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Improving Risk Management
Integrated Project

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Managed by :	Simon CASE	BAE SYSTEMS	21/10/2005
Checked by:			
Approved by:	Claire MOSS / SP3 Leader	BAE SYSTEMS	21/10/2005
Released by:	Martine COUTURIER	EADS DS SA	21/10/2005

Project Coordinator

Company name EADS DS SA
Name of representative Martine COUTURIER
Address 6 rue Dewoitine, BP 14
F-78142 Vélizy Villacoublay Cedex FRANCE
Phone number +33 (0)1 34 63 73 51
E-mail
Project WEB site http://www.oasis-fp6.org/

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1 OVERVIEW

This document provides an overview to the design documents in SP3.
SP3 aims to provide functionality in the areas of:

- Situational awareness (SP3.2). Commanders and other emergency operatives effectiveness is greatly enhanced if they have a good view of the emergency as it unfolds over time. By combining information from a variety of sources users can have an improved picture of the emergency and hence make better decisions. Situational awareness addresses this need.
- Collaborative planning (SP3.3). In a disaster many different agencies must be co-ordinated to provide an effective response. Furthermore, typically generic emergency response plans will already have been prepared for particular types of disasters. Collaborative planning allows commanders to construct a concrete plan from a pre-existing generic one, and assign tasks across agencies to implement the plan.
- Operational monitoring (SP3.4). To construct plans and make amendments to plans commanders need to know the status of resources such as ambulance or police units. Operational monitoring maintains an up-to-date database of which units are currently available and when occupied units are expected to become available.
- TSO editor (SP3.5). Particularly early on in an emergency there may be no communications networks available. Operators in the field will therefore have no access to the situational awareness components described above. The TSO (tactical situation object) editor is a lightweight method for providing situational awareness information in these circumstances. The editor is a standalone application which can run on a laptop or portable device and can display the current situation. Importantly, the current situation can be written to a small file and then taken in disk or memory stick format to a user, who can then view the current situation.

The situational awareness work-package is further divided into sub-work-packages for handling data from multiple sources including legacy sources (SP3.2.2), creating a common operating picture (SP3.2.4), prioritising information from the common operating picture (SP3.2.6), and an editor for viewing/amending a Tactical Shared Object (SP3.2.3).
The collaborative planning work-package is broken into sub-work-packages for planning (SP3.3.1) and tasking (SP3.3.2).
Operational monitoring is also further broken-down into work-packages for activity monitoring (SP3.4.1) and resource management (SP3.4.2).

The following sections describe in further detail what the main modules for SP3 will be.

1.1 Situational Awareness

In an emergency situation information is distributed across many different databases and information sources. Typically individual emergency agencies will have their own systems for maintaining the whereabouts of units and resources, or important static information such as the locations of hospitals or bridges. Users at all levels of the response can benefit from a wider view of the situation, but in particular effective planning and response to an emergency is improved if users have a view on all the relevant data. The aim of SP3.2 is to produce such

a *Common Operating Picture* (COP) by enabling the interoperation of different existing systems. The COP will enable the storage and regular update of all the information received by the legacy information sources and OASIS nodes on the OASIS network. The COP will hold a real-time "picture" of the crisis and use information fusion techniques to consolidate information.

In order to achieve this, the module will provide a common format into which data can be mapped. The format must be such that it is appropriate for the information needs of a distributed operation. Furthermore, since crises are infrequent events, we cannot expect connectors to information sources to be updated with every change in the data model. Therefore, the approach will handle data from connectors for previous versions of the data model. This will maintain interoperability even as the data model changes due to lessons learned over time.

Once data is in a common format, the system will resolve conflicts where different sources report on the same object in the world with different information such as discrepancies in position or strength of a fire. The resolution of these data conflicts will depend on the nature of the data to be resolved. In some cases automatic means such as averaging might be appropriate; in others it may be necessary to make another observation depending on the importance and severity of the information.

