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A new perspective on Ambient Computing

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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)	

Integrated Project

Information Society Technologies

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3 Major Incidents Overview (MIO)

Note: *The MIO prototype is part of both WP8 and WP14. For that reason the presentation of the prototype in this deliverable (D52), and in the deliverables D48 and D50 are more or less identical*

The MIO prototype supports emergency responders (fire fighters, doctors, ambulance people and police) in obtaining and maintaining an updated overview of an incident and the ongoing emergency response process. The prototype is informed by studies of and can support emergency responders in all emergency responder's different work tasks – spanning from everyday public service tasks or minor incidents, to major events or emergencies.
MIO is designed to allow professionals to assemble large numbers of pervasive computing devices and services, to get an overview of their resources, and to get data from devices to produce an overview of the situation on the ground and thereby support collaboration.

3.1 MIO at the last review

At the year three review we showed the different aspects of the MIO prototype assemblies being worked on for the purpose of using it in the Tall Ships' Races in July 2007. So, the third year review demonstration was meant as a proof-of-concept of the set-up for the Tall Ships Races 2007. We showed the non-PalCom node Topos, with a 2D model of the harbour area, becoming the scene for the Tall Ships Races. We also showed some initial 3D modelling of specific buildings in the area. Moreover Topos was integrated with PalCom services and devices via a Topos gateway: We used the same video-camera set-up as was demonstrated in wp7, and via simulated positioning we showed how an on-line video-feet can be presented geo-referenced in Topos, e.g. to show where specific persons are situated. Moreover we demonstrated integration of the Wireless Biomonitoring system.

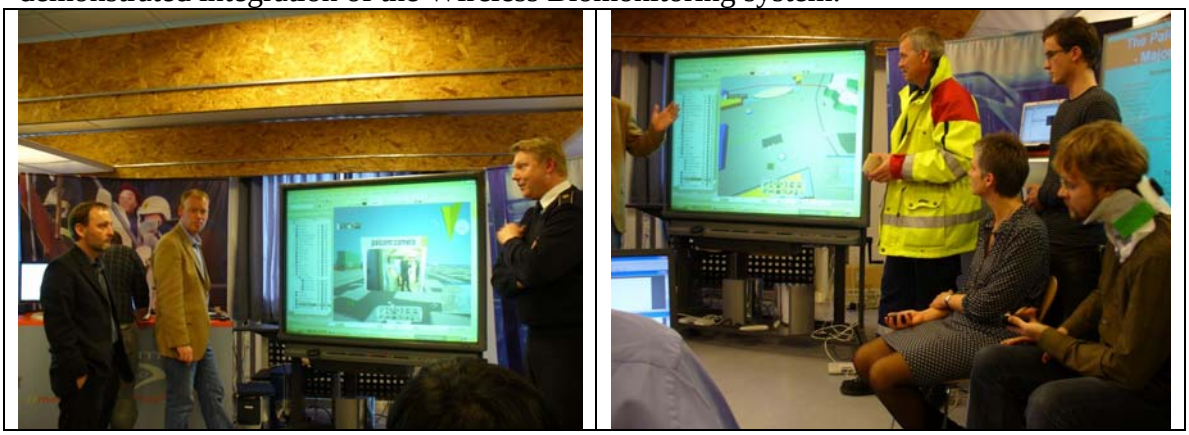


Figure #: MIO at Year Three review

3.2 Development during the year

After the proof-of-concept demonstration at the year three review, we put a lot of effort in turning MIO into a running prototype that would be meaningful – i.e. support the professional responder's work and collaboration – and make sense for them during the Tall Ships' Races. In this process we decided to concentrate on a prototype set-up mainly supporting the two groups of professionals playing the most essential roles during the Tall Ships Races' during "peace-time": the fire fighters and the police

officers. However we also had in mind the healthcare rescuers (doctors and ambulance staff). We focused on:

- Integration with several static video cameras
- Integration with a fully, within Topos, controllable video camera
- Integration with several Nokia N95 mobile phones, with GPS and camera functionality
- Physical design of equipment, especially regarding the video-cameras and the communication of data from them
- Tests of e.g. different network infrastructure and specific bearer solutions
- 3D modelling of the harbour within Topos
- Integration with GIS data, 3D terrains and aerial photography.
- Integration with the Automatic Identification System (AIS) (third party system)
- Storage services for GPS paths and periodic video still images

After Tall Ships' Races we have made a demo-version of the Tall Ships' Races set-up, e.g. with simulated GPS positions. This version is used in Siemens' lab in Munich and has moreover been used for different demonstrations in Denmark (e.g. the HI Industry 2007).

