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PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

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1 INTRODUCTION

1.1 PROJECT SCOPE

The CHORIST project will propose solutions to increase rapidity and effectiveness of interventions following natural hazards and industrial accidents, in order to enhance citizens' safety and communications between rescue actors.

1.2 PURPOSE OF THE DOCUMENT

This document describes the interface for the Public Announcement Network Gateway.

Public announcement is considered to be using heterogeneous siren networks, part of which is traditional (rotary), others being electronic, capable of transmitting high-power acoustic signalling and voice information as well.

This document describes the interface between the Message Dispatcher and the Public Announcement Network.

This document is the public version of SP3.D6-CONFIDENTIAL.

The full SP3.D6-CONFIDENTIAL document is only available for CHORIST members.

1.3 DOCUMENT VERSIONS SHEET

Version	Date	Description, modifications, authors
1.1	04-08-08	PUBLIC version of SP3.D6-V1.1-confidential

Table 1 : Document versions sheet

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2 REFERENCE DOCUMENTS, DEFINITIONS AND ABBREVIATIONS

2.1 REFERENCE DOCUMENTS

- [1] CHORIST SP3.D3: Communication channel technical specification and open interface specification
[2] CHORIST SP3.D4, Communication network architecture definition and requirements

2.2 DEFINITIONS

External interface Interface from one system to another system or entity.
File An element of data storage in a file system.

2.3 ABBREVIATIONS

BNF Backus-Naur Formalism / Backus-Naur Formula
GSM Global System for Mobile communications
HTTP **HTTP**, short for **Hypertext Transfer Protocol (HTTP)** is a communications protocol used to transfer or convey information on the World Wide Web.
IP Internet Protocol
ISDN Integrated Switched Data Network
MD Message Dispatcher
PAN Public Announcement Network
PAN GW Public Announcement Network Gateway
RPC **Remote Procedure Call** is a technology that allows a computer program to cause a subroutine or procedure to execute in another address space (commonly on another computer on a shared network) without the programmer explicitly coding the details for this remote interaction.
TCP Transmission Control Protocol
XML **eXtensible Mark-up Language** is a general-purpose mark-up language. It is classified as an extensible language because it allows its users to define their own tags.
XML-RPC **XML-RPC** is a Remote Procedure Call protocol which uses XML to encode its calls and HTTP as a transport mechanism.

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3 EXECUTIVE SUMMARY

Unlike GSM networks, the Public Announcement Networks have decades of history since World War II through the Cold War, which has made them very heterogeneous and diverse. They have been shared or built in parallel by military and civil authorities. Many different systems of local, municipal up to nationwide coverage have been built and almost all of them have to be interfaced efficiently.

A common gateway architecture is proposed in order to bridge the gap between the CHORIST high-level concepts of message dispatching and existing systems based on analogue radios, serial lines etc, which would be not efficient to be replaced at once.

Of course, a state-of-the-art electronic siren is a straightforward solution that can be directly connected to the gateway over a PMR radio, such as TETRA or TETRAPOL.

A protocol stack between Message Dispatcher (MD) and Public Announcement Network Gateway (PAN Gateway) is defined, together with interaction diagrams and other communication details.

MD to PAN GW primitives are defined in terms of requests and responses. These include:

1. Login to the PAN GW
2. Password change
3. Query a list of predefined areas (coverage of PAN systems behind the PAN GW).
4. Prepare (upload) a voice message
5. Create an (immediate) alert
6. Kill (cancel) an alert
7. Logout from the PAN GW

For Alert Request, semantics is described with respect to

- ❖ Area Definition (coverage of pan systems behind the gateway)
- ❖ Alert Type options
 - GENERAL alert,
 - FIRE alert,
 - RADIATION alert,
 - CHEMICAL alert,
 - FLOOD alert,
 - radio BROADCAST
 - voice message PLAYBACK
 - TEST only

For area definition, the WGS-84 coordinate system is taken as a standard.

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4 INTRODUCTION

4.1 GLOBAL ARCHITECTURE

Unlike GSM networks, the Public Announcement Networks have decades of history since WWII through the Cold War, which has made them very heterogeneous and diverse. For economic efficiency they have been shared (or to the contrary built in parallel) by military and civil authorities. Many different systems of local, municipal up to nationwide coverage have been built and almost all of them have to be interfaced efficiently.

