



NEXES Research and Innovation Action
Grant Agreement nº 653337

NEXES Chat specification for use with PEMEA
Version 1.1

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1. Introduction

IM is commonly referred to as chat and the two terms are used interchangeably in this document. It is of note that while the protocol for NEXES chat was developed during the project, this document is being written post project close and provides more context around the protocol and its use than was provided in the internal specification.

This document assumes a working knowledge of PEMEA and familiarity with the PEMEA specification TS 130 478 [1]. Terms common to the PEMEA specification are not redefined or explained in detail in this document.

2. Protocol aims

The aims of the protocol were to create a secure, easy to implement, interoperable chat function that could be initiated through PEMEA, support a web interface and be robust in the case of connection drops and subsequent session re-establishment.

To this end, three interoperable implementations of the protocol were in operation.

A secondary aim of the protocol was to support multiple languages simultaneously with automatic translation capabilities. Since translation services are far from perfect, though translation between some languages is pretty good and it is improving all the time, the protocol must convey not only the translated message but also the original message. This allows the user receiving a confusing, or non-sensical, translated message to see the original message sent in the case where they are able to make better use of it.

3. References

- [1] [“Emergency Communications \(EMTEL\); Pan-European Mobile Emergency Application”](#), ETSI TS 103 478 V1.1.1 (2018-03).
- [2] [“NEXES UserData Specification”](#), GHALE, Version 1.0, 22 July 2018.
- [3] PEMEA User Group (PUG) Web site: <https://www.pemea.help>
- [4] IANA language subtag registry. <http://www.iana.org/assignments/language-subtag-registry/language-subtag-registry>

4. Service definition and invocation

4.1. Service support indication and response

The NEXES chat function is implemented as a PEMEA extension and provides a concrete implementation of the “IM” service defined in the ETSI PEMEA specification TS 103 478 [1]. To indicate the support of the capability the AP includes a PEMEA *information* element in the *apMoreInformation* element of the emergencyDataSend message. This information element specifies:

- *typeOfInfo* = “IM”
- *protocol* = “NEXES”

```
<information typeOfInfo="IM" protocol="NEXES">  
  https://ap.example.pemea.help/48sne8aop[aop  
</information>
```

The URI specified in the *information* element shall be a unique for the specific emergency session.

The terminating PSP or PSAP on receipt of an EDS containing the above information element, if the service is support shall respond by sending an onCapSupportPost message to the AP with an *apMoreInformation* element containing an *information* element with a *typeOfInfo* of "IM" and a *protocol* of "NEXES".

```
<apMoreInformation xmlns="urn:eena:apps:xml:ns:pemea:base">
  <information typeOfInfo="IM" protocol="NEXES"/>
</apMoreInformation>
```

4.2. Service invocation procedure

Once the PSAP has responded to the AP that it can support the NEXES chat service then the AP shall be capable of accepting a service invocation on the proffered URI at any time. The AP shall only accept an IM service invocation from the PSAP or tPSP that sent the onCapSupportPost message.

The PSAP invokes the IM service by:

- A. The call-taker initiating their willingness to chat to the PEMEA interface module (PIM) in the PSAP or tPSP
- B. The PIM requesting the chat server create a chat-room
- C. The chat server creating a chat-room and return a URI to the PIM
- D. The PIM returning the URI the PSAP call-taker
- E. The call-taker connects to the chat-room
- F. The PIM calling the URI provided by the AP for the IM-NEXES service and including the URI for the chat-room in this invocation. Note that the URI is the same for the call-taker and the caller.
- G. The AP indicates to the App that the PSAP wishes to chat with the user.
- H. The user indicates their willingness to chat with the PSAP to AP
- I. The AP initiates a connection to the chat-room.

It is important to note that it is the AP that connects to the chat-room and that the chat-room should be able to authenticate the AP against the valid PEMEA entity list. This ensures that only valid PEMEA entities are able to converse with the PSAP call-takers. This mode of operation requires that all chat messages from the user traverse the AP in order to reach the chat-room. This document only defines the protocol between the AP and the chat-room in the PSAP, it does not define the chat Pa messaging between the App and the AP.