3.3 Current status of MIO

Here follows a description of MIO based on the set-up during the Tall Ships' Races 2007.
MIO consists of a number of PalCom devices and services integrating with and visualized through the 3D application, Topos™. In Topos PalCom-enabled resources can be shown geo-referenced in relation to 2D maps, GIS data and 3D terrains. We utilize data that the emergency agencies and their public service partner organizations (such as the council's planning and traffic engineering departments) already have. MIO, as described below, was implemented and used during the major event Tall ships' Races (TSR) in Aarhus, July 5th – 8th 2007.
Aerial photographies can be draped over a 3D terrain of the area of an event or emergency (Figure 7, item 1), so that real surfaces and existing buildings and vegetation are visible. GIS data draping and maps can be turned on or off for clarity (9). Additionally, the models and the GIS information of permanent and temporary structures (e.g. buildings and tents) can be inserted (3, 10). A GIS inspector enables users to search tabular GIS information. The boat-shaped models (5) represent the Tall Ships, indicating where they are *supposed* to dock before the start of the race. Live position tracking of different resources (e.g. ships via Automatic Identification System (AIS – see (6)) and people via their mobile phones (4)), is enabled via signals from various PalCom positioning services. Sketching functionality enables users to make drawings of e.g. newly decided access roads or cordoning off (not shown).

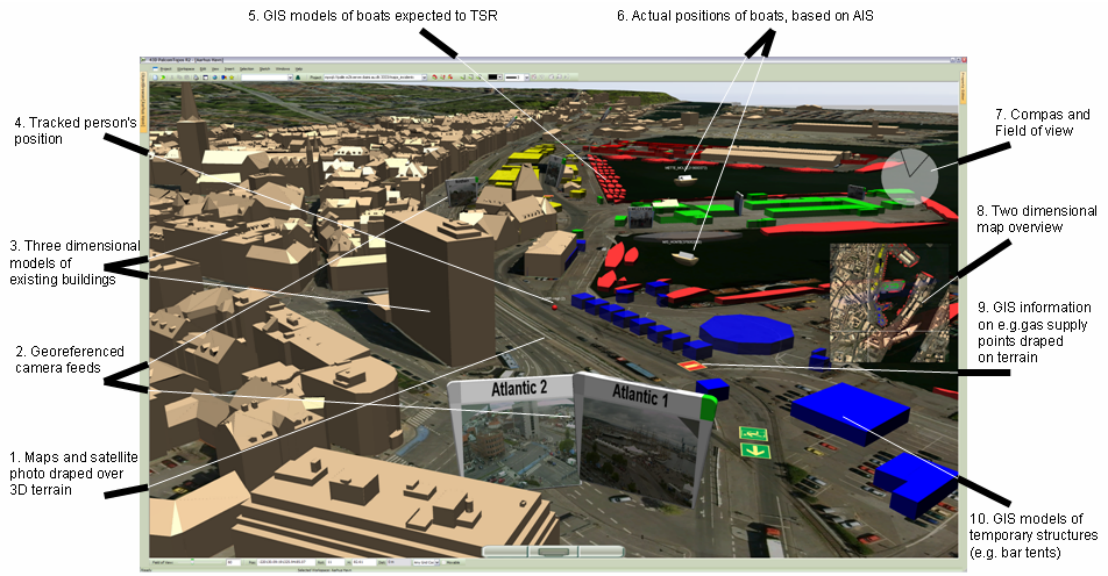
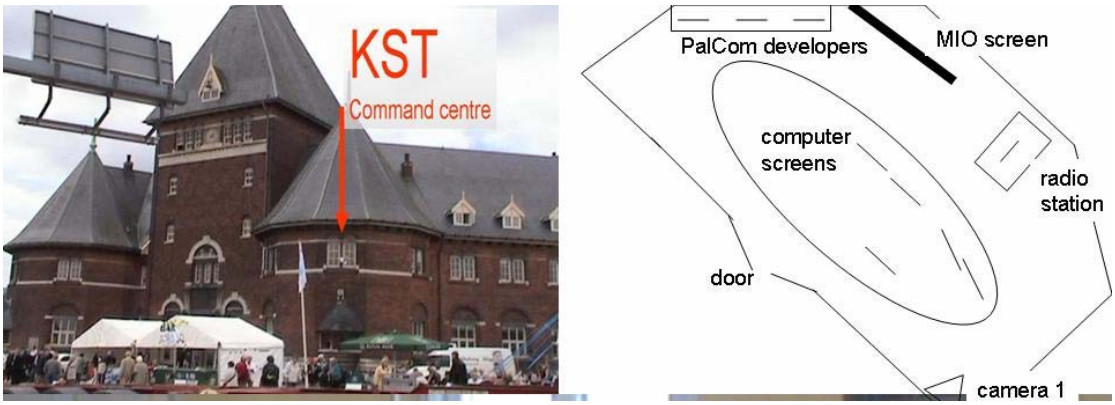


