the business context<br>• The value `coding.system` attribute value is defined in the "Code System" column of Table 3.84.5-3 | extension |

### 3.84.4.1.3 Expected Actions

The Alert Reporter and Alert Aggregator shall comply with the requirements in ITI TF-
685    1:42.1.1.1 and 42.1.1.2.

The Alert Aggregator shall issue a Mobile Report Alert Response upon validation of a received
Mobile Report Alert Request.

The Alert Aggregator shall respond with appropriate HTTP error codes as described in Section 2.1.0.13 of FHIR if any of the following conditions are met:

690
- The Mobile Report Alert Request was invalid

- The alert `communication.category.code` has value "pcd-alert" and the Alert Aggregator does not support the Disseminate and Report Alert Status Option

### 3.84.4.1.3.1 Expected Actions – Disseminate and Report Alert Status Option

Under the Disseminate and Report Alert Status Option, if the Mobile Report Alert Request:

695
- is valid

- identifies recipients within the jurisdiction of the Alert Aggregator

- contains a value of "pcd-alert" in `communication.category.code`

then the Alert Aggregator grouped with the ACM Alert Manager shall disseminate the alert to designated recipients using the Disseminate Alert [PCD-06] transaction. The grouped actor shall
700    record dissemination status updates related to the dissemination of the alert according to the translation tables in Section 3.84.5.2. Additional constraints on the `communication.category` and `communication.characteristic` data field are defined in Table 3.84.5.1-1 and Table 3.84.4.1.2.1-1 respectively.

The Alert Aggregator shall add a new `communication.dissemination` extension point for each
705    valid Report Dissemination Alert Status [PCD-07] request as described in Section 3.85.4.1.2.1. The `communication.status` and the `communication.dissemination.status` fields shall be set according to the translation tables in Section 3.84.5.2.

The jurisdiction should determine the retention policy for dissemination status events.

In Figure 3.84.4.1.3.1-1 the sequencing of the transactions for the Disseminate and Report Alert
710    Status Option.
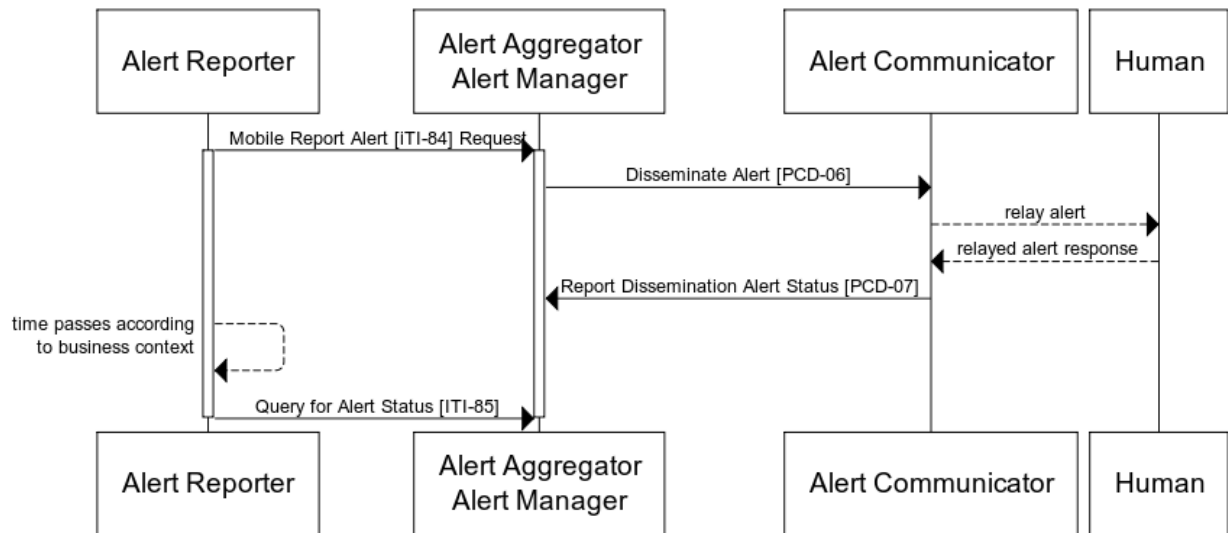
**Figure 3.84.4.1.3.1-1: Process Flow Diagram for
Alert Disseminate and Report Alert Status**

