Integrating the Healthcare Enterprise

IHE IT Infrastructure
Technical Framework Supplement

Mobile Alert Communication Management (mACM)

Draft for Public Comment

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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 V12.0. Each supplement undergoes a process of public comment and trial implementation before being incorporated into the volumes of the Technical Frameworks.

This supplement is published on May 27, 2016 for public comment. Comments are invited and can be submitted at http://www.ihe.net/ITI_Public_Comments. In order to be considered in development of the trial implementation version of the supplement, comments must be received by June 26, 2016.

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.

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.

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 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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Introduction to this Supplement

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

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.

#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 this profile to not use the term alert.

#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

This was accepted, but it looks like it should also be added to CommunicationRequest resources:

http://gforge.hl7.org/gf/project/fhir/tracker/?action=TrackerItemEdit&tracker_item_id=9773

#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

This was rejected by FHIR: "Communication represents a piece of information that *was* conveyed to a recipient. Validity period isn't relevant. (Flag on the other hand represents a piece of data that should be continuously exposed to a category of recipients over a period of time.)"

This raises the issue of whether mACM should use CommunicationRequest resources as the trigger.

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

#16) Should there be a FHIR CP for other extensions? This will depend on open issue #14 resolution.

#17) Should the dissemination extension be replaced by multiple Communication resources sharing the same original CommunicationRequest resource?

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.characteristics 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 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.

#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 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 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.

#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

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

#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

CP was rejected by FHIR and not relevant now because we're using the Communication resource.

#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

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.

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.

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 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 could be used instead of the new ITI-84 "mACM Report Alert" transaction. PCD-04 is an HL7®[1]v2 message for clinical observations. It was decided that using this would be semantically incorrect as we have many uses cases that are not observations.

[1] HL7 is the registered trademark of Health Level Seven.

Nov 20, 2014:

- Consensus: we will narrow to two use cases/healthcare workflows involving notifications (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.
- 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 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 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?
- 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 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 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. 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 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 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 Transmitter Actors were used in a HITSP Emergency Msg Distribute Element document. Response (Carl L): Updated actor names for group feedback.
- #12) The PCD referenced WCTP standard is not a formally published standard and that maintenance of WCTP is within the PCD Technical Committee.

General Introduction

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.

Note: The Alert Communicator actor is defined in Section 6.3.4 of the IHE Patient Care Device (PCD) Technical Framework Volume 1 IHE PCD TF-1 (http://www.ihe.net/uploadedFiles/Documents/PCD/IHE_PCD_TF_Vol1.pdf).

Appendix B - Transaction Summary Definitions

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

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:

None

Domain-specific additions

None

42 Mobile Alert Communication Management (mACM) Profile

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.

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.
- *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.

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;
- 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

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.

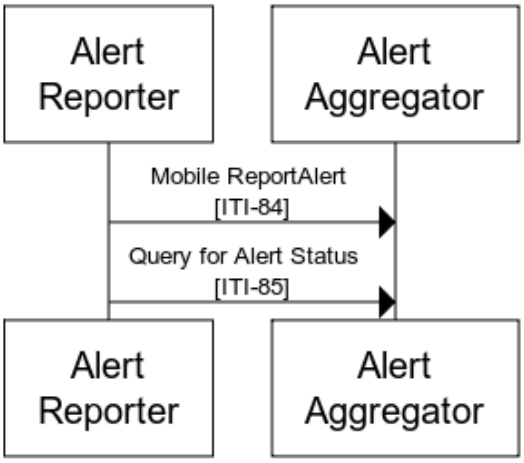


Figure 42.1-1: mACM Actor and Transaction Diagram

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

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

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 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 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 additionally reference Fast Healthcare Interoperability Resources (FHIR®[2]). An Alert Aggregator's response in these transactions 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. See ITI TF-2x: Appendix Z.5 for details.

42.1.1.2 Alert Aggregator

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, 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:

- 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`. See ITI TF-2x: Appendix Z.5 for details.

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

[2] Fast Healthcare Interoperability Resources and FHIR are the registered trademarks of Health Level Seven.

