A study on 3D cadastral geographical modeling

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contents

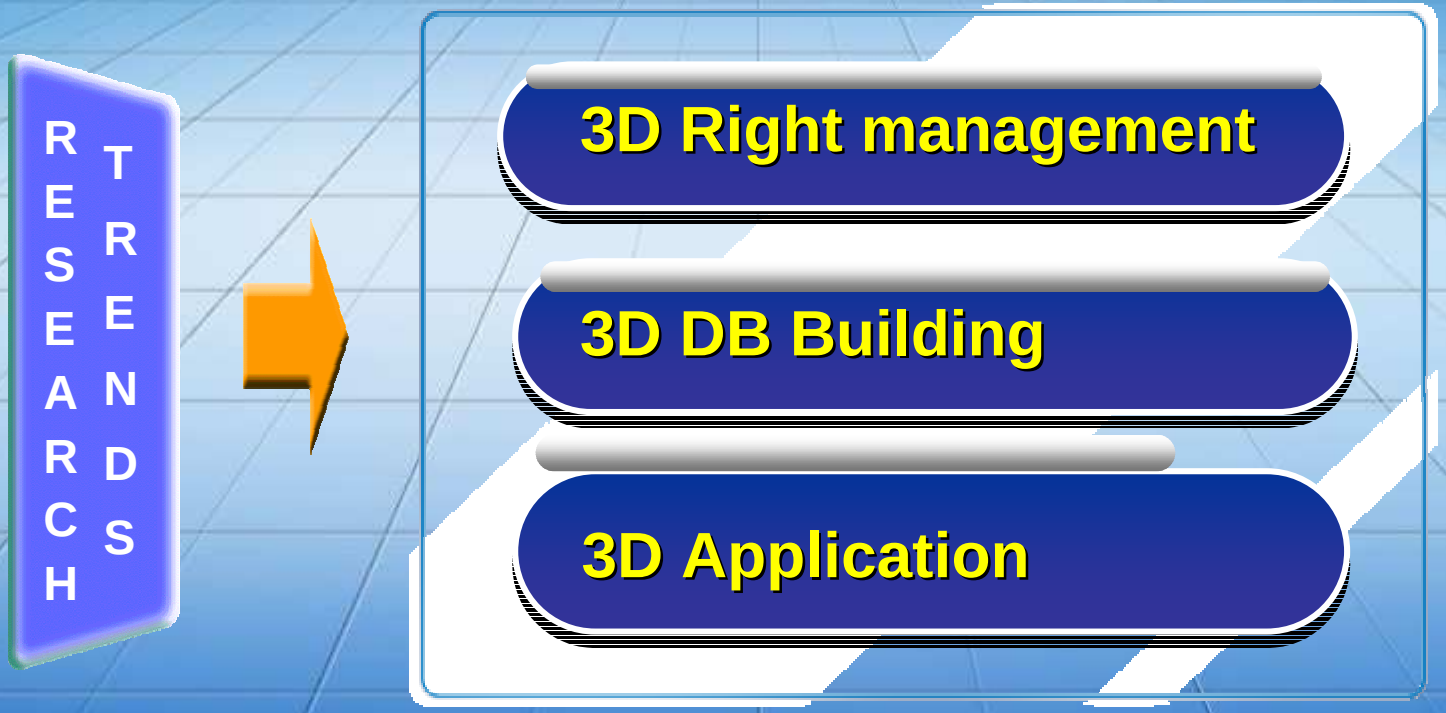
- Introduction
- Research backgroud
- 3D data model components
- 3D representation methods
- Conclusions

Definition of 3D Cadastre

Stoter	A cadastre that registers and gives insight into right and restrictions not only on parcel but 3D property unites
Valstad	Surveying, drawing and registration methods for underground and space facility in 3D cadastre
Y. H Won	Representation real world including surfaace, undergrand and air space

