

INTRODUCTION OF SYSTEM FOR SATELLITE IMAGERY INFORMATION MANAGEMENT

G. J. Chae*, G. W. Yoon, J. H. Park

ETRI Telematics Research Group, Daejeon, Korea – (cbase,gwyoony, jhp)@etri.re.kr

KEY WORDS: Databases, Archiving, Management, Hardware, Image, Imagery

ABSTRACT:

The high prices and lack of information for satellite images prevent researchers from studying remote sensing and most non-professional people doesn't have the simple and easy solutions for the manipulation of satellite images. "Satellite Imagery Information Management" system which is promoted by ETRI (Electronics and Telecommunications Research Institute) in Korea will provide the solutions for the above mentioned problems. Our system manages the satellite imagery information and provides the simple and easy software for the manipulation of satellite imagery information. We means the satellite imagery information as satellite images (Landsat, SPOT, JERS, Corona etc) and products(DEM, GCP, land cover map etc) using satellite images and other primitive sources in remote sensing. "Satellite Imagery Information Management" system consists of hardware and software system. Our hardware system consists of servers (web services and data processing), RAID (online data management) and Jukebox (nearline and offline data management). Software consists of four components: DRS (Data Registration Software), DMS (Data Management Software), DTS (Data Transfer Software), WS (Web Service). For the efficient service, we make the relation between four components and design the corresponding software. DRS has the following functions: analysis of head for satellite images and management data for products, generation of browser images and thumbnail images for raster data. DMS has the following functions: editing for metadata of satellite imagery information, control of RAID and Jukebox, backup for database and system. DTS has the following functions: online and offline transfer and media control. WS has the following functions: online color composition for Landsat images, online image treatment (zoom in and zoom out, image enhancement etc), order management etc. For the user's service, we will suggest the customized software service (e.g., geotiff image converter of Landsat image for each band) which users want to have for each work. This model of system for "Satellite Imagery Information Management" can be applied to the systems which handle large amount of data without converting the original data and promote the study of remote sensing about satellite images.

1. INTRODUCTION

Since satellite image has properties of high resolution and multispectral, it is originally used in the military and environmental field. But it is used more and more in the field of map production, agriculture, forestry, planning of national land, establishment of city plan, etc lately. Possibility of periodic data acquisition of satellite image and diverse satellite images between hyperspectral and high resolution satellite image makes the satellite images the important resource for the record of national land. So, it is necessary to preserve the satellite images which contain the change of geographic information, national land, and environment for the form of digital library or museum.

Though many government organizations, self-governing body and public research institution make use of satellite image and do its own project under the base of satellite image now in Korea, insufficient cooperation and co-work result in the overlapping purchases of satellite image widely. In addition, processing of satellite image is done using foreign software because of non-systematic management of the developed technology and these facts result in the mass budget waste for each year. For the solution of these problems, it is necessary to establish the service which gives and manages the information of satellite image systematically and distribute information to the institute which need freely.

"Integrated Management of Satellite Imagery Information" project which is being promoted by ETRI (Electronics and

Telecommunication Research Institute) in Korea will provide the solutions for the above mentioned problems. For the data construction, we will show the processing of standard for satellite imagery metadata in international domain and domestic domain. For the data management, we will introduce the hardware system for online, nearline and offline management system of data. Finally, you will experience the web service and off line service for data distribution.

2. TRENDS OF INTEGRATED MANAGEMENT OF SATELLITE IMAGERY INFORMATION

USGS (U.S. Geological Survey) has three Clearing houses for the distribution of data: EROS (Earth Resources Observation Systems) Data Center Clearinghouse Gateway, Alaska Geospatial Data Clearinghouse Gateway, and GLIS (Global Land Information System) Clearing Gateway. FGDS (Federal Geographic Data Committee) provides the metadata and distribution standard for the USGS.

The RESTEC (Remote Sensing Technology Center) in Japan has the role to perform data collection using ground station reception and processing and to perform analysis and research using the observed data. NASDA (National Space Development Agency of Japan) (which was merged to JAXA (Japan Aerospace Exploration Agency) in 2003) provides the

* Corresponding author. This is useful to know for communication with the appropriate person in cases with more than one author.

satellite image data and EORC (Earth Observation Research Center) provides the application software for the satellite image.

3. SATELLITE IMAGERY METADATA

3.1 State of standard for satellite imagery metadata

ISO/TC 211 Geographic information/Geomatics is responsible for the ISO geographic information series of standards. For the metadata about geographic information metadata, ISO 19115 defines the schema required for describing geographic information including satellite images and services. It provides information about the identification, the extent, the quality, the spatial and temporal schema, spatial reference, and distribution of digital geographic data.