**(image source: http://bit.ly/1LDIaeb)**

715

### 3.84.4.2 Mobile Report Alert Response

The Mobile Report Alert transaction uses the response semantics as appropriate according to the FHIR transaction initiated by the Alert Reporter. Specific semantics are defined in Sections 2.1.0.10 and 2.1.0.13 of FHIR for the `Communication` resource, as defined in Section 5.20 of
720     FHIR.

The `Communication` resource is furthered constrained as defined in Section 3.84.4.1.2.1.

### 3.84.4.2.1 Trigger Events

An Alert Aggregator issues a Mobile Report Alert Response upon validation of a received Mobile Report Alert Request.

725     ### 3.84.4.2.2 Message Semantics

The Alert Aggregator shall respond with the appropriate response codes as defined in Sections 2.1.0.10 and 2.1.0.13 of FHIR.

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### 3.84.4.2.3 Expected Actions

There are no additional actions required on the Alert Reporter upon receipt of the Mobile Report
730    Alert Response.

If an Alert Reporter does not receive a valid Mobile Report Alert Response, it may reinitiate the
transaction.

There are no expected actions on the Alert Aggregator upon delivery of the Mobile Report Alert
Response.

735    ### 3.84.5 Alert Terminologies and Mappings

This section contains tables of terminologies referenced as well as mappings between referenced
terminologies for the Mobile Report Alert [ITI-84] transaction.

### 3.84.5.1 Defined Terminologies

This section contains tables of terminologies referenced in the Mobile Report Alert [ITI-84]
740    transaction.

The following table describes the category with which an alert can be sent.

**Table 3.84.5.1-1: Mobile Report Alert Category**

| Code | Code System | Meaning |
|---|---|---|
| alert | 1.3.6.1.4.1.19376.1.2.5.1 | Signifies that this communication is intended to be disseminated by the Alert Aggregator according to the expected actions defined in Section 3.84.4.1.3. |
| pcd-alert | 1.3.6.1.4.1.19376.1.2.5.1 | Signifies that this communication is intended to be disseminated by the Alert Aggregator according to the expected actions defined in Section 3.84.4.1.3 and disseminated according to the Disseminate and Report Alert Status Option |

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The following table describes the priority with which an alert can be sent. This table is adapted from PCD TF-2: Table 8-4.

**Table 3.84.5.1-2: Mobile Report Alert Priority**

| Code | Code System | Meaning |
|------|-------------|---------|
| PN | 1.3.6.1.4.1.19376.1.2.5.2 | Signifies that the priority with which this message is sent is not indicated |
| PL | 1.3.6.1.4.1.19376.1.2.5.2 | Signifies that this message is sent with low priority |
| PM | 1.3.6.1.4.1.19376.1.2.5.2 | Signifies that this message is sent with medium priority |
| PH | 1.3.6.1.4.1.19376.1.2.5.2 | Signifies that this message is sent with high priority |

The following table described secondary characteristics that apply to an alert that is intended for dissemination under the Disseminate and Report Alert Status Option. This table is adapted from PCD TF-2: Table 8-3.

**Table 3.84.5.1-3: Mobile Report Characteristics**

| Code | Code System | Meaning |
|------|-------------|---------|
| N | 1.3.6.1.4.1.19376.1.2.5.3.1 | Abnormal Type: Normal, not abnormal |
| L | 1.3.6.1.4.1.19376.1.2.5.3.1 | Abnormal Type: Below low normal |
| LL | 1.3.6.1.4.1.19376.1.2.5.3.1 | Abnormal Type: Below lower panic limits |
| H | 1.3.6.1.4.1.19376.1.2.5.3.1 | Abnormal Type: Above high normal |
| HH | 1.3.6.1.4.1.19376.1.2.5.3.1 | Abnormal Type: Above higher panic limits |
| A | 1.3.6.1.4.1.19376.1.2.5.3.1 | Abnormal Type: Abnormal (for non-numeric results) |
| tpoint | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: time point |