For the use within CHORIST, the global architecture is as follows:

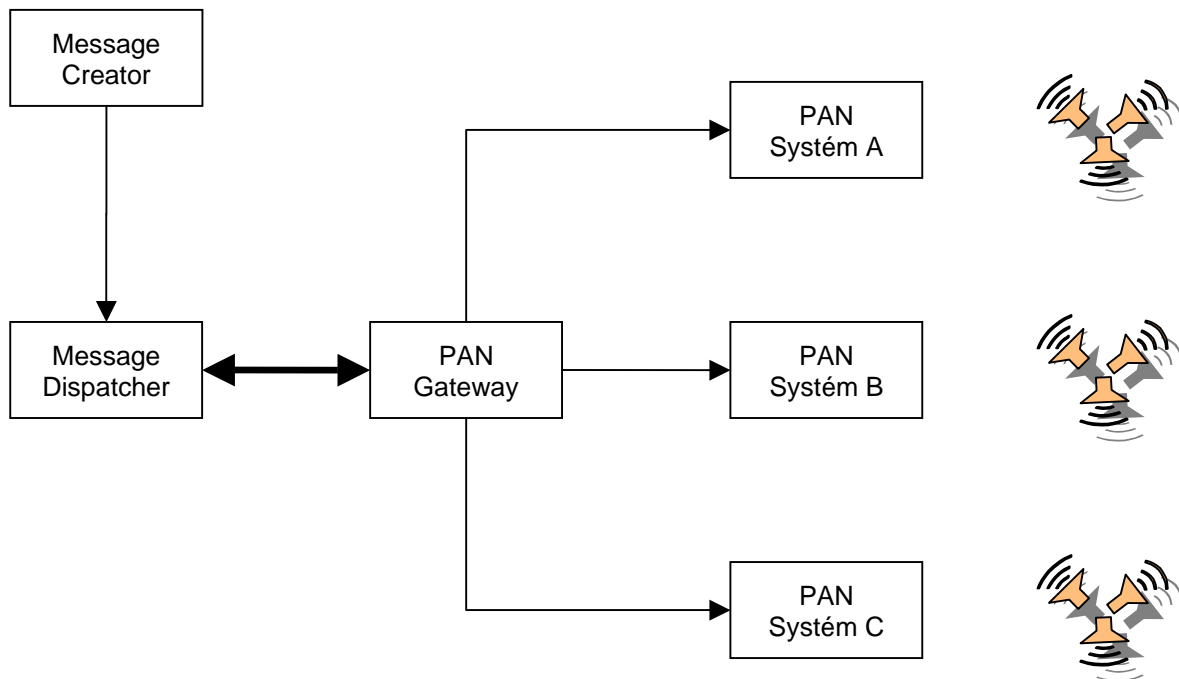


Figure 1: Global Architecture MD – PAN GW Interface

The basic reasons for the choice of the gateway were the differences between the siren systems concepts and their heterogeneity. The gateway bridges the gap between the high-level concepts of the CHORIST and large existing systems based on analogue radios, serial lines etc, which would be not efficient to replace at once.

4.1.1 Message Dispatcher (MD)

The MD is a system in front of the PAN GW sending requests to the PAN systems. The MD can, for example, be located at a government controlled central location, possibly close to PAN GW and the main (government controlled) PAN system control room.

4.1.2 Network Interfaces

The most appropriate network interface between the MD and the PAN GW is TCP/IP. The PAN GW is able to interface with multiple MDs concurrently using one network interface. In the CHORIST demonstration, only a single PAN GW and a single MD will be used and TCP/IP will be used on the interface.

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5 MD – PAN GW INTERFACE

5.1 OVERVIEW

This chapter describes the communication protocol used between the MD and PAN GW.

The transport protocol is HTTP and the message content is formatted in XML-RPC over HTTP or XML-RPC over TCP directly.

The full protocol stack is shown in Figure 2. For demo system, the HTTP layer will be omitted.