The diagram in Figure 1 shows a general approach for achieving information fusion. The purple circles represent information sources which may be existing systems such as a police database, or may be another OASIS node. Information from these sources is converted by a wrapper to a format based on the ontology representing the data model. Items of information are then passed to a model consistency layer which detects inconsistencies between new data and data already in the database. This layer identifies the strategy for fusion for this type of information, and after resolving the conflict makes changes to the database. The database, which corresponds to the current Common Operating Picture, is then available to other services which can access the database through an interface.

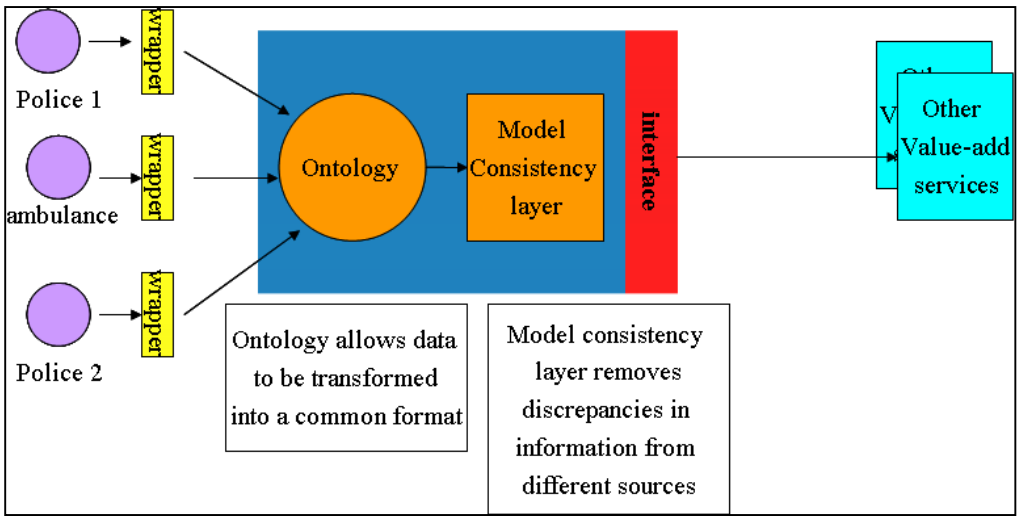

Figure 1: Information Fusion

In addition, different users will have different information needs; therefore different views on the combined database will be necessary for different types of users. Thus a strategic commander will see certain types of data, such as positions of groups of units across a large geographical area, whereas an operational commander will see the positions of individual units in a small geographical area. Therefore this design includes information prioritisation services to allow these views to be constructed.

1.2 Situation Summary HMI

The situational awareness component provides a database of information about the current situation which other services can use. The situation summary HMI is one such service. The purpose of the situation summary HMI is to allow users such as strategic commanders to make structured reports on the situation at a given time. A commander may for example wish to record the situation for 12:00am on a certain day. The user selects which items in the COP they wish to include in the report, for example all ambulances, hospitals and casualties within a certain geographical area, and the situation summary HMI generates and saves a copy of this report. Thus this component enables a record of different views on the situation to be made throughout the emergency.

1.3 Collaborative Planning and Tasking

The main objective of the "Collaborative Planning" component is to provide a user-friendly environment to support the rapid generation of action plans in a collaborative environment during the emergency phase, the transition phase and the recovery phase of crisis. The component allows the development of generic plans that can be used as templates when it is necessary to react to the emergency. No reference to real places or real resources is performed during this phase: the generic plans describe how to react to a hypothetical event which has occurred in a type of area. For example, a generic plan describes how to react to an explosion

in a chemical factory placed near a small town and an activity could be “send ambulances to the factory”.
When a real disaster occurs it is important to have a prepared generic plan that may be distributed to the in-the-field users: starting the rescue phase from an existing plan reduces the reaction time and improving the results of the interventions.

