

Incorporating Legal Space Details of Building from BIM/IFC to the LADM Sarawak Country Profile

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GeoWeek 2024 – FIG LADM & 3D LA
Kuching, Sarawak

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Introduction & Motivation

- **Digitalizing** the built environment is a major shift in industry and profession in many countries
- **BIM** is a key contributor to **spatial development**.
- **LADM** - robust **framework for legal entities** (e.g., parcels, rights, restrictions).
- **BIM** - captures rich 3D data about **building elements** and materials.

Introduction & Motivation

- Various studies have explored **integrating BIM with LADM** for better land administration, focusing on legal property storage, 3D LAS, and legal space representation.
- **Challenges** – legal-spatial fusion, semantic alignment, and interoperability between BIM and LADM.
- **Proposed solutions** – researchers suggest using IfcSpace for legal spaces, enriching IFC models with legal data, and integrating BIM into land administration workflows.
- **The aim** – to enrich IFC data with legal information and extract 3D legal spaces for strata building registration.

BIM/IFC - LADM

- **Integration of BIM/IFC and LADM** could enhances land administration precision and utility in terms of:
 - Legal Space Details
 - Sustainable Development
 - Conflict Prevention
 - Digital Transformation

Strata Management in Sarawak

- Currently in 2D representation
- Integrated E-Submission system
- Standardized naming
- Survey Strata Title System (SSTS)
- Legal recognition and management - compliance with the Strata Management Ordinance, 2019.

Methodology

Identification the types of legal spaces building, and the RRRs

- Conduct an experiment for extracting legal spaces of building via REVIT
- Classify the spaces based on their legal status
- Documents the type of ownership involved

A comprehensive legal space with their corresponding ownership types – as foundation for further modelling

Implementation of legal spaces from BIM/IFC

- Import the legal spaces from BIM environment
- Map the legal spaces and ownership types onto the model
- Ensure that all legal and administrative information is accurately represented and accessible

A detailed conceptual model that represents legal spaces & administrative of Sarawak

Conceptual modelling of Sarawak Country Profile

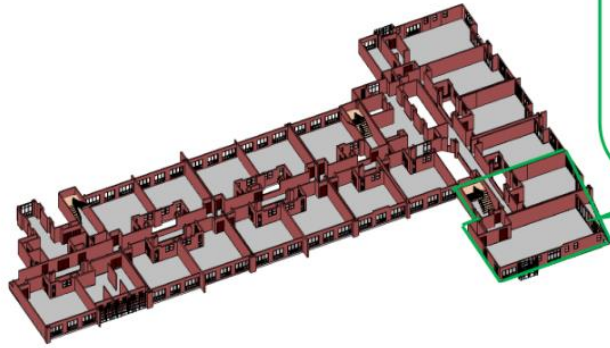
- Review the LADM Edition II standard to understand the structures & components
- Adapt LADM framework to fit with legal & administrative of Sarawak
- Develop a conceptual model that involves all the relevant legal spaces, ownership types & administrative boundaries

Methodology

- **Identification the types of legal spaces building, and the RRRs**
 - **Legal Space Classification:** prominent common areas (e.g., elevator, lobby), non-prominent common areas (e.g., storage room, car park), and individual units.
 - **Extraction via Autodesk Revit** which supports parametric modeling and 3D design.

Methodology

- **Identification the types of legal spaces building, and the RRRs**
 - **Types of ownership:** Sarawak has individual units (parcels) and common property
 - **Filtering for LADM integration:** IfcSpace for legal spaces and IfcBuildingElement for RRRs.
 - **Resolving missing elements:** components (e.g., walls) are generated in Autodesk Revit to ensure accurate 3D models, which are then used to define legal boundaries.



