

The role of LADM (ISO19152) in the digital transformation of the Land Administration ecosystem

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Introduction

The revision of the Land Administration Domain Model (LADM) is significantly changing the scope of the standard: the focus is shifting from the architectural requirements of the *agency* to the architectural requirements of the *ecosystem*. At the same time LADM is recognised as pivotal to the next phase of digital transformation where policy makers expect increased operational and process alignment between agencies in the ecosystem. This article is a condensed version of a [paper presented at the 2023 FIG Commission 7 event in Deventer](#) and describes how the LADM can support the digital transformation of the Land Administration ecosystem.

Land Administration

Land and property are characterised by the interplay of complex real right relationships formalised through different land administration stakeholders. The legitimacy of the rights can be expressed socially and legally. Formal processes generally require legal legitimacy. *Land Administration* is the process of determining, recording and disseminating information about the ownership, value and use of land when implementing land management policies. Land Administration reflects the activities of different authoritative agencies that collectively create an ecosystem. This tends to include the following types of Land and Property functions:

- Land and Property Titling (Land Registry) – managing real right registration and the subsequent transaction, and maintenance of the land register.
- Development (Planning Department) - regulating land and property development.
- Use and conservation (various departments) – regulating the use and conservation of land.
- Finance and valuation - valuing property and framing how revenue is generated from land and property through sales, leasing, and taxation.
- Disputes and conflict resolution - Land tribunals and other adjudicating agencies to resolve conflicts concerning the ownership and use of land.

Collectively these agencies provide the mechanism through which tenure is formalised. In addition, each agency has a mandate and powers to deliver that mandate: this includes holding authoritative data.

Authoritative data and Digital Transformation

Authoritative data is officially recognised data that can be certified and is provided by an authoritative source: the implication being that data is up-to-date, credible, accurate, assured, well-governed and trusted. An efficient and effective Land Administration ecosystem will use authoritative data as a *core reference* that can be re-used throughout the ecosystem. This is referred

to as the *once-only principle* (UNECE, 2021, p. 11).

Unfortunately, for the majority of jurisdictions, the products, services and processes of these agencies are not digitally integrated (UNECE, 2021, p. 11). This is generally because the ecosystem has never been re-architected to capitalise on digital systems: rather agencies have evolved independently. This often results in the duplication of capabilities and inefficient intra-ecosystem processes. In other words: many current Land Administration ecosystems are represented by agencies operating predominantly within digital silos. This makes for an inefficient digital ecosystem.

The policy expectation is that the capabilities of agencies will evolve and become increasingly integrated (see, for example, Figure 1). This requires *digital transformation*. UNECE (2021, pp. 3-4) consider *Digital Transformation* to be the key megatrend in the short-medium term. It is within this context that we wish to consider the role of the LADM.

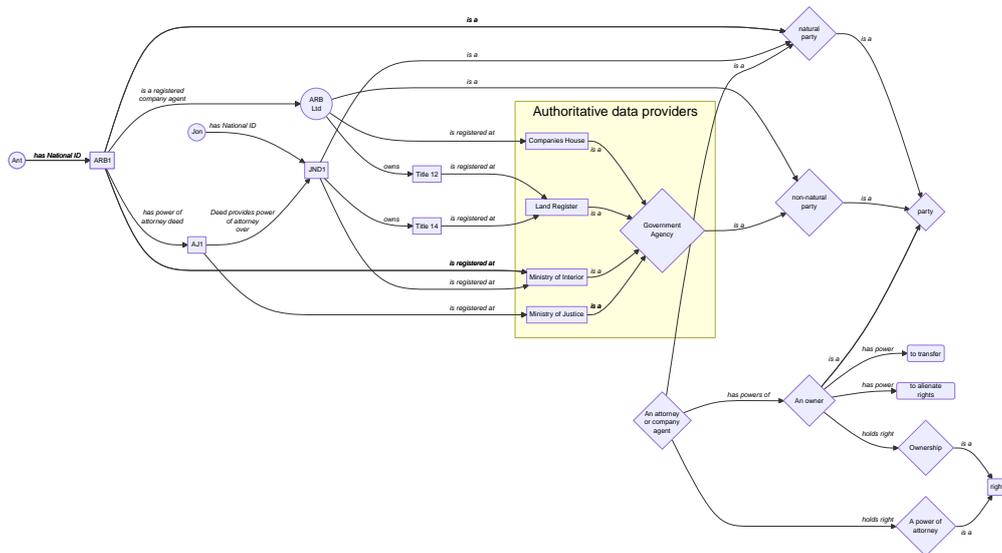


Figure 1. Authoritative agencies sharing data and concepts in an integrated ecosystem (re-used under a CC-BY licence from Ant Beck). The network demonstrates authoritative relationships between party identity systems, company registration, land registration, and power of attorney. In a digital system dynamic data is commonly exposed through Application Programming Interfaces (APIs).