4.3. Transport

The chat-room service is indicated to the AP or other entity as a HTTPS URI. The entity must authenticate to the chat-room service. Once the connecting entity is authenticated and authorization granted then the connection is upgraded to a websocket. The websocket is expected to remain open while the entity is "online". The protocol is resilient to connections being dropped, so an entity may reconnect as long as the EDS session remains active in the PSAP.

4.4. Chat room services

The chat-room represents a formal communication channel between the PSAP call-taker and the user. It may also be used to link in other responders. As such, all messages into and out of the chat-room shall be logged.

When the chat-room is first created a chatbot should be tied to room. This chatbot is responsible for managing the room, and performs tasks like providing message history for users joining the chat-room, providing missed messages when connection are lost, language translations, and session inactivity monitoring.

5. Data types

5.1. type

Defines the "type" of message being sent/received. This is an enum and may have one of the following values:

Table 1 Message types

Message type	Description
JOIN	Entity joining the chat-room
USER_LIST	List of users and that their status
TEXT_MESSAGE	Message sent by a user to the chat-room
REPLY	Reply to a specific message
TRANSLATION	Language translations for a message

5.2. languageList

Is an array containing the list of languages that the user can read and write. The languages may be any of the pertinent languages from the IANA language subtag registry [4].

5.3. room

Is a unique string providing a name for the room. This is usually the URI used to specify the room attachment provided when the chat service is invoked by the PSAP.

5.4. timestamp

All messages are sent with a timestamp and to avoid offsets, timezones, daylight savings changes etc, the time is always absolute. It is specified as an integer in milliseconds since the UTC epoch of 00:00:00 1st January 1970.

5.5. user

Defines a user in the chat-room. It consists of:

- name
- role

The name is a string that identifies a handle to which the user relates, this may be their name "George" for example, or their telephone number <tel:+34666554433> for example.

The role defines the type of user that is associated with the name. These values are constrained and defined in Table 2.

Table 2 Roles

Role	Description
CALLER	The value sent by the AP to the chat-room and used to identify the user initiating the emergency communication to all other participants in the chat-room.
PSAP	The value sent by the PSAP Call-Taker to the chat-room and used to identify the Call-Taker to all other participants in the chat-room.
POLICE	If the police are linked into the chat-room then this value is sent by them to identify that police are in the chat to all other participants in the chat-room.
FIREFIGHTER	If the fire department are linked into the chat-room then this value is sent by them to identify that firefighters are in the chat to all other participants in the chat-room.
MED	If the ambulance or medical services are linked into the chat-room then this value is sent by them to identify that they are in the chat to all other participants in the chat-room.
TRANSLATOR	Indicates that a translator service is in the chat. This may be automatic, like a chat-bot, or it may be an actual person manually doing each translation.

5.6. userInfo

Is used to combine information about the user:

- user :- defined in Section 5.5
- languages :- languageList defined in Section 5.2
- status

The status field is used to describe what the user is doing:

Table 3 status values

Status	Description
ONLINE	The user is connected to the chat-room. This may be a new user joining the chat-room, or maybe an existing user connected to the chat-room.
OFFLINE	The user was, but is no-longer, connected to the chat-room. The chat-room may only use this status as an indicator that a user has left the chat-room and then delete knowledge of the

	connection, or it may maintain a list of all users that have ever connected to the room.
TYPING	Is used to indicate that an entity is typing a message. Implementation of this status functionality is optional.

5.7. message

Is a container used to convey text and the associated language in which the text is written.

Table 4 message elements

Element NAME	Description
text	The information to be conveyed
language	The language abbreviation as specified in [4] in which the text is written.

6. Messaging

6.1. Overview

The chat protocol defines five messages, referred to as message types. These five messages keep the protocol simple while offering a feature rich chat service. The schemas for these messages are contained at the end of this document they may also be acquired via download from the PEMEA User Group (PUG) website.

Table 5 Message type details

Message type	Description
JOIN	Message sent from the AP to the Chat-room when the user wants to join the chat.
USER_LIST	Message sent from the Chat-room to the AP containing all users whenever a user enters or leaves the chat-room.
TEXT_MESSAGE	Message sent either from the AP to the Chat-room, or from the Chat-room to the AP containing a user's message. Message history is transferred as text messages. History is sent when a user joins the chat-room.
REPLY	Message sent from the AP to the Chat-room or from the Chat-room to the AP indicating the content of the message is a direct reply to a specific message.
TRANSLATION	Message from the Chat-room to the AP containing one or more translations for a specific message.