_____

| Code | Code System | Meaning |
|------|-------------|---------|
| start | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: start (of an interval event/alert) – an end is expected |
| start_only | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: start – continue and end are not to be expected |
| continue | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: continuation (of an ongoing interval event/alert) |
| end | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: end (of an interval event/alert) |
| present | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: event/alert is active at this time |
| update | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: Update |
| escalate | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: escalation of an ongoing alert/alarm |
| inactivate | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: Inactivation (e.g., silence) |
| deescalate | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: de-escalation of an ongoing alert/alarm |
| reset | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: clear latched alarm |
| stop | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: pause an event/alert; could restart with same ID later |
| update | 1.3.6.1.4.1.19376.1.2.5.3.2 | Event Phase: change |
| SP | 1.3.6.1.4.1.19376.1.2.5.3.3 | Alert Source: alarm – physiological |
| ST | 1.3.6.1.4.1.19376.1.2.5.3.3 | Alert Source: alarm – technical |
| SA | 1.3.6.1.4.1.19376.1.2.5.3.3 | Alert Source: alarm – advisory |
| SP | 1.3.6.1.4.1.19376.1.2.5.3.3 | Alert Source: alarm – physiological |
| alarm-paused | 1.3.6.1.4.1.19376.1.2.5.3.4 | Inactivation State: Alar is paused |
| alarm-off | 1.3.6.1.4.1.19376.1.2.5.3.4 | Inactivation State: Alarm is off |
| audio-paused | 1.3.6.1.4.1.19376.1.2.5.3.4 | Inactivation State: Audio is paused |

_____

| Code | Code System | Meaning |
|---|---|---|
| audio-off | 1.3.6.1.4.1.19376.1.2.5.3.4 | Inactivation State: Audio is off |
| inactive | 1.3.6.1.4.1.19376.1.2.5.3.5 | Alert State: inactive |
| active | 1.3.6.1.4.1.19376.1.2.5.3.5 | Alert State: active |
| latched | 1.3.6.1.4.1.19376.1.2.5.3.5 | Alert State: latched |

755 ## 3.84.5.2 Mappings Between Terminologies

This section contains mappings of terminologies referenced in the Mobile Report Alert [ITI-84] transaction for use in the Disseminate and Report Alert Status Option. The translation tables provide a mapping from the FHIR `Communication` resource to the data fields in the Disseminate Alert [PCD-06] and Report Dissemination Alert Status [PCD-07] transactions.

760

**Table 3.84.5.2-1: Disseminate Alert Field Translation**

| PCD-06 Data Field | `Communication` Resource Data Field | Comments |
|---|---|---|
| Alert_Location | Not applicable | Contingent on FHIR change proposal, this would be: `communication.subject (Location)` |
| Alert_Patient | communication.patient | Contingent on FHIR change proposal, this would be: `communication.subject (Patient)` |
| Alert_Identifier | communication._id | |
| Alert_Callback | | Not constrained by this profile |
| Alert_Reference | URL of communication resource | |
| Alert_Comment | communication.payload.contentAttachment.title | The appropriate choice of language of the `contentAttachment` should be made if more than one is provided |
| Alert_Evidentiary_Data | | Not constrained by this profile |

**Table 3.84.5.2-2: Disseminate Alert Status Field Translation**

| PCD-06 Data Field | `Communication` Resource Data Field | Comments |
|---|---|---|
| `Alert_Identifer` | `communication._id` | |
| `Alert_Status` | `communication.status`<br><br>and<br><br>`communication.dissemination.status` | The value in the FHIR CommunicationStatus value set shall be encoded according to Table 3.84.5.2-3 |
| | `communication.dissemination.characteristic` | This value shall be encoded according to Table 3.84.5.1-3 |

765

Table 3.84.5.2-3 contains the mapping from the Alert_Status codes used in the Report Dissemination Alert Status [PCD-07] transaction to the CommunicationStatus value set defined in Section 1.23.2.1.539.1 of FHIR.