The main objective of the “Tasking” component is to provide a user-friendly environment to coordinate and support the implementation of the plans, based on the generic plans created during the planning phase, by discharging the tasks to fulfil the actions and to deliver the required co-ordinated effects during the emergency phases, the transition phase and the recovery phase of crisis. The component therefore allows tasks to be assigned to individual people and resources and provides methods by which the progress of each task can be monitored.

Generally this component will be used during the emergency phase, when tasks are assigned to the in-the-field users. In this phase, the tasks are very specific and can have a geographical reference: according to the example a real task could be “send ambulances number A33 and A42 to the chemical factory in Oxford road”. Real assets, real people and real places are involved for the execution of real plans.

1.4 Resource Management

The objective of the "Resource Management" work package is to provide functionality for maintaining information about resources and their status. Resources can be items such as vehicles, people and facilities. For example this work package will contain services for finding out whether a rescue team is available, or when a given team will next become available.

Specifically the resource management component will provide the following services:

- Resource Manager: provides the services for adding, updating, deleting, querying and retrieving information about resources
- Resource Management HMI: provides the user interface to manage resources; this includes the capability to display information about resources including their status, position and further specific resource attributes
- Resource Inventory Manager: provides services for creating, populating and deleting OASIS Resource Inventories. Information on resources is, as far as possible, fetched from existing Legacy System Inventories.

The "Resource Management" contributed by EADS Germany (EDG), will be based on functionality provided by EDG's Joint Command Control Information System (JoCCIS) using the logical data model of the "Land C2 Information Exchange Data Model (LC2IEDM)" from the Multilateral Interoperability Programme (MIP)

1.5 TSO Editor

In many emergency situations communications networks may not be available, particularly in the first phases of the response. The TSO editor allows users to view and edit a picture of the current situation from a laptop. The concept is that users of the TSO editor can receive

updates of the current situation through files on a disk or memory stick. They can view these files on their laptop and make amendments according to their view of the situation. Any updated versions of the situational picture can be sent back to a command post via a disk or memory stick and incorporated into the current common operational picture using the situational awareness components.

The TSO Editor will be an open-source application allowing creation, display and editing of Tactical Situation Objects (TSOs). The TSO Editor will only use freeware and open-source COTS components in order that after being developed can be distributed as an open source tool.

When the TSO Editor has a connection to OASIS, it will use the import/export TSO file services provided by OASIS. In this case, the TSO Editor will be able to display a tactical situation retrieved from OASIS by using its export service or to send to OASIS a tactical situation by using the OASIS import TSO file service.

The TSO Editor shall be able to perform all its functionalities, if necessary, without a working link to the operational OASIS nodes (instances) and by entities without access to operational OASIS nodes (instances). Thus it can receive a TSO file, for instance by e-mail, and without connection to OASIS, display a given tactical situation. Moreover, it allows the creation from scratch of a tactical situation to be placed into a TSO file. The editing and update of an existing TSO file shall also be possible.

The TSO Editor is fully visual, allowing the user to build/change/display a tactical situation in a visual manner. Its main window shall display a map with the typical GIS functionalities such as zoom, pan, read position, etc, plus functionalities to manage TSO physical files and functionalities allowing placing, displaying, removing and moving the TSO items like the event, resources and missions. The tactical situation built/changed by the referred functionalities can then be exported to a TSO file.

1.6 Activity Monitoring

Activity monitoring is a user interface which allows a user in a strategic command centre to follow relevant events within the common operating picture which are of particular interest to them. A user subscribes to a set of events which are of interest to them such as events related to hydrological and meteorological information or events in connection with the activity of crews in the field, such as the status of plans e.g. this vehicle is in place, this operation has finished, etc.

The component will display both textual and GIS information. For example a user may wish to monitor the water level at a number of places in a city. The interface contains textual information but also allows the user to call a GIS component, which will display geographical information against a map background.

This component also facilitates the dissemination of such information, by allowing information to be sent to relevant parties who do not have access to this component, but are connected to the data network for example by the TETRAPOL network.

