**Integrating the Healthcare Enterprise**



**IHE Devices (DEV)**

**Technical Framework Supplement**

**Point-of-Care Monitored Communication**

**(PCMC)**

**For review and comment only.**

**DO NOT implement this public comment version.**

**Revision 1.0 – Draft in Preparation for Public Comment**

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**Foreword**

This is a supplement to the IHE Devices (DEV) Domain Technical Framework 10.0. 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 February 03, 2025 for Public Comment. Comments are invited and can be submitted at <http://www.ihe.net/Public_Comment/#domainname>. In order to be considered in development of the Trial Implementation version of the supplement, comments must be received by July 01, 2025.

*~~<For Trial Implementation:>~~* ~~This supplement is published on <Month XX, 201X> 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 <Domain Name> Technical Framework. Comments are invited and can be submitted at~~ [~~http://www.ihe.net/Public\_Comment/#domainname~~](http://www.ihe.net/Public_Comment/#domainname)~~.~~

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 [IHE](http://www.ihe.net/).

Information about the IHE Devices domain can be found at [IHE Domains](https://www.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 [Profiles](https://www.ihe.net/resources/profiles/) and [IHE Process](https://www.ihe.net/about_ihe/ihe_process/)

The current version of the DEV Technical Framework can be found at [Devices Technical Framework](https://www.ihe.net/resources/technical_frameworks/#dev).

Comments may be submitted on IHE Technical Framework templates any time at [Public Comments](http://ihe.net/Templates_Public_Comments/). Please enter comments/issues as soon as they are found. Do not wait until a future review cycle is announced.

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# Introduction to this Supplement

This supplement to the IHE Devices Technical Frameworks adds the rationale and implementation details of the Point-of-Care Monitored Communication Profile to the Framework, providing a means for standards-based monitoring of the communication between a Point-of-Care Device Reporter and Point-of-Care Device Consumer.

## Open Issues and Questions

The following list of open issues and questions need to be addressed:

1. **3.53.4.1.2 Message Semantics**: Paul Schluter proposed to support also the “start\_only” state. This will simplify the state handling at the PCD REPORTER and PCD CONSUMER side.  
     
   However, this will limit the ability of the PCD REPORTER to provide additional state changes to the PCD CONSUMER e.g. that the PCD REPORTER wants to leave the MC gracefully due to a firmware update.
2. **3.53.4.1.2 Message Semantics**: Paul Schluter proposed that the periodicity could also be defined in a separate OBX segment that follows the in-line event OBX segment and is sent as a <source> of the in-line event.  
     
   My understanding from the last working group review was that the watchdog message shall be as light-weighted as possible. In my opinion, utilizing the OBX-7 for the time limit would slightly be also simpler to parse.
3. Shall we also consider any non-heartbeat message as a heartbeat message which resets the heartbeat timer on both sides?  
     
   The problem is that any changes regarding the watchdog parameter must either be sent as an “inline-event” or as a separate message, and the acknowledgement from the PCDC cannot clearly distinguish between the acknowledgement of the heartbeat and the actual data message (e. g. PCDC wants to confirm the non-heartbeat event but wants to indicate that it needs to stop the heartbeat processing).
4. Todd Cooper suggested to have the Send and Acknowledge as one single transaction. However, this makes it a little bit more difficult to describe the two different messages in the given transaction sections (readability will decrease).
5. Rob Wilder: My only question was around line 230 in section 14, item 8.  
   If a gateway PCDR does not take the responsibility for the reliable communication with all the connected devices, the gateway PCDR shall only act as a proxy for the individual devices participating in a MC.  
   In this case it seems like the PCDR is handing off its responsibility to the devices themselves to handle PCDR duties. If I am reading that right then there is a good deal of risk in that approach we should discuss. Am I interpreting this wrong or is my take on this the actual intent?

Comment from Peter Kranich: The intent here is that some gateways only “forward” the actual messages from the device (PCDR) through the gateway to the PCDC. There might be some mapping required (from the device’s proprietary protocol to the IHE profile defined HL7 V2 message), but the device is still responsible for the correct heartbeat message and the interpretation of the response from the PCDC.