770 **Table 3.84.5.2-3: Alert Status Value Set Mapping**

| Alert_Status code from PCD-07 | Code from FHIR CommunicationStatus value set |
|---|---|
| `Received` | in-progress |
| `Undeliverable` | failed |
| `Delivered` | in-progress |
| `Read` | completed |
| `Accepted` | completed |
| `AcceptedPositive` | completed |
| `AcceptedNotRelevant` | completed |
| `AcceptedFalse` | completed |
| `Rejected` | rejected |
| `Cancelled` | failed |
| `CancelledOther` | failed |
| `CallBackStart` | in-progress |
| `CallBackEnd` | in-progress |

Table 3.84.5.2-4 contains a mapping from the facets for the Report Alert [PCD-04], Disseminate Alert [PCD-06], and Disseminate Alert Status Report [PCD-07] transactions to the FHIR `Communication` resource data fields as extended by this transaction.

775

**Table 3.84.5.2-4: Disseminate Alert Facet Translation**

| PCD-04, PCD-06 and PCD-07 Facet | `Communication` Resource Data Field | Comments |
|---|---|---|
| Event identification | `communication._id` | |
| Source identification | `communication.sender._id` | Applicable only in the case that the sender was a device |
| Event phase | `communication.characteristic` for the code system `1.3.6.1.4.1.19376.1.2.5.3.2` | |
| Alert state | `communication.characteristic` for the code system `1.3.6.1.4.1.19376.1.2.5.3.5` | |
| Inactivation state | `communication.characteristic` for the code system `1.3.6.1.4.1.19376.1.2.5.3.4` | |
| Alarm priority | `communication.priority.code` | |
| Alert type | `communication.characteristic` for the code system `1.3.6.1.4.1.19376.1.2.5.3.3` | |

### 3.84.6 Security Considerations

See the security considerations defined in IHE ITI TF-1:42.5.

In addition, appropriate precautions should be taken against Denial of Service attacks or spam
780    when the Alert Aggregator is exposed outside of a data center.

#### 3.84.6.1 Security Audit Considerations

The ATNA logging policy, if any, is defined by the implementing jurisdiction taking into account the implementation context.
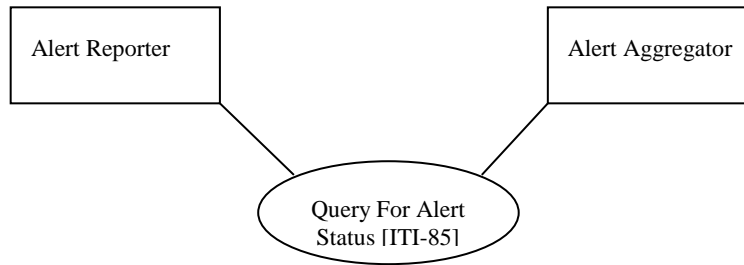
## 3.85 Query for Alert Status [ITI-85]

785    ### 3.85.1 Scope

This transaction is used by an Alert Reporter to determine from the Alert Aggregator the status and any acknowledgements of one or more alerts by the recipient.

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## 3.85.2 Actor Roles



**Figure 3.85.2-1: Use Case Diagram**

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**Table 3.85.2-1: Actor Roles**

| Actor: | Alert Reporter |
|---|---|
| Role: | Queries an Alert Aggregator for the status of one or more alerts that it issued. |
| Actor: | Alert Aggregator |
| Role: | Sends any status messages and human recipient acknowledgments for the indicated alerts |

## 3.85.3 Referenced Standards

- FHIR DSTU2 Ballot http://hl7.org/fhir/2015May/index.html

795
- HL7 - Health Level 7 Version 2.6 Ch7 Observation Reporting
- ISO/IEEE 11073-10201 Domain Information Model
- ISO/IEEE 11073-10101 Nomenclature
- World Geodetic System WGS-84
- JSON – IETF RFC 7159

