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maXML: COORDINATING MINE ACTION WITH XML TECHNOLOGIES

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The Mine Action XML (maXML) is an Extensible Markup Language (XML) schema developed by the Geneva International Centre for Humanitarian Demining (GICHD). It aims to standardize data management and data exchange among actors in the mine action community, which includes individuals and groups involved in any aspect of addressing the landmine and explosive remnants of war (ERW) contamination. In this field, data exchange is mostly manual and often has to deal with chaotic environments. The goal of maXML is to contribute to the automatization of many of these processes, saving valuable time for staff in the field and improving the information flow for decision makers who have to allocate resources for land clearance activities. The maXML vocabulary provides a formal definition of the terminology used in this domain and an initial set of tools and services that produce and consume maXML data.

Provided by the GICHD as an information management system, the maXML schema was originally created in 2002 by identifying data that members of the mine action community were interested in sharing. This was done through interviews and by reviewing various mine action information systems, standards, and processes. Since then, maXML has been further developed by adding vocabulary that reflects the developments of the data in the Information Management System for Mine Action (IMSMA). The rationale behind the exchange format was to allow each organization to retain their established data management practices but still facilitate data sharing with GICHD and other collaborators. The problem maXML addresses is facilitating data exchange between humanitarian actors in a way so that (a) data can be accessed in a standardized way, (b) standardized terminology and identifiers for commonly used entities can be defined, and (c) the use of those identifiers is supported at the time of reporting.

RELATED WORK

Data exchange between different actors has been a challenge both for GICHD and the humanitarian field as a whole. GICHD and other organizations tried to address different aspects of this problem by developing multiple data collection and management systems. Over the past few years, several different standards for data exchange in the humanitarian domain were developed.

The **Humanitarian Exchange Language** (HXL) tries to collate data regarding humanitarian needs and response activities conducted by a large number of humanitarian actors. HXL, inspired by social-media hashtags, is a simple standard that adds hashtags to spreadsheet headers to make it easier to share and compare humanitarian data.[1] maXML is a completely different approach since it converts user-entered data to XML structures and then shares them (by exporting/importing functionalities) with other compatible systems.

The **Emergency Data Exchange Language** (EDXL) is a collection of XML-based messaging standards initiated by the U.S. Department of Homeland Security and developed by the Organization for the Advancement of Structured Information Standards (OASIS).[2] EDXL consists of different components that specify how to exchange data about distributions, resources, hospital availability, situation reporting, and tracking of emergency patients. As the name suggests, EDXL was designed to speed up the direct communication between the different actors in an immediate emergency (e.g., when an ambulance quickly needs to find a hospital nearby that can accept a patient). maXML, in contrast, focuses on standardizing and streamlining data reporting in long-term humanitarian operations. It provides a method to track information such as affected population, education provided, quality management (QM), clearance activities, etc.

The **International Aid Transparency Initiative** (IATI) is an effort that targets the transparency of development aid spending.[3] It consists of an XML schema for describing an organization involved in any stage development cooperation (funding, implementing, etc.) and an XML schema for describing the details of individual development cooperation activities and projects. maXML goes beyond organizations and activities and focuses also on affected populations and victims, education and victim assistance provided, land clearance activities performed, etc.