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

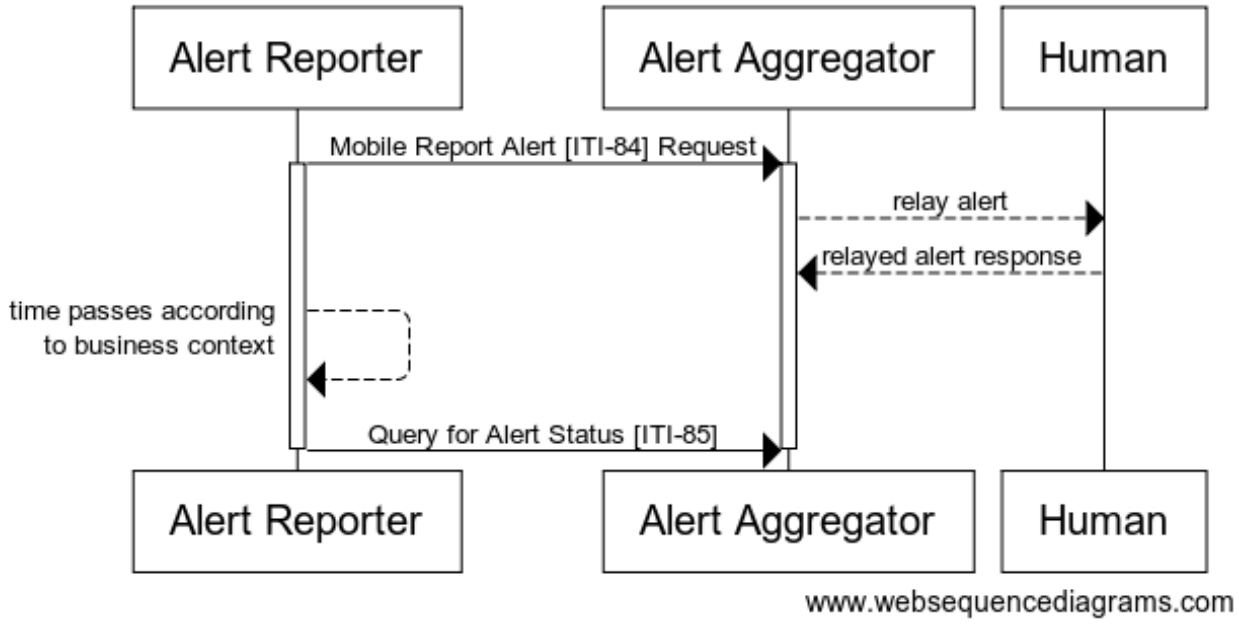


Figure 42.4-1: Process Flow Diagram

42.4.2 Use Cases

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

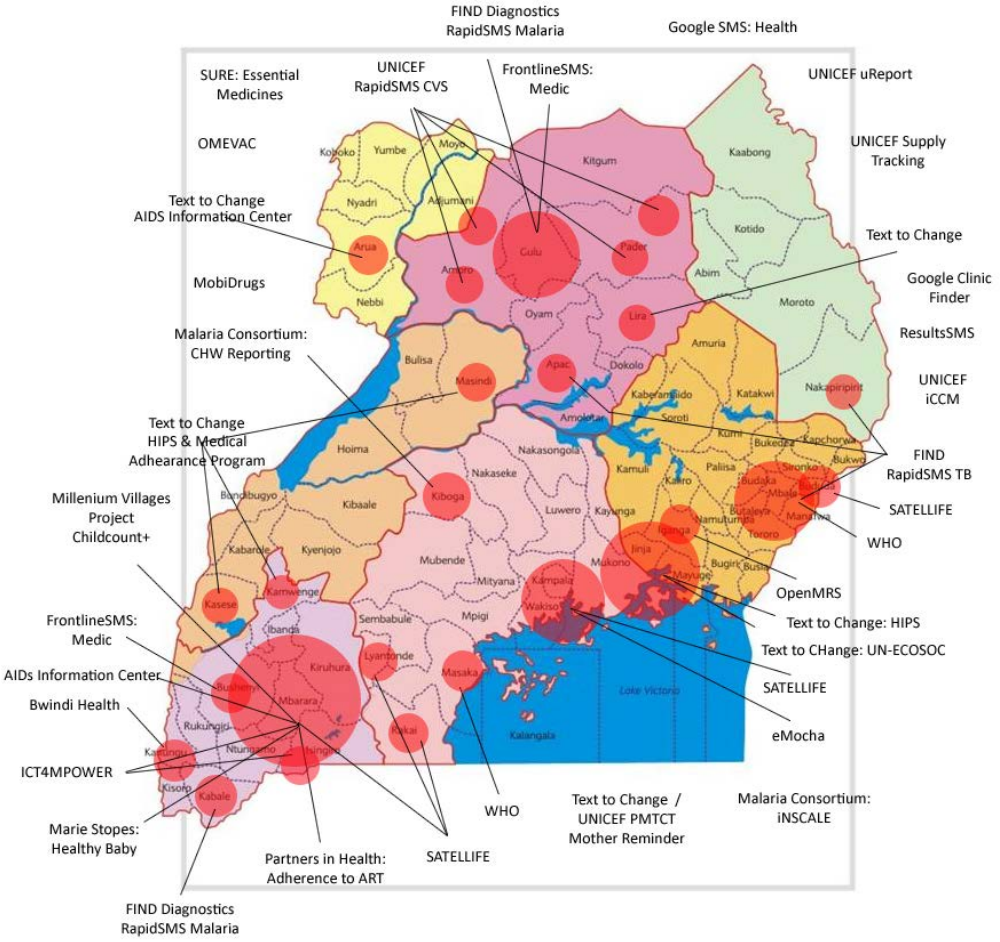
A critical requirement of the mACM Profile is the ability to provide basic alerting services within resource-constrained environments with a low barrier to entry. Such communities may

exist at national context for Low and Middle Income Countries (LMICs[3]), as well as underserved communities in high-income countries (e.g., the population targeted by Detroit's Beacon Project[4]). 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:

- 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

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

[4] http://www.healthit.gov/sites/default/files/beacon-factsheet-semi.pdf



450

Figure 42.4.2-1 Extant mobile based mHealth Services in Uganda

(Courtesy UNICEF/Blaschke/2011)

42.4.2.1 Use Case #1: Crisis Response

455 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 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

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

42.4.2.1.1 Crisis Response Use Case Description

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.

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

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.[5]

42.4.2.1.2 Crisis Response Process Flow

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

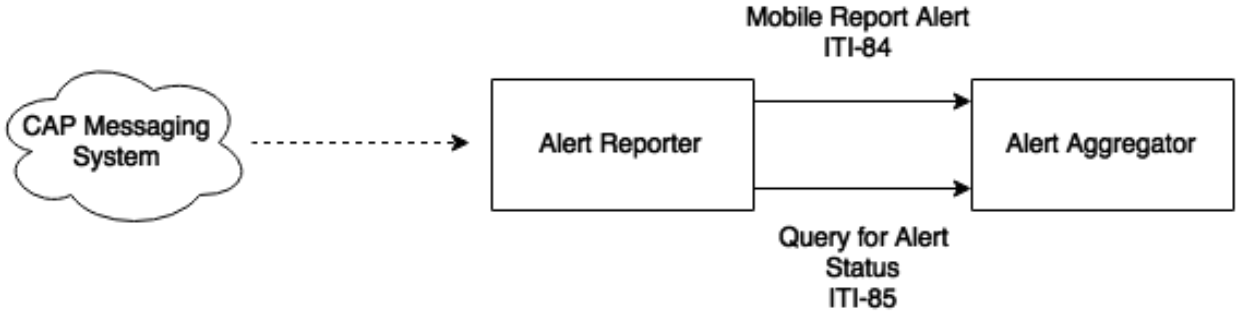


Figure 42.4.2.1.2-1: CAP Delivery and Acknowledge

[5] 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

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 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

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.

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 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.
- (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 Community Health Worker, a village elder, or a sub-village chairman.