2 SP3 INTERACTION FOR POS1

The different components in SP3 need to access each other to provide their functionality. The main interactions between components for POS1 can be seen in Figure 2. The green blocks are HMI (human-machine interaction) components, in this case graphical user interfaces. The purple blocks are the business logic (main information processing components.) Blocks in dark blue are OASIS applications which use a particular system.

Situational awareness functionality is accessed by a user either through the situation summary HMI, or in the case where there are no communications networks through the TSO editor .As can be seen the TSO editor can communicate with the Common Operating Picture. The communication here is by an import/export mechanism. For POS1 the common operating picture will not be implementing the full resource management data model. This functionality is expected to be provided in later versions. For this reason the situation summary HMI will take information from both the common operating picture and the resource management system to provide a situation summary. Because of the SOA architecture adopted in OASIS, other applications can access the common operating picture through the web-service interface.

Commanders are able to create and implement plans through the planning HMI. This is the front-end to the planning system. The planning system uses information in the resource management system to populate the plan.

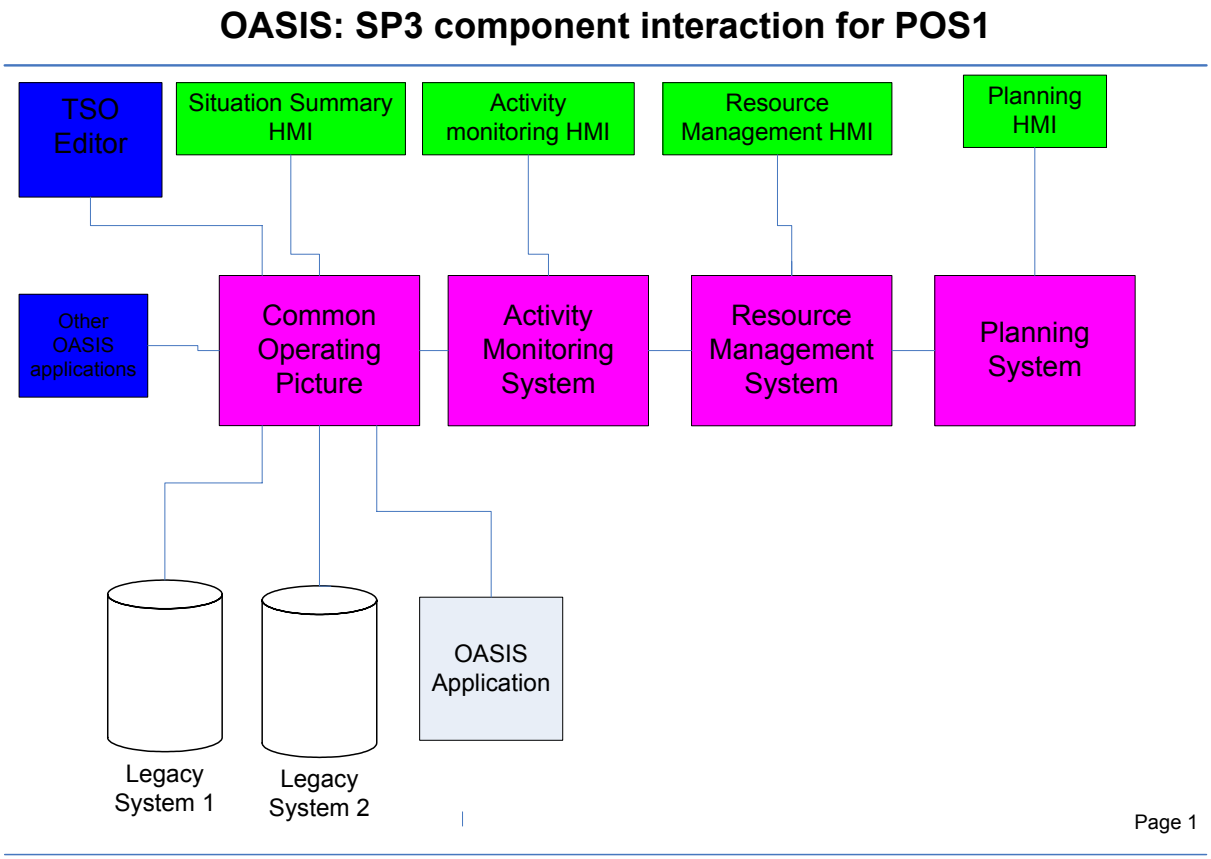

Figure 2: OASIS SP3 main component interactions

The resource management HMI allows commanders to view the status of resources (free, busy, ready in 10 minutes etc.) The resource management system handles all the processing of this information and passes this information to the planning system. Since for POS1 full resource information is not available in the common operating picture, the resource management system also passes resourcing information to the Activity Monitoring system.

The activity monitoring HMI provides a dynamic picture of the situation using information from the COP and the resource management system.

3 LOGICAL STRUCTURE OF SP3

This section shows the main linkages between work areas in SP3. The diagrams show connections between these components and other components in OASIS. SP3 components are highlighted. Readers may use this section to gain an overview of the interactions between components. For in-depth descriptions of these interactions, they are directed to the design document relating to the SP3 work area.