I’m personally do not see a risk here since the device is still responsible for MC: if the gateway cannot send the heartbeat message, the device and the PCDC will detect a timeout; if the gateway can send the heartbeat message but not the response from the PCDC, the device will detect a timeout; if the gateway maps the heartbeat message or the response message incorrectly, the error will be detected by the PCDC and/or PCDR.

1. Rob Wilder: In the transactions it seems like there is a departure from the PCD-05 model and still an indication of awareness of the end point communication devices by the AR/PCDR actors. There is also some concern in regard to what looks to be implied AR awareness of endpoint communication assignments along with status of those end points. I would like to find some time for some additional discussion on end to end to verification to review this further. We do not have another ACM WG meeting until next month but I could set up a special session or we can cover in the back end of a domain meeting as well.  
     
   Comment from Peter Kranich: There are two aspects why not using a PCD-05 message: a.) the PCMC can be used for multiple IHE profiles and is not limited to the ACM profile (although it has a great value for this profile), and   
   b.) my understanding is that a PCD-05 is always tied to a previous alert event announced by a PCD-04. However, the PCMC is independent of any active alert events. The PCMC profile ensures that if there was an active alert event, the AR and the AM would be capable of announcing the alert to the caregiver.

## Closed Issues

The following list of issues and questions has been addressed:

1. According to Paul Schluter, the issue can be closed: “Treating MDC\_EVT\_WATCHDOG as an event that spans multiple timing trials is fine, and it provides a clean way of starting and ending the watchdog timing trials. Please feel free to remove lines 125 to 131 inclusive if you’d like.”
2. According to Paul Schluter, the issue can be closed with additional recommendation in the related section: “You can remove this comment as well. That said, I would recommend that the profile recommend that the testing period be some factor (e.g. 2X) the latency limit expressed in OBX-7 ‘Reference Range’ be described as the desired maximum one-way latency and that the recommended testing period be at least twice that amount to reduce the likelihood of confusion between the messages and responses. For example, if you require a maximum one-way latency of less than two seconds, why not test at a period of five to ten seconds? [This can be resolved during the public comment discussion with the larger group, since others may want to weigh in on this topic. It’s up to you.]”

# IHE Technical Frameworks General Introduction

The [IHE Technical Frameworks General Introduction](https://profiles.ihe.net/GeneralIntro) is shared by all of the IHE domain technical frameworks. Each technical framework volume contains links to this document where appropriate.

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# IHE Technical Frameworks General Introduction Appendices

The [IHE Technical Framework General Introduction Appendices](https://profiles.ihe.net/GeneralIntro/index.html) are components shared by all of the IHE domain technical frameworks. Each technical framework volume contains links to these documents where appropriate.

Update the following appendices to the General Introduction as indicated below. Note that these are **not** appendices to this domain’s Technical Framework (TF-1, TF-2, TF-3 or TF-4) but rather, they are appendices to the IHE Technical Frameworks General Introduction located [here](https://profiles.ihe.net/GeneralIntro/index.html).

**NEW: REQUIRED APPROVAL OF ACTORS, TRANSACTIONS and TERMS -** To avoid duplication and ensure consistency across domains, all **new or modified** actors, transactions and glossary terms need approval by IHE’s Domain Coordination Committee (DCC) before they are published in a trial implementation supplement. Please see [this Wiki page](https://wiki.ihe.net/index.php/Approval_Process_for_IHE_Actors,_Transactions_and_Glossary_Terms) for additional guidance and links to the forms for approval submission.

# [Appendix A](https://profiles.ihe.net/GeneralIntro/ch-A.html) – Actors

Add the following **new** actors to the [IHE Technical Frameworks General Introduction Appendix A](https://profiles.ihe.net/GeneralIntro/ch-A.html):

| New Actor Name | Description |
| --- | --- |
| Point-of-Care Device Reporter | Any point-of-care device or system (e. g. device gateway) that reports data by utilizing an IHE Devices profile such as DEC, ACM, and so on. |
| Point-of-Care Device Consumer | Any point-of-care device or system (e. g. alarm manager) that receives data by utilizing an IHE Devices profile such as DEC, ACM, and so on. |
|  |  |