The Land Administration Domain Model: an introduction

LADM is a conceptual model which supports the modelling of social relations with land articulated through rights. There are three principal concepts within LADM: the *party* (*the who*) that has a *rights relationship* (*the what*) with a *plot of land* (*the where*). As a standard, LADM dominates the domain and supports nuanced representations of Party-Right-Land relationships.

LADM edition 1 and Land Registration

The first edition of the LADM was published in 2012: it focussed principally on the needs of the Land Registration community (Lemmen et al., 2023, p. 9). The Land Register is key to the Land Administration ecosystem and describes land and associated property rights which are created, modified or extinguished as part of the conveyancing process. Parties can ‘own’ land and property

which, when spatially described, is known as a cadastral unit. Land and Property can be segmented into different juridically defined forms (e.g. leasehold, strata, units in real estate complexes etc.). We have described these forms of Land and Property as *primary interests*. *Primary interests* can be owned by parties and traded in land markets. *Subordinate interests* are other rights which can provide benefits to third-parties but after their initial grant are not intrinsically tradeable (such as easements). The Land Register describes these primary and subordinate interests using Party-Right-Land relationships. The owner of a primary interest tends to have powers to alienate a legally defined set of subsidiary *primary* and *subordinate* interests to specified third-parties. The Land Register also describes these transactions and their outcomes using Party-Right-Land relationships.

Rights, restrictions and responsibilities

Land Registration is the process of recording rights in land either in the form of registration of deeds or the registration of title to land. When articulating title, rights are described that either 1) **benefit the owner** as they are rights held directly by the owner or indirectly via the property; or 2) **encumber the owner** as they are rights held by specified third-parties. Encumbering rights introduce a *duty* on the property owner which within LADM are referred to as either:

- A restriction: "formal or informal obligation on the **land owner** to refrain from something", or
- A responsibility: "formal or informal obligation on the **land owner** to allow or do something"