Figure 1: MIO in 3D mode

The screenshot, taken on the day before the TSR event shows that two ships are arriving in the harbour (6) The small white 'boxes' that can be seen on top of these representations are the associated radar transponder AIS (Automatic Identification System) retrieved locations, that is, the ship's *actual* position. Live streaming of video and still images captured through GPS tracked mobile phones can also be shown at geo-referenced positions (2). A 2D Overview (8) provides at-a-glance awareness of one's own position within the model, and a 2D Bird's eye mode (not shown) enables easy navigation.

MIO was set up in and around the command centre established in the strategically located old customs house at the harbour (Figure 8). In the command centre the large smartboard screen was used to display the Topos model, to sketch and discuss on the model and images sent by personnel on the ground, to interact with the devices and to interrogate them. In addition, three computers were used, mainly by developers, to monitor the status of devices within the MIO assembly and to support the staff in using MIO.



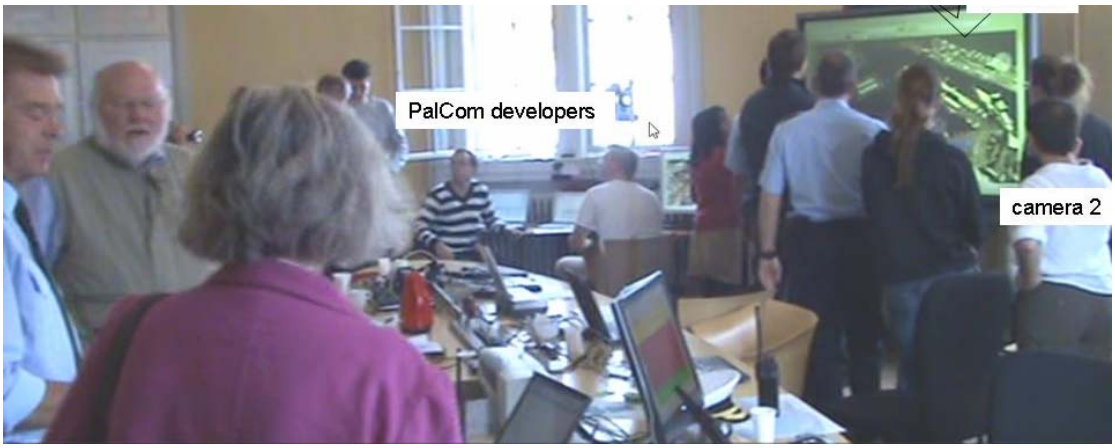


Figure 2: The Tall Ships' Race command centre with MIO, and a view of the harbour during the preparations for the event