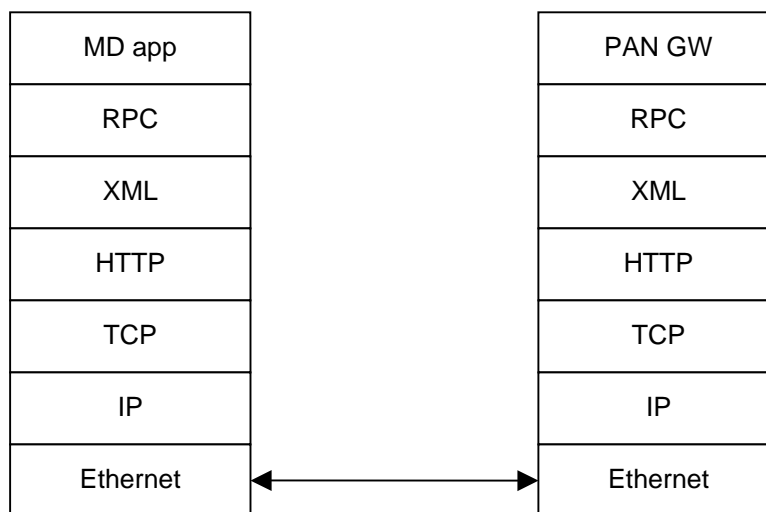


Figure 2: Protocol stack

5.2 HTTP

The transport protocol being used is HyperText Transfer Protocol (HTTP), which is the most widely used synchronous transport protocol today. It is a generic, stateless protocol. Support is included in almost every language/OS and it is relatively easy to implement. The required minimum version of HTTP protocol is HTTP-1.0.

5.3 XML – RPC

The message content is based on XML-RPC. XML-RPC is a specification and a set of implementations that allow software running on disparate and different operating systems and environments to make procedure calls over the Internet. It has been designed to be as simple as possible, while allowing complex data structures to be transmitted, processed and returned.

5.4 INTERACTION DIAGRAM

For each service the client wants to perform on any PAN, an XML request must be constructed and sent to the PAN GW.

After receiving and interpreting a request message, the PAN GW will respond in the form of an HTTP response message. A typical interaction between a client and a PAN GW is shown in Figure 3. In this example, the client issues three HTTP requests to the PAN GW, which is a minimal reasonable sequence.

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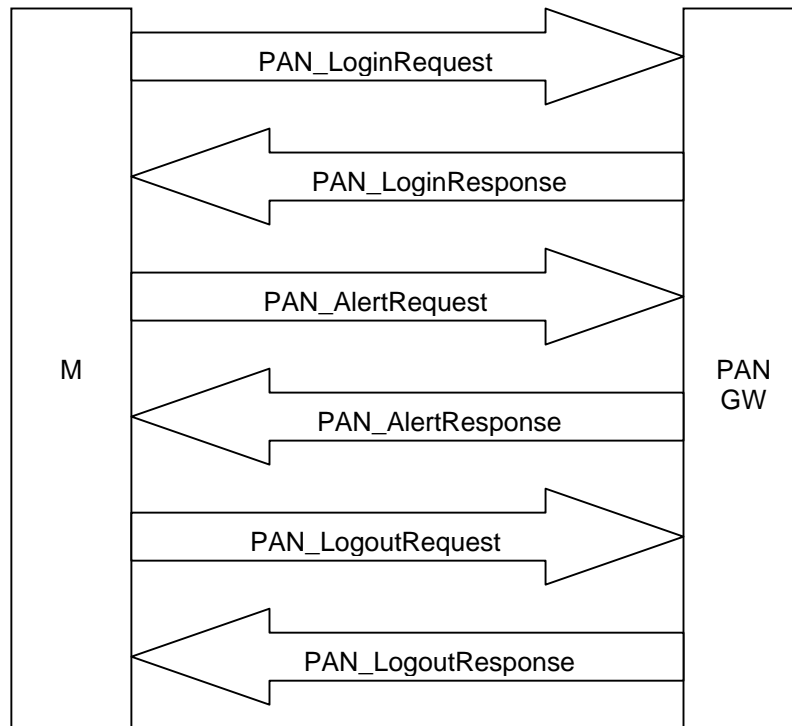


Figure 3: Client – MD Gateway Typical Interaction Diagram

The first request that the MD sends to the PAN GW must be a **PanLoginRequest**. When the login was successful any other requests may be sent to the PAN GW. When the client has finished, a **PanLogoutRequest** must be sent to PAN GW, so that the PAN GW can clean up the resources that are associated with that client.

The PAN GW can handle multiple requests from multiple clients at any time. This means that one client may send multiple HTTP requests to the MD Gateway at any time. The client could implement this by executing each request in a separate thread. Exceptions to this are the **PanLoginRequest** and **PanLogoutRequest**. These requests MUST NOT be sent while other requests are running from the same client.