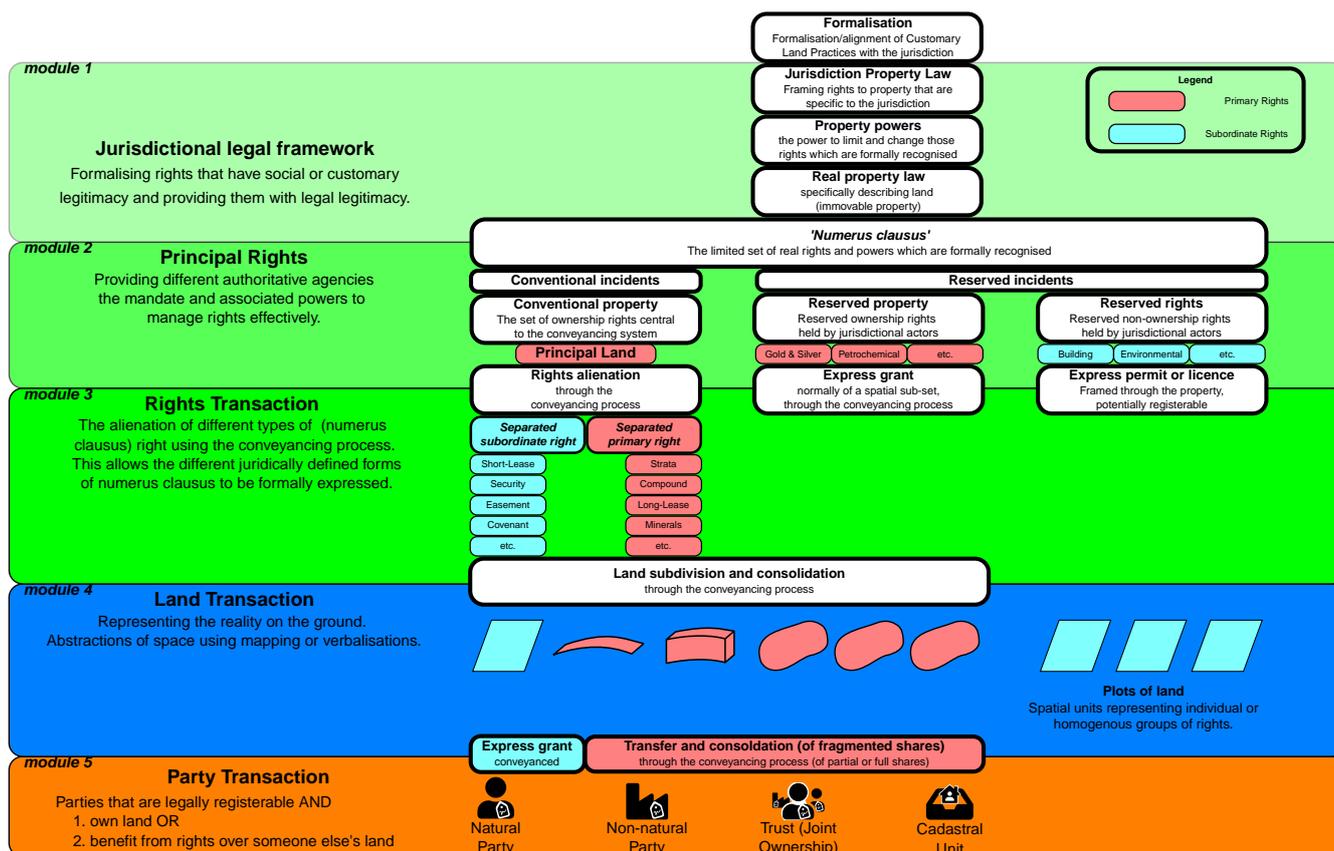


Figure 2. The modular arrangement of rights relationships describing conventional incidents (framing the conveyancing process) and reserved incidents (re-used under a CC-BY licence from Ant Beck).

The rights of others

However, as described by [FAO \(2022, p. 6\)](#): "All parties should recognize that no tenure right, including private ownership, is absolute. All tenure rights are limited by the rights of others and by the

measures taken by States necessary for public purposes." The "rights of others" predominantly refers to rights granted to specified third-parties by property owners through the conveyancing process. This could be the current owner or any previous owners. We call rights managed through the conveyancing process *conventional incidents*. The "measures taken by States necessary for public purposes" refers to rights that are reserved by the jurisdiction and managed by formal agencies empowered through public law. We call such rights *reserved incidents* (also called Public Law Restrictions) which we see as a combination of *reserved property* and *reserved rights*. The relationship between *conventional incidents* and *reserved incidents* is summarised in Figure 2.

Public Law Restrictions and permits

From the point of view of the property owner *reserved incidents* encumber *conventional property* by restricting the rights the *property owner* is permitted to enjoy. These reserved incidents can be described using Party-Right-Land relationships. The authoritative agencies can grant permits to property owners that allow them to undertake what would otherwise be restricted activities (normally for a time limited period). Theoretically, the issuing of a permit to a property owner involves the use of data and concepts held by the Land Register and the relevant authoritative agency (see Figure 3). These permits can be described using Party-Right-Land relationships.

Powers and the bundle or rights

Each jurisdiction creates a set of primary and subordinate rights which are recognised by the state and legally formalised. This is *numerus clausus*: the closed list of basic land and property rights recognised by the jurisdiction. Rights within *numerus clausus* represent both the *bundle* and the *sticks* in the *bundle of rights* model. The actual relationship between the *bundle* and the *sticks* is determined when *title* is articulated. The property law that defines *numerus clausus* will also describe the *powers* associated with each right. *Powers* define how any right can be granted, licenced, alienated, discharged, or varied.