# [Appendix B](https://profiles.ihe.net/GeneralIntro/ch-B.html) – Transactions

Add the following **new** transactions to the [IHE Technical Frameworks General Introduction Appendix B](https://profiles.ihe.net/GeneralIntro/ch-B.html):

| New Transaction Name and Number | Definition |
| --- | --- |
| Send Heartbeat Message [DEV-53] | A Point-of-Care Device Reporter (PCDR) sends a heartbeat message to the Point-of-Care Device Consumer (PCDC) to indicate its current operational state. In normal operational state the heartbeat message is sent on a regular basis from the PCDR to the PCDC to indicate that the PCDR is still fully operational. |
| Acknowledge Heartbeat Message [DEV-54] | A Point-of-Care Device Consumer (PCDC) sends an acknowledgement message back to the Point-of-Care Device Reporter (PCDR) to confirm the heartbeat message from the PCDR, and to indicate its current operational state. |

# [Appendix D](https://profiles.ihe.net/GeneralIntro/ch-D.html) – Glossary

Add the following **new** glossary terms to the [IHE Technical Frameworks General Introduction Appendix D](https://profiles.ihe.net/GeneralIntro/ch-D.html):

| New Glossary Term | Definition | Synonyms | Acronym/  Abbreviation |
| --- | --- | --- | --- |
| Point-of-Care Device Reporter | Any point-of-care device or system (e. g. device gateway) that reports data by utilizing an IHE Devices profile such as DEC, ACM, and so on. |  | PCDR |
| Point-of-Care Device Consumer | Any point-of-care device or system (e. g. alarm manager) that receives data by utilizing an IHE Device profile such as DEC, ACM, and so on. |  | PCDC |
| Monitored Communication | The Monitored Communication facilitates a mutual monitoring of the operational state of the communication between the Point-of-Care Device Reporter and the Point-of-Care Device Consumer. |  | MC |

Volume 1 – Profiles

## Domain-specific additions

None

Add new Section 8

# 14 Point-of-Care Monitored Communication (PCMC) Profile

The optional Point-of-Care Monitored Communication (PCMC) Profile utilizes heartbeat messages sent from the PCD REPORTER (PCDR) to the PCD CONSUMER (PCDC) to facilitate a MONITORED COMMUNICATION (MC) with the following properties:

1. The PCDR is able to announce to the PCDC that it is ready for participating in a MC.
2. The PCDR is able to announce to the PCDC that it is leaving the MC intentionally.
3. The PCDR is able to inform the PCDC on a regular basis that it still participates in a MC.
4. The PCDC is able to inform the PCDR on a regular basis that it still participates in a MC.
5. The PCDC is able to inform the PCDR that it cannot participate in a MC at all or any longer.
6. The PCDR and PCDC are able to detect based on defined timeouts that the communication partner participating in the MC does not confirm the participation on a regular basis any longer.
7. If a gateway PCDR only announces itself as a participant in the MC with the PCDC, the gateway PCDR takes the responsibility for the reliable communication with all the connected devices, and for announcing any unintended communication failure by other means (e. g. technical alert event).
8. If a gateway PCDR does not take the responsibility for the reliable communication with all the connected devices, the gateway PCDR shall only act as a proxy for the individual devices participating in a MC.

## 14.1 PCMC Actors, Transactions, and Content Modules

This section defines the actors, transactions, and/or content modules in this profile. General definitions of actors are given in the Technical Frameworks General Introduction Appendix A. IHE Transactions can be found in the Technical Frameworks General Introduction Appendix B. Both appendices are located at <https://profiles.ihe.net/GeneralIntro/index.html>.

Figure 8.1-1 shows the actors directly involved in the PCMC Profile and the relevant transactions between them. If needed for context, other actors that may be indirectly involved due to their participation in other related profiles are shown in dotted lines. Actors which have a required grouping (if any), are shown in conjoined boxes (see Section 8.3).

Send Heartbeat Message [DEV-53] ↓

Point-of-Care Device Reporter

Point-of-Care Device Consumer

↑ Acknowledge Heartbeat Message [DEV-54]

Figure 14.1-1: PCMC Actor Diagram

Table 14.1-1 lists the transactions for each actor directly involved in the PCMC 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 14.1-1: <Profile Acronym> Profile - Actors and Transactions

| Actors | Transactions | Initiator or Responder | Optionality | Reference |
| --- | --- | --- | --- | --- |
| Point-of-Care Device Reporter | Send Heartbeat Message [DEV-53] |  | R | DEV TF-2: 3.53 |
| Point-of-Care Device Consumer | Acknowledge Heartbeat Message [DEV-54] |  | R | DEV TF-2: 3.54 |

### 14.1.1 Actor Descriptions and Actor Profile Requirements

Most requirements are documented in DEV TF-2 Transactions. This section documents any additional requirements on profile’s actors.