5.5 SESSION TRACKING

The HTTP protocol is by design a connection-less/stateless protocol. The PAN GW should use HTTP State Management Mechanism as described in RFC2109 [5]. Session tracking through HTTP cookies is the most used session tracking mechanism. The session tracking mechanism will not be explained in this document. When the client sends a login request, the MD Gateway responds by sending a response to the client. In the response a cookie is included that the client must retrieve and store. The cookie contains a session-id that the MD Gateway uses for session tracking. It does not contain any security-related information. The cookie must be returned to the MD Gateway on each subsequent request to the MD Gateway. Refer to the references for more information.

In the demo system, because of direct use of XML over TCP, the session tracking is omitted.

5.6 TCP CONNECTION

Before an MD can send any requests to the PAN GW, it must first open a TCP connection. A connection can be made via an IP network. The PAN GW will check whether the originating IP address is allowed to open a connection.

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5.7 TCP DISCONNECTION

A MD may be disconnected from the PAN GW in several ways:

- Explicit disconnect by client (MD) or server (PAN GW): communication links of this connection will be closed. Communication links of other connections will remain unaffected (gentle disconnect).
- Idle time detection: if there has been no communication between MD and PAN GW over a connection during a specified time, this connection will be closed (forced disconnect by server).
- Connection or link failure: if, due to a technical failure or mishap, a link or a connection has broken down the MD is responsible for restarting communication.

5.8 LOGGING

All the communication on the PAN GW connection shall be logged for the purpose of possible auditing in the future, including any unsuccessful log attempts on XML level or refused attempts to connect on TCP level.

5.9 MD – PAN GW PRIMITIVES

Primitives are defined in terms of requests and responses. The PAN GW can generate several types of answers to the MD. Answers are optionally stored in a history file within PAN GW. Possible answers are acknowledgements (class 0), informational messages (class 1) and error messages (class 2).

The PAN GW interface supports the following request primitives:

8. Login to the PAN GW – **PAN_LoginRequest / Response**
9. Change password – **PAN_ChangePasswordRequest / Response**
10. Query a list of predefined areas – **PAN_QueryNamesRequest / Response**
(coverage of PAN systems behind the PAN GW).
11. Prepare (upload) a voice message – **PAN_WaveUploadRequest / Response**
12. Create an (immediate) alert – **PAN_AlertRequest / Response**
13. Kill (cancel) an alert – **PAN_KillAlertRequest / Response**
14. Logout from the PAN GW – **PAN_LogoutRequest / Response**

For each **Request** type, a corresponding **Response** primitive exists, which all have a similar fixed part in the beginning, plus and optional variable part.

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6 REQUESTS AND RESPONSES

6.1 GENERAL COMMAND STRUCTURE

6.1.1 Names convention

Each request command to the PAN GW has the name of **PAN_keywordRequest**

Each response from the PAN GW has the name of **PAN_keywordResponse**

6.1.2 BNF notation and XML-RPC structure

All PAN GW requests follow the XML-RPC notation.

The BNF notation of XML-RPC in general is shown below:

```

request ::=
    <methodCall>
        <methodName> methodName </methodName>
        <params> {param} </params>
    </methodCall>

response ::=
    <methodResponse>
        <params> {param} | fault </params>
    </methodResponse>

fault ::=
    <fault>
        <value>
            <struct> faultcode, faultstring </struct>
        </value>
    </fault>

param ::=
    <param> value </param>

value ::=
    <value>
        struct | array | string | integer | double |
        nautho | dateTime.iso8601 | base64
    </value>

struct ::=
    <struct>
        {member}
    </struct>

member ::=
    <member>
        <name> {any_character} </name>
        value
    </member>

array ::=
    <array>
        <data> { value } </data>
    </array>

integer ::=
    <i4> {any_integer} </i4> |
    <int> {any_integer} </int>

string ::=
    <string> {any_character} </string>

double ::=
    <double> {any_integer} "."{any_integer} </double>

nautho ::=
    < nautho> 0 | 1 </ nautho>

dateTime.iso8601 ::=
    <dateTime.iso8601>
        datetime
    </dateTime.iso8601>

base64 ::=
    <base64> {any_character} </base64>

```

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Each request follows this pattern, confirming the BNF notation described before:

```
<?xml version="1.0"?>
<methodCall>
  <methodName>PAN_methodRequest</methodName>
  <params>
    <param>
      <value>
        <struct>
          { members }
        </struct>
      </value>
    </param>
  </params>
</methodCall>
```