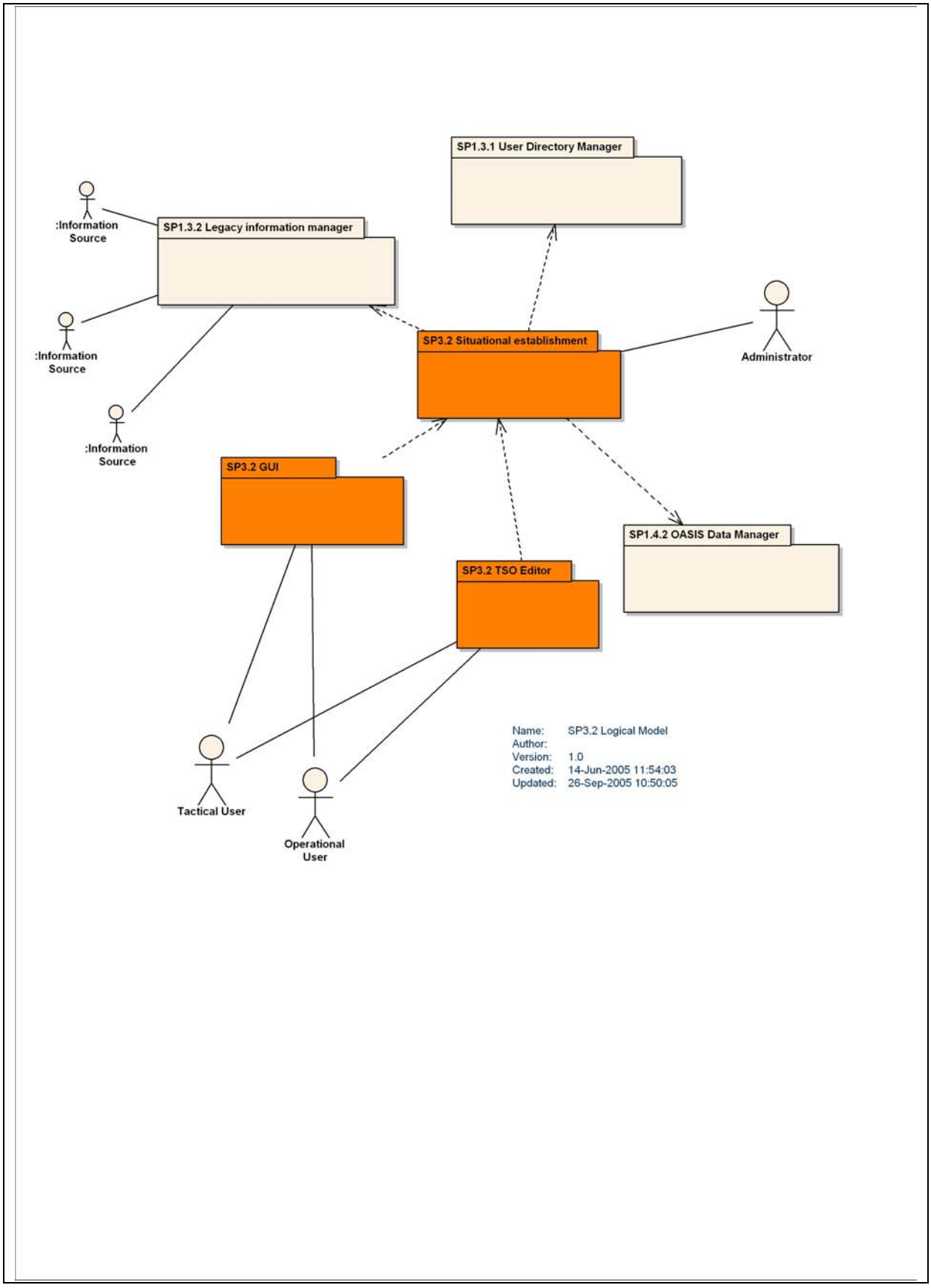

Figure 3: Situational Awareness and interactions with main components.

