pulse

Platform for European Medical Support During Major Emergencies

D4.5 Training Tools

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PULSE

Platform for European Medical Support during major emergencies

WP4 Tools

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Abstract:
The purpose of this document is to describe the functionality & features available to the MPORG training tool and the PULSE LMS/LRS system. The document is the supporting document for the training component delivery for D4.5.

Keywords:
MPORG, Training, Learning Management System, Learning Record Store

D4.5-MPORG Training Tool REVISIONS:

Revision	Date	Description	Author (Organisation)
0.1	20/08/2015	Initial Draft	Shane Carty (Skytek)
0.9	26/11/2015	Functional Specifications	Karl Chadwick (Skytek)
1.0	30/11/2015	Addition of URL details on live PULSE LMS/LRS server	Paul Kiernan (Skytek)

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1   List of acronyms

Table 1 List of Acronyms

Acronym	Definition
AS	Authentication Server
DES	Discrete Event Simulation
DSVT	Decision Support and Validation tool
DoW	Description of Work
ENSIR	ENhanced SIR
GPS	Global Positioning System
GUI	Graphical User Interface
IAT	Intelligence Analysis Tool
IP	Internet Protocol
JWT	JSON Web Token
LDAP	Lightweight Directory Access Protocol
LMS	Learning Management System
LRS	Learning Record Store
LT	Logistic Tool
MPORG	Multi-Player Online Roleplaying Game
PCET	Post Crisis Evaluation Tool
REST	Representational State Transfer
SA	Smartphone application
SGCT	Surge Capacity Generation Tool
SIR	Susceptible - Infected - Recovered
SOAP	Simple Object Access Protocol
TT	Training Tools

2 Executive Summary

This document is a report focused on the development of the Training as part of the PULSE platform architecture.

This set of tools supports the implementation of the training methodologies defined in WP5 "Methodology".

The tools include a MPORG training platform for personnel involved in crisis management and a Learning Management System/Learning Record Store tailored for the emergency and health services with access to training courses from a wide variety of browsers and mobile devices.

3 Introduction

3.1 Scope of the Document

This document summaries the software components delivery and provides high level details on the architecture, technologies and underlying libraries on which the components have been developed.

3.2 Structure of the Document

This document is structured into the following sections.

1. MPORG:
   - Main features and functionality of the software component.
   - Architecture used within the software component and an overview of where the software component is located within the overall PULSE system architecture.
   - Technologies used for development of the component.
   - List of technologies used by the software.
   - List of underlying 3rd party libraries used by the system and license summaries of these components.
2. Learning Management System/Learning Record Store:
   - Main features and functionality of the software component.
   - Usage of the System for Trainers & Trainees
   - List of technologies used by the software.
   - List of underlying 3rd party libraries used by the system and license summaries of these components.

3.3 Relation with other Deliverables

D2.4: Requirements gathering for Training Tools

D3.5: Functional definition of the MPORG tool

D4.1 & D4.3, D4.6, D4.7: MPORG integrates with the DVST system, including with the

Logistics Tool for source data, Post Crisis Evaluation Tool for results comparison and the Event Evolution Model (ENSIR) for patient details.

4 MPORG

4.1 Overview

MPORG training platform for personnel involved in crisis management and a training learning management system tailored for the emergency and health services with access to training.

The MPORG tool services two major purposes:

- The first purpose is to train decision makers in managing healthcare resources in "Stadium crush- like" emergencies in the Response phase, using a game like environment and shared game world with many actors playing different roles.
- The second purpose is to provide experts with a simulation tool that allow them to extract feedback information for SOPs updates or testing resource management heuristics.

It is envisioned that the training tool will be used in a classroom like situation where there will be 4 or 5 users logged in on the local network, and they will all be viewing the same MPORG scenario through their Internet Browser.

They will then interact with the scenario by deploying resources and selecting treatments for patients etc.

Each time a user makes a change to the global scenario, this will be reflected in the other users' view of the scenario, so that a decision made by one participant, will affect the rest of them.

On completion of the training session, the users will be presented with the results of their actions and a comparison to the optimal recommendation results for evaluation.

4.2 Features

4.2.1 Platforms:

Lightweight & cross-platform web interface, compatible with: Chrome, Firefox, Internet Explorer, and other modern web standards compliant browsers.