Most requirements are documented in DEV TF-3 Content Modules. No additional requirements are needed.

#### 14.1.1.1 Point-of-Care Device Reporter

The Point-of-Care Device Reporter represents a device or system utilizing an IHE DEV profile for sending information that requires a reliable communication to the Point-of-Care Device Consumer.

The PCDR can either be an individual device or system, or a gateway.

A gateway proxy sends heartbeat messages on behalf of the individual devices or systems connected to the gateway. To the PCDC, a gateway proxy representing an individual device or system is transparent.

A gateway PCDR manages the reliable communication to its connected medical devices and only reports its own health state to the PCDC.  
Usually, the gateway is connected to medical devices which are used for different patients in different locations. Therefore, no specific patient or location can be reported in a heartbeat message from the gateway.

#### 14.1.1.2 Point-of-Care Device Consumer

The Point-of-Care Device consumer represents a device or system utilizing an IHE DEV profile for receiving information that requires a reliable communication to the Point-of-Care Device reporter.

The PCDC is responsible for the appropriate measures when the communication is not monitored – and potentially not reliable – anymore.

On the other hand, the PCDC shall also indicate to the PCDR that the communication is not reliable anymore on its side, so that the PCDR can react accordingly.

## 14.2 PCMC Actor Options

Options that may be selected for each actor in this profile, if any, are listed in Table 14.2-1. Dependencies between options, when applicable, are specified in notes.

Table 14.2-1: PCMC – Actors and Options

| Actor | Option Name | Reference |
| --- | --- | --- |
| Point-of-Care Device Reporter | No options defined | -- |
| Point-of-Care Device Consumer | No options defined | -- |

## 14.3 PCMC Required Actor Groupings

There is no required actor groupings specified in the Point-of-Care Monitored Communication (PCMC) Profile

## 14.4 PCMC Overview

### 14.4.1 Concepts

In order to improve the reliability of the communication between a PCD REPORTER and a PCD CONSUMER, the PCD REPORTER needs a way to check on a regular basis whether the PCD CONSUMER is still fully operational. The same is true for the PCD CONSUMER which needs to be able to detect whether a PCD REPORTER is still able to report data – especially when the data are critical and not provided periodically.

### 14.4.2 Use Cases

#### 14.4.2.1 Use Case #1: Reliable Alert Distribution

Alert event from a medical device needs to be distributed reliably to the caregivers’ edge alert communication devices.

##### 14.4.2.1.1 Reliable Alert Distribution Use Case Description

This use case describes the reliable ability to disseminate alert events as defined in the IHE ACM profile. The ALERT REPORTER (AR) needs to be able to check on a regular basis whether the ALERT MANAGER (AM) is still fully operational, even when there are currently no active alert events. In the case of a problem, the AR may notify the caregiver operating the medical device (alert source) that the AM is currently not responding to alert events (e. g. an INOP at the display of the device).

The same is true for the AM, which needs to be able to detect whether an AR is still able to report active alert events, even when there are currently no active alert events. The AM may notify the responsible caregiver through its corresponding ALERT COMMUNICATIOR (AC) about the problem with a certain AR, and that alert events from the AR are currently not provided to the AM.

##### 14.4.2.1.2 Reliable Alert Distribution Process Flow

The AR sends heartbeat messages on a regular basis. The periodicity of the heartbeat messages is defined by the AR and provided in each heartbeat message to the AM. The AM has to acknowledge the heartbeat message within the defined time interval – otherwise, the AR would interpret this as a failure on the AM side.

Vice versa, when the AR stops sending heartbeat messages without intentionally ending the communication, the AM would interpret this as a failure on the AR side.

Both the AR and the AM can gracefully end the Monitored Communication.

Send Heartbeat Message [DEV-53]

Send Heartbeat Message [DEV-53]

Alert Reporter

Alert Manager

Acknowledge Heartbeat Message [DEV-54]

Loop

**Normal operation**

Acknowledge Heartbeat Message [DEV-54]

**Alert Reporter or Alert Manager ends MC**

Figure 14.4.2.2-1: Basic Process Flow in PCMC Profile

## 14.5 PCMC Security Considerations

This profile itself does not impose specific requirements for authentication, encryption, or auditing, leaving these matters to site-specific policy or agreement based on careful risk. The IHE DEV Technical Framework identifies security requirements across all DEV profiles.