42.4.2.2.2 Care Reminder Process Flow

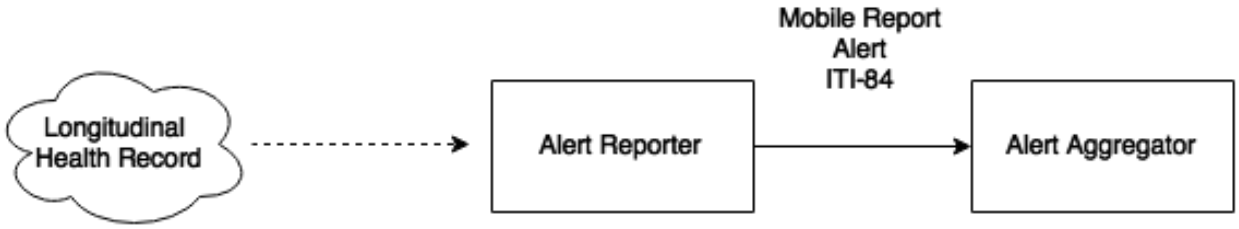


Figure 42.4.2.2.2-1: Care Reminders

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 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, 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 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 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

42.6.1 Health Worker Directory Services

The Alert Reporter 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 in the Care Services Discovery (CSD) Profile
- Provider Information Directory in the Healthcare Provider Directory (HPD) Profile
- Personnel White Pages Directory 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 interactions.

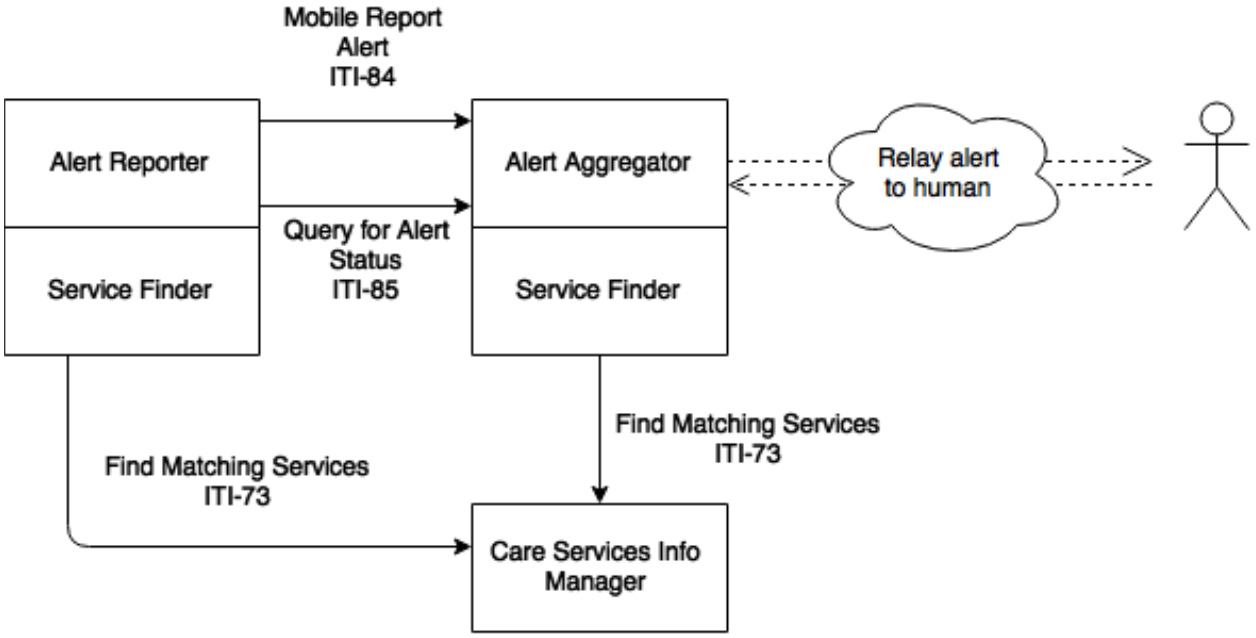


Figure 42.6.1-1: mACM Actor Interactions with a Health Worker Registry

In Figure 42.6.1-1, the CSD Info Manager 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 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.

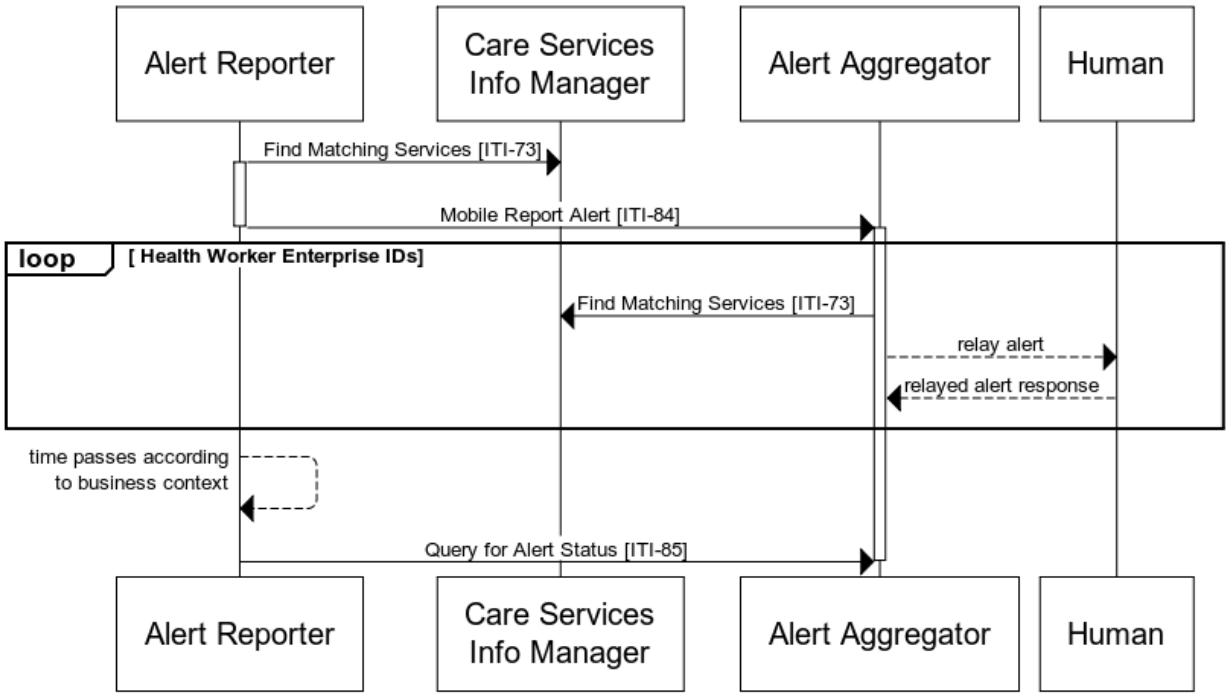


Figure 42.6.1-2: Sequencing of mACM Actor Interactions with a Health Worker Registry

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:

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.
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 Manager.