Types of ownership



Missing elements (e.g., IfcWall) in 3D model

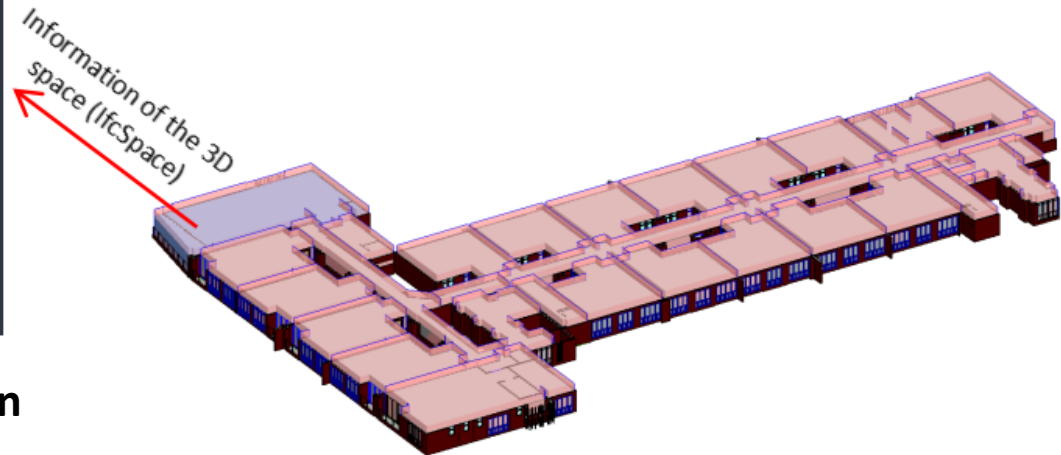
Methodology

- **Implementation of legal spaces from BIM/IFC**
 - mapping the legal spaces and ownership types
 - IfcSpace (rooms) were generated, covering the inner surfaces of the walls, floors, and ceilings following the Strata (Subsidiary Titles) Ordinance, 2019 guideline

Methodology

Rooms (1)		Edit Type
Constraints		
Level	Rooms (1)	Floor 01
Upper		Floor 01
Limit Offset		3.0480 m
Base Offset		0.0000 m
Text		
Ownership Type		Individual Unit
Property Type		Apartment Unit
Dimensions		
Area		31.751 m ²
Perimeter		23.6736 m
Unbounded Height		3.0480 m
Volume		66.681 m ³
Computation Height		0.0000 m