## 14.6 PCMC Cross Profile Considerations

This profile is intended to supplement a variety of DEV profiles such as the Device Enterprise Communication (DEC) profile, Alert Communication Management (ACM) profile, and others, where a reliable communication is required.

Appendices to Volume 1

None

Volume 2 – Transactions

Add Section 3.11 and 3.12

## 3.53 Send Heartbeat Message [DEV-53]

### 3.53.1 Scope

This transaction is used to send heartbeat messages from the PCD REPORTER to the PCD CONSUMER.

### 3.53.2 Actor Roles

The roles in this transaction are defined in the following table and may be played by the actors shown here:

Table 3.53.2-1: Actor Roles

|  |  |
| --- | --- |
| **Actor:** | Point-of-Care Device Reporter |
| **Role:** | Indicates its communication state by sending heartbeat messages with the current state information on a regular basis. |
| **Actor:** | Point-of-Care Device Consumer |
| **Role:** | Receives the current communication state information |

Transaction text specifies behavior for each role. The behavior of specific actors may also be specified when it goes beyond that of the general role.

### 3.53.3 Referenced Standards

* HL7 2.6 Chapters 2, 3, 5 and 7

### 3.53.4 Messages

The interaction diagram shows the detailed standards-based message exchange that makes up the IHE transaction:

Point-of-Care Device Reporter

Send Heartbeat Message [DEV-53]

Point-of-Care Device Consumer

Figure 3.53.4-1: Interaction Diagram

#### 3.53.4.1 Send Heartbeat Message [DEV-53]

For the heartbeat information, an “in-line” alert event is utilized, which indicates to the PCD CONSUMER (PCDC) the MONITORED COMMUNICATION (MC) state of the PCD REPORTER (PCDR).

Heartbeat messages are sent by the PCDR to the PCDC periodically. The periodicity is part of the heartbeat information and depends on the individual PCDR.

Depending on the IHE PCD profile, the heartbeat message conforms to the same format as defined for the corresponding IHE PCD profile.

##### 3.53.4.1.1 Trigger Events

Heartbeat messages are sent automatically from the PCDR to the PCDC. The following states will trigger the sending of a heartbeat message:

* The PCDR intends to start a MC.
* The defined time interval expired and the PCDR needs to indicate to the PCDC that it is still fully operational
* The PCDR wants to indicate that one or more heartbeat parameters changed (e. g. the periodicity).
* The PCDR intends to end a MC intentionally (e. g. device will be switched off).

##### 3.53.4.1.2 Message Semantics

For the heartbeat information, an “in-line” alert event is utilized.

Depending on the IHE DEV profile, the heartbeat message conforms to the same format as defined for the corresponding IHE DEV profile but may only contain the OBX segment with the heartbeat information in the OBSERVATION group of the HL7 ORU^R01 message.

The following table defines the content of the individual fields in the OBX segment (see also “DEV TF-2 B.8 OBX - Observation/Result segment” for further information):

|  |  |  |
| --- | --- | --- |
| **OBX Field** | **Value** | **Note** |
| OBX-1 Set ID - OBX | See section “OBX-1 Set ID – OBX” in “B.8 OBX - Observation/Result segment” |  |
| OBX-2 Value Type | “ST” |  |
| OBX-3 Observation Identifier | “198200^ MDC\_EVT\_WATCHDOG^MDC” |  |
| OBX-4 Observation Sub-ID | <n>.0.0.1 | <n> identifies the Medical Device System (MDS) which has issued the heartbeat information.  In the case of a PCD gateway proxy reporter, the heartbeat message may contain heartbeat information from multiple MDSs.  In the case of a PCD gateway reporter managing the reliable communication to the connected devices, the heartbeat message shall only contain the one MDS and the heartbeat information from the gateway. |
| OBX-5 Observation Value | Event Phase of Watchdog Event | The following phases are supported for the Watchdog event:   * **start**: PCDR starts the MC * **continue**: PCDR sends another heartbeat message without any changes * **update**: PCDR sends another heartbeat message with changes (e. g. the periodicity has changed) * **end**: the PCDR ends the MC |
| OBX-7 Reference Range | Periodicity of the heartbeat message and maximal PCDC response time in milliseconds | Only milliseconds are supported.  Only the upper limit shall be set. For example, “**<2000**” when the PCDR sends a heartbeat message every 2 seconds and the PCDC shall respond to the message within 2 seconds. |
| OBX-8 Abnormal Flags | “N~ST~PL” | Indicates a normal status of a technical alert event with low priority. |
| OBX-11 Observation Result Status | “F” |  |
| OBX-14 Date/Time of the Observation | Date/time when the PCDR has restarted the timer for generating the next heartbeat message | The PCDC shall confirm the reception of the heartbeat message within the time interval with OBX-14 as the start time and OBX-14 + OBX-7 as the end time. |

