MODELING CUSTOMARY LAND TENURE WITHIN THE NATIONAL LAND ADMINISTRATION USING THE SOCIAL TENURE DOMAIN MODEL (CASE STUDY ULAYAT LAND IN MINANGKABAU COMMUNITY, WEST SUMATRA, INDONESIA)

TEDDI GUSPRIADI

February, 2011

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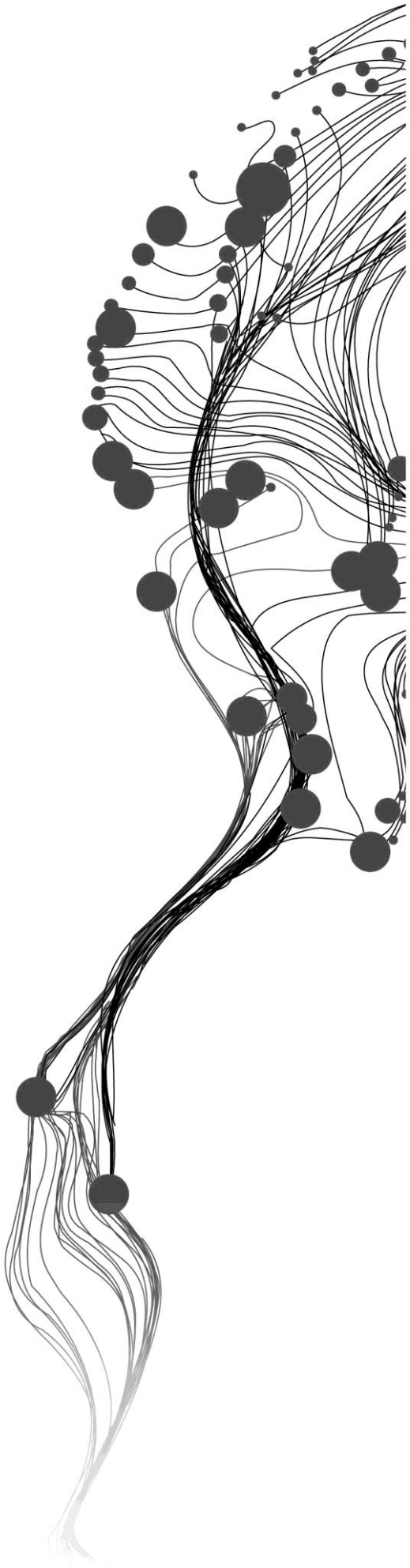

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Enschede, The Netherlands, February, 2011

Thesis submitted to the Faculty of Geo-Information Science and Earth Observation of the University of Twente in partial fulfilment of the requirements for the degree of Master of Science in Geo-information Science and Earth Observation.
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ABSTRACT

Conventional land administration systems have always concerned registration of legal rights and do not effectively address the customary rights to land. The customary land tenure systems have not been accommodated on the existing Indonesian National Land Administration System (NLAS). There are twenty three customary regions within the country. The thesis aims on providing an assimilation approach that can accommodate the customary tenure with the Indonesian NLAS. The approach is expected to become a proper concept to be used in land administration system for Indonesia as well as an example for others countries.

In this thesis describes how to develop an assimilation approach has been developed that can accommodate customary tenure (*ulayat* land in *minangkabau* community) within the Indonesian NLAS. This approach concerns a process whereby the national land administration institute will recognize the customs and attitudes of the prevailing cultures and customs and related customary tenure concepts and principles through an integrated tool. The Social Tenure Domain Model has been used as a standard to develop this model. The model has been validated by doing some demonstrations. Some demonstrations verify that the model is valid to accommodate customary land tenure within the national land administration system.

Key Words: Social Tenure Domain Model (STDM), Land Administration Domain Model (LADM), *Ulayat* Land, *Minangkabau*, Customary, National Land Administration System.

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Enschede, February 2011

Teddi Guspriadi

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LIST OF ABREVIATIONS

BPN	Badan Pertanahan Nasional (National Land Agency)
CAD	Computer Aided Design
DXF	Digital Exchange Format
FIG	Federation Internationale des Geometres (International Federation of Surveyors)
GIS	Geographic Information System
HGB	Hak Guna Bangunan (right to construct building)
HGU	Hak Guna Usaha (right to cultivate land)
HM	Hak Milik (right of ownership)
HP	Hak Pakai (right of use)
HPL	Hak Pengelolaan (right of management)
IPPT	Ijin Perubahan Penggunaan Tanah (land use permit)
ISO	International Organization for Standard
LADM	Land Administration Domain Model
MDA	Model Driven Architecture
NLAS	National Land Administration System
OGC	Open Geospatial Consortium
OMG	Object Management Group
PPAT	Pejabat Pembuat Akta Tanah (special kind of notary in Indonesia that is eligible to create land deed)
PIM	Platform Independent Model
PSM	Platform Specific Model
SQL	Structure Query Language
TM	Transfer Mercator
UML	Unified Modeling Language
UTM	Universal Transfer Mercator

1. INTRODUCTION

Institutional arrangements for legitimizing land tenure including laws and regulations are not the same for all places. The normative behavioral code refers to cultural values that legitimize arrangements and constraints in the behavior how land is used. These arrangements are always different from one country to another country and even within one country, as it is often influenced by history, politics, culture, religious and social systems, and economic situation. The relationship between an individual or a group of people or communities and a spatial unit of land through tenure rights is the most important part of land tenure and its institution in the establishment and maintenance of Land Administration Systems (Tuladhar, 2004).

The relationship between land and people via land rights in legislation is the foundation of every conventional land administration. In the Social Tenure Domain Model it is about the social tenure relation between "Persons" and "Spatial Units". In this model there is no direct relationship between "Person" and "Spatial Units", but only via "Social Tenure Relations" (Lemmen et al., 2007). However, conventional land administrations just define the relationship between person and land through statutory right. This right is protected by the state based on the legal system.

The legal system in Indonesia reflects the pluralistic characteristics of society. Many different communities in the country have regulated their livelihood according to *adat*, meaning their traditional norms and customs (Warman, 2008). However, considering that there exist 23 customary regions in Indonesia, each with different customary land tenure arrangements, it is not easy to formulate a concept of unification (Abdulharis, 2007).

West Sumatera is one of the biggest customary regions in Indonesia, people of the Province of West Sumatera are named *minangkabau*. They are still upholding their customs, especially the customary land tenure arrangement. The existence of customary land tenure arrangement is of the reason of the failure of formal land registration process in Province of West Sumatra (Abdulharis et al., 2008). In practice, the diversity of customary tenure has no decent place in national land administration system. As a consequence, the legal certainty of formal rights is pre-dominant in the national land administration system. The customary tenure which exists in the community has no legal certainty (Warman, 2009).

Based on the situation above, in order to accommodate customary tenure within the Indonesian National Land Administration System (NLAS), an approach is needed to model the relationships between people and land as a basis for land administration. This is not an easy task. Such models should be developed on proper concepts that can be adoptable to varying local conditions; it can vary with the type of social tenure relationship and other rights.

This research analyses the existing of customary tenure that still is very much alive, and develops an assimilation approach with the help of models in multi-level government system (supported by decentralization policy of the land administration in Indonesia) to bring the customary tenure system within Indonesian NLAS.

1.1. Background of Research Case Studies

1.1.1. Customary Tenure in Indonesian Land Administration System

Since 1960, the Indonesian government has tried to provide formal land tenure security (legal certainty) through the enactment of the Basic Agrarian Law (BAL). According to the BAL the formal land tenure system in Indonesia was formulated based on the customary land system. Practically, Indonesia is still experiencing the land tenure dualism to date. Within daily practice, there are still no implementing rules related to customary tenures in the Indonesian NLAS.

Since 1998, post new order and Suharto regimes, the new political freedom and the decentralization policy adopted had important implications for the governance of the country including land. The government tends to modify not only the legal categories of rights to natural resources, but also the constellations of actual rights-relationships pertaining to concrete natural resources. The government holds the rights to suck resources.

There has been an interesting development in the area of agrarian law through promulgation of Regulation No. 5 of 1999 of the Minister of Agrarian Affairs/Head of National Land Agency (BPN), concerning guidance for resolution of problems of the *ulayat* right of *adat* Law Communities. Promulgation of this regulation is a positive development, because it can be seen as a starting point toward respect and protection of *ulayat* rights.

1.1.2. The Ulayat land in Minangkabau Community

The *minangkabau* ethnic group is local community to the highlands of West Sumatra Province, Indonesia. The lineage system is matrilineal. In this system property and land are passing from mother to daughter. This community is the world's largest matrilineal society. In the most general terms it can be said that *minangkabau* society is divided into two basic *adat* groups (see chapter 4). These are made up of a large number of named clans (*suku*). From there on terms and descriptions differ, but it is generally stressed that there are sub-clans, major and minor lineages held together by an ascriptive leadership and various degrees of customary landownership.

The Dutch colonial government in the late 19th century issued its Domain Declarations taking legal control over what it regarded as 'wastelands' in order to facilitate a capital agricultural economy the control over natural resources on the territory of *minangkabau* villages (*Nagari*), the village commons (*ulayat*), has been a point of contention between villagers, village governments, officials of various state agencies, and entrepreneurs who received exploitation rights from the government (Franz. et al., 2010)

The term of *ulayat* is used only by *minangkabau* people in West Sumatra in order to define their territory (Soesangobeng, 2004). In general is used to identify all customary lands in Indonesia as a first point of the describing term. In the Local Government Regulation of West Sumatra it is mentioned that the *ulayat* land is a piece of heritage land within the natural resources above and underneath the earth which is achieved through heritance and it is a right of the customary law people in the province of West Sumatra (Gubernur Sumatera Barat, 2008).

1.1.3. The Social Tenure Domain Model

Modeling the relationships between people and land as basis for land administration and/or land management is of a complex nature (Augustinus et al., 2006). Many factors should be considered in order to create proper model such as politics, laws, economics, cultures and norms. Many existing models are often influenced by politics, economics and laws. A model without considering social cultures and customs factors that still existing in the people is of the reason of the failure of formal land administration system. Therefore, modeling process require the development of innovative approaches.

One of the tools for the innovative approach to develop land administration is Social Tenure Domain Model (STDM). The Social Tenure Domain Model is about the 'SocialTenureRelation' between 'Persons' and 'SpatialUnits'. In the model there is no direct relationship between 'Person' and 'SpatialUnits', but only via 'SocialTenureRelations'(Lemmen, et al., 2007). This model can be used for land administration system that can support all forms of social tenure relationships. Diversity of social tenure relationship relate with norms and traditional values in each local conditions.

Localities are very important issues that should be considered in order to accommodate local community requirements in land administration systems. Depending on the local conditions, there are a variety of social tenure relationship types and other rights (Zevenbergen et al., 2010). The STDM provides a basic concept tool for innovative approach to develop a proper model based on local conditions within national land administration system.

1.2. Research Justification and Problem

1.2.1. Research Justification

Deininger (2010) in the World Bank joint discussion paper mentioned that land registration system has always concerned with identification of legal rights in support of an efficient land market and do not adequately address the more informal and indigenous rights to land found especially in developing countries where tenures are predominantly social rather than legal. Therefore an innovative approach is needed to accommodate the social tenures which exist in the local community.

For example, Koran Tempo, Tempo newspaper, dated 18th Nov 2008, highlighted news about Riau community to legalize of *ulayat* rights. The community requested to legalize common land (*tanah ulayat*) as the result of many conflicts about customary land ownership. These conflicts arise all the time when local community meets investors and government. It is also creating instability in social economy and politic. Ironically, custom is the basic fundamental in BAL. In practice, the customary tenure has not a decent place in the legal system (Samosir, 2008). In BAL there is no further regularization.

Antara News, website news, dated 21st July 2008, highlighted news about local government regulation about *ulayat* land as a legal foundation to solve land dispute in the West Sumatra. The news says that government regulation of the *ulayat* land would strengthen recognition and existence of *ulayat* rights. This news also mentions that there is a need to formulate a mechanism to register *ulayat* land in order to protect rights of the owners and of the investor on the *ulayat* land (Antara, 2008).

1.2.2. Research Problem

The customary land tenure system is not accommodated within formal land administration. Even, in BAL, it is mentioned that custom is fundamental consideration as basis for formal land tenure system. In fact, the customary tenure that has already existed before colonization in Indonesia is completely unprotected. Conflicts among community members and other communities would possibly arise if legal protection regarding customary community land ownership is not put in good order.

The conflicts referred to can arise between individuals or between individuals and a community that owns customary land. Furthermore, vertical conflicts may be triggered between the individuals/community and the government (Exposto et al., 2003).

Ideally, the customary tenure that already exists in communities should be accommodated within the national land administration system. However, there is a gap between customary tenure system and statutory tenure system. In order to bridge this gap, there is a need of a model that can map the social

relationship between customary land and local community within the national land administration system. This model should be a proper concept that can accommodate local community requirements and be suitable with the legal framework of the Indonesian NLAS.

1.3. Hypothesis

The current Indonesian NLAS does not support the security of local community rights on customary lands.

1.4. Research Objectives

The main objective of this research is to develop an assimilation approach that can accommodate customary tenure within the Indonesian National Land Administration System (NLAS). The approach is expected to become the proper concept to be used in land administration system for Indonesia as well as a possible example for others countries.

Beside the main objective mentioned above, there are two sub objectives:

1. To identify an assimilation approach of the customary land tenure system within the Indonesian NLAS.
2. To develop and validate model requirements in this assimilation approach for customary lands (*Ulayat* land) in Indonesian NLAS using the STDM.

1.5. Research Questions

Based on the research problem and the research objectives, the research questions can be formulated as follows:

General Question:

How to develop an assimilation approach to map customary lands (*Ulayat* lands) within the Indonesian land administration system?

Sub objective 1:

1. What are the differences and similarities between the statutory tenure system and customary tenure system (*Ulayat* Rights)?
2. How to tackle the differences between the statutory tenure system and the customary tenure system (*Ulayat* Rights)?
3. What STDM concepts can be used in an assimilation approach in order to optimize flexibility in Indonesian NLAS?

Sub objective 2:

4. What are the requirements in terms of integrated land administration data models supporting decentralization policy?
5. What are the contents of the data model including classes, attributes and associations in the integrated model?
6. Can this model supportive in the provision of customary tenure security?

1.6. Conceptual Framework

Land administration systems are basis for conceptualizing rights, restrictions, and responsibilities. Property rights are normally concerned with ownership and tenure whereas restrictions usually control use and activities on land. Responsibilities relate more to social ethical commitment or attitude to environmental sustainability and good husbandry (Deininger, 2010). Based on that, modeling relationship between people, policies and land should be considered including social ethical commitment - this means to recognize cultures and norms that exist in people's mind.

Although the existences of *ulayat* rights are formally recognized in the BAL, their substantive recognition has been a problem. There is no customary tenure in the catalogue of formal tenure mentioned in the BAL, and also there is no regulation to document and register the related lands. As most of the existent implementing regulations of BAL fail to elaborate and event contradict, the *adat* principles (Ubink et al., 2009). In practice, Indonesia is still experiencing the land tenure dualism to date.

There is no single uniform tenure system in Indonesia, and there is a great variety of very different regional and local forms which are the product of cultures and traditional norms (*adat*). Each tenure system reflects the cultural properties of each community.

Because of the diversity of tenure systems it is a difficult task to create single system. In order to achieve secure tenure there is a need for an assimilation approach to unify these systems. Assimilation approaches in this part means is process whereby national land administration system will adapt to the customs and attitudes of the prevailing culture and customs to fit with customary tenure concepts and principles through an integrated tool (STDM). As an integrated tool, STDM should be able to accommodate all user requirements in a single system.

Many aspects should be considered to develop an integrated model, including decentralization and technical issues. In the decentralization, the model should be able to accommodate elements of land information systems in a multilevel government system. In the technical issues, the model should be able to integrate different types of datasets through Figure 1-1).

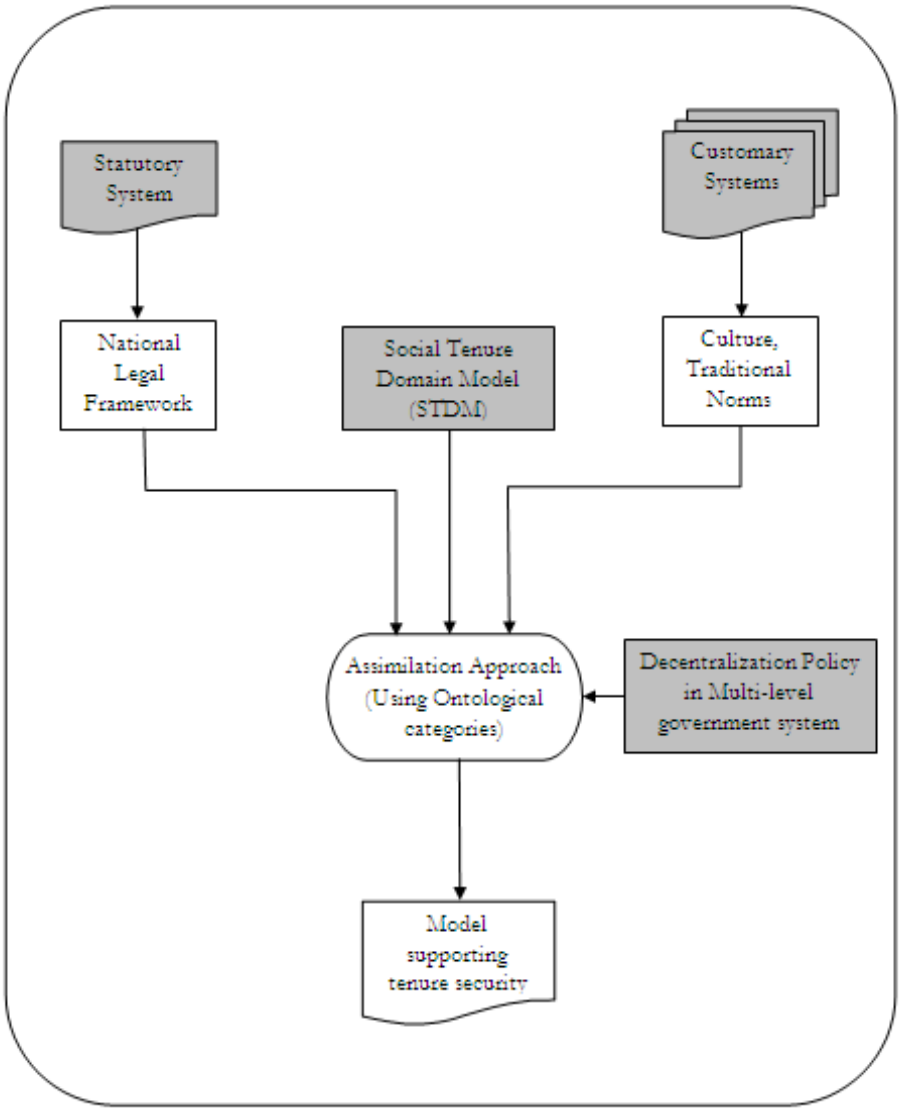


Figure 1-1: Conceptual Framework of the research

1.7. Research Methodology

1.7.1. Research Methods and Approaches

A research method is a way to systemize observation, describing ways of collecting evidence and indicating the type of tools and techniques to be used during data collection (Cavaye, 1996). There are different approaches of research methods such as case study research, phenomenology research, ethnography research, etc. Based on the objectives and nature of research, this research is desk research which is fully dependent on secondary data. Whereas the aims of the case study method in this research is to support desk research. There are two purposes of this method, those are:

1. To identify the assimilation approach both of systems by using an ontological category.
2. To develop and validate the model based on a real case (customary tenure in *minangkabau* community).

This research is modeling the *ulayat* land tenure in *minangkabau* community within the Indonesian NLAS as a case. The customary tenure system is complex system, in which many aspects should be concerned such as the government system, the social structure, the lineage system etc. Therefore, to understand how the Indonesian NLAS is accommodated the customary tenure particularly the *ulayat* rights of detail is needed. Detailed study helps to make comprehensive study. The *ulayat* land tenure in *minangkabau* community is taken as case because of the structure landholder refers matrilineal system and this community still upholding their custom.

Principally, there are two kinds of data sources: primary and secondary. Primary sources of data entirely depend on interviews, questionnaire, focus group discussions, participant observation and observation. It provides first-hand information about the issue and area of study. Some of the weaknesses can be costly, time consuming, and sometimes failure to access data. Secondary data entirely comes from a range of documents and archives. These can be researches done by other scholars (books, journal article); newspapers, websites; data collected by other governmental and non-governmental institutions; laws, decrees, etc. This research does not involve any field work. Therefore, the research totally depends on secondary data.

Software used in this research to develop model, create geo database, visualize the result and present the work in a better way. This research has used the application of some software for the above mentioned purposes. Lists of this software are:

- Enterprise Architect 7.5 - This software is used to create conceptual model.
- PostgreSQL 9.0 which has the spatial extension in PostGIS 1.5 - To create geo database and store the data simulation.
- Quantum GIS 1.4 - To produce maps for visualization and interpretation.
- AutoCAD Map 3D 2008 - This software is used for digitized spatial data simulation.

1.7.2. Research Design

The research design has been classified in two stages: the assimilation stage and the modeling and validation stage (Figure 1-2: The stages of research design). The explanation of activities for each stage has been done below:

- The assimilation stage;

This stage is begun with extract concepts of statutory systems and customary (*ulayat*) systems by using the ontological categories. The aim of this method is to define differences and similarities of both systems. The analytic ontology category is the way to answer question 1 and question 2. Both of tenures systems were reformulated by using the STDM as reference concept to answer question 3.

- Modeling and Validation stage;

The aim of this stage is to develop the proper model based on model requirements and validate the model by prototyping and demonstrating. This stage can be using to answer question 4, question 5 and question 6. This research applied desk research method and literature reviews, wherein for the purpose of demonstration

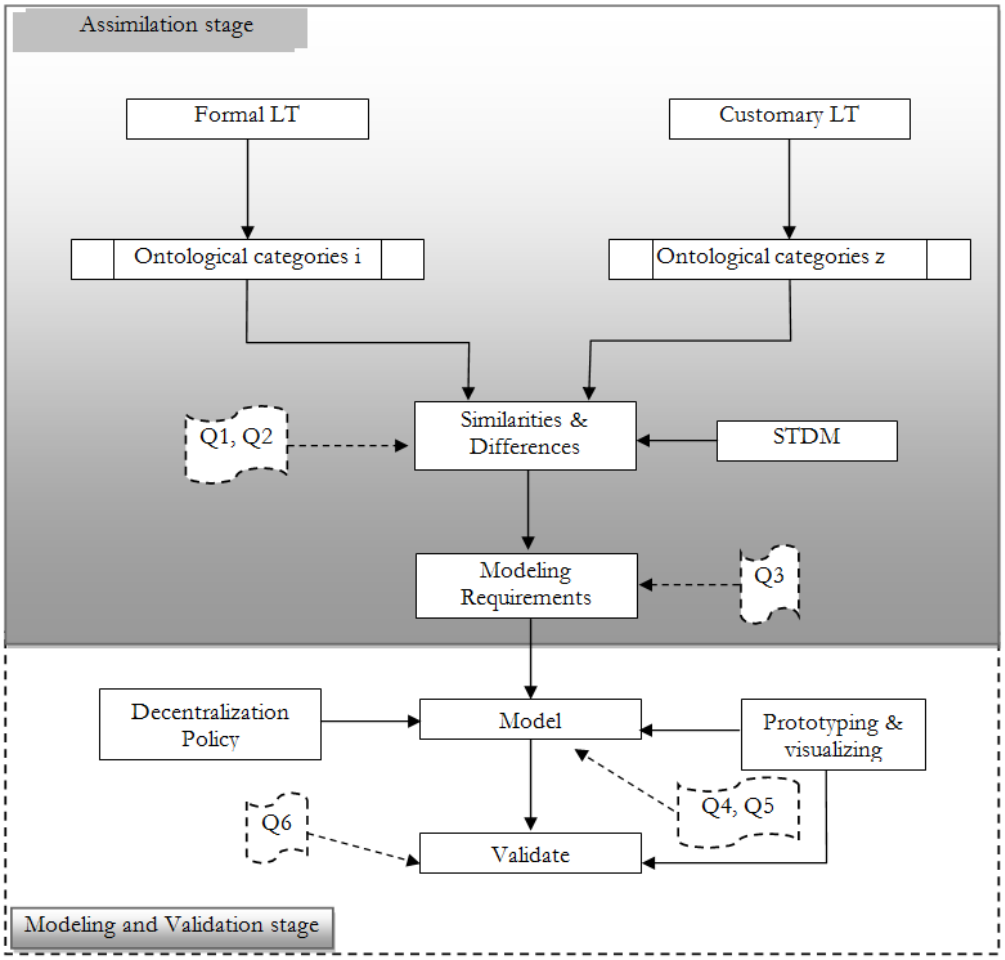


Figure 1-2: The stages of research design

1.8. Thesis Structure

Chapter 1: Introduction

This chapter consists of introduction, a general background about the case study, research justification and identification of research problems, it also includes the hypothesis, the main research objective and sub objectives, research questions formulated based on sub objectives and methodology research.