4.2.2 GUI:

Top down, "Google Maps" like graphical interface, where the user can dispatch ambulances from hospitals to an emergency, and then assign patients to hospitals based on their injury and resource availability.
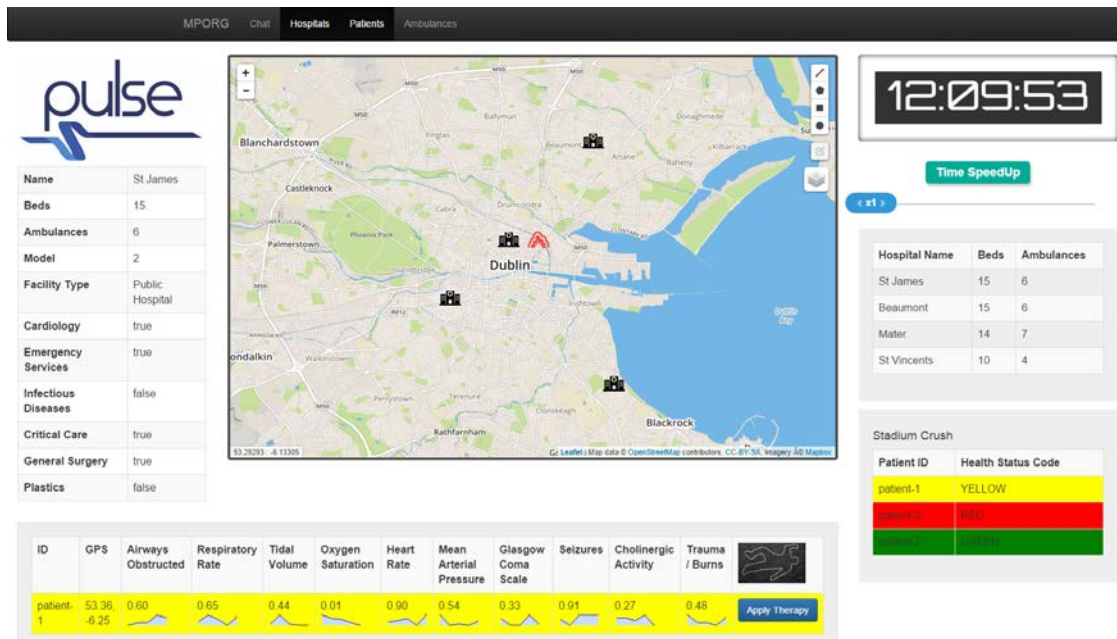
Figure 1 Full Screen Display

4.2.3   Direction API:

Uses Google maps directions API when sending ambulances to hospitals in order to realistically simulate the ambulance journey time.

4.2.4   Logistic Tool:

Uses the logistic tool developed by SES for WP4.3 to store and retrieve resource information such as doctors and resources available at a hospital.

4.2.5   Patient Model Web Service:

Uses the patient web model developed by Biomatematica for WP3.1 to simulate the evolution of a patient health status, which changes as the game progresses, whether from the application of therapy or the passage of time.

4.2.6   Optimisation Tool:

Uses the Optimisation tool developed by SES for WP4.1 to gauge the user performance by comparing the decisions they made during the game, such as where to send a particular patient, to the decision which would have been selected by the optimisation tool.

4.2.7   Time Speed Control:

Simulation allows you to speed up and slow down time, so that the user does not

have to wait for the ambulances to arrive in real time, for example.

4.2.8 Feedback:

At the end of the scenario, the user is presented with a training evaluation screen which gives them feedback on their overall performance as well as a breakdown of the individual decisions made throughout the scenario, and whether they were optimal or not.

4.3 Usage:

Instructions on carrying out basic actions in the MPORG are as follows:

1. To dispatch an ambulance to the emergency, select a hospital icon on the map, and click the grey button beside "ambulances available" in the pop-up that is displayed. You are then prompted to select where you would like to send the ambulance.
   To send it to the scene of the emergency, you can then click on the icon representing it, which at the moment is a red explosion icon.

2. To assign a patient to an ambulance, you have two options, you can:

   a. Select a patient from the list on the right hand side by clicking on their name, you will then see their details displayed at the bottom of the screen, if you then click on an ambulance icon on the screen, this patient will be picked up by that ambulance.

   b. Or instead you can click on the red emergency icon, which represents the stadium crush, and click the grey button beside "people injured" in the pop-up that is displayed. You are then prompted to click on the ambulance that you would like to pick up the patient.

3. To send an ambulance to a hospital with a patient on board, you click on the ambulance icon on the map, then select the "Go To Hospital" button which is shown in the pop-up displayed, and you are then prompted to click on which hospital you want to send the ambulance to.
   If you have the "Ambulances" option selected on the top menu bar, you can see the progress bar showing how far the ambulance has to go.
   You should probably then speed up time using the sliding button below the clock if you have not already, as the shortest journey takes 5-6 minutes in real time.

4. To apply therapy to a patient, you can select their name from the right hand side of menu, which then displays their information at the bottom of the screen, and then you can click on the therapy button beside their attributes.
   With integration to the ENSIR, this gives the option to select a particular therapy based on the patient's injuries and allow for a more realistic model of patient progression.

When all patients have been collected and arrived at a hospital the scenario is over, and it displays the Training Evaluation screen, with the feedback on the users performance, as well as a time stamped list of decisions they made.

