Supplementary

Conversion of Access Protocol

Because the specified access protocol of access protocol and enhanced Earth Observation Metadata profile model (APEOPM) is exposed to the interface of a Sensor Observation Service (SOS), so the implementation of the conversion between the heterogeneous EO data system and the interface of the SOS web service is essential. By analyzing the inherent interfaces of the SOS web service, we know that SOS includes three mandatory operations, GetCapabilities, GetObservation and RegisterSensor operations. A user obtains the observation data and metadata information from the sensor via the GetObservation operation. However, the request should be converted because the GetObservation request cannot be interpreted by the data system. Specifically, the implementation should convert the GetObservation request to a request to meet the access protocol of the data system. In the GetObservation request, the spatial and temporal extent compose the main content, including <beginPosition> </beginPosition>, <endPosition></endPosition>, <lowerCorner></lowerCorner> and <upperCorner> </upperCorner>. In the access protocol conversion process, the temporal and spatial range is important for accessing the EO data system and the data product type is necessary. Three parameters, the Temporal, spatial and data product type, are adequate for data system access protocol conversions and other necessary parameters, including the login username and login password, which are included during the implementation of the configuration file of the adapter in EO data systems and do not need to be illustrated in the conversion.

In the case of the National Aeronautics and Space Administration Earth Observing System Clearing House (NASA ECHO) data system, the access protocol is the Web services Definition Language file (WSDL) interface. The application program will be generated through the WSDL, which will allow us to log onto the data system, query the data system, and log out of the data system. The rule of the data system access protocol conversion of NASA ECHO is shown in Table S1. IIMSAQL is the specific query language of the NASA ECHO data system. Users or applicants can construct query sentences by using IIMSAQL to query the NASA ECHO data system and obtain the desired data product.

Conversion of the EO data system access protocol allows a general user to obtain desired data without the user knowing the data system access portal. Moreover, mapping enables fast searching and retrieval by using the standardized Open GIS Consortium catalogue interface.

Table S1. The access protocol conversion of the data system of NASA ECHO.

Query Options		Path Query Conditions
Time Start	SOS	/GetObservation/eventTime/Time_During/TimePeriod/beginPosition
	IIMSAQL	/query/where/granuleCondition/temporal/startDate
Time End	SOS	/GetObservation/eventTime/Time_During/TimePeriod/endPosition
	IIMSAQL	/query/where/granuleCondition/temporal/endDate
Spatial Extent	SOS	/GetObservation/BBox/Envelope/lowerCorner /GetObservation/BBox/Envelope/upperCorner
	IIMSAQL	/query/where/granuleCondition/spatial/IIMSPolygon/IIMSLRing/IIMSPoint

