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The Geoscience Internet of Things

K. Lehnert (1) and J. Klump (2)

(1) Columbia University, Lamont-Doherty Earth Observatory, Palisades, United States (lehnert@ldeo.columbia.edu), (2) GFZ German Research Centre For Geosciences, Telegrafenberg, D-14473 Potsdam

Internet of Things is a term that refers to "uniquely identifiable objects (things) and their virtual representations in an Internet-like structure" (Wikipedia). We here use the term to describe new and innovative ways to integrate physical samples in the Earth Sciences into the emerging digital infrastructures that are developed to support research and education in the Geosciences.

Many Earth Science data are acquired on solid earth samples through observations and experiments conducted in the field or in the lab. The application and long-term utility of sample-based data for science is critically dependent on (a) the availability of information (metadata) about the samples such as geographical location where the sample was collected, time of sampling, sampling method, etc. (b) links between the different data types available for individual samples that are dispersed in the literature and in digital data repositories, and (c) access to the samples themselves. Neither of these requirements could be achieved in the past due to incomplete documentation of samples in publications, use of ambiguous sample names, and the lack of a central catalog that allows researchers to find a sample's archiving location. New internet-based capabilities have been developed over the past few years for the registration and unique identification of samples that make it possible to overcome these problems.

Services for the registration and unique identification of samples are provided by the System for Earth Sample Registration SESAR (www.geosamples.org). SESAR developed the International Geo Sample Number, or IGSN, as a unique identifier for samples and specimens collected from our natural environment. Since December 2011, the IGSN is governed by an international organization, the IGSN eV (www.igsn.org), which endorses and promotes an internationally unified approach for registration and discovery of physical specimens in the Geoscience community and is establishing a new modular and scalable architecture for the IGSN to advance global implementation.

Use of the IGSN will, for the first time, allow to establish links between samples (or the digital representation of them), data acquired on these samples, and the publications that report these data. Samples can be linked to a dataset by including IGSNs in the metadata record of a dataset's DOI® when the dataset is registered with the DOI® system for unique identification. Links between datasets and publications already have been implemented based on dataset DOIs® between some Geoscience journals and data centers that are Publication Agents in the DataCite consortium (www.datacite.org). Links between IGSNs, dataset DOIs, and publication DOIs will in the future allow researchers to find and access with a single query and without ambiguity all data acquired on a specific sample across the entire literature.