Integrating the Healthcare Enterprise



# IHE Devices
# Technical Framework Supplement

# Point-of-Care Monitored Communication (PCMC)

## Revision 1.1 – Trial Implementation


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

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## Foreword

This is a supplement to the IHE Devices (DEV) Domain Technical Framework. 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 October 1, 2026 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 Devices Technical Framework. Comments are invited and can be submitted at https://www.ihe.net/DEV_Public_Comments.

This supplement describes changes to the existing technical framework documents.

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

*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.net.

Information about the IHE Devices domain can be found at IHE Domains.

Information about the organization of IHE Technical Frameworks and Supplements and the process used to create them can be found at Profiles and IHE Process

The current version of the Devices Technical Framework can be found at https://profiles.ihe.net/DEV/index.html.

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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 Heartbeat Reporter and Heartbeat Consumer.

## Open Issues and Questions

The following list of open issues and questions need to be addressed by the PCMC working group during the Trial Implementation:

1. 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 HC cannot clearly distinguish between the acknowledgement of the heartbeat and the actual data message (e.g., HC wants to confirm the non-heartbeat event but wants to indicate that it needs to stop the heartbeat processing).

## Closed Issues

The following list of issues and questions has been addressed:

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## IHE Technical Frameworks General Introduction

The IHE Technical Frameworks General Introduction is shared by all of the IHE domain technical frameworks. Each technical framework volume contains links to this document where appropriate.

## 9 Copyright Licenses

IHE technical documents refer to, and make use of, a number of standards developed and published by several standards development organizations. Please refer to the IHE Technical Frameworks General Introduction, Section 9 - Copyright Licenses for copyright license information for frequently referenced base standards. Information pertaining to the use of IHE International copyrighted materials is also available there.

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## IHE Technical Frameworks General Introduction Appendices

The IHE Technical Framework General Introduction Appendices 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.*

## Appendix A – Actors

*Add the following **new** actors to the IHE Technical Frameworks General Introduction Appendix A:*

| New Actor Name | Description |
|---|---|
| Heartbeat Reporter | Initiates a request heartbeat response acting as a trigger for receipt acknowledgement response. |
| Heartbeat Consumer | Receives a request heartbeat response and sends acknowledgement back |

## Appendix B – Transactions

*Add the following **new** transactions to the IHE Technical Frameworks General Introduction Appendix B:*

| New Transaction Name and Number | Definition |
|---|---|
| Request Heartbeat Response [DEV-53] | Sent to act as trigger for receipt acknowledgement response. |

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# Appendix D – Glossary

*Add the following **new** glossary terms to the IHE Technical Frameworks General Introduction Appendix D:*

| New Glossary Term | Definition | Synonyms | Acronym/ Abbreviation |
|---|---|---|---|
| Heartbeat Reporter | Any point-of-care device or system (e.g., device gateway) that sends Request Heartbeat Response (HRR) messages. | | HR |
| Heartbeat Consumer | Any point-of-care device or system (e.g., alarm manager) that receives Request Heartbeat Response (HRR) messages and sends back receipt acknowledgement messages back. | | HC |
| Request Heartbeat Response | Transaction between the Heartbeat Reporter and Heartbeat Consumer. | | HRR |
| Monitored Communication | The Monitored Communication facilitates a mutual monitoring of the operational state of the communication between the Heartbeat Reporter and the Heartbeat Consumer. | | MC |
| Inoperable Event | An event that is caused by a technical issue or condition. Examples are “Sensor off”, “Poor signal quality”, “Battery empty”, “Connection lost”, etc. | | INOP |

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# Volume 1 – Profiles

## Domain-specific additions

None

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*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 HEARTBEAT REPORTER (HR) to the HEARTBEAT CONSUMER (HC) to facilitate a MONITORED COMMUNICATION (MC) with the following properties:

1. The HR is able to announce to the HC that it is ready for participating in a MC.
2. The HR is able to announce to the HC that it is leaving the MC intentionally.
3. The HR is able to inform the HC on a regular basis that it still participates in a MC.
4. The HC is able to inform the HR on a regular basis that it still participates in a MC.
5. The HC is able to inform the HR that it cannot participate in a MC at all or any longer.
6. The HR and HC 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. A gateway HR only announces itself as a participant in the MC with the HC. The gateway HR 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. A proxy HR does not take the responsibility for the reliable communication with all the connected devices. The proxy HR shall only relay messages for the individual devices participating in a MC, it is the responsibility to the devices themselves to handle HR duties.