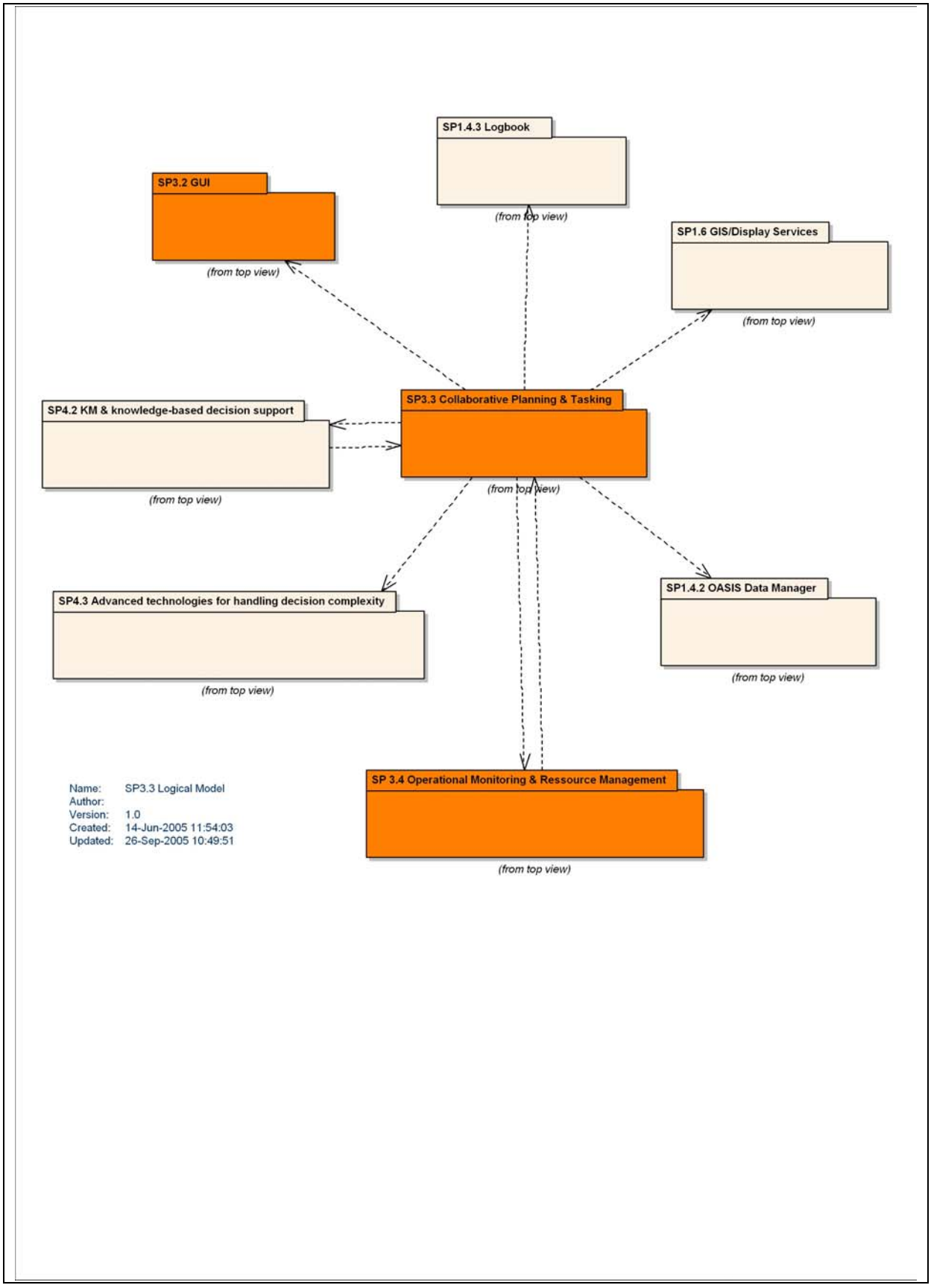

Figure 4: Collaborative planning and interactions with main components.