Unified Modeling Language (UML) Diagram

According to the description structure of the seven-tuple node information, the common metadata features and their data types and constraint conditions are defined in the UML diagram shown in Figure S1. In the UML diagram, the father class is APEOPM_EOP while APEOPM_geolocation, APEOPM_Platform, APEOPM_ProductTag, APEOPM_ProductMetadata and APEOPM_ProductQuality inherit the father class. APEOPM_geolocation presents information regarding the geolocation observation product, APEOPM_Plaform presents information regarding the earth observation platform, and APEOPM_ProductTag presents information regarding the product tag, such as product identification and product name. Furthermore, APEOPM_ProductMetadata presents product metadata information. According to the UML diagram, the schema can be generated using open source software, such as eclipse. The APEOPM_EOP object instantiated from the APEOPM_EOP class can be applied in program design and development. The enhanced EOP encoding document covers most metadata attributes that exist in the EO data system archiving metadata, which can guarantee the integrity of the recorded metadata archived in the EO data system. From the UML diagram, the common, essential and straightforward attributes of remote sensing sensors, namely, satellite and earth observation products and metadata from remote sensing images, are defined. In addition, the legend reveals the relationship between two different classes in the class diagram.
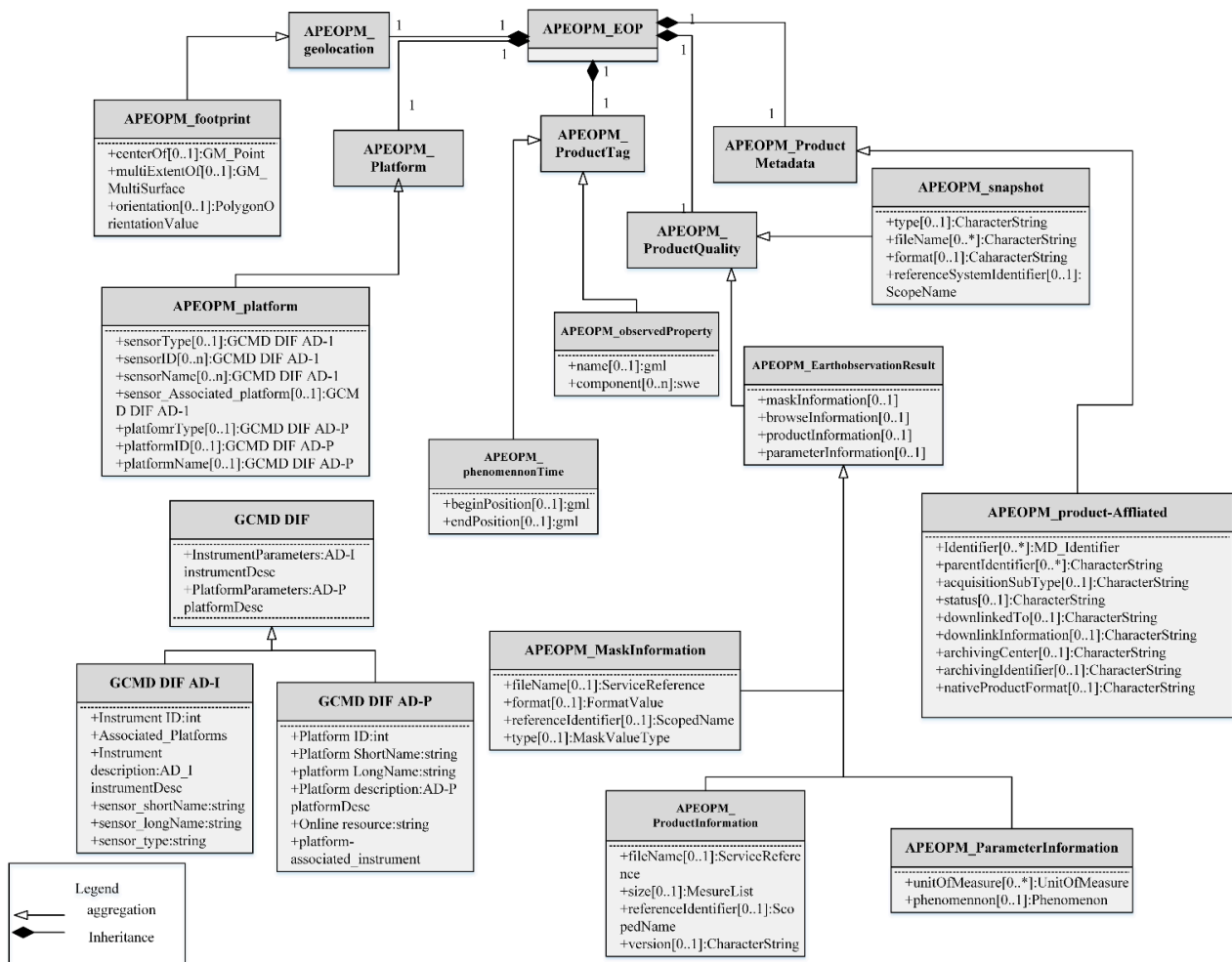

Figure S1. UML diagram of the enhanced EOP meta-model.