6.2. JOIN message

The JOIN message is sent when the AP joins the chat-room. This occurs the first time that the AP joins the chat-room. It also occurs if the connection between the AP and the chat-room is broken for some reason. The JOIN message consists of the following required fields:

Table 6 JOIN message elements

Element Name	Description	
type	"JOIN" The message being sent by the AP to the Chat-room	
timestamp	Integer Number of milliseconds from epoch (00:00:00:00 1st January 1970)	
user	name	Name and role of entity joining the chat-room. The Name may be the user's name or their telephone number.
	role	The role will depend on the type of user joining the chat-room. In the case of the user initiating the emergency communication this will be "CALLER"
languages	Is a list the languages that the user can read and write. It is specified as a list of languages from the IANA language subtag registry [4]	
since	Send all messages after this time. The time is specified as milliseconds since epoch. A value of zero means send all messages	

since

When an AP is connecting to the chat-room for the first time then it will send a "since" value of zero, indicating that it wants all messages. This is in case that the PSAP call-taker joined the chat-room before the caller did. This will ensure that when the history is sent from the chat-room to the AP that the AP receives all messages in chronological order.

The JOIN message is also used to reconnect to the chat-room in the case that the connection terminated, AP or chat-server restarted. In this case, the AP will set the since value to be the time that the AP knew it last had a connection to the chat-room, often this will be last received message from the chat-room. On a successful connection, the chat-room will send all messages that have occurred "since" the specified time.

```
{
  "languages": [
    "es",
    "en"
  ],
  "since": 0,
  "timestamp": 1574092280213,
  "type": "JOIN",
  "user": {
    "name": "PSAP-IXHJh219",
    "role": "PSAP"
  }
}
```

6.3. USER_LIST message

The USER_LIST is sent to all participants in the chat-room whenever a user enters or leaves the chat-room.

Table 7 USER_LIST message elements

Element Name	Description
type	"USER_LIST" The message being sent by the Chat-room to the AP
room	String identifying the chat-room
timestamp	Integer Number of milliseconds from epoch (00:00:00:00 1st January 1970). See Section 5.4
users	An array of userInfo containing the name, role and status of each user in the chat-room. See Section 5.6

Each participant in the chat-room is required to keep a list of the participants so that it knows when participants join and leave the chat.

```
{
  "type": "USER_LIST",
  "room": "ttRRkzORz",
  "users": [
    {
      "languages": [],
      "user": {
        "name": "Translator-Bot",
        "role": "TRANSLATOR"
      },
      "status": "ONLINE"
    },
    {
      "languages": [
        "es",
        "en"
      ],
      "user": {
        "name": "PSAP-XqwFbQ-A",
        "role": "PSAP"
      },
      "status": "OFFLINE"
    },
    {
      "languages": [
        "es",
        "en"
      ],
      "user": {
        "name": "PSAP-IXHJh219",
        "role": "PSAP"
      },
      "status": "ONLINE"
    }
  ],
  "timestamp": 1574092280231
}
```

6.4. Text message

The text message is used by a chat-room participant to contribute to the chat-room dialogue. Every message has an identifier associated with chat-room so that it can uniquely identified. This is important to allow translations and replies to be linked to the original message to which they refer.

Table 8 textMessage elements

Element Name	Description
id	Unique identifier for this message within the chat-room.
type	"TEXT_MESSAGE" refer to Table 5
room	The identifier for the chat-room. This is usually the URI provided so that the participant can join the chat session.
timestamp	The time that the message was sent. Refer to Section 5.4
user	The user sending or that sent the text message. Refer to Section 5.5
message	The details of the text being sent and the language in which the message is composed. Refer to Section 5.7.

```
{
  "id": "5dd2bd8ba5568000079fa11c",
  "type": "TEXT_MESSAGE",
  "message": {
    "language": "es",
    "text": "hola"
  },
  "room": "ttRRkzORz",
  "user": {
    "name": "PSAP-XqwFbQ-A",
    "role": "PSAP"
  },
  "timestamp": 1574092171988
}
```

6.5. Reply message

The reply message allows a user in the chat-room to respond to a specific message sent by another user in the chat-room. This is important to ensure context between messages is maintained when there are lots of messages or more than two active participants in the chat-room.