Chapter 2: The Representation of Reality in Land Administration

This chapter introduces the main aspects of the philosophical foundation of this thesis as a basis for the construction of a computational model. This chapter provides the theoretical background of the representation of reality in land administration based on ontological categories.

Chapter 3: Social Tenure Domain Model

This chapter explains the so called Social Tenure Domain Model (STDM) as a reference model to assimilate customary systems and statutory systems in land administration systems.

Chapter 4: Indonesian Land Administration System and Customary Tenure System in *Minangkabau* Community.

The main objective of this chapter is to describe the structure of tenure system in the Indonesian NLAS and the *ulayat* land tenure system in *minangkabau* community

Chapter 5: Model Requirements Analysis

This chapter describes analysis of requirements based on the ontological categories in land administration system (subject, object, relationship between subject and object). The requirements identified are based on the characteristics of both tenure systems (the Indonesian NLAS and the *ulayat* tenure system)

Chapter 6: Design Data Model and Validation

This chapter describes a conceptual modeling of the Indonesian NLAS in order to accommodate the *ulayat* land in *minangkabau* community. This conceptual model is formed based on the model requirements which introduced in the chapter 5. The listed of requirements expose a set of modeling concepts that need to be handled.

Chapter 7: Conclusions and Recommendations

This chapter presents conclusions and recommendations. In this chapter, the questions is posed in the chapter one is revisited. Contribution of this research is also included in this chapter.

2. THE REPRESENTATION OF REALITY IN LAND ADMINISTRATION

2.1. Introduction

This thesis describes the reality in land administration system, which is determined by the activities related to cadaster and land registration, land law, and the actors involved in land administration. This domain is a part of social reality. This chapter introduces the main aspects of the philosophical foundation of this thesis as a basis for the construction of a computational model. This chapter provides the theoretical background of the representation of reality in land administration based on ontological categories.

2.1.1. Definition of Ontology

Ontology as a branch of philosophy is the science of what is, of the kinds and structures of objects, properties, events, processes and relations in every area of reality (Smith, 2003). The notions of ontology as described in this section are distinguished in the two kinds of sense; those are ontology in the philosophy sense and ontologies in the computer science sense.

In the computer science sense, an ontology is a logical theory which gives an explicit, partial account of a conceptualization i.e. an intentional semantic structure which encodes the implicit rules constraining the structure of a piece of reality (Gruber, 1993; Guarino et al., 1995). It is used to describe the domain. The main idea behind the ontologies in this sense is to provide reusable information for actors in the certain domain.

In the philosophical sense, there are different definitions of ontology. The definition of ontology in the perspective of philosophers and in the perspective of scientists is different. Ontology from the perspective of philosophers is the science of being, or the science what is, of the entities making up reality. While the scientists define ontology is a rigorous and exhaustive organization of some knowledge domain that is usually hierarchical and contains all the relevant entities and their relations. Donna Peuquet et al.(1998) mentioned that "Ontology as traditionally conceived is not a description of how we conceptualize the world, but rather a description of the world itself". It assumes that there is one world to be described.

Bittner (2001) distinguished ontology in two independent languages, those are *epistemology* ontological (e-ontologies) and *reality* based on ontology (r-ontology). An e-ontology describes parts of the world based on human knowledge, while r-ontology describes what is independent of human knowledge (see Figure 2-1).

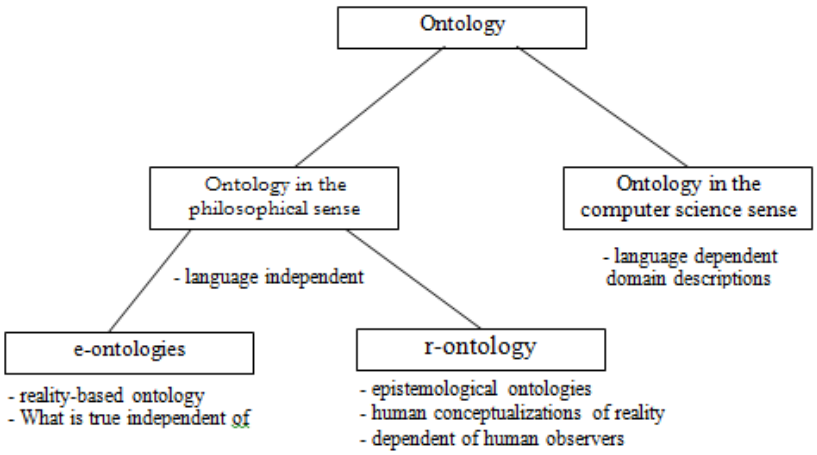


Figure 2-1: Categorization of ontology (source Bittner 2001)

Based on the term of ontology above, this thesis uses the theory of institutional reality from John Searle in order to develop institutional facts actually exists in land administration domain. The aim of r-ontology of institutional reality is to show how the institutional reality is developed. While the aim of e-ontologies to conceptualize the land administration domain that actually exists in reality.

This thesis uses a concept of ontology in the context of conceptual model design and includes not only physical ontology that can be described as the physical reality, but also social and institutional ontology that can describe human activities and social arrangements.

2.1.2. Ontology in Conceptualization Reality

The terminology of ontology recently has increased in many discussions about databases. The discussions relate with the relationship between information system and reality. In order to describe reality in the information systems and their implementation as databases ontological commitments are used (Andrew, 2003).

Many questions arise when information systems are built for purposes involving the representation of reality in space and time such as how do information systems like spatial –temporal databases fit with discussion of ontology. At least the designer of information system should realize what the nature of the information that they want to represent is. Andrew (2003) argues that the information expressed by the information system corresponds to the state of the real world. This correspondence between reality and information system is used to define formally the meaning of ontology in a model.

2.1.3. Ontology of Institutional Reality

Searle's (1995) describes that reality consists of two parts; those are physical reality and institutional reality. Physical reality exists independent of human being, while the institutional reality exists only in human agreement. Physical reality consists of physical phenomena, such as objects and events that have systematic relationships. Searle argues that there exists a specific class of these objects capable of collective intentionality and also have capability to symbolize i.e., create language (Searle et al., 2001). These specific objects are human beings. Human beings assign status to phenomena in which this assignment can be described by constitutive rules. Human beings also have capability to sharing beliefs about assigned status function. Status functions assigned to physical phenomena, which are collectively recognized by the majority of a community, Searle refers to as institutional facts (Bittner, 2001).

From the explanation above as the conclusions, there are human being and other physical phenomena in physical reality, while institutional reality exists only in the mental state of these human beings.

2.2. Reality in Land Administration

This section explains the reality in land administration based on ontology of institutional reality. The most important thing that should be captured is how to understand the interaction of the land administration with its environment. In order to explain this interaction need to develop ontology of institutional reality in land administration domain. Based on characterization of ontology in the ontology of institutional reality in land registration is part of reality.

2.2.1. Parcel

In land administration, parcel is basic unit of land ownership which is representing institutional fact. In order to understand reality in land administration is important to investigate the relationship between land pieces which are existing facts and parcels as institutional facts. This subsection explains the definition of parcel boundaries and the relationship between parcel and rights.

1. Parcel boundaries

Smith et.al. (1997) distinguish two types of boundaries which are fiat and bona fide boundaries. They define Bona fide boundaries as boundaries in the objects themselves that exist independent in human cognitive such as coast line, river etc. Fiat boundaries are created based on bona fide boundaries or without bona fide boundaries.

Bittner (2001) characterizes parcel boundaries always as fiat boundaries. Perhaps they can be related to bona fide boundaries, as it is the case for coast lines, but they need not. The parcel boundaries only exist in human institutions. Smith et al.(2001) argue that the existence of land parcels is ontologically independent on highly complex system of cognitive acts, belief and expectations of human being. In line with the terminology of parcel boundaries in land administration, the parcel boundaries always deal with the legal boundaries. According to Smith, legal boundaries are always fiat boundaries. The fact of legal boundaries are secured and enforced by the power state.

Based on the explanation above, parcel boundaries are defined as the representation of reality of legal boundaries. Parcels are represented in cadastral map as the legal boundaries of ownerships.

2. Parcel and Rights

Parcels are constructed based on institutional fact of the real world that represents legal boundaries which are always having identifier. Rights are always relate to the parcels as whole i.e., to the parcel identifier (Bittner, 2001). The identifier form could be characters or numeric that should be unique. Rights are related to the identifier of a parcel, and the space of ownership determined by legal boundaries. Figure 2-2 illustrates the relation between land, parcels and rights (Bittner, 2001).

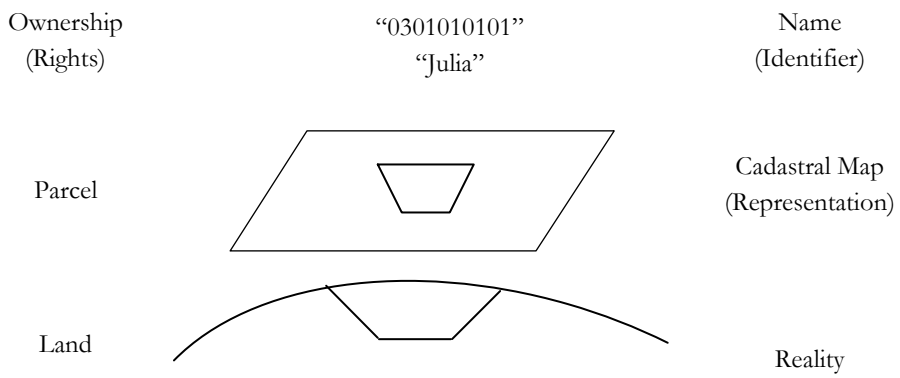


Figure 2-2: The relation between land parcels and rights (source Bittner 2001)

2.2.2. Right in Land Administration

According to Searle's theory, the ownership of right is the institutional fact and the individual rights are conventional powers assigned to the institutional fact. The institutional fact remains unaffected even though no conventional power is assigned (Bittner, 2001). The explanation of rights of ownership can be described with the metaphor 'bundle of stick' in which each stick represents a particular right.

Ownership of land is complex proposition rights. The bundle of rights is common way to explain the complexity of relationship between human beings and land. The bundle of stick is very useful to explain that rights can be separated and reassembled. For each stick represents an individual right which is a common analogy made for the bundle of rights. For each owner possesses a set of sticks related directly to the land.

Rights relevant for land administration in the legal sense can be characterized by two basic types of rights duty and power. Duties describe obligations between persons, whereas powers define possibilities activities of sovereign individual.

The interest of the owner is enforced and protected by the state, and the legal system defines general rules of person to acts based on their rights.

2.3. Ontological Categories of Phenomena in Land Administration

According to Searle's theory, there are three ontological categories of phenomena, those are: object (e.g. sentences, birth of certificates, pieces of land etc.), subject (e.g. Professors, wives, chairmen, etc.), and event (e.g. weddings, wars, elections etc.) (Searle, 1995, p. 97). He holds that the ontological categories of phenomena can be determined by status function. Ontological categories in land administration are intended to see the phenomena in land administration.

Bittner (2001) uses the ontological categories in order to see one of the reality in land administration which is transfer of ownership. He categorizes legal persons as the subjects of rights, in which a specific person is the owner of the parcel which has some right to perform activities concerning the parcel. He categorizes land parcels and the system of documentation as the object. He justifies that parcels are the object of property rights whereas legal documents represent change in land administration, these are status indicator. He classifies transfer of ownership as the events. The event is caused by an activity of the subjects involved in the event. Figure 2-3 shows the ontological categories in transfer of ownership.

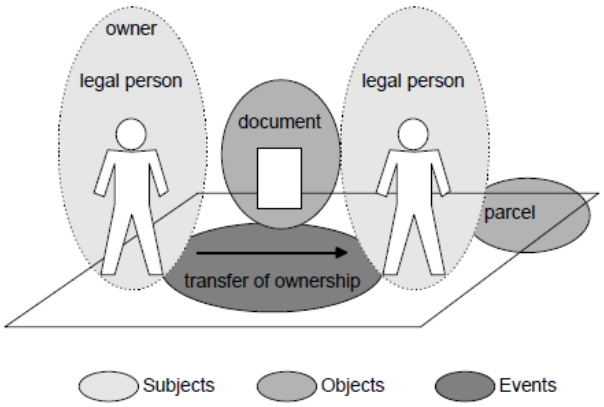


Figure 2-3: Ontological categories phenomena in land administration (source Bittner 2001)

In the different way, Henssen (1995) look at the phenomena in land administration from the core perspective. He also categorizes of phenomena in land administration particularly cadaster and land registration into three categories, which are man, right (stewardship), and parcel (see Figure 2-4). He explains the concept of land tenure can be defined as the "the act, right, manner or term of holding a landed property" or as "the nature of legal estate in land". If land tenure is related to the broad field of land use, it is more than the "man-land" relationship. In that connection, it can be defined as the institutionalized relationship of people involved in the use of land and the distribution of its products(Henssen, 1995). However, this model explains about objects and properties in the formal land administration systems.

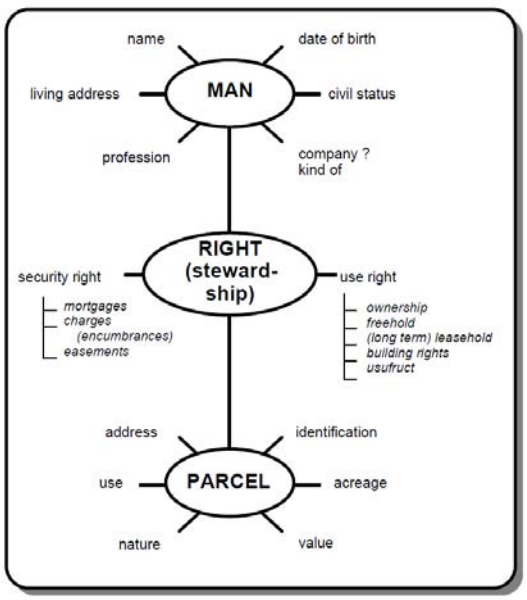


Figure 2-4: Phenomena in formal land administration (Henssen, 1995)

Van der Molen et al.(2006) come up with the broader concept of land administration systems in which these systems reflect in principle the social relationship between people concerning land, as they are recognized by a community or a state. This concept is in line with the objectives of this thesis in terms of concept the social relationship between people and land. Properties of object in land administration systems have a social and legal meaning, and are based on accepted social concepts. That concern about owners, rights and land, no matter whether these concepts are laid down in the statutory or customary systems. Land administration systems have meaningful properties that refer to the basic relationship of man to land through a right, legal meaning is attached to who can be right holder, which right can executed, and what objects might be subject to the exercise of rights.(van der Molen, et al., 2006).

Based on three concepts of phenomena in land administration above, in principle there is one category which different. Event, rights, and social tenure relationship are realities that should be recorded in a specific manner, in this study all of them dealing with administrative.

2.4. Overview

This chapter introduces the philosophical foundations of this thesis. The foundation of this thesis is the representation of reality in land administration system. Land administration system is a part of social reality, in which its system rest on the institutional reality.

Reality in land administration is embedded into its environment. The representation concept of right in is an institutional fact and the individual rights are conventional powers assigned to the institutional fact. This concept is in line with the formal land administration in terms of rights of ownership can be described with the metaphor 'bundle of stick' in which each stick represents an individual right. The interest of the owner are enforced and protected by the state, and the legal system defines general rules of person to acts based on their rights.

The concept of parcel is representing institutional facts related a piece of land as a physical fact. Parcels are constructed based on institutional facts representing legal boundaries in reality which are identified. Rights are always related to the parcels as whole i.e., to the parcel identifier.

The representation of reality in land administration systems are explained in this chapter is determined ontological categories of phenomena. These aspects conclude the structure of reality in land administration.

The major goals of this chapter are not only to explain the representation of reality in land administration systems but also to develop the foundations for the construction of a computational model. How the systems are managed can be derived from specific view of the world or specific ontology. The specific ontology in this chapter describes the basic relationship between human beings and land through the right, whether right in the formal systems or in the context social relationship.

Searle argues that there are three ontological categories of phenomena, those are: object, subject and event. Henssen describes the three basic interactive system of land administration that involves land registration and cadaster, which are man, parcel and right. Van der Molen, et al. comes up with the social relationship between people concerning land, as they are recognized by a community or a state. However, dealing with this major goal of this study, the ontological categories of phenomena in land administration can be concluded consist of Subject (Party), Object (Spatial Unit) and administrative (Conclusive overview see Figure 2-5).

Represented by	Representation of Reality in Land Administration (Ontological Categories)		
(Bittner as he adopted from Searle)	Subjects (Legal Persons)	Events (transfer of ownership)	Objects (parcel and document)
Henssen	Man	Right	Parcel
Van der Mollen et.al.	Person	Social Tenure Relationship	Land

Figure 2-5: Conclusive overview of the representation of reality in land administration

3. SOCIAL TENURE DOMAIN MODEL

3.1. Introduction

This chapter explains the so called Social Tenure Domain Model (STDM) as a reference model to assimilate customary systems and statutory systems in land administration systems. STDM provides the basic structure of the model that can be extended for assimilate both systems in national land administration systems. STDM uses UML (Unified modeling language) as represent part of ontology in land administration in which STDM describes the basis of phenomena in land administration. The general goal of UML is to capture reality in an ideal world and represent entire system clearly in a single picture that all understand without confusion.

3.2. Alternative Land Administration Tools in Recognizing Customary Lands

Modeling the relationship between people and land as a basis for land administration system is complex task (Lemmen, et al., 2007). Conventional land administration system is not sufficient to support the complexity of customary systems. The need to find an alternative land administration tools to recognize customary land become an important issue to guarantee that the local community are not marginalized on their own land or to avoid that local community are overruled by facts provided from formal (statutory systems).

The acknowledgement of customary land tenures into national land administration system becomes an important issue to provide tenure security for customary community. By having tenure security the customary community can take advantages from the productivity of their lands and a proper compensation if their lands are used by third party. There is a need land administration tool that has capability to accommodate customary tenure into national system. As an alternative land administration tool, the Social Tenure Domain Model (STDM) is a pro-poor land administration tool that can be used as an option.

3.3. UML for Land Administration Systems

This section explains why modeling approach for land administration and what concepts are available in UML.

Unlike many other geographic information systems, which provide information about geographical objects and their attributes, land administration systems reflect the social relationship between people concerning land, as they are recognized by community or state (van der Molen, et al., 2006). Therefore this system is not only concern about physical aspects but also social and legal aspects.

All aspects that involve in land administration are represented as complex system, which consists of many subsystems with many sets of activities or processes and supporting geo data bases. Therefore, system developer need a systematic modeling approach for requirement determination, analysis, design and implementation of the systems (Tuladhar, 2002).

UML is a modeling language that consists of several concepts and notations used at different levels of abstraction throughout the system development and maintenance. These concepts and notations can be used for many purposes such as visualizing and documenting business processes, specifying system requirements, and design and developing information system (Tuladhar, 2002).

The general goal of UML is to capture reality in an ideal world and represent entire system clearly in a single picture that all understand without confusion. This ideal is difficult to achieve, because a system has many different aspects; functional (its static structure and dynamic interactions), non-functional (timing requirements, reliability, deployment, and so on), along with organizational aspects (work organization mapping to code, and so on). A system description requires a number of views, where each view represent a projection of the complete system that show particular aspect (Eriksson et al., 2004).

The Object Management Group (OMG) has established standards for Model Driven Architecture (MDA). The MDA provides a means for using models to direct the course of understanding , design, construction, deployment, operation, maintenance and modification (OMG, 2003). Within MDA the system development process is determined by modeling activity. The development system begins with the analysis requirements, mostly in text. Based on these requirements, the artifacts (use cases, class diagram, and other UML models) are created. The artifacts are collection of concepts and notations (model) that can be understood by human and machine. There are two models within MDA. The first model is Platform Independent Model (PIM). This model is an abstraction of real world and independent of any implementation technology. The second model is Platform Specific Model (PSM). This model is a view of system from the specific implementation technology such as PosgreSQL, Java etc. In the implementation, these models are used to transform from model to code.

3.4. The Social Tenure Domain Model (STDM)

The Social Tenure Domain Model (STDM) is an initiative of UN-HABITAT to support pro-poor land administration (UN-HABITAT, 2009). STDM is meant specifically for developing countries, countries with very little cadastral coverage in urban or rural areas. It is also meant for post conflict areas, areas with large scale informal settlements, or large scale customary areas. The focus of STDM has been on all relationships between people and land, independently from the level of formalization, or legality of those relationships (ISO TC 211, 2010). STDM contains the functionality of LADM, but under different terminology. Formal terminology as used in LADM may not always be applicable because of the informal environment (ISO TC 211, 2010).

The social tenure domain model is a UML diagram which presenting the object classes and the relationship among them. All the object classes and their relationships are manifest of domain ontology in land administration. All together provide an abstract conceptual framework in land tenure system whether formal, customary, informal etc.

The STDM is also organized into three packages and one sub-package (ISO TC 211, 2010). Each package has arranged set of classes that intended to be able to present STDM in comprehensive part yet maintain and develop package independently. This is means that the packages enable the maintenance of different data sets by different organizations. The complete model can be implemented by one or more maintenance organizations, operating at national, regional or local level.

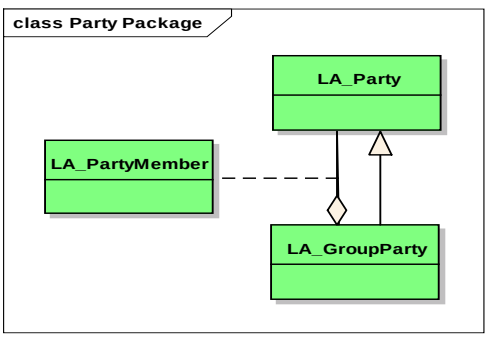


Figure 3-1: Party Package (ISO TC 211, 2010)

The packages are marked by specific color in the class diagram. Explanation of each package, sub package and some special classes as is follows:

1. Party Package is marked by green color. The main class of Party Package is the basic class "LA_Party", in which an instance of this class is party (see Figure 3-1). Class "GroupParty" is specialization class of class "Party". An

instance of class group party is group. The class "PartyMember" is an optional association class between class "LA_Party" and class "GroupParty".

2. Administrative Package is marked by yellow color. The main class of administrative package is the abstract class "SocialTenureRelationship" and class "LA_BAUnit". This package has four specialization classes which are class "LA_Right" (with formal rights), class "STDM_Relationship" (with customary rights, informal rights, etc), class "LA_Restriction" (with restrictions) and class "LA_Responsibility" (with responsibilities). The main principle of this package is all the social tenure relationships are based on an administrative source document as an instance of class "LA_SocialTenureInventory". Another public class in this package is class "Colateral". This class is associated to class "LA_Right", in which right is the basis of collateral. Figure 3-2 shows the administrative package of STDM.

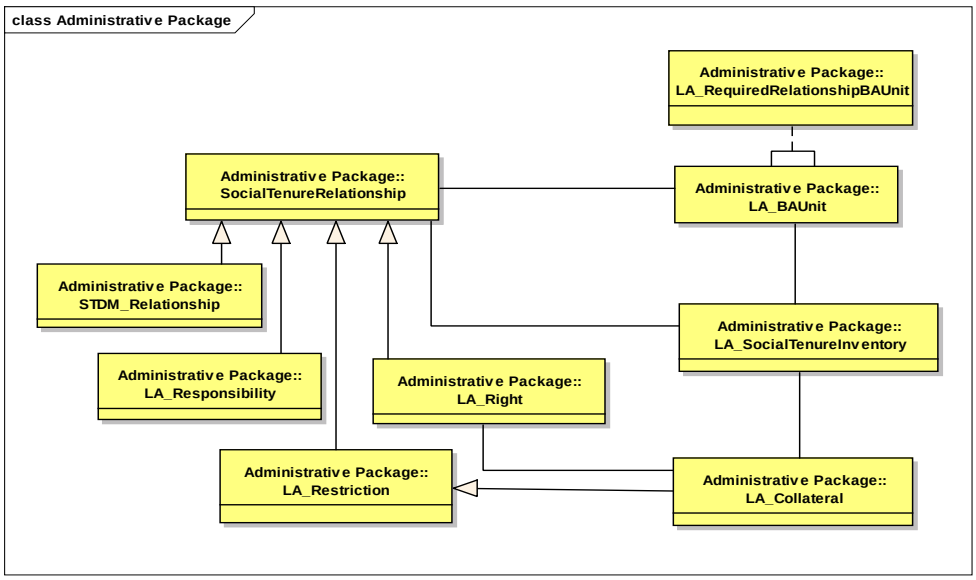


Figure 3-2: Administrative Package (ISO TC 211, 2010)

3. Spatial Unit Package is marked by bluish green color. The main class of the Spatial Unit Package is basic class "LA_SpatialUnit". An instance of class "LA_SpatialUnit" is spatial units. LA_Parcel is an alias for LA_SpatialUnit.