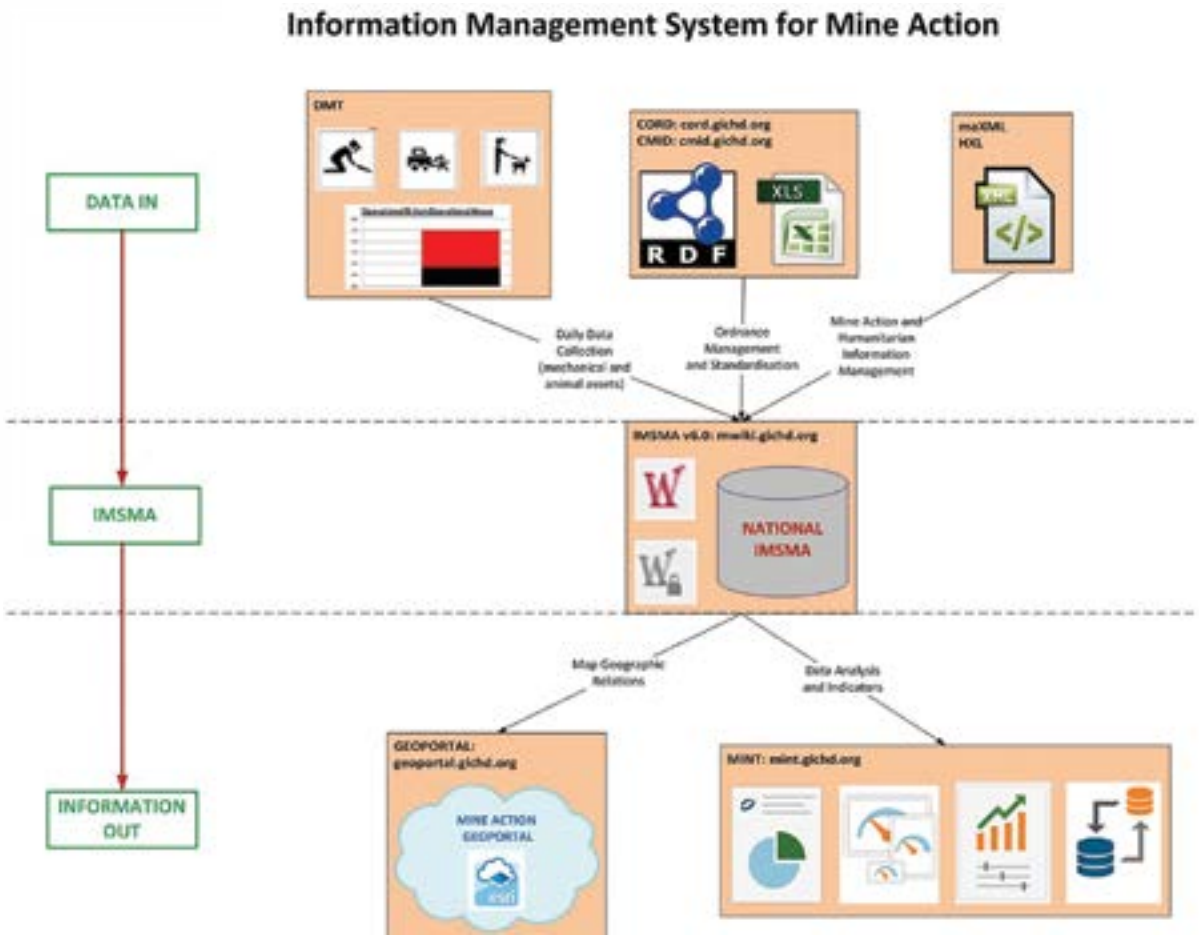

Figure 1. IMSMA Architecture.
All graphics courtesy of GICHD.

The **Geography Markup Language** (GML) is a version of XML that handles geographic features and enables open format communication of geographic data. In 2006, the Croatian Mine Action Center (CROMAC) coordinated with Geofoto LLC to develop a geoinformation system used for a digital visualization and analysis of geographic features and events.[4] maXML is a broader XML schema since it provides additional information on top of the geo data.

The **Ushahidi Platform** uses the Management Of A Crisis (MOAC) vocabulary and collects and visualizes information while enabling interactive mapping.[5,6] It allows individuals to share their stories on their own terms, using the tools they already have. Instead of being a story-telling platform, maXML followed another direction and is considered an XML schema to share and exchange data in mine action.