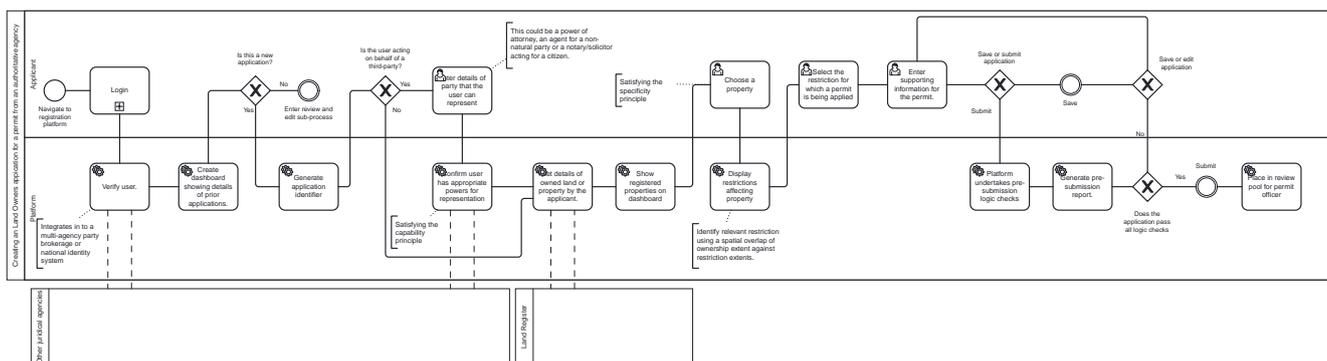


Figure 3. Conceptual representation of permit creation using Business Process Modelling Notation (BPMN). Note the agency relationships described in the process (re-used under a CC-BY licence from Ant Beck).

Rights duality and the Land Administration ecosystem

The LADM approach to *restrictions* and *responsibilities* frames encumbrances in terms of their impact on a *land owner* rather than the benefit that the *right holder* has over land owned by someone else. The distinction is subtle but important, reflecting a concept called *rights duality*. The implication of *rights duality* is that a registered right that is legitimately held (and has corresponding tenure security) imposes a *duty* (either a *restriction* or *responsibility*) on the property

owner. The duality represents two relationships:

1. The *positive* or *negative* duty owed by the affected property owner and
2. The interest held by a third-party.

The duality of rights and duties provides a finely nuanced mechanism to define relationships between parties framed through land and property. In this manner *reserved incidents* are *rights* controlled by authoritative agencies which create *duties* in the form of *restrictions* and *responsibilities* on any affected *property*. This has important ramifications when considering the whole Land Administration ecosystem.

The rights-duality paradox in an integrated ecosystem

Rights duality dictates that if a Land Register records a duty (as a *restriction* or *responsibility*) then within the Land Administration ecosystem there exists a specified third-party or authoritative agency which holds the corresponding right. Do we register the right (the benefit for the right holder), the duty (the encumbering restriction or responsibility against the property), or both?

This is a difficult question and, in part, the answer depends upon the maturity of the ecosystem and the level of data, service and process integration between authoritative agencies. The *once-only principle* **demands** efficient recording: it does not matter whether it is the right or the duty which is recorded. What matters is that other agencies have the ability to infer the respective right or duty from the information which is exposed in the ecosystem. However, where an agency has a **mandate**, then they manage the right or duty relationship and produce the associated authoritative data: no other agency has the legitimacy to authoritatively manage this specific data.

Unfortunately not all ecosystems are mature and most do not rigorously deploy the *once-only principle*. While such jurisdictions are being reformed it is important that *rights duality* is embraced. The authoritative agency should also record any appropriate ancillary data which is required so that the right or duty can be effectively re-used by other actors in the ecosystem. It is only by understanding the operational requirements of the ecosystem at a holistic level can the *once-only principle* be effectively implemented. This is not an easy task.

Revision of the LADM to focus on an ecosystem

The revision of the LADM extends the scope of the 2012 standard towards addressing the needs of the broader Land Administration ecosystem (Lemmen et al., 2023). We believe that the LADM revision has the potential to do more than provide semantic interoperability between jurisdictions; it can support the delivery of integrated e-Government services. As a standard, the revised LADM should be foundational to the *digital transformations* required to deliver integrated services.

Making ecosystem operations generic

How is this to be applied to the Land Administration domain (which is, after all, a subset of the broader government ecosystem)? Each jurisdiction is unique in the way it determines the social value of rights which are defined in property law. Property law also describes the powers that a right holder has to grant, licence, alienate, discharge, or vary a right. While the specific details relating to powers depends on the type of tenure, legal tradition and social need expressed in a

jurisdiction, the broad nature of powers are, we believe, generic. In summary, the relationships between parties and rights may be unique to a jurisdiction, while the abstract operations available through powers to change rights are broadly generic across jurisdictions.

