

SYMPOSIUM ON INTEGRATED APPLICATIONS (B5)
Tools and Technology in Support of Integrated Applications (1)

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CAPSULE: A FAULT-TOLERANT MULTI-CLOUD STORAGE SERVICE FOR SATELLITE
IMAGERY.

Abstract

The satellite remote sensing technology is a key stone for the observation of earth phenomena and disaster management projects. This technology produces maps, geospatial data and satellite images, which represent a heritage for ground segment of space agencies. In this context, the mechanisms of the archive and distribution segment (ADS) that are crucial for the preservation of satellite imagery and for delivering images to any of research institutes, organizations or government departments. The cloud technology has been an outsourcing solution for ADS to face up the complexity in management of the satellite imagery in a cost-efficiency manner. However, security, lack of control of geospatial data and vendor lock-in are some the main obstacles for organizations to adopt this type of technology. This work describes Capsule: a fault-tolerant multi-cloud service for storing satellite images in a reliable and secure manner. This service manages the satellite images by using catalogs, which are abstractions describing the source of geospatial data arriving to ADS mechanisms from the ground segment. The catalogs are stored in virtual spaces called capsules, which are spread through different cloud storage locations. The capsules can be invoked by end-to-end applications installed in ADS segment for ensuring images before to send them to the cloud by using two basic services: The first one is an encoding/decoding mechanism based on information dispersal, which splits the images into redundant portions and send them to the cloud capsules; as a result, the systems of ADS can get access to satellite imagery even during the failure of a set of cloud storage location, which reduces the side-effects from lack of control of geospatial data as well as vendor lock-in as images are available during outages of the cloud storage service provider. The second service includes security cryptosystems based on policies and attributes for agencies to define access authorization policies over their satellite imagery depending on organizational dynamics. We performed a proof of concept through a Capsule prototype, which was evaluated by using a set of images captured by an antenna called ERIS placed at Chetumal, Mexico, which currently is managed by the Mexican Space Agency (AEM by Spanish Acronym) and an organization called ECOSUR. The evaluation reveals the feasibility, in terms of reliability, performance and confidentiality, of applying Capsule scheme to the management of satellite imagery. The Capsule scheme is a result of an ongoing research and development project for AEM.