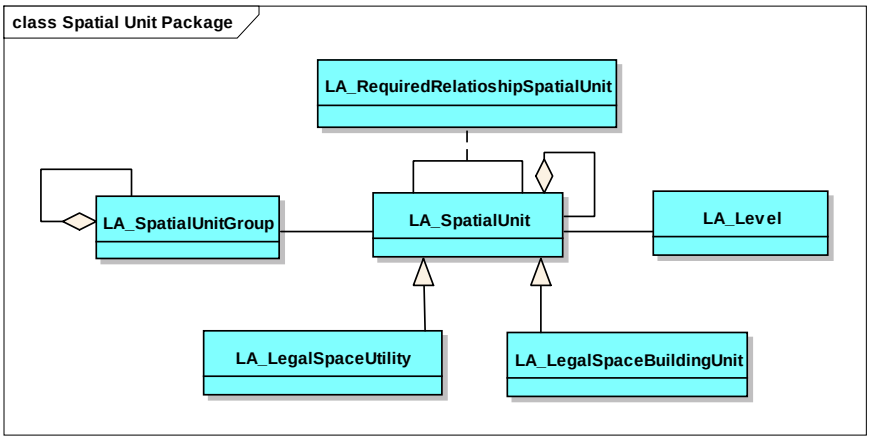


Figure 3-3: Spatial Unit Package (ISO TC 211, 2010)

Spatial units may be grouped into two forms, which are as administrative spatial unit and as sub spatial unit. Spatial unit group is an instance of class "LA_AdminSpatialUnit", in which as an instance of

class "LA_AdminSpatialUnit" it also realized by an aggregation of class "LA_AdminSpatialUnit" itself. For instance a spatial unit group is a district, in which a district may be a grouping of the sub districts. As sub spatial units which is a grouping of spatial unit into its parts.

There are two specialization classes of class "SpatialUnit" which are class "LA_Unit" and class "LA_UtilityNetwork". Both of these classes concern legal space, which do not necessarily coincide with the physical space.

Class "LA_RequiredRelationshipSpatialUnit" are explicit links between spatial units, and instances of class "LA_RequiredRelationshipSpatialUnit".

4. Surveying and Representation Sub Package is marked by pink and blue color. This package consists of four classes which are class "LA_Point", class "LA_SpatialSource", class" LA_BoundaryFaceString", and class "LA_BoundaryFace", see Figure 3-4.

An instance of class "LA_Point" is point, which is can be acquired in the field through terrestrial surveys or extra-terrestrial surveys (satellite navigation systems). It also can acquire in an office by compiling from various sources, for example cadastral maps, field sketches etc.

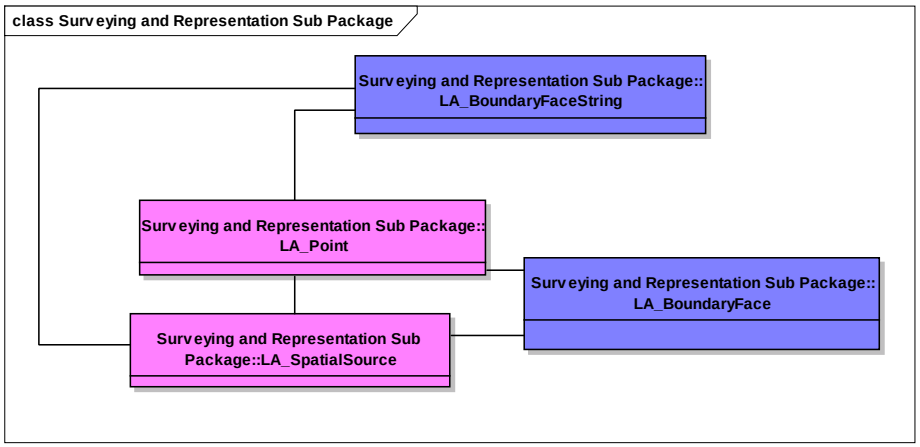


Figure 3-4: Surveying and Representation Sub Package

An instance of class "LA_SpatialSource" is spatial document. The document may be the final documents, or all document related to a survey activity. Sometimes, it can be several documents are the result of single survey. A spatial source may be official or non-official (i.e. a registered survey plan or an aerial photograph), and the format documents it can be paper based documents (which may be scanned) can considered as an integral part of the land administration systems.

A set of measurements data (bearing, distance, etc.) is an attribute of class "LA_SpatialSource". Class "LA_Point" is associated to class "LA_SpatialSource.

An instance of class "LA_BoundaryFaceString" is boundary face string which representing 2D and 3D of spatial units. And an instance of class "LA_BoundaryFace" is boundary faces, in which coordinates themselves obtained from points, or capture as linear geometry.

Spatial units may share the same representation structure: existing 2D data, whether topologically structured or not, or polygons, or unstructured boundaries, or simply point or textual descriptions, can be included.

5. Special Classes

In order to support the STDM as a standard model, there are special classes that should be exists in the model.

a. Class "VersionedObject"

This class is introduced in order to manage and maintain historical data in the database. A history has specific time whether begins and end time. Every event that deal with the database are given a time-stamp.

By implementing this class, the historical data can be reconstructed. This class is mother class of all classes in STDM, in which all classes in STDM are specialization class of class "VersionedObject", see Figure 3-5.

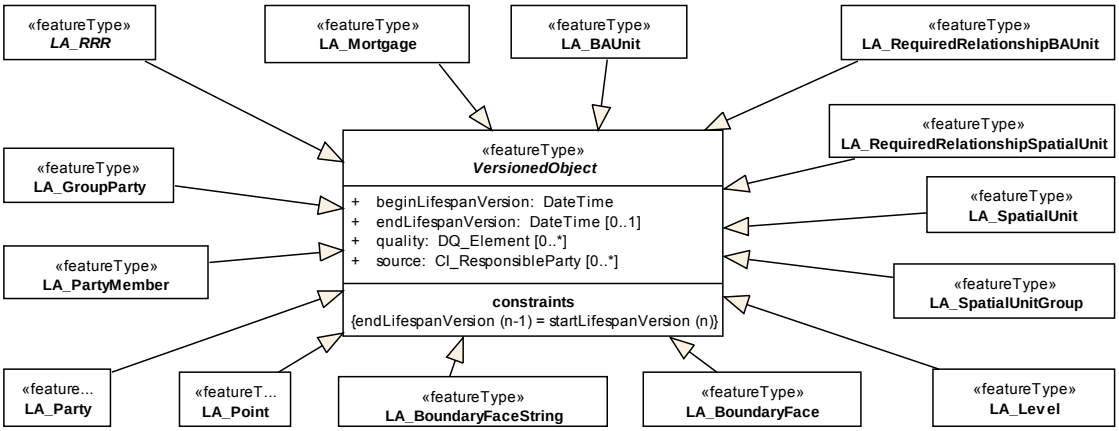


Figure 3-5: Special Class "VersionedObject" (ISO TC 211, 2010)

b. Class "LA_Source"

Class "LA_Source" is an abstract class that has two subclasses, which are class "LA_AdministrativeSource" and class "LA_SpatialSource", see Figure 3-6. This class is introduced in order to manage and maintain documents in every event.

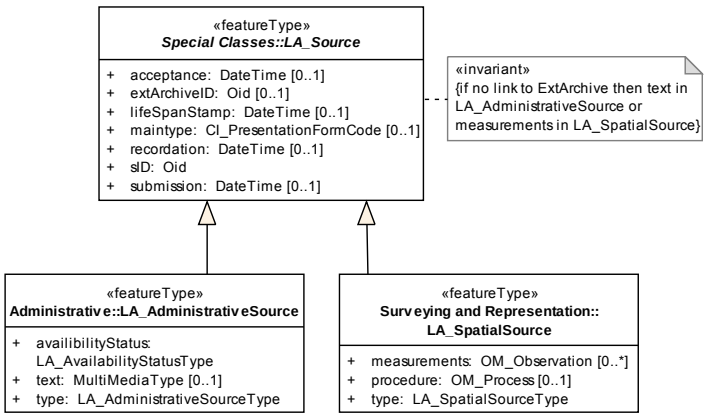


Figure 3-6: Class "LA_Source" with the subclasses (ISO TC 211, 2010)

3.5. Summary

STDM contains the functionality of LADM, but under different terminology. Formal terminology as used in LADM may not always be applicable because of the informal environment (ISO TC 211, 2010).

The Social Tenure Domain Model (STDM) is described with a UML class diagram. The core classes of the STDM are Party, Spatial Unit, and the Social Tenure Relationship to this spatial unit, which this party is involved in. These classes represent phenomena in land administration, in which in each core class represents ontological category. The Class Party represents subject of land right, the class spatial unit represents object of land right and the class social tenure relationship represents land right and imply event inside this class.

The STDM consists of three packages (party package, administrative package and spatial unit package) and one sub package (surveying and representation sub package). These packages expended from the core classes of STDM. The surveying and representation is a sub package of the spatial unit package. The main class of each package has one mother class which is versioned object. Class versioned object enables to manage and maintain historical data in the database.

In Figure 3-7, an overview is presented on the main ontological categories in land administration. This terms the following relations with the package in STDM.

Represented by	Representation of Reality in Land Administration (Ontological Categories)		
(Bittner as he adopted from Searle)	Subjects (Legal Persons)	Events (transfer of ownership)	Objects (parcel and document)
Henssen	Man	Right	Parcel
Van der Mollen et.al.	Person	Social Tenure Relationship	Land
		All exist in	
The packages in the STDM	Party	Administrative	Spatial Unit

Figure 3-7: The overview of ontological categories in the STDM

4. INDONESIAN LAND ADMINISTRATION SYSTEM AND CUSTOMARY TENURE SYSTEM IN MINANGKABAU COMMUNITY

4.1. Introduction

The main objective of this chapter is to describe the structure of tenure system in the Indonesian NLAS and the *ulayat* land tenure system in *minangkabau* community.

4.2. National Indonesian Land Administration System

This section describes the National Indonesian Land Administration System which is based on the legal framework BAL that is an umbrella act for Indonesian NLAS.

The legislative in Indonesian government system is arranged in a hierarchy, as in the Act of the People's Consultative Assembly No.3/ 2000. On this hierarchy of legal provisions only 7 types of ranked legal products are mentioned: (1.) the constitution (*UUD 45*), (2.) acts of the People's Consultative Assembly (*TAP MPR*), (3.) laws (*Undang-Undang*), (4.) government regulations substituting laws (*Peraturan Pemerintah Pengganti Undang-undang*), (5.) government regulations, (6.) presidential decrees and (7.) regional/local regulations (*Peraturan Daerah*).

Based on the Indonesian constitution of 1945, Indonesia enacted The Basic Agrarian Law of 1960 (BAL) on September 24, 1960 as a foundation for national agrarian law. The main concerns to the establishment of BAL are:

1. To lay the basic foundation of a national land law formulation for justice, prosperity and welfare of the people.
2. To lay the basic foundation to unify and simplify the land law.
3. To lay the basic foundation to provide land right security for all people.

BAL also creates unification in agrarian law that can be seen from its principles; those are nationalism (non Indonesians are excluded from land rights), socialism (all Indonesians shall have access to minimum of land), Indonesianism (land law based on traditional, customary law: *Adat*).

The government regulation Number 24 (1997) is about the Indonesian land registration system. It provides the basic principles of land registration which are simple, secure, affordable, up-to-date and open. This regulation is mentioning that land registration aiming on (i) ensuring tenure security to the land right holder, (ii) providing information to the stakeholders, (iii) establishing good land administration (Presiden Republik Indonesia, 1997). The regulation mandates BPN as the only one government institution which conduct Indonesian land registration. Furthermore, BPN is assisted by *Pejabat Pembuat Akta Tanah* (PPAT). Usually, the PPAT is a notary or a head of sub-district in particular area which is pointed by BPN. The PPAT assist BPN in terms of providing all kinds of deeds, such as transfer deed, mortgage deed etc.

The Ministry of Agrarian/ Head of National Land Agency Regulation Number 3/1997 is a provision to implement government regulation number 24/1997. It regulates procedures and mechanisms of

Indonesian land registration system, which consist of the surveying and mapping, the initial registration and the data maintenance (Menteri Negara Agraria/ Kepala Badan Pertanahan Nasional, 1997).

4.2.1. The Characteristics of Land Tenure in Indonesian Statutory System

State through the constitution obtains a right to control land resources within the country. As mentioned in article 33 of Indonesian constitution (1945) that the entire earth, water, and air space are controlled by the state. It means that the right of the state to control land resources is the highest level of right. From the perspective of nation this right has the public aspect. According to the article 2 BAL (1960) this right gives the authority for the state to regulate and implement, the utilization, the reservation and the cultivation of the land resources; to determine and regulate the legal relation between persons and land resources; to determine and regulate the legal relations between persons and legal acts concerned with land resources.

Manifestation of this right given to the state can be seen from tenure arrangement in BAL. According to Article 16 BAL (1960) there are 8 (eight) basic types of land tenure of which four of them are derived directly from the state (primary rights), those are right of ownership (*Hak Milik-HM*), right to cultivate (*Hak Guna Usaha-HGU*), right to build (*Hak Guna Bangunan*-HGB), right to use (*Hak Pakai*-HP). Other rights are secondary rights, which are derived by the owner of primary right such as right of lease (*Hak Sewa*), right to clear land (*Hak Membuka Tanah*), right to harvest forest product (*Hak Memungut Hasil Hutan*), and other right not included in the above-mentioned rights which are of temporary nature. The implementation of these rights is regulated by government regulations. From the eight basic types of rights aforementioned, only the primary rights have implementation regulation.

There are three types of rights which are not explicitly mentioned in BAL. Those are right of management (*Hak Pengelolaan -HPL*), right of waqf (benefaction of land for religious purposes according to Islam law), and right of apartment. The complete characteristics of statutory rights are included in APPENDIX A.

4.3. Customary Tenure in Indonesia

Adat regulates the living system based on unwritten law which exists in traditional community. As the living system, *adat* also regulates tenure system within its region. According to van Vollenhoven (1919), Indonesia consists of twenty three customary regions. Each region has specific characteristics. This thesis focuses on *minangkabau* region in West Sumatra, which has specific inheritance system (matrilineal).

4.4. Customary Tenure System in Minangkabau Community

4.4.1. Ulayat Land, Ulayat Rights and Nagari

The term of *ulayat* for the first time is used by *minangkabau* community to define their territory. Van Vollenhoven in his book "*Miskenningen Van Het Adatsrech"* characterizes the *ulayat* land tenure system into five, those are:

1. Parties that can exploit forest (virgin lands) in their territory are only the people from their own community. They may use only for their own family. If they use for sale then they should pay for that (*bungo*). They can open forest for agriculture, construct the small village, and gathering forest products.
2. The outsiders only may use customary land as long as they get permision from the leader of community. They have to pay retribution (*recognitie*) for the *adat* community.
3. The *adat* community still has rights to control cultivated lands.
4. The *adat* community has responsibility in terms of unaccountable action within the area.
5. *Ulayat* rights cannot be transferred permanently.

According to regulation of Agrarian Ministry no. 5 (1999), *ulayat* right is an authority which is owned by an *adat* community in particular region where its community's members live and take advantage of natural

resources on it. This includes land in this region for livelihood of community's members, which occur in a way outwardly and inwardly from heritage without disconnected between its community and its region. Definition of *ulayat* land is a piece of land which has *ulayat* land on it. Based on these definitions, it can be concluded that *ulayat* right is accumulation of characteristics of *ulayat* right which is mentioned above. In *minangkabau* region, the highest level of *ulayat* right is managed by *Nagari* (*adat* village authority).

According to regional regulation of West Sumatra no 2 (2007), *Nagari* is a unit of *adat* community which has the particular territorial boundaries and the authority to manage and take care of local community interest based on *adat* in *minangkabau* community (Gubernur Sumatera Barat, 2007).

4.4.2. Territory of Nagari

Adat in *minangkabau* community regulates and manages the living system of people within *Nagari*. The *Nagari* is formed by the process of forest clearing with temporary settlements (*taratak*), to hamlet (*kampuang*), to combinations of hamlet (*koto*), and finally *Nagari*. *Nagari* is a unit of the customary community in the West Sumatra province, which contents of clans (suku); it has territory with the particular boundaries.

Concepts of territory in *adat* are important to determine the boundaries of *Nagari*. *Nagari's* territory is determined by the region that holds by member of community (*Anak Nagari*). All lands and forests areas that are hold by all members of the community are territories of *Nagari*. The forest areas which are using as shifting area, such a temporary settlements, or hamlet, is one of indicator to determine territory of *Nagari*. Besides factual evidence, the territorial *Nagari* also rests on the histories (*tambo*), which are describing the boundaries. Another way to determine the territory of *Nagari* is recognizing of boundaries from the adjacent of *Nagari* (Contradictory delimitation). Based on the explanations above, it can be concluded that territory of *Nagari* is the entire earth surface till the territory of *Nagari* adjacent. It is means that there is no land without holder. In other words, there is no state land or forest state along the territory of *Nagari*.

4.4.3. Subject of Land Resources in Minangkabau Community

In *minangkabau* community, each member of community in *Nagari* (*Anak Nagari*) is the subject of land resources in *Nagari*. As the ownership and land holder system according to *adat* is communal, it is important to understand the structure of society in *minangkabau* community. Subjects of rights in *adat* system are determined and arranged in layers, for example individual and collective member of *adat* community in *Nagari*, see further Table 4.1 and Figure 4-1:

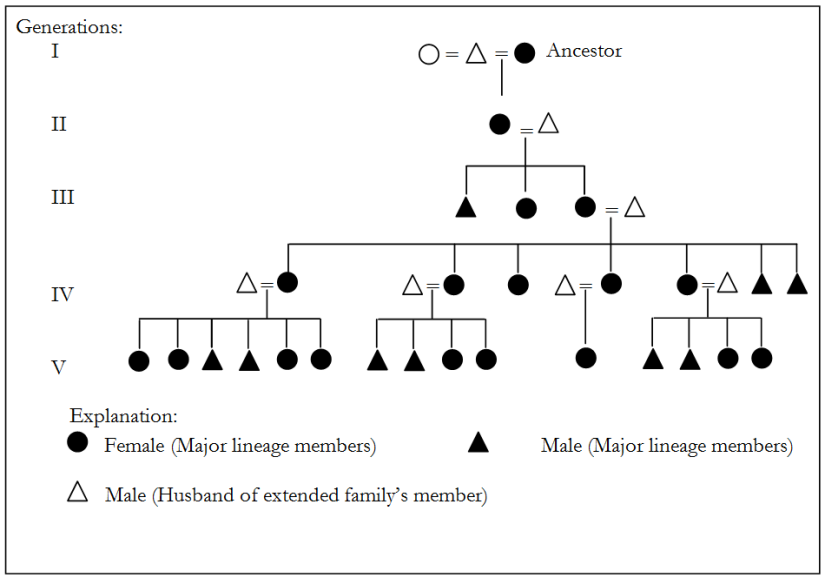


Figure 4-1: Structure of the extended family in *minangkabau* community (adopted from H.D.Evers, 1975)

According to Warman (2009) the structure of society in *Nagari* begins from the extended family or major linage (*kaum*) as shown in the diagram above. The member of *kaum* is determined by consanguinity. All the husbands of its members are not the member of *kaum*. The member of a *kaum* consists of mothers and their children (males and females), all brothers and sisters from the mother, all children from the grandmother's sisters, all daughters from the grandmother, all children from the mother's sisters, grandmother, all brothers and sisters from the grandmother, great-grandmother, all brothers and sisters from the great-grandmother, all children from the great-grandmother, all children from the great-grandmother's sisters, great-great-grandmother (*puyang*), all great-great-grandmother's children, all children from the great-great-grandmother's sisters. Generally, it can be concluded that a *kaum* consists of five generations.

In fact, a *kaum* can have large number of members, and it may split into some minor lineages (*paruik*). *Paruik* consists of some households which have a kitchen (*tungku*) to share. A kitchen is developed by the women after they are married. A small household consists of all persons (children) from a single mother (*sainduak*). It can be concluded that each *Anak Nagari* is also a member of small household (*sainduak*). In other word, a *Nagari* is aggregated of some kaum, while kaum is aggregated of some paruik, and paruik is aggregated of some sainduak as depicted in Figure 4-2.

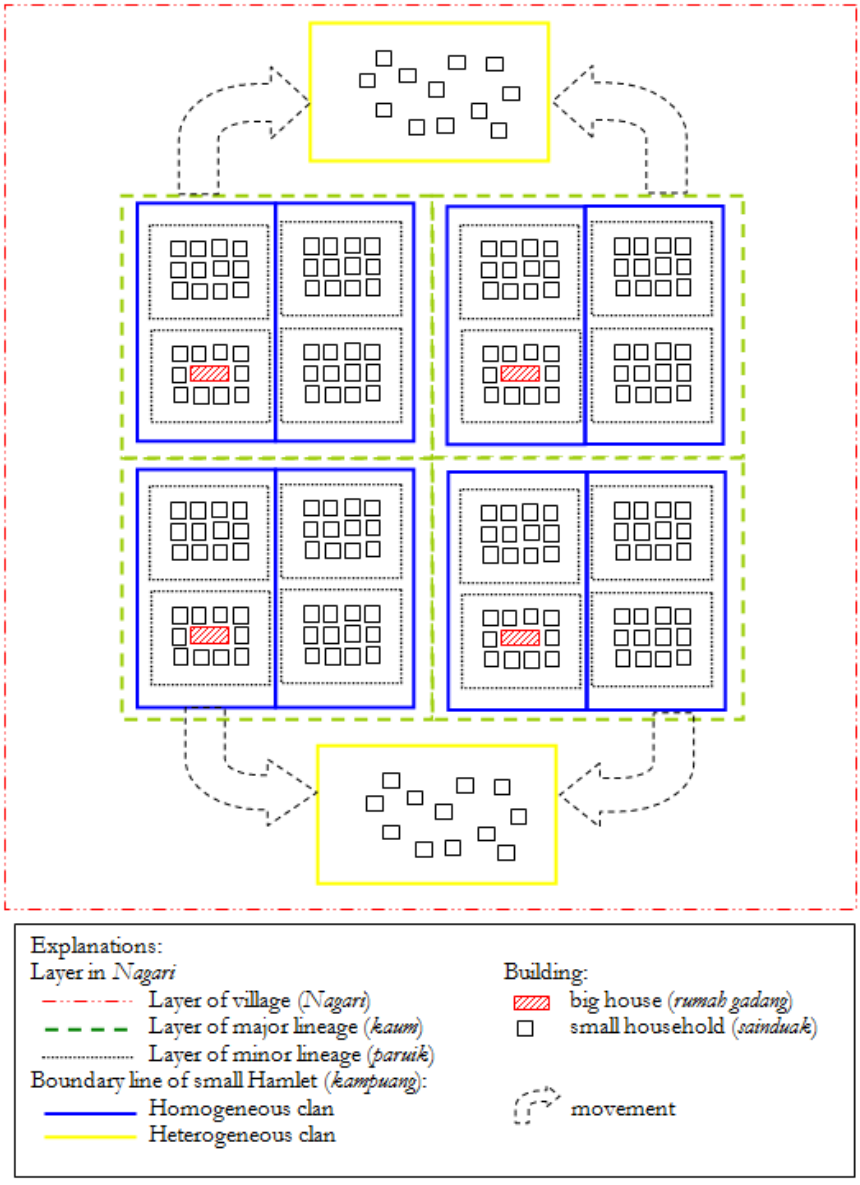


Figure 4-2: Visualization of structure boundaries within a *Nagari*

Every kaum and paruik has a chief. The chief has the authority to manage members of his lineage and their inheritances. Even though, the lineage system in *minangkabau* community is matrilineal system, chief in its group (kaum and paruik) cannot be a woman. A chief in a group is a man that is named Mamak.

The authority of Mamak originates from agreement of the group. A Mamak in a paruik is the oldest brother mother's. All of the children from his sisters, all of the children from his mother and all of the sisters from his mother are his nephew (*kamanakan*). *Mamak* in *Kaum* is named *Panghulu kaum*. *Panghulu*

kaum is a man from the mother lineage who elected from the Mamak in paruik. He is the oldest Mamak paruik within kaum.