## 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 14.1-1 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).

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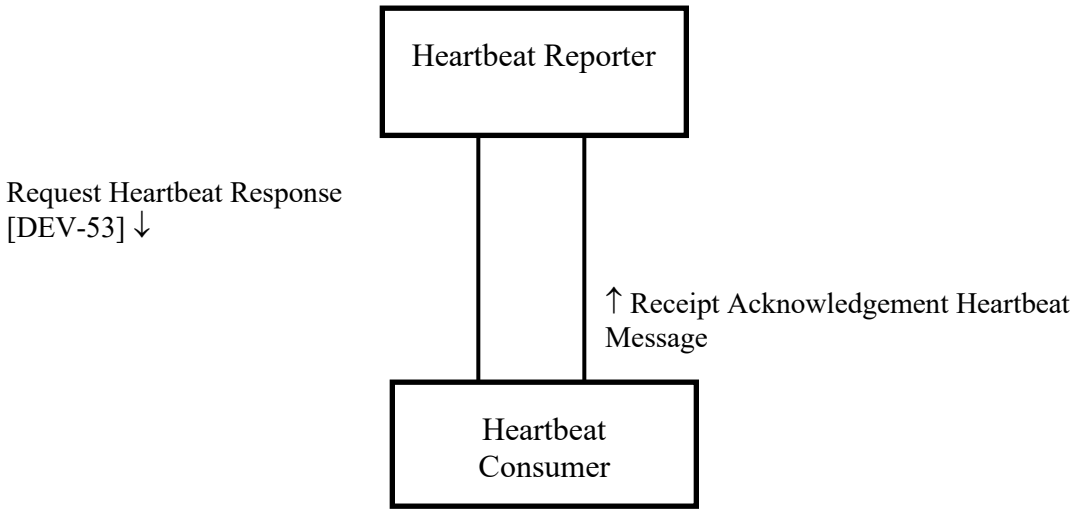



**Figure 14.1-1: PCMC Actor Diagram**

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: PCMC Profile - Actors and Transactions**

| Actors | Transactions | Initiator or Responder | Optionality | Reference |
|---|---|---|---|---|
| Heartbeat Reporter | Request Heartbeat Response [DEV-53] | Initiator | R | DEV TF-2: 3.53 |
| Heartbeat Consumer | Receipt Acknowledgement Heartbeat Message | Responder | R | DEV TF-2: 3.53 |

### 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.

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#### 14.1.1.1 Heartbeat Reporter

The Heartbeat Reporter represents a device or system utilizing an IHE DEV profile for sending information that requires a reliable communication to the Heartbeat Consumer.

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

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

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

A proxy is a transaction aggregator without responsibility for the devices behind it. It relays heartbeat messages on behalf of the individual devices or systems connected to the proxy. To the HC, a proxy representing an individual device or system is transparent.

#### 14.1.1.2 Heartbeat Consumer

The Heartbeat Consumer represents a device or system utilizing an IHE DEV profile for receiving information that requires a reliable communication to the Heartbeat Reporter.

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

On the other hand, the HC shall also indicate to the HR that the communication is not reliable anymore on its side, so that the HR 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 |
|---|---|---|
| Heartbeat Reporter | No options defined | -- |
| Heartbeat 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

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## 14.4 PCMC Overview

### 14.4.1 Concepts

In order to improve the reliability of the communication between a HEARTBEAT REPORTER and a HEARTBEAT CONSUMER, the HEARTBEAT REPORTER needs a way to check on a regular basis whether the HEARTBEAT CONSUMER is still fully operational. The same is true for the HEARTBEAT CONSUMER which needs to be able to detect whether a HEARTBEAT 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

Reported alerts (physiologic alarms, technical alarms, and advisories) from an Alert Communication Management (ACM) Alert Reporter (AR) actor needs to be disseminated reliably to ACM Alert Communicator (AC) associated endpoint communication devices (various types of pagers, phones, tablets, badges, watches, computers, etc.) as actionable, for message and procedural response by doctors, clinicians, and other alert event assigned staff.