800
- XML
- HTTP 1.1
- XML Schema 1.1

### 3.85.4 Interaction Diagram
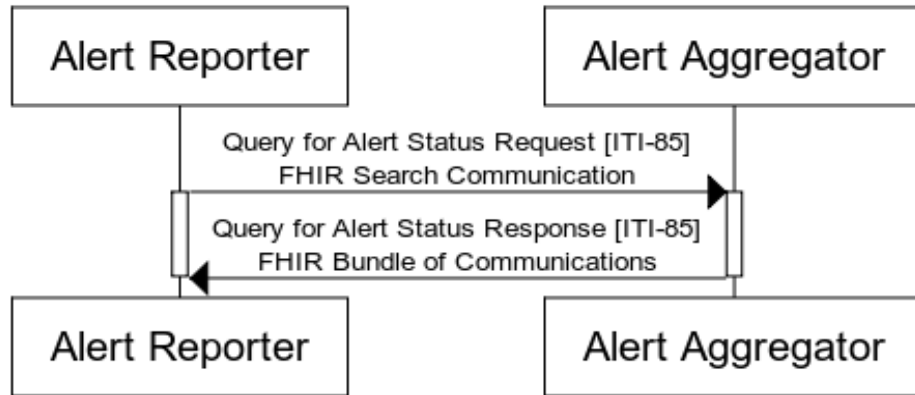
**Figure 3.85.4-1: Query for Alert Status Sequence Diagram**

**(image source: http://bit.ly/1Imt5yx)**

### 3.85.4.1 Query for Alert Status Request

The Alert Aggregator shall support the search request message as defined in Section 2.1.0.14 of
810   FHIR on the `Communication` resource, defined in Section 5.20 of FHIR.

The `Communication` resource is furthered constrained as defined in Sections 3.84.4.1.2.1 and 3.85.4.1.2.1.

### 3.85.4.1.1 Trigger Events

An Alert Reporter triggers a Query for Alert Status Request according to the business rules for
815   the alert(s) being investigated. These business rules are out of scope of this profile.

### 3.85.4.1.2 Message Semantics

An Alert Reporter initiates a search request as defined in Section 2.1.0.14 of FHIR on the
`Communication` resource as constrained in Sections 3.84.4.1.2.1 and 3.85.4.1.2.1.

An Alert Aggregator shall support AND and OR combinations of search parameters as defined in
820   Section 2.1.3.13 of FHIR, "Composite Search Parameters."

In addition to the search parameters required in Section 5.21.4 of FHIR, an Alert Aggregator
shall support searching against the search parameters in Table 3.85.4.1.2-1.

**Table 3.85.4.1.2-1: Additional Search Parameters on `Communication` Resource**

| Data Field |
| --- |
| `communication.period`* |
| `communication.priority`* |
| `communication.characterisitic`* |
| `communication.dissemination.timestamp`* |
| `communication.dissemination.code`* |
| `communication.dissemination.location`* |
| `communication.dissemination.recipient`* |

825    * Note that this search parameter is on an extension element. See Section 6.19.5 of FHIR for more details on defining searches on extension elements.

As described in 3.84.4.1.2.1, an Alert Aggregator shall provide an extension definition as specified in Section 1.16.1 of FHIR.  The Alert Aggregator shall include in the extension
830    definition the search parameters in Table 3.85.4.1.2-1.

An Alert Aggregator shall support receiving a request in both the JSON and the XML messaging formats as defined in FHIR. An Alert Reporter shall use either the XML or the JSON messaging formats as defined in FHIR.

### 3.85.4.1.2.1 FHIR Communication Constraints

835    An Alert Aggregator and an Alert Reporter that supports the Query for Alert Status [ITI-85] transaction shall use a FHIR `Communication` resource. The FHIR `Communication` resource shall be extended as described in Table 3.85.4.1.2.1-1.

The dissemination status extensions shall contain the sub-extensions as described in Table 3.85.4.1.2.1-2.

840    An Alert Aggregator shall provide an extension definition as specified in Section 1.16.1 of FHIR.  The extension definition shall include the dissemination status extension fields as defined in Table 3.85.4.1.2.1-2 and 3.85.4.1.2.1-3.