Part of the 3D space information



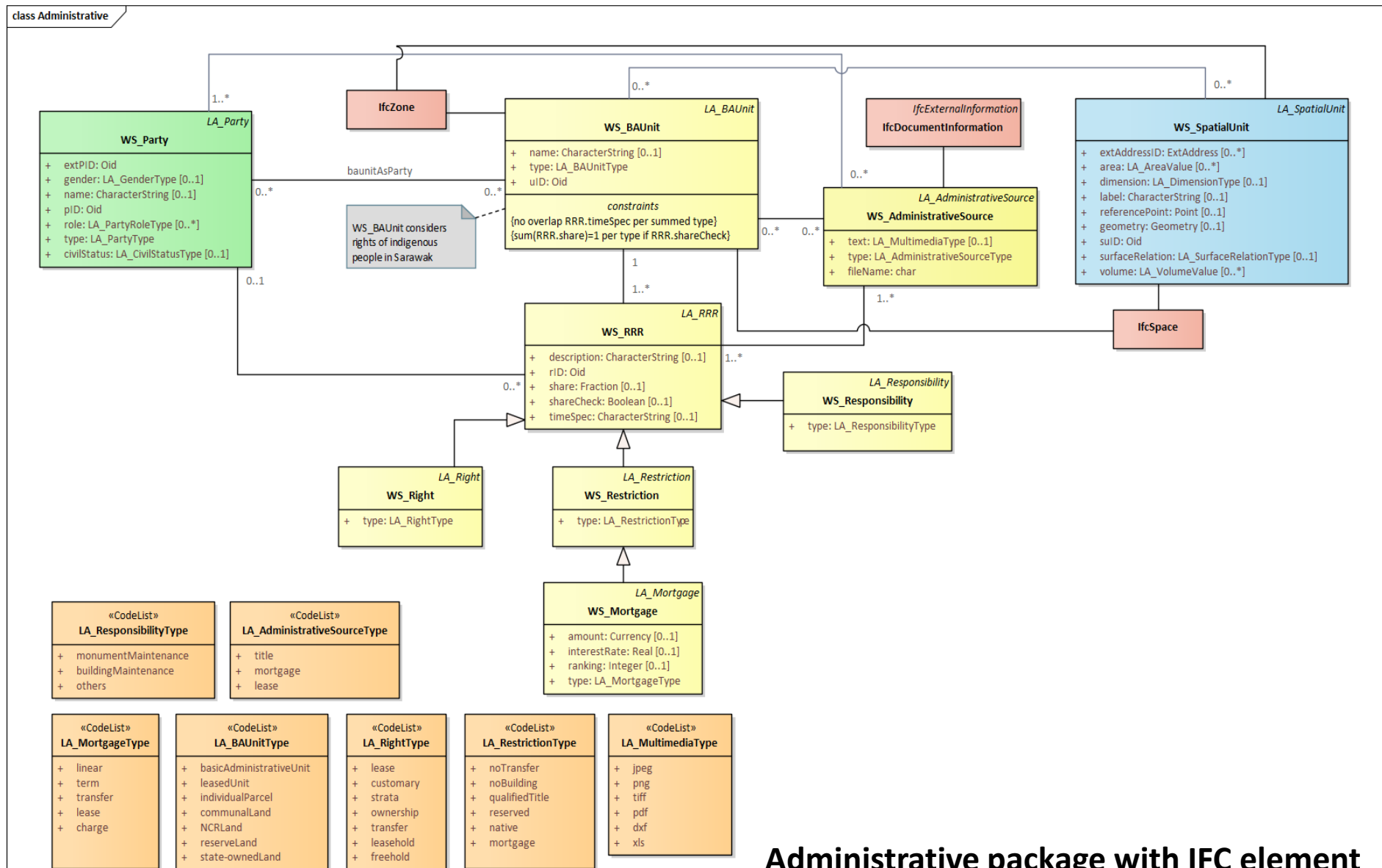
Generated 3D spaces of units

Methodology

IFC Entity Type	LADM
IfcZone: unit number, space type	WS_SpatialUnit, WS_BAUnit
IfcBuildingElement: structural building	WS_BoundaryFace, WS_BuildingElement
IfcSpace: IfcGloballyUniqueId; geometric representation	WS_LegalSpaceBuildingUnit, WS_SpatialUnit, WS_BAUnit

**Proposed IFC entities and its mapping to LADM
 (adopted and revised from Meulmeester, 2019)**

Output (Sarawak Country Profile)



Administrative package with IFC element

Discussion

- **Conceptual Model**
 - A model was created to integrate BIM/IFC data into LADM.
 - It includes 9 main LADM classes and 12 sub-classes.
 - IFC data is added as attributes and code lists to LADM classes.
 - The model needs validation for Sarawak's land management.
 - More building details could improve the model, especially for Sarawak.

Discussion

- **Benefits of Integration**

- Harmonizes data: BIM provides detailed building info, LADM covers legal/admin aspects.
- Accurate spatial data: LADM reflects real-world property locations; BIM offers precise 3D models.
- Automated validation: BIM and LADM data can be checked and corrected automatically.
- Enhanced information: Combines detailed semantic info for complex situations.
- Unified model: All property info are shown in one model.

Discussion

- **3D LAS Input**

- IFC model should include IfcSpace (for rooms) and IfcZone (for units).
- BIM usage is at early stage; most info is handled manually.
- Digitizing documents into 3D models is beneficial.
- Map digitized data to IFC schema entities (e.g., IfcSpace, IfcZone).
- Validate digital data against original documents.
- Use validated data to create 3D legal space models.
- Keep digital cadastral info updated to reflect changes.

Future Works

- Create a BIM database that matches LADM's legal info
- Add Part 4 – Valuation Information for better land administration.
- Use FME to extract and convert legal spaces from IFC files.
- Store legal spaces in a PostgreSQL database with PostGIS.
- Use CesiumJS for validation and visualization.

Recommendations

- Include 3D legal objects like tunnels, utilities, and water columns, not just apartments thus, full picture of legal spaces.
- Explore new workflows and laws for registering BIM/IFC models.

Acknowledgement

- Premier Sarawak Research Grant
 - from 2024 – 2026 (2 years)
- **BIM data** – Uda & Legacy Sdn Bhd
- **Spatial data** – Lands and Surveys Department Sarawak

Thank you

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