4.4 Functionality
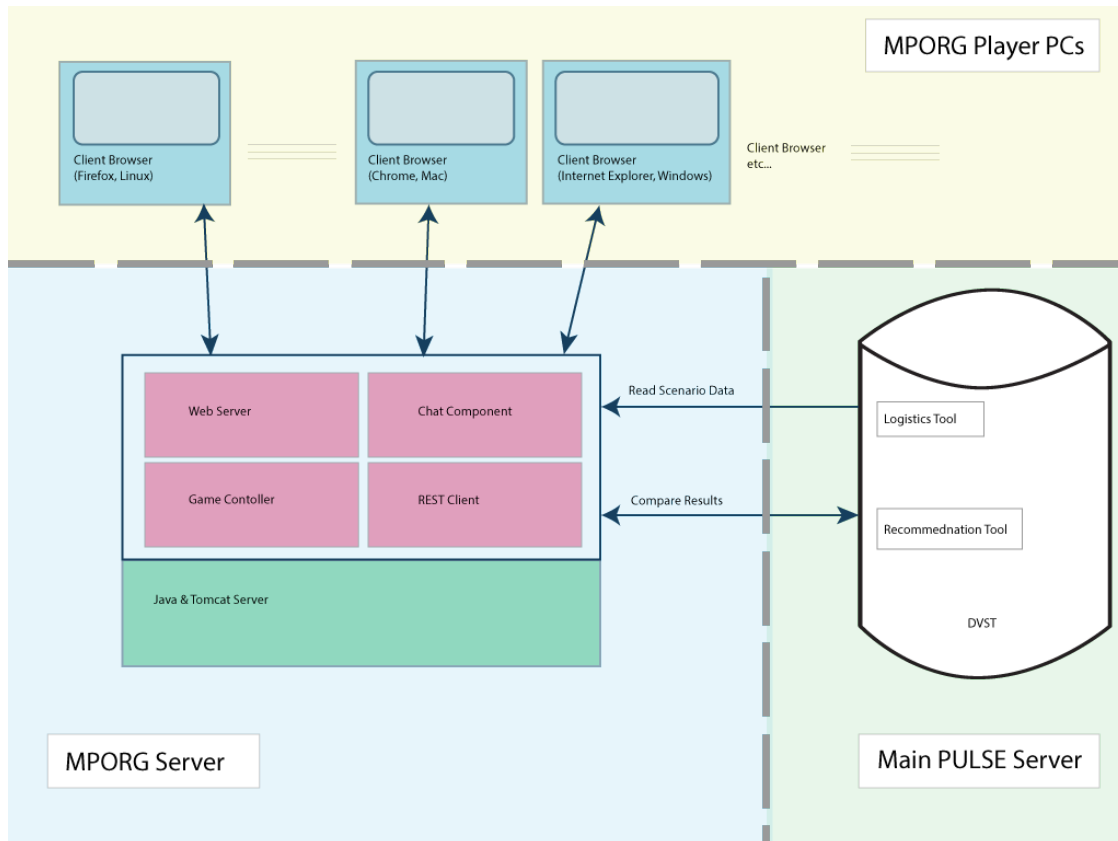
Figure 2 MPORG Architecture

The MPORG System is a client-server model, where the server component is itself a client to the main PULSE DVST.

The server fetches the scenario data from the main Pulse server and sets up a new training session, chat server & prepares for the client browsers to connect. The clients connect via a web browser and share the current training session until complete.

Once the training session is finished, the server reconnects to the DVST to get & compare the recommended results for feedback

4.4.1 The MPORG Server

On start-up, the MPORG server expects the main Pulse server to be running.

A request is made to get resources for the latest (or a known) incident:

```
GET [PulseServer]/crisismanagement/incident/ID
GET [PulseServer]/crisismanagement/eventlocation/ID
GET [PulseServer]/crisismanagement/hospitals/ID


Etc…
```

These details are used to build up the initial simulation model for the training session.

A chat server component is started automatically and listens for incoming messages. The chat server uses web sockets and runs at the following endpiount:

```
ws://[PulseServer]/mporg/chat
```

Any JSON formatted messages received here are re-broadcast to all connected clients.

Chat messages to be displayed are of the form:

```
{ "user" : "karl", "message": "Hello" }
```

When one or more clients are ready, the training session begins.

The server maintains the state of the session, with list of actions taken, the time increments and travel of resources, evolution of the patients, etc..