DATA EXCHANGE IN THE MINE ACTION ECOSYSTEM

Mine action is inherently geographic, and activities are usually associated to geographic areas undergoing a series of other activities, all of which aim to release previously hazardous areas for productive use. Related mine action processes that require data collection and management include non-technical survey, technical survey, clearance, collecting casualty data, and mine risk education (MRE).

Within countries, these activities are usually carried out by different organizations reporting to a national mine action center (NMAC) or other national authority. This induces a data flow from several different actors into a central entity. The NMAC is an organization that, on behalf of the National Mine Action Authority (NMAA), is responsible for the planning, coordination, overseeing, and implementation of mine action projects. For national mine action programs, the NMAC acts as the operational office of the NMAA.

IMSMA is traditionally deployed and used at the NMAC or NMAA level. The information gathered during mine action operations is reported by the implementing organizations to the NMAC. Typically, data is sent in any format (e.g., paper, spreadsheet, or via

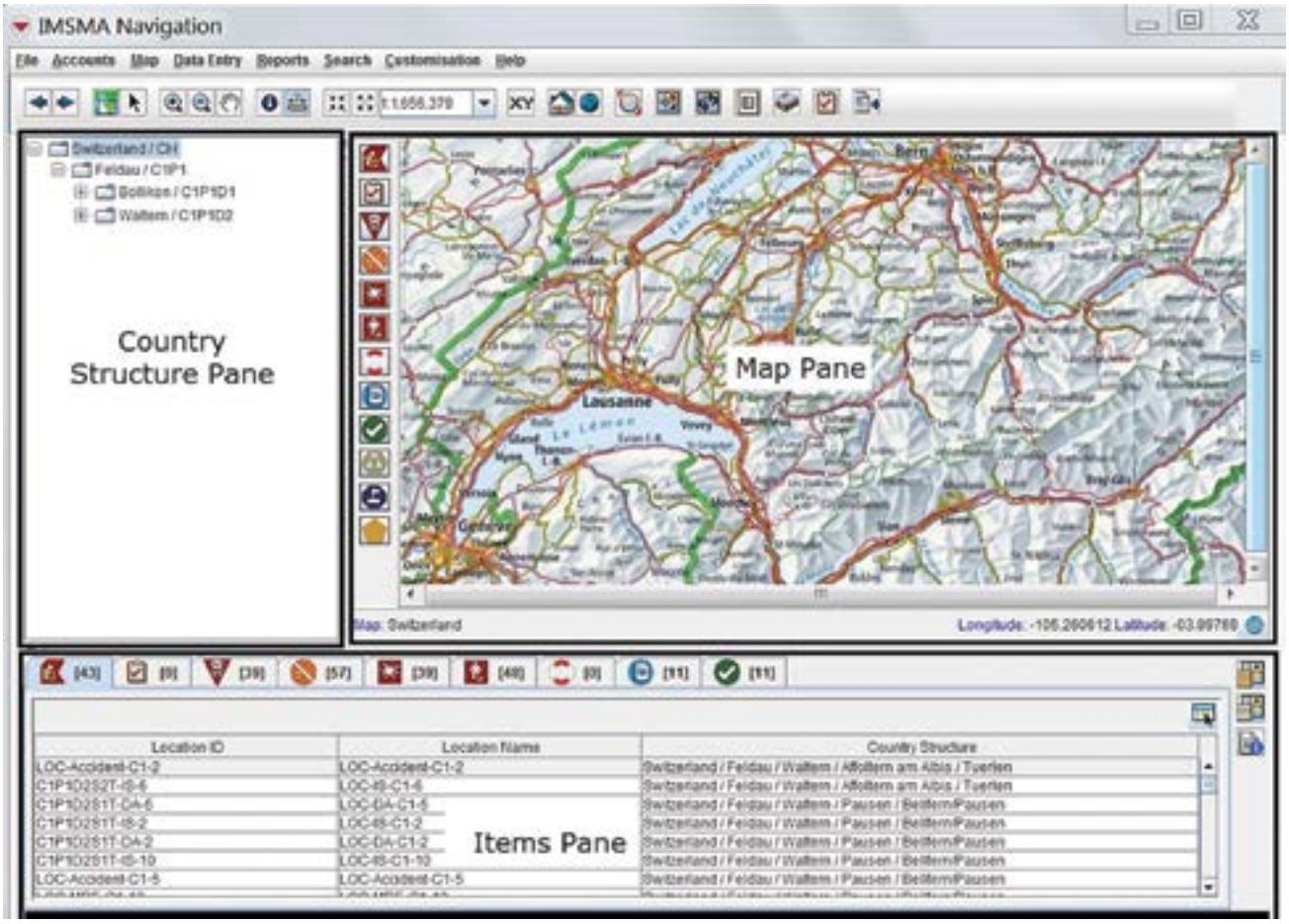

Figure 2. IMSMA graphical user interface.

digital mobile data collection tools) to the NMAC, where the data is entered into IMSMA. Alternatively, the implementing organizations have access to IMSMA and enter information that can be imported into the NMAC's system.

REQUIREMENTS SPECIFICATION

The primary requirement for maXML is that it addresses the fundamental information management problem described previously: maXML must make the compilation of a common operational picture more efficient. The identification of this problem comes from the experiences of information managers who have worked in multiple MACs over the last several years.

In solving this fundamental problem, proposed solutions must not significantly increase the reporting burden already imposed on humanitarian actors. Ideally, solutions should reduce burdens by only requiring that organizations report data once and in a way that serves the diversity of users, from operational partners to analysts at the global level. To be successful, solutions should not replace existing information management systems but rather focus on interoperability between existing systems. A standard way of describing and encoding operational humanitarian data can achieve this interoperability; however, a standard alone is not adequate to solve the problem.

PROPOSED SOLUTION

After analyzing these requirements, a solution based on XML was identified as the most promising. An XML vocabulary for the domain provides a sound definition of the most important domain concepts. The first step towards maXML was the definition of the vocabulary, which is described in the following section.

maXML VOCABULARY

Developed to annotate humanitarian data, the maXML schema syntax conforms to the World Wide Web Consortium (W3C) Recommendation (October 6, 2000) for XML 1.0. The current version of the vocabulary focuses on quantitative information