For the extension points defined in Table 3.85.4.1.2.1-1, Table 3.85.4.1.2.1-2 and Table 3.85.4.1.2.1-3, the relative portion of the `url` attribute are qualified with the implied base URL:

845        http://www.ihe.net/fake_url_for_trial_implementation/mACM/Profile

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### Table 3.85.4.1.2.1-1: `Communication` Resource Constraints

| Data Field & Cardinality | Description & Constraints | FHIR Data Type |
|---|---|---|
| extension [0..*] | The extension point for the dissemination status resource.<br>This data field is defined as an extension which shall be constrained so that:<br>• the `url` attribute has relative value "communication.dissemination"<br>• it contains Dissemination Status sub-extensions as defined in Table 3.85.4.1.2.1-2 | extension |

### Table 3.85.4.1.2.1-2: Dissemination Status Extension

| Data Field & Cardinality | Description & Constraints | FHIR Data Type |
|---|---|---|
| extension [1..1] | This data field specifies a means to identify an alert recipient for which this dissemination status event is referencing.<br>This data field is defined as an extension which shall be constrained so that:<br>• the `url` attribute has relative value "communication.dissemination.recipient"<br>• it contains Dissemination Status Recipient sub-extensions as defined in Table 3.85.4.1.2.1-3 | extension |
| extension [1..1] | The time at which a dissemination status was generated by the Alert Communicator or upon which the recipient responded with an unstructured text message.<br>This data field is defined as an extension which shall be constrained so that:<br>• the `url` attribute has relative value "communication.dissemination.timestamp"<br>• a timestamp stored in `valueInstant`. | instant |

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| Data Field & Cardinality | Description & Constraints | FHIR Data Type |
|---|---|---|
| extension [0..*] | Indicates a dissemination status of the alert.<br><br>This data field is defined as an extension which shall be constrained so that:<br><br>• the `url` attribute has relative value "`communication.dissemination.status`"<br>• a valid status code is stored in `valueCodeableConcept` according to the CommunicationStatus value set defined in Section 1.23.2.1.539 of FHIR | CodeableConcept |
| extension [0..*] | This data field contains as unstructured text content, associated to the dissemination event.<br><br>This data field is defined as an extension which shall be constrained so that:<br><br>• the `url` attribute has relative value "`communication.dissemination.response`"<br>• a valid status code is stored in `valueString` | extension |
| extension [0..1] | An extension point for location information for a dissemination status event.<br><br>This data field is defined as an extension which shall be constrained so that:<br><br>• the `url` attribute has relative value "`communication.dissemination.location`"<br>• a valid location, if known, is stored in `valueLocation` | location |

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| Data Field<br>&<br>Cardinality | Description<br>&<br>Constraints | FHIR Data Type |
|---|---|---|
| extension<br>[0..*] | This data field identifies secondary characteristics of the alert.<br>This data field is defined as an extension which shall be constrained so that:<br>• the url attribute has relative value "communication.characteristic"<br>• a valid characteristic code is stored in valueCodeableConcept<br><br>In the case of an Alert Aggregator which is exercising the Disseminate and Report Alert Status Option, the valueCodeableConcept shall further be constrained so that:<br>• The coding.code attribute value is defined in the "Code" column of Table 3.84.5-3, as appropriate to the business context<br>• The value coding.system attribute value is defined in the "Code System" column of Table 3.84.5-3 | extension |

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### Table 3.85.4.1.2.1-3: Dissemination Status Recipient Extension

| Data Field<br>&<br>Cardinality | Description<br>&<br>Constraints | FHIR Data Type |
|---|---|---|
| extension<br>[0..*] | This data field specifies a means to identify an alert recipient as a health worker.<br>This data field is defined as an extension which shall be constrained so that:<br>• the url attribute has relative value "communication.recipient.practitioner"<br>• a valid reference to a Practitioner resource is stored in valueReference | Reference(<br>  Practitioner<br>) |
| extension<br>[0..*] | This data field specifies a means to identify an alert recipient as a subject of care.<br>This data field is defined as an extension which shall be constrained so that:<br>• url attribute has relative value "communication.recipient.patient"<br>• a valid reference to a Patient resource is stored in valueReference | Reference (<br>  Patient<br>) |