Note: the periodicity of the heartbeat message may depend on the criticality of a reliable communication between the PCD REPORTER and PCD CONSUMER.

The PCD CONSUMER must also consider the latency for the internal processing of the response, the network transmission, and so on. Therefore, it is recommended that the PCD Consumer should respond to the heartbeat message within the first half of the defined interval.

For the IHE ACM profile, a maximum time interval of 10,000 milliseconds is recommended since some of the particular alarm standards require the annunciation of an alarm event within 10 seconds.

For the IHE DEC profile, the time interval may be identical with the export interval of the periodic observations.

Examples:

PCDR indicates the start of participation in a MC by sending heartbeat messages every 2000 milliseconds:

OBX|2|ST|198200^MDC\_EVT\_WATCHDOG^MDC|  
1.0.0.1|start|||<2000|N~ST~PL||F|||20191218165144+0100

PCDR indicates that it wants to continue the MC by sending another heartbeat message after 2 seconds of the previous heartbeat message:

OBX|2|ST|198200^MDC\_EVT\_WATCHDOG^MDC|  
1.0.0.1|continue|||<2000|N~ST~PL||F|||20191218175146+0100

PCDR indicates that it wants to continue the MC but with a change in the heartbeat message periodicity from 2000 to 5000 milliseconds being effective with the next heartbeat message:

OBX|2|ST|198200^MDC\_EVT\_WATCHDOG^MDC|  
1.0.0.1|update|||<5000|N~ST~PL||F|||20191218175148+0100

PCDR indicates that it wants to leave the MC intentionally:

OBX|2|ST|198200^MDC\_EVT\_WATCHDOG^MDC|  
1.0.0.1|end| ||<0|N~ST~PL||F|||20191218175153+0100

##### 3.53.4.1.3 Expected Actions

Heartbeat messages are sent from the PCDR, which initiates the connection, to the PCDC.

When the network connection between the PCDR and the PCDC got lost, the PCDR shall send the first heartbeat message after the reconnect with the Event Phase “**start**” in OBX-5.

It is the responsibility of the PCDR to react accordingly on the acknowledgement and application error code in the response message (please refer to 3.12 Acknowledge Heartbeat Message [DEV-54] for further details) from the PCDC (e. g. the medical device may show a message to the caregiver that the alert distribution is not functioning properly any longer).

In the case of a “CA” and “CR” acknowledgement code, the PCDR shall continue to send heartbeat messages to the PCDC since some errors might only be temporary (e. g. alert communicator had a bad wireless connection, but caregiver moved to an area with a better Wifi coverage).

In the case of a “CE” acknowledgement code, the PCDR shall stop to send heartbeat messages to the PCDC since this indicates that the PCDC does not support heartbeat messages at all.   
After reconnecting to the PCDC, the PCDR may send another heartbeat message in order to check if support of heartbeat messages has changed at the PCDC, for example, due to a configuration change.

Heartbeat messages sent directly from the medical devices or from a gateway proxy sending the heartbeat messages on the behalf of the medical devices differ slightly from heartbeat messages sent by a gateway managing the reliable communication to the connected medical devices in the background:

**Heartbeat Messages from Medical Device or Gateway Proxy Reporter**

The heartbeat message from medical device or gateway proxy shall conform to the corresponding IHE profile for which a MC is required. The OBX segment containing the information on the MDS level also identifies the individual device to which the heartbeat message corresponds.