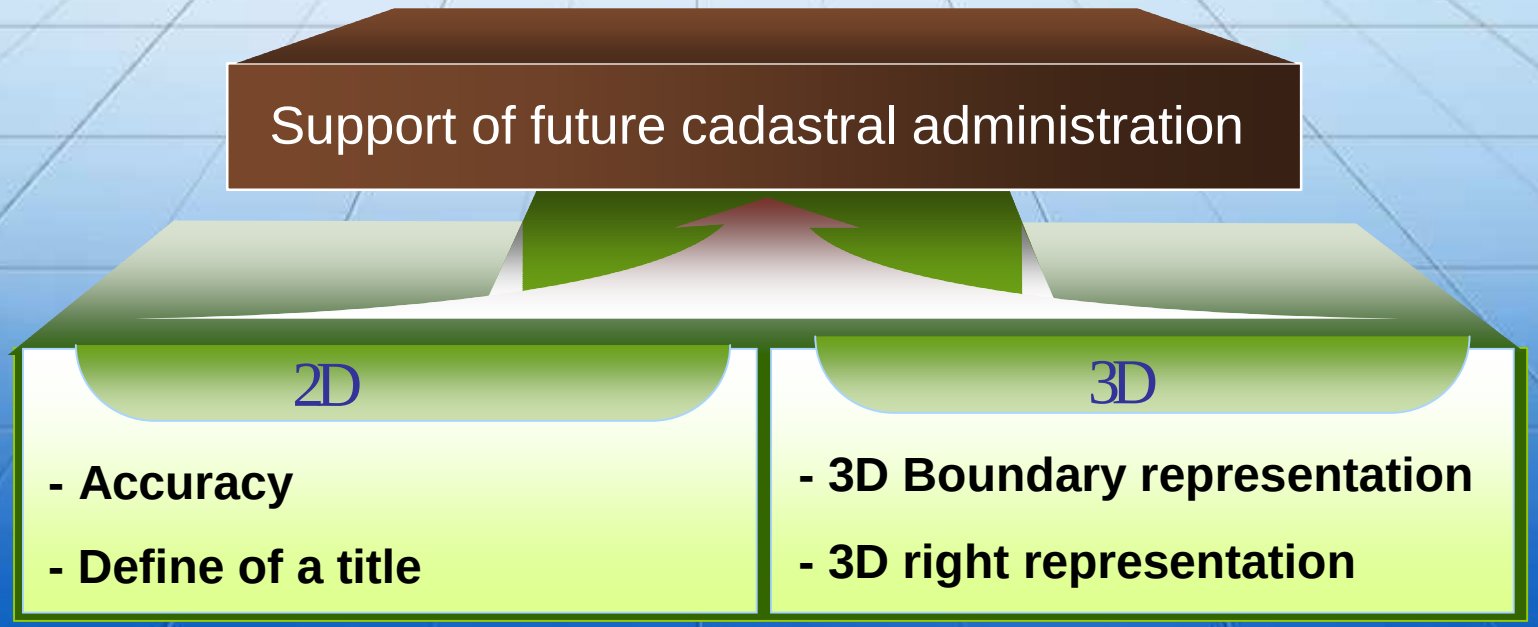
Prior Research 3D Cadastre

Limited Land → Underground, surface, air apace



Background of 3D Cadastre

- Limited representation by current 2D concept
- Increasing land value and land development
- Increasing interest of a right view and a right to enjoy sunshine