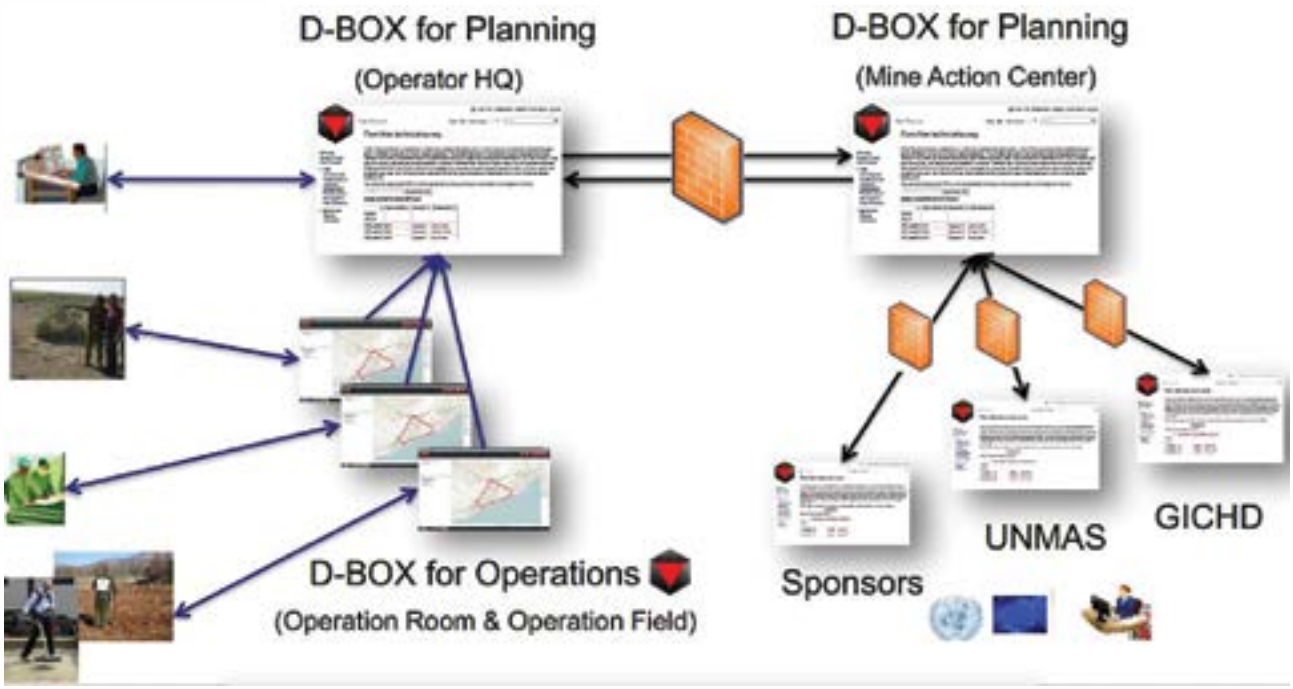

Figure 3. D-BOX: Interoperability with maXML.

that can be directly used to generate reports, maps, and interactive dashboards. The main sections of the vocabulary are presented by topic:

Geolocation. Provides the elements to annotate geographic information. It builds on the Open Geospatial Consortium's (OGC) Simple Features model and extends it. This approach ensures that all maXML data is fully compliant with OGC and hence support complex spatial queries in a standardized way.

Activity. Conveys information pertaining to the technical survey activity, the area in which the activity was conducted, the result of the activity (data collected as part of a technical survey), and other relevant information.

Victim Assistance. Defines the elements required to publish data about the populations affected by landmines and the assistance received by different organizations. The elements in this section correspond to the humanitarian profile, breaking down the person by the way in which the corresponding populations are affected (victim, direct beneficiaries, victim assistance, etc.). In addition, the various organizations involved in assistance activities—including name, abbreviation, and internal ID—are defined here.

Education and Quality Management. Contains the elements to describe the MRE and QM involved in land release activities.

Ordnance. Describes hazardous devices, their characteristics and technical details such as effect, case color, case material, detectability, diameter, dimension, explosive component weight, fuze method, transportation, etc. The main source is the Collaborative ORDnance Data Repository (CORD).[7]

DESIGN PRINCIPLES

Reusing existing vocabularies is a central principle to ensure interoperability. However, in the context of maXML, special care is taken to ensure that any existing vocabularies still used by actors are stable and that the definitions of concepts correspond exactly to those used in the mine action context. These points constrained the number of potential vocabularies to reuse considerably. An element such as country could be taken from existing vocabularies. However, when maXML is specified, no definition that includes nations along with dependent territories was found.

From a technical perspective, the vocabulary is divided into thematic sections as introduced in the previous subsection. This makes the vocabulary more tractable and allows for the automatic generation of a well-structured documentation for the vocabulary.

DEVELOPMENT PROCESS

In recent years, IMSMA expanded and evolved in order to meet the requirements of international humanitarian standards and the general developments of mine action. This process progressed quickly so the definition of maXML specifications and their documentation has lagged behind. As a result, maXML became an internal protocol rather than a well-known one.

Since the expansion and evolvement trend is expected to continue, the GICHD decided to review the current maXML situation and determine the future sustainability of the protocol.