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| Data Field & Cardinality | Description & Constraints | FHIR Data Type |
|---|---|---|
| `extension [0..*]` | This data field specifies a means to identify an alert recipient as a subject of care.<br>This data field is defined as an extension which shall be constrained so that:<br>• `url` attribute has relative value "`communication.recipient.device`"<br>• a valid reference to a `Device` resource is stored in `valueReference` | `Reference ( Device )` |
| `extension [0..*]` | This data field specifies a means to identify an alert recipient as a subject of care.<br>This data field is defined as an extension which shall be constrained so that:<br>• `url` attribute has relative value "`communication.recipient.organization`"<br>• a valid reference to an `Organization` resource is stored in `valueReference` | `Reference ( Organization )` |
| `extension [0..*]` | This data field specifies a means to identify an alert recipient as a subject of care.<br>This data field is defined as an extension which shall be constrained so that:<br>• `url` attribute has relative value "`communication.recipient.relatedPerson`"<br>• a valid reference to a `RelatedPerson` resource is stored in `valueReference` | `Reference ( RelatedPerson )` |

### 3.85.4.1.3 Expected Actions

Upon receipt of a valid Query for Alert Status Request from an Alert Reporter, an Alert
855     Aggregator shall:

- Determine if there are any alerts matching the request

- In case of matching alerts, send a Query for Alert Status Response to the Alert Reporter.
  This Response is a FHIR `Bundle` containing the results of the search as a list of matching
  FHIR `Communication` resources.

860     The Alert Aggregator shall respond with appropriate HTTP error codes as described in Section
2.1.0.13 of FHIR if any of the following holds:

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- The request was invalid
- No matching alerts were found

### 3.85.4.2 Query for Alert Status Response

865   The Query for Alert Status transaction uses the response semantics as appropriate according to the search response message as defined in Section 2.1.0.14 of FHIR as applicable for the `Communication` resource, as defined in Section 5.20 of FHIR.

The `Communication` resource is furthered constrained as defined in Sections 3.84.4.12.1 and 3.85.4.12.1.

870   ### 3.85.4.2.1 Trigger Events

The Alert Aggregator sends the Query for Alert Status Response to the Alert Reporter upon receipt of a Query for Alert Status Request.

### 3.85.4.2.2 Message Semantics

The Alert Aggregator shall support the search response message as defined in Section 2.1.0.14 of
875   FHIR on the `Communication` resource, defined in Section 5.20 of FHIR.

The `Communication` resource is furthered constrained as defined in Sections 3.84.4.1.2.1 and 3.85.4.1.2.1.

### 3.85.4.2.2.1 Bundle Pagination

If an Alert Aggregator wishes to page query results, then it shall do so as defined in Section
880   2.1.0.19 of FHIR. In this case, the Alert Aggregator shall provide the first and next navigation links and the Alert Reporter shall support the paging semantics as defined in Section 2.1.1.4.6 of FHIR.

### 3.85.4.2.3 Expected Actions

The Alert Reporter and Alert Aggregator shall comply with the requirements in Section 42.1.1.1
885   and Section 42.1.1.2.

The Alert Reporter shall process the Alert Query Status Response message according to the capabilities of its application.

This behavior is not further defined or constrained by IHE.

### 3.85.5 Alert Terminologies and Mappings

890   The constraints on alert terminologies and their mappings described in Section 3.84.5 shall apply to this transaction.

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### 3.85.6 Security Considerations

See the security considerations defined in IHE ITI TF-1:42.5.

### 3.85.6.1 Security Audit Considerations

895    The ATNA logging policy is defined by the implementing jurisdiction taking into account the implementation context.

## Volume 2 Namespace Additions

*Add the following terms to the IHE General Introduction Appendix G:*

The mACM Profile defines following OIDs:

900    • 1.3.6.1.4.1.19376.1.2.5 the root OID for the mACM Profile

• 1.3.6.1.4.1.19376.1.2.5.1 the OID for the code set used by mACM for specifying the category of a FHIR `Communication` resource