##### 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 Alert Communication Management (ACM) Profile. The ACM ALERT REPORTER (AR) needs to be able to check on a regular basis whether the ACM ALERT MANAGER (AM) is still fully operational, even when there are currently no active alert events. In the case of a problem, the ACM AR may notify the caregiver operating the medical device (alert source) that the ACM AM is currently not responding to alert events (e.g., an INOP at the display of the device).

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

##### 14.4.2.1.2 Reliable Alert Distribution Process Flow

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

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

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

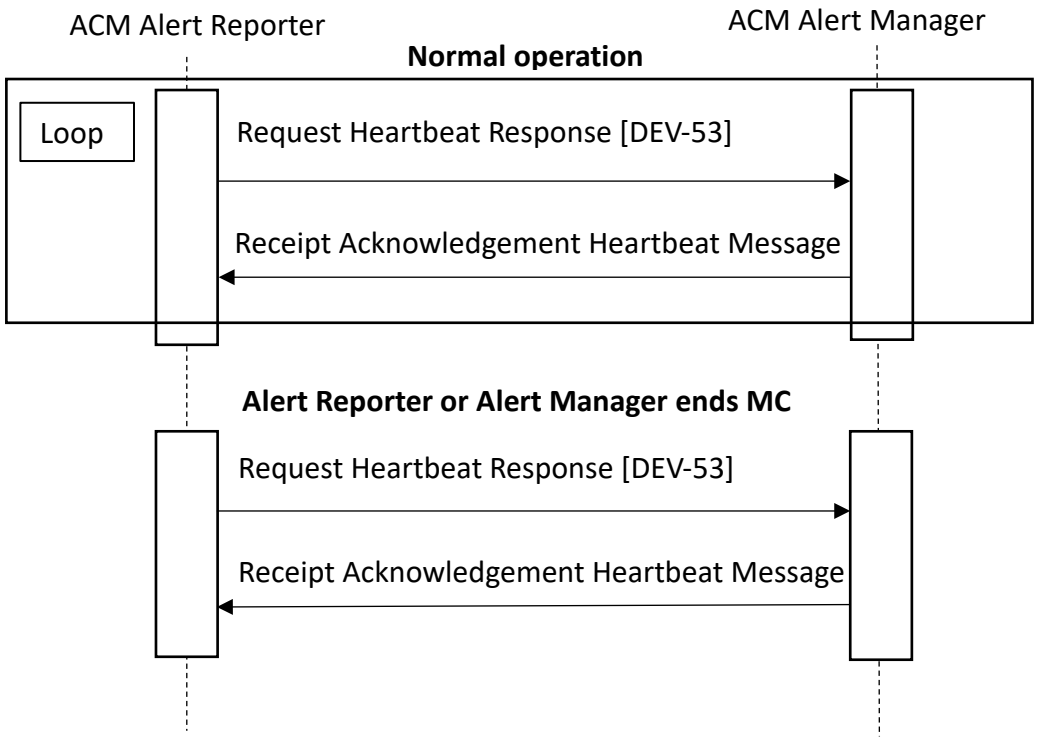



**Figure 14.4.2.1.2-1: Basic Process Flow in PCMC Profile**

## 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.

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# Appendices to Volume 1

None

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# 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 HEARTBEAT REPORTER to the HEARTBEAT 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:** | Heartbeat Reporter |
| **Role:** | Indicates its communication state by sending heartbeat messages with the current state information on a regular basis.<br>Receives HL7 acknowledgement messages with the current communication state information of the Heartbeat Consumer. |
| **Actor:** | Heartbeat Consumer |
| **Role:** | Receives the current communication state information of the Heartbeat Reporter.<br>Indicates its communication state by acknowledging heartbeat messages with the current 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:

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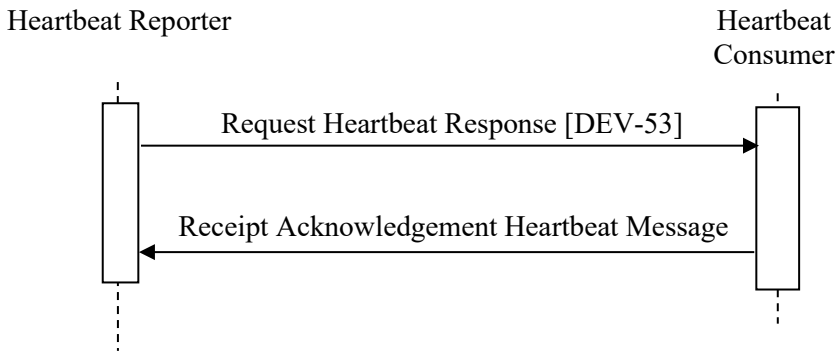



