Building High Performance MUSES Processing Systems in Amazon Web Services
Lewis Graham

Teledyne Brown Engineering created the Multi-User System for Earth Sensing (MUSES). Scheduled for launch in August 2016, MUSES will attach to the International Space Station (ISS). It is designed to host up to four robotically-installed Earth-observing instruments. The first instrument to be hosted by MUSES is developed by the German Space Agency (DLR). The DLR Earth Sensing Imaging Spectrometer (DESIS) is a 30 meter ground sample distance, 30 kilometer swath, imaging spectrometer with 235 bands ranging from 400 to 1,000 nm. DESIS will launch in early 2017.

GeoCue Group Inc. has been contracted by Teledyne to create a MUSES data processing, cataloging and archiving infrastructure. Building such an infrastructure prior to knowing the full complement of sensors that will eventually be hosted by MUSES, as well as the demand pattern of users, requires a “pluggable” systems architecture that will accommodate new sensors without the need to revise core system components. In addition, the deployment model must be able to automatically and elastically scale in an economic manner to accommodate a wide range of anticipated intake, processing and servicing demands.

To meet this rather unique set of requirements, we are designing a flexible system hosted in Amazon Web Services (AWS). While “cloud” hosted solutions for image cataloging and distribution have existed for more than a decade (consider the original USGS TerraServer project), the use of remote hosted systems for large scale image production has been minimal. Industry reluctance to embrace cloud services for this application area has been largely based on the high cost of data transfer (both in time and dollars) as well as a lack of scalable services that are amenable to image processing algorithms.

The array of hardware and software platform services available from cloud providers has greatly expanded in the past 24 months, making high performance, large data volume processing viable. In this presentation we review the general algorithm patterns of sensor-to-base product image processing and discuss how we have mapped those algorithms to capabilities within AWS. We also discuss the use of self-service ordering to drive back-end image production, creating a customer-driven “just-in-time” (JIT) processing workflow. Finally, we present flows for data staging and archiving based on the tradeoffs between the costs of various storage tiers versus the time lines required for data access.