42.6.2 Client Registry Services

The Alert Reporter 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:

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

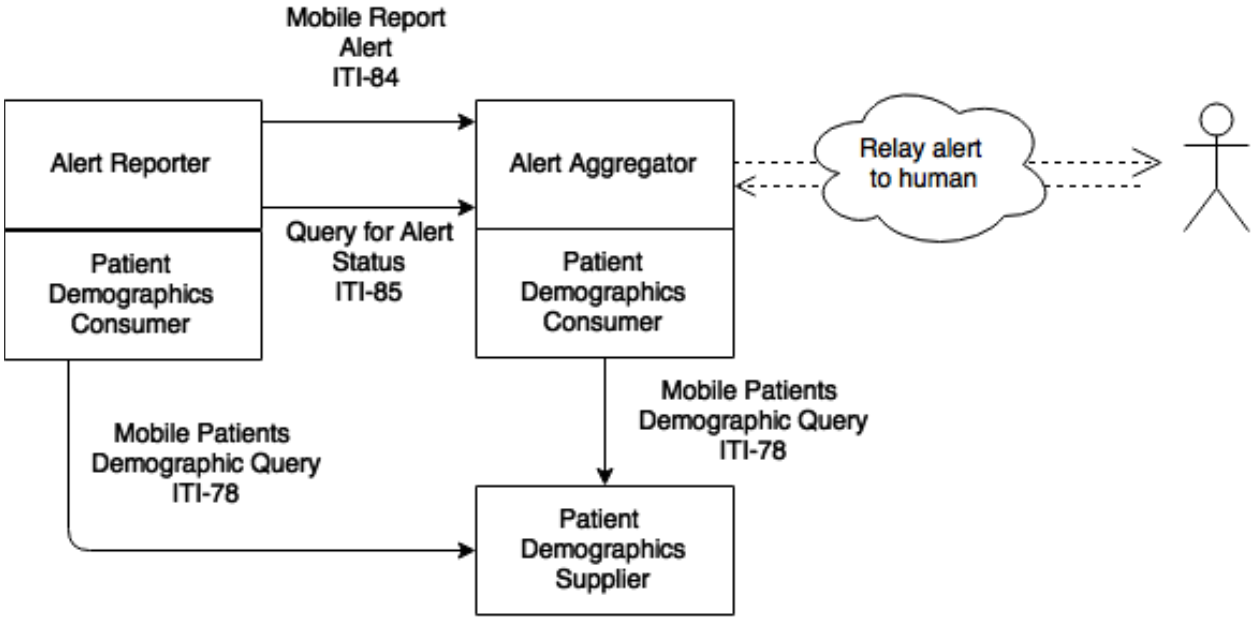


Figure 42.6.2-1: mACM Actor Interactions with a Client Registry

In Figure 42.6.2-2, the PDQm Patient Demographics Supplier 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 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.

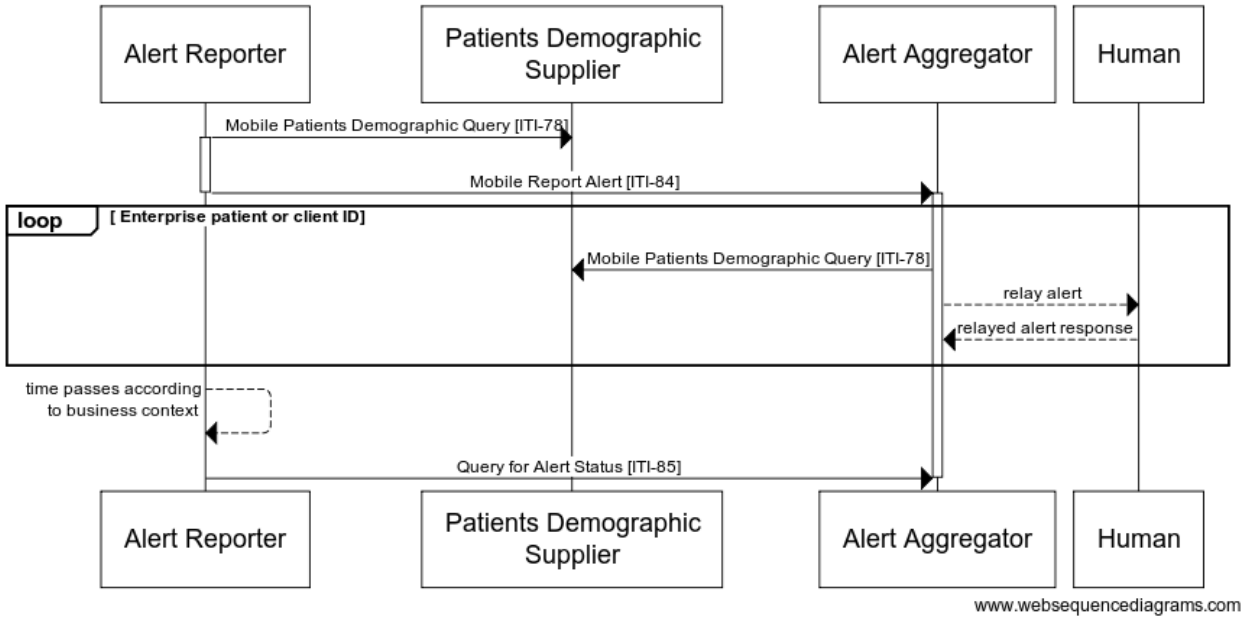


Figure 42.6.2-2: Sequencing of mACM Actor Interactions with a Client Registry

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 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.
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.

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.