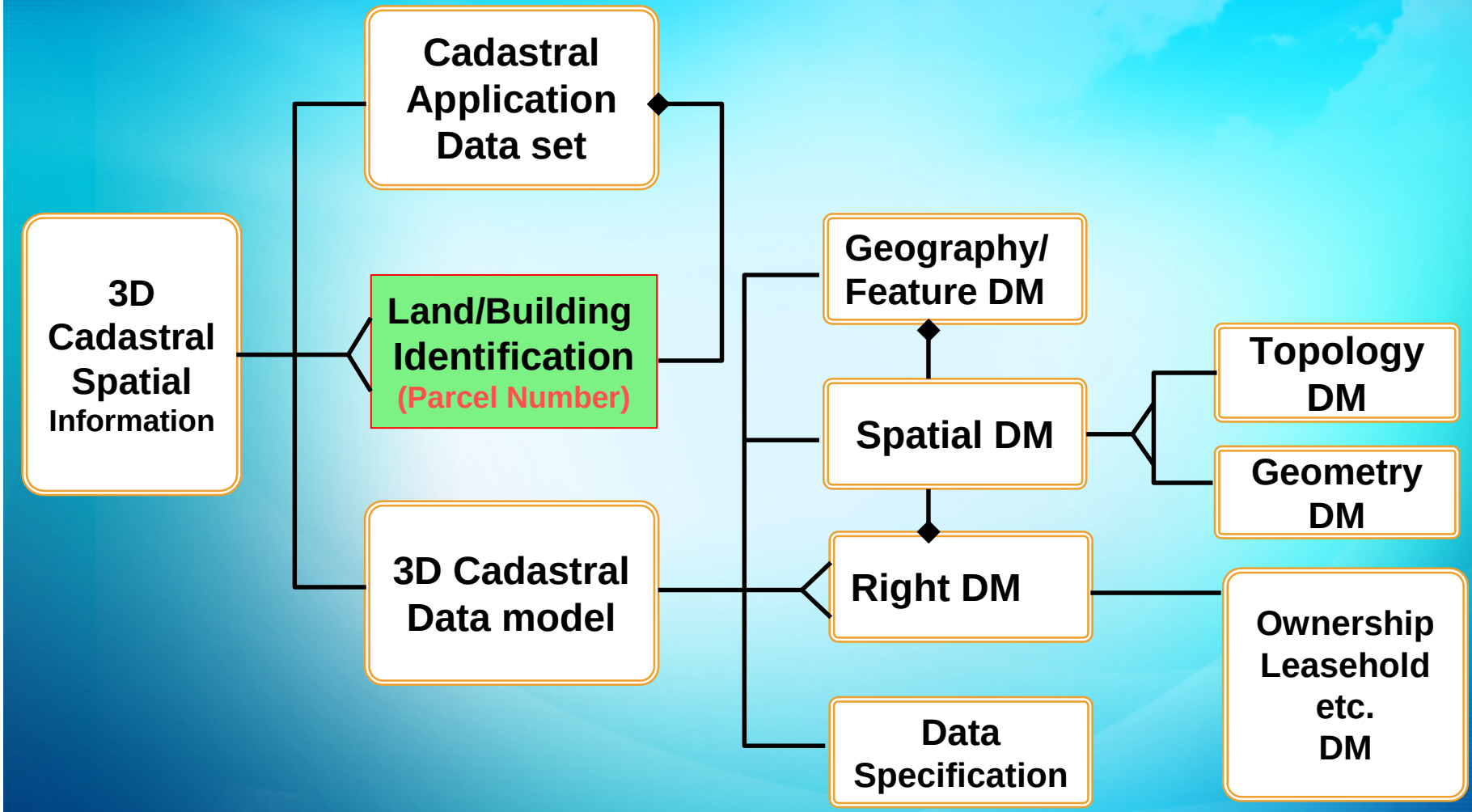


Components of data model

3D Data Model Components

- **3D spatial data acquisition and management**
- **Designing 3D DB Schema**
- **Plane space and solid space unique ID : PN**

Components of data model

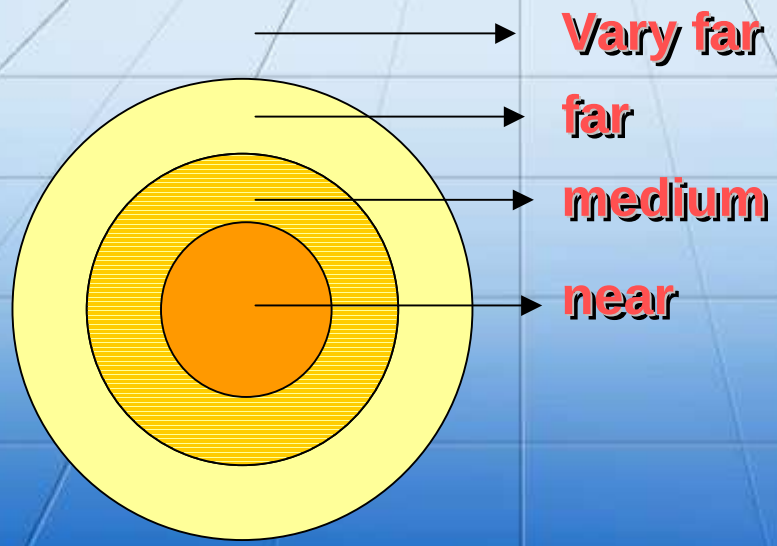


3D data modeling procedure

Data creation	**1D or 2D line and feature data extraction**
Data update	**- Updating height data in 2D data** **- Updating 3D data when it changes**
Data visualization	**- Visualization : Data visualization and LOD** **- Data representation : image matching, tiling**
Data query	**- Fast data query and data integrity** **- Spatial and attribute data computational process**

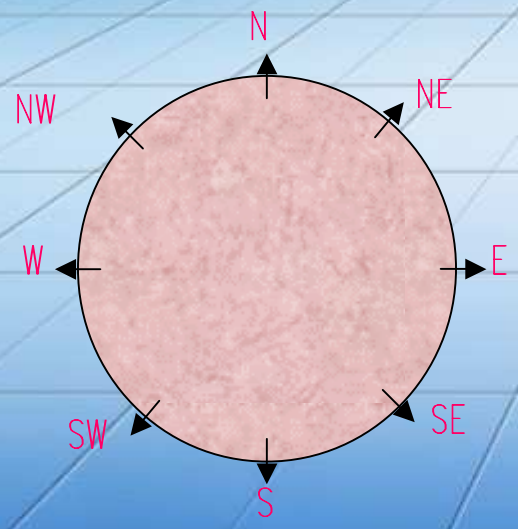
3D representation methods

Representing the distance with symbol, with the center of two objects connected together