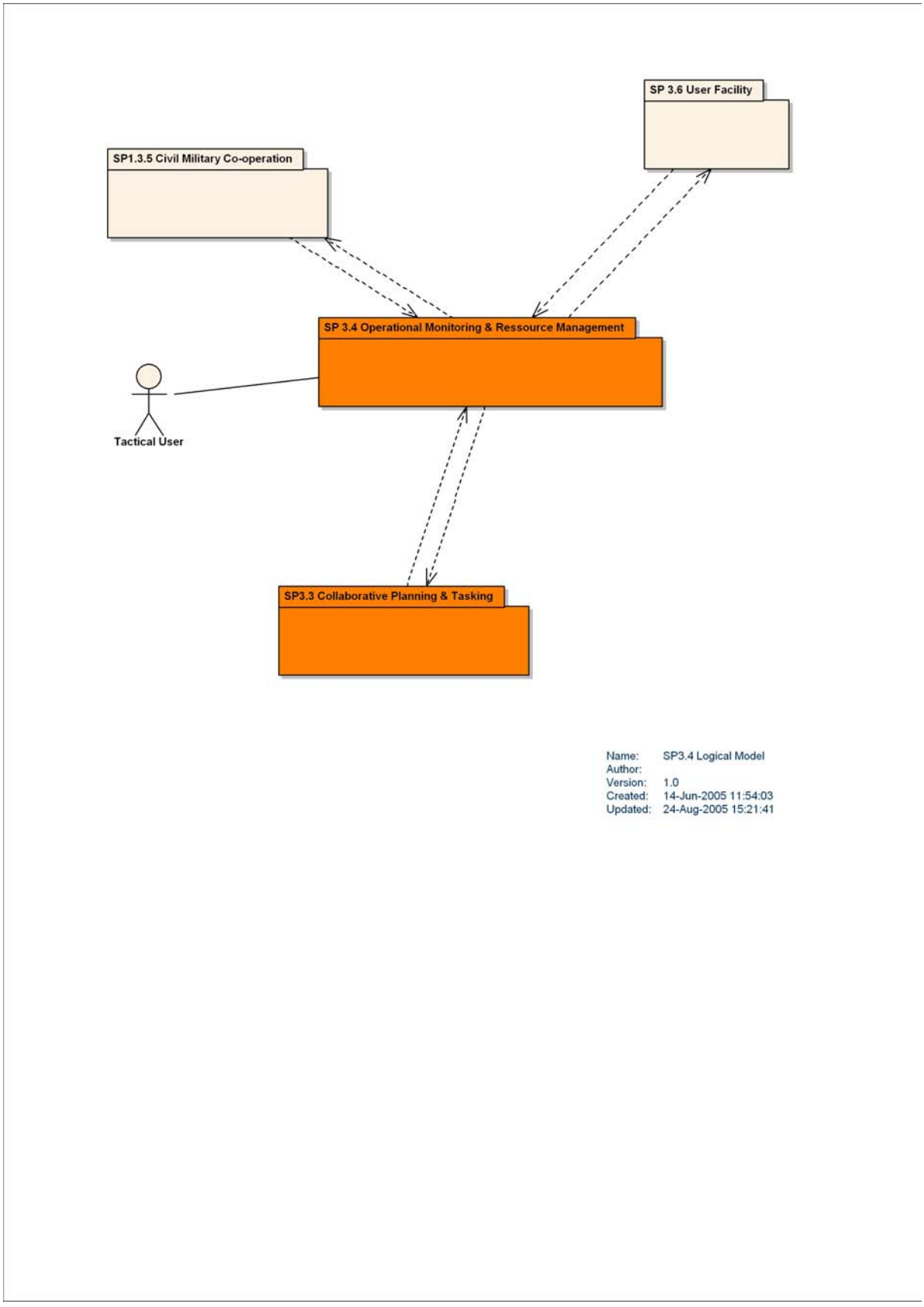

Figure 5: Resource Management and interactions with main components.

4 DESIGN DOCUMENTS

SP3 is a large sub-project with several main themes. Therefore to improve readability there are several design documents for SP3 corresponding to the main work areas from a design perspective. A work-area is a set of components within SP3 which are tightly coupled. Each document contains a description of the functionality of the work area and the design for those sub-components. Consequently, the design is divided into seven documents.

- This overview,
- A design document for SP3.2(situational awareness)
- A design document for the TSO editor (as part of SP3.5)
- A design document for the Situation Summary HMI (also part of SP3.2)
- A design document for SP3.3 (collaborative planning)
- A design document for SP3.4.1 (activity monitoring)
- A design document for SP3.4.2 (resource management)

To assist the reader this document contains a logical structure of the main interfaces between SP3 components and other OASIS components. However for a full description of these interfaces, the reader is directed to the design documents themselves.

4.1 Purpose of Design Documents

OASIS provides a common set of services for users in the emergency service domain. It has been decided that a *service-oriented architecture* (SOA) will be the approach for delivering these services. In such an approach functionality is exposed to other components by web interfaces usually with the use of a service directory (see the following link for further information:
http://webservices.xml.com/pub/a/ws/2001/04/04/webservices/index.html).