3.84.2 Actor Roles

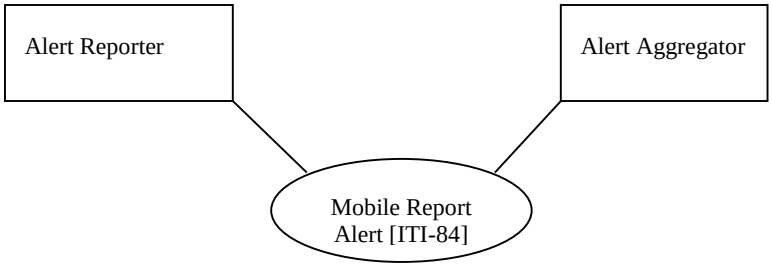


Figure 3.84.2-1: Use Case Diagram

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

3.84.3 Referenced Standards

- FHIR DSTU2 http://hl7.org/fhir/DSTU2/index.html
- HL7 - Health Level 7®[6] Version 2.6 Ch7 Observation Reporting
- ISO/IEEE 11073-10201 Domain Information Model

[6] Health Level Seven is the registered trademark of Health Level Seven.

- ISO/IEEE 11073-10101 Nomenclature
- JSON – IETF RFC 7159
- XML
- HTTP 1.1
- XML Schema 1.1
- 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 `CommunicationRequest` resource.

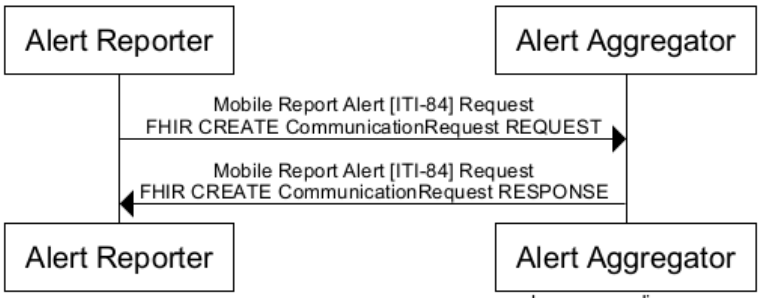


Figure 3.84.4-1: Interaction Diagram

3.84.4.1 Mobile Report Alert Request

The Alert Aggregator shall support the message semantics for read, update, and create as defined at http://hl7.org/fhir/DSTU2/http.html#read, http://hl7.org/fhir/DSTU2/http.html#update, http://hl7.org/fhir/DSTU2/http.html#create as applicable to a `CommunicationRequest` resource defined at http://hl7.org/fhir/DSTU2/communicationrequest.html.

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

3.84.4.1.1 Trigger Events

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.

3.84.4.1.2 Message Semantics

An Alert Reporter initiates a create request as defined at http://hl7.org/fhir/DSTU2/http.html#create on the `CommunicationRequest` resource in order to report a new alert.

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. See ITI TF-2x: Appendix Z.6 for more details.

3.84.4.1.2.1 FHIR CommunicationRequest Resource Constraints

An Alert Aggregator and an Alert Reporter that supports the Mobile Report Alert [ITI-84] transaction shall transaction shall use a FHIR `CommunicationRequest` resource. The FHIR `CommunicationRequest` 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 at http://hl7.org/fhir/DSTU2/communicationrequest.html#resource.

An Alert Aggregator shall provide an extension definition as specified at http://hl7.org/fhir/DSTU2/defining-extensions.html#1.17.1. 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

Table 3.84.4.1.2.1-1: `CommunicationRequest` 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. This data field shall be constrained so that: • The `coding.code` attribute value is defined in the “Code” column of Table 3.84.5.1-1 • The value `coding.system` attribute value is defined in the “Code System” column of Table 3.84.5.1-1	`CodeableConcept`
`_lastUpdated [1..1]`	The last time that the `CommunicationRequest` 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. 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. The `payload` element shall have at least one `contentAttachment` element that meets the following requirements: • The payload shall contain the language of the unstructured plain text content in the `contentAttachment.language` attribute • The payload shall contain the unstructured plain text content of the alert to be communicated in the `contentAttachment.title` attribute • The payload shall have the value “plain/text” in the `contentAttachment.content-type` attribute	`Attachment`
`priority [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. This data field is defined as an extension which shall be constrained so that: • The `coding.code` attribute value is defined in the “Code” column of Table 3.84.5.1-2 • The value `coding.system` attribute value is defined in the “Code System” column of Table 3.84.5.1-2	`CodeableConcept`

3.84.4.1.2.1.1 FHIR CommunicationRequest Resource Constraints – Disseminate and Report Alert Status Option

For Disseminate and Report Alert Status Option the message semantics have the additional following constraints in place.

Data Field & Cardinality	Description & Constraints	FHIR Data Type

Data Field & Cardinality	Description & Constraints	FHIR Data Type
`extension [0..*]`	This data field identifies secondary characteristics of the alert. This data field is defined as an extension which shall be constrained so that: • the `url` attribute has relative value "`CommunicationRequest.characteristic`" • a valid characteristic code is stored in `valueCodeableConcept` 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: • The `coding.code` attribute value is defined in the "Code" column of Table 3.84.5.1-3, as appropriate to the business context • The value `coding.system` attribute value is defined in the "Code System" column of Table 3.84.5.1-3	`CodeableConcept`

3.84.4.1.3 Expected Actions

The Alert Reporter and Alert Aggregator shall comply with the requirements in ITI TF-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 at http://hl7.org/fhir/DSTU2/http.html#create if any of the following conditions are met:

- The Mobile Report Alert Request was invalid
- The alert `CommunicationRequest.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:

- is valid
- identifies recipients within the jurisdiction of the Alert Aggregator
- contains a value of "pcd-alert" in `CommunicationRequest.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 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`CommunicationRequest.category` and `CommunicationRequest.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 create a new Communication resource as described at http://hl7.org/fhir/DSTU2/communication.html when the alert is sent. Figure 3.84.4.1.3.1-1 shows the sequencing of the FHIR resource updates.