Even though a Panghulu kaum is elected by all its members, but he still needs admission from all Panghulu kaum within *Nagari*. If there is no agreement among them, then they have to decide by voting. After this agreement a *Panghulu kaum* gets a new degree which is called *Datuak*.

Datuak as a leader in his *kaum* still has position as a leader in *Paruik*. In other words a *Datuak* has two functions; those are 1) as a leader in his minor lineage which is equal with the other *Mamak* within his major lineage, 2) as a leader in his kaum which has higher position than the other Mamaks in his kaum. Due to Datuak represents his community to the outside. A kaum has inheritance and particular settlement. It has clear boundaries which split each kaum within Nagari.

A kaum has evolved such a way until five generations, it will generate segmentation. The segmentation will create a new community environment that has the same clan (suku) but different kaum. Suku is a unit of community which its members have consanguinity feeling according to mother lineage. They have feeling as a family each other within clan (*badunsanak*).

Suku is a unit of community without boundaries territory. Because it can be happens different *kaum* have the same *suku*. The number of members of a *suku* will increase if the female within its *suku* deliveries babies (males and females) everywhere. Moreover, the number of members of *suku* within *Nagari* can increase from incoming outsiders. An outsider can be a member of particular *suku* that move to another *Nagari*. He/she apply to become a member of particular *suku* in the new *Nagari* wherein he/she settles. The join process to a new *suku* is called *malakok*. A new member of *suku* will be a nephew from *Panghulu kaum*. Even though he/she has a new *suku* in the new *Nagari* but he/she doesn't have any inheritance in this *Nagari*. Because only a member of *kaum* who has mother's lineage within its *kaum* has ancestral property. In other word ancestral in *minangkabau* community is not attached to the *suku* but attach to the *kaum*.

According to Navis (1984) *suku* has important role in *Nagari*. A *Nagari* is formed by at least four *suku*. This rule is one of clause in constitutional law in *minangkabau* community. A suku also has a role in marriage law. In order to keep integrity of its *suku*, each member of community within *Nagari* do not allowed to marrying a person who has the same *suku* (exogamy).

Another unit of people in *Nagari* is hamlet (*kampuang*). *Kampuang* formed through the exogamy process. In which every married woman in *kaum* develops a new house close to the big house (*Rumah Gadang*) or on the high ancestor land (*tanah pusako tinggi*). Due to large size of *tanah pusako tinggi* thus the new houses creates a new *kampuang*. Therefore a *Kampuang* will be occupied by homogenous *suku*.

Besides the homogenous *suku* in the *kampuang* there is another type of small village which is occupied by the heterogeneous *suku*. This type obtained due to no more available land to develop the new houses which close to the *rumah gadang* or on the *tanah pusako tinggi*. Therefore the members of *kaum* looking for another place which separate from their originate land. At the same time the other people from the other *kaum* do the same thing, so that at the new location they develop a new *kampuang*. At this time, this type of *kampuang* is dominated within *Nagari*. In other words, the establishment of *kampuang* is not only determined based on genealogies but also territorial. Unlike the establishment of *Nagari* which requires at least four *suku*, the establishment of *kampuang* can be established by single *suku*.

Each *kampuang* has a chief that called *Panghulu kampuang*. In the structure of government, a *kampuang* is a part of *Nagari*. The term of *kampuang* in the government system in *Nagari* is named *jorong*. Some *kampuang* that closed each other establish a *Nagari*. In other words *Nagari* is the highest layer in structure of custom of *minangkabau* community. It can be concluded that a *Nagari* can be seen from the perspective of territory and genealogies. In the territory, a *Nagari* should have a region which has particular boundaries. In the genealogies, a *Nagari* should have at least four *suku*.

4.4.4. Categorization of Ulayat Land in Minangkabau Community

The specific character of the management of *ulayat* land in *minangkabau* is its inheritance system. Those are high inheritance (*harta pusako tinggi*) and low inheritance (*harta pusako rendah*). *H*igh inheritance represents the property of a lineage to which a household only has user rights, it is not allowed to sale. It is inherited from the ancestors and includes rice fields and the house. It is traced down from the mother to her daughters, whereas men may not inherit any of it. Low inheritance represents individual property, which is obtained from the household earnings or buys by a person before married. Land clearing in primary forest and bought land also include under this category. It is shared equally between daughters and sons.

Based on the explanations above, it can be concluded that customary land which exists in *minangkabau* community is divided into two categories:

1. Communal land which is held by each community. It is named ancestral land (*tanah pusako*).
2. Individual land which is obtained from the small household earning or land clearing of primary forest in the *Nagari*. Someone allows opening *Nagari's* forest after he/she gets permission from the authority of *Nagari*.

4.4.5. Land Tenure System in Minangkabau Community

According to Evers (1975) there are three basic types of land tenure in *minangkabau* community based on land holders:

- Land held by individuals under individual ownership rights
- Land held by descent groups of varying size and generational depth under communal ownership rights.
- Land held by local groups, namely village (*Nagari*) communities.

In order to determine types of land tenure is important to know from where land is obtained. According to Warman (2009) in *Minangkabau* community land is obtained by two ways, which are self-earned (*harta pencarian*) or low inheritance property and ancestral property (*harta pusaka tinggi*) or high inheritance. Table 4.1 shows the types of land tenure based on land holders and category of obtain.

Table 4.1: Types of land tenure based on land holders and categories of obtain (source: Ever, 1975)

No.	***Land are held by***	***Property rights***	***Category of obtain***
1	an individual	*hak milik* (private, individual property rights)	*harta pencaharian* (self-earned property)
2	a descent group minor lineage (*paruik*) major lineage (kaum)	*ulayat kaum* (communal property rights)	*harta pusaka* (ancestral property)
	Suku (suku)	*ulayat suku* (*Suku* rights)	
3	a local group village (*Nagari*) some hamlets (*Kampuang*)	*ulayat nagari* (community property rights)	e.g. virgin land e.g. forest, market place)

According to Warman (2009) as he cited from Dt. Perpatih Nan Tuo, all lands within customary region is named *ulayat* land. *Adat* in *minangkabau* community defines *ulayat* land comprises everything over the land and underneath the land. In other words, object of land resources in the *adat* principles comprise land, forest, materials and minerals, water and space on it. Refer to Dt. Perpatih Nan Tuo, there are four types of *ulayat* land which represent object of land resources:

1. *Tanah Ulayat Rajo* is *ulayat* land which is held by *Panghulu*. Location of this land is far from the village. It consists of the forest area, the hill and the mountain, the field and the groves, the swamp and the brackish, the lake and the river, and the sea and the pond.
2. *Tanah Ulayat Nagari* is *ulayat* land which is held by the *Panghulu Nagari*. Location of this land is close from the village. It can be grassland, bush, meadow, hill, mountain, dam, etc.
3. *Tanah Ulayat Suku* is *ulayat* land which is owned by a group of people within a *suku*. This land obtained through hereditary which is held by *Panghulu suku* on behalf all member of *suku*.
4. *Tanah Ulayat Kaum* is *ulayat land* which is owned by a group of people within a mother lineage (*matrilineal*). This land obtained through heritage in form of one piece of land. It is held by the *Panghulu Kaum* on behalf all member of lineage community. This land more dominant than *ulayat Suku*.

Based on categories of customary land above can be concluded that land resources which are object of land resources within *minangkabau* community are all natural resources over the land and under the land. Higher level of land holding is wider scope of object. It can be seen from the *Ulayat Nagari* and *Ulayat Rajo* wherein a *Nagari* as the highest level customary system. A *Nagari* has large authority which is covering land and all the resources in the *Nagari*. *Tanah Ulayat Suku* and/or *Tanah Ulayat Kaum* are only the land (trees, building, crop) and nothing underneath the land.

4.5. The Position of Ulayat Rights in Indonesian Land Administration System

4.5.1. Customary Tenure (Ulayat Rights) System in Indonesia

According to Warman (2009) legal certainty is given only by the state through the statutory tenure system which is vulnerable and unable to exist when the state is in a condition of instability. This condition generates many reclaiming actions at the beginning of reformation (post Suharto regimes). Furthermore the fact shows as if the customary law supports these actions. Even though, not necessarily these actions get support from adat. This condition will never happen, if at the beginning adat is also involved in order to give legal certainty for all. In other words, if the condition of the state is instable then adat through its institutions give legal certainty for the interested parties to tackle the irresponsibility parties.

The decentralization policy gives opportunity to the local governments to develop responsive policy for the adat that exists in each region by using statutory system as guidance. By using this policy, each local government expected has capability to develop local policy that can manage assimilation between statutory tenure system and customary tenure system. This concept will support the principle of diversity in unity in terms of tenure arrangement.

4.5.2. Decentralization of Land Tenure Management

Decentralization of government system especially for regional autonomy is becoming a hot issue in the developing country. One of the reasons is discrepancy between the rhetoric and the reality, i.e. discrepancy between policy and implementation of regional autonomy in the field. This condition becomes long discussion among the experts. The question arise what is the proper concept that can be referenced in the regional autonomous. So far there is no concept of decentralization agreed by the experts and the policymakers (Warman, 2009).

Cheema (2005) argues that decentralization can improve the economy and financial situation in developing countries. He also argues that in many countries services are provided by central governments

inefficiency and ineffectively. He defines decentralization as the transfer of authority, responsibility, and resources through deconcentration, delegation, or devolution from the centre to lower levels of administration. Transferring power and authority from the central government to local government units provide opportunities for local authorities and empower communities to pursue local aspirations. It is important for local government to play stronger role. Decentralization of authority is one way to strengthen the state in terms of welfare distribution for its citizens.

In the land resources management, decentralization is a great opportunity for increasing the relevance of local authorities to local people. In other side it is a threat to central authorities and some elites who fear loss of income or resources. It can be seen from reluctance of some elites during the early time of reformation post Suharto regimes.

Decentralization gives expectation for the people to play the role in government administration. According to article 1 point 7 Law No. 32 year (2004) mentioned that decentralization is transfers of power from central government to local autonomous in terms of administration and management of government affair within the framework unitary state system of Republic of Indonesia (Presiden Republik Indonesia, 2004). In the implementation, decentralization is not only about transfer of power but also should be accompanied by transfer of accountability.

Decentralization of land resources in the implementation depends on the political will of central government and the integrity of all actors that involve. In one hand, decentralization gives autonomy to the local governments, so that they have wider movement to actualize their authorities. In other hand, decentralization also creates the excessive euphoria, so that they fell no need to do coordination with the central government (Warman, 2009 as he cited from Utomo, 2003). Therefore, in order to avoid conflicts of interest in decentralization the process needs intensive communication between local components and the central government.

The question arises about how to implement autonomy in the lowest level of government such as village government. Whether placing *adat* institution as a part of the governmental system has guaranteed rights to its community? The answer is that this cannot be sure, at least it can be seen from the Malaysia experience in the state of Sarawak. Whereas most of the chiefs and customary institutions tend to be businessman agents to exploit natural resources, so that ignoring rights of its community. As its results create the illegitimate customary institutions as the competitors the original customary institutions (ICRAF, 2003).

Learning by Sarawak's experience, provincial government of West Sumatra did not create the customary institutions automatically as a part of government system, but creates government institutions which legitimate in customary community. Therefore, a *Nagari* as the lowest level government should have acknowledgment from its community. A leader of Nagari (*Wali Nagari*) is a member of its community who is selected by all members of community in *Nagari* through general election. Beside, *Wali Nagari* as the executive there are two components of *Nagari* that should be involved in terms of *Nagari's* government system, which are the Parley of *Nagari* (*Badan Permusyawaratan Nagari* –BAMUS) as the legislative and *Adat Nagari* Assembly (*Kerapatan Adat Nagari* –KAN) as judicative. In other words, the *Nagari's* government system is an adoption of modern government systems, wherein for each *Nagari* has components of modern government system. This concept is really touching local community interest and deals with democracy and good governance.

Decentralization of land resources has long story. It has started from BAL, wherein contents and the explanations of BAL itself are centralistic. Even though, in implicit it gives opportunity for

decentralization. According to article 2 verse (4) BAL (1960) mentioned that implementation of right of the state to control land resources can be transferred to the autonomous regions and to the customary communities. In article 3 BAL (1960) declared that the state recognize *ulayat* right even though with some requirements. In article 5 BAL (1960) also declared that Agrarian law which applicable for agrarian resources arrangement is *adat* law. It is clear that BAL itself allows decentralization management of agrarian resources particularly land resources.

In land management, generally there are three aspects as the scope of management:

1. Planning aspect, i.e. arrangement about planning, use or utilization and maintenance of land.
2. Properties aspects, i.e. arrangement and determination legal relationship between people and land.
3. Transfer aspects, i.e. arrangement about legal activities and legal events in terms of transfer of rights.

In BAL, these aspects include in a packed is named "Right of the state to control the land resources" (*Hak Menguasai dari Negara* in short HMN), wherein principle this right belongs to the state.

This right still leaves some implementation problems in terms of decentralization policy. In fact, planning aspect and legal activities aspect in land management can be transferred to local government even to *Nagari*. It is possible as long as there is good coordination and communication between the government institutions involved. Whereas determination land rights is difficult to be implemented. A person is not allow to create new land rights for himself/herself except rights mentioned in law (Warman, 2009 as he cited from Abdulkadir Muhammad, 1990). Therefore, in BAL there is an article which determines land rights; this is a closed system of land right (article 16 BAL). The problem is implementation concept of centralistic in BAL is not fit with decentralization of government system policy. In local level even in *Nagari,* there is asynchronous between BAL and decentralization policy, which creates difficulties to formulate compatible decision. If the type of land rights in BAL is compatible with the type of land rights according to *adat*, then there is no problem.

Type of land rights is the dominant issue in order to formalize customary rights. There are big differences between type of land rights in BAL and type of land rights according to adat. In adat principle there are two kinds of land rights; those are the right of ownership and the right to use. Whereas in BAL there are two kinds of rights that have no equivalence in *adat*; those are *Hak Guna Usaha* and *Hak Guna Bangunan*. This is because of the formulation of the BAL is not only according to adat law but also influenced by the western law. On other hand, these differences are becoming threats in implementation, for example *Hak Guna Usaha*. According to BAL this right is given on the state land and could not be on the *ulayat* land. Even though many *Hak Guna* Usaha are given on the *ulayat* land, wherein *adat* community is understood as right to use. In understanding of the local people the right to use is a temporary right. If its duration is over or the land is abandoned by the right holder, then *adat* community assume that this land returns back to the *ulayat* land. Whereas according to BAL this land becoming the state land.

Post new order regime since 1998, the Indonesian government has produced some decentralization policies through laws and government regulations. Law no.22 year (1999) substituted in law no 32 year (2004) is an umbrella act in terms of the decentralization of government system. In line with this law, the government has sought to reform agrarian law, especially land law, through the spirit of decentralization and local autonomous law. Agrarian reform should start from BAL as the umbrella act in terms of management of agrarian resources. Therefore the President Republic of Indonesia issue decrees no.34 year (2003) about national policy in land affairs. This decree is one of the government efforts to revise BAL, in order to accommodate requirements of communities' in autonomous environment. In order to revise and synchronize BAL with other law and norms of societies should involve many departments and actors, such as forestry department, mining department, marine department and also civil society.

The regional government of West Sumatra takes this opportunity by producing policies to establish a form of the village government underneath sub-district (*Kecamatan*) is *Nagari*. This policy gives positive impacts in terms of land resources management in *Nagari*. *Nagari* has the role as the administrative government and also *adat* administrative. Local government could be more aspirated to taking into account the existence of norms in its community and keeping reference to higher levels of law. *Nagari* as the village government and also *adat* government have a role in terms of revitalize *ulayat* land in its region. By implementing this policy is expected to bring reinforcement of *ulaya*t land. This policy also unifies the entities of *adat* community. In the past, management of *ulayat* land is arranged by *adat* institutions and separated from government administrative. Nowadays, the implementation of *Nagari* government system supports the existence of *ulayat* rights. By integrating *Nagari* into the government system, automatically *adat* institutions take a role in government system. The regional government quite responsive to accommodate *adat* institutions that can be took role in government system, wherein these institutions should have legitimacy by all components in *Nagari*. Legitimacy government of *Nagari* as represent of *adat* community will reinforce *ulayat* land.

According to Warman (2009) the reinforcement of a right is determined by the three factors, those are (1) reinforcement of subject, (2) reinforcement of object and (3) reinforcement of authorities of the subject to object according to law. The question arises how to determine the existence of *ulayat* right. According to the regulation of Ministry of Agrarian/Head of NLA no 5 (1999) the existence of *ulayat* right is determined by three requirements, those are: (1) the existence of people as subjects of right, (2) the existence of land and other natural resources which stick to its land as object of *ulayat* right, (3) The existence of obvious authorities of subjects to manage and to use its land (Menteri Negara Agraria/ Kepala Badan Pertanahan Nasional, 1999).

Acknowledgement of *ulayat Nagari* is one of consequence from recognition of *Nagari* as the lowest level of government system. Because of a *Nagari* as a unit of customary community is not only consists of *Nagari's* governments but also all members of community and their territorial as the place for their live and their livelihood. The reinforcement of *ulayat Nagari* gives opportunity for *Nagari* to manage all *Nagari's* properties. All *Nagari's* properties, which are managed by the state and/or private companies based on one of right in BAL such as right to cultivate land and/or right of use, if the duration of its right is over, then those properties return back to *Nagari* as *Nagari's* properties. It is means that *ulayat* land which is held by private company, if the duration is over then its land should returned to *Nagari*. Even though in law, if its right expire then its land automatically becoming the state land then local government should returned back this land to *Nagari* by using applicable law.

4.6. Conclusions

This chapter has described land administration system in Indonesia and customary tenure system in Indonesia particularly customary tenure system in *minangkabau* community. Customary tenure in the case study area has been described in detail from a social perspective with its impact on land use right. Indonesia national land administration system based on legal framework, wherein BAL has function as umbrella act for the laws and regulations that deal with land resources. Whereas customary tenure in Indonesia based on custom or *adat* laws.

5. MODEL REQUIREMENTS ANALYSIS

5.1. Introduction

This chapter describes analysis of requirements based on the ontological categories in land administration system (subject, object, relationship between subject and object). The requirements identified are based on the characteristics of both tenure systems (the Indonesian NLAS and the *ulayat* tenure system).

5.2. Model Requirements Indonesian National Land Administration System

Indonesian national land administration system arranged based on laws and regulations. The data model requirements rest on the government regulation number 24 (1997) and regulation of Ministry of Agrarian/ Head of BPN number 3 (1997). This data consist of textual data and spatial data. Textual data consists of all information about subjects of the land rights, object of the land rights, and the relationship between subjects and objects (right, restriction, responsibility, and event which create this relationship). The spatial data consists of geometric data that represents the spatial unit or object of land right. The properties of model are initiated by analysis of model requirements. Analysis of model requirements is important part in order to develop a proper model. However, the model requirements have to be in line with of the purpose system. The model requirements can be seen in the sub-sections below.

5.2.1. Person

In the Indonesian NLAS, there are two main types of person; those are the real person, and the juridical person. A person registered in this system when it owns a piece of land based on a right. The histories of ownership should be handled in the database. Therefore, a person cannot be removed in the system even though the right has transferred to another person. A person in land administration is a temporal object and its lifespan is defined based on person type.

1. Natural Person

This person represents a real man or woman. She/he can still exist in the database system after his/her death. In the existing system, the real person has the following attributes:

- person_Id: this attribute is identifier number of person.
- name: The name of person is an attribute to put the sure name of a person.
- birth place: The name of the place where a person was born.
- birth date: The date of birth of a person.
- gender: the gender of a person.

2. Juridical person

In Indonesian NLAS, all kinds of institutions, organizations, foundations such as, private company, government institution, etc. are registered as a juridical person. Juridical person may have member, which identified as a constituent of a group person. The juridical person has following specific attributes:

- juridical_Id: this attribute is identifier number juridical person
- type: This attribute describes typology of juridical person. For example: Private company, government organization etc.

5.2.2. Register Parcel

Register parcel in Indonesian NLAS consists of parcel, administrative, and land use. Forest area excluded from domain of register parcel.

1. Parcel

Parcel is a basic unit in land administration which shows the boundaries of the land ownership. All data in cadastre and land registry are compiled on its. Subjects and events in a land administration system have

relationships with land parcel. All types of information on parcel may change by the time, such as parcel value, land use, etc. Even, land parcel itself may change because of sub division and amalgamation. The system has to be handled to keep the histories of land parcel. A land parcel has spatial temporal attributes. Spatial temporal attributes have geometric aspects whereas temporal attributes may change over the time. A Parcel in Indonesian NLAS consists of the following attributes:

- Parcel identifier (*Nomor identifikasi bidang* in short NIB): Each parcel must have a unique parcel identifier which can be defined as composite attribute and decomposed into, (i) five digits parcel number (identification number of a parcel that is uniquely defined in a village (*Desa*), (ii) two digits village code (identification number of a village that is uniquely define in a sub district (*Kecamatan*), (iii) two digits sub district code (identification number of a sub district that is uniquely define in a district), (iv) two digits district (*kota/kabupaten*) code (identification number of a district that is uniquely in a province), (v) two digits province code (identification of province that is uniquely in a country). There is an exception of parcel identifier system for land parcel which is owned by HGU or HPL. For both of these rights, district level is used as lowest spatial unit level by using 0000 as Id code. For example: the parcel identifier number '03130000.00001' was assigned to parcel number '00001' in Padang Pariaman district.
- Parcel area: This attribute can be legal area and/or computed area. Legal area is issued to the public as in legal document, whereas computed area is derived from the coordinate of boundary nodes. It cannot be determined if there is vagueness about boundary marks. For example, if there is no agreement about the borders between neighboring parcel owners, or there is lawsuit about boundary wherein the whole or partial boundary cannot be defined until the lawsuit ends.
- Geometric: A land parcel has a two dimensional closed polygon shape in cadastral maps. Nodes in polygon define with (X, Y) coordinates series and the lines connect these nodes.

2. Spatial Administrative Level

Spatial administrative level in Indonesian NLAS is related with the structure of administrative government system, from the highest level till the lowest level, wherein a parcel is located in a spatial administrative. A spatial administrative level has following structures:

a. Province (*Provinsi*)

A province is the highest level of spatial administrative unit which formed by several districts. It is a spatial object, wherein boundaries of province are defined for administrative purposes. Province should be defined as spatial temporal database because a province may also change over the time. For example, sub division of a province creates a new province or some of its districts separate to constitute a new province. A province has following attributes:

- Province code: It is defined by the province's national code number (two digits). For example, it is '03' for West Sumatra province.
- Name: Name of the province
- Geometric: A province has a two dimensional polygon shape which is defined by the nodes, and the nodes are connected by the lines. Its boundaries can change over the time.

b. District (*Kabupaten/Kota*)

A district is spatial administrative unit underneath of a province which has several sub districts, wherein a district is located in a province. It is a spatial object wherein its boundaries are defined for administrative purposes. District should be defined as spatial temporal database because a district may also change over the time. For example, a new sub district can be added to a district. A district has following attributes:

- District code: It is uniquely identified in Indonesia. The district code has four digits number wherein the province code number that district belongs to was used as prefix. For example, the code district '0313' was assigned to Padang-Pariaman district, wherein '03' represents West Sumatra province and '13' represents Padang Pariaman district.
- Name: Represent the district name, wherein can be changed with the state's decision.

- Geometric: A district has a two dimensional polygon shape which is defined by the nodes, and the nodes are connected by the lines. Polygon of a district inside the polygon of its province. It boundaries can change over the time.

c. Sub-district (*Kecamatan*)

A sub-district is the spatial administrative unit underneath district which has some villages. It is a spatial unit wherein its boundaries are defined for administrative purposes. Sub-district should be defined as spatial temporal database because a district may change over the time. For example, a large sub-district can be divided into two or three sub-district by decision of mayor of district. A sub-district has following attributes:

- Sub-district code: It is a unique number which define a particular sub-district. This code is defined by adding the corresponding district code to the sub-district code number that is orderly given in the district. For example, the code sub-district '031311' was assigned to Ulakan Tapakis sub-district, wherein '0313' represents Padang Pariaman district and '11' represents Ulakan Tapakis sub district.
- Name: Represents the sub-district name. This attribute information can be changed without any change on its geometric.
- Geometric: A sub-district also has a two dimensional polygon shape which is defined by the nodes, and the nodes are connected by the lines. Polygon of a sub-district inside the polygon of particular district. It boundaries can change over the time.

d. Village (*Desa/Kelurahan*)

A Village is the smallest spatial administrative unit. It is a spatial unit wherein its boundaries are defined for administrative purposes. The boundaries may change over the time. Therefore it is defined as spatial temporal database. A village may be divided into some villages or merger with one or more villages. A village has the following attributes:

- Village code: It is a unique number which define a particular village. This code is defined by adding the corresponding sub-district code to the village code number that is orderly given in the sub-district. For example, the code village '03131101' was assigned to Tapakis village, wherein '031311' represents Ulakan Tapakis sub-district and '01' represents Tapakis village.
- Name: Represents the village name. This attribute information can be changed without any change on its geometric.
- Geometric: A sub-district also has a two dimensional polygon shape which is defined by the nodes, and the nodes are connected by the lines. Polygon of a sub-district inside the polygon of particular sub-district. It boundaries can change over the time.