ISO 19115 defines mandatory and conditional metadata sections, metadata entities, and metadata elements and optional metadata elements to allow for a more extensive standard description of geographic data, if required. It also provides a method for extending metadata to fit specialized needs. Figure 3 shows the UML of the ISO 19115.

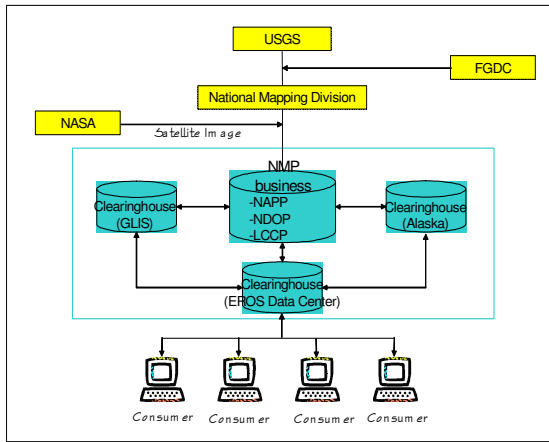


Figure 1 USA Satellite Imagery Information Service organization

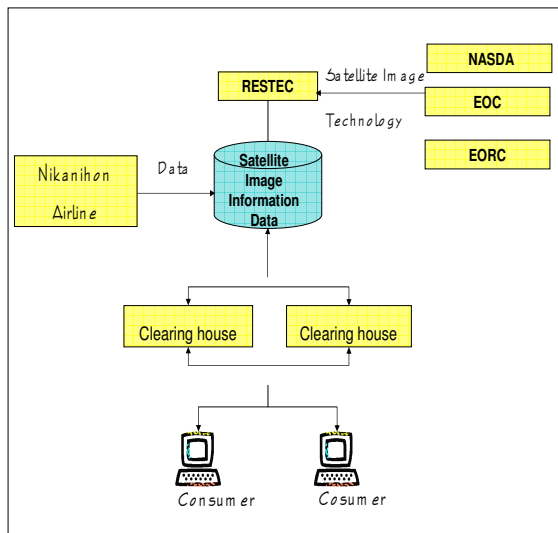


Figure 2 Japan Satellite Imagery Information Service Organization

For the foreign cases, we can note that the information of satellite image is systematically managed by the government.

For the domestic case, integrated management of satellite image information service is not constructed, but some institutes have their own search and distribution service and another institute distributes their own data for the institutes which needs them.

From these facts, the overall information of satellite image should be constructed for the efficient use of information of satellite image in KOREA. Though we cannot manage overall satellite images in Korea, this project will be the basis of the upcoming integrated management of satellite image information of Korea.

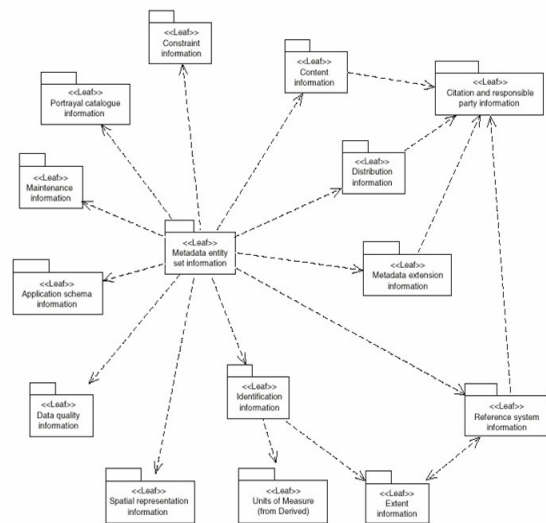


Figure 3 UML of ISO 19115

To complement standard to ISO 19115 Geographic information – Metadata, “ISO 19115 Part2” define metadata elements to support imagery, and gridded data and extend the UML model for metadata: it support the collection and processing of natural and synthetic imagery produced by remote sensing and other imaging processes.

In US, The Federal Geographic Data Committee approved the Content Standard for Digital Geospatial Metadata (FGDC-STD-001-1998) in June 1998. In Korea, TTA (Telecommunications Technology Association) approved the Metadata Standard for Geographic Information Distribution (TTAS.KO-10.0139) in December 2002. Since this standard add necessary items for distribution of geographic information to ISO 19115 which has target for metadata of vector data, it is necessary to add some items for satellite imagery information.