**Figure 3.53.4-1: Interaction Diagram**

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

For the heartbeat information, an "in-line" event is utilized, which indicates to the HEARTBEAT CONSUMER (HC) the MONITORED COMMUNICATION (MC) state of the HEARTBEAT REPORTER (HR).

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

#### 3.53.4.1.1 Trigger Events

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

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

#### 3.53.4.1.2 Message Semantics

For the heartbeat message, an ORU message with the trigger event R44 and message structure ORU_R44 is utilized.
The OBR-4 "Universal Service Identifier" field shall be set to "198200^ MDC_EVT_WATCHDOG^MDC".

For the heartbeat information, an "in-line" event is utilized.

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The heartbeat message may only contain the OBX segment with the heartbeat information in the OBSERVATION group of the HL7 ORU^R44 message.

The following table defines the content of the individual fields in the OBX segment (see also
340 "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.<br>In the case of a PCD gateway proxy reporter, the heartbeat message may contain heartbeat information from multiple MDSs.<br>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:<br>• **start**: HR starts the MC relationship<br>• **continue**: HR sends another heartbeat |

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| OBX Field | Value | Note |
|---|---|---|
| | | message without any changes<br>• **update**: HR sends another heartbeat message with changes (e.g., the periodicity has changed)<br>• **end**: the HR ends the MC relationship |
| OBX-7 Reference Range | Periodicity of the heartbeat message and maximal PCDC response time in milliseconds | Only milliseconds are supported.<br>Only the upper limit shall be set. For example, "**<2000**" when the HR sends a heartbeat message every 2 seconds and the HC shall respond to the message within 2 seconds. |
| OBX-11 Observation Result Status | "F" | Final (F) is indicated so as to avoid encumbering clinical staff with review and confirmation effort for a system-to-system internal event that is not patient physiology associated and occurs in high volumes over the course of a staff shift. |
| OBX-14 Date/Time of the Observation | Date/time when the HR has restarted the timer for generating the next heartbeat message | The HC 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. |
| OBX-15 Producer's ID | This field is only set when the heartbeat messages relate to a dedicated IHE profile (e.g., DEC, | If the field is not set the heartbeat messages relate to all IHE profiles supported |

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| OBX Field | Value | Note |
|---|---|---|
| | ACM, etc.).<br><br>In this case, the field contains the IHE profile ID as defined on the IHE DEV OID Management Wiki website. | through the same network connection.<br><br>The HR may send an individual heartbeat message for each supported IHE profile through the same network connection by setting the IHE profile ID in this field.<br><br>ID examples are:<br>**DEC**: IHE_DEV_DEC^IHE DEV^1.3.6.1.4.1.19376.1.6.2.1<br>**ACM**: IHE_DEV_ACM^IHE DEV^1.3.6.1.4.1.19376.1.6.2.4 |

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

The HEARTBEAT 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 HEARTBEAT 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**:

HR indicates the start of participation in a MC by sending heartbeat messages every 2000 milliseconds and the heartbeat message only applies to the IHE ACM profile:

```
OBX|2|ST|198200^MDC_EVT_WATCHDOG^MDC|
1.0.0.1|start|||<2000|||F|||20191218165144+0100|IHE_DEV_ACM^IHE
DEV^1.3.6.1.4.1.19376.1.6.2.4
```

HR 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|||F|||20191218175146+0100|IHE_DEV_ACM^IHE
DEV^1.3.6.1.4.1.19376.1.6.2.4
```

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HR 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|||F|||20191218175148+0100|IHE_DEV_ACM^IHE
DEV^1.3.6.1.4.1.19376.1.6.2.4
```

HR indicates that it wants to leave the MC intentionally:

```
OBX|2|ST|198200^MDC_EVT_WATCHDOG^MDC|
1.0.0.1|end| ||<0|||F|||20191218175153+0100|IHE_DEV_ACM^IHE
DEV^1.3.6.1.4.1.19376.1.6.2.4
```

#### 3.53.4.1.3 Expected Actions

Heartbeat messages are sent from the HR, which initiates the connection to the HC.