Figure 3 Training Evaluation Screen

Once the goal of all taking care of all patients is complete, the session ends and the results are gathered for evaluation.

```
GET [PulseServer]/recommednation/incident/ID
```

Training Evaluation

Simulation Type	Ranking	Patients Survived	Patients Died	Patients Dispatched Correctly	Correct Therapy Applied	Real Time Taken	Sim Time Taken	Overall Score	Stats
Stadium Crush	4th	13	3	67%	3/5	0:05:55	3:42:30	55/100	View Decisions

Decisions Made

Type	From	To	Dispatch Time	Arrival Time	Optimal Decision	Reason
Dispatched Ambulance	Beaumont	Stadium Crush	Tue Sep 01 2015 12:11:14 GMT+0100 (GMT Summer Time)	Thu Sep 10 2015 10:54:34 GMT+0100 (GMT Summer Time)	true	N/A
Dispatched Ambulance	Mater	Stadium Crush	Tue Sep 01 2015 14:46:45 GMT+0100 (GMT Summer Time)	Sat Sep 05 2015 04:36:45 GMT+0100 (GMT Summer Time)	false	N/A
Dispatched Ambulance	Stadium Crush	Mater	Tue Sep 01 2015 15:43:45 GMT+0100 (GMT Summer Time)	Sat Sep 05 2015 08:37:05 GMT+0100 (GMT Summer Time)	false	More Suitable Hospital near by
Assign Patient	patient-0	Mater	Tue Sep 01 2015 15:43:45 GMT+0100 (GMT Summer Time)	null	true	N/A
Dispatched Ambulance	Stadium Crush	Mater	Tue Sep 01 2015 15:45:45 GMT+0100 (GMT Summer Time)	Sat Sep 05 2015 06:25:45 GMT+0100 (GMT Summer Time)	true	N/A

Figure 4 Evaluation with Breakdown of Results

4.4.2   Client Interface:

The main section of the interface is the map that is displayed in the centre of the screen. This is populated with resource icons such as hospitals and ambulances, which can be dispatched by the user.
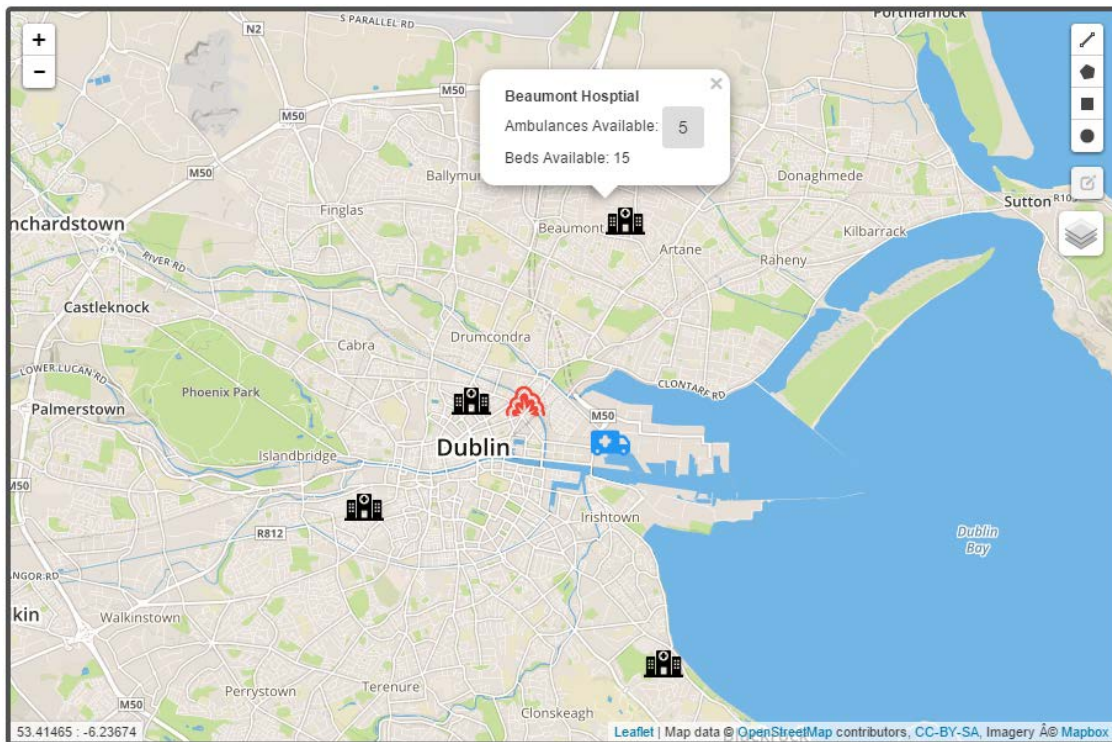
Figure 5 Map Interface