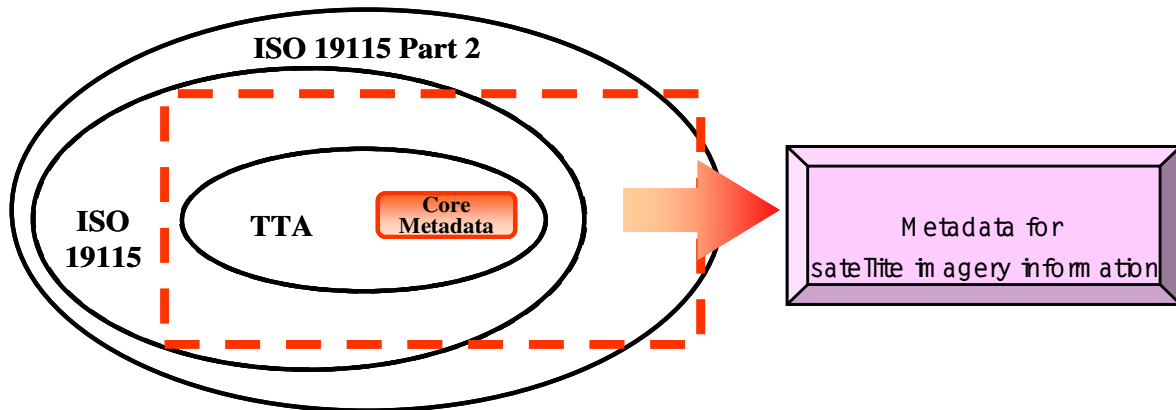


Figure 4 Metadata schema

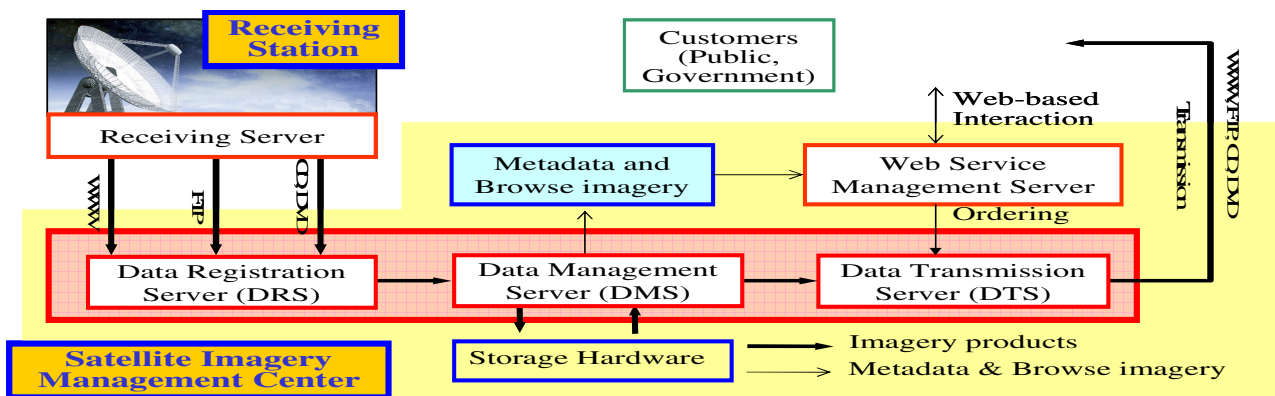


Figure 5 Model of Services

3.2 Metadata schema for our service

We analyzed the above international and domestic standard for metadata to design metadata of our satellite imagery information service. From these results, our metadata schema are based on the ISO 19115(international metadata standard for geographic information) and ISO 19115 part 2(extension of ISO 19115 for grid metadata) and we try to improve the domestic standard (Metadata Standard for Geographic Information Distribution (TTAS.KO-10.0139)) for applying the satellite imagery information. Figure 4 shows the metadata schema for our satellite imagery information

4. FUNCTIONS OF SERVICE

For the registration and management of data, we made the DRS (Data Registration Software), DMS (Data Management Software) and DTS (Data Transfer Software). The role of DRS is making the browser images and thumbnail images to view the brief image of large satellite images and extract the metadata from the diverse satellite images. The role of DMS is managing the raw data in hierarchical process. The role of DTS is distributing the raw data to users. Figure 6 shows our model of system for DRS, DMS and DTS.

4.1 Data Registration System

For registering the satellite imagery information, we have the following two strategies. We made the metadata of satellite imagery information from raw data if we have raw data. If we have no raw data, we will make the metadata information about the place of the raw data. For these purposes, the import things to consider is extract the common metadata for diverse satellite images. We design the DRS for the satellite images such as LANDSAT 2 ~ LANDSAT 7, CORONA, SPOT, JERS, KOMPSAT-1, IKONOS. For the core metadata of ISO 19115, we design the DRS to acquire the metadata almost automatically. Figure 6 shows the picture of DRS.