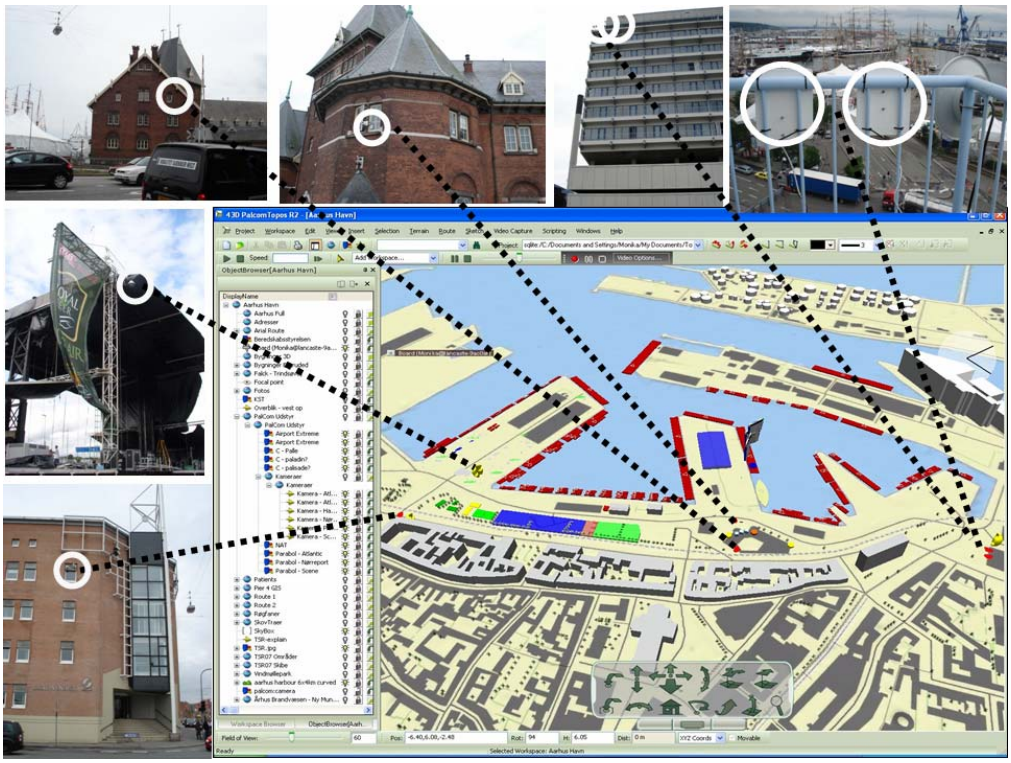


Figure 3: Web-cams on Tall Ships' Race

Figure 4: Tracked person (Jens Fonseca) and boat with rescue divers. Pictures taken by tracked personnel in top left corner

Figure 5: Pictures taken of patrolling officers, sent to and presented in Topos in command centre

Six geo-positioned video cameras were assembled into the MIO application via PalCom services: five fixed web cams and a remote controllable dome-camera, all mounted in strategically important places (Figure 9). So too were six Nokia N95 phones incorporating GPS, four of which were carried by different officers on patrol in the event area, while the fifth was on a rigid inflatable boat (RIB) patrolling the harbour with rescue divers (Figure 10). Apart from being tracked via the phones' GPS unit, the officers also used the phones to take pictures of specific incidents they wanted to report to/discuss with the officers in the command centre. In the Topos application the images from the cameras (video and mobile phones) are geo-positioned according to the actual location of the cameras/officers. This enables staff at the command centre to see the live pictures in the context of the modeled surroundings. Figure 11 shows two examples on pictures used in managing the event. To ensure enough bandwidth for streaming video we set up our own wireless network with small directional satellite dishes.