3. Land use

The land use characterize into agriculture and non-agriculture. It can change over the time. For example, an agriculture land can be converted into non agriculture land based on the land use change permission (*Ijin Perubahan Penggunaan Tanah* –IPPT). Land use has following attributes:

- Land use type: It is an attribute that describe land use of a parcel. There are two land use types; those are agriculture and non-agriculture.
- Geometric: A land use has a two dimensional polygon shape which is defined by the nodes, and the nodes are connected by the lines. This polygon can across administrative polygon. Information in this attribute is temporal. It can change over the time.

5.2.3. Right

The existing relationship between person and land in the Indonesian NLAS is statutory rights. This relationship is temporal and the form can be right, restriction, and responsibility.

1. Right

A Parcel can be owned by one person or more based on a right, whether juridical person or real person. Single person may own many parcels. The relationship between person and parcel based on the rights has following attributes:

- Right type (*Jenis hak*): It is an attribute which determine type of relationship between person and particular land. There are many types of right that can be put into this attribute such as *HM*, *HGU*, *HGB*, *HP* etc. Type of right is determined by the purpose of its land and reference document as an evidence of the land granted to the person.
- Right code (*Kode Hak*): It is an attribute to identify type of rights. This code only one digit, wherein the sequences of right consists of '1' for right of ownership, '2' for right to cultivate, '3' to for right to construct building, '4' right of use, '5' right of management, '6' right of waqf, and '7' right of apartment.
- Right Number (*Nomor Hak*): Each right must have a unique right identifier which can be defined as composite attribute and decomposed into, (i) five digits parcel number (identification number of a right that is uniquely defined per type of right in a village), (ii) one digit number type right code (identification number of a type of right), (iii) eight digits village code (identification code of village. For example: the right number '03131101.1.00570' was assigned to right of ownership number '00570' Tapakis village, wherein '03131101' represents Tapakis village, '1' represents right code of ownership, and '00570' represents right number. This administrative system is implemented for all type rights except right to use and right of management. For both of these rights, district level is used as lowest spatial unit level by using 0000 as Id code. For example: the right number '03130000.2.00001' was assigned to right to cultivate number '00001' Padang Pariaman district.
- Validity period: Temporary rights have validity period, such as *HGU*, *HGB*, *and HP*. The start date and end date should be held in a database system. Only *HM* has no end date information.

2. Restriction

The restriction in NLAS in terms of the relationship between people and land is designed to regulate person activities on its land. It can be relate with natural protection and legal action on its land. For example: There is no individual right allowed in forest which was determined protected area. Restriction has following attributes:

- Restriction name: It is an attribute that describes restriction on land. It can be name of an area protection, zoning city planning, legal action (collateral, transfer) etc.
- Validity period: This attribute describes start date and end date of restriction that stick on its right.
- Geometric: this attribute has a two dimensional polygon shape which is defined by the nodes, and the nodes are connected by the lines. This polygon geometric can be across the administrative polygon.

3. Responsibility

There is no specific attribute in NLAS describes responsibility in terms of relationship between person to their land.

5.2.4. Analysis Requirements

Model requirements in Indonesian NLAS which explained in ontological categories above can be analyzed from the purpose of model. The purpose of model is to establish spatial temporal database in Indonesian NLAS, and touch upon legal, geographical and other aspects. Considering those aspects, person as subject of right, register-parcel as object of right and right itself can be specified and recorded in a database. Subsequently in context spatial, these data can be extracted and shown in cadastral map. In the context temporal, information about historical data should be handled in spatial database.

5.3. Model Requirements Custommary Land Tenure System (Ulayat Land)

5.3.1. Anak Nagari

According to *adat* in *minangkabau* community, every *anak nagari* is the subject of *ulayat* right. There are two types of *anak nagari* that can be subject of *ulayat* right which are person and group person. A person can be in one or more groups. A group can be member of another group.

1. Person

This person represents a real man or woman. The system has to be able to keep person. As the subclass of person, the real person should have the same properties in the class of person

2. Group person

Group person represents community that can be *Nagari, Suku, Kaum* etc. Each group can be represented by a leader on behalf its community or all persons in community. Group person is a subclass of person, wherein the attributes group of person should be the same with real person. A natural person who is represents his group has the additional attribute in the class of person, i.e. role. According to *adat*, the role of a person in community should be defined. The role of person in *adat* can be *Panghulu Nagari* (represents *Anak Nagari*), *Panghulu Suku* (represents all members in his *Suku*), *Panghulu Kaum* (represents all members in his lineage) etc. The share information of each lineage member has to be explained in the *ulayat*.

5.3.2. The Ulayat Land

According to *adat*, the *ulayat Nagari* is the highest level of the *ulayat* land. The *ulayat nagari* is the whole lands within territorial of *Nagari* excluding individual and collective land (e.g. *ulayat kaum, ulayat suku*). These lands belong to all the community within a customary village (*Nagari*). The boundaries of the *ulayat Nagari* are fuzzy boundaries, whereas the boundaries of the *ulayat* clan and the *ulayat* lineage are fixed boundaries.

1. Parcel

Parcel in *ulayat* land shows the boundaries of the land ownership in the format of boundaries description. Furthermore it gives description about the names of the neighborhood or the nature features along the boundaries based on the cardinal points which are north, east, south, and west. The parcel boundaries clear in the field. There is no identifier number of parcel in *Nagari*. Therefore, it will be necessary to establish parcel identifier number.

2. *Nagari* Unit

Nagari unit is related with the structure of administrative territory. The highest level of administrative unit in *minangkabau* community is *Nagari*. A *Nagari* has a specific name and description of territory. The lowest hierarchy in spatial *Adat*'s administrative unit is *Kampuang*. A *Kampuang* has attributes name and description of territory. The boundaries of *Nagari* units are fuzzy boundaries.

3. Land Use

The land use characterize into the forest land, the agriculture land and the settlement land. It can change over the time. For example, a forest land can be converted into agriculture land based on the *Adat* agreement.

5.3.3. The Ulayat Right

The characteristic of the *ulayat* right in *minangkabau* community is eternal, in which there is no validity time. The *ulayat* land may use by *Anak Nagari* as long as they use for their livelihood. The social tenure relationship between people and land can be described into right, restriction, and responsibility.

1. Right

The basic foundation of the *ulayat* land is the *ulayat Nagari*, wherein *ulayat Nagari* is the common land which owned by *Anak Nagari*. Which is community in *Nagari* that can be used the *ulayat* land? It is depends on the type of *ulayat* land (subsection 4.4.3). A person can be the owner of the *ulayat* land based on the position of a person on particular community within a *Nagari*. For example, a person as a member of community within particular s*uku* has the right on the *ulayat suku*, and a person as a member of community within the *kaum* has the right on the *ulayat kaum* etc. The types of the *ulayat* right have to be described in basic title.

2. Restriction

The principle of communal land is not allowed to sale or diminished, but it can be leased and mortgaged. Utilization of *ulayat* land by the outsider of community is based on the principle beneficial mutually. The individual land right of the *ulayat* land in *adat* is only temporary, and then at the end will be back as communal land. It is means that there is validity period.

3. Responsibility

According to *adat*, every right which is given on the *ulayat* land attached responsibility to protect preservation of its land based on the principle of sustainable environment.

5.3.4. Analysis Requirements

Model requirements in *ulayat* land tenure system as explained in ontological categories above have to be analyzed from the purpose of model. The purpose of the model is to allow assimilation *ulayat* land tenure system within the Indonesian NLAS. The requirements for this purpose are (i) the specific information in customary tenure system has to be recorded in database, (ii) the information of customary tenure system can be shown in cadastral map, and (iii) the historical data should be existed in database.

5.4. Assimilation in Model Requirements

The main objective of assimilation the *ulayat* land tenure system with the Indonesian NLAS is not only to promote recordation of the *ulayat* rights as themselves but also to promote registration of the *ulayat* right in the statutory right and the other way around. These lands can be registered into one of the rights in Indonesian NLAS. Determination of type of right in registration of the *ulayat* land depends on the characteristics of the *ulayat* land itself. Based on characteristic of ownership, the *ulayat* land can be classified into common ownership and collective ownership. The landholders of common ownership are blur and it is difficult to determine particular landholder. This type of land tends to be the public ownership (territorial aspect). Whereas the landholders of collective ownership are clear. The landholders are determined based on their clan and lineage (genealogies aspect).

According to regional regulation of West Sumatra no. 16 (2008), the *ulayat* lands can be registered in one of the rights in NLAS as long as they do not contradict with the characteristics of *ulayat* lands (Gubernur Sumatera Barat, 2008). Based on this regulation, the typology of the *ulayat* rights determines the right of its land as described in Table 5.1.

No	Ulayat Land Right	Characteristics	Can be Registered	Person (Subject)
1.	*Ulayat Nagari*	▪ Common land that is owned by *Anak Nagari* ▪ Reserve Land for *Anak Nagari* ▪ Cannot be sold, but can be leased to another party and attached temporary right. ▪ Can be mortgaged ▪ Boundaries are also the Administrative boundaries.	HGU HGB HP HPL	*Penghulu* KAN on behalf *Anak Nagari*
2.	*Ulayat Suku*	▪ Collective land ownership of particular *suku*. ▪ Reserve land only for all member of its *suku*. ▪ Can be leased, fragmented, and sold as long as all *suku* members agree (really reasonable or *Force majeure*) ▪ Fixed boundaries (contradictory delimitation)	HM	*Penghulu Suku* on behalf all his *Suku* members
3.	*Ulayat Kaum, Ulayat Paruik*	▪ Collective land ownership of particular *kaum*. ▪ Reserve land only for all member of its *kaum*. ▪ Can be leased, fragmented, and sold as long as all *kaum* members agree (really reasonable or Force majeure) ▪ Fixed boundaries (contradictory delimitation)	HM	*Mamak Kepala Waris* on behalf all members of *Kaum* or *Paruik*
4.	*Ulayat Rajo*	▪ Common land that is owned by all *relatives rajo*. ▪ Cannot be sold but, can be leased to another party and attached to a temporary right. ▪ Fuzzy boundaries. ▪ Most of the lands are forest area	HP HPL	The all relatives *rajo*

Table 5.1: Types of right the *Ulayat* land within the Indonesian NLAS

Based on the table above, it can be seen that the *ulayat* land rights have equivalent characteristics as the rights in Indonesian NLAS. For the *ulayat* rights which characterized as collective ownership, those rights can be converted to the right of ownership (HM) without any problems in the concept. Whereas the *ulayat*

rights which characterized as common land is could not be converted directly to the temporary right (HGU, HGB). There is a conceptually problem in this case. Which in according to BAL, those rights are given on the state lands. This concept contrary with adat, in which according to adat there is no state lands within the adat territory.

In order to solve this gap, there is a need to create two different layers, which are statutory layer and customary layer. The statutory layer describes the position of the state as the landholder which has authority to give right to cultivate land (HGU) or right to build (HGB). Whereas in customary layer, this right is customary right (ulayat nagari) which is given to the land holder based on lease. From those concepts, a way to assimilate the customary right and statutory right is by establishing what is termed as tenancy (hak sewa). This right represents the relationship between the HGU/HGB holders and customary land holders to promote mutual benefit. If the duration of the HGU/HGB is over, then those lands can be returned back to local community as the landholder. Dealing with this case, the integrated model is required to be able to record statutory right and customary right without contradiction in the implementation.

5.5. Summary

This chapter has described the analysis of model requirements in the assimilation of the *ulayat* land tenure system within the Indonesian NLAS. These requirements based on the ontological categories in land administration system, wherein the reality in land administration can be described through person, land and the social tenure relationship between person and land.

The assimilation of the *ulayat* land tenure system within the statutory tenure system enables to record and register the *ulayat* lands in Indonesian NLAS. The model requirements in terms of assimilation customary tenure system within the Indonesian NLAS can be summarized in three requirements, which are:

1. The model has to be able to show the information in cadastral map.
2. The model has to be able to keep historical data and to update data change.
3. The model has to be able to record detailed relationship between person and land through right or customary right without contradiction in the implementation.

6. DESIGN DATA MODEL AND VALIDATION

6.1. Introduction

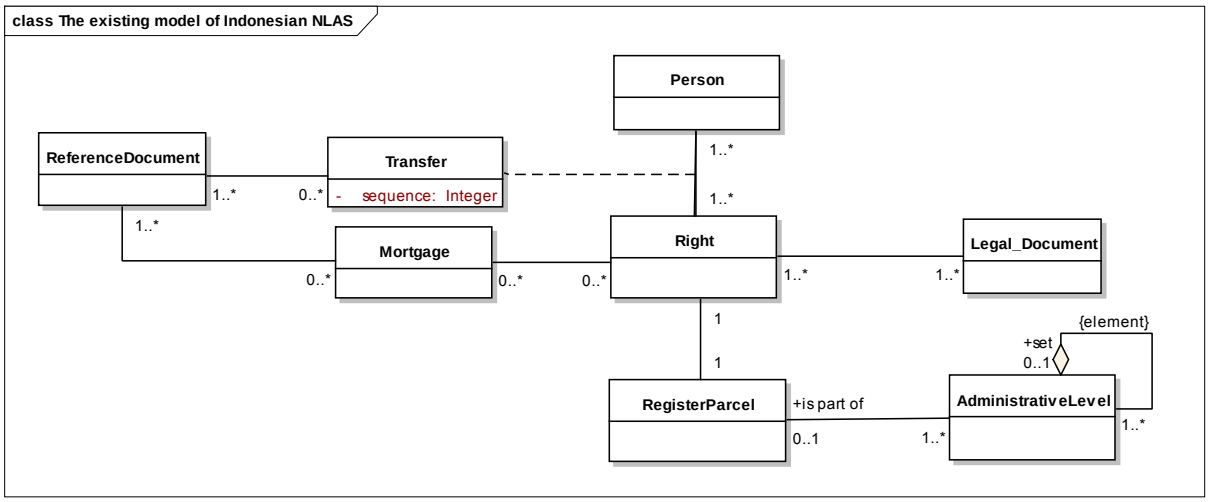
This chapter describes a conceptual modeling of the Indonesian NLAS in order to accommodate the *ulayat* land in *minangkabau* community. This conceptual model is formed based on the model requirements which introduced in the chapter 5. The listed of requirements expose a set of modeling concepts that need to be handled. Based on these requirements, the STDM as a reference model and schema are to be extended with new constructs.

The design of conceptual model is carried out in mainly two stages. First, the main classes of a conceptual model are mapped into a general existing model. In this stage, both of the existing systems (Indonesian NLAS and the *ulayat* tenure system) are mapped based the ontological categories of land administration (see chapter 2). These categories are represented in the three main classes of each existing model, in which the association between classes represent the requirements of interclass relationship. In the second stage, both of the existing models are transformed into the STDM schema. The result of a conceptual model is a semantic schema, i.e. a diagram using the notation of the chosen conceptual data model that captures and desired aspects of the reality modeled at a high level of abstraction (Tryfona et al., 2000). In order to validate this schema, a model transformed into a prototype and demonstrated in the real data.

6.2. The Existing Model of Indonesian NLAS

Based on the ontological category, the existing model of Indonesian NLAS consists of three main classes ("Person","RegisterParcel","Right"). This model describes the general existing database of Indonesian land administration system (see Figure 6-1). Here is explanation of each class:

Figure 6-1:The existing model of Indonesian NLAS



1. Class "Person"

An instance of class "Person" is person (natural/non-natural) as subject of right. Class "Person" is associated to one or more [1..*] class "Right". There is an association class between person and right, which is class "Transfer".

2. Class "Right"
An instance of class "Right" is a statutory right. Class "Right" is associated to one or more [1..*] class "Person", exactly one [1] class "RegisterParcel", one or more [1..*] class "Legal_Document", and to zero or more [0..*] class "Mortgage".

3. Class "RegisterParcel"
An instance of class "RegisterParcel" is a register parcel. Class "RegisterParcel" is associated to exactly one [1] class "Right". This is means that every register parcel has exactly one right. This class is also associated to one or more [1..*] class "AdministrativeLevel", in which a parcel is located in particular administrative unit.

4. Class "AdministrativeLevel"
An instance of class "AdministrativeLevel" is administrative structure of government system from province until village. This class is associated to zero or one [0..1] class "RegisterParcel". This class is also aggregated to itself, in which an instance of this class is also element of class itself. For example a district is an element of a province.
5. Class "Legal_Document"
An instance of class "Legal_Document" is a legal document (certificate). This class is associated to one or more [1..*] class "Right".

6. Class "Transfer"
Class "Transfer" is an optional association class between class "Person" and class "Right". An instance of this class is event transfer. This class is associated to one or more [1..*] class "ReferenceDocument". Every transfer usually is recorded until certain periods. The previous owners are completely written in the certificate, whereas the system automatically removes the previous owners.

7. Class "ReferenceDocument"
An instance of class "ReferenceDocument" is reference document such as deed trading deed, court decision, mortgage deed etc. The instances of this class are used as the reference document for the registration purpose. This class is associated to zero or more [0..*] class "Transfer" and to zero or more [0..*] class "Mortgage".

8. Class "Mortgage"
An instance of class "Mortgage" is mortgage. This class is associated to one or more [1..*] class "ReferenceDocument" and to zero or more [1..*] class "Right".

6.3. The Existing Model of The Ulayat Land Tenure System

The existing model of the *ulayat* land tenure system of *minangkabau* community consists of three main classes ("AnakNagari", "UlayatRight", "UlayatLand"), one public class and one specialization class (see Figure 6-2).

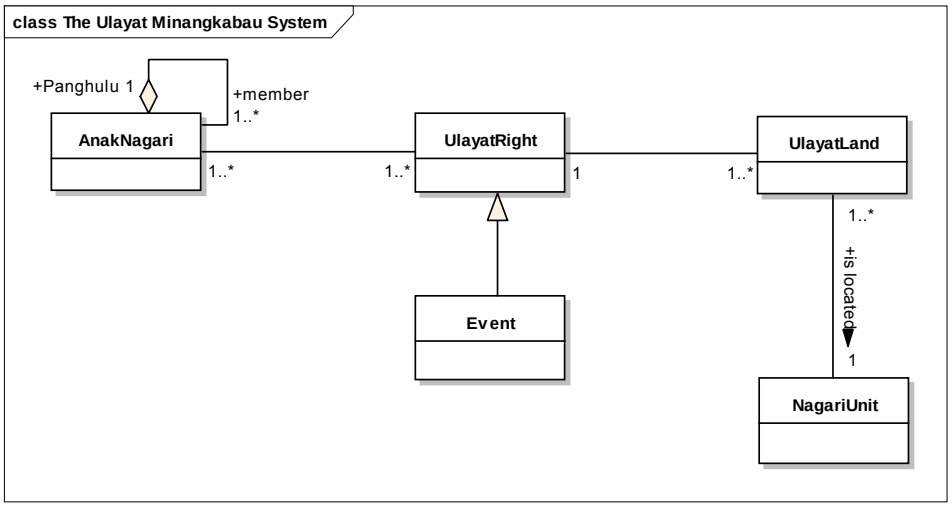


Figure 6-2: The existing model of the *ulayat* land tenure system of *minangkabau* community

Here is explanation of each class:

1. Class "AnakNagari"

An instance of class "AnakNagari" is a person as member of *Nagari* community. Class "AnakNagari" is associated to one or more [1..*] class "UlayatRight". This is means that every *Anak Nagari* may have at least one or more the *ulayat* right. This class is also aggregated to itself, in which a member may have exactly one Panghulu (representative) and contrary the *Panghulu* may have at least one or more member.

2. Class "UlayatRight"

An instance of class "UlayatRight" is the *Ulayat* Right. Class "UlayatRight" is associated to one or more [1..*] class "AnakNagari" and to one or more [1..*] class "UlayatLand". This class has an instance class "Event".

3. Class "UlayatLand"

An Instance of class "UlayatLand" is the *Ulayat* land. Class "UlayatLand" is associated to exactly one [1] class "UlayatRight". This class is also associated to exactly one [1] class "NagariUnit".

4. Class "NagariUnit"

An instance of class "NagariUnit" is the *Nagari*. Class "NagariUnit" is associated to one or more [1..*] class "UlayatLand".

5. Class "Event"

This class is an instance of class "Right". Every event dealing with the *Ulayat* right has to be recorded as an instance of this class.

6.4. Design Model

The aim of the model is to accommodate the *ulayat* land tenure system within the Indonesian NLAS. The model is designed by using the STDM as a reference model, in which structure of all classes are following packages within the STDM (see APPENDIX B).
The differences of both of models can be resolved by following stages below:

1. Differences in Classes

The differences of classes which occur between existing systems defined in the packages in STDM, as can be seen in Table 6.1.

Table 6.1: Categorization class of the existing models into STDM Packages

Tenure System	Party Package	Administrative Package	Spatial Unit Package
Indonesian NLAS	Person	Right Legal_Document Reference_Document Mortgage Transfer	Register_Parcel AdministrativeLevel
The *ulayat* land tenure system in *minangkabau* community	Anak_Nagari	Ulayat_Right Event	Ulayat_Land NagariUnit

The table above shows that all classes in both of tenure systems can be classified in the STDM packages. The names of class refer to the classes in STDM, in this case two classes similar have different name.

2. Differences in attributes

The differences in attribute may be name and data type. The differences in attribute names can be resolved by renaming in proper context. For example attribute transaction in Indonesian NLAS is not fit

with the context *ulayat*. Therefore this attribute is changed to attribute event_name which acceptable for both of the tenure systems. The differences in data type can be resolved by referring to the national system, in this case there is no different data type.

3. Differences in association

The differences in association can be resolved by referring to the existing model of Indonesian NLAS. For example in *ulayat* tenure system class "UlayatLand" is associated to exactly one [1] class "Nagari", whereas in Indonesian NLAS class "RegisterParcel" is associated to one or more [1..*] class "AdministrativeLevel". In integrated model class "UlayatLand" and class "RegisterParcel are represented in class "SpatialUnit". Class "Nagari" and class "AdministrativeLevel" are represented in class "AdminSpatialUnit". Therefore, class "SpatialUnit" is associated to one or more [1..*] class "AdminSpatialUnit".
The complete explanation of the model is presented in every package of STDM.

6.4.1. Party Package

This package consists of two public classes and one association class. These public classes consist of the class "Party" and the class "Group Party", which in an instance of class "Party" is a party and class "PartyMember" is optional class to store all members of the group party. There is no extendable class for this package, except additional code list and enumeration for the specific case the *ulayat* land (see Figure 6-3). The explanation of each class follows:

1. Class "Party"

A party is associated to zero or more [0..*] instances of a subclass "SocialTenureRelationship". This is means that the party may have nothing or more the social tenure relationship. A party is also associated to zero or more [0..*] instances of a subclass "LA_AdminSource". This is means that the party may have nothing or more the administrative source document. This class is also associated to zero or more [0..*] instances of a subclass "Collateral". This is means that the party (money provider) may have nothing or more mortgages. There is no association to the class "LA_BAUnit" for the purpose registration and recordation the *Ulayat* land. Attributes class "Party" consists of:

- partyID : the identity number of a party
- name : the name of the party
- birthDate : the birth of date a party, which in for specifies a party in case two or more party have the same name.
- birthPlace : the birth of place.
- clan : the clan name of a party.
- role : the role of a party
- type : the party type

2. Class "GroupParty"

A class "GroupParty" is a specialization of class "Party", is also a party. This is means that the aggregation relationship between class "Party" and class "GroupParty" creates group parties with parties as constituents. Every party, being a constituent of a group party, may then be registered as a party member of class "PartyMember". Attributes class "GroupParty" consists of:

- groupID : the identity number of group party
- name : the name of group party, which is the same with the party name as a constituent of a group party.
- type : the type of group party.

3. Class "PartyMember"

The class "PartyMember" is an optional association class between class "Party" and class "GroupParty". An instance of this class is party member. Attributes class "PartyMember" consist of:

- share : the fraction of the whole part.
- level : the generation level of a member.