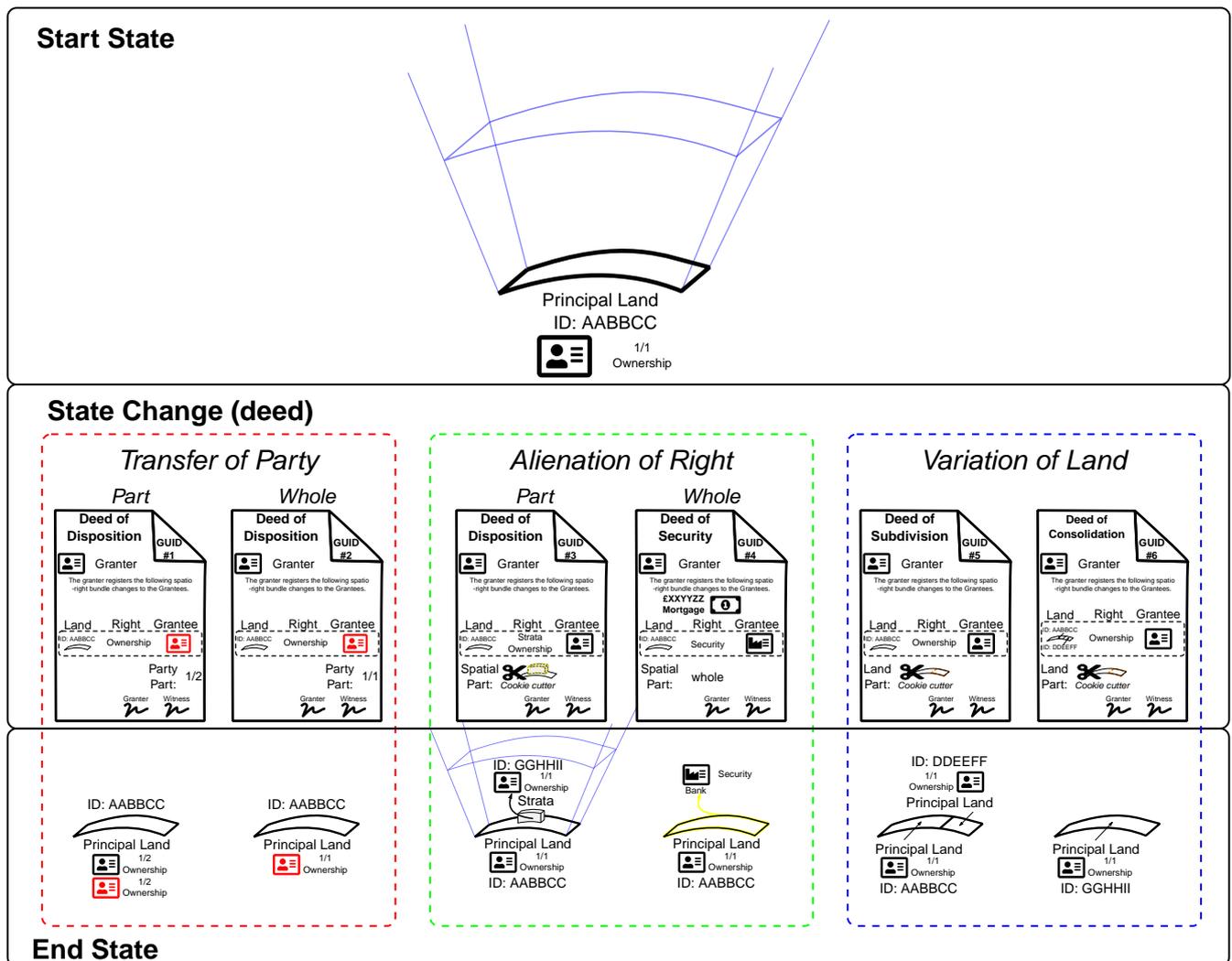


Figure 4. Transactions associated with Land and Property based on LADM concepts (re-used under a CC-BY licence from Ant Beck): (1) A Transfer of Party, (2) An Alienation of Right, and (3) Variation of Land.

The role of LADM in generic operations

To support transparency and interoperability transactional operations should be grounded in the standard LADM primitives. We will use *alienation* as an example. FAO (2002, p. 10) describe *alienation* as:

- A right to alienate all rights to the entire holding (e.g. through sale), or to a portion of the holding (e.g. by subdividing it).
- A right to alienate only a portion of the rights (e.g. through a lease).
- A residuary right to the land, i.e., when partially alienated rights lapse (such as when a lease expires), those rights revert to the person who alienated them.

As described in Figure 4 and Figure 5 alienation can occur through a party, right, or land

dimension.

The ability to "alienate all rights to the entire holding (e.g., through sale)" is what we refer to as a *Transfer of Party* transaction: alienation through the *party* dimension. A ToP is the transfer of all or a proportion of the ownership to specified third-parties. Fragmented shares held by different parties can be consolidated using a ToP operation.

The ability to "alienate all rights to a portion of the holding (e.g., by subdividing it)" is what we refer to as a *Variation of Land* transaction: alienation through the *land* dimension. A VoL is a subdivision of a cadastral unit to create two or more cadastral units or the consolidation of multiple cadastral units to create a single cadastral unit.

