Social Tenure Domain Model (STDM) Online

Author: Arnulf Christl (Metaspatial, OSGeo)

Coauthor: Cyprian Celebalo (UN HABITAT)

Coauthor: Danilo Antonio (UN HABITAT)

Coauthor: John Gitau (UN HABITAT)

Abstract

Map based cadastre and land registries are core assets for sustainable land management and tenure security. The market for professional software packages is geared towards the needs of the developed world and follows a top-down approach. The developing world typically lacks the know-how to operate these tools, budgets are too small and the centralized operation of high-scale software often does not last beyond aid project life times. This results in lost data, investment and broken, unsustainable systems. The Global Land Tool Network (GLTN) has set out to design a bottom-up approach to land tenure. The Social Tenure Domain Model (STDM) was extensively presented at the World Bank Conference on Land and Poverty in 2015. This paper will showcase STDM-Online, the next phase of the project. The paper presents the architecture design, core software components and data security aspects. At the conference an online presentation of the prototype and demo server will be given to attract the interest of early adopters and co-developers. STDM tool development does not focus on implementing one specific software or product. Instead, priority is given to sustainable solutions, interoperability with other systems, data secure, affordability and sustainability.

The Social Tenure Domain Model

UN-HABITAT through the Global Land Tool Network (GLTN) is working in partnership with international partners in the promotion of secure land and property rights for all through the development of pro-poor and gender appropriate land tools. This objective is aligned towards the realization of the Habitat Agenda which states that: “Access to land and legal security of tenure are strategic prerequisites for the provision of adequate shelter for all and for the development of sustainable human settlements affecting both urban and rural areas. [...] The failure to adopt, at all levels, appropriate rural and urban land policies and land management practices remains a primary cause of inequity and poverty. It is also the cause of increased living costs, the occupation of hazard-prone land, environmental degradation and the increased vulnerability of urban and rural habitats, affecting all people, especially disadvantaged and vulnerable groups, people living in poverty and low-income people” (Habitat Agenda, 1996, Article 75).

The conventional land administration approaches based on land registration have not been successful, especially in developing countries where there shortage of resources, capacity and there prevails land governance challenges. RICS estimates: “that there are around 6 billion land parcels or ownership units world-wide, but currently only 1.5 billion parcels are formally registered and have security of tenure. Within many of the 4.5 billion unregistered parcels, 1.1 billion people live in the squalor of slums.” (RICS Report, 2011)

GLTN advocate for inclusive approaches where land rights are not restricted solely to registered rights and not only to individual property rights. The concept identifies a continuum of land rights from informal to formal and the categories of tenure in the continuum may include pavement dweller, squatter tenant, squatter owner, tenant (unauthorized subdivision), owner (unauthorized subdivision), legal owner (unauthorized construction), tenant with contract, leaseholder and freeholder. From the perspective of the poor, access to security of tenure based exclusively on the allocation of registered rights and individual property titles is not necessarily efficient, equitable or affordable. The diversity of stakeholders’ needs, objectives and strategies requires a diversity of tenure options including leases, rental contracts and various informal arrangements. Inclusion of all types of rights will then get reflected in the land market making it more realistic and effective.

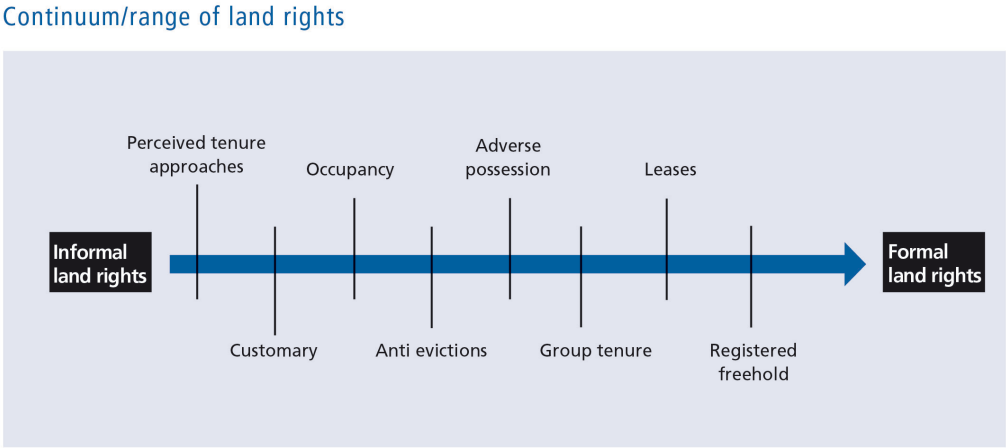

Figure 1: Continuum / range of land rights

In order to actualise the Continuum concept GTLN, in partnership with ITC, FIG, UN-Habitat and World Bank developed the Social Tenure Domain Model (STDM). STDM is designed to model the relationships between people and land as a basis for land administration and/or land management. The focus is on modeling the relations independently from the level of formalization and/or legality of those relationships. It supports all forms of land rights including customary and informal rights. The underlying drivers to the development of STDM are, that it adheres to the principles and core values of GLTN which are pro poor, good governance, equity, subsidiarity, sustainability, affordability, systematic large scale approach and gender sensitiveness. In addition it follows "fit for purpose land administration" principles like being flexible in spatial data capture approaches, inclusive in scope, affordable for governments, reliable, authoritative and up-to-date. Further, information tools should be attainable and operational within a short time frame and within available resources and should be upgradeable with regard to incremental improvement over time in response to social and legal needs and emerging economic opportunities. For more details see also the "Guide for Fit-For-Purpose Land Administration " (GLTN, UN Habitat, Kadaster International: Stig Enemark , Robin McLaren , Christiaan Lemmen , unpublished draft).