These documents provide the design for the Pre-Operational System (POS1) milestone in the OASIS system taking into account the SOA architecture. Therefore the documents describe the main functionality of each component in SP3. For each component a description is given of a) the interfaces it provides i.e. which functionality is made available to users of other services; and b) which interfaces it expects to be provided by other OASIS or non-OASIS services. The purpose is to ensure that in the case of a) proposed components provide the expected functionality for end-users and other OASIS components; and in the case of b) that services are provided by other components which will allow them to achieve the necessary functionality.

4.2 Structure of the Documents

Each design document follows the same structure.

- Overview – this section gives a description of the main functionality of the component.
- Glossary – a description of the terms used in the document. This section also contains a list of the roles of human actors in the sub-system.

- Assumptions – this section describes which assumptions have been made in creating the design document.
- Logical View – this section shows the interaction of the module with other modules in OASIS.
- Mini-scenarios – this section provides examples of the module in use in concrete situations
- Use-cases – this section describes the uses cases for the methods for each service.
- Interfaces to other SPs – has two sections. The first section "consumed interfaces" describes which interface methods the component expects from other OASIS services. The second section "provided interfaces" describes what functionality is exported to OASIS services. Designers of further services are directed to this section.
- Class Diagrams – contains UML diagrams of the main classes within the module
- Sequence Diagrams – contains UML sequence diagrams of method calls between components.
- Open Issues – contains a list of issues which have been raised. These may be resolved or still open.
- Appendices – Each design document may contain appendices of information relevant to this component only.