All classes in the party package can be implemented for the purpose of registration and recordation the *ulayat* land within Indonesian NLAS, in which the specific information that deals with the land holders may be recorded. Each person as *Anak Nagari* has a clan and specific role in its community. Role and clan are important information to determine the social tenure relationship between person and land. This information can be used to extract the land owners and to trace back source of its land. Attribute clan is a key to trace back a person belongs to which community, and attribute role determine status function of a person within a community. Attribute clan in the class "Party" records clan name which is offers in the enumeration Clan Name, and attribute Role records role of a party which is offers in the enumeration Party Role Type.

The class "Party" also has an attribute Type that can be used to determine a party type. If a party as a group, then information of this group can be extracted through the class "GroupParty". The attribute type in the class "GroupParty" enable to determine type of group party.

Every *Anak Nagari* has a share in their group, due to in the class "PartyMember" share information for each person is enabled in the attribute share. For the specific case member of lineage, class "PartyMember" also provides attribute level of generation. Each group member has share based on their level of generation.

In case of land dispute, all parties that involve in a dispute are recorded as a group party, which in the attribute group party type is claimer, and every party that involve are recorded as member in the class "PartyMember".

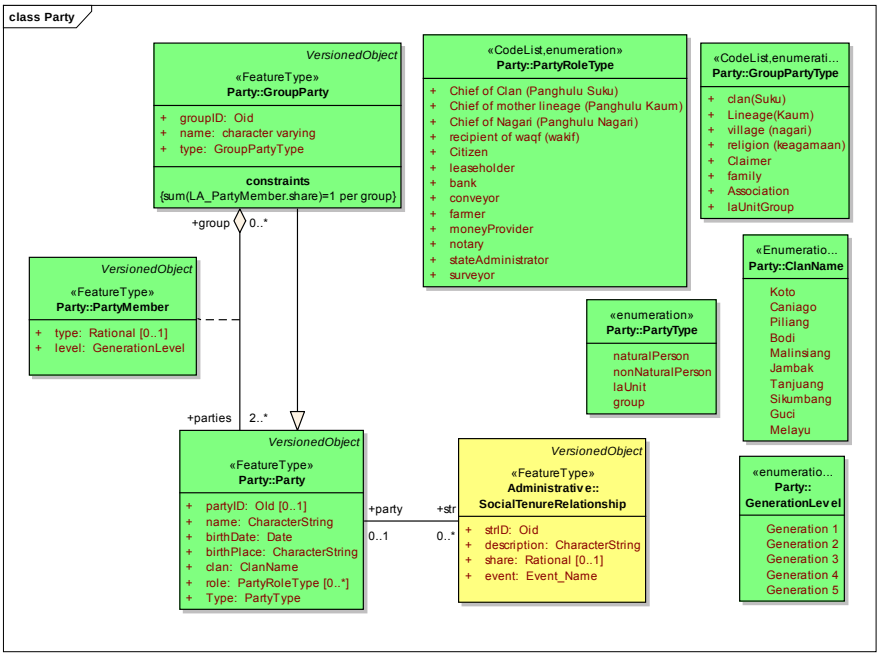


Figure 6-3: Party Package of integrated data model of Indonesian NLAS

6.4.2. Administrative Package

The administrative package in the STDM for the purpose of registration and recordation of the *Ulayat* land consists of two main classes, three specialization classes and two public classes (see Figure 6-4). The explanation of each class follows:

1. Class "LA_BAUnit"

An instance of class "LA_BAUnit" is a basic administrative unit, and subject to registration/recordation. This class is one of the main classes in the administrative package. A basic administrative unit is associated to zero or more [0..*] class "LA_SocialTenureInventory". This is means that every basic administrative unit may have nothing or more administrative document. This class is also associated to one or more [1..*] class "SocialTenureRelationship" and zero or more [0..*] class "SpatialUnit". This is means that basic administrative unit allows the association of one right to a combination of spatial units. These associations

enable to support registration of right to cultivate land (HGU) which is located between two or more *Nagari*. In current implementation, to avoid this condition registration of HGU based on the district administrative, whereas *Nagari's* boundaries and sub-district boundaries are not taking into account. Attributes of class "LA_BAUnit" follows:

- uID : the unit identity number
- name : the name of basic administrative unit

2. Class "SocialTenureRelationship"

This class is one of the main classes in the administrative package. A social tenure relationship is associated to zero or one [0..1] party. Class "SocialTenureRelationship" is an abstract class. An instance of a subclass of "SocialTenureRelationship" is class "LA_Right", class "STDMRelationship", and class "LA_Restriction". If it is right then it is associated to exactly one [1] Class "Party" and exactly one [1] class "LA_BAUnit". Attributes of class "SocialTenureRelationship" follows:

- strID : the social tenure relationship identity number
- description : the description of tenure relationship regarding the right (formal or customary), restriction.
- share : a share an instance of subclass "SocialTenureRelationship".
- event : the event name, all events that occur regarding social tenure relationship are recorded in this attribute.

3. Class "LA_Right"

This class is a specialization of class "SocialTenureRelationship", which in an instance of this class is a right. In the implementation a right is registered based on the type of right within a *Nagari* exclude the right to cultivate land. Due to large an area of right to cultivate land may cover more than one *Nagari* and maybe more than one sub districts, this right registered in a district.

This class is also associated to zero or more [0..*] collateral. This is means that a land right can be a collateral of one or more mortgages. Attributes of class "LA_Right" follows:

- rID : the right identity number or the sequence number of right.
- type : the type of right
- rightIdentifier : the identifier number of right based on the type of right in a *Nagari*. Exception for the right to cultivate the land, this right registered in a district.

4. Class "STDMRelationship"

This class is also a specialization of class "SocialTenureRelationship", which in an instance of this class is all types of relationship between person and land for the purpose recordation such as the *ulayat* right and dispute. The recordation of its instance based on type of tenure relationship within *Nagari*. Attributes of class "STDMRelationship" follows:

- stdmID : the stdm identity number
- type : the type of STDM relationship (the *Ulayat* land, dispute etc).

5. Class "LA_Restriction"

This class a specialization of class "SocialTenureRelationship" and it also super class of class "Collateral". This class has attributes follows:

- partyRequired : indicates whether a party is require for the registration of the restriction in the association to class "Party".
- type : the type of restriction.

6. Class "SocialTenureInventory"

Class "LA_SocialTenureInventory" is a public class in the administrative package. An instance of class "LA_SocialTenureInventory" is administration source document. This class is associated to four classes within the administrative package; those are (i) one or more [1..*] to class "Party", (ii) zero or more [*] to

class "Collateral", (iii) one or more [1..*] to class "LA_SocialTenureRelationship", and (iv) zero or more [0..*] to class "BA_Unit". The attributes of class "LA_SocialTenureInventory" are:

- availabilityStatus : this attribute define availability of document in social tenure inventory
- text : this attribute explain the content of document
- type : this attribute define type document in administrative source.

7. Class "Collateral"

An instance of class "Collateral" is a mortgage. Collateral is a subclass of "LA_Restriction". Collateral is associated to zero or more [0..*] class "LA_Right", and to class "Party" as money provider (financial institution). This means that collateral may have one or more collaterals. This class has attributes follows:

- amount : the amount of money borrowed from the financial institution.
- ranking : the ranking order, if more than one collateral applies to a right or rights.

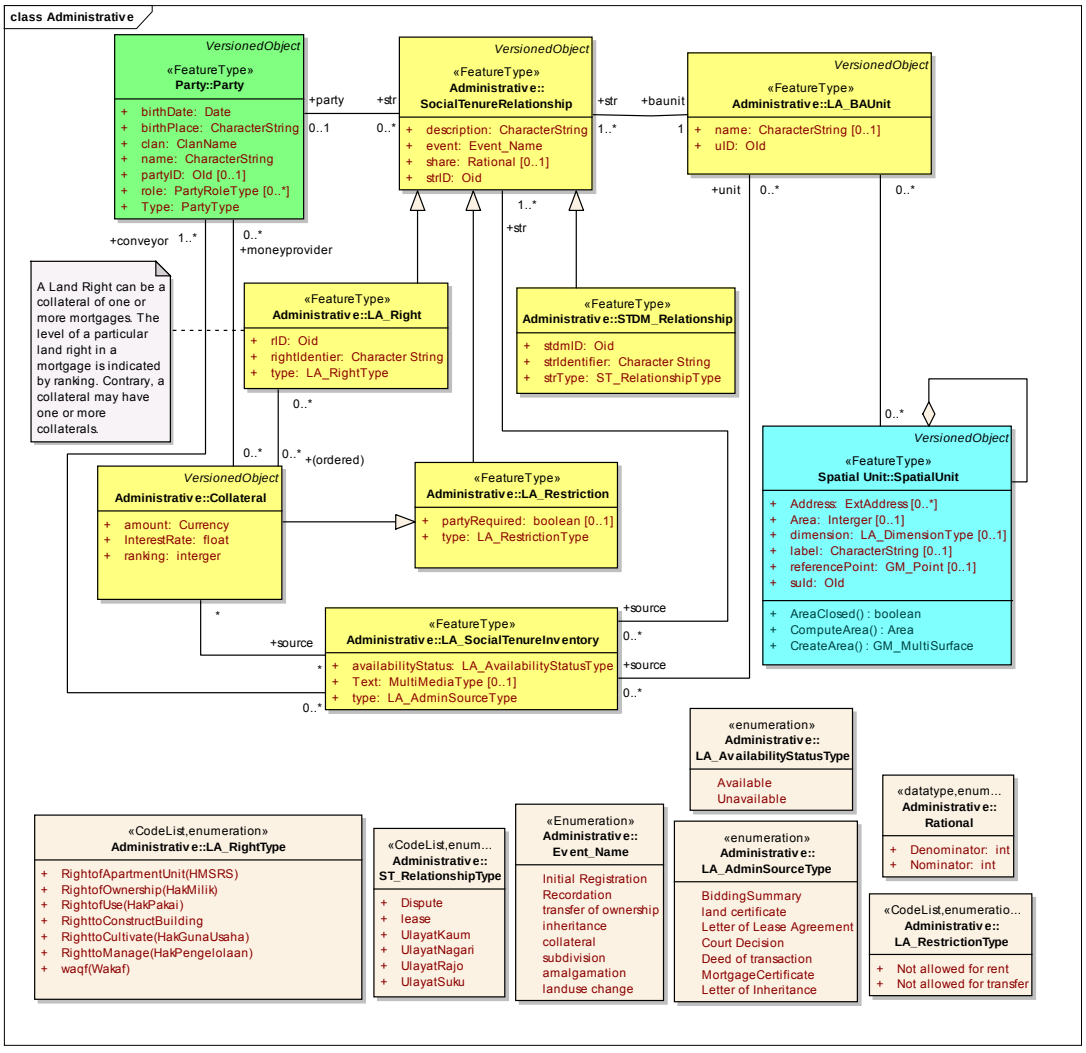


Figure 6-4: Administrative Package of integrated data model of Indonesian NLAS

Based on this administrative package, the model allows customary tenure to get place in the class "STDMrelationship" which is one of the instance classes of the class "SocialTenureRelationship". This is means that for the purpose of recordation, the *ulayat* land can be recorded in the class "STDMrelationship". On the other hand for the purpose of registration, the *ulayat* land can be recorded in the class "LA_Right". Both of classes describe both of tenure system from different perspective. In the one hand the formal right recorded in the class "LA_Right", in the other hand customary right and

dispute recorded in the class "STDMrelationship". In order to keep the history of land registration, every event that deal with registration data maintenance are recorded in the attribute event.

6.4.3. Spatial Unit Package

The spatial unit package in the STDM for the purpose of registration and recordation of the *ulayat* land consists of one main class, two public classes, and one specialization class (see Figure 6-5). The explanation of each class follows:

1. Class "SpatialUnit"

The class "SpatialUnit" is the main class of the spatial unit package. This class is associated to zero or more [0..*] class "LA_BAUnit". This is means that the class spatial unit may no or more instances in the class "LA_BAUnit". This class is also associated to one or more [1..*] the class "AdminSpatialUnit". This is means that an instance of the class "SpatialUnit" can be one or more part in the class "AdminSpatialUnit". The class "SpatialUnit" is also associated to zero or one [0..1] class "LA_Level" which is the class "SpatialUnit" may have no or one instance in the class "LA_Level". The attributes of class "SpatialUnit" are:

- suID : The identity number of spatial unit
- area : this attribute instance the area 2D spatial unit
- dimension : the dimension of the spatial unit.
- label : short textual description of the spatial unit.
- referencePoint: the coordinate a point within the administrative spatial unit.

2. Class "AdminSpatialUnit"

An instance of class "AdminSpatialUnit" is spatial administrative unit. In Indonesian case, hierarchy of administrative spatial unit is sequence from province, district, sub district, and village/*Nagari* etc. This class is associated to zero or one [0..1] class "SpatialUnit". This is means that the class "AdminSpatialUnit" may no instances or one instance in the class "SpatialUnit". The attributes of class "AdminSpatialUnit" are:

- asuID : this attribute is the identity number of administrative spatial unit.
- level : this attribute is the level of hierarchy of an administrative or zoning subdivision, which in the highest level of administrative is one (1) and the lower level is incremented by 1.
- label : this attribute is the short textual the spatial administrative unit.
- name : this attribute is the name of the administrative spatial unit.
- referencePoint: the coordinate a point within the administrative spatial unit.

3. Class "LA_Level"

An instance of class "LA_Level" is a level. This class is associated to zero or more [0..*] class "SpatialUnit". The attributes of class "LA_Level" are:

- lID : the identifier of the level
- name : the name of the level
- registerType: the register type of the content of the level
- structure : the structure of the level of geometry
- type : the type of the content of the level

4. Class "LandUse"

Class "LandUse" is the specialization class of class "SpatialUnit". The attributes of class "LandUse" are:

- luID : the identifier of land use
- type : the type of land use

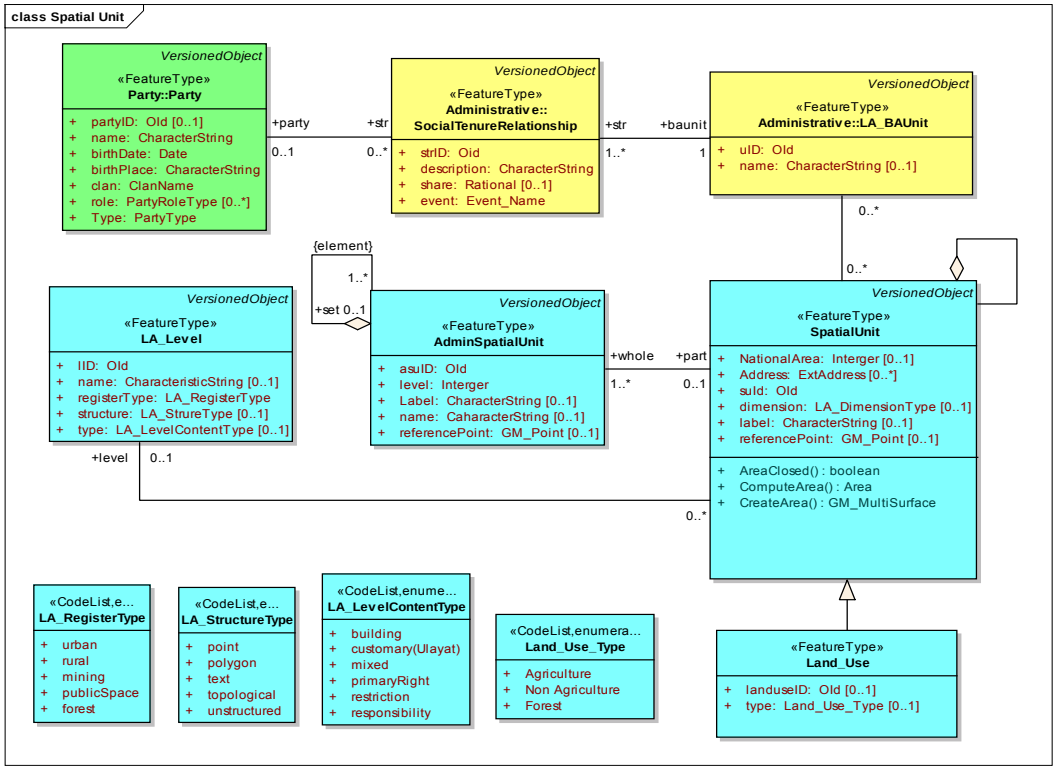


Figure 6-5: The Spatial Unit Package of integrated data model of Indonesian NLAS

6.5. Model Validation

According to Robinson (1994) a valid model is both accurate an able to meet the objective of simulation project for which it being used. Model simulation is applied after the logical design phase in order to know model capability in the real implementation. In this thesis validity of this model can be asses through demonstrating the model.

There are two software were used for the system implementation. PostgreSQL 9.0 which has the spatial extension in PostGIS 1.5 as additional plug-in. On the other hand, QuantumGIS Enceladus 1.4 was used to display, manipulate and to analyse spatial data.

6.5.1. The Prototype

The prototyping model is an early approximation of a final system. In order to achieve a final system, a prototype is built and has to be passed the simulation test.

This prototype is developed based on the all packages in the STDM. After completing the first stage of the design model (read section 6.2), the structure of spatial database tables are developed based on the data definition language (DDL). The table structures consist of (i) the table name which refers to the name of the classes in the conceptual model, (ii) the column name which corresponds to the attributes of the class (or the inter relation class), (iii) data type which refers to the predefined database object types, (iv) size that represents the total characters which allowed hold in an attribute, (v) null which indicates if an attribute is allowed to be null, and (vi) the constraint which shows the defined constraints on a column such as primary key, and foreign key. The table structures and DDL statements for the "SpatialUnit" are explained in Table 6.2. The whole DDL statements to create tables in this prototype are provided in the APPENDIX C.

Table 6.2: The structure of Spatial Unit table

COLUMN NAME	DATA TYPE	SIZE	NULL	CONSTRAINTS
oId	Integer	-	NOT	Primary Key/foreign key
parcel_Identifier	Character Varying	19	NOT	-
beginvalidityversion	Date	-	NOT	-
endvalidityversion	Date	-	YES	-
adminspatialunit_oId	Integer	-	YES	Foreign key
ba_unit_gid	Integer	-	YES	Foreign key
right_identity	Character Varying	19	YES	-
right_type	Character Varying	30	YES	-
stdm_identity	Character Varying	19	YES	-
stdm_type	Character Varying	30	YES	-
land_use	Character Varying	30	YES	-
the_geom	Geometry		YES	Check (dimension, geometrytype, srid)

DDL Statement:

```
-- Table: spatialunit
-- DROP TABLE spatialunit;
CREATE TABLE spatialunit
(
  oId serial NOT NULL,
  parcel_identifier character varying(19) NOT NULL,
  beginvalidityversion date NOT NULL,
  endvalidityversion date,
  adminspatialunit_oId integer,
  ba_unit_gid integer,
  right_identity character varying(19),
  right_type character varying(40),
  stdm_identity character varying(19),
  stdm_type character varying(30),
  land_use character varying(30),
  the_geom geometry,
  socialtenuretype character varying,
  CONSTRAINT spatialunit_pkey PRIMARY KEY (oId),
  CONSTRAINT adminspatialunit_oId_fkey FOREIGN KEY (adminspatialunit_oId)
      REFERENCES adminspatialunit (oId) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION,
  CONSTRAINT baunit_gid_fkey FOREIGN KEY (baunit_gid)
      REFERENCES baunit (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION,
  CONSTRAINT enforce_dims_the_geom CHECK (st_ndims(the_geom) = 2),
  CONSTRAINT enforce_geotype_the_geom CHECK (geometrytype(the_geom) = 'POLYGON'::text OR
the_geom IS NULL),
  CONSTRAINT enforce_srid_the_geom CHECK (st_srid(the_geom) = 23832)
)
WITH (
  OIDS=FALSE
);
ALTER TABLE spatialunit OWNER TO postgres;
-- Index: spatialunit_the_geom_gist
```

```
-- DROP INDEX spatialunit_the_geom_gist;
CREATE INDEX spatialunit_the_geom_gist
  ON spatialunit
  USING gist
  (the_geom);
```

The spatialunit table is a spatiotemporal database, in which the spatial aspect of the table is defined by the_geom attribute. Begin and end time of every record is represented by beginvalidityversion and endvalidityversion attributes respectively. The geometry of a spatial unit is valid if the endvalidityversion column is null.

In the following subsection, the data simulation for the purpose of demonstration is explained. The data source, data conversion, data population processes are also explained.

6.5.2. Simulation Data

The simulation data in this prototype represents two *Nagaris* in Padang-Pariaman district; those are Tapakis and Tapakis Baru. This simulation data focuses on the *Nagari* Tapakis, whereas the *Nagari* Tapakis Baru is used as complement data. All data that represented in this prototype are the fictional data. These data are only for the demonstration purpose without reducing values of real data representation. These data classified into two types, which are the textual data and the spatial data.

1. The textual data

The textual data represent the real condition in the field, in which a *Nagari* is formed from at least four clans. In line with this requirement, the *Nagari* Tapakis is formed from four clans; those are *Koto*, *Bodi*, *Piliang* and *Caniago*. Every clan consists of some mother lineage. Each clan and lineage has a chief as representative his member. This is means that every *Anak Nagari* has particular clan, lineage and role in a *Nagari* (see Chapter 4). The administrative data are created based on the Indonesian NLAS (see Chapter 5).

In order to record the *ulayat* right and any other social tenures relationship in the simulation, all of them have the identifier number. The identifier number refer to the Indonesian NLAS, in which this number consists of six digits of *Nagari*'s identifier, two digits of type of the *ulayat* right and five digits sequence number of right. The differences of statutory right identifier and the *ulayat* right identifier is index type of right.

2. The spatial data

The spatial data obtained from the aerial photograph, which is produced on 2006. The area of interest is covered by thirteen sheet images. These images stored in geo TIFF format. The coordinate system which applied in this data simulation is the national coordinate system TM-3°. The area of interest lay on zone 47.2 TM-3°. Due to the technical problem, there are three images cannot be showed.

In order to represents the spatial unit in this demonstration, the images of aerial photograph are digitized and stored by using software AutoCAD. This file AutoCAD (dwg) transformed to the dxf file that can be read in the GIS software. Subsequently, the dxf file is imported to the shape file in the software QuantumGIS and from the shape file import to the PostgreSQL.

The feature objects consists of *Nagari* boundary, the *Ulayat* boundaryFollowing are statistical data in the prototype:

Table 6.3: The statistical information of prototype

Table Name	*Records Number*
Party	36 records
Group_Party	20 records
PartyMember	180 records
SocialTenureRelationship	56 records
LA_Right	45 records
STDMRelationship	41 records
BA_Unit	55 records
SpatialUnit	55 records

6.5.3. Demonstration

Demonstration of the prototype is important in order to validate the model. By having some demonstration, the capability of prototype can be assessed. For the purposes of demonstration, all packages in this prototype tried to use for an operation on Indonesian NLAS in terms of registration and recordation particular case of the *ulayat* land. This prototype has to able to capture all detailed information of the *ulayat* land which follows Indonesian NLAS. The ability to extract information from this database also gets big concern in this prototype. This demonstration is used to try capability of the prototype to handle the spatial database tasks. This prototype expected to have capability:

1. To shows information in the cadastral map.

In this prototype Quantum GIS is chosen software, it has capability to render spatial data which is stored in PostGIS database. This software has simple user interface, stable, and fast enough. This software also provides basic tool for viewing and editing spatial data map. In this demonstration Quantum GIS can display parcel map boundaries of study area. Key information that can be need for the purpose of data retrieval also can be seen by using identify feature tool. The identify results show the open information that represent land registration status and land recordation information, whereas the party name is closed information. Figure 6-6 shows Quantum GIS render cadastral map from the prototype.