The ability to "alienate only a portion of the rights, e.g., through a lease" is what we refer to as an *Alienation of Rights* transaction: alienation through the *right* dimension. An AoR is where rights can be separated from the body of a property (and subsequently transferred to third-parties).

At first glance this looks like these operations are only applicable for Land Registration. However, the authoritative agency who manages reserved property has powers to alienate rights and transfer them to third-parties. This allows these agencies to create permits and other waivers that benefit third-parties using these generic operations.

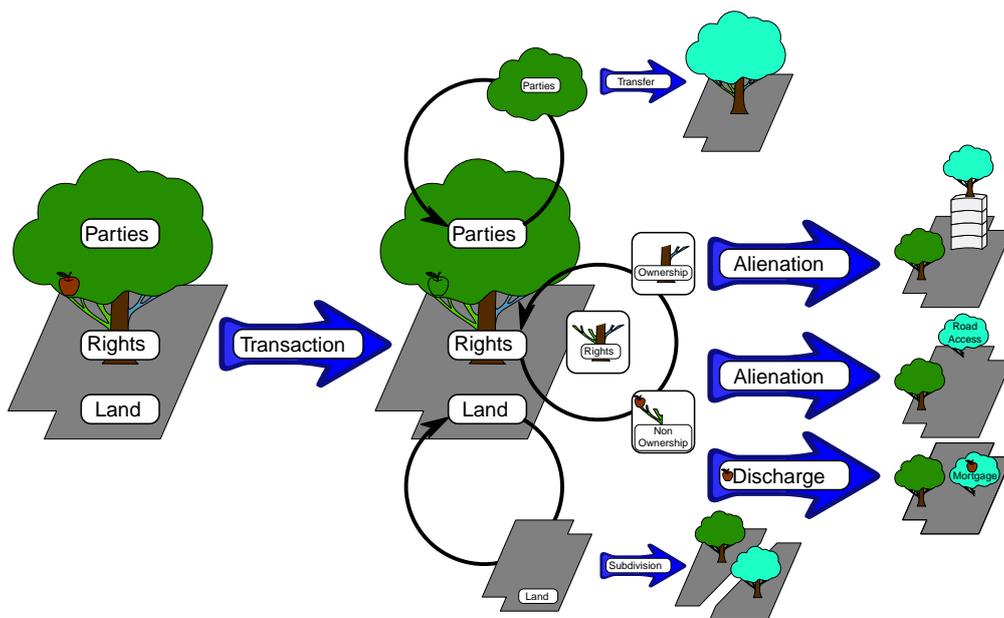


Figure 5. How transactions can change Party, Rights and Land relationships (re-used under a CC-BY licence from Ant Beck).

Conclusion

We have argued that policy initiatives and the LADM standard are both moving from the architectural requirements of the *agency* to the architectural requirements of the *ecosystem*. This represents a significant change in perspective. The challenge is in how to frame and deliver such transformation. We have considered this from the point of view of developing well defined generic processes grounded in legal, operational and standards-based concepts. Property law describes both *numerous clausus* and the powers that a right holder has to grant, licence, alienate, discharge, or vary a right. We argued that while the relationships between parties and rights may be unique to a jurisdiction, the abstract operations available through powers to change rights are broadly

generic between jurisdictions. To reflect this we proposed that generic transactions in the ecosystem can be framed through core LADM primitives: a transfer is a transaction in the party dimension; a subdivision or consolidation is a transaction in the land dimension; and a rights alienation or amalgamation is a transaction in the rights dimension.

The change in focus from the agency to the ecosystem highlights the importance of rights duality in delivering the *once-only principle*. While it is clear that the mandated agency should manage authoritative data, in a *once-only* ecosystem this agency also has the burden of ensuring the *once-only* data is suitable for re-use scenarios outside their mandated remit. Such understanding requires transparent communication between stakeholders. It is only by understanding the operational requirements of the ecosystem at a holistic level can the *once-only principle* be effectively implemented. This requires significant social engineering.

LADM is pivotal to establishing and supporting these ecosystem wide principles. The LADM revision should provide clarity in terms of the foundational concepts, implementation patterns and generic business logic. While LADM was designed to provide interoperability between jurisdictions the revision should support interoperability between agencies within a functioning ecosystem. This is essential to achieve the digital reforms envisaged by UNECE, FAO, and FIG ([UNECE, 2021](#)).

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