Each XML-RPC request is described in the following pattern. A C-like notation is used to describe XML-RPC messages. After each description, an example is provided. For example:

```
methodName = PAN_method
{
  string str,
  int    val
}
```

If str = Ping and value = 12345678 this will result in the following XML-RPC request message:

```
<?xml version="1.0"?>
<methodCall>
  <methodName>PAN_method</methodName>
  <params>
    <param>
      <value>
        <struct>
          <member>
            <name>str</name>
            <value>
              <string>Ping</string>
            </value>
          </member>
          <member>
            <name>value</name>
            <value>
              <int>12345678</int>
            </value>
          </member>
        </struct>
      </value>
    </param>
  </params>
</methodCall>
```

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6.2 ALERT

6.2.1.1.1 Area definition

The area MAY have a name, or a definition by coordinates, or both.

If there is no name, the polygon is used and only the request id is kept for possible future reference in case of alert cancellation request (PAN_KillAlertRequest).

If a name is used instead (with no other data), the list of named areas is looked up; if not found, an error is returned.

If both name and polygon definition are used, the polygon definition is kept persistent for future reference by name. If the name existed before, the polygon is replaced.

The names of areas and their definitions can later be retrieved using PAN_QueryNamesRequest.

6.2.1.1.2 AlertType

As the <alerttype>, following strings are suggested as standard options: GENERAL, FIRE, TEST, RADIATION, CHEMICAL, FLOOD, BROADCAST, PLAYBACK.

6.2.1.1.2.1 GENERAL

The GENERAL alert is performed is an option applicable to any type of siren (both rotary and electronic). Recommended tone is no less than two minutes in duration, switching between 4 seconds Hi (400 Hz) and 3 secs Lo (150 Hz) through the time.

6.2.1.1.2.2 FIRE

The FIRE alert primarily serves for volunteer fire-fighters to gather for help with local fire. It consists of two periods of 25 seconds Hi and 10 seconds Lo each.

In case of electronic sirens this is accompanied by pre-recorded vocal announcement.

6.2.1.1.2.3 TEST

The TEST alert primarily serves for Public Alerting system tests. It consists of steady tone for over two minutes. In case of electronic sirens this is accompanied by pre-recorded vocal explanation.

6.2.1.1.2.4 RADIATION

The RADIATION alert is used in the vicinity of atomic power plants, where modern electronic sirens are usually used. This is – of course - accompanied by pre-recorded instructions.

In case of obsolete sirens this is not applicable and GENERAL alert is applied instead.

6.2.1.1.2.5 CHEMICAL

The CHEMICAL alert is used in the vicinity of chemical plants, where modern electronic sirens are usually used. This is – of course - accompanied by pre-recorded instructions.

In case of obsolete sirens this is not applicable and GENERAL alert is applied instead.

6.2.1.1.2.6 FLOOD

The FLOOD alert is used downstream of dams and other areas of flood risk. In case of electronic sirens this is accompanied by pre-recorded instructions.

In case of obsolete sirens this is not applicable and GENERAL alert is applied instead, but people in such areas are usually instructed what to do in case of emergency.

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6.2.1.1.2.7 BROADCAST

The BROADCAST instructs the electronic siren controller to turn on the built-in FM radio receiver, tuned up to the local radio station, where instructions are supposed to be transmitted.

For rotary sirens this command is not applicable.

6.2.1.1.2.8 PLAYBACK

The PLAYBACK instructs the electronic siren controller to replay a previously pre-recorded (ad-hoc) message, stored within the controller.

For rotary sirens this command is not applicable.

6.2.1.2 Repetition

Except for the BROADCAST alert, the alerting may be performed more than once. Two or three repetitions are possible on request, usually after two minute pause (determined by the controller). For more repetitions, a new PAN_AlertRequest should be performed under control of Message Dispatcher.

6.2.2 Coordinate systems

As can be seen from the XML example above, coordinate systems with lat/lon pairs are supposed instead of more general x/y.

The first of the coordinate pair, latitude, is the vertical one and grows to the North.

The second of the pair, longitude, is the horizontal one and grows to the East.

When using WGS-84 coordinate system, on Western hemisphere the longitudes are negative.

The <double> number is a decimal fraction of degrees.

The two other possible but not preferable notations are (numeric strings) ddmm.mmmm or ddmms.sss. If any of these is used close to zero longitude, the leading zeros **MUST** be written in order to avoid misinterpretation. On output, the PAN GW uses the first manner.