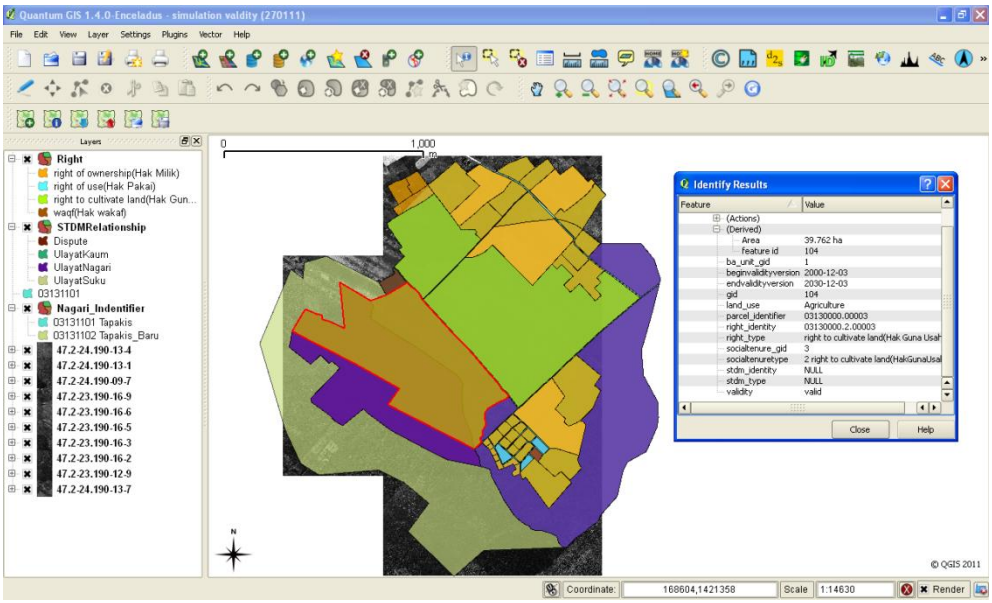


Figure 6-6: The cadastral map in Quantum GIS

2. To keep the history and update data change.

The textual and spatial data are stored and updated in the Post GIS. Implementation of versioned object in this prototype enables the user to store and update data. All spatial data that stored in the Post GIS can be extracted based on the theme and particular time.

In this demonstration, the new government of *Nagari* Tapakis wants to inventory their *Ulayat Nagari* land. They want to know information of the forest changes over their *Ulayat Nagari* land since 01/01/2000 until 31/12/2005. This information can be extracted based on the land tenure type (the *Ulayat Nagari*) and the land use type (forest) for the specific time. There are three steps that have to be done to show this information, those are:

a. Step one; the user extracts the existing data on 01/01/2000. The data extracted by using time range since 01/01/2000 until 31/12/2005. The SQL statements in the PostGIS therefore:

```
SELECT* FROM
(SELECT spu.gid, spu.ba_unit_gid, spu.parcel_identifier,str.stidentity, str.strtype, spu.beginvalidityversion,
        spu.endvalidityversion, spu.land_use,spu.the_geom
FROM public.spatialunit AS spu, public.ba_unit As bau, public.socialtenurerelationship As str
WHERE spu.ba_unit_gid = bau.gid
AND bau.str_gid = str.gid
AND str.strtype = 'UlayatNagari'
AND spu.land_use = 'forest'
AND spu.nagari_id = '03131101'
AND (spu.endvalidityversion is NULL OR spu.endvalidityversion <= '2005-12-31')
UNION
SELECT spu.gid, spu.ba_unit_gid, spu.parcel_identifier,str.stidentity, str.strtype, spu.beginvalidityversion,
        spu.endvalidityversion, spu.land_use,spu.the_geom
FROM public.spatialunit AS spu, public.ba_unit As bau, public.socialtenurerelationship As str
WHERE spu.ba_unit_gid = bau.gid
AND bau.str_gid = str.gid
AND str.strtype = 'UlayatNagari'
AND spu.land_use = 'forest'
AND spu.nagari_id = '03131101'
AND (spu.endvalidityversion >='2000-01-01' OR spu.endvalidityversion >= '2005-12-31')) AS
existforestnagari2000 ORDER BY beginvalidityversion;
```

The Figure 6-7shows the result SQL above.

Output pane

Data Output | Explain | Messages | History

	gid integer	ba_unit_gid integer	parcel_identifier character varying(19)	stidentity character varying(17)	strtype character varying(50)	beginvalidityversion date	endvalidityversion date	land_use character varying(30)	the_geom geometry
1	6	6	03131101.00043	03131101.21.00001	UlayatNagari	2000-05-26	2005-08-12	forest	010300000
2	48	48	03131101.00044	03131101.21.00002	UlayatNagari	2000-05-27	2000-12-03	forest	010300000
3	23	23	03131101.00046	03131101.21.00004	UlayatNagari	2000-05-29		forest	010300000
4	17	17	03131101.00048	03131101.21.00005	UlayatNagari	2000-05-31		forest	010300000
5	18	18	03131101.00049	03131101.21.00006	UlayatNagari	2000-06-01	2005-08-12	forest	010300000

Figure 6-7: The result of the existing forest area over the *Ulayat Nagari* Tapakis on 01/01/2000

The result of SQL statement above is five rows of spatial data. These data represent the *Ulayat Nagari* land, in which land use type of all those land are forest. However, there are three rows that had changed during this period of time (2000 – 2005) as can be seen from column "endvalidityversion". The result of existing spatial data on 01/01/2000 is showed in the Quantum GIS (see Figure 6-8).

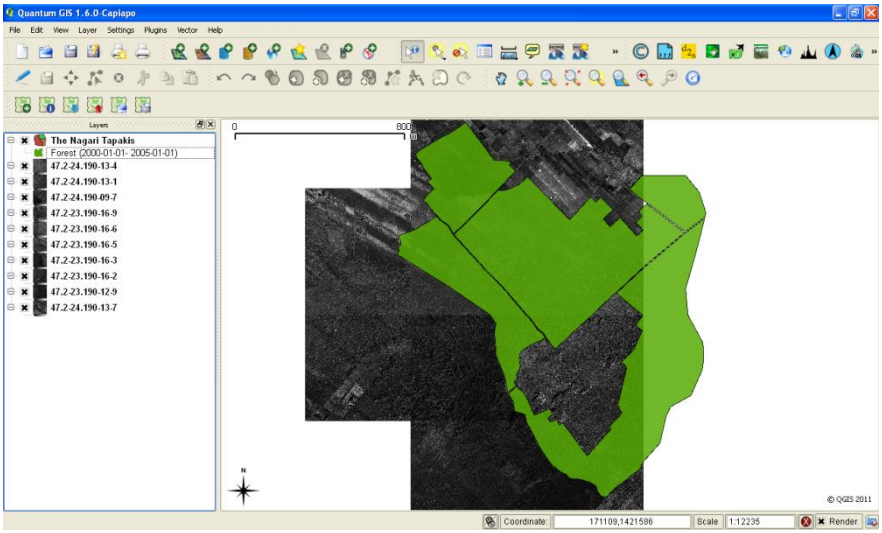


Figure 6-8: The forest area on the *Ulayat Nagari* land of Tapakis on 01/01/2000

b. The second step, the user extracts the data of land use conversion over the *Ulayat Nagari* land at the time (31/12/2005), in which the parcel identifier can be used as a key to extract this information. The SQL statements and result in the PostGIS therefore:

```
SELECT spu.gid, spu.parcel_identifier,str.stidentity, str.strtype, spu.beginvalidityversion,
        spu.endvalidityversion, spu.land_use, spu.the_geom
FROM public.spatialunit AS spu, public.ba_unit As bau, public.socialtenurerelationship As str
WHERE spu.ba_unit_gid = bau.gid
AND bau.str_gid = str.gid
AND str.strtype = 'UlayatNagari'
AND (spu.parcel_identifier = '03131101.00043'
OR spu.parcel_identifier = '03131101.00049'
OR spu.parcel_identifier = '03131101.00044')
AND (spu.endvalidityversion  is not NULL OR spu.endvalidityversion <='2005-12-31');
```

The Figure 6-9 shows the result SQL above.

Output pane

Data Output | Explain | Messages | History

	gid integer	parcel_identifier character varying(19)	stidentity character varying(17)	strtype character varying(50)	beginvalidityvers date	endvalidityversio date	land_use character varying(30)	the_geom geometry
1	116	03131101.00043	03131101.21.00001	UlayatNagari	2005-08-12		Agriculture	0103000020
2	117	03131101.00049	03131101.21.00006	UlayatNagari	2005-08-12		Agriculture	0103000020
3	105	03131101.00044	03131101.21.00002	UlayatNagari	2000-12-03		Agriculture	0103000020

Figure 6-9: The information of land use conversion from forest to agriculture (31/12/2005)

The information above shows that the conversion of forest area into agriculture area over the *Ulayat Nagari* land. The result of this spatial information can be seen in Figure 6-10.

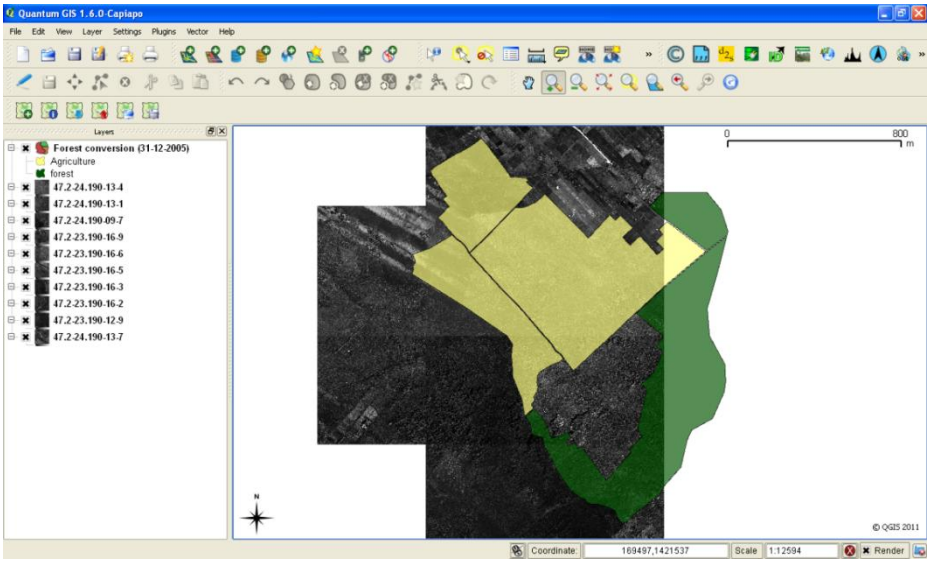


Figure 6-10: Forest conversion over the *Ulayat Nagari* land of Tapakis (31-12-2005)

3. To record detailed relationship between person and land through right or customary right without contradiction in the implementation.
   This prototype may record all land administration data based on categorization of social tenure relationship. All the data can be easily extracted by using SQL statement. For the purposes demonstration of this capability, there are some cases that can be demonstrated:

   a. Case one; in order to enhance investment in a *Nagari*, the *Anak Nagari* lease their lands to the private companies for twenty five until thirty years. These lands are used to the palm oil plantation, in which these lands registered in the statutory right as the right to cultivate land.
   Continuing the previous information of forest conversion, in which the conversion intended to give opportunity to the investor to use these lands (see Figure 6-9). With the purpose of legal protection, the investors and the *Anak Nagari* have the lease contracts. This prototype enables to record these contracts. By having this data in the prototype, the information of the leaseholders can be easily extracted. The SQL statement to extract this information in the PostGIS therefore:

```
SELECT bau.str_gid, p.name, p.type, p.role, str.beginvalidityversion, str.endvalidityversion
FROM public.socialtenurerelationship As str, public.party As p, public.ba_unit As bau
WHERE str.party_gid = p.gid
AND bau.str_gid = str.gid
AND str.eventname = 'Land lease'
AND (str.stidentity= '03131101.21.00001'
OR str.stidentity = '03131101.21.00006'
OR str.stidentity = '03131101.21.00002')
AND (str.endvalidityversion is NULL OR str.endvalidityversion >= CURRENT_DATE);
```

   The SQL statement above uses the event name and the *Ulayat* identity as the key variable to extract this information. The result of this SQL statement shows in the Figure 6-11.

Output pane

Data Output | Explain | Messages | History

	str_gid integer	name character varying(100)	type character varying(35)	role character varying(35)	beginvalidityversion date	endvalidityversion date
1	50	PT. Badri Palm Plantation	Non Natural Person	Leaseholder	2005-08-12	2030-08-12
2	51	PT. Bina Karya Plantation	Non Natural Person	Leaseholder	2005-08-12	2030-08-12
3	59	PT BINA NUSANTARA TANI	Non Natural Person	Leaseholder	2000-12-03	2030-12-03

Figure 6-11: The information of the leaseholders

Figure 6-11 shows the information of the leaseholders of the *Ulayat Nagari* Tapakis with the time information begins and end date.

b. Case two, in order to provide legal protection for all, every right should be respected. By facilitate recordation of the *ulayat* land right in this system, automatically it will support legal protection for the landholders. In this case, the *Ulayat Nagari* that registered into the right to cultivate land can be investigated in this prototype. The right to cultivate land is registered in the district level, in which the *Nagari* boundaries and/or the sub-district boundaries are not to be concerned. Continuing the previous information of the land holders above, a landholder (PT. Bina Nusantara Tani) has the right to cultivate land which laying on two different *Nagari,* those are the *Nagari* Tapakis and the *Nagari* Tapakis Baru. This means that there are two of the *Ulayat Nagari* lands which covering by a right to cultivate land. Both of *Nagari* communities may know their land which covering by this right. There two steps to extract this information:

- First step, the user extracts the right identity that belongs to particular leaseholder (PT. Bina Nusantara Tani). The SQL statement for this information therefore:

```
SELECT str.gid, str.party_gid, p.name, str.ridentity, str.rtype,
        str.beginvalidityversion, str.endvalidityversion
FROM    public.socialtenurerelationship AS str, public.party AS p
WHERE str.party_gid = p.gid
AND P.name = 'PT BINA NUSANTARA TANI'
AND str.ridentity is not NULL;
```

The result of SQL statement above shows that PT Bina Nusatara Tani has two rights as can be seen in Figure 6-12.

Output pane

Data Output | Explain | Messages | History

	gid integer	party_gid integer	name character varying(100)	ridentity character varying(17)	rtype character varying(50)	beginvalidityversion date	endvalidityversion date
1	61	33	PT BINA NUSANTARA TANI	03130000.2.00003	right to cultivate land (Hak Guna Usaha)	2000-12-03	2005-10-03
2	52	33	PT BINA NUSANTARA TANI	03131101.3.00001	right of building utilization (HGB)	2006-04-05	2031-04-05

Figure 6-12: The information right that belongs to particular landholder

- Second step; the user may extract the *Ulayat Nagari* land which cover by a particular right.
  The information above shows that PT Bina Nusantara Tani has a right to cultivate land with the right identity "03130000.2.00003". The information can be extracted by using right identity as a key. The SQL statement for this information therefore:

```
SELECT spu.gid, str.stidentity, str.strtype, spu.nagari_id, spu.right_identity,
        spu.nagari_name, spu.parcel_identifier
FROM public.spatialunit AS spu, public.socialtenurerelationship AS str
WHERE spu.socialtenure_gid = str.gid
AND spu.right_identity = '03130000.2.00003'
AND spu.stdm_identity is not NULL;
```

The result of SQL statement above shows that the right to cultivate land with the right identity "03130000.2.00003" consists of two of the *Ulayat Nagari* land as can be seen in Figure 6-13.

Output pane

Data Output | Explain | Messages | History

	gid integer	stidentity character varying(17)	strtype character varying(50)	nagari_id character varying	right_identity character varying(19)	nagari_name character varying(35)	parcel_identifier character varying(19)
1	106	03131102.21.00003	UlayatNagari	03131102	03130000.2.00003	Tapakis Baru	03131102.00003
2	105	03131101.21.00002	UlayatNagari	03131101	03130000.2.00003	Tapakis	03131101.00044

Figure 6-13: information of the *Ulayat Nagari* land which covers by a right to cultivate land

The Quantum GIS shows this information in the Figure 6-14.

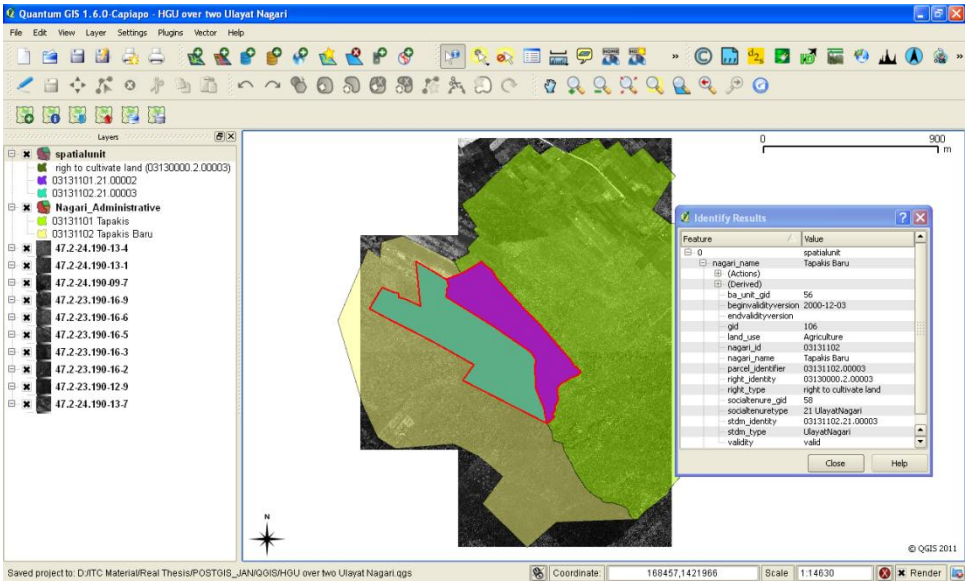


Figure 6-14: The right to cultivate land between two *Ulayat Nagari*

c. Case three; because of inventory reason, the government of *Nagari* Tapakis Baru applies to reconstruct their *Ulayat Nagari* which leased by an investor (PT Bina Nusantara Tani). They apply to reconstruct their *Ulayat Nagari* before and after investment. For this request, the user has parcel identifier from the previous demonstration, which is "03131102.00003". This request can be extracted in two steps;

- First step, extract the parcel reference number based parcel identifier. This extraction is used to find original parcel before investment. The SQL statement for this information therefore:

```
SELECT spu.gid, spu.socialtenure_gid, spu.parcel_identifier, str.stidentity,
        str.strtype, spu.land_use,spu.parcel_ref_no
FROM public.spatialunit AS spu, public.socialtenurerelationship AS str
WHERE spu.socialtenure_gid = str.gid
AND spu.parcel_ref_no is NOT NULL
AND spu.parcel_identifier = '03131102.00003';
```

The figure below shows the result SQL statement above.

Output pane

Data Output | Explain | Messages | History

	gid integer	socialtenure_gid integer	parcel_identifier character varying(19)	stidentity character varying(17)	strtype character varying(50)	land_use character varying(30)	parcel_ref_no character varying(19)
1	115	58	03131102.00003	03131102.21.00003	UlayatNagari	Agriculture	03131102.00001

Figure 6-15: Information of original parcel identifier

The result of SQL statement above shows that this parcel is sourced from the parcel's number "03131102.00001".

- Second step, based on the information above, the whole partition parcels can be extracted. The SQL statement to extract this information therefore:

```
SELECT spu.gid, spu.parcel_identifier, str.stidentity, str.strtype,
        spu.beginvalidityversion, spu.land_use,spu.parcel_ref_no
FROM public.spatialunit AS spu, public.socialtenurerelationship AS str
```

```
WHERE spu.socialtenure_gid = str.gid
AND (spu.parcel_ref_no is NOT NULL OR spu.parcel_ref_no = '03131102.00001');
```

The result of SQL statement above as can be seen in the Figure 6-16.

Output pane

Data Output | Explain | Messages | History

	gid integer	parcel_identifier character varying(19)	stidentity character varying(17)	strtype character varying(50)	beginvalidityversion date	land_use character varying(30)	parcel_ref_no character varying(19)
1	114	03131102.00002	03131102.21.00002	UlayatNagari	2000-01-03	forest	03131102.00001
2	115	03131102.00003	03131102.21.00003	UlayatNagari	2000-01-03	Agriculture	03131102.00001

Figure 6-16: The information of partition parcel

The result of SQL statement above shows that the original parcel has two new parcels, in which begin date of the new parcels is the end date of its original parcel. In the Quantum GIS, this information is extracted by using parcel identifier as a key (see Figure 6-17).

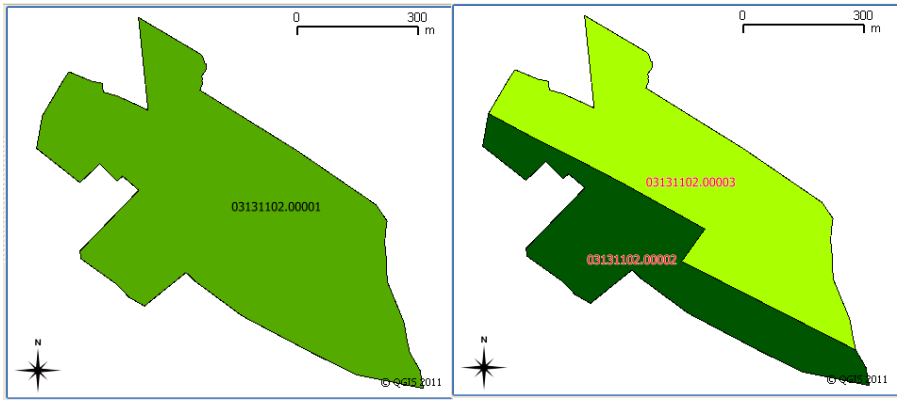


Figure 6-17: The *Ulayat Nagari* before and after investment

d. Case four; according to information in the field, the right to cultivate land number "03130000.2.0003" has been transferred several times. For an administrative reason, the government of *Nagari* Tapakis request information about the current landholder and the history of transaction over this right.

In this case, there are two kinds of information have to be extracted:

- The first information is current landholder, in which the right identity and validity date as the key to extract this information. The SQL statement for this information is:

```
SELECT str.eventname, str.rtype, str.ridentity, str.beginvalidityversion, str.endvalidityversion,
        p.name, p.type
FROM public.socialtenurerelationship As str, public.party As p
WHERE str.party_gid = p.gid
AND str.ridentity = '03130000.2.00003'
AND (str.beginvalidityversion >'2000-12-03' AND str.endvalidityversion >= CURRENT_DATE);
```

The result of SQL statement above can be seen in Figure 6-18.

Output pane

Data Output | Explain | Messages | History

	eventname character varying(50)	rtype character varying(50)	ridentity character varying(17)	beginvalidityversion date	endvalidityversion date	name character varying(100)	type character varying(35)
1	Transfer of right	right to cultivate	03130000.2.00003	2009-11-05	2030-12-03	PT BELA NUSANTARA	Non Natural Person

Figure 6-18: The information of current landholder

The result of SQL statement above shows that the current landholder of this right is PT Bela Nusatara.

- The second information is the history of event over the right. The SQL statement for this information therefore:

```
SELECT* FROM
(SELECT str.eventname, str.rtype, str.ridentity, str.beginvalidityversion, str.endvalidityversion,
        p.name, p.type
FROM public.socialtenurerelationship As str, public.party As p
WHERE str.party_gid = p.gid
AND str.parcel_identifier = '03130000.00003'
AND (str.endvalidityversion is NOT NULL OR str.endvalidityversion < CURRENT_DATE)) as history
ORDER BY beginvalidityversion;
```

The result of SQL statement above is shown in Figure 6-19.

Output pane

Data Output | Explain | Messages | History

	eventname character varying(50)	rtype character varying(50)	ridentity character varying(17)	beginvalidityversion date	endvalidityversion date	name character varying(100)	type character varying(35)
1	Initial Registration	right to cultivate land (Hak Guna Usaha)	03130000.2.00003	2000-12-03	2005-10-03	PT BINA NUSANTARA TANI	Non Natural Person
2	Transfer of right	right to cultivate land (Hak Guna Usaha)	03130000.2.00003	2005-10-03	2009-11-05	PT MITRA TAMA AGRO SAWIT	Non Natural Person
3	Transfer of right	right to cultivate land (Hak Guna Usaha)	03130000.2.00003	2009-11-05	2030-12-03	PT BELA NUSANTARA	Non Natural Person

Figure 6-19: The history of event on right to cultivate land

Briefly, the first event is initial registration, in which PT Bina Nusantara Tani was registered as the first owner on 03/12/2000. The second event is transfer of right, taken place on 03/10/2005. This right was transferred to another company. The right was transferred again and finally the current landholder got this right on 05/11/2009.

e. Case five; dealing with the registration and recordation of the *ulayat* land, in which the prototype has to be able to record specific information. The specific information may describe subject and object of the *ulayat* land right, wherein every *Anak Nagari* has a clan and particular role in his/her community. The information of number of lands which owned by a party can be extracted based on name of party and its clan. In case for an investigation reason, the prosecutor request information about number of land that belongs to M Nur Dt. Majolelo. His clan is Koto. This information can be extracted by following SQL statement:

```
SELECT p.gid, p.name,p.clan, p.role, p.type, st.ridentity, st.rtype
FROM public.party As p, public.socialtenurerelationship As st
WHERE p.gid = st.party_gid
AND p.name = 'M.Nur. Dt. Majolelo'
AND p.clan = 'Koto'
AND (st.endvalidityversion is NULL OR st.endvalidityversion >= CURRENT_DATE);
```

The figure below shows the result of SQL statement above.