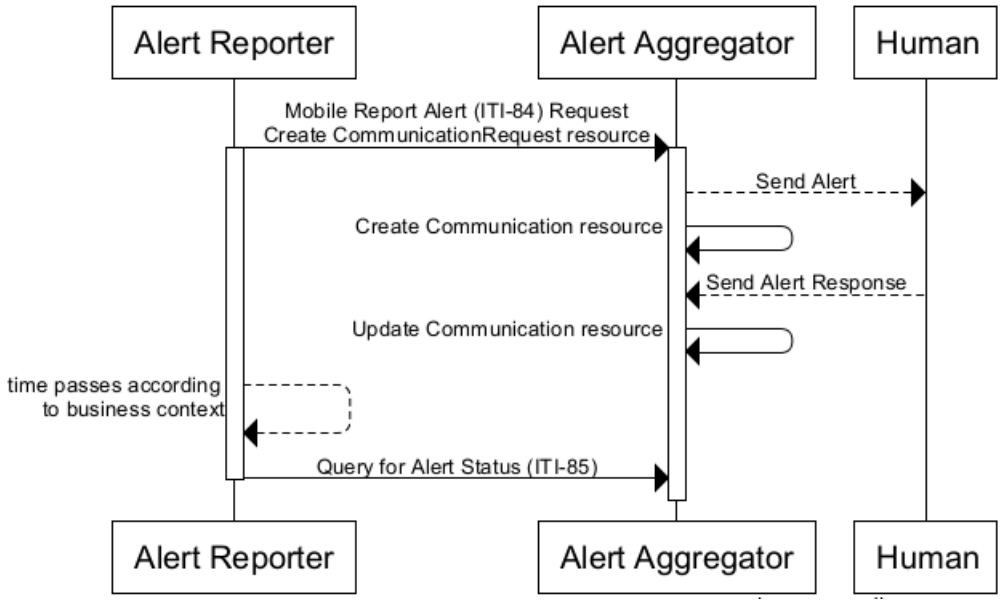


Figure 3.84.4.1.3.1-1: process flow diagram for FHIR resource updates.

The Alert Aggregator shall add a new `Communication.dissemination` extension point for each 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 3.84.4.1.3.1-2 the sequencing of the transactions for the Disseminate and Report Alert Status Option.

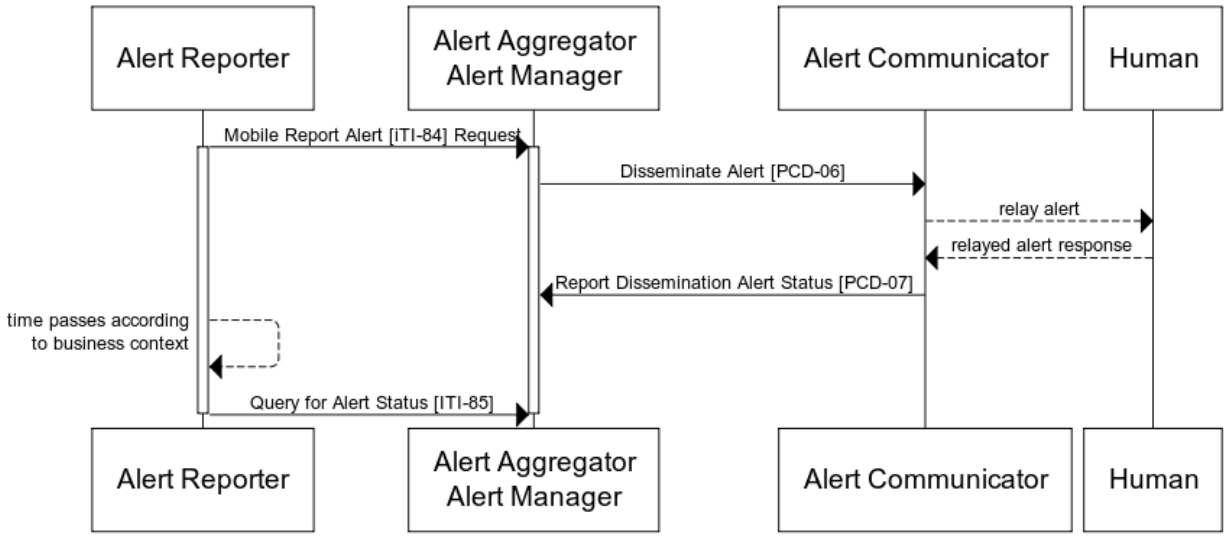


Figure 3.84.4.1.3.1-2: Process Flow Diagram for Alert Disseminate and Report Alert Status

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 at http://hl7.org/fhir/DSTU2/http.html#update and http://hl7.org/fhir/DSTU2/http.html#create for the `CommunicationRequest` resource, as defined at http://hl7.org/fhir/DSTU2/communicationrequest.html.

The `CommunicationRequest` 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.

3.84.4.2.2 Message Semantics

The Alert Aggregator shall respond with the appropriate response codes as defined at http://hl7.org/fhir/DSTU2/http.html#update and http://hl7.org/fhir/DSTU2/http.html#create.

3.84.4.2.3 Expected Actions

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

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] 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

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

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
775 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
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)

Code	Code System	Meaning
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: Alarm 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
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

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 `CommunicationRequest` resource to the data fields in the Disseminate Alert [PCD-06] and Report Dissemination Alert Status [PCD-07] transactions.

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: `CommunicationRequest.subject (Location)`
`Alert_Patient`	`CommunicationRequest.subject`	
`Alert_Identifier`	`CommunicationRequest._id`	
`Alert_Callback`		Not constrained by this transaction
`Alert_Reference`	URL of `CommunicationRequest` resource	
`Alert_Comment`	`CommunicationRequest.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 transaction

Table 3.84.5.2-2: Disseminate Alert Status Field Translation

PCD-06 Data Field	`Communication` Resource Data Field	Comments
`Alert_Identifier`	`CommunicationRequest._id`	
`Alert_Status`	`CommunicationRequest.status` and `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

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 at http://hl7.org/fhir/DSTU2/valueset-communication-status.html#definition.

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 `CommunicationRequest` resource data fields as extended by this transaction.

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	`CommunicationRequest._id`	
Source identification	`CommunicationRequest.sender._id`	Applicable only in the case that the sender was a device
Event phase	`CommunicationRequest.characteristic` for the code system `1.3.6.1.4.1.19376.1.2.5.3.2`	
Alert state	`CommunicationRequest.characteristic` for the code system `1.3.6.1.4.1.19376.1.2.5.3.5`	

PCD-04, PCD-06 and PCD-07 Facet	`Communication` Resource Data Field	Comments
Inactivation state	`CommunicationRequest.characteristic` for the code system `1.3.6.1.4.1.19376.1.2.5.3.4`	
Alarm priority	`CommunicationRequest.priority.code`	
Alert type	`CommunicationRequest.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 ITI TF-1:42.5.