When the network connection between the HR and the HC got lost, the HR shall send the first heartbeat message after the reconnect with the Event Phase "**start**" in OBX-5.

It is the responsibility of the HR to react accordingly on the acknowledgement and application error code in the response message (please refer to 3.53.4.2 Receipt Acknowledgement Heartbeat Message for further details) from the HC (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 HR shall continue to send heartbeat messages to the HC 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 HR shall stop to send heartbeat messages to the HC since this indicates that the HC does not support heartbeat messages at all. After reconnecting to the HC, the HR may send another heartbeat message in order to check if support of heartbeat messages has changed at the HC, 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 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 first OBX segment containing the information on the MDS level also identifies the individual device to which the heartbeat message corresponds.

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

Note that patient-related and location-related information are not part of the heartbeat messages. This information is provided by other IHE profiles such as DEC, ACM and others.

**EXAMPLE:**

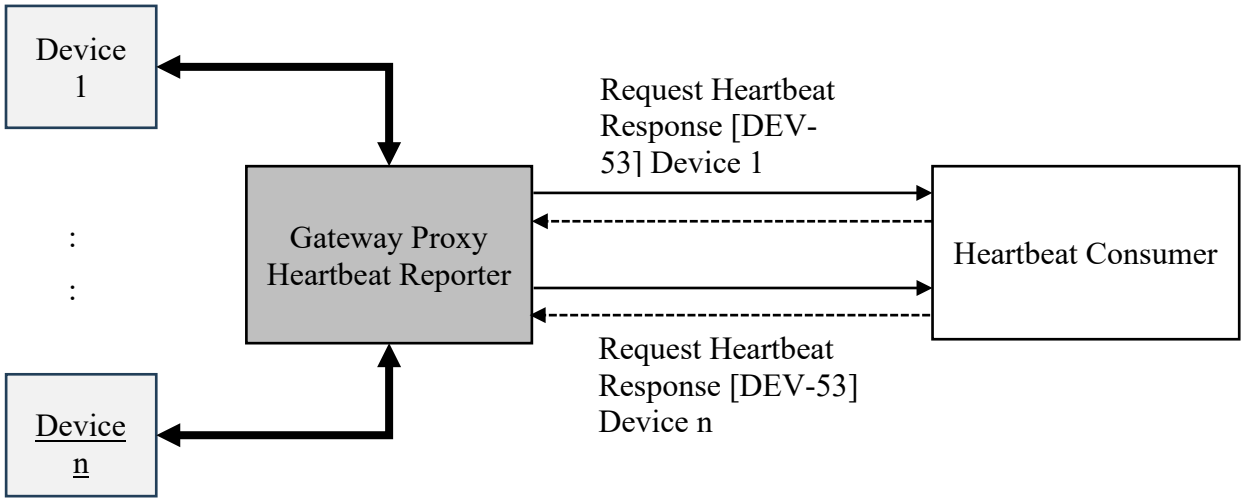
```
MSH|^~\&|PHILIPS_867315^0009FBFFFF059322^EUI64||||20220627085521038+0000||ORU^R44^ORU
_R44|PM20220627085521.038XY150Z04091|P|2.6|||AL|NE||8859/1|en^English^ISO639||IHE_DEV
_053^IHE DEV^1.3.6.1.4.1.19376.1.6.1.53.1^ISO

OBR|1||0000000B00000000^^0009FBFFFF059322^EUI-64|198200^MDC_EVT_WATCHDOG^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|||F|||2022062708552103
8+0000
```

**GATEWAY PROXY HEARTBEAT REPORTER WHICH SENDS HEARTBEAT MESSAGES ON BEHALF OF ITS CONNECTED DEVICES:**




In the example above, the gateway HR sends Request Heartbeat Response messages for each individual device connected to the gateway. For the HC, it is transparent whether the device is connected directly or via a gateway. The downside of this approach is that the network traffic caused by the heartbeat messages increases linearly with the number of the connected devices.

**Heartbeat Message from Gateway Reporter**

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

Usually, the gateway is connected to medical devices which are used for different patients in different locations.