The STDM Software Stack

At the beginning of the project STDM the team conducted a market analysis for software products in Land Information domain. The market for professional software packages is geared towards the needs of the developed world and follows a top-down approach. There are a number of software solutions addressing land administration, register and management, however none of them met all the requirements as defined by STDM. The developing world typically lacks the know-how to operate these complex tools, budgets are too small and the centralized operation of high-scale software often does not last beyond aid project life times. The result are lost data, investment and broken, unsustainable systems. One recurring issue are license fees which do not match the affordability criteria and in the long run prevent sustainability. Good governance has to take this into account. Many projects suffer from license costs which can over time be unpredictable and thus put an incalculable financial burden on long term operation. Many projects have simply stopped to function when licenses have run out and could not be renewed. In some cases this has even lead to complete data losses because the data was not manageable without the software it was created with. Therefore STDM takes great care to make the data independent from the software and follows open standards.

The logical alternative to proprietary software are Free and Open Source Software packages. In the past 10 years a healthy market of geospatial database components, import and export tools, desktop and server software has emerged. The Open Source Geospatial Foundation (OSGeo) is a not-for-profit umbrella organization for highest quality and competitive Open Source geospatial software projects. OSGeo is a GLTN partner and supports the STDM team with selecting the best suited software tools to implement the concept.

The focus of the initial version of the STDM software was to provide a self-contained environment enabling organizations and individuals to enter data collected with the help of a questionnaire. The core software components were carefully selected with the option to scale the architecture for future needs (Hall, 2008).

Going Online

To make STDM better accessible an Online version has been implemented which can be accessed through regular browsers on the Web. The rationale to implement this additional interface solution is:

- Online Accessibility greatly enhances outreach.
- Increasingly areas with a need for STDM have basic Internet accessibility
- Teaching and training requires much less preparation and infrastructure
- Hardware requirements on-the-ground are much lower than for a desktop version
- Inclusion of background data can be provisioned centrally reducing work overhead on the ground

The Online approach of STDM is intended to compliment STDM Desktop which will stay the main platform for many users who have no Online connectivity.

The current work package in the phased approach entails the implementation of the STDM-Online server components, the interface and presentation tool that complements the productive Desktop GIS environment based on QGIS.
The original architecture has already taken advantage of database technology such that it can easily be extended by adding a web server, map server and an HTML client.

- PostgreSQL (object-relational database)
- PostGIS: GNU GPL v 2.0 (spatial data extension for PostgreSQL)
- QGIS Desktop: GNU GPL version 2.0
- QGIS Server: GNU GPL version 2.0
- Apache HTTPD web server: Apache License Version 2.0
- Geraldo Reports (reports engine for Python applications)
- SQLAlchemy (SQL toolkit and object relational mapper for applications)
- Several HTML clients (STDM internal development)

PostgreSQL is used to store the data which has been modeled following the STDM concepts which are based on the ISO standard LADM (Elia, 2013). PostgreSQL (http://www.postgresql.org/) is one of the globally most widely deployed professional high performance database systems .

PostGIS (http://postgis.org) implements functionality to make geographic operations available in PostgreSQL. PostGIS has been vetted and approved by the Open Source Geospatial Foundation as high

quality software (The OSGeo Incubator, 2015)

SQLAlchemy is used to make the data stored in PostgreSQL available to the front end via SQL where they are run by Geraldo Reports to create reports of the data acquisition and mapping activities.

The QGIS project (http://qgis.org) implements two main product lines, the Desktop GIS and an Online Server. QGIS Desktop is used inSTDM as the front end API interface for users mapping tenure data. As a desktop GIS it is also used to import and export geographic data like cadastral and base map data, satellite and aerial imagery, road maps, OpenStreetMap data and many more.

QGIS Server (http://live.osgeo.org/en/overview/qgis_mapserver_overview.html) uses the same libraries as the Desktop version to publish the maps on the Web through the Apache server software. QGIS has been vetted and approved by the Open Source Geospatial Foundation as high quality software (The OSGeo Incubator, 2015).

The Apache HTTPD web server allows secure and encrypted access to a web server. It is used as authentication gateway and allows the implementation of authorization modules.