Table 9 Reply message elements

Element Name	Description
id	Unique identifier for this message within the chat-room.
reference	The unique identifier of the message to which this reply message relates.
type	"REPLY" refer to Table 5

room	The identifier for the chat-room. This is usually the URI provided so that the participant can join the chat session.
timestamp	The time that the message was sent. Refer to Section 5.4
user	The user sending or that sent the text message. Refer to Section 5.5
message	The details of the text being sent and the language in which the message is composed. Refer to Section 5.7.

```
{
  "id": "5dd2bd8ba5568000079fa1kkc",
  "reference": "5dd2bd8ba5568000079fa1lc",
  "type": "REPLY",
  "message": {
    "language": "en",
    "text": "I need help"
  },
  "room": "ttRRkzORz",
  "user": {
    "name": "PSAP-XqwFbQ-A",
    "role": "CALLER"
  },
  "timestamp": 1574092171988
}
```

6.6. Translation

The translation message is sent when the chat-room supports a translation service (this may be an automatic service). The translation message indicates which message it is translating and then includes a list of each of the translations encoded as a "message" type.

The message is translated into the set of languages specified by the chat-room users when they join the chat-room. The list may grow as more users reading and writing different languages enter the chat-room, but the number of translations will not decrease as users leave the chat-room.

Table 10 translation elements

Element Name	Description
id	Unique identifier for this message within the chat-room.
reference	The unique identifier of the message to which this reply message relates.
type	"REPLY" refer to Table 5
room	The identifier for the chat-room. This is usually the URI provided so that the participant can join the chat session.
timestamp	The time that the message was sent. Refer to Section 5.4
user	The user sending or that sent the text message. Refer to Section 5.5

translations	This is a unique array of messages. The uniqueness is based on the language specified in the message. The structure of the message is described in to Section 5.7.
--------------	--

Translated messages are sent to a user when they join chat-room and request message history. The specification leaves the option to the implementor to decide if they will further translate this history if the new participant adds a new language to the set of required languages in the chat-room.

```

{
  "id": "5dd2bdfaa5568000079fa127",
  "type": "TRANSLATION",
  "reference": "5dd2bd8ba5568000079fa11c",
  "translations": [
    {
      "language": "en",
      "text": "hello"
    }
  ],
  "room": "ttRRkzORz",
  "user": {
    "name": "Translator-Bot",
    "role": "TRANSLATOR"
  },
  "timestamp": 1574092282440
}
    
```

7. Signalling and procedures

7.1. Chat-room creation and destruction

The chat-room is created by the chat-server under direction of the PSAP call-taker via the PEMEA interface module. When the chat-room is created, a logging function shall be created with it to scribe all messages into and out of the chat-room. The chat-room may also contain a chat-bot that is used to invoke services, such as translation services when required. The chat-bot does appear as a user in the USER_LIST as its role is indicated as TRANSLATOR. This flow is shown in Figure 1.

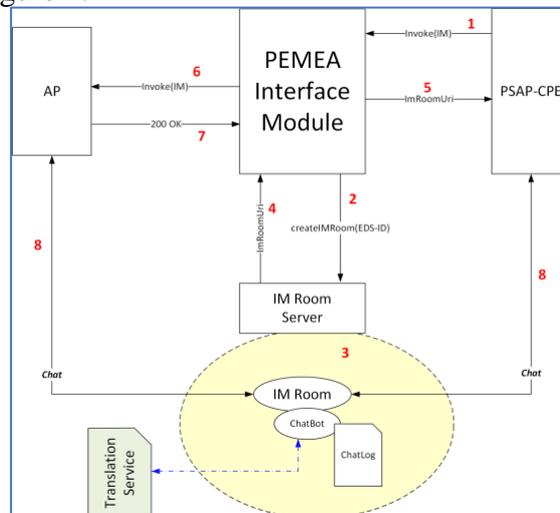


Figure 1 Chat initiation

Once the chat-room is created it remains active as long as the PEMEA interface module maintains a context for the EDS. When EDS context is deleted the chat-room is also destroyed.