A gateway proxy may send heartbeat information from multiple medical devices in one single heartbeat message as long as the other information are identical for all the devices (e. g. same patient, same location, same heartbeat information timestamp, etc.).

Example:

MSH|^~\&|PHILIPS\_867315^0009FBFFFF059322^EUI64||||20220627085521038+0000||ORU^R40^ORU\_R40|PM20220627085521.038XY150Z04091|P|2.6|||AL|NE||8859/1|en^English^ISO639||IHE\_PCD\_004^IHE PCD^1.3.6.1.4.1.19376.1.6.1.4.1^ISO

PID|||12345^^^Philips^MR~09fb593223189f5a3^^^Philips^PI~98765^^^Philips^VN||Smith^Johh^Joe^^^^L||19720229|M

PV1||I| HO 3 West ICU^10^3||||||||||||||||98765||||||||||||||||||||||||||||||||V

OBR|1||0000000B00000000^^0009FBFFFF059322^EUI-64|196616^MDC\_EVT\_ALARM^MDC|||20220627085521038+0000

OBX|1||69965^MDC\_DEV\_MON\_PHYSIO\_MULTI\_PARAM\_MDS^MDC|1.0.0.0|||||||X|||||||XY150Z0444^^0009FBFFFF059322^EUI-64

OBX|2|ST|198200^ MDC\_EVT\_WATCHDOG^MDC|1.0.0.1|continue|||<10000|N~ST~PL||F|||20220627085521038+0000

**Heartbeat Message from Gateway Reporter**

A gateway PCDR manages the reliable communication to its connected medical devices and only reports its own health state to the PCDC.

Usually, the gateway is connected to medical devices which are used for different patients in different locations. Therefore, no specific patient or location can be reported in a heartbeat message from the gateway.

The PID segment shall be set to an unknown patient.   
For IHE ACM profile utilizing HL7 message structure ORU\_R40, the PID segment may be omitted.

The PV1 segment shall be omitted.

The OBX segment containing the MDS level information shall be set as follows:

* OBX-3 shall be set to “69633^MDC\_DEV\_MDS^MDC”
* OBX-18 shall be set to the same content as OBR-2 which is the identifier for the PCDR

Example:

MSH|^~\&|PHILIPS\_867315^0009FBFFFF059322^EUI64||||20220627085521038+0000||ORU^R40^ORU\_R44|PM20220627085521.038XY150Z04091|P|2.6|||AL|NE||8859/1|en^English^ISO639||IHE\_PCD\_004^IHE PCD^1.3.6.1.4.1.19376.1.6.1.4.1^ISO

OBR|1|PHILIPS\_867315^^0009FBFFFF059322^EUI64|0^^0009FBFFFF059322^EUI-64|196616^MDC\_EVT\_ALARM^MDC|||20220627085521038+0000

OBX|1||69633^MDC\_DEV\_MDS^MDC|1.0.0.0|||||||X|||||||  
PHILIPS\_867315^^0009FBFFFF059322^EUI64

OBX|2|ST|198200^ MDC\_EVT\_WATCHDOG^MDC|1.0.0.1|continue|||<10000|N~ST~PL||F|||20220627085521038+0000

### 3.53.5 Protocol Requirements

Not applicable.

### 3.53.6 Security Considerations

No special security or security audit considerations beyond the general ones already discussed apply to this transaction.

## 3.54 Acknowledge Heartbeat Message [DEV-54]

### 3.54.1 Scope

This transaction is used to acknowledge heartbeat messages from the PCD REPORTER to the PCD CONSUMER.

### 3.54.2 Actor Roles

The roles in this transaction are defined in the following table and may be played by the actors shown here:

Table 3.54.2-1: Actor Roles

|  |  |
| --- | --- |
| **Actor:** | Point-of-Care Device Consumer |
| **Role:** | Indicates its communication state by acknowledging heartbeat messages with the current state information. |
| **Actor:** | Point-of-Care Device Reporter |
| **Role:** | Receives the current communication state information. |

Transaction text specifies behavior for each role. The behavior of specific actors may also be specified when it goes beyond that of the general role.