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 HR

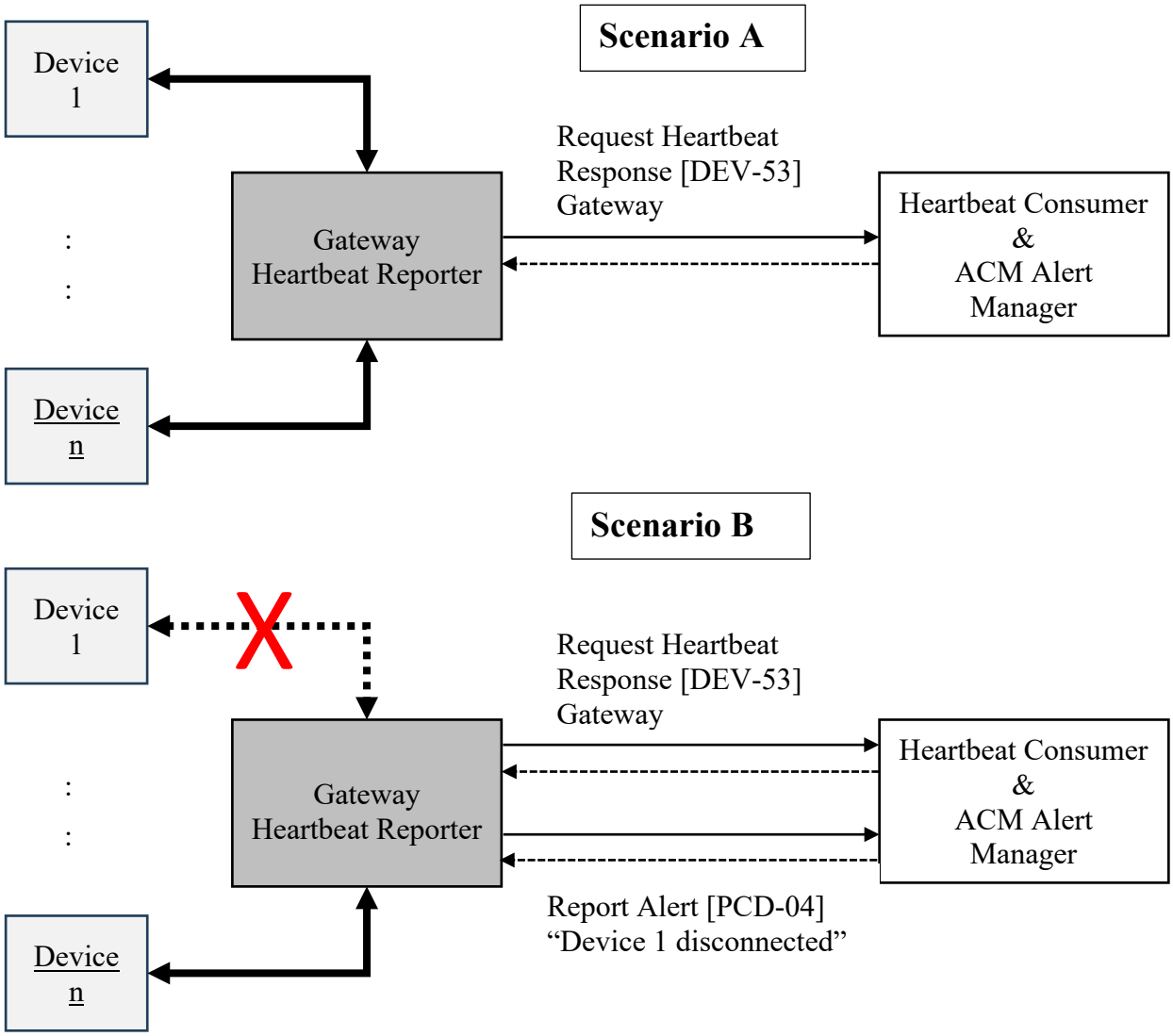
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**EXAMPLE:**

```
MSH|^~\&|PHILIPS_867315^0009FBFFFF059322^EUI64||||20220627085521038+0000||ORU^R44^ORU
_R44|PM20220627085521.038XY150Z04091|P|2.6|||AL|NE||8859/1|en^English^ISO639||IHE_DEV
_053^IHE DEV^1.3.6.1.4.1.19376.1.6.1.53.1^ISO
OBR|1|PHILIPS_867315^^0009FBFFFF059322^EUI64|0^^0009FBFFFF059322^EUI-64|198200^
MDC_EVT_WATCHDOG^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|||F|||20220627085521038+0000
```

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**GATEWAY HEARTBEAT REPORTER WHICH SENDS HEARTBEAT MESSAGES ON GATEWAY LEVEL ONLY:**




In the example above, the gateway HR sends Request Heartbeat Response message to monitor the connection between the gateway and the HC. The HC is also an ACM Alert Manager (AM).