The updated protocol should be capable of

- coping with current expansion of IMSMA
- coping with future expansion of IMSMA in relation to

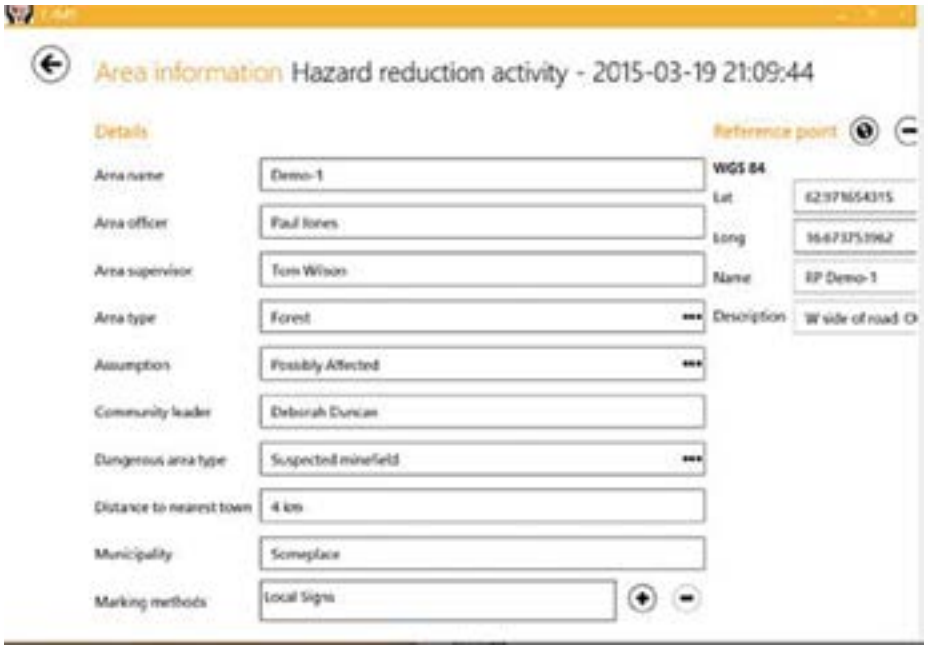

Figure 4. T-IMS: Exporting maXML data.

international humanitarian law such as the *Anti-Personnel Mine Ban Convention* (APMBC), *Convention on Cluster Munitions* (CCM), *Convention on Conventional Weapons* (CCW), and other domains such as small arms and light weapons (SA/LW) and armed violence reduction (AVR).

- ensuring data interoperability within the domain of the humanitarian sector
- ensuring that the data interoperability would not be restricted to a specific information management system.

Three different solutions to update maXML were proposed:

- **Basic solution** was a description of minimal changes to maXML to bring it up to date with current XML standards without causing any major changes on IMSMA
- **Intermediate solution** was a description of changes to maXML that would increase the interoperability with other systems, while having some effect on IMSMA
- **Advanced solution** was a description of the full update of the maXML structure, while possibly leading to major changes in IMSMA.

GICHD is in the process of selecting one of these solutions.

DATA CONSUMPTION

The maXML schema is driven by the need to be able to repurpose data into products that support many users. Humanitarian actors need a solid basis for planning their activities, donors want to prioritize projects to allocate funds, and media and academics need up-to-date information for articles on scientific studies, hence the need for machine readable data.

CURRENT USES OF maXML

D-BOX is a project funded by the European Union to develop a set of tools in support of the mine action community and can access information from a wide variety of sources. Among these, D-BOX can import data from IMSMA in maXML format and is intended to develop maXML export capability as well. The separate planning and operations tools can exchange information between each other, and there is a specific tool (D-BOX for sharing) developed for sharing between separate installations of D-BOX (e.g., between different countries or regions). This data exchange is implemented through the transfer of MediaWiki pages.

The **TIRAMISU Information Management System** (T-IMS) is another project funded by the European Union for humanitarian demining. The tool aims at receiving, collecting, and gathering tasks and reports, and compiling, analyzing, presenting, and communicating all relevant field data. T-IMS uses maXML as a communication protocol, internally and externally, and for the definition of information elements as well as user input. All communication to and from T-IMS is done via maXML. GICHD has been in touch with the developing company in order to ensure compatibility with IMSMA through the maXML import and export functionality.