### 3.54.3 Referenced Standards

* HL7 2.6 Chapters 2, 3, 5 and 7

### 3.54.4 Messages

The interaction diagram shows the detailed standards-based message exchange that makes up the IHE transaction:

Point-of-Care Device Reporter

Point-of-Care Device Consumer

Acknowledge Heartbeat Message [DEV-54]

Figure 3.54.4-1: Interaction Diagram

#### 3.54.4.1 Acknowledge Heartbeat Message [DEV-54]

When the PCDC receives a heartbeat message from the PCDR, it is required to acknowledge the heartbeat message before the next heartbeat message will be sent according to the defined periodicity - ideally as fast as possible.

##### 3.54.4.1.1 Trigger Events

Heartbeat acknowledgement messages are sent from the PCDC to the PCDR only in response to the last Heartbeat message. Depending on the acknowledgement and application error code, the PCDC can indicate to the PCDR that it:

* Confirms the participation in the MC, and it is fully operational.
* Either does not support a MC temporarily or wants to stop the participation in the MC.
* Stops the participation in the MC due to an error.
* Does not support a MC at all.

##### 3.54.4.1.2 Message Semantics

The PCDC shall respond to a heartbeat message from the PCDR with a HL7 acknowledgement message as fast as possible but no later than the given date/time in OBX-14 + the relative time in OBX-7 of the heartbeat information OBX segment.

The PCDC must also consider the latency for the internal processing of the response, the network transmission, and so on. Therefore, it is recommended that the PCDC should respond to the heartbeat message within the first half of the defined interval.

To indicate the current state of the PCDC to the PCDR, the PCDC shall set the **MSA-1 Acknowledgement Code** to one of the following codes:

* **CA**: the PCDC is fully operational and able to handle the reports from the PCDR (e. g. the alert manager is able to disseminate alert events to its alert communicators).
* **CR**: the PCDC sends this code in two different cases which can be distinct from each other by evaluating the value in the **ERR-5** field of the **ERR** segment:
  + A. the PCDC is not fully operational any longer and cannot handle the reports from the PCDR as intended (e. g. the alert manager is currently unable to communicate with its alert communicators).
  + B. the PCDC is not able to support a monitored communication temporarily or wants to stop the participation in a monitored communication intentionally.
* **CE**: the PCDC indicates to the PCDR that it does not support the MC at all.

It is the responsibility of the PCDR to react accordingly on the acknowledgement and application error code in the response message from the PCDC.

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**ERR Segment – Error Codes**

The ERR segment contain additional information about the rejected heartbeat message:

|  |  |  |
| --- | --- | --- |
| **ERR Field** | **Value** | **Note** |
| ERR-3 HL7 Error Code | “0” | No HL7 message error |
| ERR-4 Severity | “I” | Must be set to “I”, when ERR-3 is set to “0” |
| ERR-5 Application Error Code | Heartbeat message specific error code | “**WDERR^watchdog-negative-confirm^MDC**”: indicates to the PCDR that the PCDC is currently unable to respond to the reports from the PCDR as intended (see case A. above. E. g. an alarm manager is currently not responding to alert events).  “**WDLEAVE^watchdog-leave-monitoring^MDC**”: indicates to the PCDR that the PCDC wants to leave the MC intentionally (see case B. above. E. g. a shutdown of the alarm manager due to a planned system software update). |

##### 3.54.4.1.3 Expected Actions

It is the responsibility of the PCDC to react accordingly to the Heartbeat messages from the PCDR.

In case the PCDR did not stop the MC intentionally, missing or delayed Heartbeat messages must be treated as error, and a reliable communication is not guaranteed any longer.

### 3.54.5 Protocol Requirements

Not applicable.

### 3.54.6 Security Considerations

No special security or security audit considerations beyond the general ones already discussed apply to this transaction.

Appendices to Volume 2

Not applicable.

# Namespace Additions for Volume 2

The PCD registry of OIDs is located at [PCD OID Management](https://wiki.ihe.net/index.php/PCD_OID_Management).

Volume 2 additions to the PCD OID Registry are:

|  |  |
| --- | --- |
| OID | Refers to |
| 1.3.6.1.4.1.19376.1.6.1.53.1 | Point-of-Care Monitored Communication – Send Heartbeat Message [DEV-53] |
| 1.3.6.1.4.1.19376.1.6.1.54.1 | Point-of-Care Monitored Communication – Acknowledge Heartbeat Message [DEV-54] |

Volume 3 – Content Modules

Not applicable.

Volume 4 – National Extensions

Add appropriate Country section

Not applicable.