The current system architecture is composed of three main assemblies, each of which is responsible for orchestrating different devices and associated services. The choice regarding the exact number of assemblies utilized relies solely on a logical and conceptual separation of the different functionalities offered. This enables the designers and users to maintain a proper overview of the different constituents. The first assembly is in charge of assembling the mobile phones, the web cameras and the 3rd party application, Topos™. Additionally, the assembly manages the task of registering and storing every GPS position received from every GPS enabled device participating in the assembly. This is achieved by means of the purely virtual GeoPathDumperService, i.e., no physical device is or needs to be associated with it. There are many such purely software-based services participating in the prototype. In the case of the mobile phones and their ability to take pictures and geo-reference these, a GeoConverterService and StorageService are used. Secondly, the AIS assembly manages the task of assembling AIS information from the AISService with

the Topos™ application. Thirdly, the GeoFrameDumper assembly manages the task of periodically storing images from every web camera assembled. Interaction with and status of services and devices can be carried out by use of different browsers (Figure 12 shows a screenshot from the Visual Browser).

The system architecture of the MIO prototype utilizes/challenges the PalCom open architecture in various ways. Firstly, it challenges it in relation to the scalability of the system, that is, the diverse and large number of devices and services involved. During the event at any given moment about 30-40 devices (though, not all directly PalCom-enabled) and 80-100 PalCom services were actively participating in the prototype. The prototype also requires the ability to dynamically start, restart, remove and add services on the fly while still maintaining crucial functionality. To maintain such a complex system, various inspection mechanisms at the architecture level and inspection tools utilizing these were required. An example on how the Visual Browser is used for that purpose is showed in Figure 10.

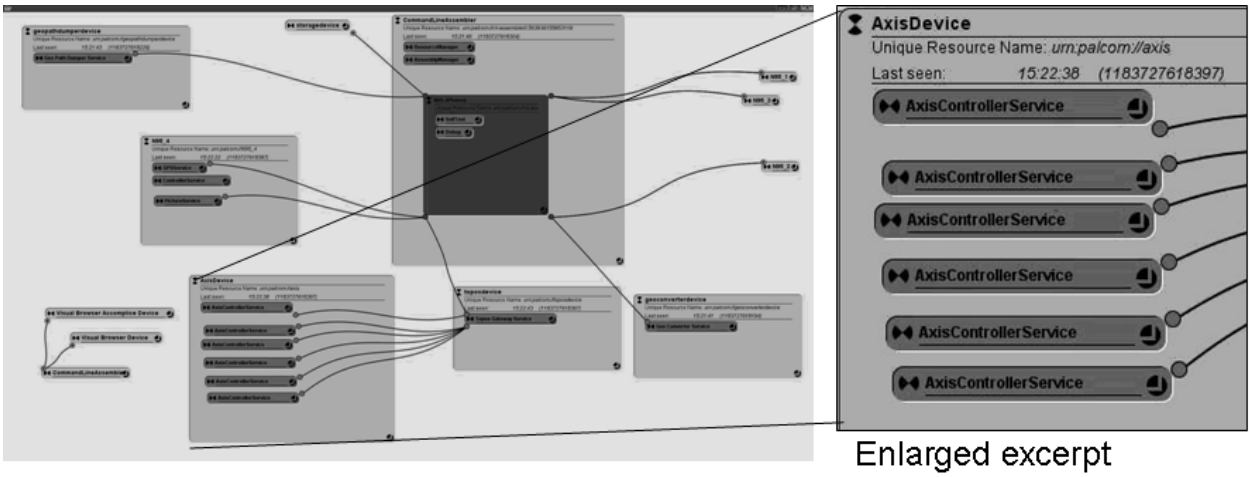


Figure 6: Screenshot of the Visual Browser showing all active/inactive devices, services and connections involved in the Overview prototype at TSR with some details of some devices and services unfolded (detail on the right, showing that there is one AxisControllerService for each of the six video-cameras)

3.4 Palpability in use

As described in the plan we have especially had the following PalCom challenges in mind:

- Change – stability in settings and situations that are highly dynamic, stressful, unexpected and unknown and where work has to be carried out immediately
- Understandability – scalability of palpable applications, meaning that the application(s) and the body of possible assemblies should be used and be useful in both small and large scale settings – and be understandable whatever 'level' of scale we have
- User control – automation in settings and situations as described above. What should be in control of the user and what should happen automatically, will possibly change, depending on the size of an incident. How to handle contingencies in these settings is of special interest.

However, all PalCom challenges have indeed been considered and dealt with in our work with MIO in Tall Ships' Races.

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