There are also a number of sidebars that can be activated by selecting the corresponding option in the menu bar along the top of the screen.
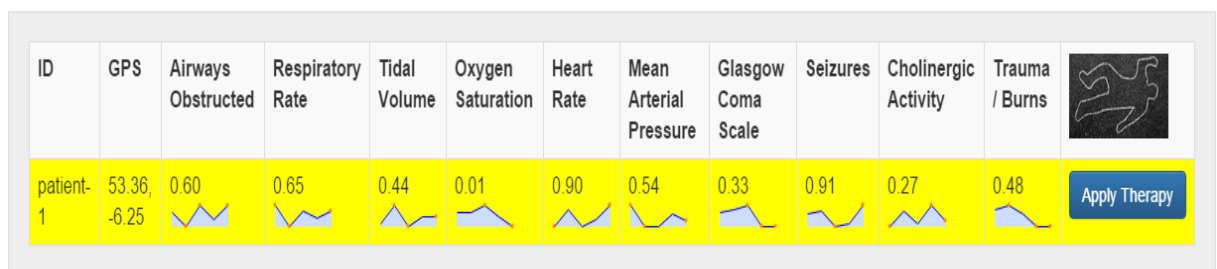

ID	GPS	Airways Obstructed	Respiratory Rate	Tidal Volume	Oxygen Saturation	Heart Rate	Mean Arterial Pressure	Glasgow Coma Scale	Seizures	Cholinergic Activity	Trauma / Burns	
patient-1	53.36, -6.25	0.60	0.65	0.44	0.01	0.90	0.54	0.33	0.91	0.27	0.48	Apply Therapy

Figure 6 Patient Health Attributes

Name	St James
Beds	15
Ambulances	6
Model	2
Facility Type	Public Hospital
Cardiology	true
Emergency Services	true
Infectious Diseases	false
Critical Care	true
General Surgery	true
Plastics	false

Figure 7 Hospital Facilities

These include:

1. List of Hospitals in the area, with a quick view showing how many beds and ambulances they have available. In order to view more detailed information about the hospital you can click on each of them to get a list of the hospitals resources and facilities displayed on the left side of the screen.

2. List of Patients at the scene, with a quick view showing their triage code of red, yellow, green or black depending on their health status. You can get more detailed information about the patients' health attributes (if available) by clicking on their name. This is then displayed on the bottom of the screen with spark lines representing the evolution of their health over time, as well as a space for a photo of the patient, sent in from the mobile app being used by the first responders.

   There is also a button that allows you to apply treatment to the patient, which

uses the Biomatematica web service to model the effects of this.

3. List of ambulances currently deployed, with a quick view showing their current location and how many patients they have on board.
   Again if you click on the ambulance you can get more detailed information along the bottom of the screen. Also if an ambulance is currently on route, be it to the emergency, or to a hospital, then there is a progress bar displayed showing the how soon the ambulance will be arriving. This information is gathered from the Google maps directions API.

4. There is also a chat room, which can be displayed in the side bar, where the participants in the MPORG can talk to each other and coordinate activities etc.

5. The current time is displayed in the top right hand corner of the screen, this also includes a slider button, where you can speed up or slow down time. The ambulance journey times get automatically updated in response to this.
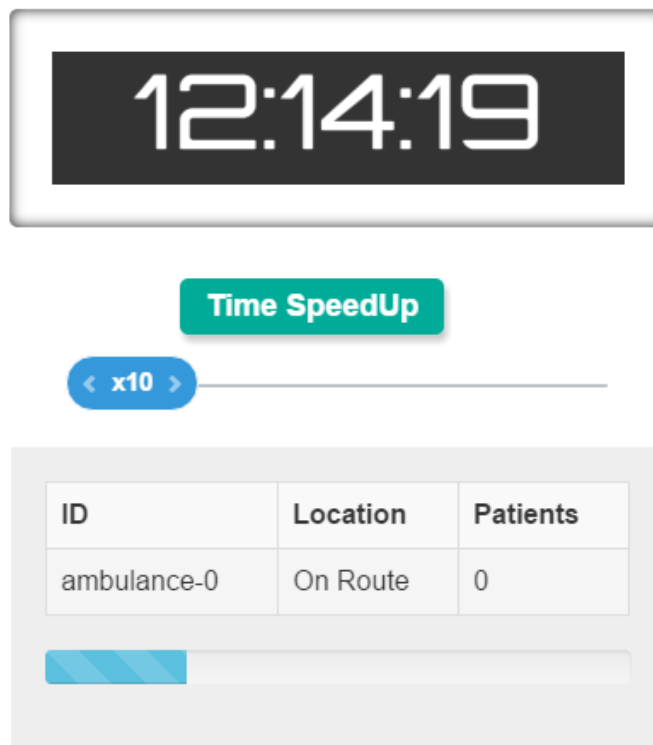
Figure 8 Time (with Speed Control)

The user can also get similar quick view information by clicking on resource icons on

the map, this is then displayed in the form of a pop-up which can then be used to deploy the resource, such as assigning a patient to an ambulance, or dispatching an ambulance to the hospital.

There is also the ability to draw lines and polygons onto the map to divide it into different sections, as well as filtering the resources currently being displayed on the screen by their type.

This can be done by selecting the options in top right hand side of the map.