In addition, appropriate precautions should be taken against Denial of Service attacks or spam 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]

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.

3.85.2 Actor Roles

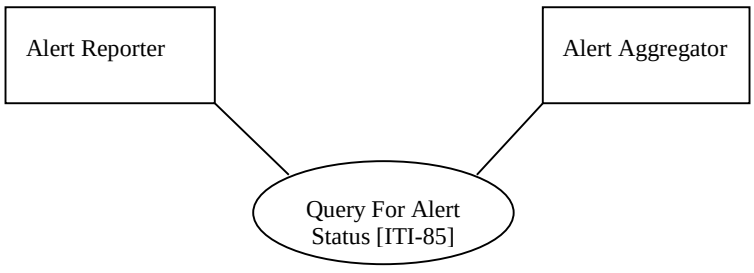


Figure 3.85.2-1: Use Case Diagram

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 http://hl7.org/fhir/DSTU2/index.html
- 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
- XML
- HTTP 1.1
- XML Schema 1.1

3.85.4 Interaction Diagram

Figure 3.85.4-1: Query for Alert Status Sequence Diagram

3.85.4.1 Query for Alert Status Request

The Alert Aggregator shall support the search request message as defined at http://hl7.org/fhir/DSTU2/http.html#search on the `CommunicationRequest` resource defined at http://hl7.org/fhir/DSTU2/communicationrequest.html or `Communication` resource, defined at http://hl7.org/fhir/DSTU2/communication.html.

The `CommunicationRequest` 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 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 at http://hl7.org/fhir/DSTU2/http.html#search on the `CommunicationRequest` resource as constrained in Section 3.84.4.1.2.1 or the `Communication` resource as constrained in Section 3.85.4.1.2.1.

An Alert Aggregator shall support AND OR combinations of search parameters as defined at http://hl7.org/fhir/DSTU2/search.html#combining, “Composite Search Parameters.”

In addition to the search parameters required at http://hl7.org/fhir/DSTU2/communicationrequest.html#search and http://hl7.org/fhir/DSTU2/communication.html#search, an Alert Aggregator shall support searching against the search parameters in Table 3.85.4.1.2-1. Also see ITI TF-2x: Appendix Z.2.

Table 3.85.4.1.2-1: Additional Search Parameters on `CommunicationRequest` and `Communication` Resources

Data Field
`CommunicationRequest.characteristic*`
`Communication.dissemination.timestamp*`
`Communication.dissemination.code*`
`Communication.dissemination.location*`
`Communication.dissemination.recipient*`

* Note that this search parameter is on an extension element. See http://hl7.org/fhir/DSTU2/searchparameter.html#srch for more details on defining searches on extension elements.

As described in Section 3.84.4.1.2.1, an Alert Aggregator shall provide an extension definition as specified at http://hl7.org/fhir/DSTU2/defining-extensions.html#1.17.1. The Alert Aggregator shall include in the extension 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. See ITI TF-2x: Appendix Z.6 for more details.

3.85.4.1.2.1 FHIR Communication Constraints

An Alert Aggregator and an Alert Reporter that supports the Query for Alert Status [ITI-85] transaction shall use a FHIR `CommunicationRequest` or `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.

An Alert Aggregator shall provide an extension definition as specified at http://hl7.org/fhir/DSTU2/defining-extensions.html#1.17.1. The extension definition shall include the dissemination status extension fields as defined in Table 3.85.4.1.2.1-2.

For the extension points defined in Table 3.85.4.1.2.1-1, Table 3.85.4.1.2.1-2, 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

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. This data field is defined as an extension which shall be constrained so that: • the `url` attribute has relative value "`Communication.dissemination`" • it contains Dissemination Status sub-extensions as defined in Table 3.85.4.1.2.1-2	See Table 3.85.4.1.2.1-2

Table 3.85.4.1.2.1-2: Dissemination Status Extension

Data Field & Cardinality	Description & Constraints	FHIR Data Type

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. This data field is defined as an extension which shall be constrained so that: • the `url` attribute has relative value "`Communication.dissemination.recipient`" • a valid recipient is stored in a valueReference • See ITI TF-2x: Appendix Z.5 for details	`Reference( Device | Organization | Patient | Practitioner | RelatedPerson | Group )`
`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. This data field is defined as an extension which shall be constrained so that: • the `url` attribute has relative value "`Communication.dissemination.timestamp`" • a timestamp stored in `valueInstant`.	`instant`
`extension [0..*]`	Indicates a dissemination status of the alert. This data field is defined as an extension which shall be constrained so that: • the `url` attribute has relative value "`Communication.dissemination.status`" • the value stored in valueCode is a valid status code from the CommunicationStatus value set defined at http://hl7.org/fhir/DSTU2/valueset-communication-status.html#definition	`code`
`extension [0..*]`	This data field contains as unstructured text content, associated to the dissemination event. This data field is defined as an extension which shall be constrained so that: • the `url` attribute has relative value "`Communication.dissemination.response`" • is the value stored in `valueString` is a string representing the textual representation of the response back from a human receiving the alert. For example, if the alert was delivered as an SMS and the recipient texted back in response, the value of this attribute would contain the contents of that response.	`string`

Data Field & Cardinality	Description & Constraints	FHIR Data Type
`extension [0..1]`	An extension point for location information for a dissemination status event. This data field is defined as an extension which shall be constrained so that: • the `url` attribute has relative value "`Communication.dissemination.location`" • a valid location, if known, is stored in `valueReference` • See ITI TF-2x: Appendix Z.5 for details.	`Reference( Location )`
`extension [0..*]`	This data field identifies any codes used for the dissemination. This data field is defined as an extension which shall be constrained so that: • the `url` attribute has relative value "`Communication.dissemination.code`" • a valid characteristic code is stored in `valueCodeableConcept` 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: • The `coding.code` attribute value is defined in the "Code" column of Table 3.84.5-3, as appropriate to the business context • The value `coding.system` attribute value is defined in the "Code System" column of Table 3.84.5-3	`CodeableConcept`

3.85.4.1.3 Expected Actions

Upon receipt of a valid Query for Alert Status Request from an Alert Reporter, an Alert 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 `CommunicationRequest` or `Communication` resources. See ITI TF-2x: Appendix Z.1 for instructions on bundles.