7.2. Chat-room creation and join signalling

Figure 2 shows the signalling involved in establishing and subsequently joining a NEXES chat session. By necessity the diagram shows four distinctive types of signalling:

- Semantic signalling across the Pa interface between the App and the AP. This is explicitly not defined in PEMEA. So, while the message names and contents may not align with any specific implementation, the semantics of what the messages and convey should be understood.
- Core PEMEA signalling. These are explicit messages defined in the PEMEA standard [1].
- Chat semantic signalling. This is messaging that needs to occur between the PSAP call-taker equipment, the PEMEA interface module and the software entities and components required to establish the chat service. These messages are intended to provide an idea of what needs to occur, not how it must be implement. Consequently, they are not normative to this specification.
- IM (chat) normative signalling. Messages and semantics explicitly defined in this specification.

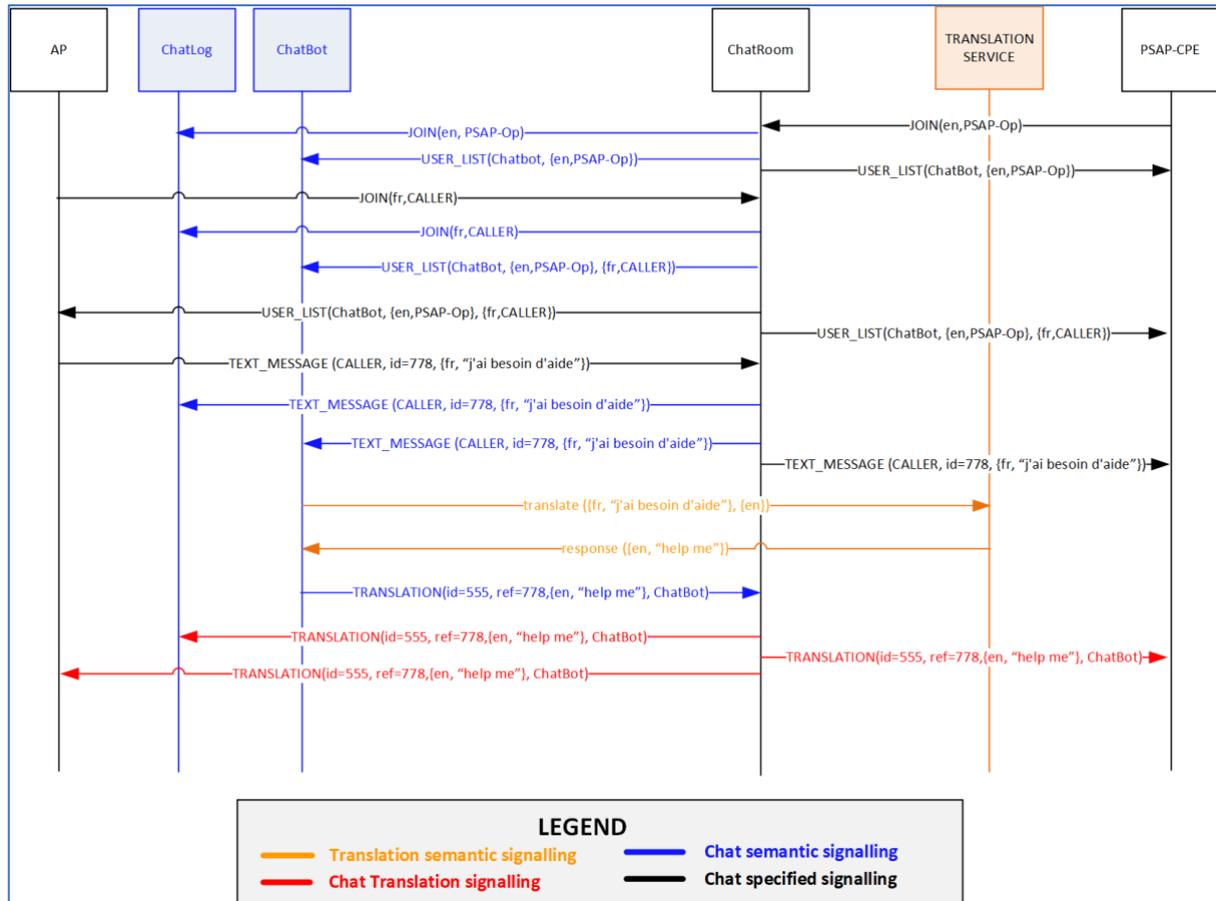


Figure 3 Translation service signalling

7.3.1. TEXT_MESSAGE translation example.

Suppose that the ChatBot understood three languages, English (en), Spanish (es) and French (fr), and it received the following TEXT_MESSAGE:

```
{
  "id": "5dd2bd8ba5568000079fa11c",
  "type": "TEXT_MESSAGE",
  "message": {
    "language": "es",
    "text": "hola"
  },
  "room": "ttRRkzORz",
  "user": {
    "name": "PSAP-XqwFbQ-A",
    "role": "PSAP"
  },
  "timestamp": 1574092171988
}
```

It would request from its translation service that the message be translated from Spanish (es) to English (en) and French (fr). Once it got back the translations it would construct the following TRANSLATION message and return it to the chat-room for logging and sending to room participants.

```
{
  "id": "5dd2bdfaa5568000079fa127",
```

```

"type":"TRANSLATION",
"reference":"5dd2bd8ba5568000079fa11c",
"translations":[
  {
    "language":"en",
    "text":"hello"
  },
  {
    "language":"fr",
    "text":"bonjour"
  }
],
"room":"ttRRkzORz",
"user":{
  "name":"ChatBot",
  "role":"TRANSLATOR"
},
"timestamp":1574092282440
}

```

7.3.2. REPLY translation example.

Suppose that the ChatBot understood three languages, English (en), Spanish (es) and French (fr), and it received the following REPLY:

```

{
  "id":"5dd2bd8ba5568000079fa1kkc",
  "reference":"5dd2bd8ba5568000079fa11c",
  "type":"REPLY",
  "message":{
    "language":"en",
    "text":"I need help"
  },
  "room":"ttRRkzORz",
  "user":{
    "name":"George Hurtman",
    "role":"CALLER"
  },
  "timestamp":1574092171988
}

```