4.5   MPORG Component Technologies

4.5.1   MPORG List of core technologies

The core technologies selected for the implementation of the software component are:

- HTML5
- Javascript
- Java (Apache Tomcat)
- Maven

4.5.2   MPORG 3rd Party libraries and licenses

Below is a list of third party libraries/frameworks used and the licenses under which they are distributed.

Table 2 MPORG 3rd Party Libraries

Product	Version	Vendor	License
Tomcat	8.0	Apache	Apache License Version 2.0
jQuery	1.11	jQuery Foundation	MIT License
Bootstrap	3.3	Bootstrap	MIT License
Leaflet.js	0.73	Vladimir Agafonkin	BSD-2-Clause

5 Learning Management System

5.1 Overview

The second technique and tool that shall be used by PULSE for the training of end users will be a dedicated Learning Management System (LMS) otherwise known as a Virtual Learning Environment (VLE). The LMS will be combined with a Learning Record Store (LRS) to provide support for modern tracking of a wide variety of learning experiences within the PULSE training system. The integrated LRS confirms to the TinCan/xAPI. The tool shall be available through an internet accessible web site which is managed and run by the PULSE partner, Skytek, for the duration of the training activity. This system will allow for trainees to undertake remote training and self-paced training activities if they are unable to travel to the classroom based sessions or wish to perform additional preparatory training in advance of the PULSE trials.

The PULSE training system shall be accessed via the following URL from a standard web browser:

---

http://training.pulse.skytek.com

Five demonstration accounts have been created within the system.

Access details are:

Username: **demo1** through to **demo5** inclusive

Password: **Pulse2016!**

Additional dedicated accounts with linked email address can be requested through an request to 'info@skytek.com'

5.2 Features

The main features of the LMS/LRS from the PULSE trainer's point of view are as follows:

- Define a PULSE training course to be undertaken and upload content either through PowerPoint presentations, HTML, Wiki content or fully interactive courses.
- Support for courses developed using SCORM compliant authoring environments.
- Assignment of the course to selected trainee
- Monitoring of course progress of individual trainees
- Assign course work to trainees
- Automatic gathering of interactive examination results from trainees

- Assignment of practical activities to trainees
- Management of different trainee groups and related courses
- Centralised and automated administration
- Provision of course both in the classroom and remotely through a web based interface
- Use of authoring tools for PULSE course development
- Integration of social media tools for communication with PULSE trainees
- Different question types in courses automatically graded i.e. multiple choice, true/false, fill in the blank etc.
- Awarding of certification to PULSE trainee on completion of training course.

The main features of the PULSE LMS/LRS system from a trainee point of view are:
- Access to the training course material both at home and while at the training site.
- Use of standard web browser and PC for access to training material
- Automatic assignment of courses to be completed
- Review of completion state of different courses to be undertaken
- Individual training plan assigned from the trainer to a trainee
- Interactive training and simulation through courses
- Support tools to contact trainer
- Social media tools to discuss courses and content with other trainees.
- Online news
- Online quiz
- Wiki
- Instant messaging
- Secure access through username/password
- Integration of training experience data from the PULSE system with other training system.

5.3 Functionality

5.3.1 Login

On initial access to the system the end user is presented with a login page maintaining access to the system only for accredited PULSE trainees who have requested and being provided accounts.

Figure 9 Login page for PULSE online LMS training system

When a user successfully logs into the PULSE training system their home page provides access to the main services of the system along with the courses which they have been approved access to. A sample end user screenshot is shown in the following figure:

Figure 10 Home page for end users with courses and support services

Figure 11Trainee can review all courses currently assigned to them

For example, a user has access to general news feeds on the site, which provide details on when classroom PULSE training sessions are being held and location of classroom within the emergency training hospital.
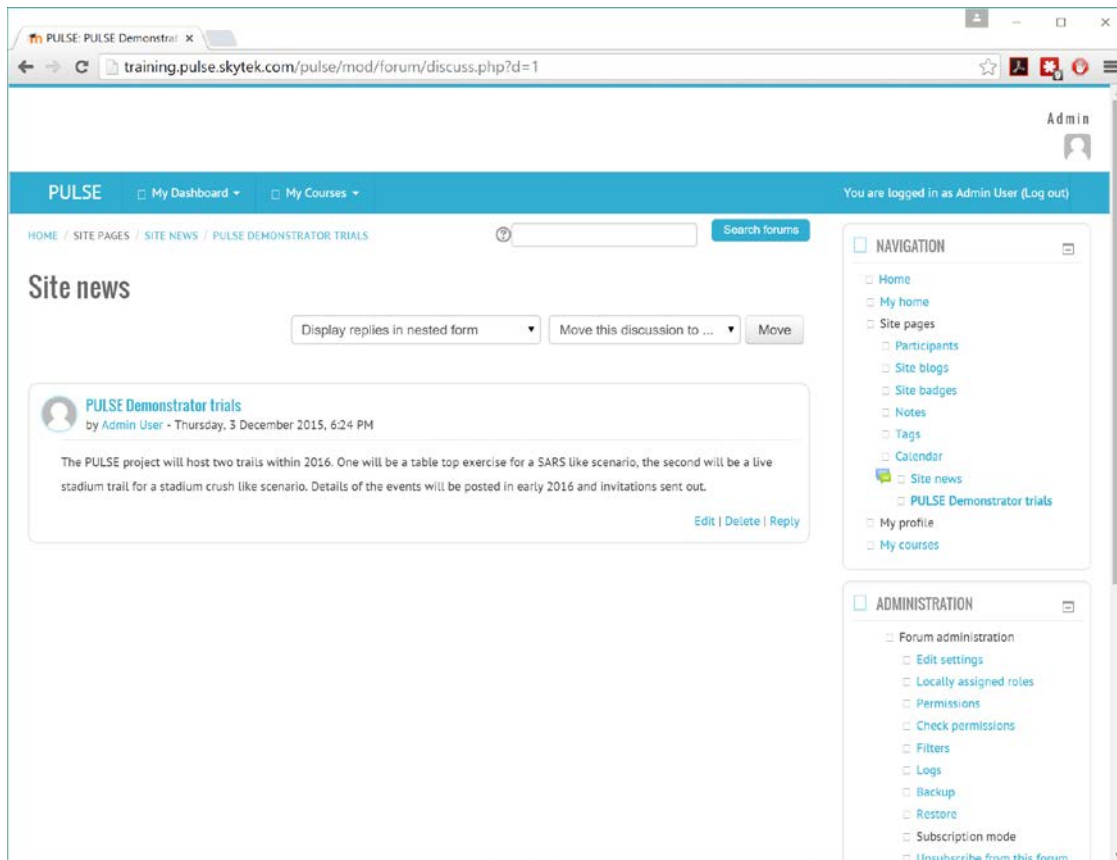
Figure 12 News sections of the PULSE training system

The system provides a large variety of activities that can be accessed by the trainer to provide powerful services to the PULSE end user undergoing training. Examples of the range of activities provided by the PULSE LMS/LRS are shown in the following screenshot.
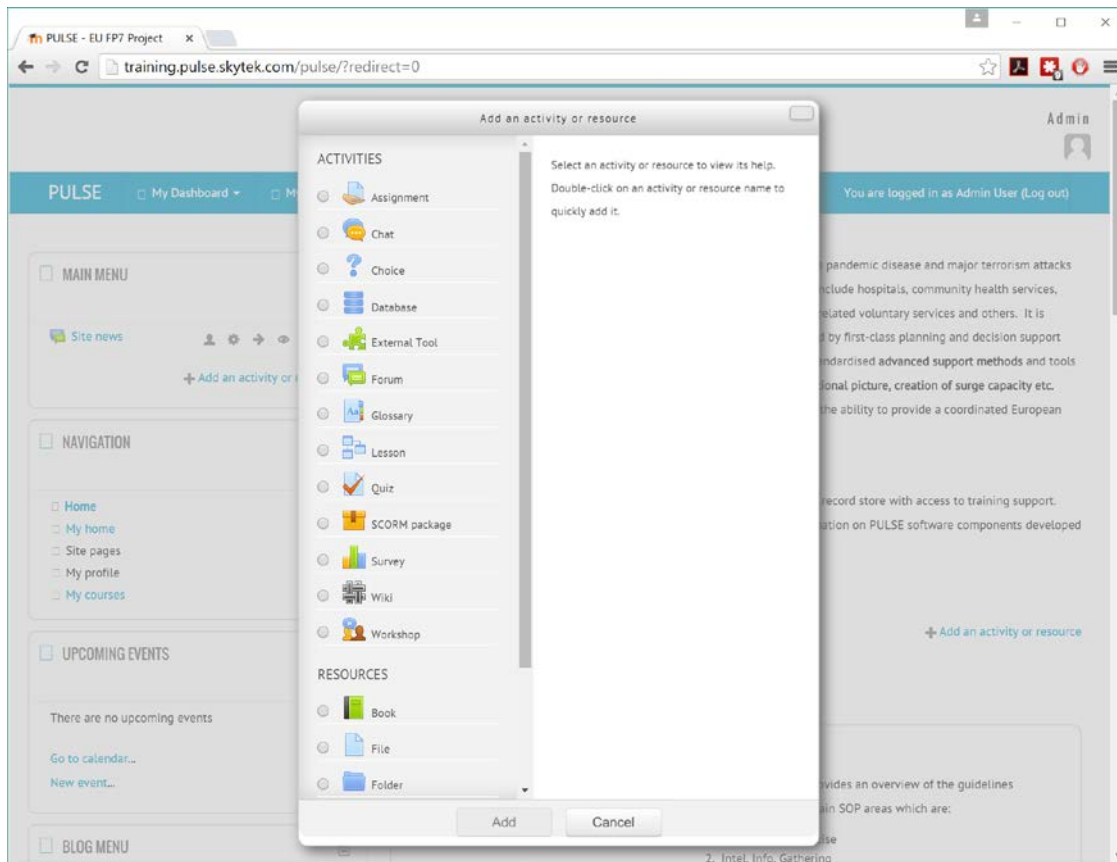
Figure 13 List of activities provided by PULSE LMS