The STDM-Online Architecture

To extend the system functionality to the Web, two core software packages have been added to the STDM architecture: QGIS Server and the Apache httpd Server. These allow to bidirectionally serve data and maps through the Internet protocol. The individually customized HTML 5 client allows to implement the forms needed to enter survey data and to request maps. HTML 5 has been identified as the best fit-for-purpose standard to implement applications of the Web (W3Schools, 2015).

The default set-up includes restricted access control with authentication and authorization on a user basis. As an extension the system can also include a public access point to browse the open data portal which has been aggregated and anonymised to protect the privacy of the tenants.

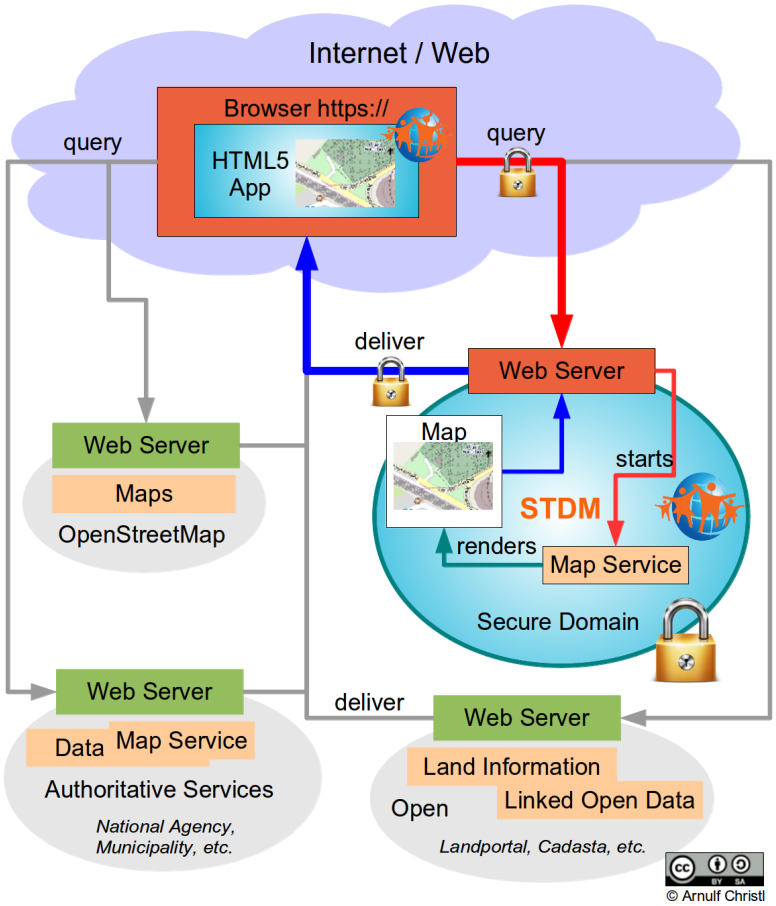

Figure 2: STDM-Online Architecture Scenario

The code base for STDM is developed on GitHub (https://github.com/gltn). The originally three major components have been extended to now include the Web interface, setup and tutorial:

1. The STDM PlugIn (STDM client component that runs as a QGIS plugin)
2. The STDM Installer (NSIS script that packages PostgreSQL, PostGIS and QGIS into a single installer, with the option of specifying which components to install)
3. The STDM Database (the PostgreSQL/Postgis template for STDM)
4. The STDM Web Client in HTML 5 technology (W3Schools 2015)

STDM is not about individual software development. Instead, STDM leverages existing software packages to get real work done while supporting it's core values pro-poor, equity, affordability, good governance, subsidiarity, gender sensitiveness, systematic large scale approach and sustainability.

Security and Privacy

The data collected through STDM has a very confidential nature **and at the same time** should also find broadest distribution in order to achieve maximum benefit. This is not a contradiction but reflects that the data has to be organized in a very clearly accessible way. Those aspects of the data that should be available under an Open Data license have to be completely anonymised and stripped of privacy related content. The other data collected through STDM has private nature and must be protected from unauthorized access as best as possible. Tenants profit from STDM if their private data is collected and can be reproduced and coherently presented in legal cases. But at the same time this private data is prone to be misused. It is crucial to communicate this apparent contradiction transparently and handle it carefully in every aspect of the project.

Conclusions

Land administration is about people, the relation between people and places, and the policies, institutions and regulations that govern this relationship. Increasingly social relations are mapped on the Web (think Facebook, Google and the like). While in more technically developed nations the infrastructure behind these technologies is taken for granted, many less developed nations still lack a reliable infrastructure.

Land administration systems provides nations with an infrastructure to implement land policies and land management strategies in support of sustainable development. In less developed countries there is an

urgent need to build simple systems using a flexible and affordable approach to identifying the way land is occupied and used. The systems should include all land and provide security of tenure for all. When considering the resources and capacities required for building such systems, the more advanced concepts as predominantly used in developed countries may well be seen as the end target but not as the point of entry. STDM started off targeting minimal requirements and is now extending this core system to also leverage the Web addressing the full spectrum of needs of a comprehensive land management solution.

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