

# Chapter 18

## A SOA-Based System for Territory Monitoring

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### ABSTRACT

*This chapter outlines the functionalities of a system that integrates sensor data transmitted by a fleet of unmanned aircrafts for territorial surveillance and protection from natural disasters.*

*Some functions of the system are based on the Service Oriented Architecture paradigm (Erl, 2005) and follow Open Geospatial Consortium (OGC) standards (Open Geospatial Consortium) in the representation of geographical data in a multidimensional, spatiotemporal view.*

*Next is a presentation of the complete system architecture, followed by a discussion of the details of the various services. Amongst these services, management and simulation of tactical planning, management of data and streaming video, the system also presents a service for the annotation of the interested spatial objects. Annotation deploys the web services (Alonso, Casati, Kuno, & Machiraju, 2004) exported by OpenStreetMap (OpenStreetMap) with the purpose to exploit the on-line information sources continuously updated by the social networks communities.*

### INTRODUCTION

In the last ten years the Piedmont region, as like many other regions in Italy and in the world, have been subjected to an increased rate of natural

disasters due to frequent episodes of extreme and severe weather conditions that cause floods, landslides, windstorms, fires, earthquakes and tidal waves. In these circumstances, agencies that deal with civil protection need to react promptly and therefore must continuously monitor for just

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such emergencies and the environment conditions. Furthermore, in regions in which industrial and agricultural activities take place there is a strong need of environmental surveillance to guarantee protection against occurrences of water pollution, unauthorized waste disposal and dumping of dangerous materials.

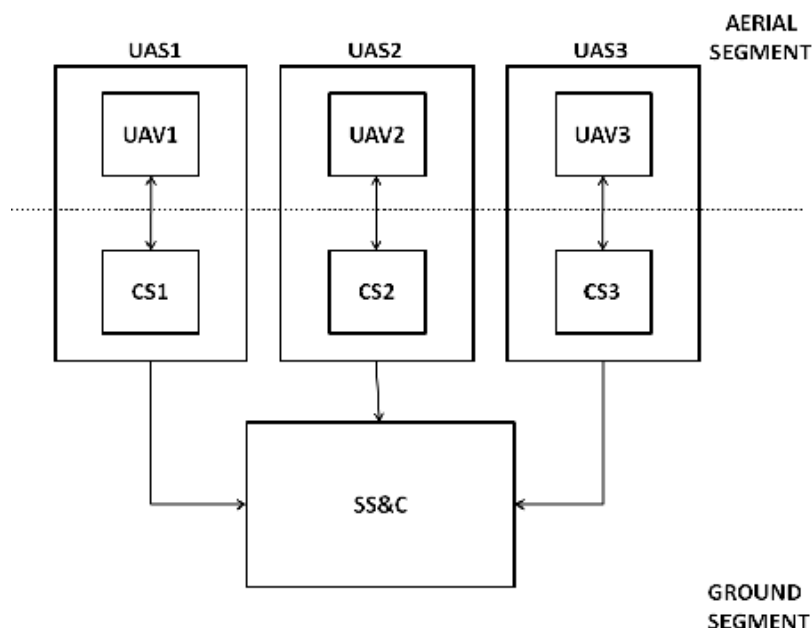
The case study addresses the geo-spatial services provided by the central station of the SMAT project<sup>1</sup>. SMAT is a distributed system that applies advanced monitoring of the territory for the prevention and control of a wide range of natural events (floods, landslides, fires) and also for environment protection against human intervention (traffic, urban planning, pollution and cultivation). The system will operate within the integrated organizational structures already in place (institutional or commercial) and will provide information in real time to the authorities responsible for civil protection and intervention in case of an emergency. Examples of these organizations are the government bodies of the Piedmont Region, Provinces, Civil Protection, municipality

and ARPA (the Regional Agency for the Prevention and the Environment).

SMAT has the aim to perform territory surveillance by means of Unmanned Aircraft Systems (UAS). SMAT is a *system of systems* since it controls and coordinates at least three different platforms, each responsible of a fleet composed by specific typology of Unmanned Aircraft Vehicle (UAV). A UAV is equipped with different payload sensors (radar, hyper-spectral, EO, infrared) that will download streaming video of the target territory. Each UAV will operate at different altitudes and thus obtain different benefits in terms of speed and persistence. The operative centers of each UAS (known as Control Station, CS), are already present on the territory and will exchange information with a Supervision and Coordination Station (SS&C).

Figure 1 shows the main components involved in the SMAT project. The aerial components are constituted by three different UAVs. The ground components are constituted by three control stations that are responsible for each UAV tactical

Figure 1. The SMAT architecture



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