5.3.2 Schedule

The proposed schedule for the training activities is guided by the preparation of the different categories of end users to be proficient in the usage of the PULSE operational procedures and components during the execution of the SARS like event trial activities.

Therefore, in advance of the trial execution, the trainees organised into the different core grouping must have undertaken the initial set of training courses that have been defined by the curriculum as outlined in the following section. Upon execution of the trial the training courses and content shall be updated with recommendations and finding.

It is planned that all classroom training sessions will be performed over a week long period held at least 3 weeks before the start of the trial. The trainee will also have access to the online LMS system from the start of the classroom-training period through to the completion of the trial and for a number of weeks after the trial has completed. The provision of the service after the trial completion will allow feedback on trained standard operational procedures, processes, interfaces and features

In addition to the above timeline the following additional constraints must be taken into account in the provision of dates for the execution of the training plan:

- The project availability of major components as inputs for the creation of the training material and related training exercises. For example, the training plan is heavily reliant on the WP4 components. To prepare the training

material these components interfaces and functionality must be finalised and available in time for access by the course trainer to prepare the course material for presentation in advance of the trial execution. An absolute minimum of one month is required for the finalisation of the component features and the completion of the trainer's analysis and course material preparation.

- The availability of facilities and classrooms at the time period presented for training purposes. This assumes that classroom (training rooms) to handle the number of personnel requiring classroom training are available, with the related workstation access for interactive training which are networked to required simulation tools.

5.3.3 Evaluation

5.3.3.1 Metrics

The key metrics for the evaluation of end users on their understanding of the training contents within the different PULSE training sessions shall be to use the results automatically captured from the PULSE LMS/LRS questionnaire system which shall be performed by the end users at the end of a training session. These questionnaires take the form of a variety of interactive statements where the user is queried on their knowledge of the domain being trained. E.g. Usage of the PULSE surge capacity component features in addition to interface elements. Through several different techniques for example multiple choice, true/false, fill in the blank etc. the user will be ranked on the knowledge of the system. The score shall be automatically calculated and returned to the trainer for evaluation. The trainer may optionally impose a threshold that the trainee must achieve for course completion and certification award but this is still to be determined.

5.3.3.2 Strategy

There will be no specific evaluation of the trainees (i.e. through written examination/interview) who have performed the PULSE training courses, apart from the automatic monitoring of the proficiency of the end users in understanding of the concepts via the LMS/LRS system as stated above.

Feedback on the quality of the end users opinion of the training activities will be performed through the use of a Learning Questionnaire (LQ). The key questions that will be asked within the LQ are:

- What they learned from the training course?
- What they have been usefully reminded of?
- What was not included that they expected to be included?
- What they would like to have been included?

A score ranking system will be used to capture the level of response for each of the questions above and captured as part of the assessment on training quality within the PULSE project.

5.4 LMS/LRS Component Technologies

5.4.1 LMS/LRS List of core technologies

The core technologies selected for the implementation of the software component are:

- The Moodle course management system. [15]

5.4.2 LMS/LRS 3rd Party libraries and licenses

Below is a list of third party libraries/frameworks used and the licenses under which they are distributed.

Table 3 LMS/LRS 3rd Party Libraries

Product	Version	Vendor	License
Moodle	2.9.3	Moodle	GPL
TinCanLaunch	20150302	https://github.com/garemoko/moodle-mod_tincanlaunch	GPL

6 References

[1] PULSE Document of Work

[2] PULSE Project Deliverable – D2.1 Requirements specification

[3] PULSE Project Deliverable – D2.2 Use case specification

[4] PULSE Project Deliverable – D2.3 Requirements specification

[5] PULSE Project Deliverable – D4.1 DVST

[6] PULSE Project Deliverable – D4.2 IAT tool

[7] PULSE Project Deliverable – D4.3 Logistic tool

[8] PULSE Project Deliverable – D4.4 Surge capacity tool

[9] PULSE Project Deliverable – D4.6 Post crisis evaluation tool

[10]   PULSE Project Deliverable – D4.7 Event evaluation for biological event

[11]   Tomcat, http://tomcat.apache.org/

[12]   jQuery, https://jquery.org/

[13]   Bootstrap, http://getbootstrap.com/

[14]   Leaflet, http://leafletjs.com/

[15]   Moodle http://moodle.org