The Alert Aggregator shall respond with appropriate HTTP error codes as described at http://hl7.org/fhir/DSTU2/http.html#create if any of the following holds:

- The request was invalid
- No matching alerts were found

3.85.4.2 Query for Alert Status Response

The Query for Alert Status transaction uses the response semantics as appropriate according to the search response message as defined at http://hl7.org/fhir/DSTU2/http.html#search as applicable for the `CommunicationRequest` resource, as defined at http://hl7.org/fhir/DSTU2/communicationrequest.html or the `Communication` resource, as defined at http://hl7.org/fhir/DSTU2/communication.html .

The `CommunicationRequest` resource is furthered constrained as defined in Section 3.84.4.12.1 and the `Communication` resource is furthered constrained as defined in Section 3.85.4.12.1.

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 at http://hl7.org/fhir/DSTU2/http.html#search on the `CommunicationRequest` resource, defined at http://hl7.org/fhir/DSTU2/communicationrequest.html or the `Communication` resource, defined at http://hl7.org/fhir/DSTU2/communication.html.

The `CommunicationRequest` resource is furthered constrained as defined in Section 3.84.4.1.2.1 and the `Communication` resource is furthered constrained as defined in Section 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 at http://hl7.org/fhir/DSTU2/http.html#paging. 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 at http://hl7.org/fhir/DSTU2/search.html#2.1.1.5.6.

3.85.4.2.3 Expected Actions

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

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

3.85.6 Security Considerations

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

3.85.6.1 Security Audit Considerations

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

Volume 2 Namespace Additions

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

The mACM Profile defines following OIDs:

- 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 `CommunicationRequest` resource

Appendices (Normative)

Appendix Y – Diagram Pseudocode

Figure 42.1-1

```
Alert\nReporter->Alert\nAggregator: Mobile ReportAlert \n[ITI-84]
Alert\nReporter->Alert\nAggregator: Query for Alert Status  \n[ITI-85]
```

Figure 42.4-1

```
title
participant Alert Reporter
participant Alert Aggregator

Alert Reporter->Alert Aggregator: Mobile Report Alert [ITI-84] Request

activate Alert Reporter
activate Alert Aggregator


Alert Aggregator-->Human: relay alert
Human-->Alert Aggregator: relayed alert response


Alert Reporter-->Alert Reporter: time passes according\n to business context
Alert Reporter->Alert Aggregator: Query for Alert Status [ITI-85]

deactivate Alert Aggregator
deactivate Alert Reporter
```

Figure 42.6.1-2

```
title
Alert Reporter->Care Services\nInfo Manager:Find Matching Services [ITI-73]
activate Alert Reporter

Alert Reporter->Alert Aggregator: \nMobile Report Alert [ITI-84]
deactivate Alert Reporter
activate Alert Aggregator


loop  Health Worker Enterprise IDs

Alert Aggregator->Care Services\nInfo Manager: Find Matching Services [ITI-73]


Alert Aggregator-->Human: relay alert
Human-->Alert Aggregator: relayed alert response
end

Alert Reporter-->Alert Reporter: time passes according\n to business context
Alert Reporter->Alert Aggregator: Query for Alert Status [ITI-85]
```


Figure 42.6.2-2

```
title
Alert Reporter->Patients Demographic\nSupplier: Mobile Patients Demographic Query [ITI-78]
activate Alert Reporter

Alert Reporter->Alert Aggregator: \nMobile Report Alert [ITI-84]
deactivate Alert Reporter
activate Alert Aggregator


loop  Enterprise patient or client ID

Alert Aggregator->Patients Demographic\nSupplier: Mobile Patients Demographic Query [ITI-78]


Alert Aggregator-->Human: relay alert
Human-->Alert Aggregator: relayed alert response
end

Alert Reporter-->Alert Reporter: time passes according\n to business context
Alert Reporter->Alert Aggregator: Query for Alert Status [ITI-85]
```

Figure 3.84.4-1

```
title

Alert Reporter->Alert Aggregator: \nMobile Report Alert [ITI-84] Request\nFHIR CREATE
CommunicationRequest REQUEST

Alert Aggregator->Alert Reporter: \nMobile Report Alert [ITI-84] Request\nFHIR CREATE
CommunicationRequest RESPONSE
```

Figure 3.84.4.1.3.1-1

```
title
participant Alert Reporter
participant Alert Aggregator



Alert Reporter->Alert Aggregator: Mobile Report Alert (ITI-84) Request\nCreate
CommunicationRequest resource

activate Alert Reporter
activate Alert Aggregator


Alert Aggregator-->Human: Send Alert
Alert Aggregator->Alert Aggregator: Create Communication resource
Human-->Alert Aggregator: Send Alert Response
Alert Aggregator->Alert Aggregator: Update Communication resource



Alert Reporter-->Alert Reporter: time passes according\n to business context
Alert Reporter->Alert Aggregator: Query for Alert Status (ITI-85)


deactivate Alert Reporter
deactivate Alert Aggregator
```


Figure 3.84.4.1.3.1-2

```
title
participant Alert Reporter
participant Alert Aggregator\nAlert Manager



Alert Reporter->Alert Aggregator\nAlert Manager: Mobile Report Alert (ITI-X01) Request

activate Alert Reporter
activate Alert Aggregator\nAlert Manager


Alert Aggregator\nAlert Manager->Alert Communicator: Disseminate Alert (PCD-06)
Alert Communicator-->Human: relay alert
Human-->Alert Communicator: relayed alert response
Alert Communicator->Alert Aggregator\nAlert Manager: Report Dissemination Alert Status (PCD-07)




Alert Reporter-->Alert Reporter: time passes according\n to business context
Alert Reporter->Alert Aggregator\nAlert Manager: Query for Alert Status [ITI-X02]


deactivate Alert Reporter
deactivate Alert Aggregator\nAlert Manager
```

Figure 3.85.4-1

```
title

Alert Reporter->Alert Aggregator: Query for Alert Status Request [ITI-85]\nFHIR Search
Communication
activate Alert Reporter
activate Alert Aggregator
Alert Aggregator->Alert Reporter: Query for Alert Status Response [ITI-85]\nFHIR Bundle of
Communications
```