It would request from its translation service that the message be translated from English (en) to Spanish (es) and French (fr). Once it got back the translations it would construct the following TRANSLATION message and return it to the chat-room for logging and sending to room participants. It is important to note that the "reference" in the received REPLY message is not used in the TRANSLATION message. Instead, the "id" from the REPLY message is used as the "reference" in the TRANSLATION message.

```

{
  "id":"5dd2bdfaa5568000079fa127",
  "type":"TRANSLATION",
  "reference":"5dd2bd8ba5568000079fa1kkc",
  "translations":[
    {
      "language":"es",
      "text":"necesito ayuda"
    }
  ]
}

```

```
    },
    {
      "language": "fr",
      "text": "j'ai besoin d'aide"
    }
  ],
  "room": "ttRRkzORz",
  "user": {
    "name": "ChatBot",
    "role": "TRANSLATOR"
  },
  "timestamp": 1574092282440
}
```

7.4. Disconnects and reconnects

It is a fact of life that disconnects and reconnects occur, and that system failure can result in the temporary loss of service. The NEXES chat protocol does not define how the AP and the App talk, though this document does provide some high-level semantics. The communication described in this document is between the PSAP-CPE and the chat-room, and the AP and the chat-room, though it does also define how to establish a chat-room and invoke the NEXES chat service.

If the chat-room terminates for an unexpected reason, then the websockets used for communication between the participants and the chat-room will close. Should this occur, then the participants should attempt to reconnect, with an ever-increasing exponential back-off, failure to reconnect after a configurable period should result in the participant not attempting to continue to retry.

The PSAP call-taker is a special entity in this case, as they are instigator of the chat communication and to some extent the host of the service. Due to this role, the PSAP call-taker should initiate a room-recreation action in the event of a failure. In this case, a new room is created, and this room may have a new URI, but the chat-log is linked to the log created by the old room. Because the URI may have changed, a new chat invocation is sent to the AP. The AP shall auto join the newly provided chat-room URI and communication is re-established.

The AP does not need to report to the App the loss of connectivity to the chat-room until it determines that the connectivity cannot be restored. To help provide this seamless interaction, the AP may buffer messages from the App during the disconnect period, and on-send these once the session to the chat-room is re-established.

A simplified version of this flow is provided in Figure 4.