In scenario A, the communication between the gateway and its connected devices as well as the communication between the gateway and the HC works reliably, and therefore, only heartbeat messages on gateway level are sent to the HC. If there are no active alert events from any of the connected devices, no further message traffic takes place on the network.

In scenario B, one of the devices lost the connection to the gateway. In this case, the gateway sends an ACM PCD-04 message on behalf of the device that indicates the communication loss of

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the device. Like any other ACM PCD-04 message from a device, the AM is responsible for the dissemination of the alert event to the relevant Alert Communicator (AC) devices.
For other IHE profiles, the gateway may send corresponding messages which indicate a communication loss of the device. E.g., for the IHE DEC profile, the gateway may send DEC PCD-01 messages with no observations, or with observations which are all marked as "unavailable".

In the case of an unreliable connection between the gateway and the HC / AM, the gateway is responsible for announcing the issue to its connected device (e.g., a status message at the device's display that informs the caregiver that no alert events are distributed anymore), and the HC / AM is responsible for announcing the issue to the caregivers which are affected by the communication failure (e.g., all caregivers which are assigned to patients in "ICU West" and "ICU North" and which will no longer receive alert events from devices connected to the gateway).

#### 3.53.4.2 Receipt Acknowledgement Heartbeat Message

When the HC receives a heartbeat message from the HR, it is required to acknowledge the heartbeat message (HL7 general acknowledgement message (ACK)) before the next heartbeat message will be sent according to the defined periodicity - ideally as fast as possible.

The HR may send multiple heartbeat messages for different IHE profiles to the HC through the same connection. In this case, the HC must acknowledge each heartbeat message individually for the indicated IHE profile (OBX-15 field contains the IHE profile ID).

##### 3.53.4.2.1 Trigger Events

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

- Confirms the participation in the MC, and it is fully operational.
- Either does not support an 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.

##### 3.53.4.2.2 Message Semantics

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

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

- **CA**: the HC is fully operational and able to handle the reports from the HR (e.g., the alert manager is able to disseminate alert events to its alert communicators).
- **CR**: the HC 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 HC is not fully operational any longer and cannot handle the reports from the HR as intended (e.g., the alert manager is currently unable to communicate with its alert communicators).
  - B. the HC is not able to support a monitored communication temporarily or wants to stop the participation in a monitored communication intentionally.
- **CE**: the HC indicates to the HR that it does not support the MC at all.

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

**ERR Segment – Error Codes**

The ERR segment contains 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" |

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| ERR Field | Value | Note |
|---|---|---|
| ERR-5 Application Error Code | Heartbeat message specific error code | "**WDERR^watchdog-negative-confirm^MDC**": indicates to the HR that the HC is currently unable to respond to the reports from the HR as intended (see case A above. E. g., an alarm manager is currently not responding to alert events).<br>"**WDLEAVE^watchdog-leave-monitoring^MDC**": indicates to the HR that the HC 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). |

#### 3.53.4.2.3 Expected Actions

515 It is the responsibility of the HC to react accordingly to the Heartbeat messages from the HR.

In case the HR 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.

### 3.53.5 Protocol Requirements

Not applicable.

520 ### 3.53.6 Security Considerations

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

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# Appendices to Volume 2

Not applicable.

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## Namespace Additions for Volume 2

The PCD registry of OIDs is located at PCD OID Management.

Volume 2 additions to the PCD OID Registry are:

530

| OID | Refers To |
|---|---|
| 1.3.6.1.4.1.19376.1.6.4.53 | Point-of-Care Monitored Communication – Request Heartbeat Response [DEV-53] |

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# Volume 3 – Content Modules

Not applicable.

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# Volume 4 – National Extensions

*Add appropriate Country section*

Not applicable.

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