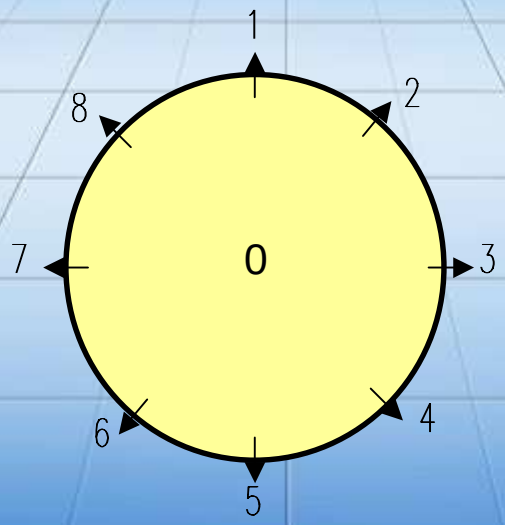


3D representation methods

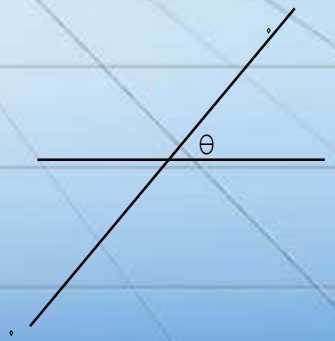
Positional relationship between objects



Azimuth representation



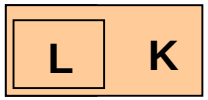
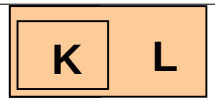
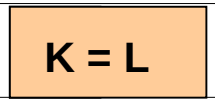
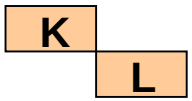
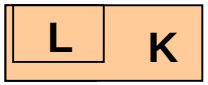
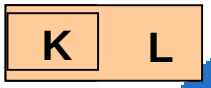
9DLT representation



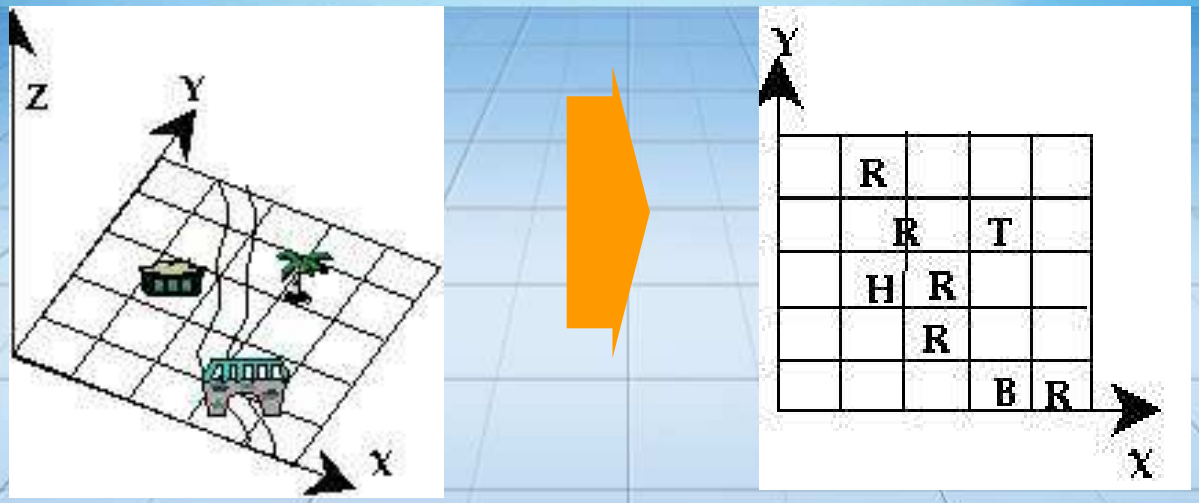
Angle representation

3D representation methods

- Topological relationship between two objects
- 4-Intersection method
  - Boundary and internal space representation
- 8-Intersection method
  - Boundary, internal space also external space representation
- Topology relationship is not changed by alteration factor such as transformation, Scaling, Rotation

Classification	symbol	Description
Disjoint(□□)		**Disjoint K and L**
Contain(□□)		**K contain L**
Inside(□□)		**L inside K**
Equal(□□)		**K equal L**
Meet(□□)		**K meet L**
Cover(□□)		**K cover L**
By cover(-□ □□)		**L by cover K**
Overlap (□□)		**K overlap L**

3D Spatial relationship Algorithm



- Represents objects on geometry X, Y, Z axis
- Reducing geometry dimensions
- Real world representation by combination of coordinate axis objects

3D Spatial relationship Algorithm

- Extracting remainder as spatial relationship not to select among the selected main ones
- Saving data storage volume and time

- P ⊨ A x B

- P ⊨ A *left_of* B

⊨

➢ Conclusion

- 3D cadastral spatial primary key is unique PN
- Designing of meta data in consideration of interoperability with NSDI
- Designing 3D spatial objects and 3D rights
- 3D cadastral spatial algorithm should be designed in the consideration of further extension

Thank you very much for your attention!