Output pane

Data Output | Explain | Messages | History

	gid integer	name character varying(100)	clan character	role character varying(35)	type character varying(35)	ridentity character varying(17)	rtype character varying(50)
1	3	M.Nur. Dt. Majolelo	Koto	Chief of Lineage (	group	03131101.1.00020	right of ownership
2	3	M.Nur. Dt. Majolelo	Koto	Chief of Lineage (	group	03131101.1.00003	right of ownership
3	19	M.Nur. Dt. Majolelo	Koto	Recipient of Waqf	Non Natural Person	03131101.5.00001	waqf(Hak wakaf)
4	2	M.Nur. Dt. Majolelo	Koto	Chief of Clan (Pan	group	03131101.1.00002	right of ownership

Figure 6-20: The number of lands which owned by a particular party

The result of SQL statement above shows that someone (M. Nur. Dt. Majolelo) has four land rights either as representative of group or as a person (natural or non-natural). Role information of a party also can determine type of customary right that registered in the formal right. For example the role party above is a Chief of Clan (*Panghulu Suku*), this is means that the land belong to a particular clan, which is Koto.

f. Case six; based on the previous case, M. Nur Dt. Majolelo was assigned as a chief in his lineage. In case, the member of his lineage request share information of their *Ulayat Kaum*. This prototype may extract this information based on the name, the clan, the specific role, and right identifier number. The statement SQL for this information is:

```
SELECT* FROM
(SELECT p.gid, p.name,m.gid, ep.name, p.clan,m.generation_level, m.share, st.ridentity, st.rtype
FROM public.party As p, public.member As m, external_person As ep,
        public.socialtenurerelationship As st
WHERE p.gid = st.party_gid
AND p.name = 'M.Nur. Dt. Majolelo'
AND p.clan = 'Koto'
AND p.role = 'Chief of Lineage (Panghulu Kaum)'
AND st.ridentity = '03131101.1.00003'
AND m.gp_gid = p.gp_gid
AND m.ep_gid = ep.gid
AND (st.endvalidityversion is NULL OR st.endvalidityversion >= CURRENT_DATE)) AS shareinfo ORDER
BY generation_level;
```

The figure below shows the result of SQL statement above.

Output pane

Data Output | Explain | Messages | History

	gid integer	name character varying(100)	gid integer	name character varying(255)	clan character	generation_level character varying(15)	share numeric(5,3)	ridentity character varying(17)	rtype character varying(50)
1	3	M.Nur. Dt. Majolelo	26	M.Nur. Dt. Majolelo	Koto	Gen 2	0.156	03131101.1.00003	right of ownership(Hak Milik)
2	3	M.Nur. Dt. Majolelo	27	Koerniati	Koto	Gen 2	0.156	03131101.1.00003	right of ownership(Hak Milik)
3	3	M.Nur. Dt. Majolelo	29	Maryana Syah	Koto	Gen 3	0.115	03131101.1.00003	right of ownership(Hak Milik)
4	3	M.Nur. Dt. Majolelo	28	Badrul Munir	Koto	Gen 3	0.115	03131101.1.00003	right of ownership(Hak Milik)
5	3	M.Nur. Dt. Majolelo	30	Musriadi	Koto	Gen 4	0.115	03131101.1.00003	right of ownership(Hak Milik)
6	3	M.Nur. Dt. Majolelo	31	Ali Imran	Koto	Gen 4	0.115	03131101.1.00003	right of ownership(Hak Milik)
7	3	M.Nur. Dt. Majolelo	32	Murniati Syahril	Koto	Gen 4	0.115	03131101.1.00003	right of ownership(Hak Milik)
8	3	M.Nur. Dt. Majolelo	33	Rahimidi Mawardi	Koto	Gen 4	0.115	03131101.1.00003	right of ownership(Hak Milik)

Figure 6-21: The share information of the *Ulayat Kaum*

The result SQL statement above shows share information for every member of lineage. In the list also can be seen the generation level of each member within their lineage. This information can be used to cross check validity member of lineage.

6.6. Summary

This chapter has described modeling the *ulayat* land tenure system in *minangkabau* community within the Indonesian NLAS. The basic idea of this chapter is to develop a proper model of the Indonesian NLAS in order to accommodate the *ulayat* land tenure system based on the STDM as a reference model. This chapter begins with the existing models of the Indonesian NLAS and the *ulayat* land tenure system. The existing models were developed by implementing the ontological category (subject, object and tenure relationship). The three packages in the STDM are implied the ontological category. Even though, both of the existing models have different numbers, name of classes and structure of relationships, however all packages in the STDM are able to assimilate these systems.

In order to achieve a proper model of Indonesian NLAS, the model has to be validated. The model transformed into a prototype and demonstrated. The fictional data were used in this demonstration. The spatial data were obtained from the aerial photograph and the textual data were created based on specific case that can be represented real condition in Indonesian land administration. With this approach, the capability of prototype can be assessed.

Based on the demonstration, it can be concluded that this model is valid for Indonesian National land administration system in terms of accommodating the *ulayat* land in its system.

7. CONLUSIONS AND RECOMMENDATIONS

7.1. Conclusions

The conclusions are discussed orderly according to the research sub-objectives and sub-questions which are raised in section 1.4. Overall discussions are derived from the explanation in the chapter 4, chapter 5 and chapter 6.

Sub-objective 1: To identify an assimilation approach of the customary land tenure system within the Indonesian national land administration system.

1. What are the differences and similarities between the Indonesian statutory tenure system and customary tenure system (*Ulayat* Rights)?

The differences of the Indonesian statutory tenure system and customary tenure system (*ulayat* rights) are concept of right to control land resources and characteristics of rights, as discussed in section 4.2 and section 4.5. In short can be explained below:

- Difference in concept of right to control land resources

According to Indonesian constitution (1945) the entire land resources are controlled by the state. Whereas in customary tenure system (the *ulayat* rights), there is no place for right of the state. This means that any lands covered by the particular customary village are in control of customary community.

- Difference in Characteristics of rights.

In *ulayat* land tenure system there are two kinds of land rights which are the right of ownership and the right to use. Whereas in Indonesian statutory tenure system there are two kinds of right that have no equivalence in *ulayat* land tenure system which are right to cultivate land (HGU) and right to build (HGB). These rights given on the state lands and could not on the *ulayat* lands.

The similarities of the Indonesian NLAS and customary tenure system (*ulayat* rights) are characteristic of landholders. The *ulayat* land tenure system is also recognizing individual land, in which land may belong to individually as a natural person or collectively as a group. Whereas public lands (*ulayat nagari*) excluding individual and collective land (e.g. *ulayat kaum, ulayat suku*) belong to all the community within a customary village (*Nagari*).

2. How to tackle the differences between the statutory tenure system and the customary tenure system (*Ulayat* Rights)?

The difference of concept is undertaken by converting the right of the state to control land resources within the country into the right of management which belong to particular *Nagari*. Subsequently a *Nagari* is entitled to manage their *ulayat* land, as discussed in section 4.5. Whereas the differences of characteristics of right is undertaken by providing two kinds of class right, which are class statutory right and class customary right, as discussed in section 5.4.

3. What STDM concepts can be used in an assimilation approach in order to optimize flexibility in Indonesian NLAS?

The concept of social tenure relationship in the STDM is able to use in assimilation approach, as discussed in section 6.4. In short, in STDM there is a concept of STDM relationship accommodating the existence of customary land. This is means that there are two layers in STDM which are layer right (statutory right) and layer STDM relationship (customary right).

In layer right, there is right to cultivate land (HGU) or right to build (HGB) which can be given on the state land to the land holder. Whereas in layer STDM relationship, this right (HGU or HGB) is customary

right (*ulayat nagari*) which is given to the land holder based on lease. From those concepts, a way to assimilate the customary right and statutory right is by establishing what is termed as tenancy (*hak sewa*). This right represents the relationship between the HGU/HGB holders and customary land holders to promote mutual benefit. However, the customary rights can be recorded as itself, and it can be registered in one of the statutory rights in the Indonesian NLAS. The flexibility in the Indonesian NLAS can be optimized by implementing this concept.

Sub-objective-2: To develop and validate model requirements in this assimilation approach for customary lands (Ulayat land) in Indonesian NLAS using the STDM.

4. What are the requirements in terms of integrated data model supporting decentralization policy?

The Requirements in terms of integrated data model supporting decentralization policy are:

- Integrated data model requires single identifier number for each object. By including customary village (*Nagari*) into the government system it will provides single identifier number of each object.
- Integrated data model requires two layers of right in the same object, in which a statutory right is an instance of the layer right and customary right is an instance of layer STDM relationship.

5. What are the contents of the data model including classes, attributes and associations in the integrated model?

The integrated model uses the STDM as a reference model. All packages in STDM are compatible model to develop integrated model. No extensions needed for classes except additional code list and enumeration for the specific case the *ulayat* land tenure system. The structure of the integrated model is completely discussed in section 6.4.

6. Can this model supportive in the provision of customary tenure security?

This model has been developed to assimilate the customary tenure system (the *ulayat* land tenure system) into the Indonesian NLAS. The customary tenure may be recorded and registered in the Indonesian NLAS. By implementing this model, it will support customary tenure security. Some demonstrations are able to explain that this model is able to support tenure security for all, as discussed in section 6.5.

7.2. Overall Conclusion

The developed assimilation approach as presented in this thesis enables to accommodate customary tenure within the national land administration system. First this approach has been presented from a conceptual perspective. In the conceptual perspective, it begins with differences and similarities of customary and statutory systems are identified by using ontological categories for land administration. Subsequently, the differences of tenure systems are tackled by implementing proper concept. In this study, we propose the introduction of the concept right of management. This right belongs to the customary community and is proposed to be implemented in two different layers of rights. From both tenure systems model requirements have been identified.

From the technical perspective, there is a need to have a reference model that enables to capture a wide range of model requirements such as STDM/LADM. In this study, STDM has been used to able to the accommodation two classes of rights. A prototype has been developed to validate the assimilation approach on a technical level. In this way the assimilation concept can be demonstrated both from customary to statutory and the other way around.

7.3. Contributions of this study

In short, contributions of this study can be drawn:

1. Assimilation approach is a new concept to accommodate customary rights in NLAS. This approach allows the customary lands may be recorded as themselves and registered as one of the formal right in the NLAS and the other way around.
2. STDM as a pro poor land tool is needed to provide tenure security for all. STDM as specialization of LADM, which international standard, should be valid in implementation. This study has validated this standard in specific case of the *ulayat* land in *minangkabau* community.

7.4. Recommendations

In this study several issues regarding modeling land tenure were encountered. Therefore, for the following issues future work is recommended:

1. There are twenty three customary regions in Indonesia. There is a need to explore detailed characteristics of each region to develop single system in Indonesian NLAS.
2. The existing system of the Indonesian NLAS is not able to keep all histories data. Every event just keeps completely in reference documents and certificate. There is a need to redevelop the existing database system by implementing International standard (LADM/STDM).
3. Investment is important to enhance economic growth. The protection of rights for the leaseholders and landholders has to be given by law. Therefore, there is a need for BPN to regulate right of lease which is already mentioned in BAL.
4. In the implementation of integrated system, we propose to create two layers of rights. Subsequently, further research in workflow processing is necessary to develop a comprehensive system.
5. Demonstration in this study uses fictional data. It required for BPN to establish a pilot project to record and register the *ulayat* lands.
6. There is a need to establish mechanism of conversion of the former statutory rights (HGU/HGB) to the customary rights by using applicable law.

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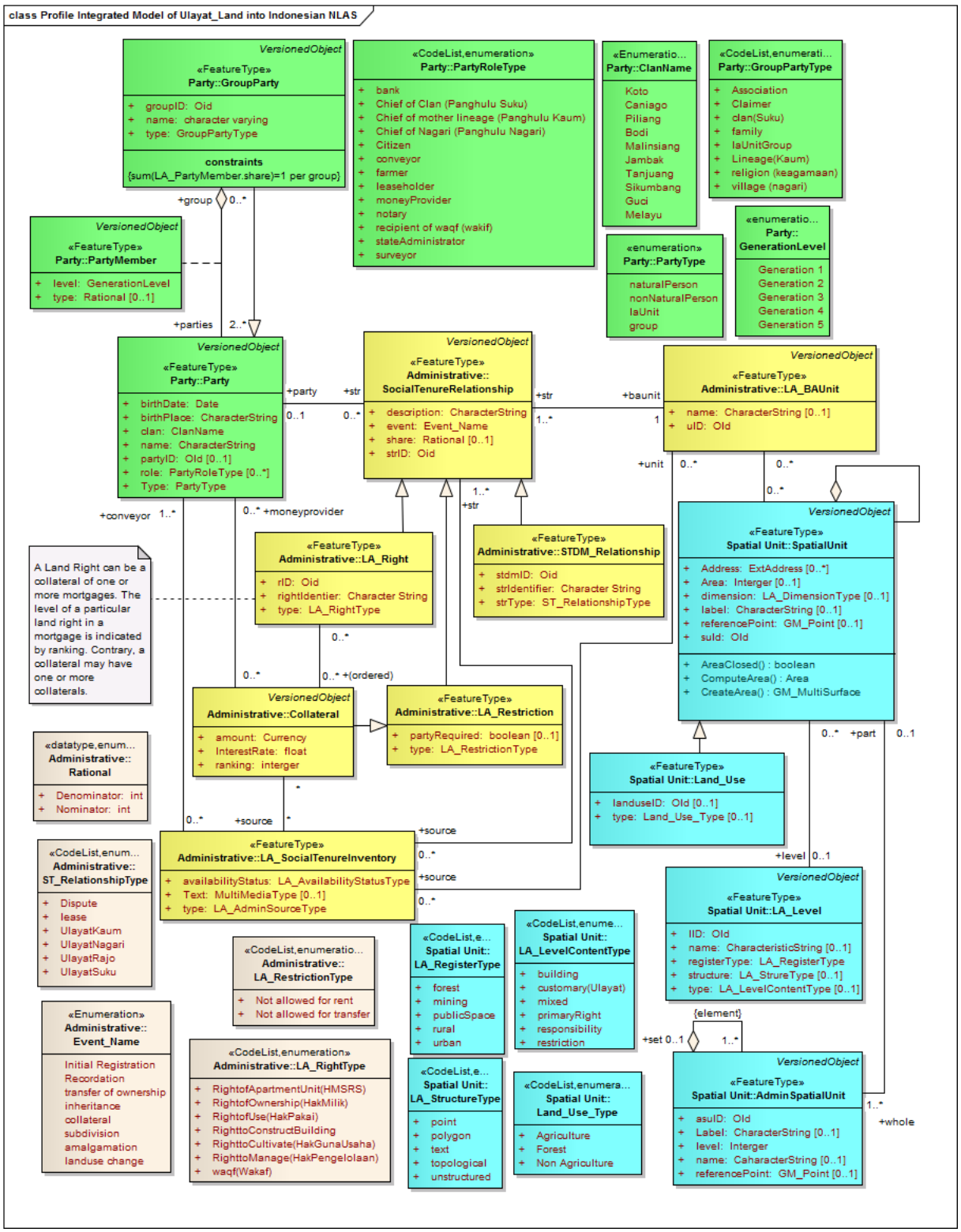
APPENDIX A: CHARACTERISTICS OF INDONESIAN STATUTORY TENURE SYSTEM

Right Name	*Subjects*	*Purposes / Uses*	*Given Over*	*Duration*	*Legal framework*
Right of Ownership (*Hak Milik* in short *HM*)	Person or group person (Indonesian citizen) Indonesia legal bodies	House, small agriculture, etc.	State land Individual land Customary land through the conversion process	No limitation	BAL Government Regulation No. 38/1963 Government Regulation No. 24/1997
Right to Cultivate land (*Hak Guna Usaha* in short *HGU*)	Indonesian citizens Indonesia legal bodies located in Indonesia	For the cultivation	State land	35 years, can be extended for maximum 25 years more	BAL Government Regulation No. 40/1996 Government Regulation No. 24/1997
Right to Build (*Hak Guna Bangunan* in short *HGU*)	Indonesian citizens Indonesia legal bodies located in Indonesia	For the Building purposes (real estate, commercial building, factory building, etc)	State land Land with the Right of Management Land with the Right of Ownership	30 years, can be extended for maximum 20 years more	BAL Government Regulation No. 40/1996 Government Regulation No. 24/1997
Right to Use (*Hak Pakai* in short *HP*)	Indonesian citizens Indonesia legal bodies located in Indonesia Central government and local government Religious and Social body Foreigner who living in Indonesia Embassy and International Organizations	For office building, public building, etc.	State land Land with the Right of Management Land with the Right of Ownership	25 years, can be extended for maximum 20 years, Can also be given as long as still use	BAL Government Regulation No. 40/1996 Government Regulation No. 24/1997

Right of Management (*Hak Pengelolaan* in short *HPL*)	Government institutions State-Owned Enterprises (BUMN) Local-Owned Enterprise (BUMD) Firms Authority bodies Other government institutions	As the delegation of the right of the state to control the land, which given for the third parties.	State land	6 years	BAL (imply) Law No.32 year 2004 Government Regulation No. 40/1996 Government Regulation No. 24/1997 Regulation of Ministry of Agrarian No.9 year 1965 Regulation of Ministry of Interior No.1 year 1977 Regulation of Ministry of Agrarian No.9 year 1999
Right of Waqf (*Hak Milik Wakaf*)	Indonesian citizens Indonesia legal bodies located in Indonesia	For the religious purposes according to Islam law	Land with the Right of Ownership	No limitation	BAL (imply) Government Regulation No. 28/1977 Government Regulation No. 24/1997
Right of Apartment (*Hak Milik atas Satuan Rumah Susun* in short *HMSRS*)	Indonesian citizens Indonesia legal bodies located in Indonesia	Apartment, Flat, stall space.	Land with the Right of Ownership Land with the Right of Management Land with the Right to Build	No limitation	BAL (imply) Law No.16 year 1985 Government Regulation No. 24/1997

APPENDIX B: CLASS PROFILE INTEGRATED MODEL



APPENDIX C: THE DDLS OF PROTOTYPE

1. Table Party:

```
-- Table: party
-- DROP TABLE party;
CREATE TABLE party
(
  gid serial NOT NULL,
  gp_gid integer,
  "name" character varying(100) NOT NULL,
  birthDate date,
  birthPlace character varying(50),
  clan character varying(35),
  gender character varying(35),
  "role" character varying(35),
  "type" character varying(35),
  beginvalidityversion date NOT NULL,
  endvalidityversion date,
  CONSTRAINT party_pkey PRIMARY KEY (gid),
  CONSTRAINT groupparty_gid_fkey FOREIGN KEY (gp_gid)
      REFERENCES groupparty (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION
 )
WITH (OIDS=FALSE);
ALTER TABLE party OWNER TO postgres;
```

2. Table Group Party

```
-- Table: groupparty
-- DROP TABLE groupparty;
CREATE TABLE groupparty
(
  gid serial NOT NULL,
  p_gid integer,
  "name" character varying(55) NOT NULL,
  grouppartytype character varying(55) NOT NULL,
  CONSTRAINT groupparty_pkey PRIMARY KEY (gid)
)
WITH (OIDS=FALSE);
ALTER TABLE groupparty OWNER TO postgres;
```

3. Table Member

```
-- Table: member
-- DROP TABLE member;
CREATE TABLE member
(
  gid serial NOT NULL,
  gp_gid integer NOT NULL,
  ep_gid integer NOT NULL,
  "share" numeric(5,3) NOT NULL,
  generation_level character varying(15),
```

```
  CONSTRAINT member_pkey PRIMARY KEY (gid),
  CONSTRAINT external_person_gid_fkey FOREIGN KEY (ep_gid)
      REFERENCES external_person (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION,
  CONSTRAINT groupparty_gid_fkey FOREIGN KEY (gp_gid)
      REFERENCES groupparty (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION
)
WITH ( OIDS=FALSE );
ALTER TABLE member OWNER TO postgres;
```

4. Table Social Tenure Relationship

```
-- Table: socialtenurerelationship
-- DROP TABLE socialtenurerelationship;
CREATE TABLE socialtenurerelationship
(
  gid serial NOT NULL,
  r_gid integer,
  ridentity character varying(17),
  rtype character varying(50),
  st_gid integer,
  stidentity character varying(17),
  strtype character varying(50),
  beginvalidityversion date NOT NULL,
  endvalidityversion date,
  party_gid integer,
  socialtenuretype_id integer,
  socialtenurerelationshiptype_idx character varying(40),
  baunit_gid integer,
  eventname character varying(50),
  parcel_identifier character varying(19),
  CONSTRAINT socialtenurerelationship_pkey PRIMARY KEY (gid),
  CONSTRAINT socialtenurerelationship_party_gid_fkey FOREIGN KEY (party_gid)
      REFERENCES party (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION
)
WITH (OIDS=FALSE );
ALTER TABLE socialtenurerelationship OWNER TO postgres;
```

5. Table Basic Administrative Unit (BAUnit)

```
-- Table: ba_unit
-- DROP TABLE ba_unit;
CREATE TABLE ba_unit
(
  gid serial NOT NULL,
  str_gid integer NOT NULL,
  spatialunit_gid integer NOT NULL,
  beginvalidityversion date NOT NULL,
  endvalidityversion date,
```

```
  validitystatus character varying(20),
  parcel_identifier character varying(19),
  CONSTRAINT ba_unit_pkey PRIMARY KEY (gid),
  CONSTRAINT socialtenurerelationship_gid_fkey FOREIGN KEY (str_gid)
      REFERENCES socialtenurerelationship (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION,
  CONSTRAINT spatialunit_gid_fkey FOREIGN KEY (spatialunit_gid)
      REFERENCES spatialunit (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION
)
WITH ( OIDS=FALSE );
ALTER TABLE ba_unit OWNER TO postgres;
```

6. Table LA_Right

```
-- Table: larights
-- DROP TABLE larights;
CREATE TABLE larights
(
  gid serial NOT NULL,
  ridentity character varying(18),
  rtype character varying(50),
  str_gid integer,
  CONSTRAINT larights_pkey PRIMARY KEY (gid),
  CONSTRAINT socialtenurerelationship_to_laright_gid_fkey FOREIGN KEY (str_gid)
      REFERENCES socialtenurerelationship (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION
)
WITH (OIDS=FALSE);
ALTER TABLE larights OWNER TO postgres;
```

7. Table STDMRelationship

```
-- Table: stdmrelationship
-- DROP TABLE stdmrelationship;
CREATE TABLE stdmrelationship
(
  gid serial NOT NULL,
  stdmidentity character varying(18),
  stdmtype character varying(50),
  str_gid integer,
  CONSTRAINT stdmrelationship_pkey PRIMARY KEY (gid),
  CONSTRAINT socialtenurerelationship_gid_fkey FOREIGN KEY (str_gid)
      REFERENCES socialtenurerelationship (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION
)
WITH ( OIDS=FALSE);
ALTER TABLE stdmrelationship OWNER TO postgres;
```

8. Table SpatialUnit

```
-- Table: spatialunit
-- DROP TABLE spatialunit;
CREATE TABLE spatialunit
(
  gid serial NOT NULL,
  parcel_identifier character varying(19),
  beginvalidityversion date NOT NULL,
  endvalidityversion date,
  validity character varying(15),
  ba_unit_gid integer,
  socialtenure_gid integer,
  right_identity character varying(19),
  right_type character varying(40),
  stdm_identity character varying(19),
  stdm_type character varying(30),
  land_use character varying(30),
  the_geom geometry,
  socialtenuretype character varying,
  CONSTRAINT spatialunit_pkey PRIMARY KEY (gid),
  CONSTRAINT socialtenurerelationship_gid_fkey FOREIGN KEY (socialtenure_gid)
      REFERENCES socialtenurerelationship (gid) MATCH SIMPLE
      ON UPDATE NO ACTION ON DELETE NO ACTION,
  CONSTRAINT enforce_dims_the_geom CHECK (st_ndims(the_geom) = 2),
  CONSTRAINT enforce_geotype_the_geom CHECK (geometrytype(the_geom) = 'POLYGON'::text
OR the_geom IS NULL),
  CONSTRAINT enforce_srid_the_geom CHECK (st_srid(the_geom) = 23832)
)
WITH (OIDS=FALSE);
ALTER TABLE spatialunit OWNER TO postgres;
-- Index: spatialunit_the_geom_gist
-- DROP INDEX spatialunit_the_geom_gist;
CREATE INDEX spatialunit_the_geom_gist
  ON spatialunit
  USING gist
  (the_geom);
```