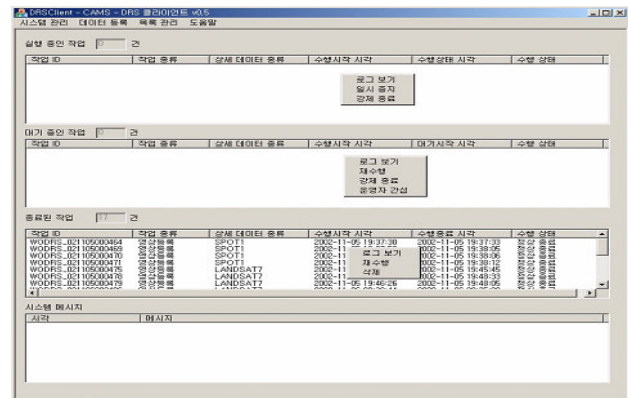


Figure 6 Data Registration

4.2 Data Management System

For managing the satellite imagery information, we design the structure of data in hierarchical process. Since the size of satellite imagery information is large, we register the satellite image in online. If the amount of online is 70 ~ 80% full, we move the satellite imagery information to the nearline. If the amount of nearline is 80% full, we draw the tape offline. The satellite image which use frequently want to service is on the online. For the safe of data, we backup the metadata, raw data, browser images and thumbnail images for periodic times. Figure 7 shows the picture of DMS.

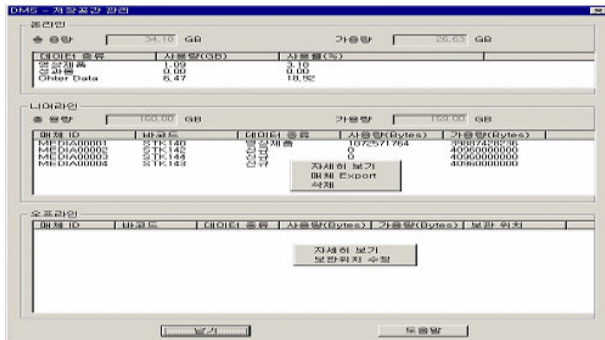


Figure 7 Data Management

4.3 Data Distribution and Web Services

For distributing the satellite imagery information to users, we design the DTS (Data Transfer Software). Since DTS and WS (Web Service) hold the information of users in common, DTS must be connected to the web service. When users search the satellite image which they want and order the satellite images, DTS receives the order. If operator accepts the order, DTS send the request to DMS for the raw data. If the requested data is on the online, DMS calls DTS to process the order. If the requested data is on the nearline state, DMS send the data which is on the nearline to the online. Figure 8 shows the picture of data order.

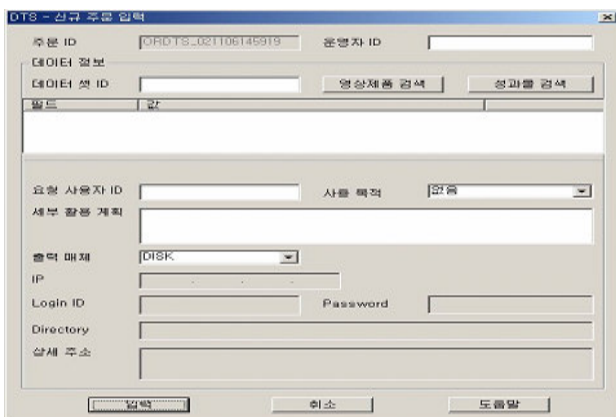


Figure 8 Data Order

For the Web Service, users can experience the educational contents for remote sensing including the practical exercise on web. Our service will offer the customized software service (e.g., geotiff image converter of Landsat image for each band) which

users want to have for each work even if they are unfamiliar with the remote sensing. Figure 9 shows the homepage of our service (<http://simc.etri.re.kr>)



Figure 9 Web Services

5. CONCLUSIONS

We are trying to expand the application of remote sensing in diversity sections and many person use the satellite imagery information management freely through the system of "Satellite Imagery Information Management". Our next step for business model is targeting to the distribution and development of user customized software for high resolution satellite images. We also update the DRS, DMS and DTS applicable to high resolution images.

6. REFERENCES

- USGS Home page, <http://www.usgs.gov>
- FGDC Home page, <http://www.fgdc.gov>
- RESTEC Home page, <http://www.restec.or.jp>
- JAXA Home page, <http://www.jaxa.jp>
- NGIC Home page, <http://www.ngic.go.kr>
- ISO/TC 211 Geographic information/Geomatics Home page, <http://www.isotc211.org/>
- SIMC Home page, <http://simc.etri.re.kr>