The **Mine Action Reporting System** (MARS), developed by GICHD, is one example of a recently developed mobile data collection tool falling under the IMSMA applications category. MARS comprises three main parts: a field data entry mobile app (MARS Mobile), a web-based data management and administration portal (MARS Web), and cloud-based data storage (MARS Cloud). After

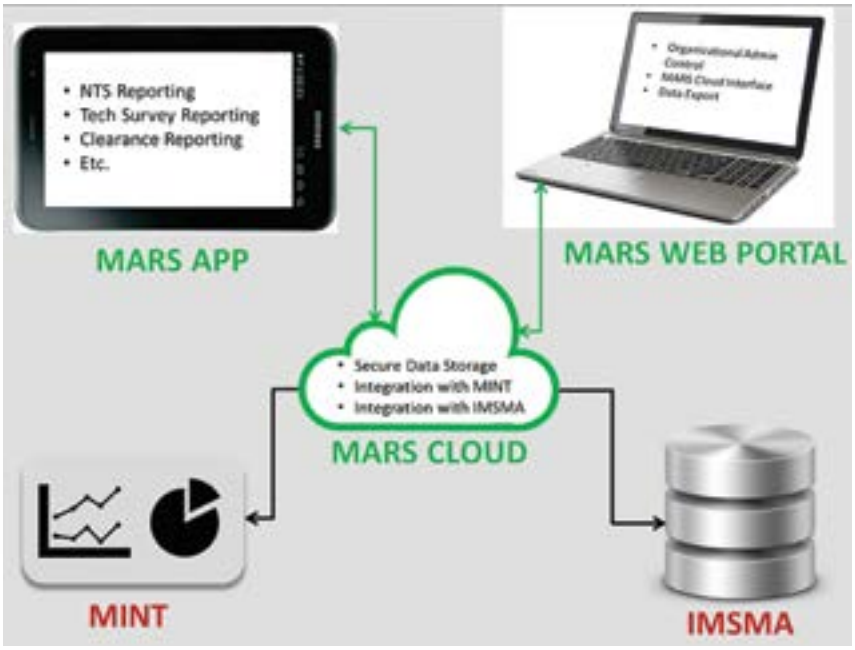

Figure 5. MARS-IMSMA integration via maXML.

initial configuration via MARS Web, authorized users can collect data in the field via custom developed data entry forms or forms designed in IMSMA and imported into MARS. The mobile application allows capturing GPS information identifying points and polygons with a few finger taps. As soon as the mobile device is connected to the internet, the collected data is synchronized with the MARS Cloud and made accessible for approval via the web portal. Finally, data collected via MARS can be imported into the IMSMA data repository.

FUTURE WORK

As a standard for exchanging operational data in mine action, maXML formalizes established terminology from the domain. It currently focuses on humanitarian profile data as well as core reference data, such as geographic information, ordnances, education, and quality management. Data according to the maXML vocabulary can currently be produced using the IMSMA software. maXML data already drive the first applications, including D-BOX, T-IMS, and MARS.

Defining the maXML vocabulary for the humanitarian system as a whole clearly goes beyond the capabilities and expertise of GICHD. In order to achieve this goal, the involvement of the global clusters in developing their respective components, such as vocabulary extensions and cluster-specific tools, is required. In order to increase interoperability with systems and communities outside of the humanitarian domain, maXML should be aligned with existing standard vocabularies.

See endnotes page 67

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Olivier Cottray joined GICHD in January 2012, initially as the division's information services coordinator. As head of the Information Management Division, he is now in charge of managing the team that provides information management capacity development and technical support to the mine action community. Prior to joining the GICHD, Olivier worked in humanitarian emergencies, running geographic information systems (GIS) support cells in U.N. and NGO field operations. Olivier completed a Bachelor of Science in geography and economics at the London School of Economics in 1998, and received a Master's in GIS and remote sensing from the University of Cambridge in 1999.